



Research Report 2011 – 2013

Max-Planck-Institut für Bildungsforschung



50 Years of Research on Human Development

Research Report 2011 – 2013

Max-Planck-Institut für Bildungsforschung
Max Planck Institute for Human Development



Impressum

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Introduction



für Bildungsforschung
Institute for Human Development



Editorial

Half a century ago, our Institute came into existence. To celebrate its 50th anniversary, over 300 guests from Germany and abroad joined us at a scientific symposium held on 9 October 2013. This occasion gave us the opportunity to reflect on the Institute's past, present, and future. In its 50 years of activities, the Institute has left its mark on scientific research worldwide and has also been influenced by developments elsewhere. Rather than riding on its prestige, the Institute has continually reinvented itself and actively risked entering new areas, as illustrated in this report.

Two new research centers and a new doctoral program have broadened our spectrum of research. Founded in July 2012 and led by Sascha Schroeder, the Max Planck Research Group "Reading Education and Development" (REaD) looks at the underlying structure and development of literacy acquisition in children and youth. The Center for Adaptive Rationality (ARC), headed by Institute Director Ralph Hertwig, began operations in October 2012. It investigates decision processes in a complex and uncertain world. Our doctoral programs have also seen a number of changes. In the autumn of 2013, the International Max Planck Research School for Moral Economies of Modern Societies (IMPRS Moral Economies) welcomed its first six doctoral students. The graduate school is a cooperation between the MPI for Human Development, Freie Universität Berlin, Humboldt-Universität zu Berlin, and Technische Universität Berlin. In addition, we were able to augment our research facilities with the acquisition of an MRI scanner and the expansion and renovation of our Movement Lab.

We are also keen on dialogue with the public. To this end, we again opened our doors on Berlin's "Long Night of the Sciences" in 2012 and 2013. Interest in our work remained at a consistently high level, averaging 670 visitors per event. As evidenced by our Children's Day 2012 and our involvement in selected children's universities, we particularly strive to spark enthusiasm in children and young people for our research topics and thereby nurture future scientists. Another important activity was the interactive display by the REaD Research Group, which went on board the MS Science—a ship converted into a floating exhibition by Wissenschaft im Dialog (Science in Dialogue) and the German Federal Ministry of Education and Research—and is currently on view at the Deutsches Museum in Munich.

On a more somber note, Peter Martin Roeder passed away on 11 September 2011. Roeder was director at the Institute from 1973 to 1995. He was one of the first to take an empirical and sociohistorical approach to educational research and is one of Germany's most influential educational researchers.

Detailed information on the structure, programs, and outcomes of the research centers' activities during the reporting period is provided on the following pages, supplemented by lists and figures in the appendix.

Berlin, February 2014

For the Board of Directors:
Gerd Gigerenzer

Overview

The MPI for Human Development, founded in 1963, is a multidisciplinary research institution dedicated to the study of human development and education. Its inquiries are broadly defined, encompassing evolutionary, historical, social, and institutional contexts of individual human development from infancy to old age. The disciplines of psychology, history, and education, which reflect the current directors' backgrounds, are enriched by the work of colleagues from behavioral and developmental neuroscience, evolutionary biology, economics, mathematics, computer science, sociology, and the humanities.

The Institute is one of about 80 research facilities financed by the Max Planck Society for the Advancement of Science (Max-Planck-Gesellschaft zur Förderung der Wissenschaften e.V.), the core support for which is provided by the Federal Republic of Germany and its 16 states. The total permanent staff at the Institute is 108, including 31 researchers, supplemented by a varying number of predoctoral, postdoctoral, and affiliated researchers and visiting fellows.

Research Centers

In the 2011–2013 period, research at the Institute was organized primarily in four research centers:

The Center for Adaptive Behavior and Cognition (Director: Gerd Gigerenzer) investigates human rationality, in particular decision making and risk perception in an uncertain world. Current research focuses on (1) adaptive and ecological rationality, that is, heuristic decision making by experts and laypeople in situations under uncertainty as opposed to known risks; (2) social intelligence in cooperation and competition; and (3) risk understanding and uncertainty management in everyday life, including applications in medicine, law, education, and financial regulation. Each of these research areas emphasizes the evolutionary foundations of behavior and cognition, in particular their domain specificity and functional adaptiveness (pp. 15–75).

The Harding Center for Risk Literacy, as part of the Center for Adaptive Behavior and Cognition, was founded by a 2.2 million euro donation from the London investment banker David Harding. Its key research topic is risk literacy in a modern technological world, with a focus on health care. To date, the Center has taught over 1,000 physicians how to

better understand health statistics and works on implementing risk literacy in schools and lobbying for transparent health information (pp. 43–55).

The Center for Adaptive Rationality (Director: Ralph Hertwig) was newly established in October 2012. The Center investigates how people make boundedly rational decisions in complex and uncertain social and nonsocial worlds. The current research focuses on (1) bounded rationality, that is, the simple heuristics that people recruit in order to navigate a complex world; (2) information search and learning as key processes in reckoning with uncertainty; (3) how decision-making strategies develop over the lifespan and respond to the challenges of cognitive aging; and (4) ways in which heuristics, mental strategies, and environments can be designed to empower citizens, patients, doctors, and policy makers to make better decisions. In each of these areas, a variety of methods are employed, including behavioral experiments, computer simulations, mathematical analyses, and neuroscientific tools (pp. 77–127).

The Center for the History of Emotions (Director: Ute Frevert), which opened in 2008, examines emotions as a major feature of human development both in an ontogenetic and a phylogenetic sense. The research rests on the assumption that emotions—feelings and their expressions—are shaped by culture and learned in social contexts through social practices. Since these contexts and practices change in space and time, emotions are held to be historically variable. In order to detect and explore this variability, the Center's scope includes different societies within and outside Europe. Special attention is paid to institutions that bear a strong impact on human behavior and development, such as the



Figure 1. Excellent working environment for the scientific research staff.

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family, school, law, religion, the economy, the military, and the state, as they have developed since the (early) modern period (pp. 129–193). The **Center for Lifespan Psychology** (Director: Ulman Lindenberger) has helped to establish lifespan psychology as a distinct conceptual approach within developmental psychology. Work at the Center is guided by three propositions: (1) to study lifespan changes in behavior as interactions among maturation, learning, and senescence; (2) to develop theories and methods that integrate empirical evidence across domains of functioning, timescales, as well as behavioral and neural levels of analysis; and (3) to identify mechanisms of development by exploring age-graded differences in plasticity (pp. 195–263).

Max Planck Research Groups

The **Max Planck Research Group "Affect Across the Lifespan"** (Head: Michaela Riediger) aims at contributing new insights on age-related differences in affective experiences and competencies, focusing primarily on the age range from adolescence to old age (pp. 265–288).

The **Max Planck Research Group "Felt Communities? Emotions in European Music Performance"** (Head: Sven Oliver Müller) studies the historical development of the emotions triggered by music in the 19th and 20th centuries. Focusing on emotions as a public form of communication, the Research Group aims to decipher the emotional structure of communities (pp. 291–313).

The **Max Planck Research Group "Reading Education and Development" (REaD)** (Head: Sascha Schroeder) began in July 2012 to investigate the underlying structure of students' reading skills and their development during childhood and adolescence. Their research will provide a more detailed description of the cognitive processes involved in reading and analyze their conditions and consequences (pp. 315–339).

Research Programs of the Directors Emeriti

With the support of the President of the Max Planck Society, the Directors emeriti Jürgen Baumert and Wolfgang Edelstein continue to pursue their research programs at the MPI for Human Development. Jürgen Baumert's work focuses on the reform of the Berlin second-

ary school system, the relationship between students' educational resources and their life course, the development of teachers' professional competence, and the potential of bilingual alphabetization in multicultural societies. Wolfgang Edelstein's work focuses on sociomoral development, democracy education, and democratic school reform. With support from the Jacobs Foundation, a Masters course focusing on these topics has been developed at the Freie Universität Berlin (pp. 341–353).

International Max Planck Research Schools (IMPRS) & Networks

An important collaborative effort involving three of the four Centers and two of the three Max Planck Research Groups at the Institute as well as universities in Berlin, the United States, and Switzerland is the **International Max Planck Research School on the Life Course (LIFE)**. The aim is advanced research training in the study of human behavior and institutional systems over evolutionary and ontogenetic time (pp. 357–361).

The **International Max Planck Research School Moral Economies of Modern Societies** started in October 2013 and explores the "moral economies" by identifying values, emotions, and habits that inform and inspire social formations which have emerged since the 18th century in Europe, North America, and South Asia. Research and the curriculum focus on the interlocking of new modes of feeling and the definition and justification of new social values (pp. 362–364).

The **International Max Planck Research School Uncertainty** integrates research in economics and psychology with a focus on cognitive and social strategies in uncertain and changing situations that involve individuals and institutions. The program extends to legal decision making and applications (pp. 365–366).

The **Max Planck International Research Network on Aging (MaxNetAging)** is a virtual institute for the advancement of research on the causes, patterns, processes, and consequences of aging. MaxNetAging consists of a doctoral and postdoctoral stipend program (MaxNetAging Research School), fellowships,

research workshops, and annual conferences (p. 367).

The MPI for Human Development also participates in the **Berlin School of Mind and Brain**. The program offers a 2-year Master's degree, a comprehensive 3-year doctoral program, and postdoctoral research and career development opportunities. The focus is on the interface between the humanities and behavioral sciences with the neurosciences. The **Max Planck Research Network on Cognition (Maxnet Cognition)** focuses on the behavioral science, the behavioral neuroscience, and the computer science of cognition. The main goal of the Network is to foster research cooperation between institutes and across sections of the Max Planck Society on a small number of particularly important research topics in the field of cognition that profit from an interdisciplinary approach (p. 368).

Max Planck Fellowship

In June 2008, Gert G. Wagner was appointed a Max Planck Fellow at the Institute. Gert G. Wagner is professor at the Technische Universität Berlin and since 2011 Member of the Executive Board of the German Institute for Economic Research (DIW Berlin). The Max Planck Society established the Fellow Program to further strengthen research cooperation between its institutes and neighboring universities and other research institutions. The cooperation with Gert G. Wagner, one of the leading researchers running the German Socio-Economic Panel Study (SOEP), allows researchers at the Institute to link their experimental work, such as cognitive interventions, to longitudinal observations from the SOEP. In addition, innovative survey technologies, such as mobile-phone-based cognitive testing in real-life settings, can be explored and validated. Ulman Lindenberger and Gert G. Wagner are two out of five Co-Principal Investigators of the Berlin Aging Study II (BASE-II) (pp. 371–375).

Scientific Services

The Scientific Services of the MPI for Human Development support the individual Research Centers, their researchers, and other ser-



Figure 2. Numerous events promote the scientific exchange.

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vice units at the Institute. The **Library and Research Information Unit** (Head: Ursula Flitner) ensures rapid access to printed and electronic resources and provides comprehensive support for the efficient and independent use and dissemination of information (pp. 379–380). The **Central IT Unit** (Head: Wolfgang Assmann) supports scientific applications with future-oriented information technologies under continuous consideration of data security and data protection aspects. The Institute's infrastructure services, such as network, computing, and storage, allows for running different kinds of complex statistical analyses (pp. 381–382).

Interdisciplinarity

Interdisciplinarity is one of the main strengths of the MPI for Human Development. Different types of events promote the scientific exchange. A new format is particularly noteworthy. In May 2013, the first Interdisciplinary Colloquium took place at the Institute. This newly established format, initiated by the Center for the History of Emotions and organized by a team recruited from all Centers, is arranged as a pre-lunch seminar series: Researchers coming from various disciplines give short talks on a set topic. The talks are commented on by somebody from a different discipline. This guarantees that there is real interdisciplinary exchange and debate. The topic of the first colloquium was MEMORY. Talks, com-

ments, and the lively discussion following the presentations indicated that this format answers an actual need and opens new ways of cross-disciplinary communication. This is to be continued.

Teaching Activities and Academic Degrees

The Institute has always considered its cooperation with universities as very important, especially in participating in teaching activities. Scientific staff members—directors, research scientists, postdoctoral as well as predoctoral fellows—have held seminars and lectures at German universities and abroad, for example, University of Basel, Charité Universitätsmedizin Berlin, Freie Universität Berlin, Humboldt-Universität zu Berlin, University of Bielefeld, University of Erfurt, Justus Liebig University Giessen, University of Mannheim, Osnabrück University, University St. Petersburg FINEC, University of Vienna, etc. In addition, institute members were supported in completing their academic degrees in cooperation with universities in Berlin and elsewhere. Between 2011 and 2013, 6 habilitations and 28 doctoral dissertations were completed by research staff members of the Institute.

All degrees are listed in the Appendix. The Appendix also provides lists of research colloquia, workshops, and conferences held at the Institute. It also includes further information about visiting researchers and the scientific staff members.

Governance of the Institute

The Institute is governed by a **Board of Directors** that consists of the members of the Institute who are Fellows (Wissenschaftliche Mitglieder) of the Max Planck Society. The Board of Directors elects one of the directors to serve as the Managing Director on a rotational basis, usually for a period of 2 years. In the present reporting period, the Board consisted of the following members:

Ute Frevert (Managing Director until 06/2011)
Gerd Gigerenzer (Managing Director)
Ralph Hertwig
Ulman Lindenberger

The Board is augmented by one member of the Institute's research staff (Margrit Pernau), the heads of the Max Planck Research Groups (Michaela Riediger, Sven Oliver Müller, and Sascha Schroeder), and the head of the Administration (Brigitte Merz).

Several in-house committees, composed of representatives either elected by the entire research staff or appointed, advise the Board of Directors on matters of scientific research and policy. One of the major institute-wide committees is the **Scientific Staff Committee** (Mitarbeiterausschuss), whose members are elected by all researchers.

The **International Board of Scientific Advisors** offers an important source of external review and advice to both the directors and the scientific staff on research matters at the Institute. Members are selected from an international circle of distinguished researchers and appointed by the President of the Max Planck Society. They meet triannually to discuss completed, ongoing, and future research projects at the Institute. In this reporting period, the Board consisted of the following members:

<i>Rajeev Bhargava</i>	CSDS—Centre for the Study of Developing Societies, Delhi, India
<i>Joanna Bourke</i>	Birkbeck College, London, UK
<i>Jacquelynne S. Eccles</i>	University of Michigan, Ann Arbor, USA (until 12/2012)
<i>Ido Erev</i>	Technion—Israel Institute of Technology, Haifa, Israel
<i>Andreas Gestrich</i>	German Historical Institute London, UK
<i>Reid Hastie</i>	University of Chicago, USA
<i>Joachim I. Krueger</i>	Brown University, Providence, USA
<i>Ruth Leys</i>	Johns Hopkins University, Baltimore, USA
<i>Herbert W. Marsh</i>	University of Oxford, UK (until 12/2012)
<i>Barbara A. Mellers</i>	University of Pennsylvania, Philadelphia, USA
<i>Denise C. Park</i>	University of Texas at Dallas, USA
<i>Manfred Prenzel</i>	Technische Universität München, Germany (until 12/2012)
<i>Patricia A. Reuter-Lorenz</i>	University of Michigan, Ann Arbor, USA
<i>Frank Rösler</i>	Universität Hamburg, Germany
<i>Wolfgang Schneider</i>	University of Würzburg, Germany (until 12/2011)
<i>Hans Spada</i>	University of Freiburg, Germany
<i>Michael R. Waldmann</i>	University of Göttingen, Germany



**Center for
Adaptive Behavior
and Cognition**

The Center for Adaptive Behavior and Cognition

The **Center for Adaptive Behavior and Cognition (ABC)** (Director: Gerd Gigerenzer) investigates human rationality, in particular decision making and risk perception in an uncertain world. Current research focuses on (1) adaptive and ecological rationality, that is, heuristic decision making by experts and laypeople in situations under uncertainty as opposed to known risks; (2) social intelligence in cooperation and competition; and (3) risk understanding and uncertainty management in everyday life, including applications in medicine, law, education, and financial regulation. Each of these research areas emphasizes the evolutionary foundations of behavior and cognition, in particular their domain specificity and functional adaptiveness.



Research Team 2011–2013

Henry Brighton, Uwe Czienskowski, Flavia Filimon, Wolfgang Gaissmaier, Mirta Galesic, **Gerd Gigerenzer**, Konstantinos V. Katsikopoulos, Monika Keller, Shenghua Luan, Julian N. Marewski (as of 08/2011: University of Lausanne, Switzerland), Björn Meder, Jonathan D. Nelson, Hansjörg Neth, Henrik Olsson (until 07/2012), José Quesada (until 09/2011), Lael J. Schooler, Özgür Şimşek, Jeffrey R. Stevens (as of 09/2011: University of Nebraska–Lincoln, USA), Odette Wegwarth, Anja Westram (until 03/2013)

Postdoctoral Fellows

Florian Artinger (as of 02/2013: University of Warwick, UK), Sabrina Artinger, Bryan Bergert (until 11/2012), Nicolai Bodemer (until 11/2013), Markus A. Feufel (as of 07/2012: Charité Universitätsmedizin Berlin, Germany), Mario Fific (as of 09/2011: Grand Valley State University Michigan, USA), Wasilios Hariskos, Juliane E. Kämmer (as of 12/2013: Center for Adaptive Rationality), Amit Kothiyal, Michelle McDowell, Mehdi Moussaïd (as of 10/2013: Center for Adaptive Rationality), Azzurra Ruggeri, Laurianne Vagharchakian

Predocctoral Fellows

Daniel Barkoczi (IMPRS Uncertainty), Stojan Davidovic (IMPRS Uncertainty), Hanna Bettine Fechner (MaxNetAging Research School), Nadine Fleischhut (until 10/2011), Perke Jacobs, Jana Jarecki (IMPRS Uncertainty), Astrid Kause, Niklas Keller (as of 07/2013: Charité Universitätsmedizin Berlin, Germany), Jan Multmeier (as of 01/2012: National Association of Statutory Health Insurance Physicians, Berlin, Germany), Malte Petersen, Pantelis Pipergias Analytis (IMPRS Uncertainty), Roman Prinz, Martin Rosenauer (until 10/2013), Hagen Sinodoru, Jolene H. Tan (IMPRS Uncertainty), John Wong (MaxNetAging Research School)

Adjunct Researchers

Florian Artinger (Warwick Business School, University of Warwick, UK), Ana Paula Bortoleto (University of Sheffield, UK), Edward T. Cokely (Michigan Technological University, USA), Markus A. Feufel (Charité Universitätsmedizin Berlin, Germany), Rocio García-Retamero (Universidad de Granada, Spain), Julian N. Marewski (University of Lausanne, Switzerland), Laura Martignon (Ludwigsburg University of Education, Germany), Shabnam Mousavi (John Hopkins Carey Business School, Baltimore, USA), Jan Multmeier (National Association of Statutory Health Insurance Physicians, Berlin, Germany), Robin Pope, Jan Gerrit Schuurman (Foundation Inspire2Live, Amersfoort, Netherlands), Jeffrey R. Stevens (University of Nebraska–Lincoln, USA), Nassim N. Taleb (New York University’s Polytechnic Institute, USA), Peter M. Todd (Indiana University, Bloomington, USA), Gregory Wheeler (Carnegie Mellon University, Pittsburgh, USA)

Visiting Researchers

Susanne Abele (Miami University, Oxford, USA), Hal R. Arkes (Ohio State University, Columbus, USA), Uljana Feest (Technische Universität Berlin, Germany), Adam Feltz (Schreiner University, Kerrville, USA), Kevin A. Gluck (Air Force Research Laboratory, Ohio, USA), Wayne D. Gray (Rensselaer Polytechnic Institute, Troy, USA), Till Grüne-Yanoff (Royal Institute of Technology KTH, Stockholm, Sweden), Simone Guercini (Università degli Studi di Firenze, Italy), Bonnie L. Halpern-Felsher (University of California, San Francisco, USA), Niklas Keller (Charité Universitätsmedizin Berlin, Germany), Kevin McConway (The Open University, Open Keynes, UK), Henrik Olsson (Berlin), Garold Stasser (Miami University, Oxford, USA), Danilo Streck (Universidade do Vale do Rio dos Sinos, São Leopoldo, Brasil), Brian Taylor (University of Ulster, Londonderry, UK), Gregory Wheeler (New University of Lisbon, Caparica, Portugal), Wei Zhu (Tongji University, Shanghai, China)

Introductory Overview

The Center for Adaptive Behavior and Cognition investigates reasoning and decision making under uncertainty at the levels of both individuals and social groups. The research group consists of psychologists, neuroscientists, computer scientists, economists, and researchers from other fields. Using a range of methodologies, such as experimental methods, computer simulation, and mathematical analysis, we cooperate in solving the same problems. The Center's program combines a strong theoretical focus with practical applications, that is, the research group both develops specific models and explores their applications. Applications range from helping physicians and patients understand the statistical evidence arising from medical research to working with the Bank of England to develop simple heuristics for a safer, more robust financial world. These practical applications are divided into two sections, one focusing on risk literacy in health and the other on decision making in the wild. Our interdisciplinary approach to studying rationality also stresses the critical role of theory integration in the advancement of psychological theory, a topic which we will detail in a separate section. The Center's main theoretical focus on rationality can be, albeit artificially, divided into three aspects: bounded, ecological, and social rationality.

Bounded Rationality

Models of bounded rationality attempt to answer the question of how people with limited time, knowledge, money, and other scarce resources make decisions. Specifically, we study how people make—and should make—decisions in situations under “uncertainty” (where not all alternatives, consequences, and risks are known) as opposed to situations with “known risks.” This program is an alternative to the dominant optimization paradigm in cognitive science, economics, and behavioral biology that poses the question of how Laplacean superintelligences or near omniscient beings would behave. We study the proximal mechanisms of bounded rationality, that is, the adaptive heuristics that enable quick and frugal decisions under uncertainty. This collection of heuristics and their building blocks is what we call the adaptive toolbox.

Ecological Rationality

Models of ecological rationality describe the structure and representation of information in actual environments and their match with mental strategies, such as boundedly rational heuristics. To the degree that such a match exists, heuristics need not trade accuracy for speed and frugality: Investing less effort can also improve accuracy. The simultaneous focus on the mind and its environment, past and present, puts research

on decision making under uncertainty into an evolutionary and ecological framework, a framework that is missing in most theories of reasoning, both descriptive and normative. In short, we study the adaptation of mental and social strategies to real-world environments rather than compare human judgments to the laws of logic and probability theory.

Social Rationality

Social rationality is a variant of ecological rationality, one for which the environment is social rather than physical or technical. Models of social rationality describe the structure of social environments and their match with boundedly rational strategies that people might use. There is a variety of goals and heuristics unique to social environments. That is, in addition to the goals that define ecological rationality—to make fast, frugal, and fairly accurate decisions—social rationality is concerned with goals, such as choosing an option that one can defend with argument or moral justification or that can create a consensus. To a much greater extent than the cognitive focus of most research on bounded rationality, socially adaptive heuristics include emotions and social norms that can act as heuristic principles for decision making.

Bounded Rationality

Humans and other animals must make inferences about unknown features of their world under constraints of limited time, knowledge, and computational capacities. We do not conceive bounded rationality as optimization under constraints nor do we think of bounded rationality as the study of how people fail to meet normative ideals. Rather, bounded rationality is the key to understanding how people make decisions in an uncertain world, without utilities and probabilities. Bounded rationality consists of simple step-by-step rules that function well under the constraints of limited search, knowledge, and time—whether an optimal procedure is available or not. Just as a mechanic will pull out specific wrenches, pliers, and gap gauges to maintain an engine rather than just hit everything with a hammer, different tasks require different specialized tools. The notion of a toolbox lacks the beauty of Leibniz' dream of a single all-purpose inferential tool. Instead, it evokes the abilities of a craftsman, who can provide serviceable solutions to almost any problem with just what is at hand.

Key Reference

Helversen, B. von, Wilke, A., Johnson, T., Schmid, G., & Klapp, B. (2011). Performance benefits of depression: Sequential decision making in a healthy sample and a clinically depressed sample. *Journal of Abnormal Psychology, 120*, 962–968. doi:10.1037/a0023238

The Adaptive Toolbox

This repertoire of specialized cognitive mechanisms, which include fast and frugal heuristics, are shaped by evolution, learning, and culture for specific domains of inference and reasoning. We call this collection of mechanisms the “adaptive toolbox.” We clarify the concept of an adaptive toolbox as follows:

- It refers to a specific group of rules or heuristics rather than to a general-purpose decision-making algorithm.
- These heuristics are fast, frugal, and computationally cheap rather than consistent, coherent, and general.
- These heuristics are adapted to particular environments, past or present, physical or social.
- The heuristics in the adaptive toolbox are orchestrated by some mechanism reflecting the importance of conflicting motivations and goals.

Fast and frugal heuristics generally consist of three building blocks: simple rules for guiding search for information (in memory or in the environment), for stopping search, and for decision making. They are effective when they exploit the structure of the information in the environment and basic cognitive capacities, such as memory and perception. That is, their rationality is a form of “ecological rationality” rather than one of consistency and coherence. We continue to explore fast and frugal heuristics and their importance in diverse disciplines, such as biology, economics, and cognitive psychology. In what follows,

we describe some examples of research into the adaptive toolbox. Here, we focus on how depression influences how people search the environment and how the world is represented in memory, and how these memory representations can help solve the problem of how to select heuristics from the adaptive toolbox.

Performance Benefits of Depression in Sequential Decision Making

Sadness, apathy, and preoccupation are traits that come to mind when people think about depression, the world's most frequently diagnosed mental disorder. Yet, according to a study by von Helversen, Wilke, Johnson, Schmid, and Klapp (2011), depressed individuals perform better than their nondepressed peers in sequential decision tasks. In their study, participants—who were healthy, clinically depressed, or recovering from depression—played a computer game designed to resemble everyday decision problems, such as household shopping and dating. In the game, the participants could earn money by hiring an applicant in a simulated job search. Each applicant was assigned a monetary value and applicants encountered applicants one after the other. Participants faced the challenge of determining when to halt search and select the current applicant. As von Helversen and colleagues report, while healthy participants searched through relatively few candidates before selecting an applicant, depressed participants searched more thoroughly and made choices that resulted in higher payoffs.

For decades, psychologists have debated whether depression has positive side effects. While researchers have recognized that most symptoms of depression impede cognitive functioning, some have proposed that depression may promote analytical reasoning and persistence—that is, qualities useful in complex tasks. Past research provides some evidence that supports this possibility, but it focused on individuals with low levels of nonclinical depression. Von Helversen and colleagues demonstrate that even severe depression might benefit decision making.

The Cognitive Niche Framework for Strategy Selection

Most theories of strategy selection assume the existence of an effort-accuracy trade-off: Expending more effort leads to greater accuracy. Marewski and Schooler (2011) proposed a complementary approach that asks how the interplay of the cognitive system and the environment creates *cognitive niches* that restrict the range of strategies that are applicable at any given moment in time. Marewski and Schooler (2011) used computer simulations to model how the environment shapes a person's representation of the environment in memory. These representations define cognitive niches, where some heuristic strategies operate better than others. To illustrate, consider the situation in which a customer asks a bartender what kinds of beer are available. The bartender mentions two beers that the customer has never tried, so the customer now must infer which of two beers they will prefer. The customer may recognize both brands of beer, just one of them, or neither of them. For a brand they recognize, they may, in addition, know something about it. What a person knows about these beers depends on their past experience and how memory represents this experience. It is this interplay between the cognitive system and the environment that carves out a cognitive niche for each strategy, or to put it in other words, a limited number of situations in which the strategy can be applied. For instance, using the recognition heuristic requires that the decision maker recognizes just one of the two brands. Here, a straightforward application

of the recognition heuristic would lead to the inference that the recognized brand is better. Importantly, these niches may not overlap, alleviating the problem of strategy selection. For instance, the fluency heuristic, which depends on discerning how quickly the brands were recognized, will most likely be applicable when a person is familiar with the brands, but knows nothing else about them. In such situations, knowledge-based strategies cannot compete because the requisite knowledge is unavailable. Overlapping niches would arise when, for example, abundant knowledge about the alternatives is available. Where different strategies' niches overlap, the selection could be guided by the traditional selection mechanisms that depend on effort-accuracy trade-offs. In short, for those situations where two or more strategies do not overlap, the cognitive niche framework provides an account of how strategy selection can emerge as a bottom-up process—in the absence of feedback and learning—solely through the interplay between the cognitive system and the environment.

Mapping the Structure of Semantic Memory

The cognitive niche framework illustrates that the more we know about how the environment is represented in memory, the better we can understand the heuristics that depend on knowledge retrieved from memory. A limitation of Marewski and Schooler's (2011) analysis is that it did not take into account the semantic associations that guide what knowledge is likely to be retrieved from memory when a person is using any given heuristic. To reveal these associations, Morais, Olsson, and Schooler (2013) mapped the structure of individuals' semantic memory with a new snowball sampling paradigm, illustrated in Figure 1. To start, participants were asked to generate associates to cue words. During approximately 6 weeks of 1-hour daily sessions, the responses to a cue generated by an individual on one day were used as cues for eliciting their semantic associates on a subsequent day. In the map of an individual's semantic network, depicted in Figure 1, words are represented as nodes joined by links that

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Key Reference

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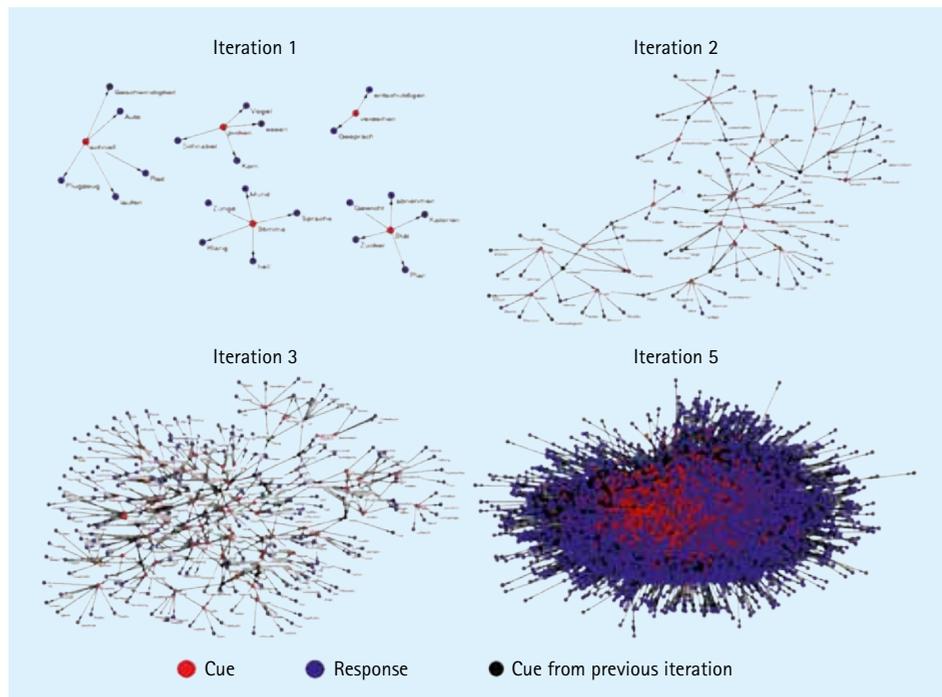


Figure 1. Five iterations of the snowball sampling paradigm. For example, on day 1, the individual was given cue words, such as *schnell* and *picken*. In response, the individual generated the words *Rad* and *Vogel*, among others. *Rad* and *Vogel*, in turn, were used as cues on day 2. After 54 days and 5 iterations, the original set of cues had snowballed in to a network of 9,129 interconnected words (adapted from Morais, Olsson, & Schooler, 2013).

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represent whether a word was named as an associate by that individual in response to a cue word. Computer simulations suggest that these network maps of semantic structure constructed using the snowball sampling paradigm reliably depict the structure of semantic memory. Statistical analyses of the semantic networks of individuals showed that they have, among other distinctive features, distributions of links across nodes that indi-

cate that most words are poorly connected and a minority of words have a high number of links. This type of distribution arises naturally when a memory system incurs costs for learning and maintaining connections between concepts. From a functional standpoint, connections between concepts reflect statistical associations that can be used to retrieve information that is likely to be useful in heuristic inference.

Ecological Rationality

The performance of a decision rule will depend on the structure of the environment in which it is applied. The ABC Research Group studies this relationship systematically by specifying formal models of heuristics and other decision rules. The research program on ecological rationality aims to characterize the structure of environments and understand the fit between these structural characteristics and the performance of decision rules. Performance is measured by external criteria, such as speed, frugality, and accuracy. Notice how this objective differs to the study of logical rationality, where performance is measured by internal criteria, such as consistency. Here, we present a sample of recent research on the ecological rationality of simple heuristics.

The Importance of Noncompensatory Processing

An intriguing finding in the study of ecological rationality is that simple heuristics which ignore information can often match or exceed the accuracy of the linear decision rule. Our recent research has focused on understanding why. To take an illustrative example, consider the problem of deciding which one of two cities, such as Berkeley and Chicago, has a higher value on a numerical criterion, such as a city's homelessness rate. The inference is made using cues (e.g., one city, in this case Chicago, has a basketball team, while the other city, in this case Berkeley, does not) which correlate to some degree with the criterion. The linear rule uses all cues to make an inference. It estimates the criterion by calculating a weighted sum of all the cue values and then decides on the city with the greater estimated criterion value. For example, standard multiple regression is a special case of the linear rule, where the weights of the cues minimize the sum of squared errors.

There are two ways to simplify the linear rule: First, the cues are not added, but are simply inspected one-by-one based in a prespecified order; as soon as a cue is found which discriminates between the two cities (e.g., the basketball-team cue), a decision is made based on that cue alone, ignoring the remaining cues. Such heuristics are *noncompensatory*; the decision made based on the first discriminating cue cannot be compensated by the remaining cues, even if those cues would, if considered, lead to an alternative decision. Elimination by aspects and take-the-best are examples of noncompensatory heuristics. These heuristics weight, but do not add, cues. The second way of simplifying the linear rule

is to ignore weights and simply add cues. This heuristic is called tallying.

Because they use less information and computation relative to the general linear model, are noncompensatory decision rules and tallying necessarily less accurate? In previous work, it has been shown that the noncompensatory heuristic take-the-best achieves perfect accuracy if the true cue weights are noncompensatory (i.e., the weight of the first cue is greater than the sum of all other cue weights and so on; e.g., for four cues, the weights 4, 2, 1, and 0.5 are noncompensatory) and these weights are known. Tallying achieves perfect accuracy if the true cue weights are equal, in which case the cue weights are termed fully compensatory. More generally, the space of true cue weights is populated by sets of weights that are neither noncompensatory nor fully compensatory. In such cases, which decision rule is most accurate? One possibility is that take-the-best and tallying perform much worse than, say, the perfect benchmark of the linear rule which uses the true cue weights.

This turns out not to be the case. Enumerating all possible data sets comprised of binary cues, previous research has found that, for a wide range of compensatory cue weights and across different sizes of the consideration set (i.e., the set of decision alternatives, e.g., the cities that are compared according to homelessness rate), take-the-best and tallying achieve near-perfect performance. For example, if there are three or four binary-valued cues, one of take-the-best, tallying, or both, achieve at least 96% accuracy for each combination of cue weights and consideration set size. Two of our recent studies have provided explanations for this intriguing finding.

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Şimşek, Ö. (2013). Linear decision rule as aspiration for simple decision heuristics. *Advances in neural information processing systems: Vol. 26. Proceedings of the 27th Annual Conference on Neural Information Processing Systems, December 5–8, 2013, Lake Tahoe, Nevada, USA*. Red Hook, NY: Curran Associates.

Table 1
Are Noncompensatory Cue Weights Necessary for Noncompensatory Decision Rules to Perform Well?

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
(a)																
Consideration set size																
Take-the-best accuracy	98	98	97	96	96	96	96	97	98	99	99	100	100	100	100	100
Tallying accuracy	94	91	91	92	94	96	97	99	99	100	100	100	100	100	100	100
(b)																
Consideration set size																
Take-the-best accuracy	92	88	87	88	90	92	94	96	97	98	99	100	100	100	100	100
Tallying accuracy	99	99	99	99	100	100	100	100	100	100	100	100	100	100	100	100

Note. In (a), the accuracy of take-the-best and tallying (in % of correct inferences) are shown as a function of the size of the consideration set for four cues and with cue weights that are the least compensatory. Both take-the-best and tallying reach 100% accuracy when the size of the consideration set increases. Are compensatory cue weights necessary for compensatory decision rules to perform well? In (b), the accuracy of take-the-best and tallying (in % of correct inferences) are shown as a function of the size of the consideration set for four cues and with cue weights that are most compensatory. Again, both take-the-best and tallying reach 100% accuracy when the size of the consideration set increases.

Katsikopoulos (2013) derived expressions for the accuracy of take-the-best and tallying as a function of the cue weights, the size of the consideration set, and the number of binary cues. For four cues, with cue weights that are the least compensatory (e.g., cue weights of 4, 1, 0.75, and 0.5), Table 1a compares the accuracy of take-the-best and tallying as function of size of the consideration set. Table 1b compares the decision rules for the most compensatory weights (e.g., cue weights 3, 2.5, 2, and 1.25). These results confirm that heuristics are, under some conditions, robust to apparently unfavorable cue weights. As can be seen in Table 1a, although cue weights which are highly noncompensatory do not in general favor tallying, this simple strategy achieves 100% accuracy when considering 10 or more alternatives. As can be seen in Table 1b, although highly compensatory cue weights do in general favor take-the-best, this compensatory strategy achieves perfect accuracy when considering 13 or more alternatives.

In a related study, Şimşek (2013) considered the degree to which natural environments have a noncompensatory structure. For a large number of environments, the most predictive linear rule was identified for each environment using statistical and machine learning techniques, including regularized linear models. The resulting cue weights were, by and large, compensatory (in 83% of the data sets). However, as Figure 2 shows, the corresponding noncompensatory decision rule, which uses substantially less information than the linear rule, competed very well with the linear rule and could, in some data sets, achieve higher predictive accuracy. Thus, we again see a noncompensatory decision rule performing very well even though the environments are largely compensatory. Why is this? Şimşek pointed out that even if the environment is compensatory, the cue values might be such that cues with smaller weights do not in fact compensate for the cues with larger weights. In 51 data sets, this property—termed noncompensation—

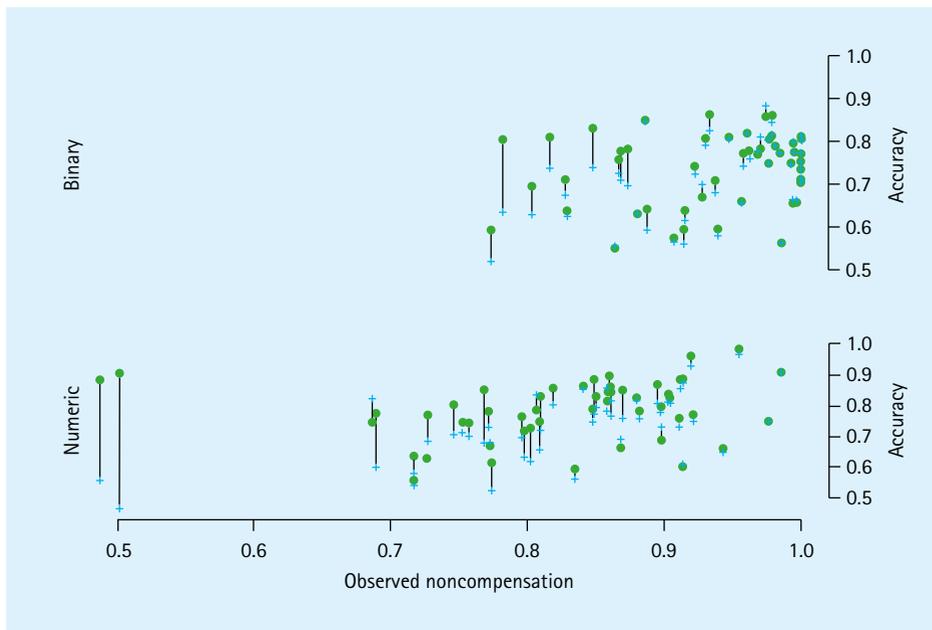


Figure 2. Relative to the best-predicting linear model for a given environment, does predictive accuracy increase or decrease when the cues are processed using a noncompensatory decision rule? Plotted as a function of the degree of noncompensation, this figure depicts the change in predictive accuracy in 51 natural environments. Environments are categorized as either containing numeric or binary cues. The accuracy of the best-predicting linear rule is shown by a green circle and the accuracy of the corresponding noncompensatory decision rule is displayed by a blue plus sign. Accuracies on the same data set are connected by a straight line.

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was observed quite frequently, as shown in Figure 2.

Intelligence in the World

In 2012, the ABC Research Group published *Ecological Rationality: Intelligence in the World*, a book detailing new contributions to the study of ecological rationality (Todd et al., 2012; see Box 1). Much of the book focuses on understanding the adaptive fit between simple heuristics and the structure of natural environments. A key step toward understanding this fit is to explain why simple heuristics—such as take-the-best—can, in many natural environments, outperform more familiar cognitive models. Taking a slightly different perspective from the work detailed above, Brighton and Gigerenzer (2012) examined the ability of simple heuristics to achieve high predictive accuracy under uncertainty, where the weights of environmental cues are not known, but have to be inferred from observations. They argue that a more thorough understanding of heuristic performance is

gained by viewing strategies as addressing what is termed *the bias-variance dilemma*.

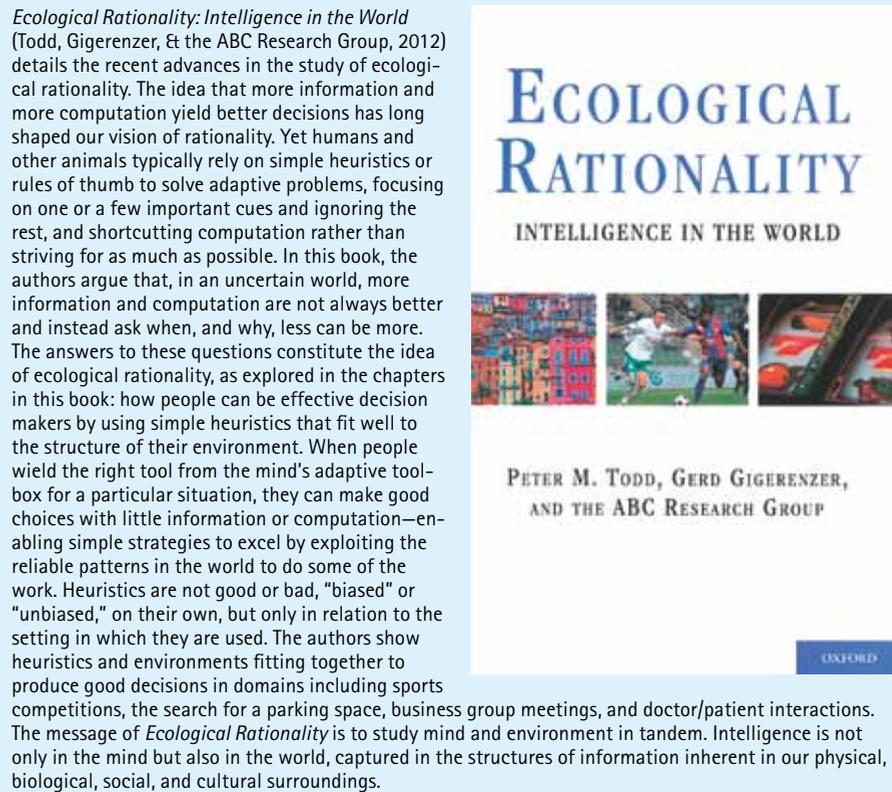
Simple Heuristics and the Bias-Variance Dilemma

All statistical models, including heuristics, err when making predictions. In a given task environment, a model's prediction error can be decomposed into bias, variance, and noise. The bias component of prediction error reflects the inability of a model to represent the systematic patterns that govern the observations. The variance component of prediction error reflects the sensitivity of the model's predictions to different observations of the same problem, such as a different sample from the same population. Together, bias and variance additively contribute to the total prediction error as follows: Total error = (bias)² + variance + noise. To achieve low bias, models should be capable of fitting diverse patterns of data. To achieve low variance, models need to restrict the range of patterns they consider in order to limit the

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Todd, P. M., Gigerenzer, G., & the ABC Research Group. (2012). *Ecological rationality: Intelligence in the world*. Oxford: Oxford University Press.



Box 1.

model's sensitivity. Under uncertainty, a model cannot do both simultaneously, and this is why all models must strike a balance between limiting bias and variance—all models face a bias-variance dilemma.

Brighton and Gigerenzer (2012) first showed that, when cue weights are not known, but must be inferred from observations, take-the-best will often outperform more sophisticated models such as the decision tree induction algorithms C4.5 and CART, the nearest neighbor classifier, and a version of take-the-best which takes into account conditional dependencies between cues (known as greed take-the-best). Figure 3 compares, in two natural environments, the performance of take-the-best and these alternative models: Take-the-best outperforms the four alternative models, all of which expend additional effort in searching for conditional dependencies between the cues. Why is this? To answer this question, Brighton and Gigerenzer analyzed the relative ability of take-the-best

and its sophisticated counterpart, greedy take-the-best, to reduce bias and variance. In two artificial environments designed to elicit extreme performance differences between the two models, Figure 4 details the predictive accuracies of the two models but also decomposes their prediction error into bias and variance. The performance differences arise due to differences in variance, crucially, because both models are noncompensatory. The performance differences cannot be explained by an appeal to properties of the decision rule: The extreme performance differences arise due to the assumptions made when inferring cue weights rather than how these weights are used once they have been inferred. These findings have significant implications. First, they provide a statistical explanation for why ignoring information can improve performance—one cannot assume that more effort will lead to better inferences, less effort can have a dramatic and positive effect on predictive accuracy by reducing variance.

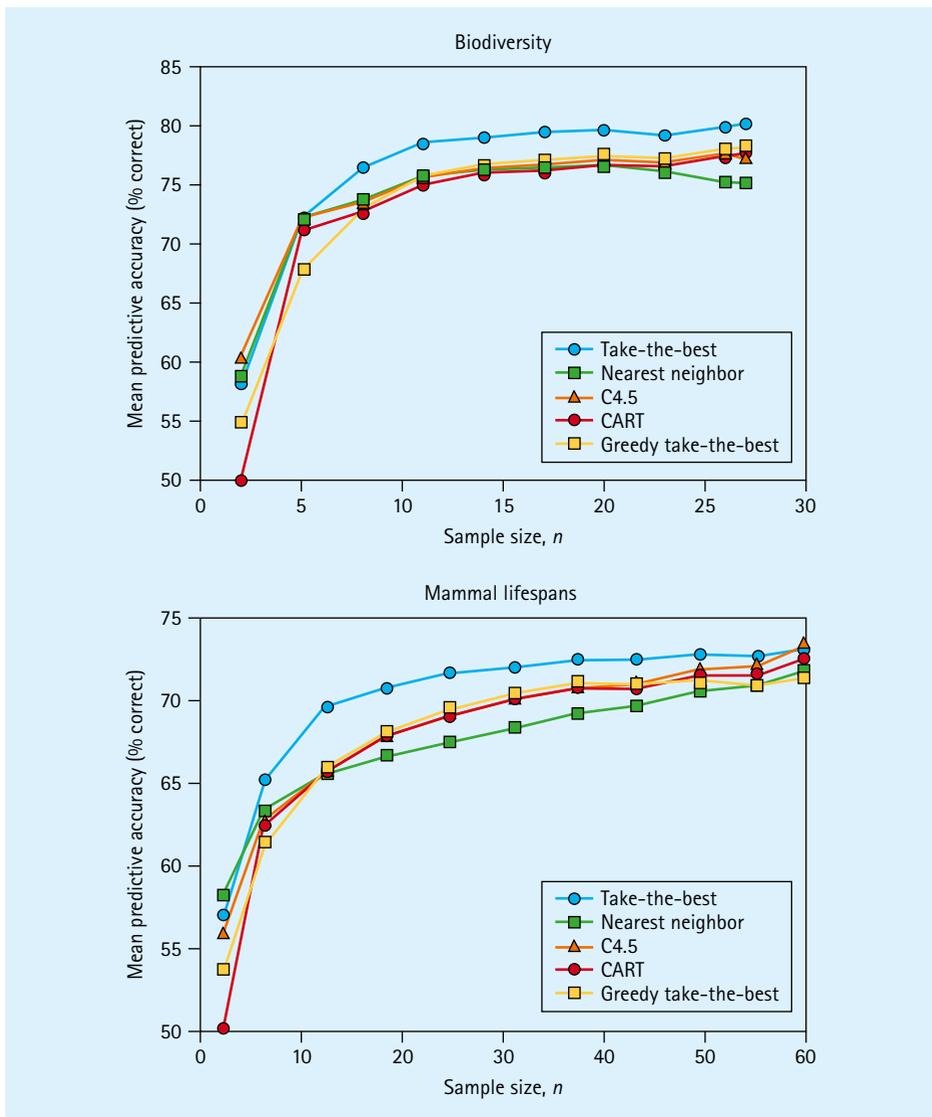


Figure 3. How well does the simple heuristic take-the-best perform in comparison to sophisticated tree induction algorithms C4.5 and CART, the nearest neighbor classifier, and a variant of take-the-best which searches for conditional dependencies between environmental cues? Here, in two natural environments, the predictive accuracies of the models are plotted as a function of the size of the sample used to estimate the model parameters. In this first environment, the task is to predict which of two Galapagos islands has greater biodiversity. In the second environment, the task is to predict which two mammals is likely to live longer. In both cases, take-the-best achieves a higher predictive accuracy than the alternative models for the majority of sample sizes.

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Second, these results suggest that improved performance is not always due to the ability of a model to accurately model the environment—variance reduction is often achieved by making simplifying assumptions when inferring properties of the environment, even though these assumptions are known not to hold true in practice.

Naïveté: The Good and The Bad

Complementing the study of the relationship between environmental conditions and the performance of cognitive models, Jarecki, Meder and Nelson (2013) investigated the relationship between environmental conditions and human behavior. Focusing on a categorization task, they considered an artificial

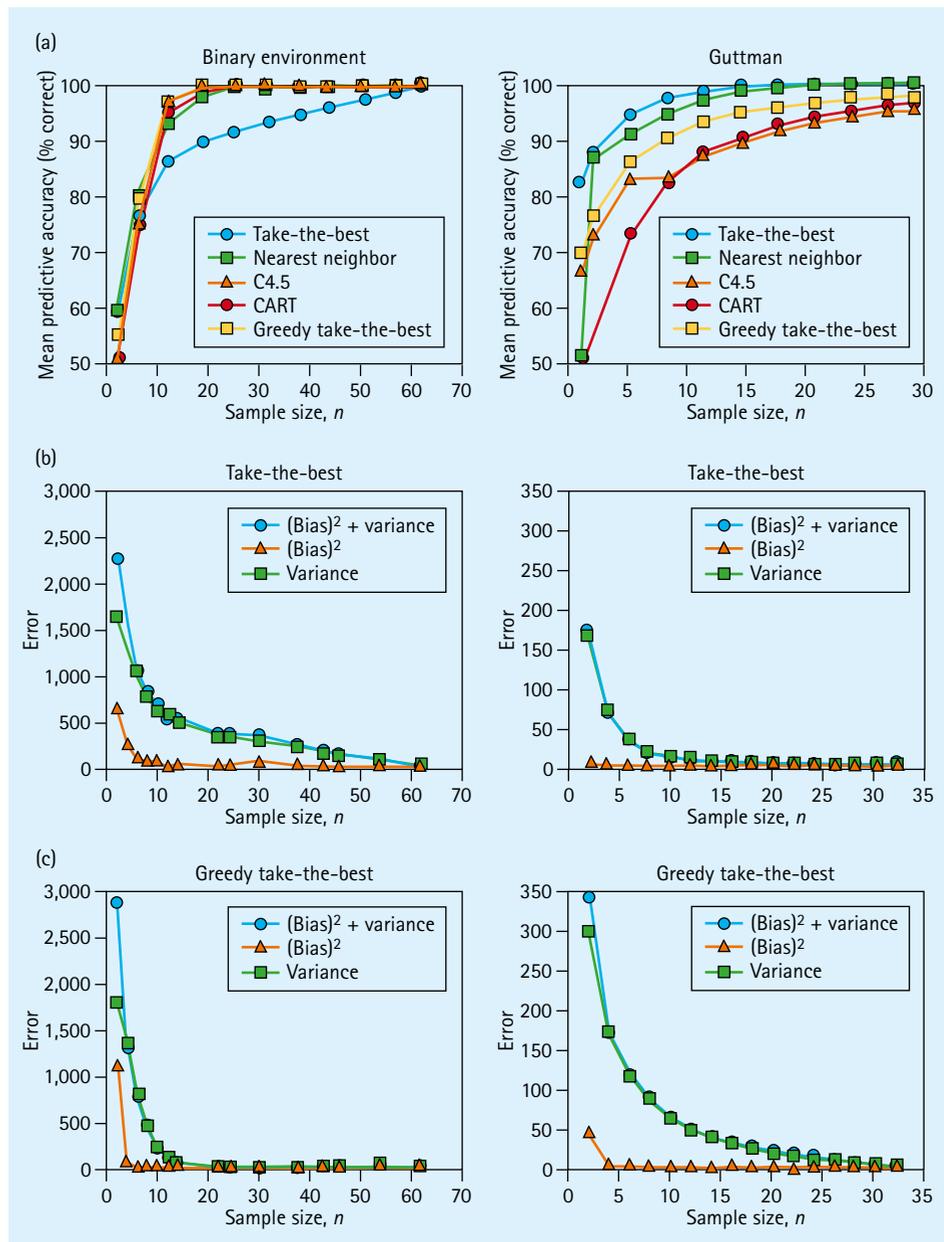


Figure 4. Why does ignoring information benefit performance? Here, the performance of take-the-best and its sophisticated counterpart, greedy take-the-best (which searches for conditional dependencies between cues) are compared in a critical test. In the left-hand column, the models are compared in a "binary" environment designed to elicit poor performance in take-the-best (top-most plots). Take-the-best performs poorly due to its relative inability to reduce variance (shown in the middle and lower plots). In the right-hand column, the models are compared in a "Guttman" environment designed to favor take-the-best (top-most plots). Here, take-the-best performs well due to its relative ability to reduce variance. In both cases, variance explains the performance differences. Note that, because both take-the-best and greedy take-the-best use a noncompensatory decision rule, these performance differences are unrelated to the distinction between compensatory and noncompensatory processing.

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environment where the cues are independent of each other, conditional on the category. For instance, if the two categories in question are "has breast cancer" and "does not have breast cancer," and two available cues are the results of a mammography and the person's family history, the cues are conditionally independent if the probability of cancer given the result of the mammography would not change if family history also became known. The label "naïve" is often used to describe the assumption of class-conditional independence.

In previous work, it has been shown that the environmental condition of conditional independence is favorable to the accuracy of heuristics such as take-the-best. Thus, to the extent that people use take-the-best, it should be the case that people believe in conditional independence. Jarecki et al. (2013) tested this hypothesis. They asked participants to play biologist and classify plankton specimens to one of two possible categories, labeled "A" and "B." The planktons had three binary cues, "eye," "tail," and "claw." Figure 5 provides an example illustration of a plankton provided to the participants.

Jarecki et al. (2013) designed statistical environments in which learners who presume class-conditional independence would make particular kinds of errors, especially early in learning. This is because, for certain configurations of features, the true category (species) and the predictions of the naïve model strongly diverge. Interestingly, the configura-

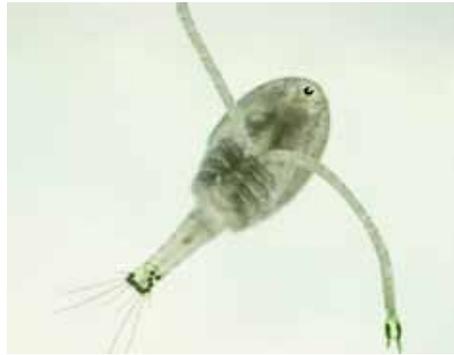


Figure 5. Image of a plankton shown to participants for categorization. Three cues were used to classify plankton: eye (located in the top right), tail (located in the bottom left), and claw (bottom right). The images were based on pictures from the Florida Medical Entomology Laboratory.

Source. Florida Medical Entomology Laboratory (with special thank to Prof. Jorge Rey and Prof. Sheila O'Connel).

tion for which the naïve model and the true probabilities most strongly diverge is also the configuration that required the greatest number of learning trials for the participants. This provides evidence for the hypothesis that people may presume class-conditional independence early in the learning process. Class-conditional independence or related assumptions provide one way that learners could make inferences early in the learning process, before accumulating enough evidence to learn the actual class-conditional dependencies among features that may apply in a particular environment.

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Social Rationality

Humans are remarkably social. No other species has such elaborate cooperative practices, exhibits so much empathy toward others, or relies so much on social learning and the cultural transmission of knowledge and values. Decades of research on social cognition seem to suggest that people suffer from a number of biases in their social judgments and behaviors. Studies of different aspects of social rationality conducted by the ABC Research Group focus on the interplay of human minds and their social environments and show that many seemingly irrational behaviors can be explained by simple rules adapted to particular environmental structures. Here, we present such recent work in the areas of cooperation, social cognition and learning, group decision making, and crowd behavior.

Key Reference

Zhu, L., Gigerenzer, G., & Huangfu, G. (2013). Psychological traces of China's socio-economic reforms in the ultimatum and dictator games. *PLoS ONE*, 8(8): e70769. doi:10.1371/journal.pone.0070769

Cooperation

Do Socio-Economic Changes Within a Society Affect Altruistic Sharing?

Zhu, Gigerenzer, and Huangfu (2013) took advantage of a natural quasi-experiment provided by post-Mao reforms in China to study people from the same society who were raised with radically different values about distribution of wealth and altruistic behavior. A main moral principle in the Mao era (1949–1976) was equal allocation, which meant state-owned productive sources, equal distribution of wealth and welfare, and no difference in workers' socioeconomic status (Figure 6). In 1978, China launched its economic reform led by Deng Xiaoping, which has resulted in enormous economic growth accompanied by changes in social values. Equal allocation gave way to allocation in terms of contribution, where the absolute level of common prosperity takes priority over equality (Figure 7).

Zhu et al. (2013) studied behavior in ultimatum and dictator games of 248 Chinese citizens from three cohorts: people born before Mao's regime (Cohort I), during the regime (Cohort II), and after it (Cohort III). They predicted and found that altruistic sharing, that is, the size of offers in the games, increased with the number of years lived in the Mao era. Cohort I, which spent the maximum time possible under Mao's regime, provided the highest offers in the games (Table 2). Also as predicted, older members of Cohort II offered more than the younger ones, while there was no correlation between age and offers in the other two cohorts, in each of which all members spent equal time under Mao. This result provides additional support that selfishness was influenced by the number of years under Mao's regime and not by age. Taken together, these results suggest that people's behavior in laboratory experimental games is strongly affected by socioeconomic values they experienced in their social environment over



Figure 6. In Mao's era, people lived in collectives and took all their meals together in a public dining room. The characters mean: "Eating costs nothing, but we need to work hard."

Source. Wikimedia Commons/Public Domain.



Figure 7. Under Deng's leadership, social-economic reforms led to modernization and changes in social values. The characters mean: "Development is the last word."

Source. Bernd Gross/Wikimedia Commons/Public Domain.

Table 2
Socioeconomic Changes Affect Sharing in Laboratory Games

	Size of offers as % of total sum		Correlation of age and offers	
	Ultimatum game Mean (SE)	Dictator game Mean (SE)	Ultimatum game r (SE)	Dictator game r (SE)
Cohort I: Born ≤ 1950	53.8 (2.3)	44.0 (3.1)	-.08 (.12)	-.30 (.12)
Cohort II: Born 1951–1975	46.0 (1.9)	38.5 (2.6)	.14 (.10)	.38 (.10)
Cohort III: Born ≥ 1976	46.1 (2.1)	35.4 (2.8)	-.06 (.11)	-.18 (.11)

Note. The table shows participants' offers and their correlations with age in the ultimatum game and the dictator game, by cohorts. Cohort I, which spent the maximum time possible under Mao's regime provided the highest offers in the games (second and third columns). Older members of Cohort II offered more than the younger ones, while there was no correlation between age and offers in the other two cohorts, in each of which all members spent equal time under Mao (fourth and fifth column) (Zhu et al., 2013).

their lifetime and, in particular, during their formative years.

Do Social Emotions Make Us Altruistic?

In the 18th century, the philosopher David Hume argued that moral judgments evolve from sentiment and immediate feelings instead of reasoning. However, existing psychological and economic research has mostly focused on the cognitive antecedents of other-regarding preferences, such as theory of mind. Developmental studies are particularly rare, and those that do exist are mostly cross-sectional rather than longitudinal. Filling this gap, our research has used longitudinal and cross-sectional designs to investigate how social emotions influence altruistic behavior in children, adolescents, and adults. Malti, Gummerum, Keller, Chaparro, and Buchmann (2012) followed a sample of 175 six-year-old children, their primary caregivers, and their teachers over a 3-year period. They show that sharing resources developmentally increased in children from 6 to 9 years of age. Sympathy toward anonymous others and feelings of social acceptance strongly predicted sharing with anonymous others in later years, even after controlling for earlier sharing, intelligence, and socioeconomic status.

Malti, Keller, and Buchmann (2013) report the data from a representative two-wave longitudinal study of 995 fifteen-year-old

adolescents followed for a period of 3 years in Switzerland. The adolescents reported their decisions and emotions regarding hypothetical moral conflicts in close friendships. Adolescents predominantly made moral decisions and reported feeling good following these decisions. However, a small number of adolescents made selfish decisions and consistently reported feeling good about these decisions.

Edele, Dziobek, and Keller (2013) continued the exploration of individual differences by investigating emotional precursors of altruistic behavior in adults. Their participants first made sharing decisions in dictator games. After 5 to 7 months they were reinvited (for the second part of the study) to assess two kinds of empathic abilities: cognitive empathy (ability to understand what another person is feeling) and affective empathy (ability to experience feelings congruent with another's emotional situation). Figure 8 shows one of the items used to measure affective empathy. Affective empathy emerged as the strongest predictor for the size of offers in the previously played dictator games, while cognitive empathy did not explain the offers. This suggests that altruistic sharing is strongly shaped by affective reaction tendencies rather than by reasoning about others' reactions. These findings fit well with Hume's contention that affect rather than reason is critical both for moral behavior and reasoning, which

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Galesic, M., Olsson, H., & Rieskamp, J. (2012). Social sampling explains apparent biases in judgments of social environments. *Psychological Science*, 23, 1515–1523. doi:10.1177/0956797612445313

has implications for educational settings. Cognitive interventions could be supplemented with interventions aimed at supporting emotional reactions of sympathy and care, thus increasing orientation toward others and decreasing antisocial behaviors.

Do Simple Heuristics Make Us Good?

Recognizing that behavior in moral situations is a form of decision making under uncertainty, Fleischhut and Gigerenzer (2013) argue that the study of simple heuristics provides a valuable perspective for understanding moral behavior. They argue that (a) moral actions are typically guided by heuristics, and (b) these heuristics are not moral rules, but social rules that are also applied outside of moral domains. They show that these two assumptions imply inconsistencies in moral behavior across situations, inconsistencies between moral judgment and reasoning, and between moral judgment and behavior. These inconsistencies have been a problem for "rational" moral theories that attribute the cause of moral behavior to some internal disposition instead of to an interaction between social heuristics and the structure of the environment.

It has been shown that simple heuristics can make us smart. In the context of moral situations, however, the question is: Do simple heuristics make us good? The answer is no. Just as simple heuristics only perform well in some environments, the same holds true for heuristics in the moral domain. The study of bounded and ecological morality does not suggest that simple heuristics make us good. But the more we know about the heuristics in the adaptive toolbox, including what triggers their use, the greater the prospects for designing environments which can make us behave better.

Social Cognition and Learning

How Do People Make Judgments About Their Social World?

Research on social cognition is dominated by demonstrations of biases in our judgments of other people. The list of biases is long and includes opposite effects such as findings of both self-enhancement and self-depreciation relative to other people. Galesic, Olsson, and Rieskamp (2012) proposed a simple social sampling model that explains these biases without assuming faulty minds. According to their model, people make inferences about

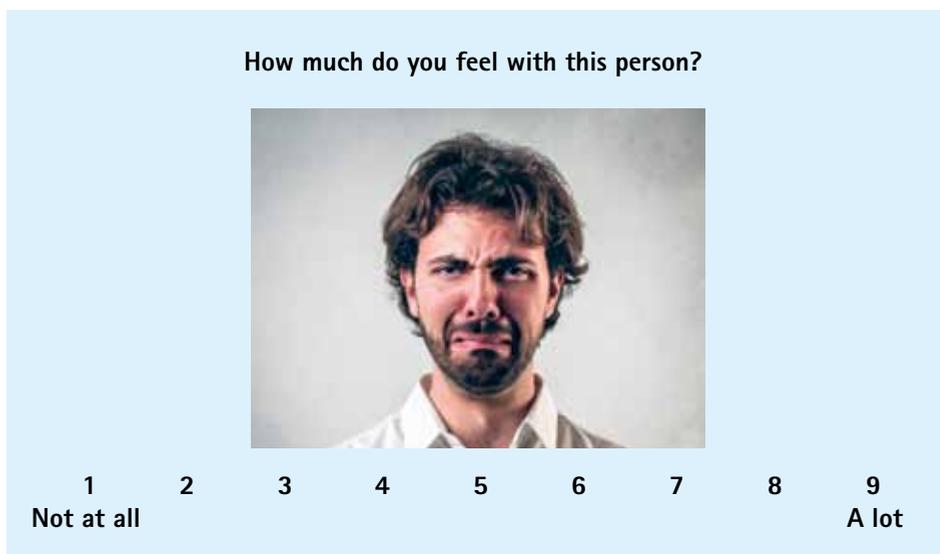


Figure 8. The face represented here is a photo analogous to the items of the MET (Multifaceted Empathy Test) used by Edele et al. (2013) to assess affective empathy. Participants with stronger affective empathy showed more altruistic sharing with anonymous others.

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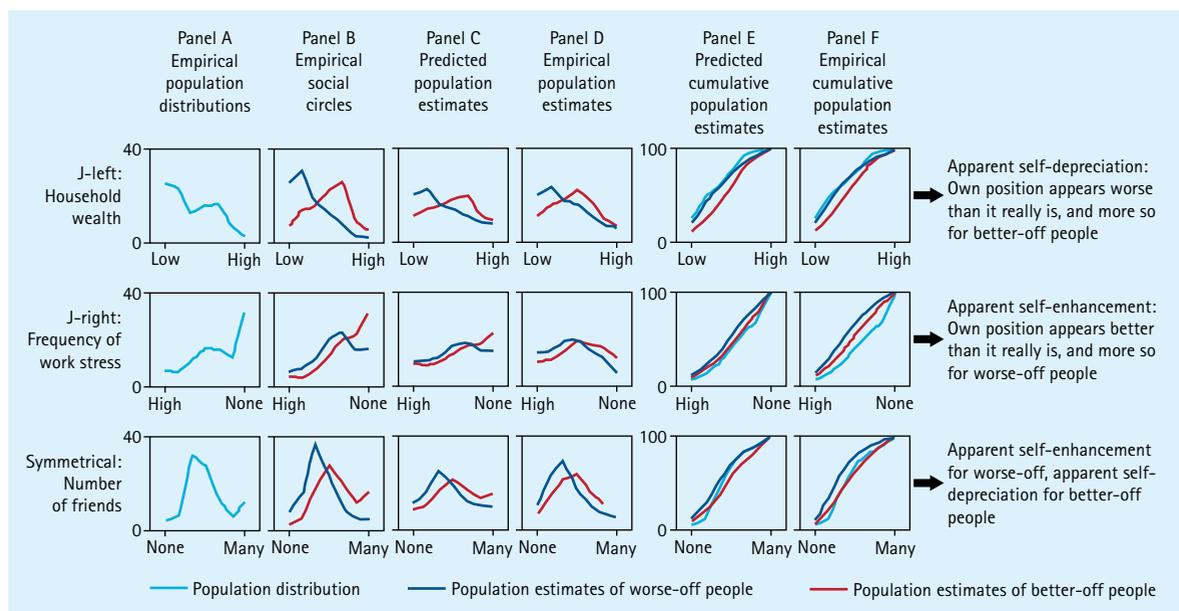


Figure 9. People make inferences about broader populations by sampling from their immediate social environments (Galesic et al., 2012). Empirical data and predictions of the social-sampling model for 3 of 10 studied characteristics of the Dutch population. The x-axes show levels of each characteristic and the y-axes show percent of people at each level. Panel A: Different characteristics have different shapes of population distributions (J-left most people doing badly, J-right most people doing well, or symmetrical). Panel B: Social environments are clustered people tend to know more people similar to themselves. “Worse-off” people are those positioned at one of the three lowest levels of a particular characteristic, while “better-off” people are those positioned at one of the three highest levels. Panel C: The social-sampling model predicts that people use their social circles to estimate population distributions, which is supported by empirical data in Panel D. Panel E: The model predicts apparent self-depreciation and self-enhancement effects that are supported by empirical data in Panel F. The social-sampling model makes two predictions about people’s estimates of their social environments. First, because of the interplay of the shapes of population distributions and the sampling process, apparent self-enhancement will occur when the underlying distribution of the general population is J-right shaped (i. e., when most people are doing well) and apparent self-depreciation when the underlying distribution is J-left shaped (when most people are doing badly). Second, because of the interplay of spatial clustering of social environments and people’s reliance on social circles when estimating population distributions, worse-off people will appear to make larger errors in their estimates when the underlying distribution is J-right shaped, but smaller when the underlying distribution is J-left shaped. All of these patterns of results occurred in previous studies, but so far no single model was able to explain them.

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broader populations by sampling from their immediate social environments. Interplay of these sampling processes and the specific structure of social environments leads to apparent biases in social perception. As shown in Figure 9, Galesic et al. (2012) tested the predictions of the social-sampling model on a large probabilistic national sample of Dutch participants who evaluated their own and others’ life circumstances. The social-sampling model better predicted the findings than existing accounts based on motivated reasoning, cognitive incompetence, egocentric focus, or simple regression effects. This work highlights the importance of studying both people’s inference processes and their environments to obtain a deeper understanding of human behavior.

What Are the Building Blocks of Social Learning Strategies?

Humans and other animals often rely on social learning when solving problems. Most studies of social learning focus only on the decision phase of social learning strategies (e. g., imitate-the-majority), disregarding the interaction between information sampling and the structure of the social environment. To begin filling this gap, Barkoczi and Galesic (2013) model social learning strategies in terms of three basic building blocks, specifying how people search for social information (e. g., by searching randomly from the whole population or only among contacts), when they stop the search (e. g., after sampling a small or large number of social contacts), and how the decision is made (e. g., by imitate-

Key Reference

Barkoczi, D., & Galesic, M. (2013). Social learning in complex networks: The role of building blocks and environmental change. In M. Knauff, M. Pauen, N. Sebanz, & I. Wachsmuth (Eds.), *Cooperative minds: Social interaction and group dynamics. Proceedings of the 35th Annual Conference of the Cognitive Science Society* (pp. 1821–1826). Austin, TX: Cognitive Science Society.

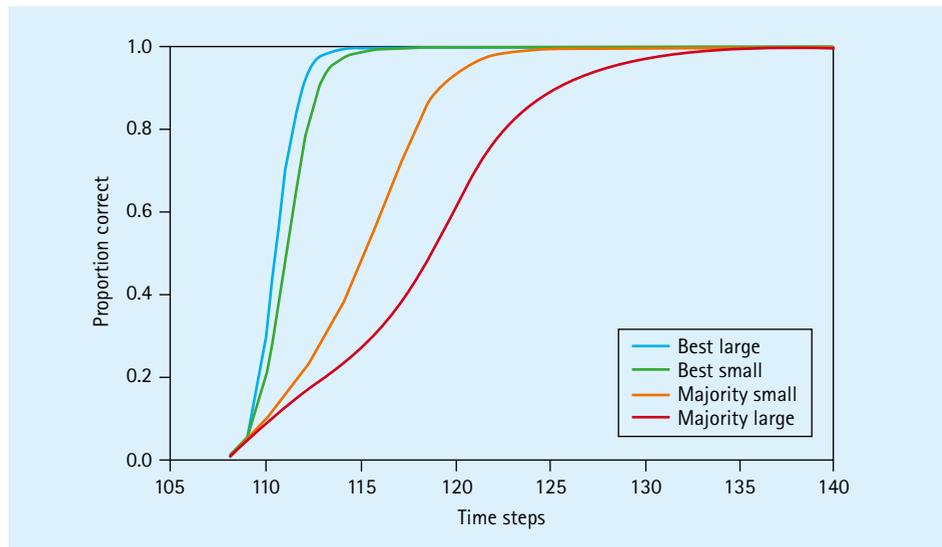


Figure 10. Smaller samples can trump larger samples (Barkoczy & Galesic, 2013). Here, the task was to make repeated decisions between two options where one option was correct and the other incorrect and, over time, the environment may change, rendering previously learned information obsolete. After environmental change, when most agents possess outdated information, imitate-the-majority benefits from smaller rather than larger samples.

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the-majority or imitate-the-best). Their results revealed that, under the assumption that the best member can be reliably identified, imitate-the-best almost always outperforms imitate-the-majority because it is faster to respond to environmental change. However, while searching for more agents always benefits imitate-the-best, less exhaustive search helps imitate-the-majority after environmental change, when most agents possess outdated information (see Figure 10). This counterintuitive result occurs for three reasons: (1) a smaller sample is more likely to include a majority of agents with the correct option; (2) while the correct option is in minority, a smaller sample keeps the overall accuracy of the group higher compared to a larger sample; and (3) smaller samples require fewer instances of correct behavior to reach a decision in favor of the correct option, allowing for faster learning.

Group Decision Making

When Can Diversity Trump Ability in Group Decision Making?

In decision-making tasks, it is often unclear what is more important for group perfor-

mance: diversity among its members or their individual abilities. Luan, Katsikopoulos, and Reimer (2012) addressed this issue in a simulation study in which they manipulated agents' individual accuracy and group diversity. As Figure 11 illustrates, Luan et al. (2012) compared performance of groups with members using these two heuristics while varying several external factors, including differences between cue validities and errors in information that agents had about cue values. They found that individual accuracy was more important than diversity when cue validities differed substantially. In contrast, when all cues had similar validities, diversity was more important than accuracy. Surprisingly, Luan et al. (2012) also found that erroneous information agents had about cue values had a nonlinear effect on group accuracy, as shown in Figure 11. With a larger error magnitude, group performance started to get better, reached its best at some intermediate error level, and only got worse slowly afterward. In other words, the right magnitude of information errors could actually help a group make better decisions than when there was no error. This

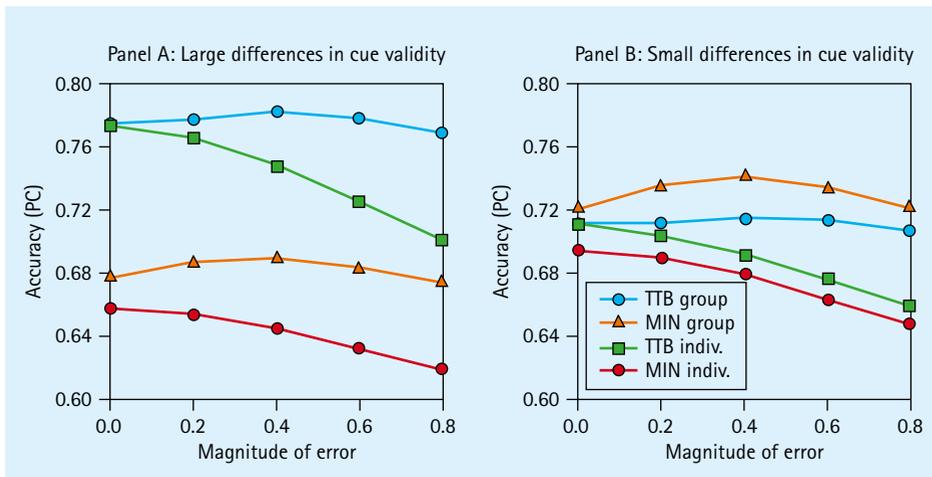


Figure 11. Errors in information have a nonlinear effect on group decision accuracy (Luan et al, 2012). When choosing between two options described by a number of cues, individuals and groups used either take-the-best ("TTB indiv." and "TTB group") or minimalist heuristic ("MIN indiv." and "MIN group"). Agents using take-the-best tended to be more accurate, but their decisions less diverse than those using minimalist. Agents were embedded in groups of five and a simple majority rule was applied to determine the group decision. Panel A shows results in an environment where there are large differences in validity, a measure for information quality, among the cues, and Panel B shows results in another environment where the validity differences among the cues are small. The magnitude of information error is measured as the standard deviation of a normal distribution from which random errors are generated and then added to true cue values.

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rather counterintuitive result was observed no matter which strategy, take-the-best or minimalist, agents were using and how cue validities were distributed. How can this be explained?

Luan et al. (2012) speculated that the answer lies in the opposing effects that information errors have on group decisions. On the one hand, the information errors undermine individual agents' performances and drag the group's performance down. On the other hand, those errors diversify the information searched by a group of agents and their individual decisions, and this increased diversity increases the group's performance. These two opposing effects are always present, but do not always cancel each other out perfectly. With smaller magnitudes of errors, the gain of group accuracy due to added diversity compensates for the loss due to reduced individual accuracy, resulting in a net accuracy gain. As the magnitude of errors increases, the gain reaches its maximum at some intermediate level, with its exact value depending on factors such as the strategy used, the cue validity distribution, and the size of the group.

Finally, when there is too much error, the group accuracy gain disappears, and groups perform below the level they could have achieved with no information error. These results demonstrate that "flawed" individuals may rely on groups to achieve levels of performance that they cannot reach alone and imply that groups should be tolerant of, and even welcome, occasional errors made by its members.

How Do Groups Make Decisions Under Uncertainty?

In two projects, Kämmer and her collaborators apply the framework of ecological rationality to the group level in order to explain some of the heterogeneous findings of research on group decision making. The ecological rationality perspective assumes that no decision strategy is good or bad per se; rather, its success depends on the structure of the environment and on the composition of the group. Kämmer, Gaissmaier, and Czienskowski (2013) compare the learning success of individuals and dyads in a multi-attribute paired-comparison task, where

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Luan, S., Katsikopoulos, K. V., & Reimer, T. (2012). When does diversity trump ability (and vice versa) in group decision making? A simulation study. *PLoS ONE*, 7(2): e31043. doi:10.1371/journal.pone.0031043

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Kämmer, J. E., Gaissmaier, W., Reimer, T., & Schermuly, C. C. (in press). The adaptive use of recognition in group decision making. *Cognitive Science*.

participants had to learn the most adaptive strategy in an unknown task environment. They found that dyads were better able to adapt to the (changing) environment than individuals, but only when successful learning required ignoring less valid information. These results suggest that groups are superior when the environment structure requires replacing a default strategy by a more appropriate strategy. Small group research often implicitly or explicitly suggests that groups perform best if they pool all information that is available to their single group members and that their larger knowledge base makes them superior to individual decision makers. Kämmer, Gaissmaier, Reimer, and Schermuly (in press) show that this is not always the case. They examined a paired-comparison task in which the recognition heuristic can play an important role (e.g., “Which of two German companies has the higher market capitalization?”). In line with the ecological rationality perspective, they find that some groups perform—in a theoretically predictable way—better if they bet on group members who lack some knowledge, namely, those who do not recognize an object. Both of these projects show that individuals as well as small groups are able to intuitively use the most adaptive decision strategies in different choice tasks. They also reveal that group level regularities are similar to those that have been extensively studied on the individual level and thus extend the decision-making research to the practically relevant domain of groups.

Crowd Behavior

Can Complex Crowd Behavior Be Predicted by Simple Heuristics?

Understanding and modeling the behavior of pedestrians and the collective dynamics of crowd movements is a critical issue for the safe management of people in urban environments and during mass events. Moussaïd and Nelson (in press) compare two approaches to simulating crowd dynamics: outcome models that describe the behavior of pedestrians by means of analogies with physical systems and process models that describe the cognitive process underlying the behavior by means of

navigation heuristics. An example of process models is the study of heuristics described by Moussaïd, Helbing, and Theraulaz (2011). They suggest that the movements of a pedestrian can be described by the interplay of two simple navigation heuristics: The first describes how pedestrians choose a walking direction by searching for deep empty spaces in their field of vision. The second rule describes how pedestrians adapt their walking speed by keeping the time to collision with surrounding obstacles above a certain threshold time. The combination of these two heuristics predicts the emergence of many self-organized crowd patterns, such as the highway formation, stop-and-go waves, and the sudden transition to crowd chaos at extreme densities—a phenomenon that has been observed during recent crowd disasters. Moussaïd and Nelson (in press) show that process models constitute a simpler and more realistic description of crowd movements compared to sophisticated and idealized outcome models. This research could help urban planners to design better exit routes for evacuation of large crowds from buildings and to adapt the environment for a safe planning of mass events.

How Do Ideas Spread in Large Groups?

The dynamics of collective opinion formation has important implications for understanding a range of social phenomena. Based on the results of laboratory experiments, Moussaïd, Kämmer, Pipergias Analytis, and Neth (2013) show how participants answering factual questions revise their initial judgment after being exposed to the opinion of others. By means of a simple model derived from empirical observations, they have studied how the collective opinion changes in a large group of people repeatedly, influencing one another. The results, detailed in Figure 12, show that two major mechanisms determine the collective opinion: (1) the expert effect, induced by the presence of a few highly confident individuals in the group and (2) the majority effect, caused by the presence of a critical mass of laypeople sharing a similar opinion. This work opens practical applications for the management of conflicting situations in

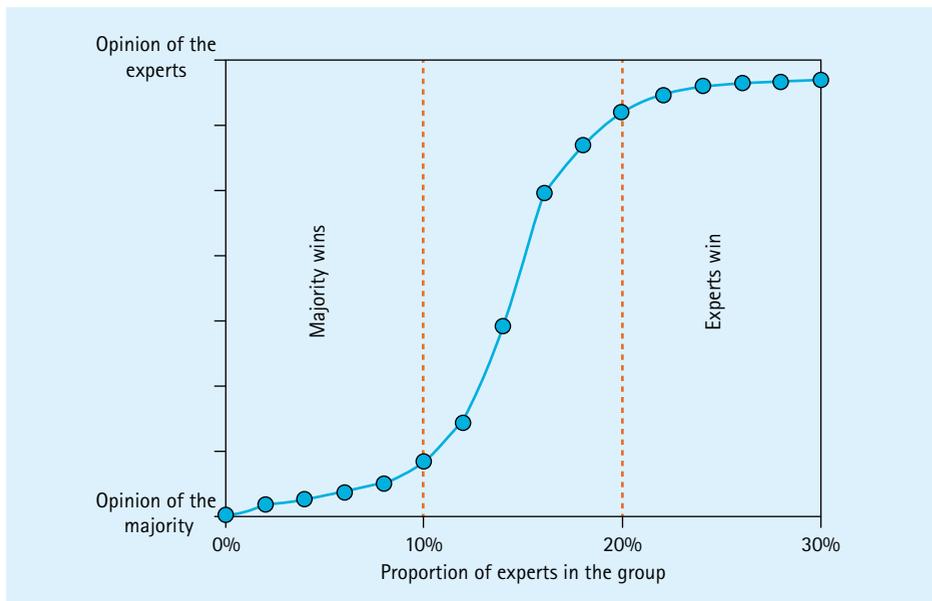


Figure 12. Computer simulations indicating the collective opinion of a population in which a large majority of laypeople interact with a small minority of highly confident experts (Moussaïd et al., 2013). At least 20% of highly confident experts are needed to counterbalance the strength of the majority.

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which well-informed minorities challenge the views of a large majority of laypeople, such as helping doctors convince a population of laypeople to adopt certain disease prevention methods or preventing extremist groups from taking control of a large population of people.

Can Election Results Be Predicted From Small, Lousy Samples?

“The trouble with free elections is, you never know who is going to win,” former political leader of the Soviet Union, Leonid Brezhnev, supposedly said. Polling agencies try to solve this problem by interviewing large representative samples of citizens to forecast elections. Gaissmaier and Marewski (2011) demonstrated that very simple forecasting models based on small unrepresentative samples can provide a surprisingly accurate alternative. They aggregated judgments on (1) which of the parties participants recognized (recognition-based forecasts) and (2) how participants think the parties will fare in the elections (wisdom of crowds). Gaissmaier and Marewski compared these forecasts to simulated polls in four major German elections and found

that recognition-based forecasts were particularly competitive when forecasting the success of smaller parties. In polls, very few people (if any) declare they will vote for smaller parties, resulting in too few observations. Wisdom-of-crowds forecasts were even more successful by drawing on the benefits of recognition while avoiding its downsides – recognition cannot discriminate among major parties and is sometimes caused by factors unrelated to success. As shown in Figure 13, a simple extension of recognition-based forecasts—asking participants what proportion of the population would recognize a party instead of whether they themselves recognize it—eliminated these downsides.

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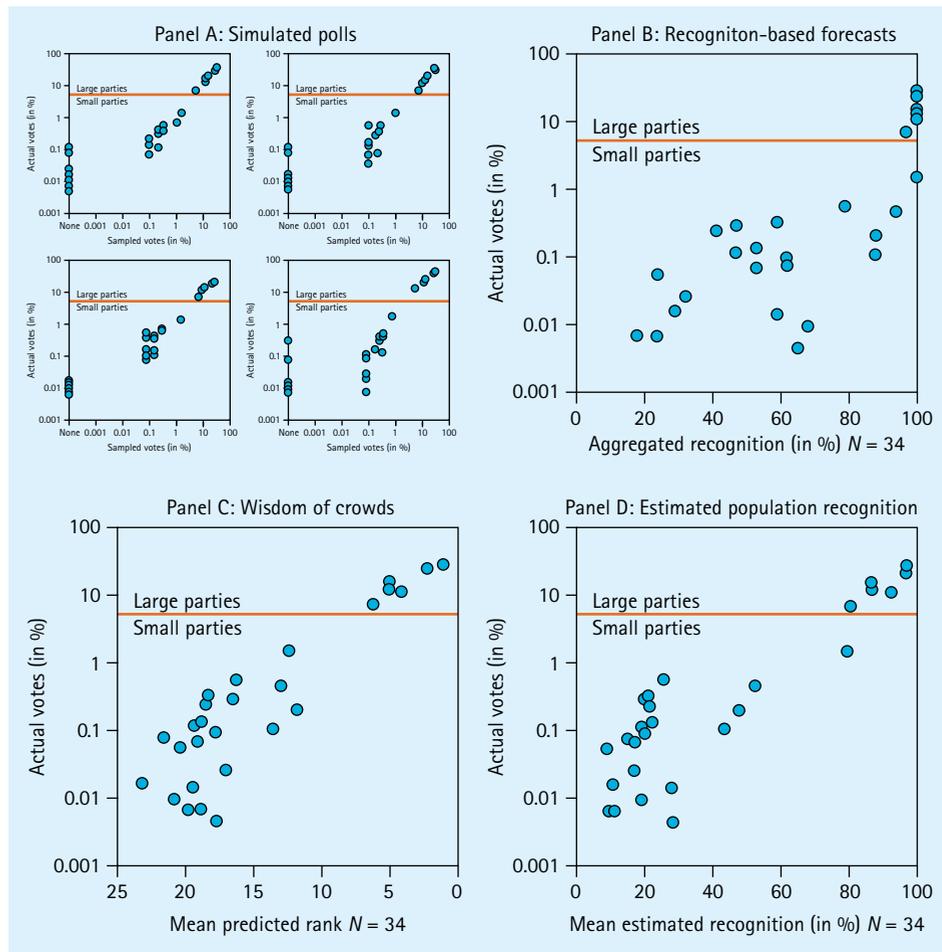


Figure 13. Comparison of four different models in their ability to forecast the success of the 27 parties in the German National Elections 2009 (Gaissmaier & Marewski, 2011). Predictors are on the x-axes and actual success on the y-axes. The orange line (large parties vs. small parties) indicates the threshold to enter parliament, which is 5% in Germany. Panel A: Shown are four randomly drawn runs from simulated polls based on the actual election results with $n = 1,000$ each. These polls work well until the share of votes of a party is smaller than about 1%, and there is a substantial risk of not at all observing voting intentions for very small parties. Panel B: Recognition-based forecasts work well for small parties, but do not discriminate among the major parties. Additionally, there are some very small parties that are nevertheless recognized by many, such as the German Communist Party (votes: 0.0044%; recognition: 65%). Panel C: Wisdom-of-crowds forecasts are generally better able to differentiate between parties than recognition-based forecasts as they draw on the benefits of recognition, but avoid its downsides. Panel D: Asking people about the proportion of the population that would recognize a party, rather than about their own recognition, also eliminates the downsides of recognition-based forecasts.

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Theory Integration

Psychologists take pride in devising new theories, models, and frameworks that differ from those that preceded them. As Walter Mischel (2009) pointed out, psychologists have a tendency to treat theories like toothbrushes—no one wants to use anyone else's. This "toothbrush" mentality has hindered progress in psychology. But much can be gained when researchers venture out of their comfort zone, learn from theories developed in other areas, and discover how these theories relate to their own. Put simply, theory integration can lead to new, surprising discoveries and provide fresh impetus for understanding puzzling problems and unexplained phenomena. The interdisciplinary nature of the ABC Research Group means that we are well-poised to explore the benefits of theory integration and, in this section, we detail some examples.

Herbert Simon's Spell on Judgment and Decision Making

In order to assess the degree to which research in judgment and decision making attempts to integrate theories, Katsikopoulos and Lan (2011) analyzed all 377 articles published from 2006 to 2010 in *The Journal of Behavioral Decision Making and Judgment and Decision Making*. The first step was to identify the articles that focus on Herbert Simon's idea of bounded rationality. The authors found 91 such articles. For each article, they judged whether it was theoretically integrative or not. Articles on descriptive theory were judged to be integrative if they contributed to building a theory that *reconciled* different conceptualizations of cognition, such as neural networks and heuristics. That is, the goal was to find those articles that helped create a metamodel that incorporated concepts from various models. Articles on prescriptive theory were judged to be integrative if they contributed to building a theory that combined elements of other methods, such as heuristics and optimization models. The goal was to identify articles that helped to create an integrated view that fuses ideas from various sources.

The main results of this exercise were: (a) The number of descriptive articles was much higher than the number of prescriptive articles (71 vs. 27) and (b) the proportion of integrative articles was higher for prescriptive than for descriptive articles. In both cases, slightly more than half the articles were integrative (67% and 52%, respectively). Overall, it seems that a substantial number of articles focus on novel effects, but not on

developing theories, which is consistent with complaints about a general lack of theory in social and cognitive psychology (Gigerenzer, 2010). The authors went on to provide more subtle examples of the lack of theoretical integration. For example, they pointed out that, in debates on the descriptive adequacy of cognitive theories, researchers were often divided into "advocates/proponents" and "critics" of different theories. In general, the authors concluded that too much time and ink have been spent on paying attention to who said what and when rather than trying to create a shared and improved understanding of the issues.

In the final part of their article, Katsikopoulos and Lan (2011) offer suggestions for fostering theory integration in research into judgment and decision making. They argue that researchers need to spend more effort on thinking about the primitive aspects of their theories (e.g., whether a model should include observable or latent variables). It was further suggested that precise conceptual thinking should be taught in classrooms, and examples should be given more exposure in textbooks.

Intuitive and Deliberate Judgments Are Based on Common Principles

Some of our judgments seem intuitive: They come to mind quickly and effortlessly without much of our awareness of their origins or of the manner of their formation. Others seem deliberate: They arise from a lengthy and painstaking thought process that is transparent and accessible to consciousness. Corresponding to this subjective experience, numerous models in social and cognitive psy-

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chology have been premised on the assumption that judgments can be formed via two qualitatively distinct processes or systems. Such dual-system models typically characterize intuitive judgments as associative, quick, unconscious, effortless, heuristic, and error-prone, whereas deliberative judgments are described as rule-based, slow, conscious, effortful, analytic, and rational. This distinction, according to Kruglanski and Gigerenzer (2011), is superfluous. Instead, they present arguments and evidence for a unified theoretical approach to intuitive and deliberate judgments: Both types of judgment are rule-based and, in fact, the very same rules (e.g., tallying and take-the-best) can underlie both. Key to understanding the formation of judgments of any kind is rule selection: How do individuals select a rule from their adaptive toolbox for a given task? Kruglanski and Gigerenzer propose a two-step process in which: (a) characteristics of the task and an individual's memory constrain the set of applicable rules and (b) the individual's processing potential and the (perceived) ecological rationality of a rule—that is, a match between the rule and the informational structure of the task with regard to performance—guide the final selection from the rule set. The following points provide further insights on the rule-selection process.

- (1) *There is no general relation between the type of rule and its difficulty of application.* Rules are based on core cognitive capacities, and individual differences in these capacities can influence the speed and the accuracy with which a rule is executed. Thus, rules typically characterized as intuitive may be easy or difficult to apply, depending on their degree of routinization and their momentary accessibility; and the same applies to rules considered deliberative.
- (2) *The greater the difficulty of application, the more processing potential is needed from an individual.* Therefore, when processing potential is limited, only easy-to-apply rules will mediate judgments. In contrast, when processing potential is high, both easy and difficult rules may be considered and selected.

- (3) *Rules' ecological rationality determines their accuracy.* Because of their better fit with the presented task, heuristics that require less effort to apply and ignore parts of the information can at times be more accurate than cognitive strategies that process more information and demand more computation.

In summary, Kruglanski and Gigerenzer (2011) suggest that the dichotomy between two separate systems of judgments is unwarranted. Though instances of judgment formation may differ in multiple ways, such as the content, effort invested, difficulty of formation, and so on, the underlying process is uniform across cases. It consists of rule application in conditions that require a given amount of cognitive resources, motivation, and core capacities.

A Signal-Detection Analysis of Fast-and-Frugal Trees

Models of decision making can be classified as the following two types: Those that aim for an optimal solution in a world that is precisely specified by a set of assumptions (a so-called "small world") and those that aim for a simple but satisfactory solution in an uncertain world where the assumptions of optimization models may not be met (a so-called "large world"). Despite the great advancement made in each model family, there have been few attempts to connect the two. Given the potential for theory integration to offer new insights, Luan, Schooler, and Gigerenzer (2011) attempted to draw connections between these two families of model. They showed how psychological concepts originating in a small-world approach to decision making, namely, the classic signal-detection theory (SDT), can be used to understand the workings of a class of large-world models known as the fast-and-frugal trees (FFT). Their conclusions were:

- (1) *The setting of a subjective decision criterion in SDT corresponds directly to the choice of the exit structure in an FFT.* This correspondence is illustrated in Figure 14. Specifically, the earlier an *s* exit, which points to a *signal* decision, and the more such exits in an FFT, the more "liberal" the FFT, which means a stronger tendency of the

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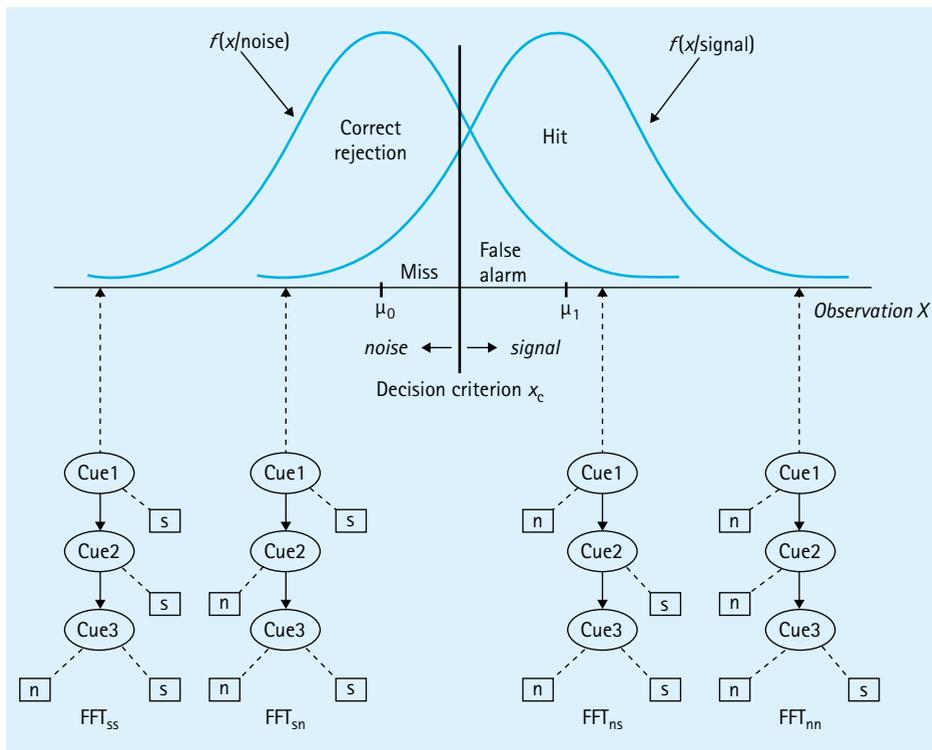


Figure 14. The correspondence between signal detection theory (SDT) and fast-and-frugal trees (FFTs) when understanding the decision criterion. The upper part illustrates the main assumptions and concepts of SDT in a binary decision task, and the lower part illustrates the four possible FFTs that can be constructed when three cues are searched in a set order. Based on the decisions pointed to by the first two exits, the trees are named from left to right FFT_{ss} , FFT_{sn} , FFT_{ns} , and FFT_{nn} . The arrows connecting the two figure parts indicate the rough locations of the four FFTs' decision criteria when they are used to make a binary s/n (for signal and noise, respectively) decision. Among the four, FFT_{ss} has the most liberal decision criterion and FFT_{nn} has the most conservative one. The decision criteria of FFT_{sn} and FFT_{ns} are less extreme than the other two, with FFT_{sn} being more liberal than FFT_{ns} .

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tree to make more *signal* than *noise* decisions relative to their base rates. Setting a decision criterion that matches the payoff structure (e.g., the penalties for miss and false alarm) and base rates of a task is one crucial characteristic of an ideal observer in the world of SDT. The exit structure in an FFT can be adjusted to result in a proper decision criterion in this regard.

- (2) *The sensitivity of an FFT is reflected by the order of cues searched and the properties of cues in an FFT.* In general, the more the cues are searched according to the orders of their d 's—a popular measure of sensitivity or accuracy in SDT—the higher the d ' of an FFT. The properties of the cues, including the mean and variance of the cues' individual d 's, the intercue correla-

tion, and the number of cues, can affect an FFT's d ' as well.

- (3) *FFTs perform well compared to the ideal and the optimal sequential sampling models in SDT.* Models in SDT are built to optimize. In a large world, where sample sizes are small, search is costly, and resources are limited, the performance of these models may fail to set the upper benchmarks as they are supposed to. FFTs can perform better or as well as these SDT models in the large world, with respect to frugality (i.e., the number of cues searched for a decision), accuracy, and expected payoffs.

These findings demonstrate the potential of theory integration to improve the understanding of common underlying psychological

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structures drawn from apparently disparate theories of cognition. They also demonstrate how discoveries can be made by examining models of one kind from the perspectives of another.

Statistical Foundations of Ecological Rationality

The distinction between small and large worlds mentioned above draws on the work of Leonard Savage (1954), the inventor of Bayesian decision theory. While Savage's theory, which he set out in *The Foundations of Statistics*, is accepted by many as providing a solid foundation for the study of rational decision making, Savage himself considered it "utterly ridiculous" to apply the theory outside what he termed small worlds, where all states, acts, and consequences are known. How does the work of the ABC Research Group, whose expressed purpose is to study decision making under uncertainty, relate to Savage's concerns? Investigating the connection, Brighton and Gigerenzer (2012) framed the study of ecological rationality as a response to what they called Savage's problem: the problem of assessing the potential

dangers of using analytic methods geared for small worlds to theorize, and make statements about, large worlds.

From a statistical standpoint, the study of ecological rationality deviates from the common practice of assuming a probabilistic model of the environment. This is why our research rarely makes claims about, or assumes the existence of, optimal solutions. Instead, ecological rationality adopts what is sometimes termed the statistical culture of algorithmic modeling, where the "true" state of nature is treated as unknown, and the statistical objective changes to making accurate predictions relative to the observations. This is why much of our research stresses the ability of simple models to achieve high predictive accuracy relative to alternative models, rather than make optimal predictions relative to a model of nature. Put simply, in a large world, the concept of optimality will always rest on assumptions which are known to be incorrect. By focusing on the question of how to make accurate inferences in a "large," uncertain world, the ABC Research Group addresses Savage's problem by adopting alternative statistical foundations.

Risk Literacy in Health

In the 1930s, H. G. Wells predicted that, for an educated citizenship in a modern democracy, statistical thinking would be as indispensable as reading and writing. At the beginning of the 21st century, nearly everyone in industrial societies has been taught reading and writing, but not statistical thinking. However, in a world that is full of uncertainty and risk, statistical thinking is an indispensable skill. The general lack of training to deal with uncertainties and risks in today's technological society has become a huge problem, which has become apparent in various recent crises, from BSE (mad cow disease), to swine flu, to EHEC (Escherichia coli), to the Euro crisis.



"Our aim is to study how people behave in risk situations. We believe that our work can contribute toward the ideal of a society that knows how to calculate risks and live with them."
Gerd Gigerenzer

Should I have a flu vaccination or not? Is it safer to travel by car or by plane? Can early-detection screening tests for cancer prolong my life? Questions like these are the research focus of a team of scientists led by Gerd Gigerenzer, director of the Harding Center for Risk Literacy.

The goal of the Harding Center is to help people to understand and assess the risks facing them. The primary focus is on health and medicine as well as educating people from childhood onward to understand statistics. By conducting studies, experiments, and surveys, researchers investigate people's problems with understanding numbers, and then find solutions. Importantly, researchers of the Harding Center often leave the laboratory to study how real people make real decisions, including interviewing experts, such as physicians, and laypeople, such as patients. Their research is published in the top international journals in medicine (including *Annals of Internal Medicine*, *British Medical Journal*, *JAMA Internal Medicine*, *Vaccine*) as well as psychological journals. Gerd Gigerenzer writes a regular column on the art of risk communication for the *British Medical Journal*. The Harding Center is also involved in the university teaching of physicians as well as their continuing education, often in collaboration with leading universities, such as the Charité Universitätsmedizin Berlin and the Heidelberg University. Members of the Harding Center give about 50 keynotes, talks, and workshops per year to the medical community. Finally, the Harding Center aims to provide understandable health information to the public in collaboration with, for example, the Bertelsmann Foundation.

The Harding Center for Risk Literacy was established in 2009. It is named after David Harding, who provided a generous endowment for the Center. Harding—global investment manager and director of Winton Capital—became aware of Gerd Gigerenzer's work after reading *Reckoning with Risk*, which was shortlisted for the Royal Society Prize for Science Books.



Box 2. The Harding Center for Risk Literacy.

Key Reference

Arkes, H. R., & Gaissmaier, W. (2012). Psychological research and the prostate-cancer screening controversy. *Psychological Science*, 23, 547–553. doi:10.1177/0956797612437428

At the Harding Center for Risk Literacy (see Box 2), we investigate how people cope with risk and uncertainty, the major obstacles to understanding them clearly, and how citizens can be informed more effectively. It is therefore important to complement laboratory experiments by studying real-world problems and how people—such as physicians or patients—make real decisions, as opposed to studying hypothetical tasks using undergraduate students. One major focus of the Harding Center is risk literacy in health. Risk literacy in health means that patients and doctors understand the benefits and harms of different treatment options so that an informed decision based on the best available clinical evidence can take place. As we demonstrated in this section, difficulties in understanding health statistics are widespread and common among physicians and politicians. As a consequence, both societal and individual decisions about health are often not based on scientific evidence. Patients should not, therefore, blindly follow the advice of their doctors. Much can be done to remedy this situation, and we will illustrate new methods to assess risk literacy in a more effective way and new ways to better inform people of the risks they face. Educated citizens are the objective. These citizens will know which questions to ask and, as a consequence, acquire a more informed (and relaxed) attitude toward health risks as well as risks more generally.

Risk Illiteracy Has Severe Consequences for Societies and Individuals

Understanding the Prostate-Cancer Controversy

In early October 2011, the U.S. Preventive Services Task Force (USPSTF) released a draft report in which they recommended against using the prostate-specific antigen (PSA) test to screen for prostate cancer. Overall, their conclusion was that the test does more harm than good because it results in many unnecessary and sometimes dangerous treatments. This, too, was the conclusion in the final report released about half a year later. The resulting furor, fueled by presidential candidates, spokespersons for advocacy organiza-

tions, and prostate-cancer survivors, involved a number of serious misunderstandings. The PSA controversy engendered rancorous “discussion” punctuated by denigrating personal attacks on the panel members by politicians and other individuals. Even faced with overwhelming evidence, such as a meta-analysis that showed that the test did not save lives, many activists and medical professionals are clamoring for men to continue receiving their annual PSA test. How can the personal belief and also the personal experience of some people be so contrary to the scientific evidence that motivated the panel’s recommendations?

Arkes and Gaissmaier (2012) discuss several factors documented by psychological research that may have contributed to the public’s condemnation of the report. They summarize studies showing that an anecdote or two can have a more powerful effect on decision making than a compendium of more reliable statistical data. When a reader of the USPSTF report tries to digest the information about statistical lives, this information does not have the same impact as information about, for example, the reader’s mail carrier’s older brother who had a positive PSA test, a biopsy, and a radical prostatectomy, and is now still alive. The information given by the USPSTF that “no trial has shown a decrease in overall mortality with the use of PSA-based screening through 11 years of follow-up” will not have the same probative value as awareness of a putative identified beneficiary of the PSA test. The positive view of the PSA test is further exacerbated because many people do not understand that a control group is needed in order to evaluate the effectiveness of a medical intervention or test: Most men who receive PSA screening and are still alive do not realize that their outcome would have been the same had they not been screened.

Psychological research is not only instructive to understand the public reaction to the USPSTF report; it has also developed more effective means to represent statistical information about clinical evidence so that it can be easily understood even by laypeople. Two very helpful representations that have repeat-

Prostate cancer early detection

by PSA screening and digital-rectal examination. Numbers are for men aged 50 years or older, not participating versus participating in screening for 10 years.

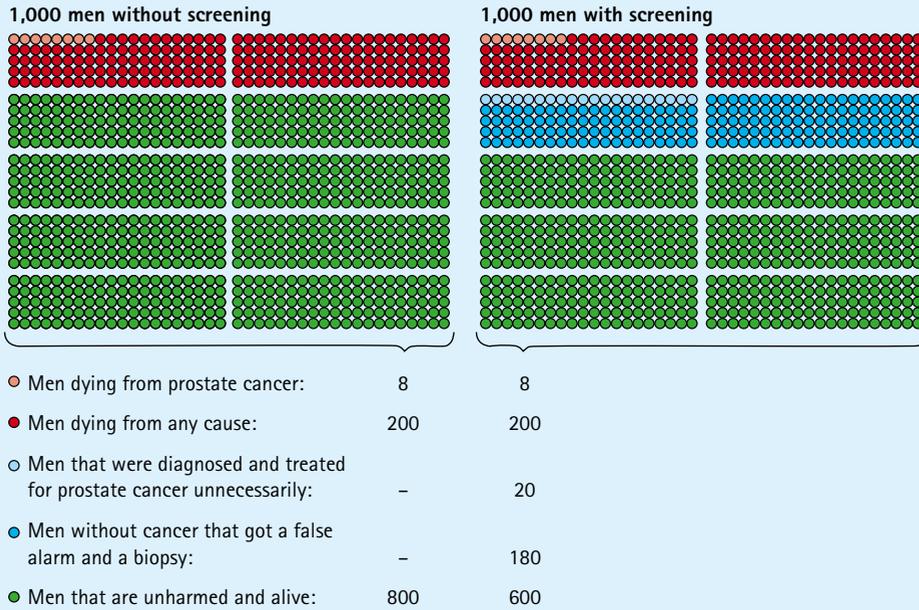


Figure 15. An icon array illustrating the benefits (or lack thereof) and harms of prostate-specific antigen (PSA) screening and digital-rectal examination for men aged 50 years and older. Based on about 200,000 men in the screening groups and as many in the control groups in randomized trials (Djulbegovic et al., 2010). After 10 years, out of every 1,000 men in the control group (left side), 200 had died, including 8 from prostate cancer. These mortality rates did *not* differ among those in the screening group (right side), but about 200 men were harmed, such as being treated unnecessarily with incontinence and impotence for life (right panel, second group). These numbers are not meant to be the final verdict on PSA screening, but rather serve to illustrate the order of magnitude of the effects. Note that in light of the most favorable evidence reported, the number of men dying from prostate cancer could be reduced from 8 to 7 out of 1,000, but in light of the total evidence, there is no such reduction. In any case, overall mortality did not decrease as a result of screening in any of the existing trials.

Source. Arkes & Gaissmaier (2012).

edly been proven to be effective are facts boxes and icon arrays. Figure 15 illustrates the benefits (or lack thereof) and harms of the PSA test with such an icon array. The authors suggest that augmenting statistics with these representations might help committees communicate more effectively with the public and with the U.S. Congress and could more generally be used to educate the public and elevate the level of civic discussion.

Risk Literacy in Health as a Prerequisite to Shared Decision Making

Risk literacy in health is not only required to have civilized and informed debates on a societal level but also for each individual patient. Doctors have been increasingly

encouraged to involve patients in decision making about their health, rather than pursuing the paternalistic model in which doctors make the decisions for their patients. However, it is not clear to what degree patients actually want to participate in medical decision making and whether their preferences are influenced by their abilities. An ability that is essential for the understanding and use of quantitative information about health, and which is therefore an essential aspect of risk literacy in health, is numeracy. Patients with low numeracy might prefer a passive role in their interactions with doctors because they have problems understanding the risks and benefits of different medical options. Extant studies cannot answer

Key Reference

Galesic, M., & García-Retamero, R. (2011b). Do low-numeracy people avoid shared decision making? *Health Psychology, 30*, 336–341. doi:10.1037/a0022723

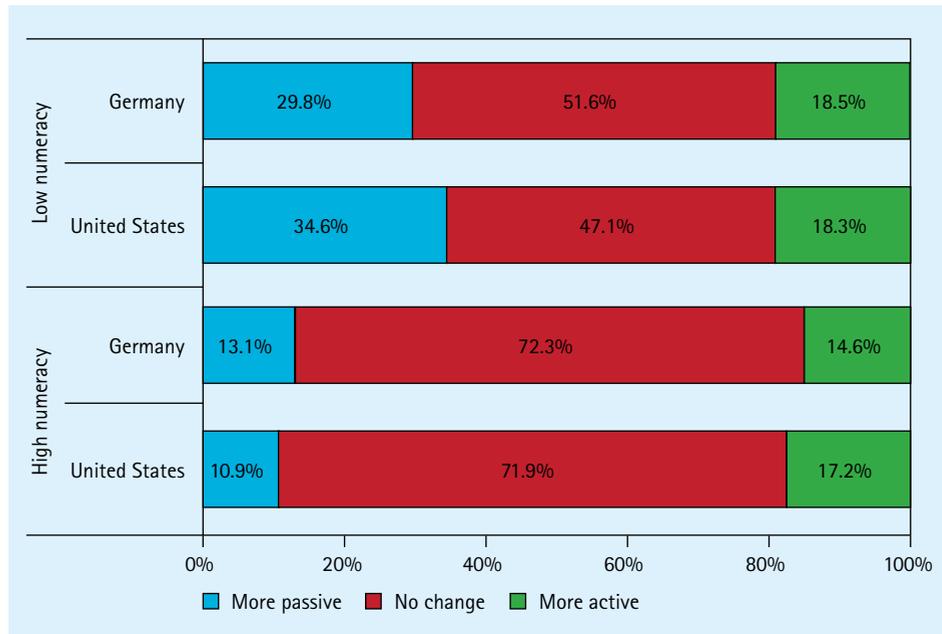


Figure 16. Divergence of usual and preferred role of patients in medical decision making by numeracy and country. Shown is the percentage of participants who would like to play a more passive role than they usually play, not to change the role they usually play, or to play a more active role than they usually play. People with low numeracy often wish to be more passive than they currently are.

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these questions because most are based on nonprobabilistic, highly selective patient samples that prevent generalizations to a broader population.

In a survey on probabilistic national samples in the United States and Germany, Galesic and García-Retamero (2011) interviewed participants with low- and high-numeracy skills and asked them about their usual and preferred role in medical decision making. The roles could be more passive (doctor makes decisions), collaborative (doctor and patients decide together), or active (patient makes decisions). Figure 16 illustrates the difference between the participants' preferred and usual role. A significant number of people with low numeracy in both the United States and Germany preferred to be more passive than they currently were. High-numeracy people, in contrast, were mostly satisfied with their current role. These results suggest that education efforts to increase numeracy as well as using nonquantitative communication formats, such as analogies and visual displays, may foster involvement of low-

numeracy patients in making decisions about their health.

Trust Your Doctor? Physicians Are Unlikely to Inform Their Patients Adequately

Some people argue that the general public will never be risk literate enough to make good decisions about their health. Rather, these decisions should mostly be delegated to the experts—physicians. There are, however, many reasons to assume that physicians will not always decide in the best interest of their patients. Besides conflicts of interest and defensive decision making, research at the Harding Center showed that physicians often do not inform their patients adequately and that many physicians themselves actually lack the skills to interpret health statistics correctly.

Patients Are Not Informed About Overdiagnosis and Overtreatment

Cancer screening looks for cancer in people without symptoms. It can produce benefits: Finding true cancer at an early stage can

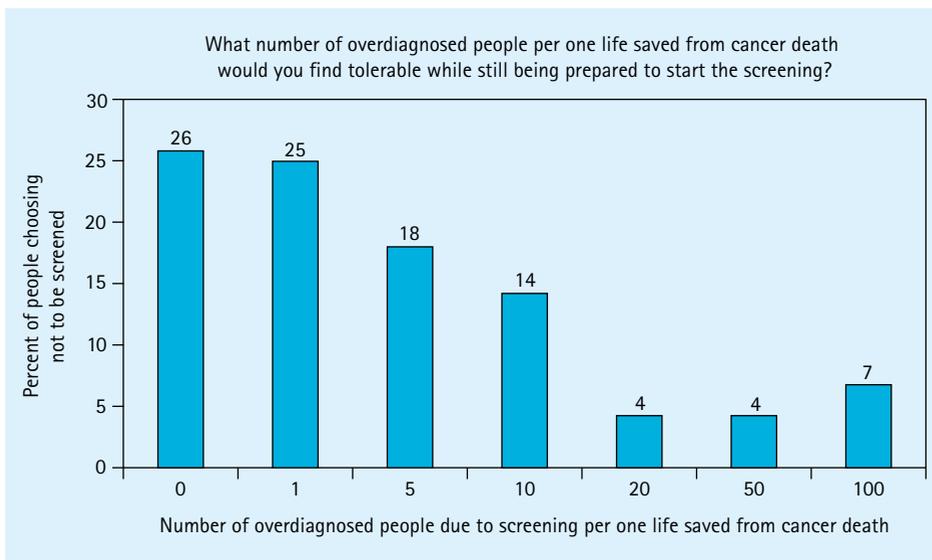


Figure 17. Faced with the decision to undergo cancer screening, how many overdiagnosed people per life saved are you willing to accept? This graph shows, as a function of overdiagnosed people per life saved, the proportion of people willing to undergo cancer screening.

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reduce the likelihood of the person dying from it. But screening can also produce harms: The most important harm is overdiagnosis, which can eventually lead to overtreatment. Overdiagnosis is defined as the detection of an abnormality that would never progress to cause problems in a patient's lifetime, such as a nonprogressive prostate cancer. Treating a nonprogressive prostate cancer is obviously not beneficial, and it can even be harmful and cause impotence or incontinence as a side effect. What do people who are offered cancer screening by their physician learn about the potential harms of screening, and what extent of overdiagnosis would they tolerate?

Wegwarth and Gigerenzer (2013) surveyed 317 men and women from the United States, aged 50 to 69 years. Of those, 83% had attended one or more cancer screenings in the past, but only 9% ($n = 30$) had been informed about the possibility of overdiagnosis and overtreatment. In stark contrast, the great majority expressed a desire to be informed: 80% of all participants said they would like to have been informed about screening harms before being screened. Of people who had not yet had any cancer screening, 34% indicated that the possibility of overtreatment had been

an argument against screening. Fifty-one percent of all participants were not prepared to enter a screening program that results in more than one overtreated person per one life saved from cancer death (see Figure 17). However, 59% would continue their routine cancer screening even if they learned that it results in 10 overtreated persons per one life saved from cancer.

For counseling on screening, the results of the study indicate that physicians remain the most highly rated source of health information. However, the information they provide does not meet patients' standards.

Many Physicians Do Not Understand Cancer Statistics

While it seems natural to assume that survival is the same as "1–mortality," the term "survival" takes on a different meaning in the context of screening. Here, the calculation of survival is based only on those people diagnosed with cancer, while mortality is based on the whole study population. To illustrate, imagine a group of patients in whom cancer was diagnosed due to symptoms at 67 years of age, all of whom die at 70 years of age. Each patient survives only

Key Reference

Wegwarth, O., & Gigerenzer, G. (2013b). Overdiagnosis and overtreatment: Evaluation of what physicians tell their patients about screening harms. *JAMA Internal Medicine*, 173, 2086–2087. doi:10.1001/jamainternmed.2013.10363

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Wegwarth, O., Schwartz, L. M., Woloshin, S., **Gaissmaier, W.,** & **Gigerenzer, G.** (2012). Do physicians understand cancer screening statistics? A national survey of primary care physicians in the United States. *Annals of Internal Medicine*, 156, 340–349, W-92–W-94.

3 years, so the 5-year survival for the group is 0%. Now imagine that the same group undergoes screening. Screening tests by definition lead to earlier diagnosis. Suppose that with screening, cancer is diagnosed in all patients at 60 years of age, but they nevertheless die at 70 years of age. In this scenario, each patient survives 10 years, so the 5-year survival for the group is 100%. Yet, despite this dramatic improvement in survival (from 0% to 100%), nothing has changed. The same people die at the same time. Thus, only reduced mortality rates prove that cancer screening saves lives, whereas improved survival rates and increased early detection do not. Nevertheless, these two statistics are often used to promote screening in high-profile medical journals and

patient leaflets alike. Do physicians who have to decide which screening tests to offer to their patient know what screening statistics to rely on?

To learn whether primary care physicians understand which statistics provide evidence about the benefits of screening, Wegwarth, Schwartz, Woloshin, Gaissmaier, and Gigerenzer (2012) presented 412 internal medicine physicians from the United States with two scenarios: In one scenario, the effect of a cancer screening X was described as improved 5-year survival and increased early detection; in the other scenario the effect of cancer screening Y was described as decreased cancer mortality and incidence. Physicians were further asked additional knowledge questions about screening statistics.

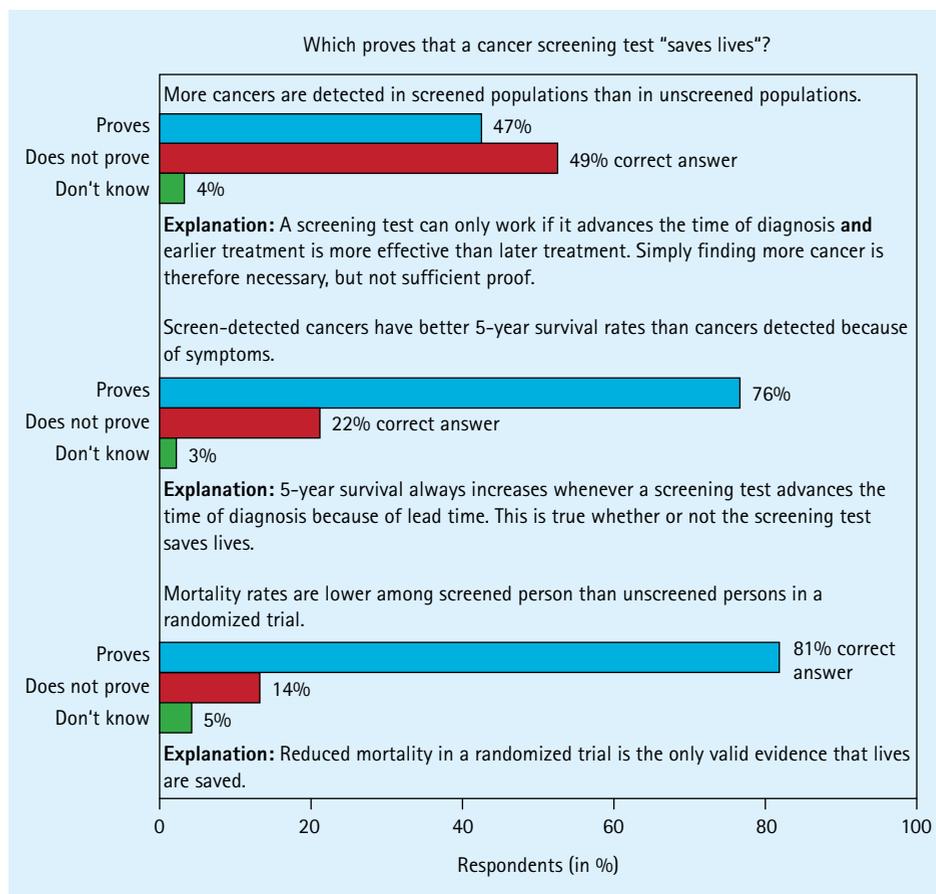


Figure 18. Only reduced mortality rates in randomized trials proves that screening actually saves lives. However, many physicians incorrectly believed that better survival rates (76%) or even just higher detection rates (47%) demonstrate that screening saves lives (Wegwarth et al., 2012).

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Primary care physicians were more enthusiastic about the test when it was "supported" by misleading evidence (5-year survival increased from 68% to 98%); in this case, 69% of physicians would definitely recommend the test. However, when actually the valid though less impressive sounding evidence about the test was provided (cancer mortality decreased from 2 to 1.6 in 1,000), the physicians were much less enthusiastic: Only 23% of them would definitely recommend the test in this case. Furthermore, many physicians did not distinguish between misleading evidence (improved survival) and relevant evidence (reduced cancer mortality) when judging the benefit of screening: 76% versus 81%, respectively, stated that these data prove that screening saves lives. About half (47%) of the physicians incorrectly believed that finding more cancers in screened as opposed to un-screened populations "proves that screening saves lives."

The majority of primary care physicians mistakenly interpreted improved survival and increased detection with screening as evidence that screening is beneficial. As shown in Figure 18, few correctly recognized that only reduced mortality constitutes evidence of benefit for screening.

Many Physicians Do Not Provide Complete and Transparent Information Even When They Have a Summary of All Relevant Clinical Evidence at Their Disposal

Because physicians are a primary source of information for patients during informed consent, it is important that physicians inform their patients both accurately and transparently. The last two examples have already shown this may often not be the case. Gaissmaier, Anderson, and Schulkin (in press) investigated in detail the statistical information physicians choose to provide their patients. To do so, they provided physicians with summary statistics describing the benefits and side effects of an antidepressant detailed in a Cochrane review summarized in Figure 19a. Cochrane reviews are considered to offer the most trustworthy summaries of clinical evidence. In one scenario, 142 physicians were asked to imagine a patient

for whom they, in principle, believed the antidepressant to be safe and effective. Which pieces of information would they choose to provide to this (hypothetical) patient? The authors assessed whether physicians chose statistical information that was complete, transparent, and interpretable, all of which is necessary to enable informed consent. *Completeness* means communicating both benefit and side effects. A *transparent* representation makes clear which proportion of people are affected by the antidepressant. An example of a transparent representation would be reporting the event rates for both the placebo and treatment groups (i.e., that the proportion increases from 5.5% to 11.4%). Alternatively, one could report the absolute risk change (i.e., that it increases by 5.9 percentage points). An example of a nontransparent representation is the use of relative risk. For example, stating that an antidepressant increases the risk of sexual problems by 107% ($100\% \times (11.4 - 5.5) / 5.5$) details a relative risk. It is well documented that relative risks lead people—including physicians and health professionals—to overestimate the effects of drugs. Finally, *interpretability* means that the information is meaningful without additional information. This is not the case when only one event rate (either under treatment or placebo) is presented in isolation without providing comparative information about the other event rate or a measure of risk change. For instance, knowing that 45% of patients who took the antidepressant got better is not interpretable without knowing that 26% who took the placebo also got better.

The results showed that only about a quarter of physicians selected information that was complete and transparent (Figure 19b). Among the remaining three quarters of physicians, it is interesting to distinguish two ways in which the information could be presented in a nontransparent way. First, it could be represented in a way that makes it difficult to impossible for the patient to understand it. This was the case for about half of the physicians who selected information that was complete, but not transparent (Figure 19c), or that was not interpretable for the patient

Key Reference

Gaissmaier, W., Anderson, B. L., & Schulkin, J. (in press). How do physicians provide statistical information about antidepressants to hypothetical patients? *Medical Decision Making*. Advance online publication. doi:10.1177/0272989X13501720

(a) The complete information that was provided to physicians

	Under treatment (%)	Under placebo (%)	Absolute risk change in percentage points	Relative risk change (%)
Benefit				
Condition improved	45.4	26.1	19.3	74
Side effects				
Dry mouth	22.4	12.1	10.3	85
Sexual problems	11.4	5.5	5.9	107

(c) 33 of 142 physicians (23.2 %) chose complete but nontransparent information (example)

	Under treatment (%)	Under placebo (%)	Absolute risk change in percentage points	Relative risk change (%)
Benefit				
Condition improved				74
Side effects				
Dry mouth				85
Sexual problems				107

(b) 32 of 142 physicians (22.5 %) chose complete and transparent information (examples)

	Under treatment (%)	Under placebo (%)	Absolute risk change in percentage points	Relative risk change (%)
Benefit				
Condition improved	45.4	26.1		
Side effects				
Dry mouth	22.4	12.1		
Sexual problems	11.4	5.5		

	Under treatment (%)	Under placebo (%)	Absolute risk change in percentage points	Relative risk change (%)
Benefit				
Condition improved			19.3	
Side effects				
Dry mouth			10.3	
Sexual problems			5.9	

(d) 36 of 142 physicians (25.4 %) chose information that was not interpretable because comparative information was missing (example)

	Under treatment (%)	Under placebo (%)	Absolute risk change in percentage points	Relative risk change (%)
Benefit				
Condition improved	45.4			
Side effects				
Dry mouth	22.4			
Sexual problems	11.4			

(e) 34 of 142 physicians (23.9 %) made the benefit appear to outweigh the harm (example, mismatched framing)

	Under treatment (%)	Under placebo (%)	Absolute risk change in percentage points	Relative risk change (%)
Benefit				
Condition improved				74
Side effects				
Dry mouth			10.3	
Sexual problems			5.9	

Figure 19. Which information do physicians choose to provide to (hypothetical) patients when they have a summary of all relevant clinical evidence at their disposal? In this scenario, 142 physicians were asked to imagine a patient for whom they, in principle, believe an antidepressant to be safe and effective. They could select from complete information shown in (a). A similar proportion of physicians (roughly 25% each) selected information that was (b) complete and transparent, (c) complete but not transparent, (d) not interpretable for the patient because necessary comparative information was missing, or (e) suited for nudging by making the benefit appear to outweigh the harm.

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Measuring Risk Literacy: The Berlin Numeracy Test

We make sense of our complex and uncertain world with data about risks that are presented in terms of ratio concepts, such as probabilities, proportions, and percentages. Whether patients, consumers, and policymakers correctly understand these risks—that is, whether or not they are risk literate—depends in part on their statistical numeracy. To assess statistical numeracy, Cokely, Galesic, Schulz, Ghazal, and Garcia-Retamero (2012) introduced the Berlin Numeracy Test, a psychometrically sound instrument that quickly assesses statistical numeracy.

The Berlin Numeracy Test typically takes about 3 minutes to complete and is available in multiple languages and formats, including a paper and pencil version and an adaptive computer test that automatically scores and reports data to researchers (see www.riskliteracy.org for more information). Figure 20 illustrates the adaptive version of the test and the path and scoring depending on which questions are answered correctly (green arrows) or incorrectly (red arrows), respectively.

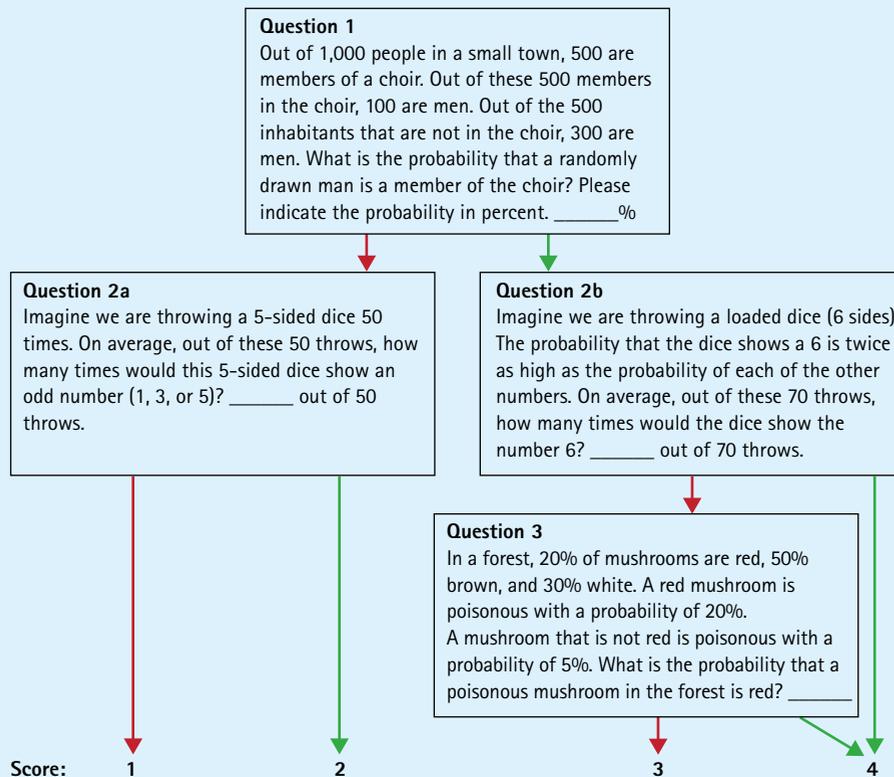


Figure 20. The Berlin Numeracy Test assesses risk literacy with two to three questions and takes only about 3 minutes to complete. The figure shows the adaptive version of the test and the path and scoring depending on which questions are answered correctly (green arrows) or incorrectly (red arrows), respectively. Correct answers are as follows: 1 = 25, 2a = 30, 2b = 20, 4 = 50.

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A total of 21 studies ($n = 5,336$) showed robust psychometric discriminability across 15 countries (e.g., Germany, Pakistan, Japan, USA) and diverse samples (e.g., medical professionals, general populations, Mechanical Turk web panels). Analyses demonstrated desirable patterns of convergent validity (i.e., that it was correlated with related constructs such as numeracy or general cognitive abilities), discriminant validity (i.e., that it was not correlated with unrelated constructs such as personality or motivation), and criterion validity (it provided unique predictive validity for evaluating both numeric and nonnumeric information about risks). Additionally, the Berlin Numeracy Test was validated by being the strongest predictor of comprehension of everyday risks (e.g., evaluating claims about products and treatments; interpreting forecasts), doubling the predictive power of other numeracy instruments and accounting for unique variance beyond other cognitive tests (e.g., cognitive reflection, working memory, intelligence).

Box 3.

Key Reference

Cokely, E. T., Galesic, M., Schulz, E., Ghazal, S., & Garcia-Retamero, R. (2012). Measuring risk literacy: The Berlin Numeracy Test. *Judgment and Decision Making, 7*, 25–47.

because necessary comparative information—primarily on the control group—was missing (Figure 19d). Second, the information could be represented in a way that makes the benefits appear to outweigh the side effects and is thereby suited to “nudge” the patient to take the antidepressant. This was the case for the final quarter of physicians (Figure 19e): They either used a technique called “mismatched framing” by presenting the benefit as relative risk change (big number), but the side effects as absolute risk change (smaller number); or they made the antidepressant look more favorable by completely omitting the side effects.

In sum, it cannot be assumed that physicians provide patients with complete, transparent, and interpretable information about a treatment, even if they have a summary of the relevant clinical evidence at their disposal. Only about a quarter of the physicians did so and thus would have enabled informed consent. The remaining three quarters of physicians failed to facilitate informed consent by either making it difficult to impossible for the patient to understand the information or by making the benefits appear to outweigh the side effects, thereby nudging patients toward taking the antidepressant.

Communicating Statistical Information About Health Risks More Effectively

What can be done to improve risk literacy in health? One promising way is to develop methods to communicate statistical information about health more effectively. Here, we discuss the use of graphical displays and analogies to help people make sense of health statistics.

Numbers Can Be Worth 1,000 Graphs: Some People Understand Numerical Representations of Risk Better Than Graphical Representations

Graphical displays are powerful tools that can facilitate the communication and comprehension of quantitative information. It is often assumed that visualizations are always preferable to numbers in risk communication, and many studies have demonstrated the benefits of graphical information. However, interpreting graphs requires additional skills

beyond understanding numerical risks. Thus, it cannot automatically be assumed that graphs are intuitively understood by everyone.

In collaboration with the Zurich University of the Arts, Gaissmaier et al. (2012) developed graphical displays of the risks of smoking and the benefits and side effects of various painkillers. In an experiment involving 275 participants, they tested how well people understood graphical representations of health statistics in comparison to presentations of the same information using only numbers. Participants' comprehension of the health statistics was assessed when working with the materials (condition T1) as well as in recall after about half an hour (condition T2) and after about 2 weeks (condition T3). The authors also assessed graph literacy (i.e., the ability to understand graphically presented information) with a recently developed and validated instrument (Galesic & García-Retamero, 2011). As shown in Figure 21, people with high graph literacy were more accurate when working with graphs than when working with numbers. In contrast, people with low graph literacy were not only not better when receiving graphical instead of numerical information but their comprehension was even worse with graphs than with numbers. Similarly, people with high graph literacy subjectively perceived graphical information to be more accessible than numerical information, while the opposite was true for people with low graph literacy. However, when asked how much they liked the representations, most participants reported that they preferred graphical representations over numbers. This was true even for participants with low graph literacy.

Taken together, the results clearly show that it cannot be assumed that statistical information is better understood when communicated using graphs as opposed to numbers. Some people are obviously better off with numbers. However, since the majority of participants preferred graphs to numbers—including those who had difficulties understanding graphs—there is clearly a need to improve graphical presentations and make them more accessible, independent of levels of graph literacy.

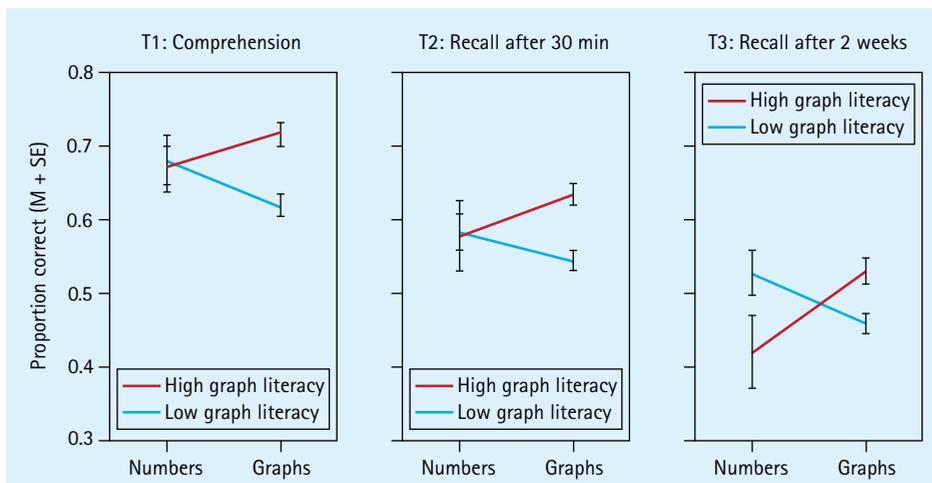


Figure 21. Gaissmaier et al. (2012) compared how well participants understood statistical information about health topics when these were represented with mere numbers or with graphs. Participants' comprehension of the health statistics was assessed when working with the materials (T1) as well as in recall after about half an hour (T2) and after about 2 weeks (T3). Graphical representations of health statistics were not better understood by everyone. Only participants with high graph literacy (i.e., high ability to understand graphical information) showed better comprehension with graphs than with numbers. Participants with low graph literacy, however, actually showed better comprehension and recall with mere numbers.

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Individual Differences in the Use of Spatial Information in Graph Comprehension

One key to the success of graphs is that they exploit the human ability to think about abstract concepts in spatial terms. Translations of spatial into conceptual information in graphs—spatial-to-conceptual mappings—are frequently rooted in our experience with the environment. For example, larger quantities of substances typically reach higher positions along the vertical dimension. This experience can be applied to infer that higher data points in graphs represent higher values. Hence, spatial features (e.g., bar heights) can convey meaning independent of the viewers' level of graph literacy. However, on some occasions, the meaning conveyed by spatial features can conflict with information in conventional features (e.g., titles, axes labels, or numerical values on scales; see Figure 22).

Okan, García-Retamero, Galesic, and Cokely (2012) investigated the impact of such conflicts on interpretations and decisions made on the basis of bar graphs depicting medical data. Results showed that people frequently misinterpreted the data, neglecting information in conventional features. Such errors were more common among individuals with

low graph literacy, indicating that such individuals more often relied on spatial features to interpret graphs. In sum, these findings indicate that caution is required to ensure that individuals with low graph literacy infer the correct meaning from graphs. Designing graphs in which spatial and conventional features convey the same meaning is an essential step toward this aim.

Using Analogies to Communicate Information About Health Risks

Doctors often use analogies to explain medical concepts to patients, but it is unclear whether analogies actually improve understanding of health information. Building on existing theories of analogies, Galesic and García-Retamero (2013) designed several analogies to explain the usefulness of medical screenings. An example is "Cancer screening is to cancer as a car alarm is to car theft." The analogy relates the domain that requires explanation (the relationship between cancer screening and cancer or the *target* of the analogy) to the domain that is better grounded in everyday experience (the relationship between a car alarm and car theft or the *base* of the analogy). Here, the

Key References

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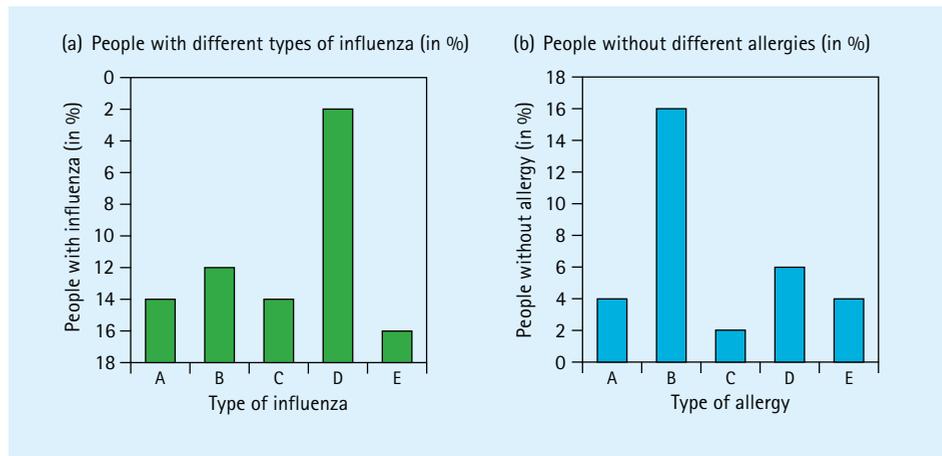


Figure 22. Examples of graphs containing conflicts between spatial and conventional features that were frequently misinterpreted in the study by Okan et al. (2012), particularly by those with low graph literacy. Such a conflict can occur when spatial features (i. e., bar heights) convey different meaning than (1) numerical values on scales (scale-spatial conflicts; left panel) or (2) textual information in the title and axes labels (textual-spatial conflicts; right panel). In both cases, a correct interpretation requires considering information in conventional features and overriding direct spatial-to-conceptual mappings (e. g., recognizing that the usual correspondence between height and quantity is reversed, implying that higher bars do not necessarily represent higher values). For instance, the graph in the left panel includes a numerical scale where values increase from top to bottom. Identifying the type of influenza affecting the largest percentage of people requires attending to the scale. The graph in the right panel presents data about percentages of people without different types of allergy. Identifying the most prevalent allergy requires attending to the title and/or the axis label.

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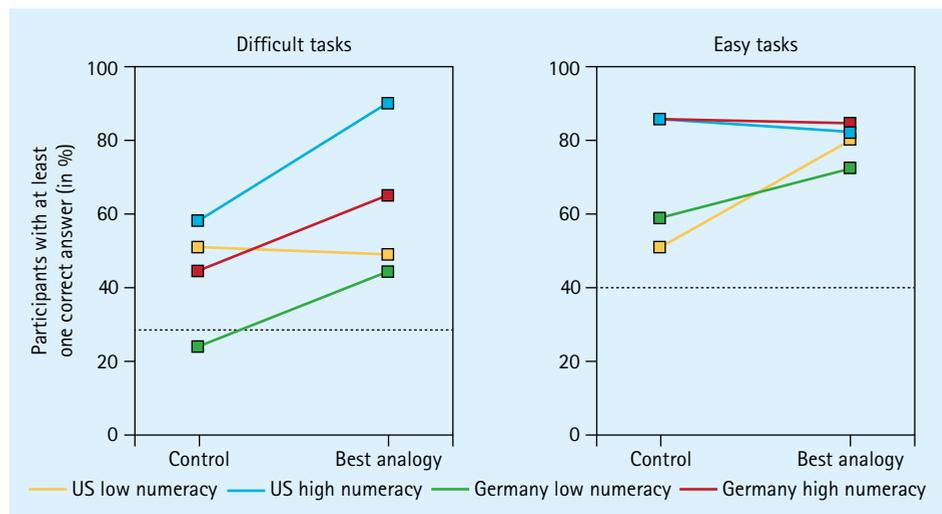


Figure 23. Percentage of participants with high and low numeracy in the United States and Germany, correctly answering at least one of the problems without analogies and with the analogy that most improved accuracy of that group. Difficulty was determined in a pretest with 400 participants in each country. The dotted line indicates chance level of performance.

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relationship that holds in the car domain (the fact that a car alarm sometimes signals theft, but sometimes gives false alarms or does not activate when it should) is also applicable to the cancer screening domain.

In a study on probabilistic national samples in two countries, Galesic and García-Retamero (2013f) investigated whether such analogies help people with low and high numeracy skills to understand easy and difficult problems involving medical screenings. They also investigated whether the helpfulness of analogies depended on the similarity of the target and the base of the analogies, familiarity of patients with the base of the analogies, and the ease of visualiza-

tion of the base of the analogies. As shown in Figure 23, they found that, for difficult medical problems, analogies helped high-numeracy people more than low-numeracy people. For easy medical problems, analogies did not further improve an already high level of understanding among people with high numeracy, but they enhanced understanding among people with low numeracy. The most helpful analogies were those with high similarity of the relationships between objects in their target and base and those with highly familiar bases. These results suggest that properly designed analogies can be useful to help patients understand complex medical information.

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Decision Making in the Wild

The study of bounded, ecological, and social rationality conceives behavior as the result of an interaction between cognition and environment. It investigates the conditions under which simple heuristics can both lead to faster, more accurate predictions and increase the transparency of the decision process. In this section, we present a selection of our work outside the laboratory, beginning with behavioral reactions to terrorism and moving on to financial regulation, sports, and slot machines.

9/11, Act II: Regional Variations in Traffic Fatalities in the Aftermath of the Terrorist Attacks

Terrorists can strike twice: first, by directly killing people and, second, through dangerous behaviors induced by fear in our minds. In the 12 months subsequent to the 9/11 terrorist attacks, there were about 1,600 more traffic fatalities in the United States than expected, presumably because fear of dread risks led people to drive rather than fly (Gigerenzer, 2006). But why would such an increase in traffic and, correspondingly, in traffic deaths be observed in some states, but not in others? And why was no increase in driving and in traffic accidents seen following the similarly devastating train bombings in Madrid in 2004 (López-Rousseau, 2005)? To answer these questions, Gaissmaier and Gigerenzer (2012) conducted new analyses.

What they found is that car traffic increased particularly in the New York vicinity, close to where the main attacks on the World Trade Center occurred. Images of these attacks, and thus the accompanying fear, appear to be particularly present for people who lived in the surrounding area; other studies also support this assumption. However, the authors further identify an even stronger factor that could explain why the traffic volume increased sharply even in some states far away from New York, especially in the Midwest: There, the infrastructure was simply very favorable to driving instead of flying, with a large number of car-friendly streets and a large number of registered vehicles in relation to the number of inhabitants (see Figure 24). The study findings support the assumption that the fear created by terrorist attacks can cause potentially risky behavior. But they also make it clear that fear alone is not enough to explain risky behavior. To predict where

the indirect damage of terrorist attacks can have particularly fatal consequences and to possibly curb similar psychological attacks in the future, one must pay close attention to the general conditions—such as the respective infrastructure—that are conducive to risky, fear-induced behaviors. This could also explain why there were fewer Spanish train travelers following the train bombings in Madrid on 11 March 2004, but without any corresponding increase in car travel. Spain has a less pronounced car-driving culture, which Gaissmaier and Gigerenzer (2012) express in numbers: In the United States in 2001, there were around 800 cars registered per 1,000 inhabitants while, in Spain in 2004, this figure was around 600.

Dread Risk

Which aspect of our brain's psychology do terrorists exploit in their second strike? Low-probability events in which many people are suddenly killed, so-called dread risks, trigger an unconscious rule of thumb: *If many people die at one point in time, react with fear and avoid that situation.*

Note that the fear is not about dying per se. It is about dying together *at one point in time*, or in a short interval. Where does this tendency to fear dread risks come from? One hypothesis is that, in human history, it was likely a rational response. For most of our evolution, humans lived in small hunter-gatherer bands that may have comprised around 100 individuals. In small bands, the sudden loss of many lives could increase the risk of predation and starvation, and thus threaten survival of the entire group.

It is difficult to test such historical explanations directly. Galesic and García-Retamero (2012) derived and tested an ingenious implication of this explanation. Although there

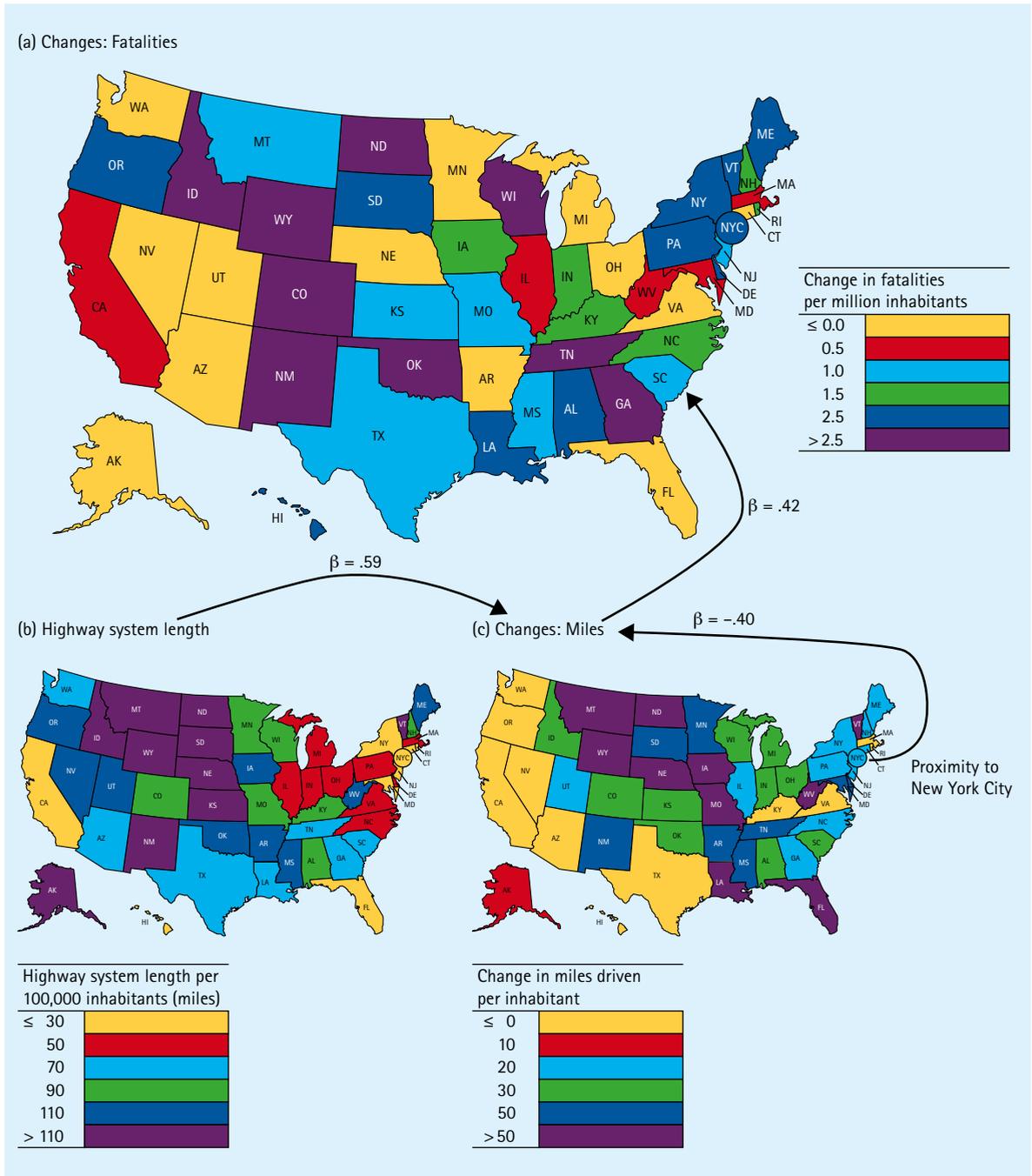


Figure 24. Maps of the United States showing by state (a) the change in driving fatalities in the 3 months subsequent to the 11 September 2001 terrorist attacks, (b) highway system length, and (c) the changes in the number of miles driven in the 3 months subsequent to the attacks. Also shown are results of regression analyses in which highway system length and proximity to New York City were predictors of changes in miles driven, which, in turn, predicted changes in driving fatalities.

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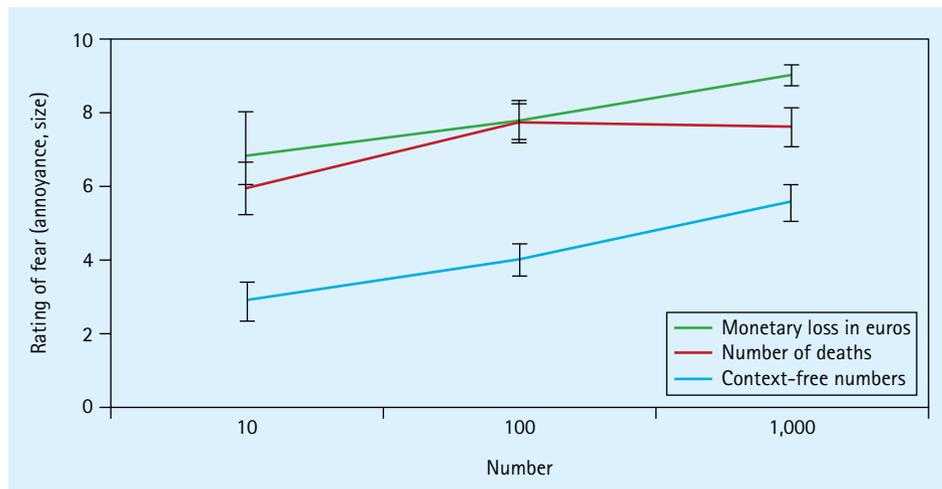


Figure 25. Ratings of fear of risks that kill 10, 100, and 1,000 people (red line), annoyance with losses of 10, 100, and 1,000 euros (green line), and size of numbers 10, 100, and 1,000 (blue line). The ratings of loss of 1,000 euros and size of number 1,000 were larger than the ratings of loss of 100 euros and size of number 100. However, fear of risks killing 1,000 people was not larger than fear of risks killing 100 people. Error bars represent ± 1 standard error.

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is some variability in the estimated sizes of human groups, past and present, these are in the order of 100 people (estimated sizes are strikingly similar for both Pleistocene groups and modern social circles, such as on Facebook). If (a) dread risk fear originates from a response to the danger that a human group will be wiped out and (b) traces of this fear still exist, then risks that kill 100 people (and thus wipe out the entire social group) should be dreaded more than those that kill 10 people, while risks that kill 1,000 people should not be feared more than those that kill 100 people. This prediction was supported in nine experiments dealing with various dangers, most of which were conducted outside the laboratory with nonstudent participants. As Figure 25 shows, the effect is specific to lives lost and is not observed for money lost, that is, when 10, 100, or 1,000 euros are lost or when no context is specified for the numbers. These results indicate that dread risk fear may indeed have an ecological origin and also stress the importance of considering social environments when studying people's reactions to dangers.

In a study on the adaptive nature of dread risks, Bodemer, Ruggeri, and Galesic (2013) tested the hypothesis that a dread risk may

have a stronger negative impact on the cumulative population size over time in comparison with a continuous risk causing the same number of fatalities. This difference should be particularly strong when the risky event affects children and young adults who would have produced future offspring if they had survived longer. The authors conducted a series of simulations with varying assumptions about population size, population growth, age group affected by risky event, and the underlying demographic model. Results confirmed their hypothesis, suggesting that fearing a dread risk more than a continuous risk is an ecologically rational strategy.

Taken together, the three studies on dread risk provide a consistent picture, indicating that (1) dread risks shape our fears and avoidance behavior, which is why an estimated 1,600 people lost their lives on the road by driving rather than flying after 9/11; (2) for dread risk fear to be elicited, the number of fatalities apparently needs to coincide with the typical size of human groups in history; and (3) dread risk appears to have been rational in environments with isolated small groups because the sudden death of a large number of its members is much more

detrimental to the survival of the entire group than if the same number of deaths occur over time. These results also highlight the domain-specificity of this emotion and the importance of risk literacy as a general skill in dealing with modern threats such as terrorism. If 9/11 ever repeats itself, terrorists should ideally face a public that does not allow them to exploit this fear.

Simple Heuristics for a Safer World of Finance

The Bank of England Project

The financial system has grown in complexity over recent years. Both the private sector and public authorities have met this complexity with complexity, whether through increasingly elaborate modeling and risk management strategies or ever-lengthening regulatory rulebooks. (The Basel Accords mushroomed from 30 pages in 1998 to 347 pages in Basel II to 616 pages in Basel III.) But this helped neither to predict nor to prevent the current financial crisis. Worse, financial models appeared to show that such a crisis was virtually impossible. In August 2007, when Goldman Sachs' flagship hedge fund lost 27% of its value from the start of the year, its Chief Financial Officer explained that "we were seeing things that were 25-standard deviation moves, several days in a row." This seems extraordinarily unlucky, considering that many models predict even a 7-standard deviation move happening only once between the Big Bang and now.

In early 2012, Andrew G. Haldane, Bank of England's Executive Director of Financial Stability, and Gerd Gigerenzer met in a meeting arranged by Mervyn King, then-governor of the Bank. The goal was to combine the economic competences of the Bank with the research on simple heuristics at the Institute. This meeting was the first of several, and a research group of four (later five) economists from the Bank regularly visited the Institute in Berlin in 2012, 2013, and 2014 as part of a project titled *Simple Heuristics for a Safer World of Finance*.

What inspired the project was the realization that an alternative is needed to traditional finance theory. Financial models may work

well in a world where risks can be reliably measured, but have consistently failed in the increasingly uncertain world since the 1980s. Research on simple heuristics has shown that, with increasing uncertainty, highly parameterized models suffer correspondingly from overfitting and prediction failure, whereas simple heuristics can be more robust and better equipped to deal with it. The key questions addressed are:

- (1) Given the failure of complex models (such as value-at-risk) to predict bank failure, can simple heuristics make better predictions? And if so, under what conditions (such as bank size)?
- (2) Given the failure of regulatory measures, what set of simple heuristics could help to create a safer world of finance?

One of the heuristics investigated was a simple, unweighted leverage ratio (the ratio between debt and capital). After the first results of our joint investigation were in, Haldane decided to change the topic of his 2012 Jackson Hole lecture at the annual meeting of the central banks in the United States. In his talk *The Dog and the Frisbee*, he argued that the way complex problems are solved by simple heuristics (e.g., the gaze heuristic used by dogs to catch Frisbees and by outfielders to catch baseballs) could serve as a model of a new approach to bank regulation. He noted that the general conditions for the ecological rationality of heuristics relative to complex models include (a) a large number of parameters to estimate, (b) relatively small samples of data, and (c) an instable or unpredictable world. Consistent with these principles, an analysis of simple leverage ratios for the major global banks in 2006 was better than an analysis of risk-based capital ratios at distinguishing between distressed and nondistressed banks. Across the banking book, a large bank may have to estimate some 1,000 default probabilities and other parameters, and the number of parameters set for the trading book can be even larger. Estimating the covariance matrix for each of these risk factors entails estimating millions of individual risk parameters. It follows that in small, simply structured banks—for instance, FDIC-insured (Federal Deposit Insurance

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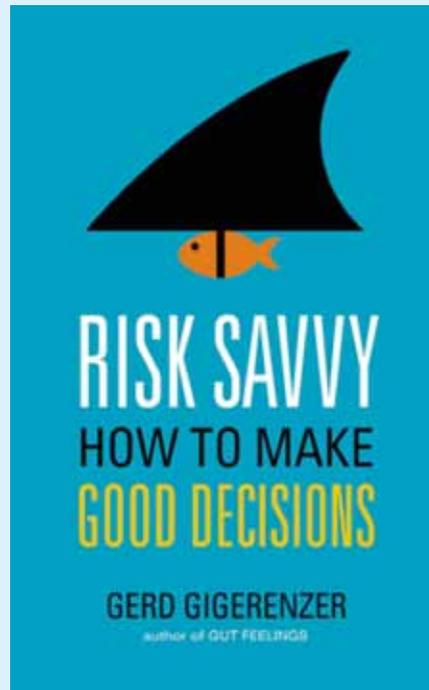
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Remember the volcanic ash cloud? The subprime disaster? How about mad cow disease? Each new crisis makes us worry until we forget and start worrying about the next one. When something goes wrong, we are told that the way to prevent further crises is better technology, more laws, and more bureaucracy. How can we protect ourselves from the threat of terrorism? Homeland security, full body scanners, further sacrifice of individual freedom. How can we counteract exploding costs in health care? Tax increases, rationalization, better genetic markers.

One idea is absent from these lists: risk-savvy citizens. And there is a reason. Behavioral economists as well as many psychologists argue that people are predictably irrational and may never learn to deal with risks due to their cognitive illusions. The political consequence proposed is paternalism, soft or hard. Based on the experimental evidence accumulated by the ABC Research Group and colleagues around the world, this book takes a different perspective: First, *everyone can learn to deal with risk and uncertainty*. This book explains principles that are easily understood by everyone who dares to know. Second, *experts are part of the problem rather than the solution*. Many experts themselves struggle with understanding risks, lack skills in communicating them, and pursue interests not aligned with yours. Giant banks go bust for exactly these reasons. Little is gained when risk-illiterate authorities are placed in charge of guiding the public. Third, *less-is-more*. When we face a complex problem, we look for a complex solution. And when it doesn't work, we seek an even more complex one. In an uncertain world, this is mistake. Complex problems do not always require complex solutions. Overly complicated systems, from financial derivatives to tax systems, are difficult to comprehend, easy to exploit, and possibly dangerous. And they do not increase the trust of the people. Simple rules, in contrast, can make us smart and create a safer world.

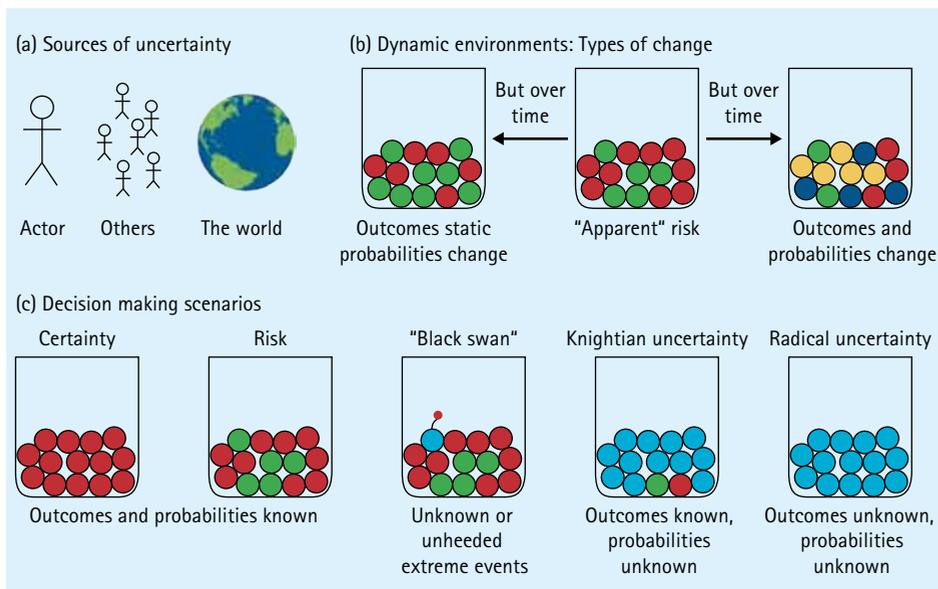


Box 4.

Corporation) banks in the United States—the complex models may pay (which the second result of our project confirmed). Haldane's talk was named *Speech of the Year* by *The Wall Street Journal*.

Since then, a number of further studies have been conducted on both questions, and the results were jointly published in the Bank of England Financial Regulation Series. Financial systems are much better characterized by uncertainty than by risk. As such, conventional methods for modeling and regulating financial systems may be flawed when the complexity is high. In these situations, simple approaches can dominate more complex ones—"less can be more." This is borne out by both simulations of capital requirements against potential losses and the empirical evidence on individual bank failures during the most recent financial crisis.

The specific results are important, but equally important is to increase awareness of an alternative to traditional finance theory, in the form of studying the ecological rationality of simple heuristics. To the many who consider heuristics to be approximations to optimal solutions, it is not yet clear that in an uncertain world, where optimization is unfeasible, heuristics may be the best strategy. As a sign of an emerging change in thinking, the term simplicity has now entered the language of bank regulation. On 8 July 2013, for instance, the Basel Committee on Banking Supervision released a press release in which "balancing risk sensitivity, simplicity and comparability" were referred to in the title. There is also a Task Force on Simplicity and Comparability, whose goal is to eliminate undue complexity from the regulatory framework.



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Figure 26. Uncertainty in its various guises. Illustrating sources of uncertainty and situations of decision making under uncertainty using an urn model. (a) Uncertainty can reside in the mind of the boundedly rational agent. Uncertainty can also result from the decisions and influences from other agents and from genuine randomness in the external environment (i. e., the data-generating process). (b) Examples of dynamic environments that involve changes in the decision-making situation over time. Left: The proportion of balls changes in unpredictable (or unknown) ways over time, therefore probability estimates at t1 are of little use at t2. Right: The outcomes themselves change over time, requiring a reformulation of the decision situation. (c) Examples of decision-making scenarios. From left to right: In situations of certainty and risk the outcomes and their probabilities are known. In a "black swan" situation, the urn contains a rare but highly consequential event ("bomb" or, in the case of a positive event, a "diamond"), which is either unknown to the decision maker or ignored in the representation of the decision situation. In a situation of "Knightian uncertainty," only the outcomes are known, but not their probabilities. The right-most situation example is of radical uncertainty, in which both outcomes and their probabilities are unknown.

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Understanding the Shades of Uncertainty

In order to develop tools that lead to a safer world of finance, understanding the distinction between measurable risk and uncertainty is essential. Uncertainty refers to situations in which risks cannot be reliably measured or where the full range of alternatives and consequences is not known in the first place. Probability theory is the proper tool for known risks, and heuristics are tools for uncertainty.

Yet some economists attribute blame to people rather than to models. A popular assumption is that economic models need to be remodeled to factor in people's apparent irrationality, their "animal spirits" or "cognitive biases." Yet the problem is that these models are not fit to accommodate uncertainty in the first place. Meder, Le Lec, and Osman (2013) argue that a critical analysis of existing mod-

els remains incomplete without a better characterization of the many forms of uncertainty with which people have to cope. For instance, high-stake decisions, such as whether to bail out banks, highlight the ubiquity of situations in which decisions need to be made in the absence of an objective basis for calculating probabilities of success.

The conceptual difference between situations in which probabilities and outcome values are known (or estimated from data) and those in which they are not was already emphasized in the seminal work of Frank Knight, who first referred to them as situations of risk versus uncertainty. Since then, however, little progress has been made in developing a more fine-grained taxonomy of uncertainty. Meder and colleagues propose such a categorization (Figure 26) and argue that, if the goal is to explain how decisions should be made,

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what is needed is a better understanding of uncertainty in its various (dis)guises. At the Cognitive Science Conference 2013 in Sapporo, they organized a workshop on the role of uncertainty in financial crises, which drew much attention.

Does the Hot Hand Exist?

The “hot hand” belief in sports refers to the conviction that a player has a higher chance of making a shot after two or three successful shots than after two or three misses (resulting in “streaks”). Beginning with a landmark article by Gilovich, Vallone, and Tversky (1985) on basketball, this belief has been usually considered a cognitive fallacy because the actual statistics do not show the effect. A key contention is that in basketball the defense will attack a “hot” player and thus prevent streaks from occurring. To address this argument, Raab, Gula, and Gigerenzer (2012) conducted the first study on the hot hand in volleyball, where the net limits direct defensive counterstrategies, meaning that streaks are more likely to emerge if a player is hot. The study addressed three questions. First, do athletes and coaches believe in a hot hand in volleyball? The answer was strongly affirmative: 91% of 115 athletes and 92% of 16 coaches believed in the hot hand. Second, and most critically, does the hot hand exist in volleyball? The answer was again yes: Depending on the criterion used, 53% of the top 26 German first-division players showed significant streaks and 46% showed significant autocorrelations. Finally, is the hot hand belief used to inform allocation decisions? Once more, the answer was yes. The experiments and systematic observations indicated an adaptive use of the hot hand belief: Playmakers allocate the ball more often to players with streaks, which leads to better performance than when allocating the ball to the player with the higher average base rate. Moreover, the study showed that coaches are able to detect players' performance variability and use it to make strategic decisions. In volleyball, the hot hand exists, coaches and playmakers are able to detect it, and playmakers tend to use it “adaptively,” resulting in more hits for a team.

Las Vegas and Slot Machines: The Illusion of Winning Is Not All in the Players' Heads

In 2007, Americans spent \$34 billion gambling in commercial casinos, considerably more than the \$600 million spent on going to the movies. To make a profit, gambling institutions are designed so that the average gambler loses money. Because gamblers can expect to lose, the fact that so many people, who are otherwise risk averse, nonetheless gamble is perplexing. A number of psychologists and economists have proposed a variety of internal causes as an explanation, from people's failure to understand probabilities to motivational illusions such as overconfidence. Yet there is another way to explain this behavior, an ecological one. False beliefs may in fact be caused by the intentional design of the external environment, not simply by internal shortcomings.

To explore this hypothesis, Bennis, Katsikopoulos, Goldstein, Dieckmann, and Berg (2012) analyzed the design of Las Vegas resort casinos. They show in detail how the casino environment is carefully designed to encourage gamblers' falsely optimistic beliefs about the probability of winning. These casino resorts have one or more floors of hundreds, sometimes thousands, of slot machines that are arranged back to back. The first type of illusory information is acoustic, delivered for instance by machines that greatly amplify the clanking of coins that drop several inches onto a metal tray in order to signal wins. When winners do not immediately collect their tokens, wins are accompanied by music at an escalating volume; the amplified sound of growing credits often accrues at a faster pace than the credits themselves, adding to the perception that players have won more than they actually have. Second, visual cues such as siren lights on top of the slot machines spin and flash whenever a major jackpot has been hit. Larger jackpots are paid by hand, and attendants are instructed to walk slowly toward the winner to extend the waiting time so that on busy nights many sirens can be simultaneously seen and heard. A third and most deceptive trick has become possible with the advent of the electronic

slot machine. Whereas the symbols (e. g., a red seven) on the interior reels of the old mechanical machines reflected what gamblers saw on the outside window, such a one-to-one correspondence no longer exists. If, for instance, the largest jackpot requires three red sevens, the gambler may see two red sevens and the foot of the third seven just one slot above the window, suggesting a near miss, even though there may not have actually been one. By inflating the number of near

misses, the outside representation creates a false perception of their actual frequency. Given that these tricks are unknown to most gamblers, no cognitive illusions are needed to explain why players overestimate the probabilities of winning. The environment provides an explanation for gambling behavior that is often overlooked in theories that search for causes inside the mind. In the casino, the illusion of winning is real; it is part of the design of the environment.

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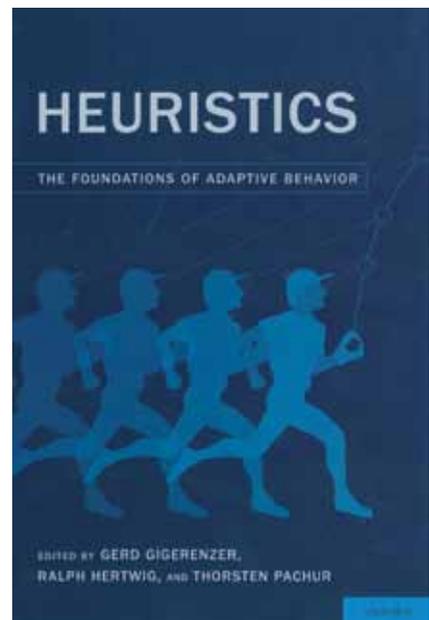
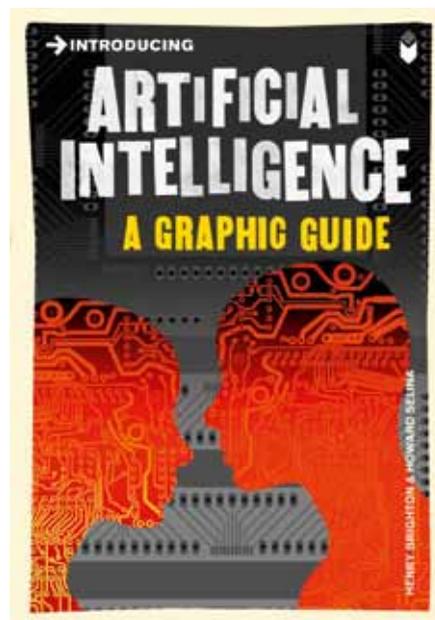
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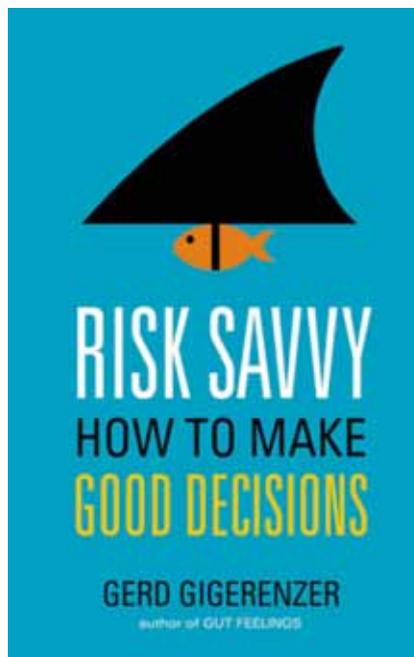
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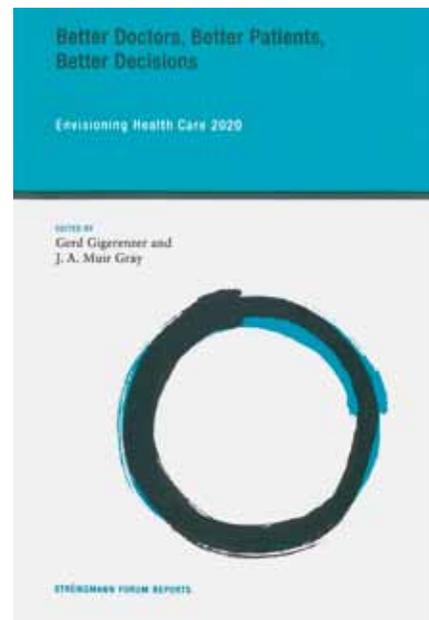
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Center for Adaptive Rationality

The Center for Adaptive Rationality

The **Center for Adaptive Rationality (ARC)** (Director: Ralph Hertwig) investigates how people make boundedly rational decisions in complex and uncertain social and nonsocial worlds. The current research focuses on (1) bounded rationality, that is, the simple heuristics that people recruit in order to navigate a complex world; (2) information search and learning as key processes in reckoning with uncertainty; (3) how decision-making strategies develop over the lifespan and respond to the challenges of cognitive aging; and (4) ways in which heuristics, mental strategies, and environments can be designed to empower citizens, patients, doctors, and policy makers to make better decisions. In each of these areas, a variety of methods are employed, including behavioral experiments, computer simulations, mathematical analyses, and neuroscientific tools.



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"Human beings viewed as behaving systems are quite simple. The apparent complexity of our behavior over time is largely a reflection of the complexity of the environment in which we find ourselves."
Herbert A. Simon, 1996

Introductory Overview

Inspired by Herbert A. Simon's notion of bounded rationality, the Center seeks to understand how flesh-and-blood decision makers of all ages cope with the staggering complexity and uncertainty of the modern world. We challenge the belief, entrenched among many scholars of the mind, that complex problems can be solved only by complex cognitive machinery. Instead, our research assumes that much of human decision making can be described in terms of simple heuristics. We study such heuristics in two broad domains, namely, games against nature and social games. We investigate how cognitive search and learning function as torchlights helping people to navigate the twilight of uncertainty. We also examine how both processes develop over the lifespan and respond to the challenges of cognitive aging. Finally, informed by insights from our research, we propose heuristics, mental strategies, and environmental changes that can empower citizens, patients, doctors, and policy makers to make better decisions. The psychologists, computer scientists, biologists, neuroscientists, and philosophers in our research group address these questions using a variety of methods, including behavioral experiments, computer simulations, mathematical analyses, and neuroscientific tools. In the following, we outline the theoretical tenets of our four research areas, reporting on work carried out between 2011 and 2013. As the Center was founded in October 2012, this report includes research conducted by ARC members formerly based at the University of Basel's Center for Cognitive and Decision Sciences. It also outlines plans for future work at the Institute.

Simple Heuristics in a Complex World

Simple boundedly rational heuristics can be as accurate as, and sometimes more accurate than, strategies that make the greatest possible use of information and computation, including optimization models (Gigerenzer, Hertwig, & Pachur, 2011a). The discovery that simplicity and accuracy are not mutually exclusive has introduced urgent new questions into the rationality debate: In which environments can a heuristic outperform a complex decision-making strategy (e.g., a Bayesian model) and in which will it lag behind? In discussions of which ecologies favor heuristics, it has often been suggested that heuristics can succeed only in nonsocial environments. Faced with complex social worlds, it is argued, heuristics are doomed to fail because their simple architecture is unequal to the task of interacting with and predicting the behavior of other intelligent (and often competitive) agents. Our approach (Hertwig, Hoffrage, & the ABC Research Group, 2013) offers an alternative to the vision of the social brain as a complex decision-making machine. The very complex-

ity of social worlds entails conditions—such as computational intractability, competing goals (e.g., fairness vs. maximization), and incommensurability (e.g., taboo trade-offs)—in which heuristics are needed because optimization is either impossible or takes more time or computational power than the decision maker can spare. But heuristics can not only substitute for complex strategies, they can also achieve goals that are relevant in many social environments and that are otherwise hard to achieve (e.g., transparency, fairness, speed). There are at least two reasons for heuristics' success: co-optation and ecological rationality. The social brain houses indisputably complex adaptations. Heuristics can afford to stay computationally and informationally lean to the extent that they cleverly co-opt these sophisticated capacities (associated primarily with the brain's frontal lobes), such as individual recognition, numerical abilities, patience, self-control, and memory (Hertwig & Herzog, 2009). Heuristics can also co-opt external structures, in which case their performance depends on the match between

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the heuristic architecture and the statistical structure of the environment in which they are used. By describing these structures, we aim to understand the conditions under which heuristics, in particular, and cognitive strategies, in general, succeed or fail. Moreover, by analyzing the interactions between simple heuristics and properties of social and nonsocial environments, we tap into another counterintuitive capacity of simple heuristics, namely, the capacity to predict and explain complex behaviors: Heuristic–environment interactions, we believe, afford elegant and parsimonious explanations for complex behaviors (Hertwig, Davis, & Sullo way, 2002).

Reckoning With Uncertainty: Search and Learning

Many human behaviors and interactions—falling in love, job interviews, marital arguments, crossing the street—lack a user’s guide detailing possible outcomes and their probabilities. Yet tools are available to help people navigate uncertainty. Decision makers can often, though not always, deal with uncertainty by searching for information and by learning. For Herbert A. Simon, external and internal search was perhaps the definitive cognitive process of human life and bounded rationality. Yet many past and current investigations and theories of choice under risk and uncertainty have largely ignored search and learning as well as the structure of choice environments. Our goal is to apply the vision of bounded rationality to a field that has been deeply wedded to domain-general neo-Bernoullian theories of choice, which often omit processes of learning and search. To this end, we bring the notion of ecological rationality to bear on life’s gambles (see Simon, 1956); we bring search back into the study of choice under risk and uncertainty (Hertwig & Erev, 2009); we explore the theoretical relationship between simple heuristics and algebraic models of choice; and we investigate the biological and cognitive foundations of cognitive search and risk taking.

Decision Making Across the Lifespan

In Cicero’s *de Senectute*, Cato, the elder, explains to two younger men how to flourish in

old age: “Nor, again, do I now miss the bodily strength of a young man [...]. You should use what you have, and whatever you may chance to be doing, do it with all your might.” Cato seems to suggest that the key to successful aging lies not in struggling to regain the strength of youth, but in using available resources flexibly to meet the aspirations and challenges one faces. Past and current research at the Institute has greatly illuminated the nature of such adaptation to aging in the cognitive realm. We aim to bring the aspect of ecological rationality to bear on this research. From this perspective, the question of how changes in cognitive capabilities—commonly gains in childhood and adolescence and declines in old age—affect decision making has no domain-general answer. Our thesis is that the impact of changes in cognitive capabilities is likely to depend strongly on the demands and affordances of specific task environments and ecologies. Thus, the quality of decisions made by people of all ages is the result of how task demands and affordances interact with heuristics and other cognitive strategies. To better understand this interaction, we aim to describe the structure of decision environments, the process of strategy selection, and the sophisticated cognitive capacities that heuristics exploit, as well as developmental trajectories of these capacities.

Empowering and Educating Decision Makers

According to Thomas Jefferson, democracy depends on an informed and educated electorate. The currently most influential approach to social engineering, however, has abandoned the goal of empowering citizens through information and education. Often called “nudging,” this approach assumes that people suffer from stable “decisional irrationalities” that lead them to make choices detrimental to their health, wealth, and happiness. Its proposal for containing the fallout from these irrationalities is to allow policy makers, for instance, to nudge people toward better outcomes by changing the default option in the decision environment. Yet while people clearly do not always make good decisions, decision making is not as egregiously

irrational as suggested by the nudge approach. Moreover, people make their decisions in a world already rife with nudges that are not designed in their interest, and the number of such contradictory, manipulative, and even malevolent nudges will always dwarf the number of those tailored by benevolent policy makers (assuming that such policy makers even exist).

Fortunately, there is an alternative to the "libertarian paternalism" of nudging. By shedding light on the mind's repertoire of heuristics and cognitive strategies and their interactions with the world, we can help people both to nudge themselves and to recognize when others are nudging them for reasons that are less than noble. For instance, patients who are educated about the difference between relative risk and absolute risk can evaluate the benefits of proposed medical treatments or tests for themselves. Patients who are so informed will recognize mismatched framing (e.g., expressing the benefits of a medical intervention as rela-

tive risks and the harms as absolute risks), for example, as a nudge toward undergoing interventions that may not be in their best interest. Likewise, teaching people about the power of two principles—diversity of opinion and error offsetting through aggregation—to foster good intuitive predictions gives them a versatile tool for tapping the wisdom of the crowd in a single mind. Both these examples illustrate that people can be empowered to make choices that are good for them—rather than merely kept from making choices that are bad for them—through education and environmental changes (e.g., matched instead of mismatched framing), an enriched cognitive repertoire (e.g., simulating the wisdom of the crowd in one mind), or both. Nudging is not enough. We must equip people to build their own competencies—and make up their own minds—by fostering risk literacy and decision-making awareness. In our view, Thomas Jefferson's belief in the importance of an educated and informed public is as relevant today as it was in his time.

Research Area 1: Simple Heuristics in a Complex World

The mind is called on to perform in two very broad domains, social games and games against nature. "Games against nature" refer to situations in which a person needs to predict or outwit nature to perform ancestral tasks and modern equivalents thereof, such as foraging for food and navigating home, exploring unknown or challenging terrains (e. g., mountains, lakes, rivers, deserts), and fighting diseases that kill livestock and people. The outcome a person experiences in these games is determined jointly by his or her decision and the true state of nature. "Social games," in contrast, refer to situations in which how well a person fares depends not on a dispassionate other such as nature, but on the decisions of other self-interested players, and includes not only decisions (e. g., whether or not to cooperate), but also judgments (e. g., about where a person lives), estimates (e. g., of a person's mate value), and categorizations (e. g., whether a person belongs to a hostile tribe) of social entities.

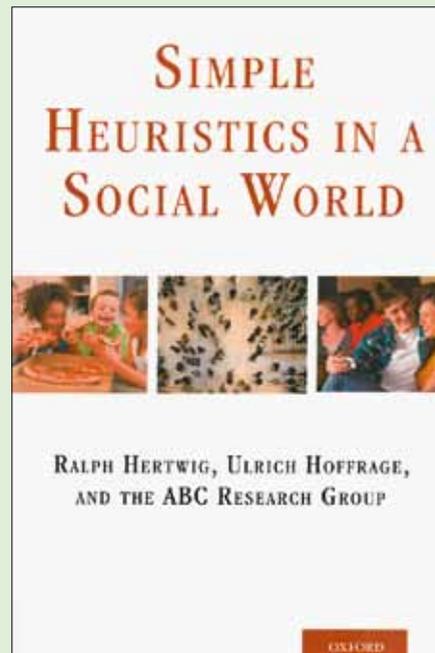
Games against nature and social games represent distinct domains. Yet the challenges that decision makers face, among them intractability, time pressure, information scarcity, and dynamically changing environmental circumstances, cut across both domains, and

simple heuristics offer solutions to problems of both types. Therefore, the starting premise of our investigation of bounded rationality in a complex world is that humans' social intelligence is not qualitatively different from their nonsocial intelligence and that impor-

Key Reference

Hertwig, R., Hoffrage, U., & the ABC Research Group. (2013). *Simple heuristics in a social world*. New York: Oxford University Press.

Our book *Simple Heuristics in a Social World* (published in 2013 by Oxford University Press) investigates how people make decisions in social domains, including mate choice, health, advice giving, persuasion, cooperation, sharing, and moral decision making. It demonstrates how to study the mind in the social environments in which decision making actually takes place. It illustrates how models of heuristics (e. g., fast and frugal decision trees) can offer a theoretical alternative to influential as-if models in economics (social preference models). It demonstrates how simple heuristics can exploit regularities of social connectivity to make inferences whose accuracy is comparable to those made by informationally more demanding strategies. Furthermore, it shows how models of simple heuristics can explain surprising moral inconsistencies and how a heuristic that was once highly efficient (the trust-your-doctor heuristic) can become dysfunctional in modern medical environments rife with conflicts of interest between patients and physicians. Finally, by shedding light on the adaptive toolbox of simple heuristics used to navigate social environments—and, in particular, by analyzing those heuristics' strengths and weaknesses—the book lays a foundation for designing social environments and heuristics in ways that empower people to make better decisions (see Research Area 4: Empowering and Educating the Decision Maker).



New Book! Simple Heuristics in a Social World

Box 1.

tant aspects of both kinds of intelligence can be modeled in terms of boundedly rational simple heuristics. This does not mean that the exact same heuristics are employed to play both types of games, although some heuristics do travel between the domains. In what follows, we describe the heuristics that we have discovered, first those employed in social worlds and then those employed in games against nature. In addition, we describe our analyses of the accuracy and ecological rationality of social tools for rendering decisions, such as making decisions in collectives or harnessing the wisdom of the crowd within the privacy of an individual mind.

Harnessing the Information in People's Social Networks: The Social-Circle Heuristic

In myriad social domains, people's decisions are influenced by their observations of others. In fact, imitating the behavior of others is a powerful and versatile heuristic that helps people navigate the thickets of complex social environments. Knowing what others do, want, like, or have can help people decide, for example, whether to engage in helping behavior and what media to purchase and consume. In Salganik, Dodds, and Watts' (2006) influential investigation of simulated cultural markets, for instance, individuals' music preferences

Key Reference

Salganik, M. J., Dodds, P. S., & Watts, D. J. (2006). Experimental study of inequality and unpredictability in an artificial cultural market. *Science*, 311, 854–856. doi:10.1126/science.1121066

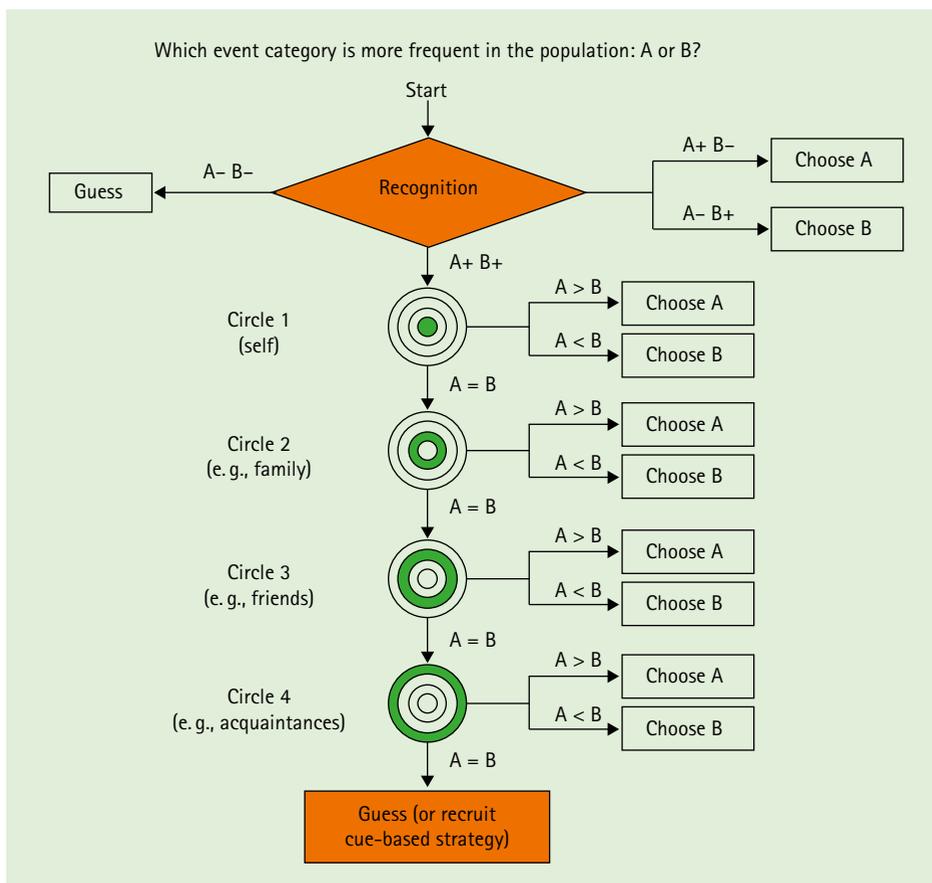


Figure 1. Flow chart showing the social-circle heuristic and the relationship of its sampling process to the recognition principle and inferences based on other cues. The heuristic first checks whether a recognition cue discriminates between the two event categories. If it does, the recognition heuristic is applied (i.e., choose the recognized category). If it does not, it inspects circles 1 to 4 sequentially to see whether the number of relevant instances differs between the two event categories. As soon as a circle discriminates, no further circles are inspected and the event with the higher number in the circle is inferred to be more frequent in the population. If none of the circles discriminates, an inference is made either by guessing or using a cue-based strategy (e.g., take-the-best, tallying) (adapted from Pachur et al., 2013a).

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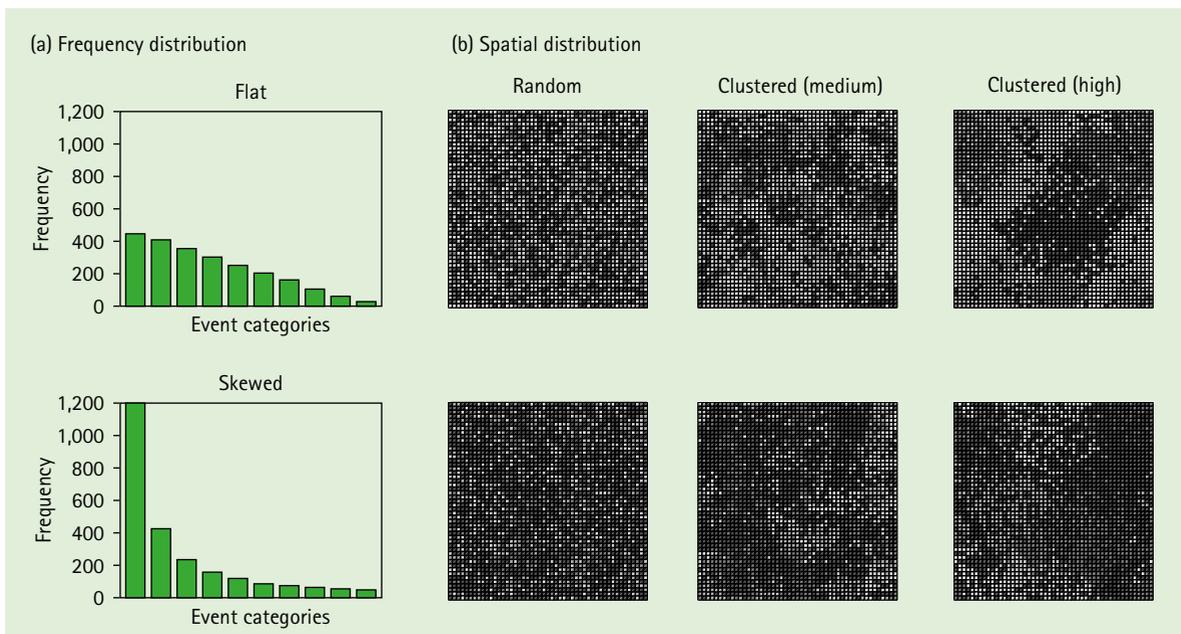


Figure 2. The ecological rationality of the social-circle heuristic. In environments with a skewed frequency distribution, the frequency drops off rapidly from the most frequent event category to less frequent categories (lower left panel); in environments with a flat frequency distribution, the frequency drops off more smoothly (upper left panel). The six grid panels show different spatial distributions of the instances of an event category (i. e., the extent to which instances of the same category occur in close spatial proximity), separately for flat and skewed frequency distributions. The spatial distribution is random, has a medium degree of clustering, or has a higher degree of clustering. The social-circle heuristic shows higher accuracy (relative to a compensatory strategy) in environments with a skewed frequency distribution and a clustered spatial distribution of instances (adapted from Pachur et al., 2013a).

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Key Reference

Pachur, T., Hertwig, R., & Rieskamp, J. (2013a). Intuitive judgments of social statistics: How exhaustive does sampling need to be? *Journal of Experimental Social Psychology*, 49, 1059–1077. doi:10.1016/j.jesp.2013.07.004

shifted substantially when they were given information about choices of other consumers in the market. Although people sometimes have the benefit of such explicit frequency information (e. g., how many people have seen a movie on its opening weekend), often no such objective social statistics are available. In such cases, people must rely on much more limited tallies of experience stored in their own memory.

One mental tool that can be used to harness the information encapsulated in a person's social network is the *social-circle heuristic*, which mentally samples instances rather than cues. Models of instance-based inference usually assume a compensatory process, in which instances are integrated across a person's various social circles (e. g., family, acquaintances). Given the considerable evidence for noncompensatory strategies in cue-based inference, however, might these also play a role in instance-based decision making?

Pachur, Hertwig, and Rieskamp (2013a)

proposed and tested one possible model of a noncompensatory instance-based strategy. To infer which of two events occurs more frequently in the general population (e. g., lung cancer vs. skin cancer), the social-circle heuristic (Figure 1) searches a person's social circles sequentially for relevant instances in the order "self," "family," "friends," and "acquaintances." As soon as the number of instances within a given circle is higher for one event than for the other, no further circles are inspected and the event with more instances is judged to be more frequent in the population. For a sizable proportion of participants in Pachur et al.'s studies, the social-circle heuristic was better able to describe how people judged the relative frequencies of various events than a compensatory process. Consistent with a noncompensatory process, participants who were classified as following the social-circle heuristic showed faster decision times the fewer circles the heuristic needed to inspect.

Coming Soon! Learning From the Most Successful: The Collective Trap

The practice of imitating one's most successful peers is often regarded as an intelligent shortcut that reduces individual learning costs, and the popular management literature advocates imitation of successful competitors. However, recent research demonstrates that the undersampling of failure may bias this approach, a problem that may be even larger when people learn in groups rather than on their own. Computer simulations based on real-world economic data sets show that success-focused imitators perform worse than both group learners who integrate the experience of other group members and isolated learners. In this new project, we are exploring explanatory mechanisms, boundary conditions, and environmental structures (stationary vs. nonstationary environments) to shed light on when and why imitation-based learning can become a "collective trap."

Joint project with Jean-Philippe Bonardi (University of Lausanne, Switzerland) and Rocio García-Retamero (University of Grenada, Spain).

Researchers

Jan K. Woike
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Box 2.

Using computer simulations, Pachur et al. (2013a) identified environmental structures that improve or undermine the accuracy of the social-circle heuristic. The simulations varied the frequency distribution of the event categories (skewed vs. flat) and the spatial distribution of agents with a particular property, such as a disease (randomly distributed or clustered; Figure 2). The social-circle heuristic (relative to a compensatory heuristic called "availability-by-recall") benefitted most from a skewed frequency distribution and from clustered occurrences of instances.

Simple Sequential Heuristics in a Social Game

Warren Buffett, one of the world's richest people, has pledged to commit more than 99% of his wealth to philanthropy during his lifetime. Not only Buffett but human beings in general display a wide array of social behaviors that are baffling to anyone who assumes—as many economists do—that people are motivated by material self-interest alone. Economists have proposed several theories to accommodate behavioral preferences that take account of other people's desires, behaviors, and outcomes in addition to one's own. All these theories retain the utility framework, injecting some psychology into the utility function by adding new terms (e.g., inequity aversion). Yet they remain as-if models, with little or no ambition to capture the actual process of decision making. An

alternative modeling approach, grounded in process models of heuristics, captures not only behavioral outcomes but also the processes behind them. Fischbacher, Hertwig, and Bruhin (2013; Hertwig, Fischbacher, & Bruhin, 2013) used decision trees to model responders' decisions in the mini-ultimatum game—a strategic exchange scenario frequently used in economics to investigate motives beyond material self-interest. In this game, one player (the proposer) chooses between two possible allocations of an amount of money—for instance, € 100 may be divided either equally (50 : 50) between players or unequally in the proposer's favor (e.g., 80 : 20)—and the other player (responder) chooses to accept or reject that allocation. If the responder accepts, the allocation will be implemented; if not, both players will go away empty-handed.

Four kinds of trees were fitted to four types of responders, identified by a finite-mixture model analysis. Figure 3 shows the proportion of correctly described responder decisions (i.e., accept vs. reject) and the predicted response times for two of the four trees. The priority tree is a process model for responders who sequentially consider two criteria: (1) Is the payoff offered at least as large as that received by the proposer (status criterion)? (2) Is the payoff offered at least as large as that represented by the other, foregone allocation (kindness criterion)? The tree predicts that a responder will take more time if he or she has to consult the kindness criterion in addi-

Key References

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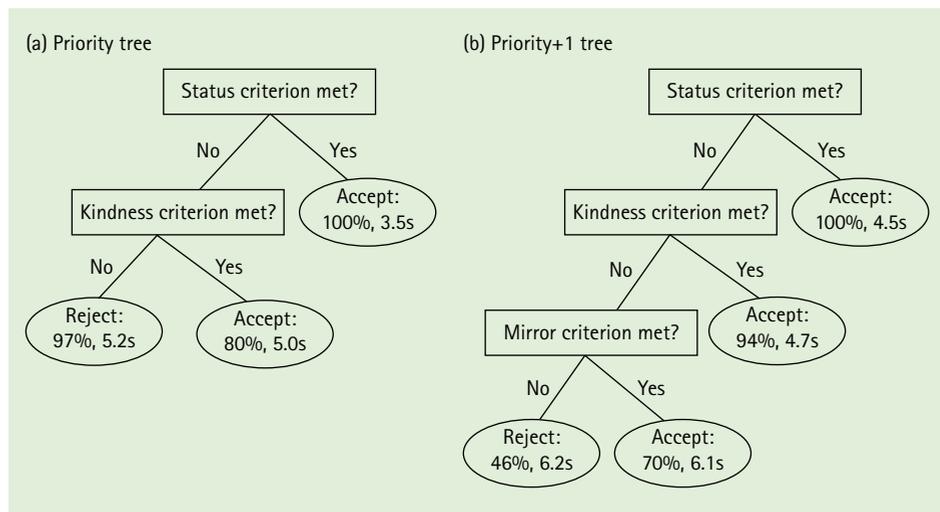


Figure 3. Two decision trees describing the processes underlying decisions in the mini-ultimatum game. The priority tree assumes that a maximum of two criteria are consulted (status and kindness); the priority+1 tree assumes use of one additional criterion (mirror criterion: "If I had been the proposer and faced the same choice, would I have proposed the same division?"). Numbers represent the correctly described decisions and the average response times. The results illustrate that the larger the number of criteria consulted, the longer it took to make a decision (adapted from Hertwig et al., 2013).

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tion to the status criterion in order to decide whether to accept the proposed allocation. The observed response times support this prediction (also in the priority+1 tree) and further suggest that a substantial proportion of respondents take various social considerations into account, sequentially and predictably. More generally, these findings suggest that models of heuristics offer a powerful process-oriented alternative to as-if utility models. We are now testing the extent to which these decision trees generalize to other social games and extending this modeling approach to the processes behind the proposer's decision making.

Heuristics in the Wild: Catching the Couriers

Experts and novices use different strategies to make inferences. Pachur and Marinello (2013) presented customs officers at two international airports in Switzerland (Zurich and Basel) with pairs of passenger profiles and had them indicate which passenger in each pair they thought would be more likely to smuggle drugs. Each passenger was described on eight dimensions, including speed of gait, number of bags, origin of flight, and direction

of gaze (i.e., looking at the customs officer or not). The customs officers had an average of 16 years' experience in the profession. A control group of novices, matched to the experts with respect to education, age, and gender, also completed the task. Pachur and Marinello modeled the two groups' decisions using compensatory and noncompensatory strategies and found substantial differences in the use of each strategy type. Whereas the novices generally seemed to rely on compensatory strategies that integrate multiple cues, most of the experts' decisions were best described by the noncompensatory take-the-best heuristic, which "bets" on one good cue. One possible explanation is that the experts' experience in making customs decisions and knowledge of the cues' diagnostic value allowed them to put the cues in diagnostic rank order and apply a simple lexicographic strategy. The novices, who had less knowledge of the cue hierarchy, weighted the cues more equally (rather than betting on one).

Dialectical Bootstrapping: The Wisdom of Many in One Mind

In 1906, British scientist and writer Sir Francis Galton visited a livestock fair where a compe-

Coming Soon! Decisions From Experience in Social Interaction

In social games, how well a person fares depends not only on a dispassionate “other” such as nature but also on the decisions of other self-interested players; that is, on the confluence of stochastic and social uncertainty. Although people sometimes (in “decisions from description”) enjoy access to statistical information about what to expect from others, they often (in “decisions from experience”) have to rely on a sample of observations from the social environment instead. In this new project, we are investigating whether the description–experience gap (see Research Area 2: Reckoning With Uncertainty: Search and Learning) observed in games against nature (monetary lotteries) generalizes to social games. Specifically, we are using the mini-ultimatum game to investigate how the way in which people acquire social information affects their behavior in a social bargaining situation. Before making each offer, proposers learn how often each allocation has been rejected in previous experiments, thus gaining insight into its acceptability in the population. In the description condition, rejection rates are given as probabilities, whereas in the experience conditions, proposers either sample previous responders’ choices for as long as they wish (“free sampling”) or are forced to sample a fixed number of them (“matched sampling”). A first finding is that people sample substantially less in this social game than in structurally identical games against nature. One interpretation is that social norms (e.g., equity), a somewhat neglected lever of bounded rationality, help people to predict unknown probabilities (e.g., of rejection) and thus to limit search for information.

Joint project with Florian Artinger (University of Warwick, UK), Sebastian Olschewski (University of Tübingen, Germany), and Kirsten Volz (University of Tübingen, Germany).

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Florian Artinger
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Ralph Hertwig

Box 3.

tion was being held. Fairgoers were asked to guess the weight of a butchered ox. Although the 787 estimates given spanned a wide range, the mean estimate was only one kilogram off the mark. This phenomenon, called the “wisdom of crowds,” arises when individual judges do not all make the same errors. Provided that some estimates are too high and others are too low, the errors tend to cancel one another out. Notably, the errors are particularly likely to diverge when people rely on different information and strategies and make their estimates independently of one another.

The “wisdom of crowds” can be conjured within a single person by instructing that person to take several different perspectives and to take the average of the resulting nonredundant estimates as a final judgment (Herzog & Hertwig, 2013a; Figure 4). Herzog and Hertwig (2009) showed that urging people to think differently when generating a second estimate can boost this averaging gain (“dialectical bootstrapping”). Furthermore, people are more likely to combine—as

opposed to choose between—their estimates when they actively contradict themselves and as the size of the disagreement between the first and the second estimate increases (Herzog & Hertwig, 2014).

The French poet Paul Valéry said, “Je ne suis pas toujours de mon avis” (“I don’t always agree with myself.”). Although vacillating between opinions can be agonizing, dialectical



Figure 4. Part of the wisdom of the many resides in an individual mind.

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Raaijmakers, J. G. W., & Shiffrin, R. M. (1981). Search of associative memory. *Psychological Review*, 88, 93–134. doi:10.1037/0033-295X.88.2.93

bootstrapping shows that being of two minds, like Valéry, can work to a decision maker's advantage. Our ongoing research aims to extend the scope and explore the boundaries of dialectical bootstrapping by addressing questions such as: What techniques other than actively contradicting oneself can boost estimate-averaging gains? Which technique is best suited to which domain, task, and performance criterion? What role do confidence and uncertainty play in resolving conflicts among estimates?

Swarm Intelligence: When Uncertainty Meets Conflict

In a phenomenon called “swarm intelligence,” animals that make shared decisions pool information, thereby offsetting individual errors and increasing decision accuracy. But what if those decisions involve conflicts of interest between individual decision makers (Figure 5)? Should animals (or people) make shared decisions with conspecifics whose goals are different from—and partly in conflict with—their own? Conradt, List, and Roper (2013) developed a group decision model that shows that, contrary to intuition, conflicting goals often increase both the accuracy and the individual gains derived from shared decisions (Figure 6). Far from hamper-



Figure 5. Meerkats are one of many species in which collective decisions can involve uncertainties and conflicts. Group members have to negotiate communal foraging routes, individual breeding opportunities within the group, and job allocations with respect to shared vigilance and cooperative care for young—all in an uncertain and changeable environment. Decision outcomes have heterogeneous fitness implications for individuals, and therefore preferences and goals between group members often differ.

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ing effective decision making, conflicts of interest can improve decision outcomes for all stakeholders as long as stakeholders have some goals in common. By contrast, conflict-free decisions made by animals with identical goals are often surprisingly poor. The underlying mechanism appears to be that individual decision makers never have perfect information, so their decision making is always subject to error. When members of a decision-making group have conflicting goals, their individual errors are only weakly correlated with one another. Such groups can thus benefit considerably from decision sharing, as it offsets uncorrelated errors. Conradt et al.'s (2013) results provide a strong argument for dominant groups not to exclude other (e.g., minority) factions from collective decisions.

Search and Working Memory in Social Recall

The proximal social environment shapes many decisions. It is therefore crucial to understand how this environment is represented in people's minds—specifically, how they “travel” through their social memory when retrieving information from it. To examine this issue, Hills and Pachur (2012) modeled responses in a social fluency task using a computational memory model inspired by Raaijmakers and Shiffrin's (1981) framework called Search of Associative Memory (SAM). The participants' task was to recall the names of people they knew personally. In modeling the order in which the names were recalled, the key question was to what extent people dynamically switched between different representational cues in memory. Candidate cues for retrieval were frequency of contact with the recalled person (e.g., a current colleague vs. an old school friend), social proximity (e.g., whether two consecutively recalled people know each other), and social category (e.g., relative, friend, colleague). By way of illustration, Figure 7 shows the retrieval order for two participants, with color indicating the social category of the people recalled. The networks on the right represent the social proximity structure by connecting members who know each other with a line.

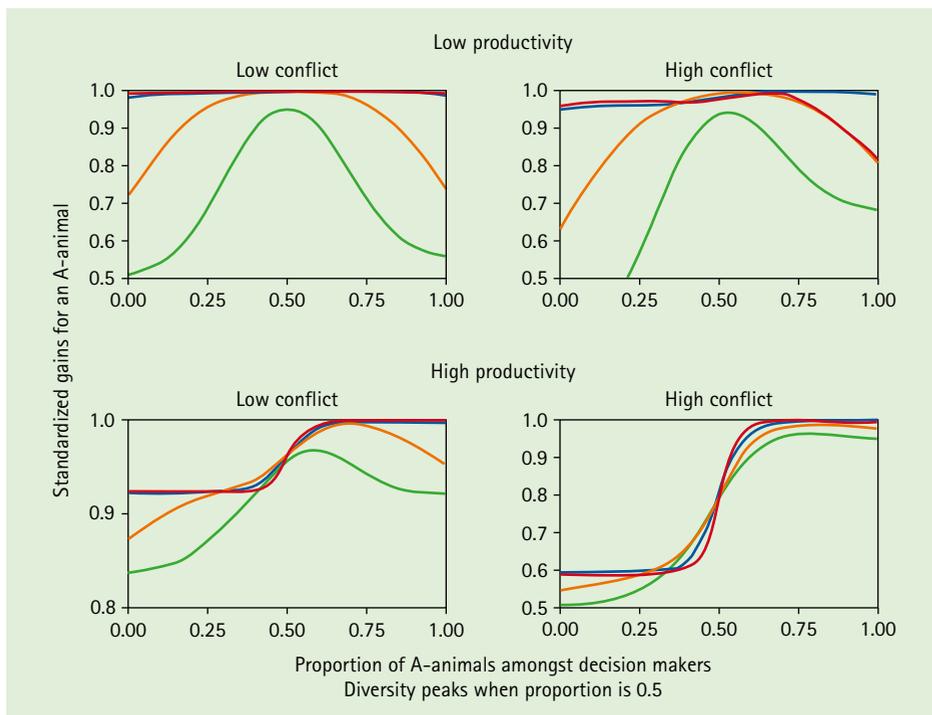


Figure 6. Decision gains as a function of the goal diversity of decision makers. Decision gains often peak when decision makers are maximally diverse with respect to individual decision goals (here: in the middle of the curves, at around point 0.5 on the horizontal axes). Results are shown for low- and high-productivity environments (i. e., environments characterized by a low or a high probability that either of two decision options yields a positive payoff); for low- and high-conflict situations; and for several levels of uncertainty (uncertainty increases from red lines, through blue and orange lines, to green lines; note that for clarity of presentation, vertical scale ranges differ across panels) (adapted from Conradt et al., 2013).

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Coming Soon! The Wisdom of Crowds in Conflicts of Interest

People may share similar goals without their interests being completely aligned. To take an example from current events, consider Western countries' collaborating on the shared goal of fighting international terrorism while at the same time spying on one another. When judgments are made in situations of uncertainty about goals that involve conflict across individuals, it can be advantageous to aggregate the judgments of several individuals ("wisdom of crowds"). Previous research has investigated aggregation methods (e. g., weighted/unweighted mean/median, trimming of outliers) that lead to accurate and robust aggregate estimates. These studies have usually assumed (at least implicitly) that judgments are made by "objective" jurors. However, individual judgments are seldom completely objective, but rather biased by personal goals. Although it is widely acknowledged that conflicts of interest can bias judgments, the problem of how best to aggregate conflict-biased judgments has been little explored. In this new project, we will investigate successful aggregation rules for judgments in environments in which individuals have conflicting goals. First, we will use computer simulations to identify the most accurate and robust methods of aggregating individual judgments by goal-biased jurors. Second, we will test experimentally whether people employ those aggregation methods in relevant conflict situations.

Researchers

*Stefan M. Herzog
Larissa Conradt*

Box 4.

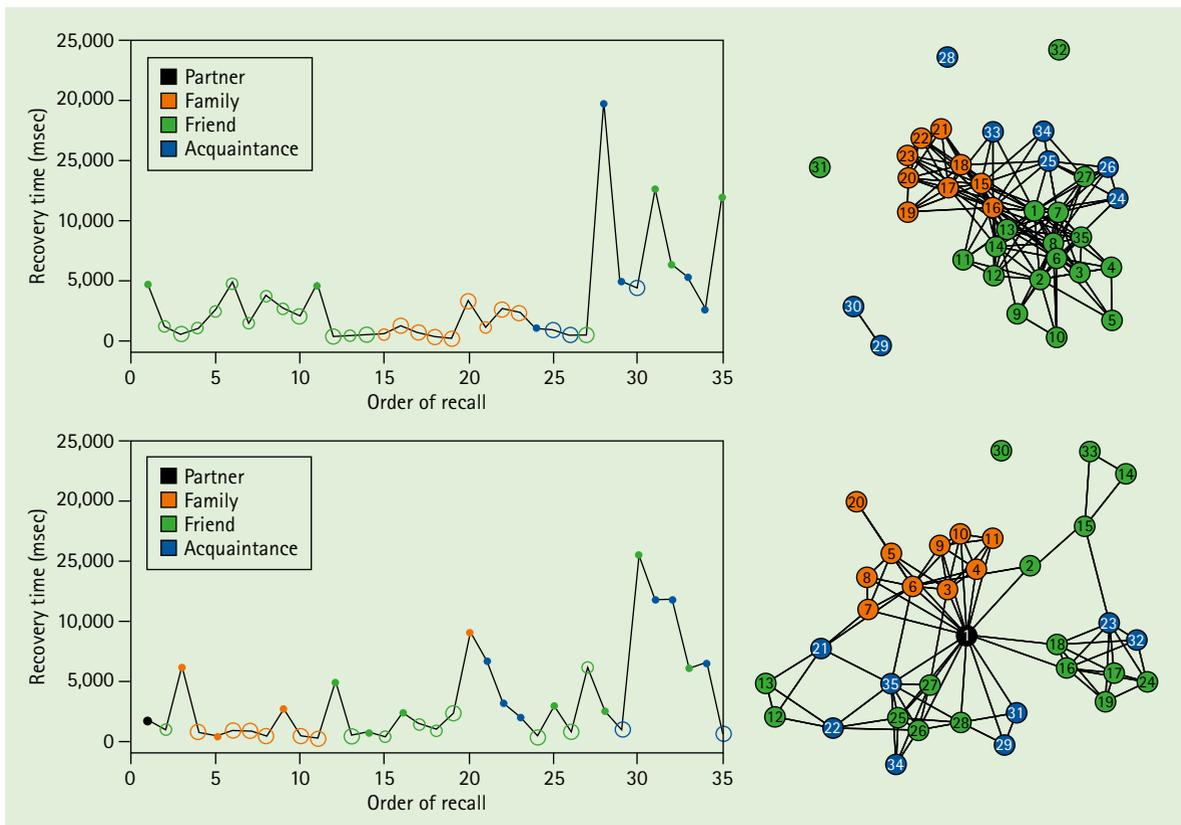


Figure 7. Typical retrieval patterns for two participants and their corresponding social networks. Dots represent individuals recalled. Size indicates social proximity to the individual previously recalled, with the smallest, filled dots indicating no social proximity with the previous individual, and largest, unfilled dots indicating the highest social proximity to the previous individual. The social networks to the right correspond with the recall patterns on the left. Numbers inside vertices indicate the order of recall. The participant in the upper panel has a working-memory capacity (measured as operation span) of 44. The participant in the lower panel has an operation span of 27 (adapted from Hills & Pachur, 2012).

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Key Reference

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A model assuming that people switch dynamically between the frequency-of-contact cue and the social proximity cue best predicted the order of retrieval. Individual differences in the number of switches between these two cues were negatively correlated with working-memory capacity. In other words, people with lower working-memory capacity were less consistent in their cue use during recall, suggesting that they may be less efficient in cognitive search. Overall, the results highlight that the external structure of the social environment (i. e., the interconnectedness of a person's social network) is an important driver in how people navigate the cognitive representation of this structure and that working-memory capacity plays a key role in searching within the cognitive representation.

How Good a Mirror of the World Is Retrieval Fluency?

Human cognitive machinery has evolved to enable people to navigate an often dangerous and uncertain world. How successfully people deal with this world depends on, among other factors, the fit between their cognitive machinery and environmental structures. In their empirical and theoretical analyses of the ecological rationality of the fluency heuristic (Hertwig, Herzog, Schooler, & Reimer, 2008), Herzog and Hertwig (2013b) found that a seeming by-product of the operation of our cognitive machinery—namely, the fluency of the processing experience, that is, the extent to which a cognitive operation feels easy or hard, swift or slow—carries information about important quantitative dimensions such as the

truth of statements, the danger of objects, and the behaviors of others. Across 25 data sets, Herzog and Hertwig calculated an average retrieval fluency validity of 62% (i. e., the object retrieved more fluently from memory scored higher on the criterion in 62% of all pair comparisons considered). All obtained fluency validities were above chance level, the sole exception being the domain of infectious disease incidence.

Thus, retrieval fluency enables people to draw inferences that clearly surpass chance performance.

To illustrate retrieval fluency and its potential to assist in making inferences about the world, consider the following two names: Bill Gates and Steve Ballmer. Which of the two men has amassed the larger fortune? Many people are likely to recognize both names and so cannot simply use recognition or lack thereof to make an inferential bet (i. e., the recognition heuristic: choosing the recognized object over the unrecognized one). However, it is likely that the retrieval fluency of both names (i. e., the time a person takes to judge whether or not he or she recognizes a name) is not the same. As Herzog and Hertwig's (2013b) analyses showed, this difference in retrieval speed has inferential power. How does retrieval fluency help inform decisions? The more often someone encounters a name, the higher is its memory strength and the more likely and quickly the memory system will be able to retrieve its record. That is, environmental frequencies (e. g., acquired through newspapers and magazines) can act as a mediator that connects an unknown or inaccessible quantity in question (the criterion) with our memory processing. In such cases, retrieval fluency can predict a variable that is not itself a frequency, but rather anything from the population size of a city or the revenues of a company to the net worth of a billionaire, as long as the variable is correlated with environmental frequencies. Retrieval fluency can thus serve as a "cheap" yet informative cue that permits people to make accurate inferences about the world (Hertwig et al., 2008). Figure 8 depicts the triangular relationship between criterion, mediator, and retrieval.

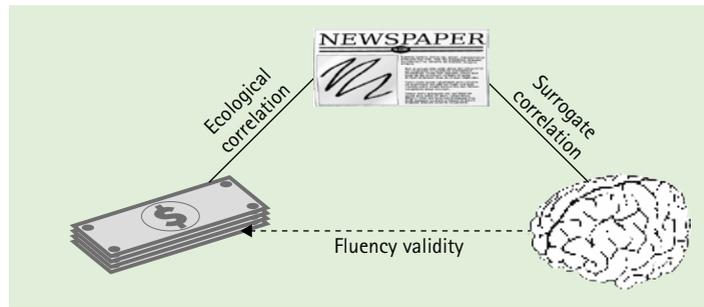


Figure 8. The ecological validity of retrieval fluency. An inaccessible or unknown criterion (e. g., a company's sales volume) is reflected by a mediator variable (e. g., the number of times the company is mentioned in the media; ecological correlation), and the mediator influences the fluency of retrieval (surrogate correlation). The mind, in turn, can use retrieval fluency to infer the criterion (fluency validity) (adapted from Herzog & Hertwig, 2013b).

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Affect and Strategic Selection

Undoubtedly, emotions and affect play a key role in the workings of the mind. Their role in bounded rationality and in how people deal with a complex probabilistic world is relatively little understood, however. For instance, how does affect help people to make inferences about the world? One prominent proposal of a mental mechanism relying on affective cues is the *affect heuristic* (Finucane, Alhakami, Slovic, & Johnson, 2000). Pachur, Hertwig, and Steinmann (2012) experimentally compared different implementations of the affect heuristic to see which was better able to account for people's judgments of risk. The affect heuristic was operationalized based on precisely defined definitions of affect—namely the amount of dread evoked by a risk—thus addressing the frequently criticized lack of precision in the original descriptions of these models. People's reliance on the affect heuristic varied as a function of how they were asked to judge the risks. The heuristic's descriptive power was higher in value-of-a-statistical-life judgments than in judgments of risk frequency. For availability-by-recall, an alternative strategy that relies on instance knowledge (see Section: Harnessing the Information in People's Social Networks: The Social-Circle Heuristic), the pattern was reversed.

In addition to being used as cues in decision making, emotions may also influence the selection of heuristics. Pachur, Hertwig, and

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Wolkewitz (in press) tested the hypothesis that people use different strategies in risky choice depending on whether the potential consequences of a decision are affect-rich or affect-poor. In support of this hypothesis, they found that the compensatory expected value strategy, which combines outcome and probability information, described people's affect-poor choices very well. In affect-rich choices, by contrast, people seemed to follow a simple noncompensatory heuristic that neglects probability information. For instance, affect-rich choices involving negative affect were best described by the minimax heuristic, which evaluates risky options simply by comparing their worst possible outcomes. This difference in strategy selection between affect-rich and affect-poor tasks even led to systematic preference reversals within one and the same person. A subsequent process-tracing study revealed that people indeed paid less attention to probability information in affect-rich choices than in affect-poor choices.

The Neural Signature of Limited Search

By definition, a heuristic is a strategy that ignores part of the available information. Does limited search for cues have a specific neural signature? In a first step toward answering this question, Khader et al. (2011) used functional magnetic resonance imaging (fMRI) to investigate the memory processes associated with the use of the take-the-best heuristic. In a learning phase, participants first memorized visual cue information about various (fictitious) companies, such as their geographic location, the face of the manager, and the type of product manufactured. Each of these cues involved visual information known to be represented in a different region of the posterior cortex. Participants were also trained in using the take-the-best heuristic, which they were instructed to employ in a subsequent decision phase. Specifically, their task was to decide, based on the cue information memorized in the learning phase, which of two companies' commercial success was greater. During the decision-making process, participants' brain activation was recorded. Some decisions could be made through retrieval and

inspection of the most important cue; others required the retrieval of additional cues. The varying retrieval demands were reflected in the patterns of blood-oxygenation-level-dependent (BOLD) activation. For instance, the BOLD activation in the dorsolateral prefrontal cortex (DLPFC)—which is assumed to selectively control posterior storage areas—was more pronounced during decisions that required the retrieval of the values on all four cues than during decisions that required retrieval of only one cue. Further, the retrieval of specific cue information was manifest in the cue-specific posterior representation areas. For instance, the BOLD activation in the area representing the location cue (lowest in the cue hierarchy) was prolonged when this cue's retrieval was required (vs. not required; Figure 9). Beyond such specific activation patterns, which presumably reflect controlled retrieval processes, there was also evidence of automatic knowledge activation. Posterior representation areas for specific cues received some boost in activation even when the cues were irrelevant to the decision. This interpretation received further support from a behavioral investigation in which Khader, Pachur, and Jost (2013) observed a so-called “fan effect” in memory-based decisions using the take-the-best heuristic. Specifically, participants showed slower response times and higher error rates when making decisions about objects for which they had more extensive cue knowledge than when their cue knowledge was sparse.

How to Integrate Models of Heuristics and Algebraic Models of Risky Choice

When the Royal Swedish Academy of Sciences awarded the Nobel Prize for Economic Sciences to Daniel Kahneman in 2002, it lauded two pillars of his joint work with Amos Tversky: the heuristics-and-biases program and cumulative prospect theory (CPT; Tversky & Kahneman, 1992). Both lines of research investigate human judgment and decision making and how it systematically deviates from standard assumptions of the rational choice paradigm in economics; both also offer alternative descriptive modeling frameworks to standard economic theory. Notwithstand-

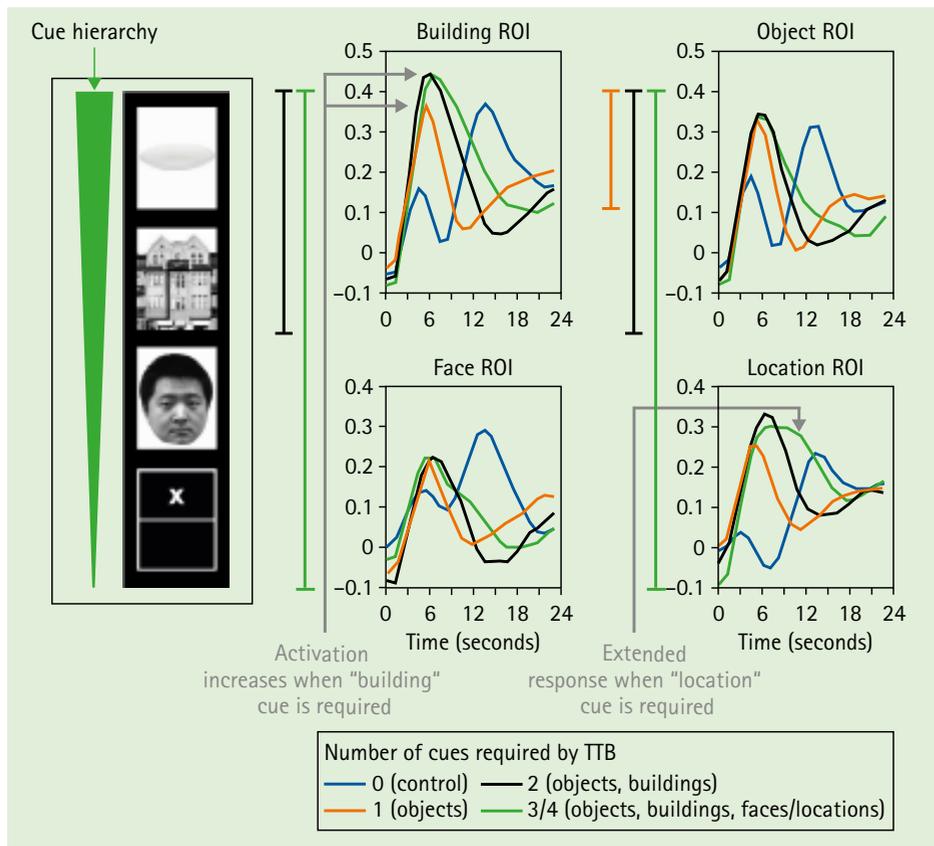


Figure 9. Blood-oxygenation-level-dependent (BOLD) activation in the four regions of interest (ROIs) in the posterior areas associated with four cues (i.e., product manufactured, image of the company building, face of the manager, and geographical location) when participants made comparative inferences about companies' commercial success using the take-the-best heuristic (TTb). The different lines in each plot represent the activation in trials that varied in terms of how many of the cues were required by TTb. The cue hierarchy (ordered by importance) is shown in the left panel (adapted from Khader et al., 2011).

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ing these commonalities, there is also a fascinating disconnect between the two lines of research. CPT was a conservative attempt to assemble the minimum set of modifications to the expected utility theory required to provide a descriptive account of risky choice, whereas the theoretical thrust of the heuristics-and-biases program was anything but conservative. For instance, the representativeness heuristic, which was proposed to explain base-rate neglect, was not a restrained modification of Bayes' theorem; it replaced Bayes' integration of prior probability with specific evidence by a similarity relationship. The dissociation between algebraic models such as prospect theory and heuristic models is particularly evident in research on risky

choice. Because the two approaches rest on fundamentally different assumptions and algorithms, they are ordinarily treated as antithetical, if not incommensurable. The two theoretical traditions can in fact be integrated, however (see Suter, Pachur, & Hertwig, 2013). CPT describes choices in terms of psychophysical constructs (e.g., diminishing sensitivity to probabilities and outcomes) as well as psychological constructs (risk aversion and loss aversion). Might this description work regardless of whether the nature of the process generating the choice is multiplicative and compensatory (as premised in CPT) or ignores considerable subsets of information and is noncompensatory (as premised in many heuristics of risky choice)?

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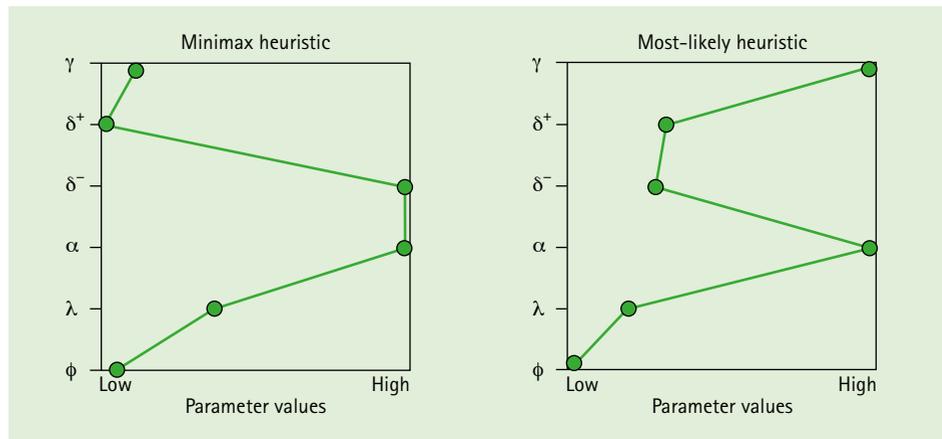


Figure 10. Parameter profiles of cumulative prospect theory's value and weighting function parameters fitted to the simulated choices of the minimax heuristic and the most-likely heuristic. The different parameter values indicate how sensitive the heuristics are to probability information (γ) and outcome information (α), their degree of risk aversion in the gain and loss domains (δ^+ and δ^- , respectively), their loss aversion (λ), and their sensitivity to differences in the subjective valuations of options (ϕ).

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Using computer simulations, Suter, Pachur, and Hertwig fitted CPT to choices generated by different choice heuristics and made the following observations: Despite starkly different algorithmic structures, CPT accommodates heuristic choices with a good model fit. Furthermore, the resulting CPT parameter profiles portray each heuristic alone and relative to the others in psychologically meaningful ways. For instance, Figure 10 shows that, when fitted to the choices of the minimax heuristic (whose policy is to ignore probability information and choose the option with the better worst case), the resulting CPT parameters indicate low sensitivity to probabilities (γ), high sensitivity to outcomes (α), and high risk aversion in the loss domain (δ^-). The most-likely heuristic (whose policy is to choose the option with the more likely best case) results in parameters indicating high probability sensitivity and high outcome sensitivity as well as low risk aversion in the loss domain. Further findings from this theory integration are that CPT parameters can reflect a lexicographic search strategy as well as the interaction of heuristics' policies and choice environments. Finally, model recovery analyses show that, although CPT is able to accommodate choices based on heuristics, CPT and heuristics can still be distinguished with high accuracy, even when observed

choices are fairly noisy. These observations suggest that the gulf between algebraic and heuristic models is not as wide as it is often made out to be, and mapping them onto one another yields substantial insights for both traditions. For instance, fitting CPT to the choices of heuristics permits researchers to describe heuristic choices using classical constructs of algebraic models, such as sensitivity to probability and outcome information, risk aversion, or loss aversion. Heuristics, in turn, offer a cognitive foundation for the parameter values estimated within the CPT framework.

Why Aren't Humans Smarter Already?

The notion of bounded rationality acknowledges the natural limits of human cognition. But must these bounds be accepted? Pharmacological enhancers of cognition promise a new, less bounded future for humankind, including more focus, more willpower, and better memory, with applications ranging from education to military combat. Underlying such promises is a "more-is-better" model of cognition. As Hills and Hertwig (2011) have pointed out, however, such a naïve linear model is at odds with cognition's evolutionary origins. Specifically, the targets of cognitive enhancers—for example, attention and memory—are subject to selection, raising the

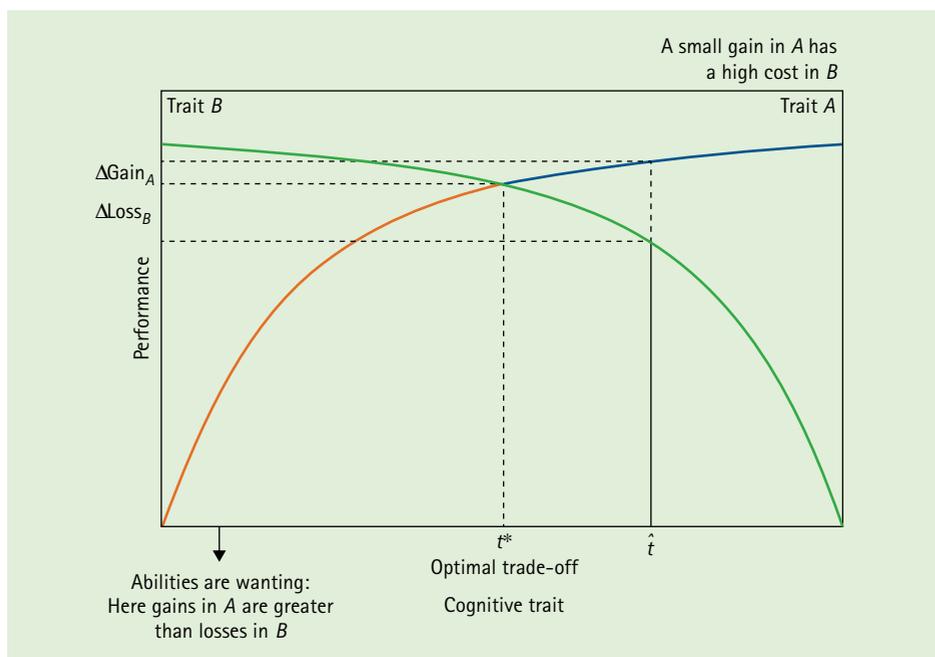


Figure 11. A gain/loss asymmetry. Performance scores associated with the cognitive traits A and B follow a decelerating function (e. g., gains in performance have diminishing returns). Using pharmacological drugs to shift the value of trait A beyond the point of the optimal trade-off between traits yields a performance gain in trait A (ΔGain_A) that is smaller than the corresponding performance loss in trait B (ΔLoss_B) (adapted from Hills & Hertwig, 2011).

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following question: Why haven't humans already evolved the abilities that cognitive enhancers offer? If better memory, for example, is unequivocally beneficial, why do seemingly trivial neuromolecular changes that would enhance memory, such as overexpression of NMDA receptors in the hippocampus, apparently not exist in natural populations? Cognition is the evolutionary product of trade-offs over multiple ecological and physiological constraints. The categorical more-is-better assumption is therefore false in this context. Many recently discovered "less-is-more" effects, such as the benefits of forgetting on heuristic inference (Schooler & Hertwig, 2005), are inconsistent with a linear model of cognition. In addition, trade-offs over constraints are reflected in the ubiquity of \cap -shaped performance curves. For example, amphetamines have been proposed as a way to boost attention. While they do improve attentional performance among low-performing individuals, they can actually reduce the performance of high performers. Optimal

control of attention entails a delicate balance between too much and too little focus. Equally important evolutionary trade-offs are reflected in unintended side effects of enhancers on other traits. Figure 11 illustrates this potential asymmetry between performance losses and performance gains. Assume that gains have diminishing returns. In that case, using pharmacological enhancers to shift the values of trait A upward will indeed yield a performance gain (ΔGain_A). Yet this gain may come at a sizable "hidden" price: a loss (ΔLoss_B) of even larger magnitude in performance associated with trait B. The promise of pharmacologically boosting the cognition of healthy individuals thus overlooks the risks associated with \cap -shaped performance curves and cognitive side effects.

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Coming Soon! The Normative Challenges of the Descriptive Theory of Bounded Rationality

Hertwig and Pedersen are editing a special issue of *Minds and Machines: Journal for Artificial Intelligence, Philosophy, and Cognitive Science*. The contributions to this special issue will focus on several philosophical implications of research on bounded and ecological rationality (see also Hertwig & Volz, 2013). A key question is how theories of rationality ought to accommodate the surprising success of boundedly rational heuristics, which violate putative norms of strategic or epistemic rationality. If a theory of rationality ought to countenance the capacities and limitations of real-world agents in the context of their environments, what epistemic or pragmatic standards can distinguish among rational, arational, and irrational decision making, inference, and belief formation? In addition, to the extent that coherence, or internal consistency among a decision maker's beliefs, choices, and reasons, must be supplemented by standards of correspondence, or the relationship between the actor's attitudes and the hard facts out there in the world, can a satisfactory systematic account of these standards be articulated? These and related questions have received scant or no attention, despite their significance for the foundations and methodology of research programs in normative and descriptive decision making, inference, and belief. The special issue will contribute to a more systematic elaboration of the implications of simple, boundedly rational heuristics for theories of rationality.

Box 5.

Research Area 2: Reckoning With Uncertainty: Search and Learning

Many human behaviors—falling in love, job interviews, marital arguments, crossing the street—come without a package insert detailing possible outcomes and their probabilities. Yet there are torchlights helping people to navigate this twilight of uncertainty. In many uncertain environments, decision makers can benefit from the vicarious experience of others or bring to bear relevant experience and knowledge of similar situations stored in memory. In some cases, they can gain hands-on experience of the initially unknown payoff distributions. We have referred to people's drawing on experience of payoff distributions and making choices on this basis as "decisions from experience" (Hertwig, Barron, Weber, & Erev, 2004). In this section, we first describe our ongoing expedition into the world of experienced-based decision making, and then sketch a set of projects designed to reveal the biological and cognitive foundations of risk taking and decisions from experience.

Studying decisions from experience is nothing new. Godfathers of modern decision science such as Ward Edwards did exactly that. Although behavioral decision researchers began to turn away from the transients of learning in the 1970s, concerns for learning and experienced-based decision making remained alive in research on experimental games (e.g., Erev & Roth, 1998) and operation research. What is novel, however, is that, in the last 10 years, various researchers have systematically pitted decisions from experience against decisions from descriptions, commonly using monetary lotteries. Their investigations have revealed a systematic and robust difference between the two kinds of decisions, and this "description–experience gap" (see Hertwig, in press; Hertwig & Erev, 2009) has rekindled

interest in decisions from experience. Moreover, it has brought to the fore what Herbert A. Simon regarded as *the* cognitive process of bounded rationality: cognitive search (and, by extension, learning).

Choice Ecology and Search

In decisions from experience, people are the masters of their information search to the extent that they control how much to explore and when to exploit. Yet some control may also reside in the environment and in interactions between the environment and psychological constructs such as loss aversion and risk aversion. Lejarraga, Hertwig, and Gonzalez (2012) analyzed several data sets to find out how two key ecological properties influence exploration: domain of choice

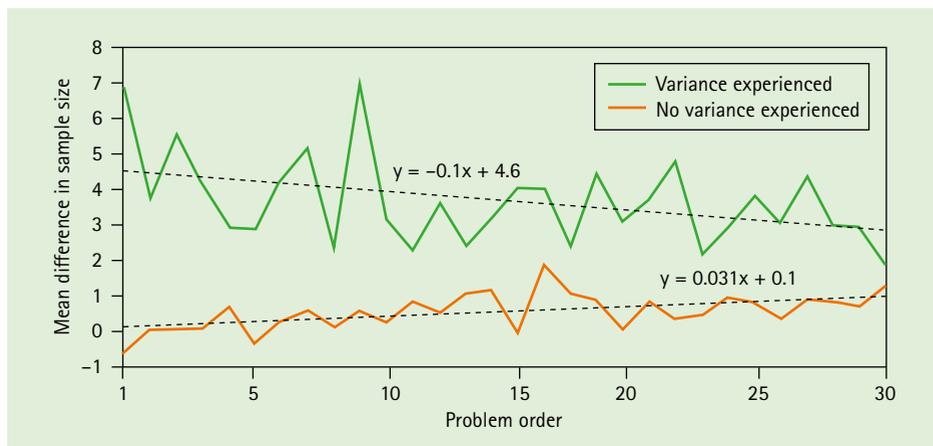


Figure 12. Mean difference (averaged across participants) in sample size between the risky option and the safe option across 30 problems in the Technion Prediction Tournament (Erev et al., 2010). The graph includes the trend lines for each mean difference and the corresponding linear equation (adapted from Lejarraga et al., 2012).

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Researchers

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Ralph Hertwig

Coming Soon! A Meta-Analysis of Decisions From Experience

About a decade after the discovery of the description–experience gap, Wulff and Hertwig have collated the data from 21 independent published articles—all employing the sampling paradigm (Hertwig et al., 2004). The data (involving more than 1,000 participants and over 10,000 choices) are currently being analyzed. Two initial results are plotted in Figure 13a. First, the original finding by Hertwig et al. (2004) that people rely on relatively small samples has proved to be robust. Across all studies, Wulff and colleagues observed a median of 14 draws per participant and problem. Second, Figure 13b demonstrates a robust recency effect: Observations made later in the sequence have more impact on the final choice than observations made earlier. Drawing on this comprehensive data set, Wulff and Hertwig plan to investigate a host of issues by, for example, running an extensive model competition, analyzing search policies, and examining the stopping rules for search.

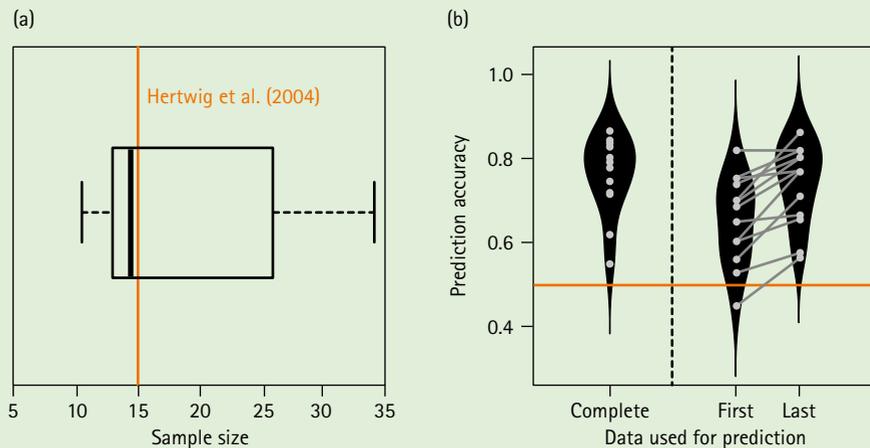


Figure 13. (a) On average, participants drew about 14 samples per problem, close to the original finding of Hertwig et al. (2004) and sufficiently small to lead to notable sampling error. (b) Participants prefer the option with the highest experienced mean. Within a sequence, however, they are more likely to choose the higher mean of the “last” samples as compared to the “first” samples.

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Box 6.

Key Reference

Pachur, T., & Scheibehenne, B. (2012). Constructing preference from experience: The endowment effect reflected in external information search. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 38, 1108–1116. doi:10.1037/a0027637

(gains vs. losses) and experienced variance (variance vs. no variance). The prospect of a loss invoked more search than the prospect of a gain, with a relative average increase in search in the range of 25% to 29% (but with substantial interindividual variability). Like losses, the experience of variance also prompted more exploration. Figure 12 shows that, averaged across all participants, samples were larger in the risky than in the safe option for participants who experienced variance. In contrast, participants who failed to experience the risky option’s variance allocated nearly equal search effort to both options (orange curve). At the individual level, 52 of 75 (69%) participants sampled more from the

risky than the safe option when they experienced variance relative to when they did not.

Constructing Preference From Experience

Decisions from experience offer a great methodological advantage relative to decisions from description. Specifically, the experimental paradigms used to investigate decisions from experience lay open what is otherwise difficult to observe: people’s search for information. Taking advantage of this strength, Pachur and Scheibehenne (2012) used the sampling paradigm to examine the information search preceding the endowment effect. The endowment effect describes people’s tendency to value items they own more

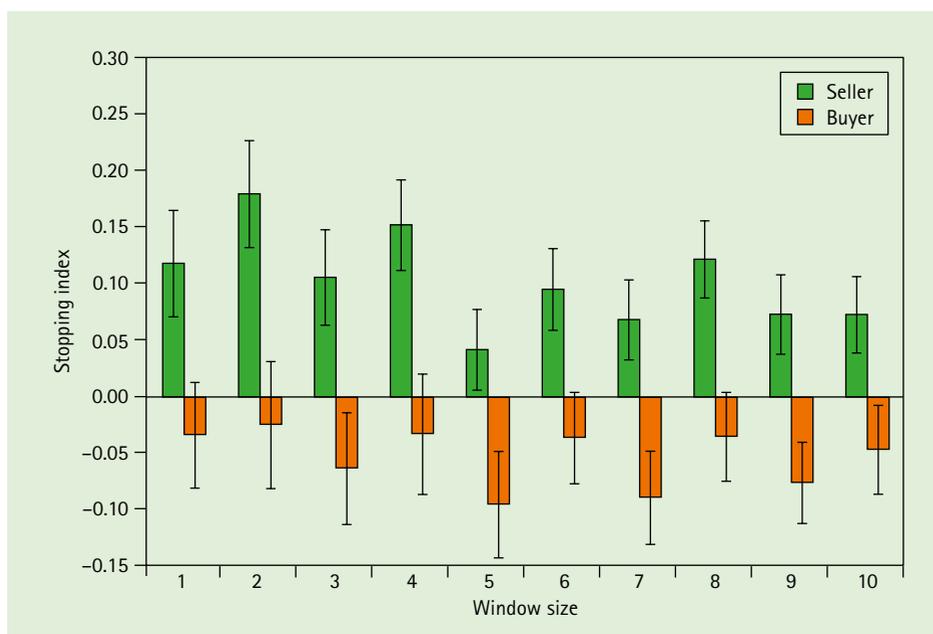


Figure 14. Stopping index characterizing the sampling behavior of sellers (in green) and buyers (in orange) prior to the evaluation of the lotteries. Bars above zero indicate that search tends to be terminated after encountering relatively high outcomes, whereas bars below zero indicate that search tends to be terminated after encountering relatively low outcomes. Error bars indicate ± 1 standard error of the mean. The graph shows that sellers tend to stop search after encountering large outcomes, whereas buyers tend to stop after encountering low outcomes. Window size refers to possible sizes of recent memories (adapted from Pachur & Scheibehenne, 2012).

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highly than items owned by others, leading to discrepancies in selling and buying prices. The most common explanation for this divergence is loss aversion: sellers simply value an object they own more highly than buyers do. This explanation remains silent about the underlying cognitive processes, however, particularly in terms of how much each party knows about the subject item.

Pachur and Scheibehenne asked a group of participants to indicate both selling prices and buying prices for lotteries, where the lotteries' payoff distributions had to be learned by sequential sampling and participants were free to decide when to stop information search. Buyers and sellers differed considerably in terms of when they stopped search. The length of search was quantified using a stopping index, defined as the log-ratio of the probability of stopping after having sampled a high outcome to the probability of stopping after having sampled a low outcome. Figure 14 shows the stopping index for assumed sampling windows of different sizes,

and separately for buyers and sellers. Sellers terminated search after having encountered relatively high outcomes, indicated by a stopping index higher than 0; buyers terminated search after having encountered relatively low outcomes, indicated by a stopping index lower than 0. These search patterns led sellers to experience the lotteries as more valuable than the buyers did, revealing a *sample gap*. Moreover, the size of the sample gap was substantially correlated with the size of the resulting endowment effect: larger discrepancies in experience were associated with larger discrepancies between buying and selling prices. These results extend past work on the cognitive underpinnings of the endowment effect and emphasize the key role of search behavior in the emergence of the effect. They also offer insights into search in decisions from experience more generally: The perspective of the decision maker—here, buyer versus seller—can have a considerable impact on how long people search and, ultimately, on their valuation of risky prospects.

Researchers

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Key Reference

Hills, T. T., & Hertwig, R. (2012). Two distinct exploratory behaviors in decisions from experience: Comment on Gonzalez and Dutt (2011). *Psychological Review*, 119, 888–892. doi:10.1037/a0028004

Decisions From Experience in Competitive Worlds

Whether the question is what to eat, where to live, or whom to mate with, decisions are often made under competitive conditions. This holds for species ranging from humans to hermit crabs. Hermit crabs are always on the lookout for new and better shells. When a solitary crab encounters an empty shell, it inspects it thoroughly before deciding whether to leave its current shell for the new one. When a group of crabs encounters an empty shell, however, the crab nearest to the shell makes a split-second decision about whether to take it based on visual inspection alone. Similarly, on a slow shopping day, a leisurely shopper can examine all of a TV's attributes and even search for expert reviews of it on his or her smartphone before deciding whether or not to buy. On a frantic shopping day like Black Friday, in contrast, the same shopper might spend only a few seconds looking at the TV before deciding whether to buy it before someone else does.

In this project, we extend the decisions-from-experience paradigm to competitive social situations. Although information search can boost the chances of identifying a superior alternative, competing decision

makers may seize the better option while others are still engaged in search. How long should people search before choosing between uncertain options under competition? And how long do people actually search? Phillips, Hertwig, Kareev (Hebrew University of Jerusalem, Israel), and Avrahami (Hebrew University of Jerusalem, Israel) examined these questions experimentally and by means of simulation. They compared the effectiveness of different search and choice strategies implemented under different competitive and solitary environments. Their simulations showed that minimal search is adaptive when people are uncertain about how long their competitors will search and when small samples are likely to distinguish good options from bad.

Will people rely on searches as minimal as just one draw? Figure 15 presents the distribution of sampling rounds across all decision tasks in solitary versus competition conditions. In the solitary condition (no competition), the median number of sampling rounds was 18. In the competition condition, in contrast, the median number of sampling rounds was just 1. These findings suggest that competition shifts the balance between exploration and exploitation (see also Hills & Hertwig,

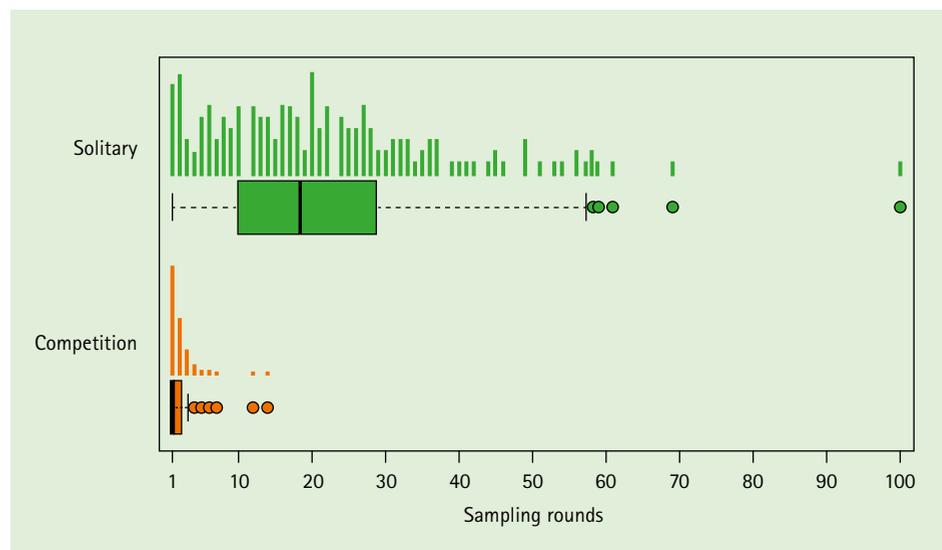


Figure 15. Distribution of sampling rounds and boxplots across all decision tasks and individuals, separately for the solitary and the competition conditions, respectively.

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2012) in an uncertain choice environment: Faced with the threat of being outpaced in the process of making a decision, people dramatically reduce search. This seems to be a smart thing to do in ecologies in which competitors can be expected to choose quickly and in which modal samples are good indicators of an option's value. It is a proverbial truth that you should "look before you leap." In our competitive environment, it emerged that a quick peek before leaping was very helpful—but that more extensive looking permitted the competitor to leap first and thus gain an edge.

DAT1 Polymorphism Is Associated With Risk Taking in an Experienced-Based Paradigm

A significant portion of individual differences in financial decision making and risk-taking behavior can be attributed to genetic differences between individuals. This result is suggested by a number of twin studies, with heritability estimates regarding behav-

ioral measures of risk ranging from 20% to upwards of 60%. Less is known, however, about the specific genes that underlie such behaviors. Mata, Hau, Papassotiropoulos, and Hertwig (2012) examined the role of a specific polymorphism of the dopamine transporter gene (SLC6A3; alternate symbol: DAT1) in a widely used and potentially clinically relevant behavioral measure of risk taking, the Balloon Analogue Risk Task (BART). Behavior in BART is known to be associated with activity in striatal reward-processing regions, and DAT1 is assumed to modulate striatal dopamine levels. Mata et al. (2012) found that carriers of DAT1 alleles, which presumably result in lower striatal dopamine availability (10R/10R), showed more risk-taking behavior than carriers of the alleles associated with higher striatal dopamine availability (9R) (Figure 16). These analyses suggest that the mechanism underlying this association is diminished sensitivity to rewards among those who take more risks.

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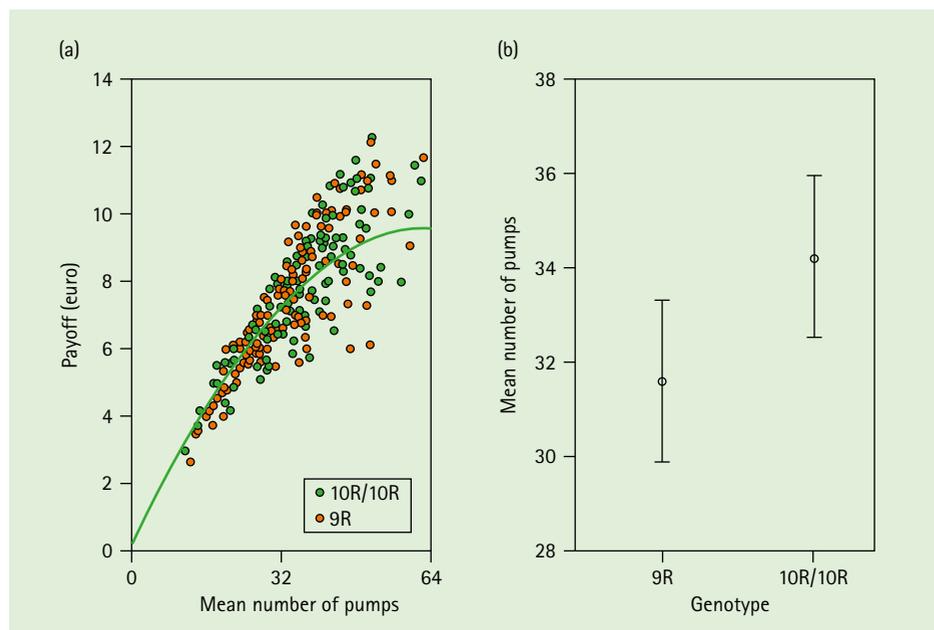


Figure 16. (a) Payoff in the Balloon Analogue Risk Task (in euro) by mean number of pumps for 9-repeat carriers (9R) and 10-repeat homozygotes and 11-repeat carriers (10R/10R). The green curve represents the expected value of the respective mean number of pumps. (b) Mean number of pumps and respective 95% confidence intervals for 9-repeat carriers (9R) and 10-repeat homozygotes and 11-repeat carriers (10R/10R) (adapted from Mata et al., 2012).

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The Biological and Cognitive Foundations of Risk Taking: The Basel–Berlin Risk Study

Although economists and psychologists share an interest in how the human mind masters risk and uncertainty, they have developed rather different theoretical frameworks and behavioral paradigms to approach the subject (Schonberg, Fox, & Poldrack, 2011). Economists understand risk as variability and risk taking as a preference for variability, and use well-defined but contrived decisions between monetary gambles to reveal people's penchant for risk. Psychologists, in contrast, often conceive risk taking as behavior with potentially harmful consequences and use behavioral paradigms that aim to be more representative of risk taking in the real world. Regardless of the behavioral paradigm used, however, one finding is common: Individuals vary dramatically in their risk-taking behavior. For illustration, let us consider Lucian Freud and Immanuel Kant. The former was one of the greatest painters of the 20th century, had at least 14 children (by various mothers), was a compulsive gambler, and amassed staggering debts before his paintings began to sell for millions. The latter was one of the greatest philosophers of all time, had no children, never married, and is purported not to have traveled far beyond the limits of his hometown, Königsberg. What is the source of these individual differences in the propensity to take risks?

The Basel–Berlin Risk Study draws on insights from decision science, cognitive psychology, and neuroscience to answer this question, among others. Specifically, the study uses a large array of behavioral paradigms—ranging from risky choices (decisions from descriptions) between well-defined lotteries and experienced-based sequential choices between alternatives with unknown consequences to simulations of real-life risky activities, such as overtaking a car on a busy highway (Figure 17)—to gauge respondents' risk-taking behavior. Second, the study uses established and new mathematical models of choice behavior to model the cognitive processes underlying risk taking. Third, the study collects genetic and hormonal samples, thus making it possible to associate overt be-



Figure 17. Participant performing a driving task that permits researchers to study the propensity to take risks in real-life traffic situations.

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havior and model parameters with candidate-specific genetic polymorphisms and hormonal states.

Data from 1,500 participants are being collected at two sites: the University of Basel and the MPI for Human Development in Berlin. Next to numerous risk-taking tasks, respondents complete a survey about their real-life risk-taking behavior (e.g., use of substances, gambling). In addition, they work on a battery of cognitive paradigms designed to quantify, for instance, working-memory capacity and numeracy. Data collection at both laboratories began in April 2013 and will last approximately 1 year. Subsamples of the core study will be used to replicate findings to measure the reliability of behavioral measures (i.e., the reliability of risk preferences) and to characterize the link between global brain connectivity and risk-taking behavior (Horn, Oswald, Reisert, & Blankenburg, in press).

Coming Soon! Neural Basis of Decision Making and Choice

Progress in the cognitive neuroscience of human decision making is relatively slow because of a gap between theory and experimentation. On the theoretical level, cognitive process models have typically been developed without much concern for neurocomputational implementations of the postulated processes. Consequently, these models do not permit researchers to derive quantitative biophysical predictions for neuroimaging data. At the same time, the integration of experimentally recorded EEG-fMRI data within a coherent functional-biophysical framework has not yet been achieved. This project strives to help bridge these gaps. To this end, a first investigation focuses on the electrophysiological constraints of risky decision making by means of stochastic time-series models (STSMs). STSMs offer a useful starting point for the noninvasive study of the neural basis of risky decision making. A well-developed STSM for choice is Decision Field Theory (DFT; Busemeyer & Townsend, 1993). It corresponds to the Ornstein-Uhlenbeck process, whose key parameters represent psychological concepts such as attention switching, memory decay, and approach-avoidance conflicts. The project's first aim is to make DFT directly accessible to Bayesian model identification and to derive neurobiologically plausible DFT predictions (see Ostwald, Kirilina, Starke, & Blankenburg, in press; Ostwald, Porcaro, Mayhew, & Bagshaw, 2012). The second goal is to demonstrate how different risky choice strategies—for instance, the minimax heuristic, the most-likely heuristic, and expected value calculus (Brandstätter, Gigerenzer, & Hertwig, 2006)—can be accommodated under the DFT framework and give rise to quantitatively different diffusion behavior. We will first consider description-based choice and then apply a similar approach to decisions from experience.

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Researchers

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Box 7.

Research Area 3: The Lifespan Development of Decision Making

Who runs the world? Judging from the average age of the people featured in the *Forbes* 2013 ranking of the *World's Most Powerful People* (61 years), political and economic power is concentrated in the hands of people who are, on average, considerably older than the general population. Older adults' overrepresentation in influential roles may be intensified in the future by demographic aging across the globe. Indeed, the average age of members of the U.S. Congress has risen fairly steadily since the 1980s. Against this backdrop, the following question is more pertinent than ever: Given that aging is associated with decline in many cognitive abilities, how does older adults' decision making compare with that of younger adults?

From the perspective of ecological rationality, no categorical and domain-general answer to this question can be given. Instead, the impact of aging on decision making will depend strongly on the demands of the specific task or ecology (Figure 18), and decision performance is ultimately the result of how the demands of specific decision tasks or environments interact with core cognitive abilities

and their developmental trajectories. Furthermore, we aim to go beyond the laboratory, exploring the implications of developmental changes in decision processes for real-world decisions, from health-care choices to the allocation of time and other resources to offspring. This section presents a sample of past, current, and planned work aimed at understanding the lifespan development of

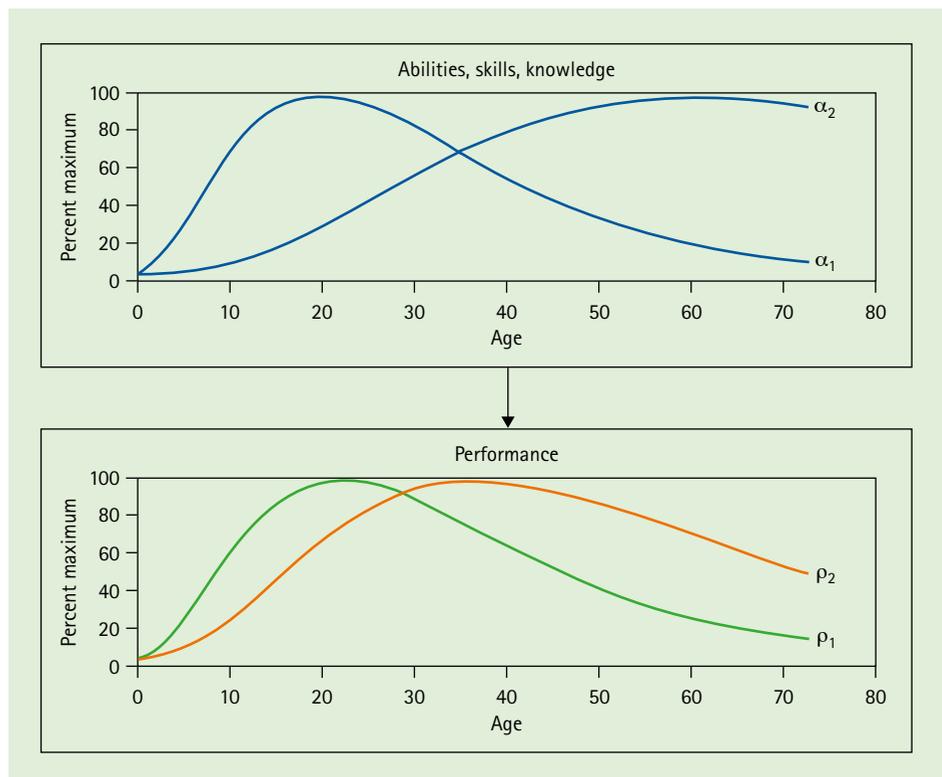


Figure 18. Illustration of the link between cognitive abilities and decision performance as a function of age. The top panel shows the hypothetical age gradients for two different factors (i. e., different abilities, skills, or knowledge); α_1 represents an early peaking ability (e. g., fluid intelligence) and α_2 a late peaking ability (e. g., crystallized intelligence). The bottom panel shows task performance for two tasks that differ in the demands put on α_1 and α_2 ; while one task (in green) taxes mostly α_1 , the second task (in orange) taxes both α_1 and α_2 , which results in the latter showing a delayed peak performance relative to the former.

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decision making and its potential implications for real-world decisions.

The Aging Decision Maker: Decisions From Memory

The link between aging and memory decline has long been recognized. But what are the potential effects of age-related memory decline on decision performance? Given that successful decision making in everyday situations often requires retrieving previously encountered information, one factor mediating age differences in decision performance is likely to be the memory demands of decision tasks. Retrieving information from memory can be an effortful process, marked by considerable involvement of control structures. Aging is associated with deficits in some frontal control structures as well as in storage components of memory (Park & Reuter-Lorenz, 2009). Consequently, older adults are likely to show difficulties in the selective retrieval of information in decisions from memory. In a study using a decision paradigm with high memory demands, Mata, Schooler, and Rieskamp (2007) found that older adults (average

age: 68.3 years) searched for less information and relied more on simpler strategies. Importantly, the tendency to rely on simpler strategies was related to individual differences in fluid abilities, suggesting that age-related cognitive decline may limit access to more complex strategies. Older adults also seem to avoid using strategies that rely heavily on memory retrieval in other inference tasks, such as estimation and categorization (Mata, von Helversen, Karlsson, & Cüpper, 2012). In a number of ongoing studies, we are investigating the impact of age-related decline on memory abilities and interactions with task demands. Specifically, these studies test the notion that decision performance is a function of both individual abilities and the way in which decision-relevant information is represented (e. g., whether decisions are made from tabulated information or from memory; see Box 8: Age Differences in Decisions From Memory). Our results point to a significant age-by-task interaction: While older and younger adults show similar decision performance when information is conveniently displayed in a tabulated manner, older adults

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Coming Soon! Age Differences in Decisions From Memory

Younger and older adults were asked to make decisions in two situations that put varying demands on memory. Specifically, participants had to decide between job candidates in a simulated personnel selection scenario. In an extensive learning phase, participants first learned about five job candidates in terms of five binary attributes or cues (e. g., previous job experience, social competencies). In addition, they learned the relative importance of each cue (i. e., cue ranking) and cue direction (i. e., which of the two cue values represents the desired attribute). Second, in a decision phase, participants chose between pairs of candidates when provided with either no information (high-memory-demand condition) or all information (low-memory-demand condition) about the candidates. Across two studies, older adults (average age of 69.9 and 68.8 years, respectively) needed more time than younger adults to reach the same memory performance level, in line with the expectation of age-related deficits in encoding newly learned information. More importantly, age-related performance differences in the decision phase increased as a function of memory demand (see Figure 19a). Both younger and older adults relied more on simpler decision strategies, that is, strategies that integrate fewer pieces of information, as memory demand increased (Figure 19b). However, as expected, older adults showed a stronger tendency to reduce cognitive load by relying on fewer pieces of information, particularly in the high-memory-demand condition. Follow-up studies will investigate whether such age differences are the result of a strategic decision to rely on simpler heuristics or of an inability to execute decision strategies that require many pieces of information to be recalled from memory.

Box 8.

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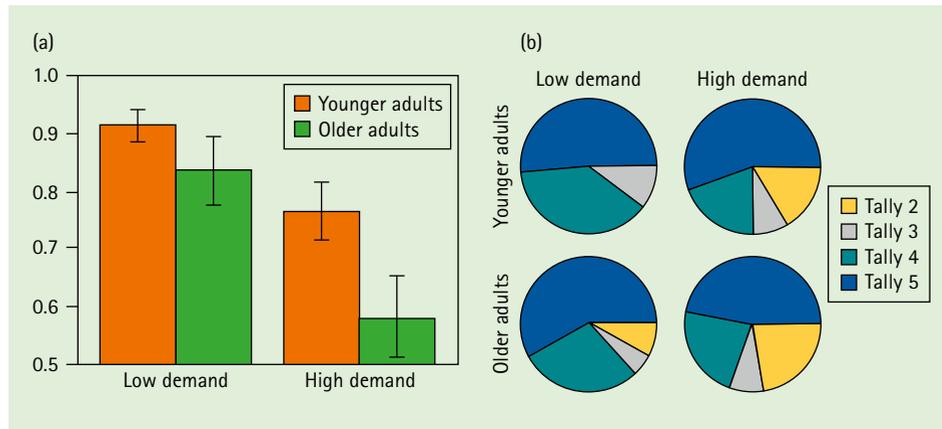


Figure 19. (a) Decision performance (error bars represent 95% confidence intervals), measured in terms of proportion of correct inferences. (b) Strategy classification of younger and older adults in the low- and high-memory-demand conditions. We fitted strategies that tallied up 2, 3, 4, or 5 pieces of information, respectively, for each candidate.

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are at a significant disadvantage when information has to be retrieved from memory. We plan to extend this line of work to the early phases of the lifespan to test the hypothesis that protracted maturation of memory abilities may also lead to difficulties in making decisions from memory. Feasibility studies are being conducted to assess whether neuroimaging studies using an inference-from-memory paradigm can shed light on how different neural structures contribute to age differences in decisions from memory. Age-related disruption of medial-temporal, hippocampal, and frontal regions may negatively affect associative binding and retrieval processes. Neuroimaging studies have the potential to help assess the relative contribution of associative and strategic components of information retrieval during decision making from memory.

Age Differences in Risky Choice

People acquire information about risk in at least two different ways. Sometimes they have access to convenient summary descriptions of risky prospects. For example, weather forecasts give a probability of precipitation, snowfall, or hurricane landfall at a given location, and decisions concerning insurance can be made on the basis of summary statistics from population information (Bundorf, Mata, Schoenbaum, & Bhattacharya, 2013). In

such cases, people can make *decisions from description* (Hertwig, 2012a). However, many consequential decisions, such as whether to make a financial investment, back up one's computer, or drive despite poor eyesight, are made without the benefit of such explicit, quantitative risk information about the possible outcomes and their probabilities. In such cases, people may adopt any of various strategies. For example, when equipped with current or recalled experiences of risks, people can make *decisions from experience* (Hertwig, 2012a). To what extent does aging lead to different patterns of risk taking as a function of how risk information is acquired? Aging is associated with structural and neuromodulatory changes thought to underlie age-related decline in some aspects of memory, learning, and cognitive control. These age-related changes may impact risky choice in different ways. First, decline in some aspects of cognitive control, such as working memory, may affect strategy selection and application (see Section: The Aging Decision Maker: Decisions From Memory, above). Second, deficits in reward learning can lead to difficulties in learning the associations between options and their payoffs and, ultimately, in adapting decision behavior to specific task structures. Such learning deficits seem particularly likely to affect decisions from experience, in which decision makers must learn about options from

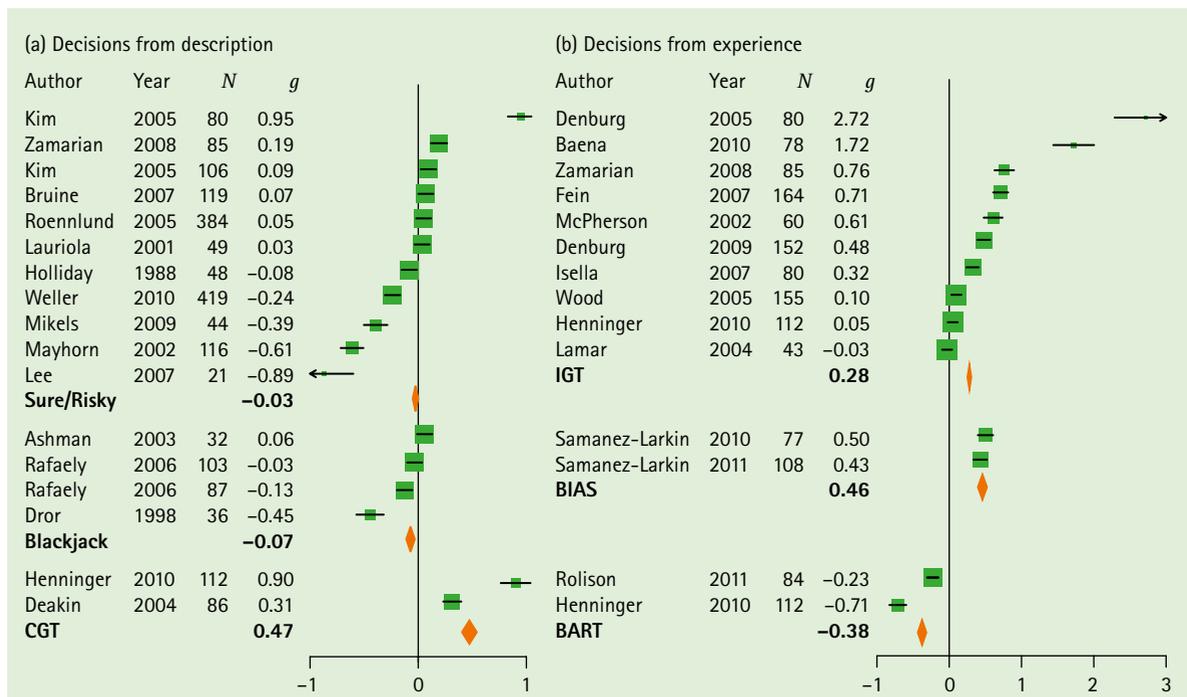


Figure 20. Forest plots indicating individual and weighted effect sizes for studies using (a) decisions from description and (b) decisions from experience. The positions of the squares on the horizontal axis indicate the effect size for each study; diamonds represent the weighted effect size for the task. Positive values indicate higher risk taking in older relative to younger adults; negative values indicate lower risk taking in older relative to younger adults. The errors bars indicate the 95% confidence intervals of the effect sizes, and the sizes of the squares are inversely proportional to the respective standard errors (i.e., larger squares indicate smaller standard errors). Sure/Risky = Sure Thing versus Risky Gamble task, CGT = Cambridge Gambling Task, IGT = Iowa Gambling Task, BIAS = Behavioral Investment Allocation Strategy task, BART = Balloon Analogue Risk Task (adapted from Mata et al., 2011).

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feedback over time and retrieve the learned information when relevant. In sum, the learning and memory demands of tasks involving decisions from experience could be an important moderator of age differences in risky choice. In a systematic meta-analysis, Mata, Josef, Samanez-Larkin, and Hertwig (2011) found 29 comparisons between younger and older adults on behavioral tasks thought to measure risk taking ($N = 4,093$). The studies relied on tasks that differed in several respects, such as the amount of learning required. The results suggest that age-related differences vary considerably with task characteristics— in particular, with learning requirements (Figure 20). In tasks involving decisions from experience, age-related differences in risk taking stemmed from lower learning performance: Older adults were more risk seeking than younger adults when learning favored risk-avoidant behavior, as in the Iowa Gambling Task (IGT) and the

Behavioral Investment Allocation Strategy (BIAS) task, but they were more risk averse when learning favored risk-seeking behavior, as in the Balloon Analogue Risk Task (BART). In decisions from description, in contrast, younger and older adults showed similar risk-taking behavior in the majority of tasks, and there were no clear age-related differences as a function of whether options were framed as gains or losses. Mata et al. (2011) concluded from these results that task characteristics may be pivotal in determining age-related differences in risky choice. One open question is which aspects of decisions from description and experience contribute to the moderation of age effects. We currently are investigating this question. For example, we are examining whether specific formats of decisions from experience can increase or decrease task difficulty for people with limited learning abilities, such as

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Coming Soon! The Development of Risk Taking During Adolescence

Adolescence is well known to be a period of increased risk taking in many domains. Most developmental studies conducted to date have used risky decisions from description or classic economic gambles. Paradoxically, most of these studies found that adolescents were as, or even more, risk averse than adults. Evidently, these kinds of tasks lack some aspect that may lead to the risk-seeking behavior often seen during adolescence.

One salient difference between decisions from description and real-life risky decisions is that in real life we often do not know the true probabilities. We may therefore have to make a choice based on unknown outcome probabilities or on some limited experience. Neuroimaging and computational modeling studies have suggested specific mechanisms that may underlie probabilistic learning across development (van den Bos, Güroğlu, van der Bulk, Rombouts, & Crone, 2009) and that these changes are related to fronto-striatal connectivity (van den Bos, Cohen, Kahnt, & Crone, 2012) and cortical thickness (van den Bos, Crone, & Güroğlu, 2012). Using simple experimental designs, we will study how both ambiguous decisions and decisions from experience change across development.

Another suggested source of adolescent risk taking that is not captured by the classic gambling paradigms is social influence. It is known that adolescence is a period of major social reorientation (van den Bos, 2013). During this period, there is a strong shift from parental to peer influence that is accompanied by great changes in the social brain. We will use novel social network analyses to identify the mechanisms of peer influence on risky behavior.

In addition, we will apply a multimodal approach, combining computational models with measures of brain function (fMRI, EEG) and structure (VBM, DTI) to identify the processes that underlie developmental changes in learning. We will implement several cross-sectional designs that sample from different age groups (early and late childhood, early and late adolescence, and young adulthood), which may be followed up later in longitudinal studies.

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Box 9.

older adults. In addition, we have extended the design of the Basel–Berlin Risk Study (see Research Area 3: Reckoning With Uncertainty: Search and Learning) to include a large sample of older adults, and we will also test the extent to which age differences generalize across different social and nonsocial domains.

Should I Stay or Should I Go? Age Differences in Internal and External Search

Search is ubiquitous in daily life. Not a day goes by in which we do not search for consumer products, online news, or names from

memory. Search is integrally associated with the exploration–exploitation dilemma, that is, the trade-off between searching for additional resources (such as information) and stopping search to exploit the resources already available. Cognitive control is a promising candidate mechanism for the regulation of exploration–exploitation trade-offs. Cognitive control refers to the system or class of processes that are involved in controlling or managing other cognitive processes, such as maintaining and updating information in working memory or focusing attention in the face of interference.

In this vein, cognitive control can be understood as the link between traditionally disparate cognitive domains or abilities, such as inhibitory function, working memory, and task switching. Crucially, cognitive control has been implicated in age differences in how people deal with exploration–exploitation trade-offs—specifically, in goal maintenance and switching (Mata & von Helversen, in press).

Age and Search in Memory

The cognitive control hypothesis—the idea that age differences in cognitive control can impact search and exploration–exploitation decisions—is best supported by work on search in memory. Assuming that memory is patchy (clustered), efficient search necessarily balances the goal of exploring different patches of the memory space with the goal of exploiting such patches. Models of memory search assume that these goals are pursued, respectively, by relying on global cues, which favor traveling from one patch to another, and local cues, which favor moving within a patch. In formal memory models, this amounts to switching between using cues such as frequency (base rate) to find semantically distant items and using cues such as similarity to find semantically related items belonging to the same patch. For example, when asked to identify tokens of a particular category, such as animals, people may start globally by using the base rate to identify a common animal, such as DOG, and then using the local cue of similarity to produce a similar item, such as CAT. Using local cues serves the goal of exploiting the specific patch (e.g., pets) whereas using global cues serves the goal of exploring the memory space at large. Importantly, it is assumed that maintaining focus on local cues is an effortful process that requires cognitive control. Individuals who excel at such tasks seem to be able to find the right frequency of switching between patches—that is, to abandon the current patch when effort would be better invested in exploring the space for more promising patches. The cognitive control hypothesis suggests that aging impacts memory search through the ability to handle activation and deactivation of memory retrieval cues and hence to balance the goals of exploration and exploitation.

Hills, Mata, Wilke, and Samanez-Larkin (2013) investigated age differences in memory search (“Name all the animals you can think of”) in a group of 185 participants between 29 and 99 years of age. Their results suggest that older adults have more difficulty in maintaining focus on specific memory cues and therefore search more dispersedly in memory. More specifically, their computational modeling suggests that older adults are poor at maintaining focus on local cues (similarity) and thus switch more often than younger adults between using global cues (frequency) and local cues (similarity) to probe memory. The thesis that declining cognitive control underlies such differences received support from Hills et al.’s (2013) empirical finding that the number of switches between memory cues was correlated with a measure of cognitive ability, with more switching being correlated with lower abilities and fewer items recalled (see also Hills & Hertwig, 2010). Overall, these results suggest that, as people age, they tend to change patches too frequently, abandoning promising patches before having exhausted their full potential.

Age and Search in the World

Factors other than cognitive control, such as affect, may also lead to age differences in search. General positive affect, for example, can guide decision making by signaling that a satisfactory state has been achieved. Consequently, age differences in positive affect can also lead to age differences in search. Von Helversen and Mata (2012) investigated how cognitive ability and affect contribute to age differences in sequential decision making by asking younger and older adults to shop for items in a computerized sequential decision-making task. Older adults showed higher positive affect and searched less than younger adults. Moreover, positive affect, but not cognitive abilities, was correlated with individual differences in search, suggesting that people who were in a better mood terminated search and made decisions earlier (Figure 21). A further study that manipulated mood likewise suggested that individuals in a positive mood stopped search earlier. These results are consistent with previous findings indicating that affect can be used as a cue to guide decisions

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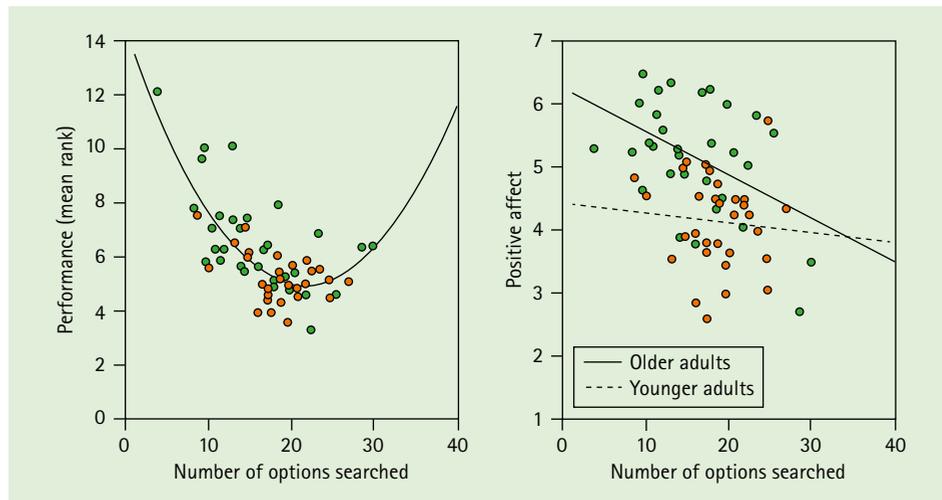


Figure 21. Search, performance, and positive affect. The left panel shows the curvilinear relationship between search and performance in the sequential decision task (lower values indicate higher ranks of the chosen option and thus higher performance) for younger and older adults (younger adults are denoted by orange dots; older adults by green dots); the right panel shows the linear relation between search and positive affect separately for younger and older adults (adapted from von Helversen & Mata, 2012).

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about when to stop accumulating information and suggest that, independent of cognitive control abilities, the typically higher levels of positive affect in older age may contribute to insufficient search and lower performance in simple decision tasks.

What Predicts Grandparental Investment Decisions in Contemporary Europe?

Evidence from traditional societies shows that the presence of a grandparent can be as beneficial to children's survival as such fundamental life improvements as the introduction of a safe water supply (Coall & Hertwig, 2010). In industrialized nations, the evidence is mounting that—especially in families with few resources—grandparents can buffer children's development against the potentially adverse effects of impoverished environments (Figure 22). At the same time, millions of grandparents invest nothing in their grandchildren. Why do grandparents invest (or not invest) in their grandchildren? And what factors impact their levels of investment?

Coall, Hilbrand, and Hertwig (in press) analyzed a wide range of biological, economic, sociological, and psychological predictors of grandparental care in contemporary Europe, using data collected in the Survey of Health,

Ageing and Retirement (SHARE). SHARE encompasses 11 European countries and 22,967 grandparent–child dyads. Drawing on this large-scale data set, Coall et al. (in press) were the first to show that the biological relationship between grandparents and grandchildren contributes to variation in grandparental



Figure 22. In contemporary Europe, biological grandparents are more likely than their nonbiological counterparts to invest heavily in their grandchildren (looking after them on a daily or weekly basis). Paradoxically, however, they are also more likely to invest nothing at all.

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Coming Soon! Does Grandparental Care Influence Cognitive Aging and Mortality?

Most research on grandparental investment has focused on its effects on grandchildren, but such investment is not a one-way street (see Coall & Hertwig, 2011). Grandparents may reap benefits from their good deeds and from the resulting relationships with their children and grandchildren, and those potential benefits go far beyond inclusive fitness. Some studies suggest that grandparents report significantly greater satisfaction with their contact with their children and grandchildren than parents do with their children. One possibility is that grandparenting is inherently rewarding because it becomes a central "life project" for people later in life.

Providing resources to grandchildren may have a measureable impact not only on a person's life satisfaction but on health as well. In a recent study, Poulin, Brown, Dillard, and Smith (2013) tested the hypothesis that providing help to others (family members and friends) is associated with less stress and lower mortality among the helpers. Specifically, over the 5 years of the study, they found that, when faced with stressful situations, those who had helped others during the previous year were less likely to die than those who had not helped others. While Poulin et al.'s (2013) study sheds light on the association between stress and mortality, little is known about how helping grown children and grandchildren (grandparental investment) might influence the process of cognitive aging and mortality. Specifically, grandparental care may help delay time-to-death trajectories of change for indicators of cognitive functioning (see Gerstorf, Ram, Lindenberger, & Smith, 2013). In a joint project between ARC, LIP, Sonja Hilbrand (University of Basel, Switzerland), and Denis Gerstorf (Humboldt-Universität zu Berlin, Germany), we are currently investigating the effects of caring for grandchildren on cognitive aging. With its rich set of measures, the Berlin Aging Study (BASE) (pp. 233–238) offers a unique opportunity to conduct such a comprehensive analysis of the degree to which grandparental care impacts time-to-death trajectories of late-life developmental change in various domains.

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Box 10.

investment in modern European societies. Biological grandparents were more likely than nonbiological grandparents to make high investments in their grandchildren. Paradoxically, however, they were also more likely to invest nothing at all. Central to understanding why biological and nonbiological grandparents invest differentially in their grandchildren are the dimensions on which they differ. Many factors previously found to be linked to increased investment were also associated with being biologically related to grandchildren. Specifically, biological grandparents were more likely to be female, felt more duty to their family, lived closer to their grandchildren,

had fewer children and grandchildren, and had children who were more likely to be employed. At the same time, biological grandparents were more likely to have characteristics associated with reduced or no investment: They were less healthy and older, and their children and grandchildren were older as well. Moreover, biological grandparents were less likely to have a partner and had more conflicts with their children about how their grandchildren were raised. This pattern of differences between biological and nonbiological grandparents can help explain why biological relatedness is associated with high as well as with no investment in grandchildren.

Research Area 4: Empowering and Educating the Decision Maker

In his utopian novel, *Walden Two*, B. F. Skinner (1976) set an ambitious goal for the behavioral sciences, namely, to use their knowledge of human behavior to create environments and institutional structures conducive to the pursuit of human happiness and fulfillment under conditions that today would be called "sustainable." In words that sound eerily prescient, he wrote: "It is now widely recognized that great changes must be made in the American way of life. Not only can we not face the rest of the world while consuming and polluting as we do, we cannot for long face ourselves while acknowledging the violence and chaos in which we live. The choice is clear: either we do nothing and allow a miserable and probably catastrophic future to overtake us, or we use our knowledge about human behavior to create a social environment in which we shall live productive and creative lives and do so without jeopardizing the chances that those who follow us will be able to do the same." (p. xvi)

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As this quote illustrates, in the heyday of behaviorism, scientists like Skinner were committed to "engineering" environments and institutions to increase the quality and sustainability of human life. At least part of that commitment no doubt survived the demise of behaviorism by migrating into more applied fields, such as clinical and educational psychology. On a theoretical level, however, mainstream cognitive psychology, the paradigm that supplanted behaviorism, abandoned the goal of social engineering. Yet recently, interest in social engineering has been rekindled by research on, for example, risk communication, goal implementation, and what has come to be called "nudging" (Thaler & Sunstein, 2008). The nudge approach has achieved widespread attention and inspired various attempts to redesign public policies. At the same time, some tenets of the nudge approach—for instance, the seemingly oxymoronic concept of "libertarian paternalism"—have been sharply criticized (see Rebonato, 2012). Although we consider some of the tools used in the nudge approach (e.g., defaults) to be useful, we do not share its underlying philosophical convictions, according to which individuals make consistently poor choices because they suffer from "decisional irrationality" (Thaler & Sunstein, 2008, p. 5) and that choice architects—policy makers and other supposedly benevolent authorities—must exploit this decisional irrationality to nudge behavior in a different direction. In our view, there is a way to guide behavior toward better outcomes that pose less (or no) risk of manipulating people or restricting

their freedom of choice. Specifically, in this section, we demonstrate how—by addressing deficits in people's knowledge, modifying choice environments, and taking advantage of existing and newly designed fast and frugal heuristics and cognitive strategies—laypeople and experts alike can be empowered to make better decisions. Let us begin with laypeople and some consequential deficits in health-related knowledge.

Which Learning Protocol Empowers Robust and Accurate Inferences?

According to Simon's vision of bounded rationality and the notion of ecological rationality, cognitive strategies enable good decisions to the extent that they are adapted to the structure of the environments in which they are used. But how do decision makers select from their repertoire of strategies such that mind matches environment? (For a review of research on the "strategy selection" problem, see Pachur & Bröder, 2013.) As Pachur and Olsson (2012) discovered, the learning protocol under which the probabilistic structure of an environment is experienced plays an important role in strategy selection. Two frequently used learning protocols were compared. In the direct-criterion-learning protocol (Figure 23a, upper part), participants were trained on individual objects and received feedback on the objects' absolute criterion value. In the learning-by-comparison protocol (Figure 23a, lower part), participants were trained on pairs of objects and received feedback on which of the two had the higher criterion value (but no information about

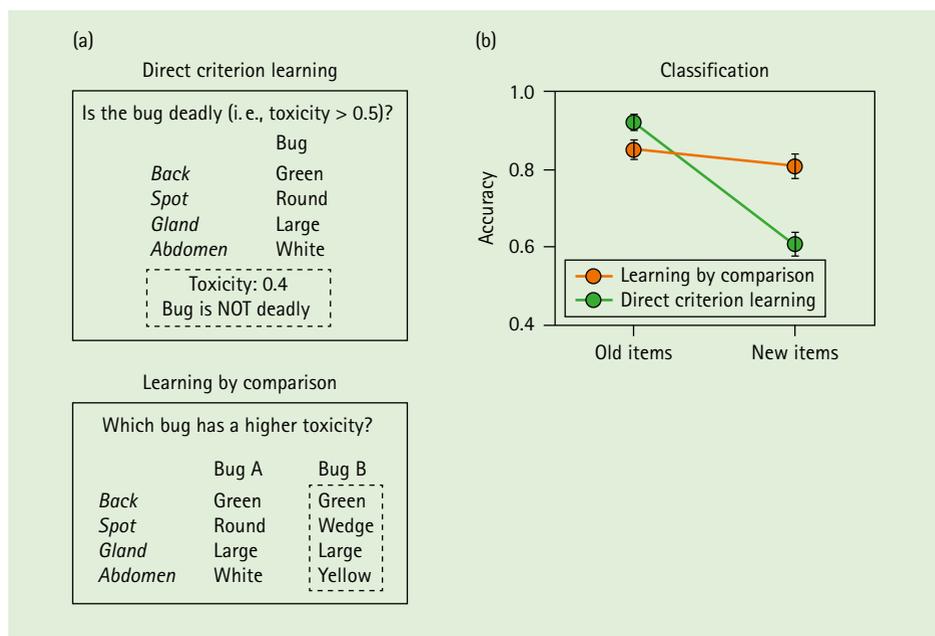


Figure 23. (a) The two learning protocols used in Pachur and Olsson (2012). In the direct-criterion-learning protocol, one object is presented in isolation, and the learner receives feedback on the object's absolute criterion value. In the learning-by-comparison protocol, two objects are presented, and the learner receives feedback on which object has the higher criterion value, without receiving any feedback on the objects' absolute criterion values. The feedback offered in the two learning protocols is shown in the dotted rectangles. (b) Performance in a classification task was considerably more robust after learning by comparison than after direct criterion learning (error bars represent ± 1 standard error of the mean). The performance of participants in the latter learning protocol dropped considerably when they judged new items (i. e., those not encountered during training) relative to old items (i. e., those encountered during training). By contrast, the performance of participants in the learning-by-comparison condition did not differ between old and new items (adapted from Pachur & Olsson, 2012).

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their absolute values). After direct criterion learning, people were more likely to make inferences about an object by comparing it with previously encountered objects (i. e., exemplar-based processing); after learning by comparison, in contrast, they were more likely to make inferences based on cues. That is, in the latter learning protocol, people abstracted cues and cue weights. One possible reason is that the abstraction of cue weights for individual cues is cognitively easier when two objects are presented together than when each object is shown in isolation. Importantly, the differences in strategy selection between the two types of learning tasks also impacted decision accuracy. Performance in a classification task was considerably more robust after training in the learning-by-comparison than in the direct-criterion-learning protocol. These results suggest a promising avenue for improving decision making:

designing learning environments that offer comparative—that is, less—rather than absolute—that is, more—information. Specifically, giving the decision maker the opportunity to compare objects during learning appears to foster inferential competence that transfers more easily to a new context.

This discovery about fostering learning environments has powerful implications for training across a wide range of professional domains (e. g., medicine, law enforcement), for educational settings, and for attenuating the effects of cognitive aging.

Do People Recognize the Symptoms of Heart Attack and Stroke?

Cardiovascular diseases are the leading cause of death and a significant cause of chronic disability in Europe. To be most effective, medical interventions must be performed within a few hours of a heart attack or stroke.

Key Reference

Mata, J., Frank, R., & Gigerenzer, G. (in press). Symptom recognition of heart attack and stroke in nine European countries: A representative study. *Health Expectations*. Advance online publication. doi:10.1111/j.1369-7625.2011.00764.x

Rapid access to treatment is thus crucial to reducing rates of death and chronic disability. Citizens should ideally be able to both recognize the symptoms of a heart attack and stroke and know how to respond. To what extent do laypeople have these competencies? To find out, Mata, Frank, and Gigerenzer (in press) conducted a representative survey in nine European countries. The goal was to test people's ability to recognize symptoms of a heart attack and stroke. In addition, respondents were asked what they would do if they witnessed someone with suddenly impaired vision, speech problems, numbness, or one-sided weakness—all typical symptoms of a stroke. Data were collected from more than 10,000 residents in Austria, France, Germany, Italy, the Netherlands, Poland, Russia, Spain, and the United Kingdom. The majority of respondents recognized only a few of the symptoms of a heart attack or stroke. Of six established warning signs of a heart attack, chest pain was the only symptom recognized by most participants (80%), while 8% did not recognize any heart attack symptoms. Ignorance of stroke symptoms was even greater. Of 14 warning signs of a stroke, slurred speech, paralysis, and a lopsided face were recognized most often, but none of them by more than 44% of participants. Almost

one in five respondents did not recognize a single stroke symptom. Moreover, respondents diagnosed with high blood pressure or obesity—two key risk factors for heart attack and stroke—knew no more about stroke warning signs or how to respond to strokes than others. Germans and Austrians were "top of the class," on average recognizing the highest numbers of symptoms: about 3 of 6 for a heart attack and about 5 of 14 for a stroke (Table 1). Respondents in Italy, Poland, Russia, and Spain knew only about half as many symptoms. But did the Germans and Austrians also know what to do if they saw someone with symptoms typical of a stroke? Only one-third of them said they would immediately call an ambulance, the option with the highest chance of ensuring effective, timely treatment. In contrast, two thirds of the participants in Russia and Poland—and half of the total sample, on average—said they would call an ambulance. Rather than calling an ambulance, 28% of Germans and 30% of Austrians would suggest that the hypothetical individual suffering stroke symptoms sip tea or water or go to bed and wait. In sum, the majority of respondents in nine European countries recognized few symptoms of a heart attack or stroke, and many did not

Table 1
Recognizing Heart Attack and Stroke Symptoms and Reacting Appropriately

	Average over nine European countries	Austria	France	Germany	Italy	Netherlands	Poland	Russia	Spain	United Kingdom
Mean number of correctly recognized heart attack symptoms (out of 6 possible)	2.3	2.9	2.3	3.2	1.9	2.4	1.9	1.8	1.9	2.9
Mean number of correctly recognized stroke symptoms (out of 14 possible)	3.3	4.9	4.2	5.0	2.0	3.7	2.6	2.6	2.1	4.2
Percentage of participants who would call an ambulance if they saw a person with stroke symptoms (i.e., a person suffering from sudden impaired vision, speech problems, numbness, or one-sided weakness; respondents were not told that these symptoms are typical of a stroke)	51%	34%	43%	33%	49%	41%	66%	64%	42%	58%

Note. Highest mean or percentage per line is emphasized in orange (adapted from Mata et al., in press).

Coming Soon! From Attributions of Responsibility to Public Policies

Excessive weight and obesity reduce life expectancy and increase the number of end-of-life years with compromised health and quality of life. Policy makers, scientists, and many citizens worldwide agree that the global obesity epidemic requires a forceful response. There is less agreement, however, about the form this response should take. Public-health specialists largely blame changes in the environment for the stark rise in obesity over recent decades; consequently, they propose policies at the environmental or societal level to address the obesity epidemic (e.g., higher taxes on obesity-related products such as sugary drinks, better nutrition labeling, bans on vending machines in public places, etc.). It is much less clear what citizens think about the causes of obesity and what prevention measures they consider to be effective and are willing to endorse (e.g., higher taxes on high-calorie foods have often been opposed by the public).

To gain a better understanding of lay beliefs about obesity, Mata and Hertwig surveyed a representative sample of Germans, investigating their views on the role of causes of obesity, approaches to its treatment, and effectiveness of prevention measures.

Lay beliefs about obesity in Germany proved to be most closely aligned with those about alcoholism and tobacco dependence. In contrast to experts, who generally blame environmental factors for obesity, the lay respondents in this survey attributed obesity largely to the individual. Depression showed a contrasting pattern of results (Figure 24).

The attribution of responsibility for health problems to individuals has consequences for the public's views on policy. For example, respondents tended to support individual-level treatment of obesity (more strongly than, e.g., changes to the environment). Moreover, the more responsibility for a given health problem they attributed to the individual, the more likely they were to expect people to pay for their treatment for that problem themselves.

Researchers

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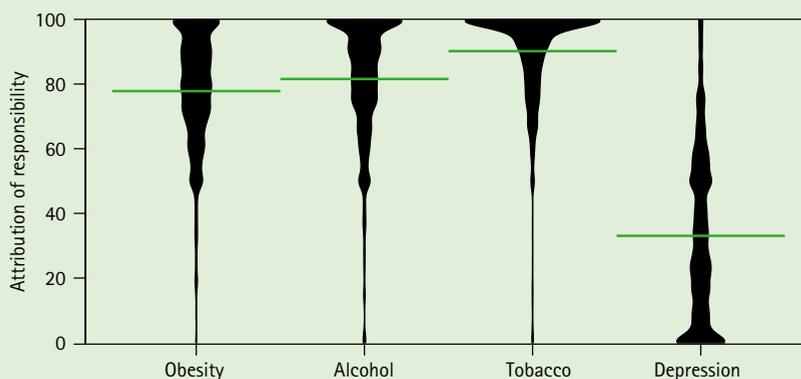


Figure 24. A representative sample of 973 Germans aged 14 years and older indicated to what extent individuals with obesity are responsible for their own weight; 0 = not responsible at all, 100 = fully responsible. Parallel questions were asked for alcoholism, tobacco dependence, and depression. Alcohol = alcoholism, tobacco = tobacco dependence. The plot widths represent the density of the distributions. The horizontal lines represent the mean judgments.

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Box 11.

Key Reference

Gigerenzer, G., Mata, J., & Frank, R. (2009). Public knowledge of benefits of breast and prostate cancer screening in Europe. *Journal of the National Cancer Institute, 101*, 1216–1220. doi:10.1093/jnci/djp237

know how to respond in case of symptoms. The discrepancy between symptom knowledge and knowledge of how to respond was especially large in Germany and Austria. The generally low level of knowledge documented in this representative survey seems likely to lead to delays in treatment, contributing to Europe's high rates of mortality and morbidity from a heart attack and stroke. These findings add to a growing body of research showing that health-related knowledge in Europe is so lacking that it may well lead to delayed or no treatment, wrong interpretation of test results, and potentially harmful overtreatment (Gigerenzer, Mata, & Frank, 2009). This research challenges health-care professionals to conceive ways of conveying such important knowledge to everyone. One approach is to go beyond unsystematic news coverage and public health campaigns and make health

education a mandatory part of the school curriculum.

How Simple Rules Guide Food Choices

The stock trader Ivan Frederick Boesky from the United States is known not only for being the person who inspired the fictional character Gordon Gekko in the movie *Wall Street*, but also for his eccentric food choices. At a lunch meeting in the Café des Artistes, a high-end restaurant in Manhattan, Boesky is said to have ordered all eight main dishes on the menu. When the food arrived, Boesky took one bite of each dish, chose one, and sent the rest back. Unlike Wall Street tycoons, most consumers cannot afford to sample all the available options before deciding what to eat. Instead, they use information available in the environment (restaurant menus, packaging labels) to make food choices.

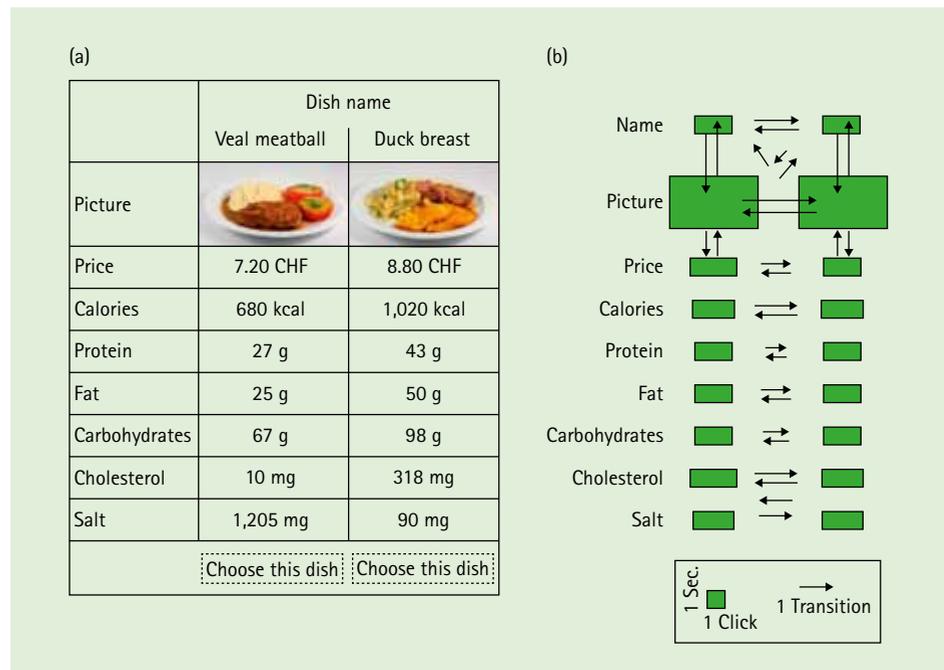


Figure 25. How can the information search process in a food choice task be studied and visualized? (a) The names of the options were displayed in a matrix, along with a picture of, the price of, and several pieces of nutritional information about each one. These boxes were covered. Participants could look up information by moving the mouse over a cell (e.g., calories in the duck breast), which then opened. It closed again as soon as the participant started inspecting other cells. After finishing gathering information, the participant made a choice by clicking on one of the buttons at the bottom of the matrix. (b) Attention plot visualizing the search process by integrating three types of information: The width of each cell corresponds to the average number of cell openings; the height of each cell corresponds to the average length of cell openings; the arrows correspond to the average number of transitions between cells (adapted from Schulte-Mecklenbeck et al., 2013).

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How is the information from these sources utilized? A common view in the food choice domain is that consumers first examine all the available information and then integrate it for each option (dishes, products) before choosing the option with the highest overall value. Skeptical of this account, Schulte-Mecklenbeck, Sohn, de Bellis, Martin, and Hertwig (2013) ran an experiment designed to detect the use of a broad range of strategies that either look up and weight all the available information (e.g., weighted additive rule) about food options or pick one attribute of the options and base the choice on that piece of information (e.g., lexicographic rule). Particular attention was paid to the process by which people arrived at their choices. Participants decided between two lunch dishes at a time (see Figure 25a). The dishes were sampled from an actual canteen. Participants were able to look up information about the dishes on nine attributes commonly provided on food packages or restaurant menus (name, picture, price, calories, protein, fat, carbohydrates, cholesterol, and sodium content). This search process was recorded using Mouselab, a process-tracing tool, and choices were assigned to strategies based on (1) how information was acquired (either within or between options), (2) the completeness of information acquisition, and (3) the (extracted) weights of the nine attributes. The strategy classification showed that only 27% of participants looked up all the available information. In contrast, 69% of participants used simple strategies based on limited information search, completing the task in less than half the time taken by those who searched exhaustively. Figure 25b combines all the process data collected within an attention plot. Participants compared the dishes' names, pictures, and prices within and between options, but switched to between-option comparison once the focus moved to nutritional information values. This pattern is consistent with the use of simple rules that rely on attribute-wise comparisons between dishes. These findings suggest that people make food choices using simple heuristics that ignore much of the available information. If so, how can food labels best

be designed to foster good consumer decisions (see Box 12)?

Fostering Surrogate Decisions

Some medical conditions can rob people of the ability to participate in decisions about their own treatment. In the United States, for instance, as many as 15,000 patients who live in a persistent vegetative state and another 100,000 who are minimally conscious cannot express their preferences in the event of life-threatening medical complications. Under such circumstances, other people have the difficult task of making decisions on the patients' behalf. The task of "surrogate" decision makers is to infer incapacitated patients' preferences accurately, thus preserving their right to autonomy and control. Several approaches to making surrogate decisions have been proposed, and many countries have adopted laws detailing how surrogate decision making should proceed. Do these laws lay out decision protocols that yield high-quality surrogate decisions?

In the surrogate context, decision quality varies on at least two dimensions: procedural satisfaction and accuracy. Procedural satisfaction refers to the perceived fairness of the decision procedures, independent of a decision's consequences. Accuracy refers to the proportion of surrogate decisions that are in line with the patient's actual preferences, which in the case of incapacitated people are—by definition—unknowable. The most direct way to assess accuracy is to elicit people's decisions in hypothetical scenarios similar to those described in living wills and to have surrogates independently infer these decisions.

To find out whether current laws specify decision protocols that facilitate procedural satisfaction and accuracy, Frey, Hertwig, and Herzog (in press) investigated (1) how people would prefer surrogate decisions to be made if they were to become incapacitated or a surrogate, respectively; (2) how accurate different ways of making a surrogate decision are in predicting patients' preferences; and (3) whether procedural satisfaction and accuracy are compatible goals or require trade-offs. First, procedural satisfaction was

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- Schulte-Mecklenbeck, M., Sohn, M., De Bellis, E., Martin, N., & Hertwig, R. (2013). A lack of appetite for information and computation: Simple heuristics in food choice. *Appetite*, 71, 242–251. doi:10.1016/j.appet.2013.08.008

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Coming Soon! Frugal and Ecologically Smart Food Labels

Based on our finding that consumers rely on little information when making food choices, we are now investigating food package labels as a key decision aid. Food labels play a vital role in informing consumers quickly and accurately about a food's healthiness and nutritional characteristics. This is particularly important in making choices between processed foods such as cereals and yoghurts, where products within the same food category can range from very nutritious to extremely low in nutritional value.

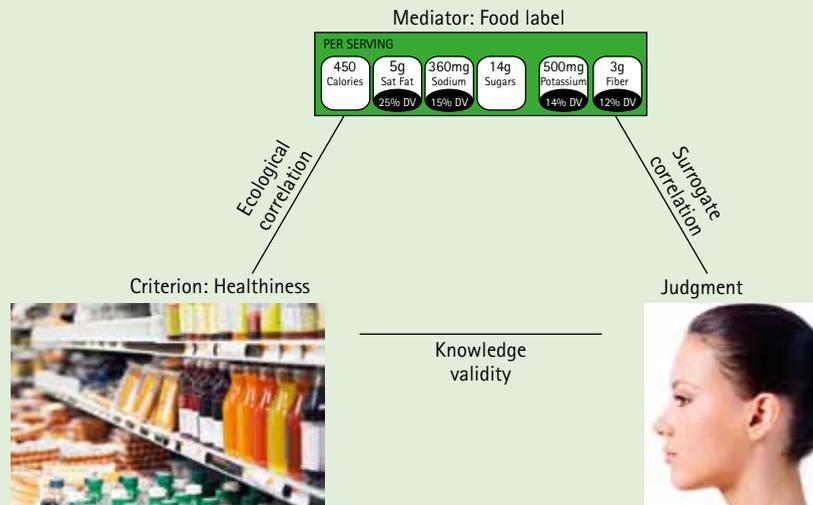


Figure 26. What is the correspondence between a food product's ingredients and consumers' judgments of its healthiness? Healthiness is often a decisive factor in food choice. A consumer can judge the healthiness of a product via either of two paths: by direct knowledge of the criterion (that is, knowing that a product is healthy or not) or by consulting product information, usually found on the food label. Food labels can thus serve as a mediator between the products to be judged and the person making the judgment.

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To evaluate how healthy a product is (a question of major concern for many), consumers without direct knowledge of the product's healthiness must rely on cue information, usually presented on the nutrition label (Figure 26). In probabilistic environments, cues are sometimes highly intercorrelated. This project examines the extent to which such intercorrelations exist in the food environment—and whether it might be possible to take advantage of them in communications of nutritional information by giving priority to the best predictors of a product's healthiness and thus reducing the amount of information that must be presented (vicarious functioning). To determine the extent to which nutrients are correlated, we have analyzed food label information on a wide range of products in German supermarkets belonging to two product groups: cereals ($N = 97$) and yoghurts ($N = 246$). Nutrients showing particularly high correlations with each other are identified as having high information redundancy; that is, knowing the value of one nutrient informs the consumer about the value of the other. For example, the correlation between fat and saturated fat in yoghurts is .97. Such redundancies offer a starting point for designing more frugal and ecologically smart food labels. The second step in this project will be to investigate the extent to which consumers are aware of such redundancies and make spontaneous use of them (or can be taught to make use of them) in applying simple heuristics to food choice.

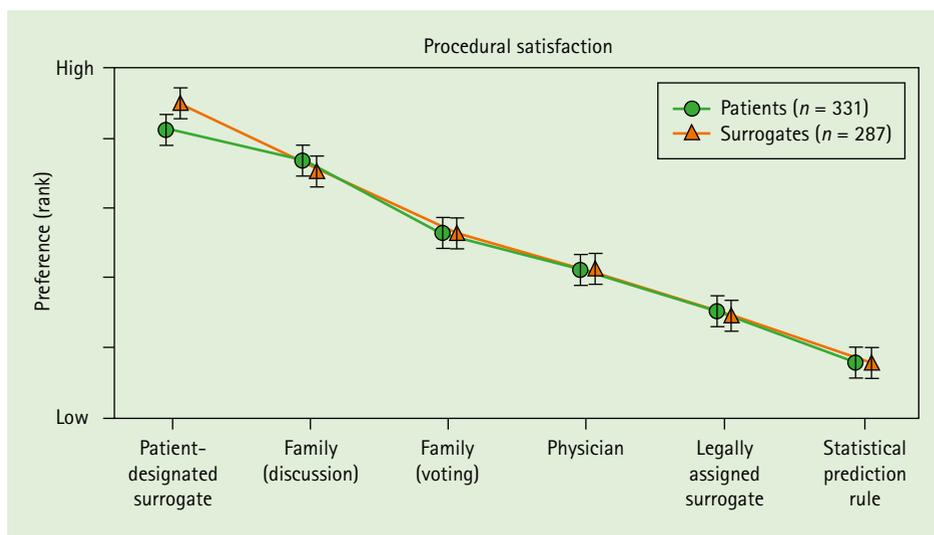


Figure 27. In a mixed-age online sample, participants were asked to assume the role of either a surrogate or a patient. They then ranked their preferences for different approaches to making surrogate decisions: having the decision made by a person previously designated by the patient; jointly by the whole family by finding a consensus through discussion; jointly by the whole family through independent and anonymous voting; by the attending physician; by a family member assigned to the role of surrogate through a legally specified hierarchy; by a statistical prediction rule that takes into account the preferences of similar patients. Error bars show bootstrapped 95% confidence intervals of mean ranks (adapted from Frey et al., in press).

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investigated by assigning participants to the role of a hypothetical surrogate or patient. The findings showed that participants in both roles had closely aligned preferences about the way surrogate decisions should be made (Figure 27): Procedural satisfaction was highest with a patient-designated surrogate, followed by shared surrogate decision-making approaches (with family members finding a consensus through discussion or, if no consensus can be found, by voting). The least preferred options were to delegate the decision to a physician, to appoint a legal surrogate according to a nearest-relative hierarchy, and to rely on a statistical prediction rule. No current legal decision architecture is in line with the order of preferences empirically observed in this study.

What would implementation of these preferences mean for inferential accuracy? A study of 64 families in Switzerland gauged the proportion of correct predictions made through each of the decision procedures (except delegating the decision to a physician or a statistical prediction rule). In each family, one person was randomly assigned to the role of

patient and asked to imagine being in different health states. She then privately indicated whether or not she would want to be treated for various potentially life-threatening medical complications and whom she wants as her designated surrogate. The other family members, acting as surrogates, inferred this person's preferences. The results showed that, leaving the decision to a patient-designated surrogate, the approach previously found to be preferred, correctly predicted 68% of the patients' treatment preferences. The second and third most preferred procedures—having family members reach a shared surrogate decision through discussion or voting—achieved 71% and 72% accuracy, respectively. The default legal surrogates were 70% accurate. Thus, the various approaches to surrogate decision making did not differ substantially with respect to accuracy. However, a more fine-grained signal detection analysis revealed that, in those medical scenarios where there was no clear majority preference (for treatment or no treatment), only the shared decision-making approaches showed better-than-chance discriminatory performance, and

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Nemec, M., Koller, M. T., Nickel, C. H., Maile, S., Winterhalder, C., Karrer C., et al. (2010). Patients presenting to the emergency department with non-specific complaints: The Basel Non-specific Complaints (BANC) study. *Academic Emergency Medicine, 17*, 284–292. doi:10.1111/j.1553-2712.2009.00658.x

only the family-voting approach had a neutral decision criterion (the others had a bias toward treatment).

These findings indicate that people prefer a shared approach to making surrogate decisions in the absence of a patient-designated surrogate and that implementing such shared, collective decision making would not compromise accuracy. Therefore, shared surrogate decision making promises high procedural satisfaction without sacrificing accuracy.

How General Practitioners Can Benefit From Simple Decision Trees

One of the key challenges that medical diagnosticians face is how to separate the wheat from the chaff, or how to identify relevant information amid what is often an abundance of symptoms, test results, and aspects of a patient's history. Their next challenge is how to integrate this winnowed-down set of information. One important aid to diagnostic data selection and integration is a fast and frugal decision tree. Because of their simplicity and transparency, decision trees are more likely to be integrated into diagnosticians' daily practice than, for instance, expert systems.

Depressive disorders are among the most prevalent psychiatric disorders and have huge personal, familial, and societal costs. More than 80% of people with a history of major depressive disorder have more than one episode of depression. Early detection and treatment—which may help prevent potential future episodes—is therefore vital. Individuals experiencing symptoms of depression often first consult their general practitioner. Because most general practitioners are not specialized in detecting depression, Jenny, Pachur, Williams, Becker, and Margraf (2013) sought to develop a simple screening tool that could help improve early detection rates. The 21-question Beck Depression Inventory (BDI), a standard instrument used to screen for depressed mood, was simplified into a decision tree consisting of four binary (yes vs. no) questions (Figure 28a). If a patient answered all four questions in the affirmative, she would be considered to be in a clinically depressed mood state and referred

to a specialist. The tree was developed and tested based on data from a large epidemiological study of 1,382 randomly selected women from Dresden (Germany) aged 18 to 25 years. The tree's ability to detect depressed mood was compared with that of a naïve maximization model and two compensatory models (Figure 28b). Specifically, the tree and the two compensatory models were fitted to the BDI score of the sample and cross-validated on the BDI score approximately 18 months later. Although the fast and frugal tree inspected only approximately one cue, on average, it outperformed the naïve maximization model and performed comparably to both compensatory models. Simple decision tools have previously received relatively little attention in mental health settings. As this analysis demonstrates, however, they offer a competitive and easily administered alternative to computationally and informationally demanding models in the everyday practice of general practitioners.

Navigating the Quagmire of Nonspecific Symptoms

Patients presenting to emergency departments (ED) with nonspecific complaints, such as weakness, fatigue, or dizziness, pose a particular challenge to the diagnostic decision-making process. General weakness, for example, is associated with hundreds of diagnoses, some of them life-threatening. Not surprisingly, the misdiagnosis rate in cases involving nonspecific complaints is higher than in cases with specific symptoms, such as chest pain (see Nemec et al., 2010): According to the Basel Non-specific Complaints (BANC) study, the misdiagnosis rate for such patients is five times higher than the overall misdiagnosis rate of 10%.

What helps or hinders accurate diagnosis of nonspecific complaints? Hertwig et al. (2013) had Swiss ED physicians, internists, and family practitioners diagnose seven real patient histories: six involving nonspecific symptoms (see Box 13: A Patient History Involving Nonspecific Symptoms, for an example). Respondents indicated the three most likely diagnoses for each history and which cue(s) they considered crucial in reaching the diagnosis.

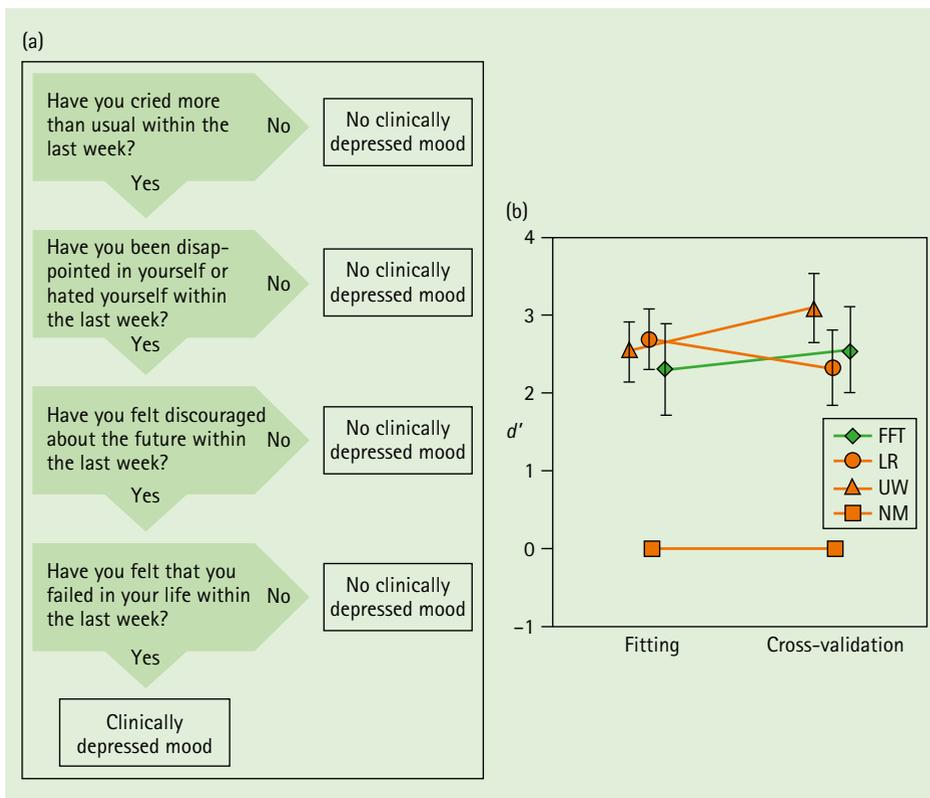


Figure 28. (a) Fast and frugal decision tree to screen for depressed mood. Questions are asked in the order given. A respondent who gives four affirmative answers is identified as having clinically depressed mood; if at least one question is answered in the negative, the respondent is not considered to be in a clinically depressed mood. The decision tree's frugality arises from the small number of questions and the fact that the interview can be terminated as soon as a respondent answers a question in the negative. (b) Detecting depressed mood by means of a simple lexicographic and noncompensatory fast and frugal tree (FFT), a simple compensatory unit-weight model (UW), a complex compensatory logistic regression (LR), and a naïve maximization model (NM), which assumes that nobody is depressed. The screening methods were compared in their ability to discriminate (d') between depressed and nondepressed women according to signal detection theory. The FFT, UW, and LR were fit to a first data set and cross-validated on a second data set (collected 18 months later). Error bars indicate Bayesian 95% highest density intervals. Despite their simplicity, the FFT and UW performed comparably to the LR. Note that the noncompensatory FFT considers less information than the compensatory UW, which by definition considers all available information (adapted from Jenny et al. (2013).

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This first study of diagnostic accuracy in cases involving nonspecific symptoms demonstrated that such cases are not invariably unsolvable, though some are. Figure 29 shows two measures of accuracy. Across histories, the percentage of correct diagnoses ranged from 14% to 64%, with an average of 34%; the percentage of correct differential diagnoses (where the correct diagnosis was listed among the three mostly likely diagnoses) ranged from 29% to 87%, with an average of 53%. In an analysis of the probabilistic nature of diagnostic inference in the context of nonspecific symptoms, two structural proper-

ties of patient histories proved to be associated with accuracy: cue consensus and cue substitutability. The more physicians agreed on which cues (symptoms) were crucial (i.e., had high cue consensus), the more likely the problem was to be correctly diagnosed. Cue substitutability denotes the extent to which a patient history allows diagnosticians to rely on cues other than the diagnostic ones (determined by experts) and still arrive at the correct diagnosis. Cue substitutability was highly correlated with diagnostic accuracy. For instance, in the patient history that was most often diagnosed correctly (64%;

A Patient History Involving Nonspecific Symptoms

A 78-year-old male patient was brought to the emergency department by ambulance, referred by his general practitioner. Starting the previous weekend, the patient noticed an increasing weakness in his legs. Also frequent hiccups. Lives at home with his wife, who is in Germany at present, and with a female caretaker. Intake of medication this morning not certain. No pains. History of cough last weekend, but not right now. No expectoration.

Final diagnosis: Pneumonia

Box 13.

urinary tract infection), four of the total of five cues (symptoms) had positive validity; that is, most cues in this history represented interchangeable paths to the correct diagnosis. Even if no diagnostic cue was identified, accuracy was nevertheless nearly 40%. In contrast, the most difficult problem (14%; congestive heart failure 2) required identifying a single diagnostic cue among six cues, and the performance of physicians who failed to identify this cue was dismal.

In addition to analyzing the structural properties of case histories, we have investigated other ways of empowering ED physicians to deal effectively with patients with nonspe-

cific complaints. For instance, to what extent might admitting physicians be able to rely, under time pressure, on their first clinical impression of a patient's health state to make a rapid disposition decision to ambulatory care? A total of 1,278 adult patients admitted to the EDs of two Swiss hospitals with nonspecific complaints were analyzed. Initial results suggest that both mortality and acute morbidity are highly predictable on the basis of first clinical impressions combined with two simple cues (sex and age). If this finding proves robust, it could be of great practical value in diagnosis and treatment—especially in emergencies.

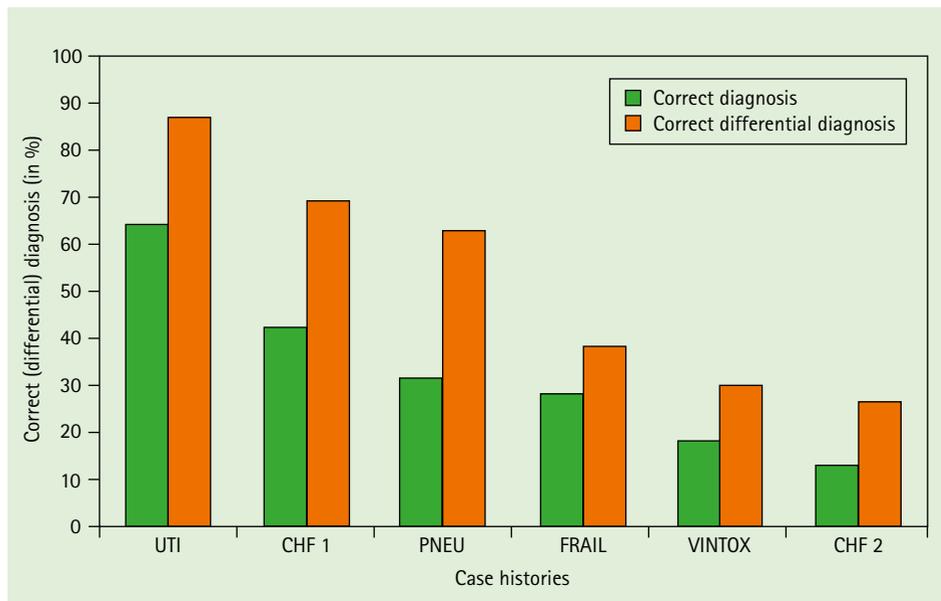


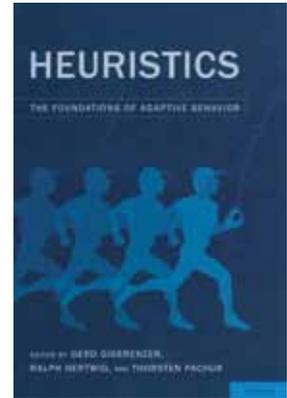
Figure 29. Number of correct diagnoses (i.e., correct diagnosis was listed as the most likely) and correct differential diagnoses (correct diagnosis was listed among the three most-likely diagnoses) per patient history, averaged across physicians (UTI = urinary tract infection, CHF 1/2 = congestive heart failure 1 and 2, PNEU = pneumonia, FRAIL = frailty, VINTOX = valium intoxication) (adapted from Hertwig et al., 2013).

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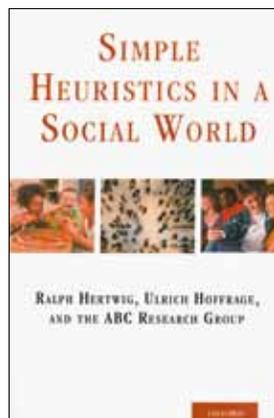
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Center for the History of Emotions

The Center for the History of Emotions

The **Center for the History of Emotions (HoE)** (Director: Ute Frevert), which opened in 2008, examines emotions as a major feature of human development both in an ontogenetic and phylogenetic sense. The research rests on the assumption that emotions—feelings and their expressions—are shaped by culture and learned in social contexts through social practices. Since these contexts and practices change in space and time, emotions are held to be historically variable. In order to detect and explore this variability, the Center's scope includes different societies within and outside Europe. Special attention is paid to institutions that bear a strong impact on human behavior and development, such as the family, school, law, religion, the economy, the military, and the state, as they have developed since the (early) modern period.



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Sensation is crucial ...
Kazimir Malevich, *The World as Non-Objectivity*
(First Edition Munich, 1927, p. 65)

Sensations and emotions, as the Russian artist Kazimir Malevich acknowledged, are crucial in a variety of ways: They are as crucial for the painter in guiding his brush as they are for the viewer in making sense of and appreciating a work of art. But they are also crucial in a wider sense, as Malevich's *Three Female Figures* suggests. The women's faces are blank and lack any sign of emotion. They resemble hollow shapes that need to be filled in order to be rendered human.



Figure 1. K. Malevich (ca. 1930). *Three Female Figures*.

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Introductory Overview

We chose Malevich's painting as the Center's signet because it invites us to think about human emotions from a social and historical perspective. As much as emotions can be seen as essential markers of human beings, they are part of a social world that is in constant flux. When Malevich painted the *Three Female Figures*, he had been witness to the Soviets' ambitious and violent education experiments. New citizens were to be created with new feelings inscribed into human faces and bodies. But the will to produce and instrumentalize emotions does not apply exclusively to totalitarian regimes. Liberal and democratic societies have also attempted to shape individual and collective emotions. Feeling rules exist in any given society, and they deeply influence what and how people feel.

Conceptual Orientation: Feeling Rules and the Experience of Emotions

To unearth these rules means to investigate a great number of social practices and contexts. In modern and dynamic societies, rules for feeling are generally not given from above, on a large-scale or societal level, or in a dictatorial manner. Rather, they are an integral part of institutional arrangements and environments that come to bear heavily on people's mental and emotional maps. Feeling rules are taught and learned in the family, in personal friendships, at school, in peer groups, in the army, at the workplace, at church, and in politics. They can be acquired by reading poems and novels, by listening to music and attending concerts, by watching a drama on stage, or by going to the movies. More bluntly still, they are exposed in advice manuals, which saw an extraordinary proliferation during the 19th and 20th centuries.

Feeling rules, again, should not be mixed up with unequivocally and authoritatively stated norms, prescriptions, and demands. They are constantly negotiated, questioned, and contested. Within a given society, they may

differ according to gender, age, social class, ethnic background, religion, and sexual orientation. What is perceived as hegemonic is open to debate, criticism, and change. Faced with numerous and potentially contradictory feeling rules in different institutions, people figure out how best to navigate them and assess their importance for their own lives and individual development. As members of social groups and institutions, they are not passive recipients and objects, but rather active participants in creating, upholding, or dismantling these rules through day-to-day social practices.

Stressing the social embeddedness of feeling rules means shedding light on their historicity. Change largely occurs through institutional rearrangements. Once an institution loses its power (we can take the army as an example), its feeling rules become less defining and binding within society at large. When families turn into intimate emotional spaces explicitly nurturing feelings of mutual trust, empathy, and love, as it happened in the 19th century, this shift has repercussions on other institutions as well, like school and friendship. Placing a

Key Reference

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Figure 2. Engravings (details) by Daniel Chodowiecki, illustrating the Center's three Research Areas.

Source. Kupfersammlung zu J. B. Basedows Elementarwerke für die Jugend und ihre Freunde, Berlin/Dessau, 1774, Tab. V, XXIV, and XXXIV./SUB Göttingen.

strong and positive emphasis on sensibility, as bourgeois cultures in Europe did around 1800 or 1900, in turn affected scientific research on emotions as it progressed from the late 18th and gathered speed from the late 19th century. Scientific approaches to emotion (and emotion regulation) were in high demand by industrial companies that tried to enhance workers' performance during the 20th century. "Emotional intelligence," a concept hyped since the 1990s, has its roots in the "psychophysics" of work developed during the late 19th and early 20th centuries.

Exploring these closely interconnected historical processes allows us to link feeling rules to the dynamic structure of modern (and modernizing) societies. But what does it tell us about feelings "as such"? If emotions are supposed to have a physiological and neuronal basis, we might conclude that this basis is set and fixed in the human body and its systemic make up. Does this not imply then, that shame, happiness, grief, etc. must always feel the same, regardless of time, space, and culture?

The answer to this question is twofold: While we agree with colleagues from the natural and life sciences that emotions are felt and embodied in a physical way, historians have begun to consider the body as a historical artifact rather than something objectively given. How the body is perceived and conceptualized clearly determines how bodily sensations are felt and experienced. At the same time, the body has long since been believed to interact with mental processes. Since the early modern period, experts and practitioners in the fields of dance and theater have been well aware of how people can create bodily feelings by using emotional language (words, mimics, gestures). In this vein, feeling rules as expressed in advice manuals or novels, or practiced in social interactions at the workplace, in religious congregations, or during political rallies, are bound to influence what an individual person experiences as his or her "inner feeling." Consequently, the change of feeling rules and practices is thought to have an effect on what and how a person feels as shame, happiness, grief, etc.

Research Areas

Historicizing emotions as a central feature of human development both in ontogenetic and phylogenetic terms requires a threefold perspective as represented in the following research areas:

- **Education and Cultivation of Emotions.**

Here, research focuses on historical attempts to form emotions in and through various institutional settings. They include advice literature in the Indian context, Persian love lyrics, and medical films, as much as character-building practices in the classroom, collective singing in schools and youth clubs, or the various initiatives to "civilize" emotions in colonial encounters.

- **Emotions and the Body.** Projects in this research area concentrate on how emotions are and become embodied through practices such as anti-AIDS activism, love for animals, religious enactments, grieving, or confrontation with illness and death.

- **Emotions and Power.** Power and power differentials are seen as crucial when feeling rules and emotional experiences are concerned. This takes place in urban spaces that can be regarded as experimental grounds for shaping appropriate emotions and emotional styles. It also appears in organizational politics, which aim to contest hegemonic frames of political action. As a major object of political communication, emotions hold value both for those in power and others challenging that power. In the economic sphere, too, the power of emotions becomes increasingly acknowledged and worked upon, both in the field of advertising consumer goods and in human resource management.

It goes without saying that these areas and perspectives are not strictly separate from each other. Instead, they inform all projects, albeit to varying degrees. The same holds true for the Center's geographical scope. While some projects use a classic comparative approach (e.g., by conceptualizing Berlin and Cairo as emotionally intense urban spaces), the majority follow a transnational approach that pays attention to encounters, entanglements, and self-comparisons. Such an approach is not confined to European countries,

but purposefully includes non-European regions, above all South Asia. Rather than assuming striking similarities or profound differences among those regions, we develop a language and methodology which takes into account cultural specificities while, at the same time, offering a common ground for general theoretical insights.

Past and Future Research

By and large, the research framework has remained relatively stable since 2008 when the Center was established. Some projects have come to an end because researchers left the Institute to pursue their careers elsewhere (e. g., as professors, in the United States, Great Britain, Germany, and India). Other projects are being continued and will eventually result in a “second book” required for a tenured university position. New projects have been added as new researchers joined the Center, thus enriching and enlarging its program without changing its general orientation and direction.

As for future projects, three are about to be launched:

- (1) Morality and Emotions
- (2) Law and Emotions
- (3) Reform Pedagogy and Emotions.

As for (1) (Morality and Emotions), the newly initiated IMPRS Moral Economies of Modern Societies poses a challenge to the Center in that it assumes a close link between morals and emotions in economic behavior and development. This link was evident at the very start of modern economies, but later fell into oblivion. Adam Smith’s *The Wealth of Nations*, widely considered the seminal text of liberal economics, built on his *Theory of Moral Sentiments*, whose title alludes to the intimate relations the author saw as prevailing between morality and emotions. Two hundred years later, the British historian E. P. Thompson explored the “moral economy of the English crowd” during the 18th century and attributed food riots to emotions incited by the breach of commonly held moral standards of market behavior. Contemporary philosophers equally stress the emotional underpinnings of moral commitment and vice versa, while recent economic experiments have pointed

to the extent that economic behavior might, under certain circumstances, be guided by moral concerns.

How can historians approach the relationship between morality and emotions, particularly with regard to economics as having largely been viewed as a social sphere beyond moral judgment and emotional motivation? Does it make sense to extend the notion of “moral/emotional economies” to include adjacent areas such as social and welfare policies, environmental issues, or leisure industries? What is to be gained (and lost) by streamlining the Center’s research program along these parameters? These questions will be discussed and answered at the Center’s upcoming retreat in March 2014, allowing for potential future redirections.

As for (2) (Law and Emotions), a call for applications was posted in September 2013, inviting researchers with an interest in legal history to focus on the relationship between law and emotions. While this field has seen growing interest by legal scholars during the last decade, it has thus far escaped the attention of both legal historians and historians of emotions. The new focus is meant to change this and introduce a new research topic. It is important in light of the fact that law has become an increasingly powerful instrument for shaping and regulating social practices since the onset of the modern period. At the same time, it constitutes a particular way of perceiving societies and is, as such, deeply influenced by social, political, economic, and cultural concerns. For historians of emotions, law—meaning legal thought, codifications, and practice—offers a highly promising perspective on how emotions have been historically conceptualized and how these concepts have shaped interpersonal relationships. Penal law is exceptionally rich and meaningful for this purpose. Two issues are prominent: so-called crimes of passion and crimes of honor (including insults and offenses). Both have been perceived and treated as criminal acts spurred by emotions (affects, passions, feelings, agitation/excitement). Law continuously struggled to make sense of these emotions, as legal professionals were under high pressure to relate emotions to paramount categories of

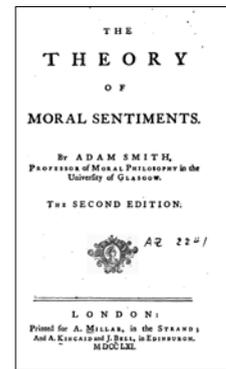


Figure 3. Cover of Adam Smith’s first work published in 1759, the founding stone for his oeuvre.

Source. archive.org.



Figure 4. Justitia.

Source. Wikimedia Commons/Public Domain.

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Figure 5. Paul Geheeb and Rabindranath Tagore, 1930.

Source. ETH-Bibliothek Zurich, Bildarchiv.

free will, individual responsibility, and culpability. Legal debates thus offer deep insights into discourses on reason and affect, good and bad morals, "cool" and "hot blood," and just–unjust/acceptable–despicable emotions. These discourses were by no means purely theoretical: Rather, they had strong repercussions on how justice was administered, how defendants framed their defense, and how the public commented on the case. Candidates were selected in December 2013 and invited to a workshop to clarify and explore further potentials of the approach. Diachronic and comparative perspectives on law making and jurisprudence will be at the fore, and the time period in question spans from the 17th to the early 21st century. Comparisons can be intra-European as well as extra-European to comply with the Center's commitment to transnational history. As for (3) (Reform Pedagogy and Emotions), it builds on the Center's long-standing interest in how emotions were taught and learned in educational institutions. This interest manifested itself in a volume on the cultivation of feelings (*Bildung der Gefühle*, edited by Ute Frevert and Christoph Wulf) followed by a special issue of *Jahrbuch für Historische Bildungsforschung*, edited by Ute Frevert and Marcelo Caruso. Introducing a history of emotions approach to the history of educa-

tion meant analyzing the changing role of emotions, such as trust and love, in teacher–student relationships. Drawing on the experience of private tutors in noble or upper middle-class households, these interpersonal emotions were questioned and challenged in public schools and only resurfaced around 1900, especially in the context of reform pedagogy.

This widely influential strand of educational theory and practice will be further examined in a collaborative project engaging researchers from other institutions. The plan is to establish a junior research group that will bring together a number of senior researchers working on a coauthored book through a series of workshops. Examining the education of emotions in reform pedagogy calls for a transnational framework, bringing together Germany, Great Britain, and India (and, at a later stage, Russia and Latin America). As the actors of the reform movement were already working in a transnational context between 1880 and 1960, the project has a genuine potential to move beyond a purely comparative study. It will shed light on how emotional knowledge and practices traveled and were communicated across cultures. For India, this is highlighted by Rabindranath Tagore's visit to Paul Geheeb's Odenwald School. It also includes Zakir Husain, who was the driving

A Year of Significant Birthdays

On the occasion of the Institute's 50th anniversary in 2013, the Board of Directors commissioned Kerstin Singer, research assistant of Ute Frevert, to develop an exhibit to commemorate founding director Hellmut Becker, born 100 years ago.

The son of a Prussian education minister began his career as the defense lawyer of the main defendant in the "Ministries Trial" (the 11th trial for war crimes in Nuremberg). In the young Federal Republic of Germany, the legal advisor specialized on cultural institutions and became a political entrepreneur regarding matters of education. He convinced the Max Planck Society of the need to found our Institute and can be considered the leading exponent of educational research in the 1960s and 1970s. The exhibit, which not only focuses on the distinctive aspects of his influential life and work but also addresses some controversial aspects, attracted markedly positive feedback from its visitors.

It also constitutes the start of the Center's deeper engagement with reform pedagogy, a fundamental issue in Hellmut Becker's and his father's life and work.



force behind Delhi's Jamia Millia University and the pedagogical program of the Congress movement. As much as he adopted ideas of Kerschensteiner's working school, he was also influenced, as Tagore was, by Tolstoi's writings.

For a long time, the history of reform pedagogy had mainly been written by its protagonists. Our approach allows for a fresh and nonpartisan perspective. By concentrating on teacher–student relations, processes of community formation, and political culture, emotions are addressed on two levels: as educational tools and as learning targets. Research will focus on pedagogical debates and practices keen on creating a personality marked by a specific set of habitualized emotions (that are often linked to creating an altogether new and, allegedly, better world).

Collaborative Projects: *Emotional Lexicons and Learning How to Feel*

From the very beginning, research at the Center was conducted both individually and collectively. Researchers worked on topics of their own choosing that spoke to the guiding questions and assumptions of the Center as a whole. But they also committed themselves to collaborative work. In 2009, they contributed to a special issue on the history of emotions in a German peer-reviewed journal, *Geschichte und Gesellschaft*. At the same time, they started to work on a joint project investigating the conceptual history of emotions over 300 years. Using European encyclopedias and dictionaries, they collected and analyzed articles on emotions and related lemmata (feeling, affect, passion, sensitivity, drive, etc.) in order to trace not only shifts and changes, but also continuities in the way those terms were defined and contextualized. The findings were published in a coauthored book in 2011. An English version was published in 2014 by Oxford University Press (OUP), under the title *Emotional Lexicons: Continuity and Change in the Vocabulary of Feeling 1700–2000*.

It was not easy, to say the least, to convince OUP that this was not an edited volume, but a coauthored monograph building on a long and intense collaboration between several members of our Center. Over the course of

2 years, we met regularly and frequently in order to designate a common corpus of sources and to develop a conceptual toolbox and share ideas, problems, and results. This kind of collaborative work can only be done at an institution that offers a common space as well as reliable financial and infrastructural backing. It sends an important signal to the community of scholars: Working closely together and critically reviewing each other's chapters on a constant and painstakingly detailed basis guarantees a high degree of coherence and thorough analysis. It thus produces results that are superior both to edited volumes and to single-author books. In their second collaborative project, the group addressed the crucial question of how emotions can be and have been learned. Drawing on current psychological research on how children's books enhance their readers' emotional awareness, such books and advice manuals dating from ca. 1870 to 1970 were chosen as primary sources. Each researcher participating in the new project focused on a particular emotion or emotional setting that was related to his/her individual research project. Again, the joint project underwent many stages and rereadings. The result was very well received by (anonymous) reviewers and will be published by OUP in 2014 under the title *Learning How to Feel*. It rests on the



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Frevert, U., Scheer, M., Schmidt, A., Eitler, P., Hitzer, B., Verheyen, N., Gammerl, B., Bailey, C., & Pernau, M. (2014). *Emotional lexicons: Continuity and change in the vocabulary of feeling 1700–2000*. Oxford: Oxford University Press.

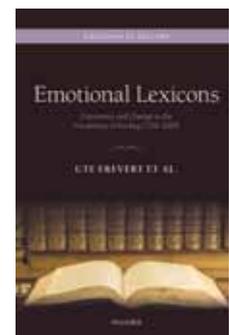


Figure 6. The *Struwwelpeter*, first published in 1845, became one of the most successful German children's books and was translated into numerous languages.

Source. Hoffmann, H. (1876). *Der Struwwelpeter oder Lustige Geschichten und drollige Bilder* (100th ed.). Frankfurt a. M.: Literarische Anstalt, [5] not paginated.

assumption that the ability to feel unfolds through a complex dialogue with the social and cultural environment. The fundamental formation of feelings takes place in childhood and youth when children gain practical emotional knowledge through manifold social interaction and, specifically, through reading. This kind of knowledge, the book argues, underwent several broader changes in the period under consideration. Emotional interaction between adults and children gave way to a focus on those among children, while gender categories became less distinct. Children were increasingly taught to take responsibility for their own emotional development, to find “authenticity” for themselves. In the context of changing social, political, cultural, and gender agendas, the building of nations, subjects and citizens, and the forging of moral and religious values, *Learning How to Feel* demonstrates how books and advice manuals provided chil-

dren with emotional learning tools that helped them to navigate their emotional lives.

A New Book Series With OUP

In 2011, negotiations about a new book series with OUP started. The publisher showed strong interest in fostering innovative research and helping to shape a new field. The first volume of this series on *Emotions in History*, edited jointly by Ute Frevert and Thomas Dixon (Queen Mary College, London), appeared in February 2014. As a second volume, Jan Plamper’s monograph on *History and Feeling* (see p. 163) has been accepted for publication. In 2013, the manuscript of *Learning How to Feel* (see above) was positively reviewed and will be published in 2014. Further projects by members and nonmembers of our Center are currently under review.



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(German translation: Editorial. *Geschichte der Gefühle—Einblicke in die Forschung*. <<http://www.history-of-emotions.mpg.de/de>>)

Internet Portal: Sources and Interpretations

Claiming that emotions have a history and render themselves to historical analysis usually invites the question of how knowledge about past emotions is possible and how to proceed in gathering information. The newly established online portal *History of Emotions: Insights into Research* (editors: Anja Laukötter, Margrit Pernau) aims at giving concrete examples of sources and methods through which the history of emotions can be explored. It provides thought-provoking impulses for other historians and stimulates interdisciplinary communication. Theoretical and methodological aspects of the history of emotions approach are touched upon in short contributions focusing on various sources. Each article starts with a specific source, such as:

- “Ego-documents” (diaries, memoirs, autobiographies) that give important information about the emotional self-construction of their authors, as well as the development of emotions over an individual’s lifespan.

- Advice literature (e. g., on raising children, love relationships, sexuality, manners); such manuals allow us to catch a glimpse into the normative construction of feelings, while illustrating the process of learning and practicing emotions.
 - Fictional literature and children’s books as important resources providing knowledge on how specific situations are emotionally experienced; they might also explain certain generational conflicts and the redefinition of the self.
 - Different media (such as photography, films, internet blogs); they not only represent emotions but also produce and create emotions, since they have intended or unintended effects on the emotional state of the reader, visitor, viewer, or listener.
- The platform went online in October 2013; new articles (both in English and German) will be added on a quarterly basis. National and international experts in the field of the history of emotions have been and will be invited to contribute. Thus, the platform will not only

become a stimulus for debates but will also offer itself as a comprehensive archive for the expanding field.

Public Colloquium

A central feature of the Center's activities is the public colloquium organized twice a month throughout the academic year. We invite internationally known scholars to present their work and explore how it touches on the history of emotions. They thus widen our own perspectives and enable us to engage in research carried out in similar or adjacent fields of knowledge. At the same time, they add to the Center's visibility and popularity. As the colloquium is open to the public and usually draws a number of university students as well as colleagues, it also helps to attract future researchers and collaborators. Speakers come from a range of disciplines. Apart from historians, we welcome sociologists, political scientists, anthropologists, evolutionary biologists, economists, philosophers, and scholars from literature studies. Between 2011 and 2013, 44 talks (see Appendix 2) were given. They addressed crucial questions regarding methods, sources, and interpretation, as well as interdisciplinary challenges and promises.

Visiting Researchers

The presence of visiting researchers is of vital importance to the Center's work. They add their projects to our research agenda and engage in mutually inspiring debates and collaboration. As a general rule, they bring their own funding (Helen Watanabe O'Kelly,



Figure 7. Picture postcard from World War I ["My love will accompany you through the battle and the danger"].

Source. www.zeno.org/bildpostkarten.

University of Oxford; Helena Flam, Leipzig University; Ursula von Keitz, University of Konstanz, previously University of Bonn, who all spent their sabbatical at the Center) and often come to us with Alexander von Humboldt Research Fellowships (Christa Ehrmann-Hämmerle, University of Vienna; Eva Giloi, Rutgers University). Apart from working on their own research and writing, they also participate in the Center's internal and public colloquia (as lecturers and interlocutors). They bring their special expertise as advisors and consultants relating to others' research, and they act as informal mentors for the Center's junior and senior researchers.

In numerous cases, formal and ongoing collaborations arose from contacts made during the visitors' stay at the Center. To give just one example: Christa Ehrmann-Hämmerle's research focusing on the Habsburg military in the late 19th century lent itself to a fruitful exchange with Ute Frevert's long-standing interest and expertise on the army as a "school" of male emotions. Her second project on *Writing (about) Love? Historical Analyses Regarding the Negotiation of Gender Relations and Positions in Couple Correspondences of the 19th and 20th Centuries* (funded by the Austrian Science Fund) examines a large sample of "love letters" as well as letter-writing manuals and other normative texts that shaped the letter cultures, even of the working classes. This project invited an intense exchange with Benno Gammerl, mainly on methodological questions regarding the analysis of qualitative data. In this context, the Center hosted a homonymous workshop on 10 February 2012. Introduced by Ute Frevert and commented by Benno Gammerl, it was attended by many internal and external researchers. Subsequently, researchers from our Center participated in conferences on *Romantic Love in Vienna* (June 2012) and in a panel on "Love" at the German History Society's annual conference in London (September 2013).

Impact

When the Center started in 2008, the history of emotions was a genuinely new approach that still had to win colleagues' attention and approval. Since then, it has witnessed an amazing surge of interest, both nationally and

Speakers included Norman Naimark (Stanford University), Robert Aronowitz (University of Pennsylvania), Mark Seymour (University of Otago), Sanjay Joshi (Northern Arizona University), Hans Ulrich Gumbrecht (Stanford University), Astrid Eckert (Emory University), Edhem Eldem (Boğaziçi University), Michael Geyer (University of Chicago), Susannah Heschel (Dartmouth College), Peter Stearns (George Mason University), Ruth Leys (Johns Hopkins University), Robert L. Trivers (Rutgers University), Carolyn Dean (Brown University), Francesca Trivellato (Yale University), Jack Barbalet (Hong Kong Baptist University), and Véronique Bénéï (CNRS, Paris).

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Gammerl, B. (2013a). Queer Romance? Romantische Liebe in den biographischen Erzählungen von westdeutschen Lesben und Schwulen. *L'Homme: Europäische Zeitschrift für feministische Geschichtswissenschaft*, 24(1), 15–34. doi:10.7767/lhomme.2013.24.1.15

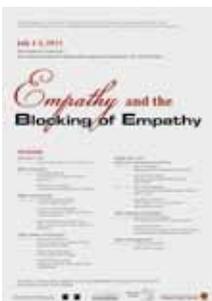
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Gammerl, B. (Ed.). (2012a). Emotional styles—concepts and challenges [Special Issue]. *Rethinking History*, 16(2). Abingdon: Routledge.



Hitzer, B. (2011a, November 23). Emotionsgeschichte: Ein Anfang mit Folgen [Forschungsbericht]. *H-Soz-u-Kult*. <<http://hsozkult.geschichte.hu-berlin.de/forum/2011-11-001>> (January 5, 2011)



internationally. In March 2013, the Comité International des Sciences Historiques (CISH) nominated Ute Frevert, together with the Australian historian Philippa Maddern, as organizers of a Major Theme Day on *Historicizing Emotions* at the 2015 Jinan Congress that welcomes historians from all over the world. This can be considered a kind of knightly accolade for the new approach, testifying to its professional appeal and attraction.

In October 2013, the annual conference of the German Studies Association (GSA) included a seminar on *Revisiting the Study of Emotions in German Studies*. Two out of three panels dealt exclusively with the research conducted at our Center, thus acknowledging its leading role in the field. They also identified Bettina Hitzer's review article as the fundamental reference. Since it was published in *H-Soz-u-Kult*, the major internet portal for historical studies, high access figures confirm the growing interest in the history of emotions both in its empirical research and methodological challenges.

Following a forum debate opened in 2010 by the journal *German History* (in which Ute Frevert had participated), the *American Historical Review* in 2012 published the sixth *AHR Conversations* on the topic *The Historical Study of Emotions*. Jan Plumper was asked to contribute and represent the Center's approach.

To mention two more important and widely quoted contributions to the theory and methodology of the history of emotions approach: In 2012, Monique Scheer published an article on how to understand emotions as social practices bridging dichotomies such as body and mind, structure and agency, and expression and experience. In 2013, Benno Gammerl edited a special issue of the journal *Rethinking History*, introducing the concept of emotional styles (rather than emotional regimes) as a promising heuristic for further research.

Conferences and (Inter-)National Collaboration

Bringing together scholars from various disciplines and national backgrounds, conferences offer the opportunity for international collaboration as well as for broadening the Center's research perspectives.

The long-standing collaboration with Aleida Assmann (University of Konstanz) and her research group on History + Memory, winner of the 2009 Max Planck Research Prize, was deepened and further developed during the review period. Assmann's and Juliane Brauer's joint publication on the emotional dimensions of how young people deal with the Holocaust showed the extent to which the research interests of both groups complement and enrich one another. This was followed by the international conference on *Empathy and the Blocking of Empathy*, organized by Aleida Assmann and Ute Frevert together with Steven Aschheim (Hebrew University, Jerusalem), in July 2011. The conference invited psychological, aesthetic, cognitive, social, and historical perspectives to redress empathy as a pro-social emotion and cross-disciplinary topic. Prosocial emotions, and especially empathy, have been considered a major driving force in mankind's cognitive and social evolution. They allow human actors to achieve mutual understanding of aims and goals, anticipate others' reactions, and cultivate the coordination of complex activities, which led to evolutionary leaps that were withheld from other species. The conference built on earlier efforts to link a historical perspective on empathy with experiments conducted by social neuroscience. Ute Frevert's talk on *Witnessing Public Cruelty and Shame Sanctions* (as part of her project on *Honor and Shame*; see pp. 172–173) used bystanders' reactions to public executions and shaming practices as a case in point. It was not before the early 19th century that predominant feelings of curiosity, indifference, *Schadenfreude*, or lust for revenge were mitigated by concepts of sympathy and compassion. Following this shift of public sensibilities, public executions and shaming practices were gradually abolished. Palgrave-Macmillan signaled clear interest in the publication of a selected essay collection and submitted the proposal for peer review. Shame and shaming remained on the Center's conference agenda. In December 2012, a conference on *Shame and Shaming in Twentieth Century History* was organized by Ute Frevert and Mary Fulbrook (UCL) highlighting common research activities of the Center (see

the project *Honor and Shame* on pp. 172–173) and the UCL AHRC Research Group Reverberations of War. Papers focused on practices, experiences, and memories of shame and shaming during and after World War II. Panels addressed how feelings of shame and practices of shaming related to gender, class, and political power. Psychological theories of shame were confronted with literary representations and political-juridical texts. Empirical cases covered France, the Netherlands, Germany, Poland, and China.



In her keynote lecture *The Disappearance of Shame?* Ruth Leys (Johns Hopkins University) questioned the motives, intentions, and methods behind the scholarly use and interpretation of shame. This was followed up on in the final roundtable discussion, which problematized shame as an iridescent term open to historically variable definitions. Considering the “what,” “who,” “how,” or “why” of shame/shaming means exploring different contexts, times, and cultures. Ongoing research must take into account shame’s intimate embeddedness in community norms and practices, which have a strong bearing on how and whether individuals feel ashamed (and of what).

The conference *Emotions and the History of Modern Anti-Semitism*, organized by Uffa

Jensen together with Raphael Gross and Daniel Wildmann (Leo Baeck Institute London) and Stefanie Schüler-Springorum (Center for Research on Anti-Semitism, Berlin), took place in April 2012. Suggesting a new understanding of anti-Semitism by studying its emotional dimension, a group of international historians investigated a broad variety of anti-Semitic phenomena, such as Russian anti-Jewish pogroms, Nazi *Rassenschande*, or postwar anti-Israeli propaganda. A selection of papers was published in a special issue of the peer-reviewed journal *Geschichte und Gesellschaft*. The conference triggered plans for future cooperations, such as an international research group on Hate Pictures.

Many more events and conferences took place during the review period. Some of them illustrate the Center’s international collaborations, like the conference entitled *Learning to Feel: Emotions Beyond Nature vs. Nurture* (April 2011) in Jerusalem, a joint international collaboration between the Center for the History of Emotions, Berlin, and Van Leer Institute, Jerusalem, in collaboration with The Hebrew University, Jerusalem, and Tel Aviv University. Others show the fruitful outcome of our collaboration with guest researchers and our dedication to an interdisciplinary approach, like the conference co-organized in October 2012 by our guest researcher, sociologist Helena Flam. The establishment and implementation of the Minerva Research Focus of *Emotions, Violence, and Peace* was marked by an interdisciplinary conference *Emotions and Violence in 20th Century Europe: Historical Perspectives on Violence Prevention and Peace Education*, June 2013. Events like the workshop entitled *Gefühlsräume* (January 2013), a joint collaboration by our three researchers Margrit Pernau, Benno Gammerl, and Joseph Prestel, not only serve as the starting point for individual research, such as Pernau’s project on *Space and Emotion*, which is currently in development. Furthermore, they show how fruitfully and successfully our researchers are able to link their individual research projects with their colleagues’ research interests and activities, which are described in the following parts.



Researchers

Ute Frevert
Margrit Pernau
Rob Boddice
Philippe Bongrand
Juliane Brauer
Merih Erol
Benno Gammerl
Uffa Jensen
Mana Kia
Anja Laukötter
Stephanie Olsen
Monika Freier
Mohammad Sajjad

Research Area: Education and Cultivation of Emotions



Figure 8. Engraving by Daniel Chodowiecki.

Source. Kupfersammlung zu J. B. Basedows Elementarwerke für die Jugend und ihre Freunde, Berlin/Dessau, 1774, Tab. V./SUB Göttingen.

Our main assumption is that emotions are subject to a complex process of cultivation, that is, of social formation and cultural learning. This process largely determines what individuals feel and how they make sense of and value those feelings. The education of feelings takes place in and through institutions, such as family, school, clubs, the military, and religious, professional, and local communities, as well as via media, such as novels, poems, advice literature, scientific tracts, music, and film. These institutions and media became increasingly important and comprehensive during the modern period, albeit to varying degrees. While schools and schooling get ever more inclusive and dominant, and thus parallel the impact of religious institutions, the latter gradually lose out as emotional learning environments, at least in Western societies. The research team examines how people were driven to have, show, or suppress certain feelings. It also pays attention to what happened when people realized that they felt "differently" and did not fit (or did not want to fit) regular patterns and how this challenged dominant feeling rules and emotional styles.



Collaborative Research Activities (Selected)

The 3-day international conference on *Childhood, Youth and Emotions in Modern History* was organized by Stephanie Olsen and Juliane Brauer. After the call for papers attracted around 200 proposals from all over the world, select scholars interested in the intersection of childhood, youth, developmental psychol-

ogy, education, and emotions in historical perspectives convened from 29 November to 1 December 2012 in Berlin. Seven panels addressed questions related to: *Schools, Space, and Discipline; Media and Emotional Knowledge Acquisition; Religion; Emotion and Children; The Nation and Its Exclusions; Emotional Education in Colonial Settings;*

Adolescence, Medicine, and the Body; and Policing, Child Welfare, and Child Observation. In 25 talks from the academic world of Germany, Denmark, Finland, Belgium, Italy, Great Britain, Canada, United States, Argentina, Japan, India, and Israel, researchers set the foundation for a comparative history of the education of emotions through an exploration of formal and informal educational contexts of the 19th and 20th centuries. The conference focused on educational strategies within different institutions, namely, family, state, school, or religious communities, which contributed to, and sometimes competed in, providing children and youth with the necessary emotional and moral frameworks for shaping the next generation of men, women, workers, and citizens. The contributions, discussions, and mainly the roundtable with well-known representatives from different disciplines linked with childhood studies, impressively demonstrated the fruitfulness of the interdisciplinary perspective. It deepened the dialogue with the Max Planck Research Group Affect Across the Lifespan, represented by Michaela Riediger's talk, as well as the roundtable participation by the developmental psychologist Rainer Silbereisen. The conference offered a variety of different answers on questions such as: How did children and youth navigate this range of emotional contexts, feelings, and expressions in different phases of growing up? To what extent were various forms of childhood education informed by questions of emotion? How did changing historical perceptions of childhood interact with changing conceptions of emotions and vice versa? How did the professionalization of disciplines related to childhood and youth, and child welfare, change the notion about a distinct set of emotions in childhood? In what ways can we integrate the history of emotions and the history of childhood and youth in order to gain further insight into both fields? What are the methodological challenges here and what sorts of source material can be marshaled? A collection of groundbreaking essays by some of the participants as well as other recognized scholars in the history of childhood and emotions is to be edited and published by Stephanie

Olsen. It will include contributions from historians of Britain and the Empire, Europe, Latin and North America, Africa, Asia, and South Asia and will focus on national, imperial, and global perspectives on childhood and emotions in the 19th and 20th centuries. In July 2011, Juliane Brauer and Martin Lücke (Freie Universität Berlin) jointly organized a conference on *Emotions and Historical Learning Revisited: Perspectives From Historical Culture and Didactics*. It deliberately followed up on a homonymous conference that took place 20 years ago on emotionality as a category of historical didactics in the wider framework of the history of mentalities and everyday life. Back then, researchers had shown deep anxieties in approaching the topic, while today the latter seems very much up-to-date and attractive, as argued by participants from the fields of historical didactics, modern history, developmental psychology, pedagogical institutions, museums, and memorial sites. In their contributions and debates, they linked new insights from the history of emotions with theories and observations about emotions in historical learning processes. The conference took a large step forward in establishing and stimulating discussions within the field of teaching and research, highlighting the potential for historical learning as well as reflecting on the contribution of emotions in the formation of historical awareness. Some of the papers were then revised and submitted to peer review. In 2013, they were published in a volume connecting emotions and central paradigms of historical culture, such as the historical formation of meaning, empathy, imagination (or narrativity), awareness, and identity.

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Researcher

Margrit Pernau

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Civility, Civilization, and Civil Society

The core questions of this research area have been followed in three different projects.

Civilizing Emotions: Concepts in Asia and Europe 1870–1920, a collaboration with the University of Oslo, has successfully finished its investigation of the semantic network of civility in four European and nine Asian languages. The book manuscript, coauthored by 13 authors from 7 countries across 3 continents, is currently under review by Oxford University Press.

Civilizing Emotions traces the history of the concepts "civil," "civility," and "civilization," which are very much in use in today's political debates. Unlike former histories of these concepts, which have been traditionally limited to Europe and rarely ventured beyond the 1840s, *Civilizing Emotions* chooses a global perspective and highlights the role of civility and civilization in the creation of a new and hierarchized global order in the era of high imperialism and the entanglements it brought about.

The hierarchy of the global order was premised on the ascription of emotions and the ability to perform a certain emotion management. *Civilizing Emotions* brings out the role of emotions as an object of the civilizing process as well as the agency which was ascribed to emotions: Emotions needed to be actively civilized, but

they were also an asset to civilize peoples and societies. The book is thus a contribution to the history of emotions, to global history, and to the history of concepts; three rapidly developing and innovative research areas, which are being brought together here for the first time. *Emopolis* (Emotions and Political Mobilizations in the Indian Subcontinent) is a collaborative project with the Centre d'Études de l'Inde et de l'Asie du Sud at the École des Hautes Études en Sciences Sociales (EHESS) at Paris, which brings together scholars from Political Science, Sociology, Anthropology, Literature, and History, who are based in France, Germany, India, Pakistan, and the United States. Within this framework, this contribution focuses on anger and its management amongst South Asian Muslims since the 18th century, exploring the interconnected levels of knowledge about anger as embodied in language, as well as in texts from theology, moral philosophy, medicine, and psychology. It also focuses on the norms making anger socially desirable or undesirable, and on the expression of anger. In connection with this project, the researcher spent 1 month as a visiting professor at the EHESS. Finally, different aspects of civility play a prominent role in the monograph *Emotions in South Asia, 1857–2000*, which is currently being written.

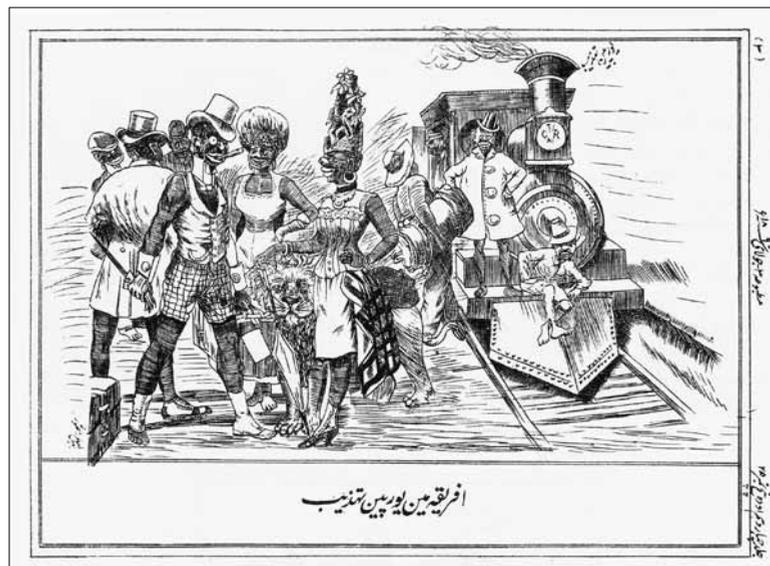


Figure 9. Africa mein European tahzeeb [European Civilization in Africa], Avadh Punch, 3 July 1890.

Source. Hasan, M. (2007). *Wit and humour in colonial North India*. New Delhi: Nyogi Books, p. 77.

The Science of Sympathy: Morality, Evolution, and Victorian Civilization

Science of Sympathy (SOS) is funded by the Deutsche Forschungsgemeinschaft, hosted by the Friedrich-Meinecke-Institut, Freie Universität Berlin, with the full collaborative support of the Center. It began as a research fellowship at the Institute in 2011. SOS takes as its starting point a paradox concerning the evolution of emotions and morality that lies at the heart of Charles Darwin's *Descent of Man*: Sympathy is the emotional glue that binds civilized society and fosters its progress, but it is also the cause of civilization's collapse through its increasing tendency to preserve the "weak." The project explores attempts to resolve Darwin's paradox and their influence on the intellectual atmosphere and the formation and implementation of social policy at the *fin de siècle* as well as the ways in which they shaped the emergence of eugenic theories. Building on extensive primary research on the private correspondence, books, experiments, and professional records of evolutionary, medical, and psychological scientists, SOS critically analyzes intellectual debates among evolutionary scientists about the definition, meaning, and role of sympathy in the evolution of morality. This gives way to an exploration of the influence of these debates in three late-Victorian controversies: vivisection and the rise of physiology, compulsory vaccination (particularly against smallpox), and eugenics. This is situated within the general context of opposition to Darwinian morality and the cultural contest over the terms of sympathy. SOS is unique in providing a history-of-emotions approach to questions of social policy, medical and scientific practice, and social engineering, enabling a single coherent analysis of all these controversies together. The project lays bare the foundations of 20th-century moral questions in relation to public health, biomedical ethics, and procreation.

The project encompasses an additional element: *Pain and Emotion in Modern History*. It is a rich exploration of the affective expression of pain, the emotional experience of pain (with or without lesion), and the

experience of others' pain as pain (sympathy, compassion, pity, tenderness). Building significantly upon the conference *Pain as Emotion; Emotion as Pain: Perspectives From Modern History*, hosted by the Birkbeck Pain Project in London in 2012, the project investigates both the emotional context of different kinds of pain as well as developing the concept of physical pain as intrinsically emotional/affective. Using newly emerging approaches from the history of emotions, the project is a collaboration of 15 international scholars at the cutting edge of the history of pain. It is interdisciplinary in scope, with expertise coming from medical practice, the medical humanities, literature studies, cultural anthropology, art history, and conceptual art. Its geographical scope includes the United States, Canada, Great Britain, Japan, China, and Europe, with a temporal range from the 18th century to the present. This part of SOS will culminate in an edited volume, to be published by Palgrave Macmillan in 2014.

Researcher

Rob Boddice

Key Reference

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Figure 10. State-enforced sympathy?

Source. *The Anti-Vivisection Review*, 2(10), 1911, p. 250.

Researcher

Philippe Bongrand

Key Reference

Bongrand, P. (2012). La mise en système et l'économicisation de l'enseignement en France au début des années 1950: La fonctionnalisation d'une institution. *Politix: Revue des Sciences Sociales du Politique*, 98(2), 35–56. doi:10.3917/pox.098.0035

Observing Emotions, Emotionalizing Observations: Children's Emotions and School Assessments in France During the 1950s and 1960s

As in many Western countries, a fundamental change occurred in France during the 1950s and 1960s. Thanks to the unification of a "modern educational system," schooling no longer focused exclusively on educating but also on orientating children within the system. While guiding children requires certain criteria, public policies clearly prompted educators to teach and guide children not on the basis of their academic performance, but according to their personality, abilities, and desires, as expressed or recognized through emotions. This project retraced this strong attempt to psychologize teaching and, in this way, to design a new status for emotions in schools. Its results provide an explanation of how this attempt failed and, as a consequence, how it unintentionally led to

the domination of the academic criterion in assessing and guiding children.

A first component of this "unsuccess story" lies in the failure of a branch of French scientific psychology, namely, *Caractérologie*, to gather consensus on the legitimate way to objectify "emotionality." Though this science of emotions enjoyed spectacular success among families, teachers, and political and academic elites at the beginning of the 1950s, it rapidly lost credibility and influence against differential psychology and intelligence tests. Schematically, intelligence science, tools, and pedagogies outdid emotion-related scientific and political discourses. At the same time, emotions at school remained central in the literature published for parents: Therein emerged a major misunderstanding.

Another component of this failed emotionalization consisted in the difficulties of designing and generalizing a unique model of "dossier scolaire," that is to say, a school record containing all academic, social, economic, psychological, or behavioral, information about every child in order to empower teachers. While different prototypes competed with each other, archival material shows that sections about personality and emotions were filled out by teachers based on academic criteria.

These case studies participate in the major social process whereby the educational system fosters new expectations among parents and children, which consist in discovering and implementing the self as well as achieving social mobility through school. The project focused on the interaction between macro- and microlevels, namely, on the link between the history of the French educational system (institutional design, schooling policies, pedagogical tools, organization of compulsory education) and the construction of (schooled) personalities (self, feelings, vocations, attitudes toward educators and knowledge). Foucault's concept of governmentality enables one to think of these separate levels together, and to deepen the hypothesis of a failed emotionalization of the educational system, which remains a (paradoxical) way to assign a social status to emotions.

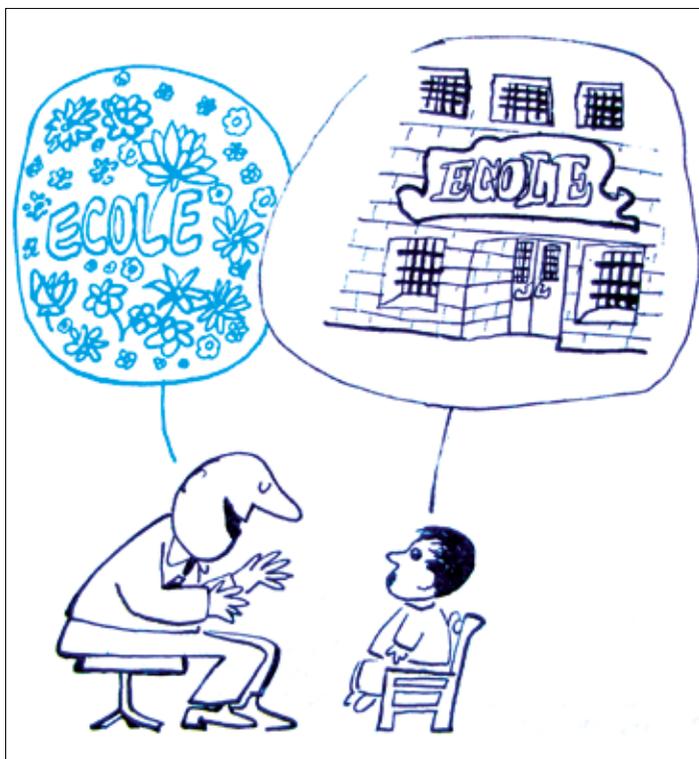


Figure 11. An advice manual teaches parents how to transmit "les attitudes positives" about school.

Source. *Mes enfants réussissent mieux en classe. Comment les aider, les soutenir, les encourager*, Marabout-Flash, 1966, p. 19.

Youth, Music, and the Cultivation of Feelings in a Divided Germany

At the end of the war in 1945, a new youth was said to emerge "with new feeling and new spirit;" a youth that "enticingly beckons the future." At least this was what one of the first new youth songs, which often resounded in 1945 in Soviet occupied Germany, declared. The collective singing of new songs, which spread an optimistic vision of the future as embodying power, courage, reliance, patriotism, and collective strength, prevailed in the Soviet occupation zone and the early German Democratic Republic (GDR) as an especially apt way to not only win over but also to shape the hearts and minds of the youth as "landlords of tomorrow." Hundreds of new children and youth songs emerged, primarily in the first two decades following the war.

Specifically, this research project deals with how the cultivation of youth feelings in East Germany compared with discourses and practices in West Germany by focusing on songs and singing. Collective singing is defined as an emotional practice, wherein emotions are experienced and inculcated *onto* the body as well as acted out *over* the body. Based on this assertion, the main questions are: What were the strategies and practices of the cultivation of youth feelings? Which emotions were officially claimed? How did they change? How and in which manner did the youth react? The musical educational discourses between 1946 and the mid-1960s, as well as the considerations about youth work in the only youth organization permitted—the Freie Deutsche Jugend (FDJ)—clearly show that the protagonists promised a strong educational effect from collective singing. In the first section, the project inquires about politically favored dispositions toward feelings in the Soviet occupation zone and the GDR such as enthusiasm, *Heimatliebe* (love of one's home), confidence, trust, and pride. Against this background, the project draws out a selective comparison to West German pedagogical discourses and youth organizations like the *Falken* and *Pfadfinder*.

The conception of emotions of the state, which had remained remarkably consistent

from the 1960s to 1980s, increasingly clashed with the conception of feelings of youth cultures. What ensued was a deliberately induced clash of different emotional styles. One can show whether and how hegemonic conceptions of feeling become broken down and nuanced. The search for true, authentic feelings, mainly in punk music around 1980, filled the state with fear of uncontrolled youth feelings. This section of the project adopts a change in perspective from one of political, pedagogical ideas and concepts, to one of alternative dispositions of feelings in youth communities. The focus here too is on developments in the GDR, though by adopting similar perspectives, a similar comparison/contrasting with the Federal Republic of Germany (FRG) can be done. Here too it is important to consider song repertoires and also to examine the performativity of singing on the emotional repertoire. The project's goal is a monograph that offers a new interdisciplinary perspective on the history of childhood and youth in a divided Germany by analyzing strategies of cultivation of feelings through music.

Researcher

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Figure 12. The song book "We sing new songs" was published by the largest publishing house for children's and youth literature in the GDR.

Source. Cover, Verlag Junge Welt, 1952.

Researcher

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Pious Emotions: The Formation of the "Ethical Self" in the Greek Orthodox Populations of the Ottoman Empire and Greece (1830–1922)

Research on religion in the context of 19th-century Ottoman and post-Ottoman Southeast Europe has often focused on the relations between institutionalized religion (the Church) and the State, while more recent research has turned its attention toward the sphere of religion, ideology, and politics. Yet little work has been done so far on personal belief and private worship. This project explored the formation of pious and moral selves in the Greek Orthodox urban populations in Ottoman Istanbul and Izmir, and Athens, the capital of the Kingdom of Greece, in the period 1830–1922, with a special interest in the role of emotions, attitudes, and dispositions linked to piety. Apart from the connectedness or the prominence of these three cities in terms of having significant Greek-speaking Orthodox populations, the specific focus on Athens, Istanbul, and Izmir provides comparative ground to observe the similarities and differences in piety and morality discourses and practices, both in a nation-state in the making and a multiethnic and multireligious empire.

This project drew on recent theoretical approaches in the anthropology of religion, which have considered pious and moral subjectivities to be formed through the reconstruction of emotions, desires, and dispositions. These studies were largely inspired by Michel Foucault's analysis of ethical formation. Foucault placed emphasis on "the forms of relations with the self, on the methods and techniques by which he works them out, on the exercises by which he makes of himself an object to be known, and on the practices that enable him to transform his own mode of being." Furthermore, by drawing on Bourdieu's concept of *habitus* and expanding their investigations into the body, these recent studies in the analysis of religion and ritual called for the study of the embodied experience of religion. Thus, based on these theoretical and methodological premises, this project analyzed the discourses and practices that were related to the cultivation of pious and moral selves among Greek Orthodox urban populations in 19th-century Athens, Istanbul, and Izmir.

With this aim, the project particularly examined first-person narratives (memoirs, autobiographies, and letters to family members from a private archive), biographies, and novels. In order to trace narratives describing the sensual experience of religion and descriptions of rituals, it also examined other primary sources, such as hagiographical literature (the lives of saints), sermons, ecclesiastical and theological journals, periodicals of religious societies and brotherhoods, newspapers, as well as European travelers' accounts. Moreover, one of the project's aims was to analyze the normative discourses on the control of passions, desires, and emotions that existed in the 19th-century religious and ethical texts to which the urban and educated Greek Orthodox had access. In doing so, it particularly looked at a body of ethical guides, written—mostly in modern Greek/*katharevousa* but also in *Karamanlidika* (Turkish written in Greek alphabet)—to be used in the education of youth and children, and the prominent monastic texts of the previous centuries whose newer editions were widely read among the Greek-speaking populations in the eastern Mediterranean in the 19th century.



Figure 13. Pious emotions described in Greek newspapers.

Source. Title page of "Akropolis," Easter, 1885.

Homosexuality and Emotional Life in Rural West Germany (1960–1990)

Focusing on emotions in the history of homosexualities helps to generate more accurate and multifaceted accounts than otherwise possible. Analyzing lesbian and gay publications from 1960 to 1990, as well as 32 oral history interviews from the perspective of emotions, time and again raises important objections against oversimplified narratives regarding queer liberation. Analyses of generation-specific scripts of fear and criticism toward the long-held belief concerning the contrast between gay-friendly cities and the homophobic countryside demonstrate this. Many commentators assume that, in the 1970s, postwar homosexual shame was supplanted by gay pride, with fear (of being discovered) simultaneously giving way to fearlessness. Comparing the narratives of Ms. Eitner (born 1951) and Ms. Otte (born 1967), however, rather reveals a qualitative change. In one typical passage, Ms. Eitner relates a fear story that leads from a bodily attack to a final gasp of relief (interview 2, sequence 172). Ms. Otte describes fear rather as an uneventful internal dialogue about what might happen if she, for example, visited a lesbian bar (interview 1, sequence 52). Ms. Eitner's attack-defense fear script corresponds with her memory of visiting a feminist seminar on violence against women in the 1970s where she had learned how female solidarity could help to overcome fear. Ms. Otte's self-reflexive timidity is instead exclusively focused on her personal development and learning to openly talk about her anxieties only once she started living in a stable partnership. If we view these diverging patterns as generation-specific, then it is not the disappearance, but the shifting patterns of fear that need to be addressed. In terms of the rural-urban divide, many observers assume that homosexuals can live happily only in large cities. Yet a closer look at the narratives of those interviewees who prefer rural habitats (see Figure 15) indicates that this metronormative stance ignores numerous opposing views. Mr. Wisneck, for example, praises rural openness over urban superficiality. Mr. Pohl claims that the longevity

of his partnership was primarily due to their life far away from the adulterous temptations of urban gay scenes. And Ms. Fischer who partook in the lesbian land movement claims that living in a rural cooperative allowed her to find her authentic self. Based on these and other articulations, one can argue that it was not so much the homosexual exodus into cities or the urbanization of the countryside that accelerated the normalization of homosexualities, but rather the manifold and continuous interactions between rural and urban lesbian and gay lifestyles.

The project has furthermore pursued three theoretical lines of enquiry. The first dwells upon the contact zones between queer theory and affect theory. The second explores the role of the researcher's emotions within the research process. The third finally engages with the interplay between spatial constellations and emotional practices. Paying attention to space-specific emotional styles allows—among other things—for an understanding of emotions as liminal phenomena that resolves the problematic dichotomies between bodily affect and verbal expression, as well as between subjective interiority and social conventions.

Remained in the countryside	Moved to town	Alternated more often
Mr. Schumann (1935)	Mr. Kuhn (1938) Mr. Weber (1943)	Ms. Schmidt (1943) Ms. Lippold (1943) Mr. Riedel (1943) Mr. Meyer (1944) Mrs. Fischer (1947)
Mr. Mellling (1949)	Mr. Ückert (1945) Mr. Harrer (1951) Ms. Jäger (1955)	Ms. Schneider (1950) Ms. Eitner (1951) Ms. Gruberova (1952) Ms. Lehmann (1954) Ms. Opitz (1955)
Mr. Pohl (1956)	Mr. Franke (1958) Mr. Albrecht (1960)	Ms. Voss (1962)
Mr. Wisneck (1957)	Mr. Helmlinger (1963) Mr. Schubert (1965) Mr. Zimmermann (1966) Ms. Gehring (1967) Ms. Otte (1967) Ms. Brehme (1969) Ms. König (1970)	
Mr. Gärtner (1963)	Mr. Uhl (1970)	
Ms. Jansen (1970)		

Figure 15. Interviewees with pseudonyms listed according to their year of birth (in brackets), their geobiographical patterns of mobility and their preferring urban residences (red), favoring rural habitats (green), valuing both equally (blue), or judging the differences between urban and rural settings ambivalently (grey).

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Researcher

Benno Gammerl



Figure 14. Logo of the project "anders fühlen"—"feeling differently."

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Curing Emotions: A Transnational History of Psychoanalysis in Berlin, London, and Calcutta (1910–1940)

Curing Emotions studies the history of psychoanalysis with a special focus on its transnational character and emotional significance. The book will discuss the dissemination of psychoanalytic knowledge and practice in Berlin, London, and Calcutta. In all three of these cities, therapeutic cultures emerged in the early 20th century largely, though not exclusively, around psychoanalysis and its application in private practices, hospitals, or psychiatric clinics. These cultures also influenced the broader middle classes in these urban centers through its use in discussions about literature, art, religion, education, etc. While Berlin became one of the first and certainly the most developed therapeutic cultures after World War I, London proved important for the international dissemination of psychoanalytic knowledge. From here, psychoanalysis “traveled” into the colonized world. Consequently, the first non-Western branch of the psychoanalytical movement would emerge in Calcutta.

Psychoanalysis was not just a body of knowledge about the self and its psychological structure. It originated in—and continued to be bound up with—questions of therapeutic practice. Here, emotions (or, in the language of psychoanalysts, “affect”) played a major role on all levels: in the relation between patient and analyst (“transference,” “countertransference”), in the nature and origins of neurosis (infantile “Oedipus complex”), in the emotionalized setting of the psychotherapeutic sessions, etc. Moreover, important aspects of the biographies of early psychoanalysts, as well

as the turbulent history of the psychoanalytic movement, can be discussed only within the framework of the history of emotions.

As a transnational history of emotions, Curing Emotions asks about the patterns of application of psychoanalysis and its effects in different cultural settings. One of the results of the project is the surprising diversity of psychoanalytic practice, which the historiography usually explained, if at all, as forms of deviation from a Freudian norm.

Curing Emotions will instead focus on the plural origins of psychoanalysis in these different settings, thus explaining its relative global success with its very productivity and flexibility. A further set of questions explores the integration of psychoanalytic knowledge and practice into different notions of selfhood in various cultural settings. In the distinct urban cultures, dissimilar *psychoanalyses* emerged, in which emotions functioned as a marker of difference, because they depended heavily on culturally specific assumptions regarding selfhood and culture. At the same time, however, psychoanalysis also created a traveling culture. In this global dimension of psychoanalysis, the role of emotions is still open to debate: Did psychoanalysis also begin to create a transnational mode of experiencing and thinking about emotions?

Curing Emotions will thus provide a new historical account of psychoanalysis. By studying the non-Western part of its global dissemination on equal basis with the European “original” setting, a new perspective *from the margins* becomes evident. Thus, many assumptions about the essentially Western nature of psychoanalysis are called into question. By foregrounding emotions within the theory and practice of psychoanalysis, its history can be retold without the usual focus on Freud as the innovator of a new scientific discipline. Hence, questions about the truth-status of psychoanalysis, which have informed much of the historical literature—and, to some degree, continue to do so—become less important. Instead, one can appreciate the wide-ranging cultural and regional applications of psychoanalytical knowledge as well as the therapeutic and emotional effects it had in a global dimension.



Figure 16. Lumbini Clinic.

Source. Anonym, Lumbini Park Silver Jubilee, Calcutta 1966.

Friendship, Love, Loyalty: Persianate Ethics of Self and Community Before Nationalism

This project focuses on how notions of friendship, love, and loyalty were formulated and expressed in the period just before and during the early phases of colonial expansion in South Asia (1739–1835). Shifting social relations and political loyalties in this period have often been considered from perspectives that assume ahistorical protonationalist sensibilities. By contrast, the project argues that a particular type of basic education among Persians contained a notion of ethics that created modes of practicing affiliation, conceiving of difference, and imagining community. This ethics of proper conduct (*adab*) structured perceptions and practices of affiliation and difference and can elucidate loyalties in the intertwined interpersonal relations of society and politics. The perception and expression of virtuous and ignoble emotions were indivisibly bound up in the perception and expression of ethical conduct. This study interrogates assumed analytic terms and concepts, like emotions, as internally located and separate from their outward expression. Proper conduct and moral substance (*akhlaq*) are deeply interrelated, demanding new readings of source materials that acknowledge the role of the body and social interactions as central sites of emotion in Persianate South Asia. Ideas of ethics, virtue, and the emotions in normative texts of education serve as a starting point for understanding what animated notions of loyalty and friendship. The project then analyzes the ways these ideas play out in social praxis by examining letters, poetry, travelogues, memoirs, and biographical texts. In particular, there was an explosion of biographical writing in this period, and these sources have often been ignored in social and cultural historical scholarship. Many socially and politically significant relationships were called friendships, highlighting the way in which the ideals of friendship were considered the model for relations in multiple social and political contexts. An understanding of loyalty based on a valorized notion of homosocial love cemented these relationships between rulers and their subjects, patrons and clients, and teachers and students. Since

the ideal virtuous Persianate self was male, Muslim and of Middle East descent, this project also explores the way in which people who did not fit this ideal were able to negotiate differences of gender, place of origin, and religion using the ethical language of *adab*. As such, this project also historicizes concepts of difference and their role in the conception and practice of social and political affiliation in this pivotal period between the decentralization of Mughal imperial power and the British colonial domination of South Asia. As the 18th century waned, Europeans, often representing colonial interests if not outright office holders of various East India Companies, entered into these Persianate forms of friendship. The project argues that it was precisely the cosmopolitan nature of these homosocial relationships, which embraced those who could master *adab* regardless of parochial affiliations, that partly enabled the rise of British colonial rule.

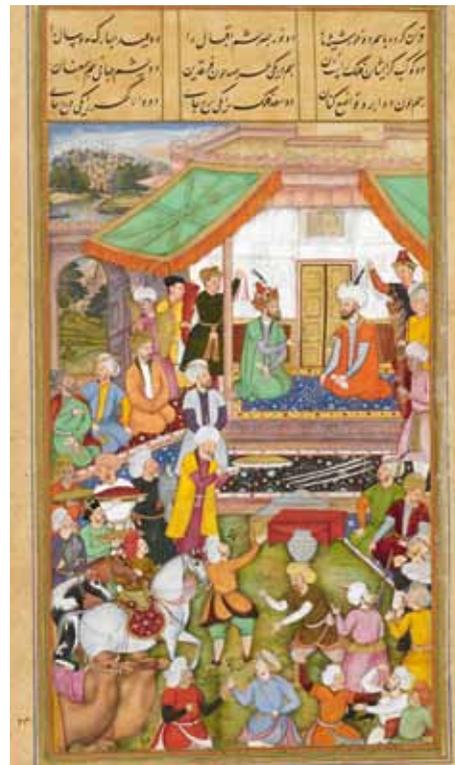


Figure 17. Humayun received by Shah Tahmasp (1544).

Source. Illustration from the *Akbarnama*, Vol. 1, by Abu'l-Fazl ibn Mubarak, ca. 1603–1604.

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Researcher

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Emotions and Knowledge in Health Education Films, 1910–1990

Science has long been interested in the research and analysis of emotions and has significantly molded the way that they are overall perceived. At the same time, emotions are often enlisted in the production and circulation of scientific knowledge, in theories, methods, practices, and media coverage. On this basis, the project examines the relationship between emotions and knowledge, focusing specifically on the medium of health education films in the period from 1910 to 1990.

Throughout the 20th century, particularly in countries such as Germany (and later the German Democratic Republic [GDR]), France, and the United States, many health education films were produced with the intention to change the attitudes of the broader public toward health. Accordingly, the project aims to show in which ways emotions such as disgust, fear, empathy, and trust were inscribed into the production and conveyance of scientific knowledge within these films. Moreover, the project questions the ways in which the films significantly changed scientific discourses, scientific practices, and the relationship between science and the public.

The project focuses on films that dealt with sexually transmitted diseases that were widely seen and discussed by the public. Moreover, these films appeared from the very beginning of film production: from films about gonorrhea in the Weimar period, to French and American films that aimed to prevent the spread of syphilis among the armed forces, to GDR HIV/AIDS films in the 1980s. Alongside many differences, we find strongly comparable developments and manifold



Figure 18. Film still: Soldiers in an educational film screening.

Source. *Sex Hygiene* (US, 1942, John Ford/Otto Brower).

transfers in the history of medical films in Germany, France, and the United States. The project attempts to connect a discursivization of emotions and knowledge with practice-oriented approaches through an analysis on three levels.

Film in discourse: An analysis of the international discourse on this important instrument of health education shows how and why both proponents and opponents of this educational tool used the linkage between knowledge and emotions in their argumentation. Moreover, the analysis shows that contemporary medicinal concepts of prevention and the “preventive self” influenced these discourses, as well as emotional approaches of film theorists and philosophical and psychological approaches, some of which continue even today and have shaped fundamentally our understanding of knowledge transfer through the media.

Film as practice: By examining case studies of health education films in Germany, France, the United States, and later the GDR, the project illuminates how a specific, varied form of the “scientifically emotionalized moral tales” was created through different film techniques (e. g., montage, animations, narrative structures) to prevent the spread of contagious diseases among the population. Several of these films were not only used within national borders but were circulated internationally. This (transnational) dimension of knowledge and emotions is analyzed against the background of contemporary medical and societal developments. In this sense, changes and continuities in strategies and techniques of the knowledge transfer process are identified.

Film as a research objective: The question of whether, how, and under what conditions health education films on the prevention of diseases influenced the attitude of viewers was not only a question discussed among experts but also a research topic. Throughout the 20th century, psychologists attempted to measure the emotional and knowledge transfer impact of these films through audience research studies. An analysis of these experiments shows how perceptions of emotions and knowledge are embedded into research methods, practices, and settings, and in which ways this remains operative even today.

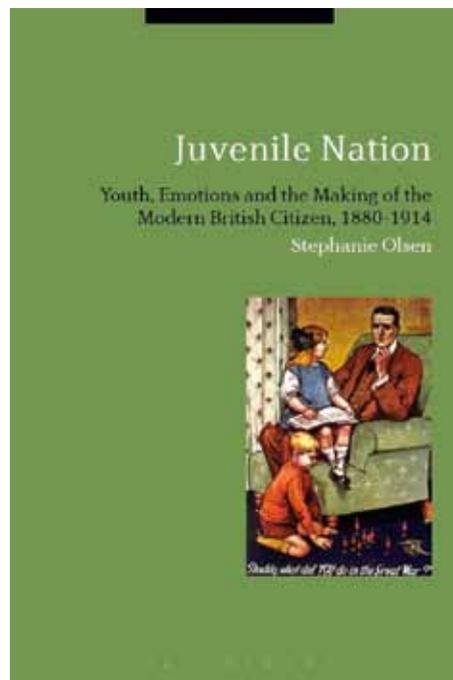
Emotional Manhood: Adolescence, Informal Education, and the Male Citizen in Britain, 1880–1914

In the first 5 months of the Great War, one million men volunteered to fight. Yet, by the end of 1915, the British government realized that conscription would be required. Why did so many enlist, and conversely, why so few? Focusing on analyses of widely felt emotions related to moral and domestic duty, *Emotional Manhood* broaches these questions in new ways. In the context of a widespread consensus on the ways to make men out of boys, an informal curriculum of emotional control, key to shaping the future citizenry of Britain and the Empire, is revealed. The project demonstrates that the militaristic fervor of 1914 was an emotional outpouring based on association to family, to community, and to Christian cultural continuity. Significantly, the same emotional response explains why so many men did not volunteer, with duty to family and community perhaps thought to have been best carried out at home.

Specifically, the project deals with how children and youth were *informally* educated, through influential popular media and youth groups in Britain and its Empire, in the generations before World War I (1880–1914). Appeals to emotion and the shaping of “correct” emotional responses on these important issues were thought key to the shaping of the next generation of men. Religious organizations that focused on the temperate and manly upbringing of boys, from the Religious Tract Society, to the Church of England Temperance Society, and the Band of Hope are a main focus, while ideological similarities between these groups and for-profit, “secular” publishers, like the Amalgamated Press, are established. All of these publishers promoted their ideas through the youth groups they organized and, perhaps even more pervasively, through the written word.

The historical study of emotions is tied to an examination of some of the fundamentals of society and the individual's place in it: family, religion, and citizenship. The project defines citizenship to represent the historical multivalence of the term, including its emotional resonance. Crucially, it was associated

with future fatherhood: Good heads of families would be good citizens. In addition, the increasing professionalization of disciplines related to childhood—education, social work, and especially psychology—is shown to have changed the nature of informal education for boys and impacted popular conceptions of boyhood and adolescence. One component of the project relates to the transmission and adaptation of British religious and missionary views on emotional education for elite boys in India. The project as a whole demonstrates that masculinity was not only about patriarchal or imperial outlooks in this era but also about emotional attachment and loyalty to family and community, in peacetime and in war.



The project's core is a monograph, *Juvenile Nation: Youth, Emotions and the Making of the Modern British Citizen, 1880–1914* (London: Bloomsbury, 2014). The central themes have been explored broadly in the international conference *Childhood, Youth and Emotions in Modern History*, hosted at the Institute and related significantly to the group project *Learning How to Feel*. The proceedings of the conference are now being edited and augmented.

Researcher

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Key Reference

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Cultivating Emotions—Hindi Advice Literature in Late Colonial India

With its focus on normative literature, this dissertation project investigated the creation of culturally and historically situated knowledge about emotions and the evolution of norms, which are styled as moral markers of excellence. The dissertation project consisted of three case studies, each centering on a different subgenre of advice books published from the late 19th to the middle of the 20th century: (1) works on ethics and etiquette, (2) religious advice literature, and (3) domestic manuals centering on marital advice, home science, and sexual hygiene. Official reports from the British colonial government, journal articles, and autobiographical material formed additional source material for the study. Archival sources were accessed in public libraries and archives in India as well as in the India Office collections

of the British Library, thanks to the financial support of the Max Planck Society and a scholarship from the German Historical Institute London.

Hindi advice literature started off in the 1870s as a genre promoted through patronage. The production of Hindi literature in the late 19th century was further fostered by a politically inspired language movement. Toward the middle of the 20th century, however, authors of advice literature had to increasingly employ effective strategies to position their works on the competitive commercial market.

Qualitative content analysis of the source material indicates the shifting and increasing role that emotions were given in normative literature. Advice books condemned anger, greed, and lust as moral vices and appealed to their readers to control, eradicate, or domesticate them. In contrast, emotional norms and styles were propagated as necessities for individual and social refinement. The Enlightenment ideal of sympathy (variously translated as *saṃvedānsīltā*, *suśīltā*, *sahānabhūti*, etc.) became styled as a universal marker of civility. Hindi self-help books and etiquette manuals reclaimed this emotional style in order to postulate the excellence of morally educated Indians and their subsequent right to cultural (and political) leadership. The popularization and ongoing reinterpretation of religious scriptures became central for Hindu reform groups, including proponents of the "orthodox" Sanatan Dharm movement. The latter promoted dispassionate feeling (*niṣkāmbhāv*) as a comprehensive emotional ideal that could unify all Hindus across sectarian boundaries. Ethical, sexual-pathological, and eugenic approaches began to inform ongoing discussion of celibacy and emotional and sexual abstinence (*brahmacārya*) in the 20th-century India. This led to the propagation of a rigid lifestyle, characterized by sexual, bodily, and emotional celibacy. Hindi domestic advice manuals, however, also promoted (bodily) love as a virtue that made the success of a marriage and that would ultimately secure the future of the nation. Hindi advice literature thus formulated prescriptive rules for the cultivation of emotions. These became markers of identification for emotional communities, formed on the basis of an education of the heart, (Hindu) religion, and political independence. Findings from the research project have been discussed with a peer audience at conferences such as the *22nd European Conference on South Asian Studies* (Lisbon, 2012) and the *8th South Asia Graduate Students Conference* (University of Chicago, 2013), and also published in a peer-reviewed journal. The dissertation was submitted to the Freie Universität Berlin in March 2013, the thesis defence was in June 2013.

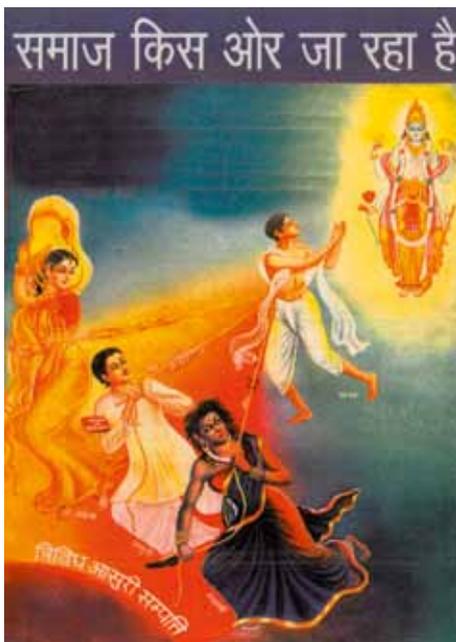


Figure 19. This book cover from an advice manual depicts three demons personifying lust, greed, and anger (left side, top to bottom). They try to morally and emotionally deteriorate a traditionally clad Hindu by pulling him away from god (right side, top) and toward the earth, which is described as the "possession of the three-fold demons."

Source. Poddar, H., *Samāj kis or jā rahā hai* [Which direction does society move?]. Gorakhpur, n.d.

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Loving the Master? The Debate on Appropriate Emotions in North India (ca. 1750–1830)

This doctoral project started in October 2008 and was successfully defended on 21 December 2012. It explored the debate on appropriate emotions within the Sufi circles in North India during the late 18th and early 19th centuries, focusing on the love relationship between the Sufi master and the disciple, as well as the practices prescribed by the Sufis to cultivate emotions. Various groups during this period intensely discussed questions regarding how to cultivate divine love and examined the role of emotions in the master–disciple relationship. They privileged emotional styles that were grounded in emotion knowledge derived from different disciplinary traditions—moral philosophy, medical discourse, theology, and Sufi ideas and beliefs. Instead of explicitly contesting established concepts, Sufi scholars emphasized the need to interpret them. Some of them intended to implicitly substantiate the ideological positions of their respective Sufi orders while others laid emphasis upon bringing reconciliation among various religious groups by giving inclusive and different interpretations. This study argues that the Sufi practices were debated for their “emotional effects,” which were held by some to be the means to cultivate divine love, while others argued that the emotions generated by them were not required by the *shari’a*. However, both of these groups claimed to support “normative and doctrinal Islam.” Thus, even “normative Islam” was subject to contestation. The analysis of the individual intellectual projects of this period proves that, despite their call for renewal and reform, Muslim scholars of this period do not fall neatly into categories of reformist Islam and traditional Islam. This project thus proposes that, instead of essentializing an antagonism between Sufism and doctrinal Islam or a dichotomy between “folk syncretic practices” and “normative high Islam,” reform should be studied as a complex process. Most Sufi scholars believed in the meditational role of the Sufi masters, in seeking help from dead saints and in miracles, and they also condoned the celebration of death anniversaries. However, concerns regarding excesses—the

violation of the injunctions of the *shari’a*, wastage of money and time, negligence of the proper ways of performing the practices—are also found in the Sufi texts. The opposition to these practices resulted in the division of Muslims in India into sects which are now known as *masalik* (schools). This division, as the dissertation argues, needs to be studied from the perspective of emotions as much as it has been studied from the perspective of the *shari’a*. Sufi practices were justified by some Sufi scholars associated with “reformist” Islam on both legal and emotional grounds. Others considered these practices to be accretions and cultural borrowings and drew a line between faith and infidelity to form a distinct religious identity by excluding not just Hindus, but also those Muslims who participated in these practices. This contestation reveals that the reformist discourse remained a contested subject with various interpretations among the proponents of normative and doctrinal Islam.

Researcher

Mohammad Sajjad



Figure 20. Cover of *Ma'mulat-I Mazhariyya Va Mahbub Al-Arifin*, written by Na'imullah Bahraichi. Besides biographical details about Mirza Mazhar (d. 1781), this book deals with the subtle components of the soul, master-disciple relationship, celebration of birth anniversary, and other mystical practices.

Source. *Ma'mulat-I Mazhariyya Va Mahbub Al-Arifin* (The Prayer Formula and Practices of Mirza Mazhar [Persian]). Lahore: Matba' Muhammadi, n.d.

Researchers

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Research Area: Emotions and the Body

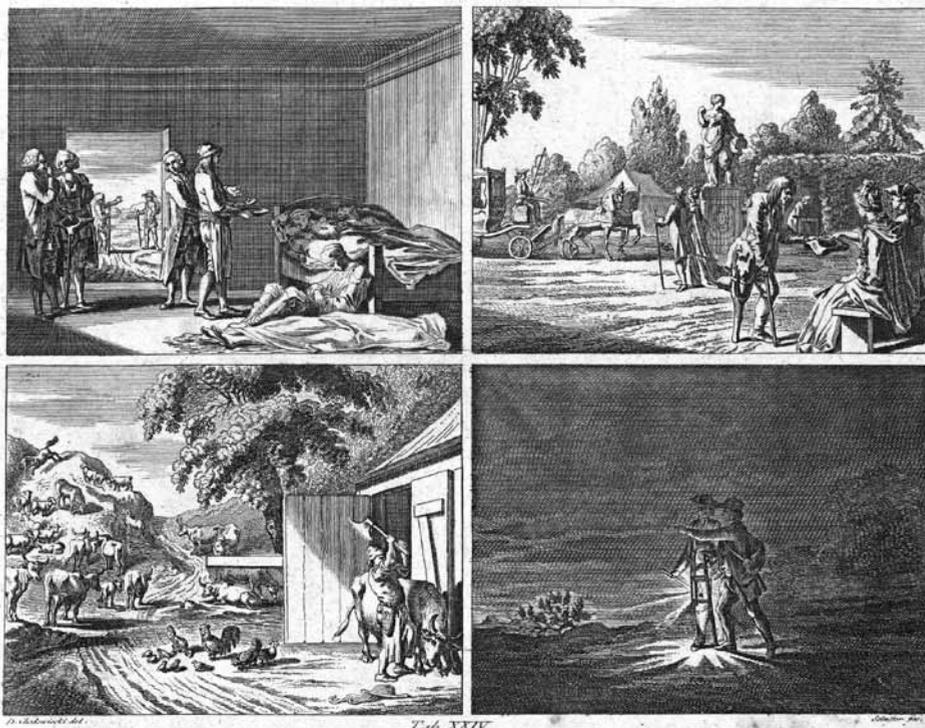


Figure 21. Engraving by Daniel Chodowiecki.

Source. Kupfersammlung zu J. B. Basedows Elementarwerke für die Jugend und ihre Freunde, Berlin/Dessau, 1774, Tab. XXIV. /SUB Göttingen.

Projects within this research area take special account of the fact that emotions are embodied. Body language, particularly mimics and gestures, are seen not only as expressions of emotions, but also as social practices encoding and “impressing” emotions. Apart from social conventions and educational efforts, changing concepts of the body influence the way in which emotions are felt and expressed, evoked and tempered. Historical analyses of emotions that consider the biological-physiological substrate of body language can and do draw on findings from the natural and life sciences. At the same time though, they historicize those findings by placing them firmly into their social, political, religious, and aesthetic contexts.

Collaborative Research Activities (selected)

From 22–24 September 2011, Bettina Hitzer and Anja Laukötter organized an international conference on *Emotions and Medicine in the 20th Century*. Combining historical perspectives and contemporary surveys, 15 talks were offered to an audience of historians, psychologists, neuroscientists, sociologists, and representatives of public health institutions. External participants such as Otniel E. Dror (Jerusalem), Christine Holmberg (Berlin/Washington D.C.), Christopher Lane (Chicago), Patrice Pinell (Paris), Rhodri Hayward

(London), as well as members of other Centers at the Institute such as Wolfgang Gaissmaier (ABC) addressed the conceptualization and use of emotions in medical and public health discourses and practices.

The first panel explored how emotions were conceptualized in the course of the 20th century, mainly in the disciplines of psychiatry, physiology, and psychology. Research here focused on how emotions worked and if they were more closely linked to the body or to the mind and soul. Those active in the field either attempted to draw the line between “normal”

and "pathological" emotions or to defer and even blur the line. How did medical staff refer to this kind of research, if at all? Were other models or assessments of emotions equally or even more important—for instance, those provided by sociology, theology, psychotherapy, political ideology, or what we could call public morale? These were some of the questions addressed by the second panel, which focused on the role of emotions in medical research and practice. It investigated not so much emotions in general, but rather networks of specific emotions that were thought to structure the work and professional relationships of researchers, doctors, nurses, and patients. Moral assessments and political uses of those emotions came to the fore in the third panel, which presented three different case studies of emotional campaigning. The fourth panel took up a question that has been tackled for centuries: Are there any emotions, emotional states, or a certain handling of emotions which have a pathologizing effect on the body? And—in reverse—could some emotions contribute to staying healthy or even cure diseases? This conference was a starting point for further international cooperation with historians Otniel E. Dror (Hebrew University,

Jerusalem) and Pilar León-Sanz (University of Navarra, Pamplona). The perspective was widened so as to encompass a more general history of science stretching back to the Middle Ages. Results have been accepted for publication in the highly ranked journal *OSIRIS* (in 2016) (*History of Science and the Emotions*, eds. Otniel E. Dror, Bettina Hitzer, Anja Laukötter, Pilar León-Sanz), with contributions from a wide range of scholars from Canada, France, Germany, Israel, Spain, Switzerland, the United Kingdom, and the United States.

BODY POLITICS

Zeitschrift für Körpergeschichte

One of the longer ranging initiatives has been the launch of the new online journal *Body Politics*. It is dedicated to the history of the body from the 18th to the 21st century, available free of charge and in open access format (using double-blind peer reviews). The first volume with two issues, on the topics of *Fordism* and *Violence*, appeared in 2013. Henceforth, articles in German or English will be published three times per year.

The project is done in collaboration with the University and Research Library, Erfurt/Gotha, simultaneously published in the Digital Library of Thuringia, and financially supported by the German Research Foundation (DFG). Pascal Eitler, founder and member of the Editorial Board, which also includes Magdalena Beljan and Monique Scheer, is currently managing editor together with Maren Möhring (Potsdam) and Marcus Otto (Braunschweig). The Scientific Advisory Board consists of international scholars from various disciplines, including Ute Frevert, Dagmar Herzog (New York), Jakob Tanner and Philipp Sarasin (Zurich), as well as Franz Xaver Eder (Vienna).

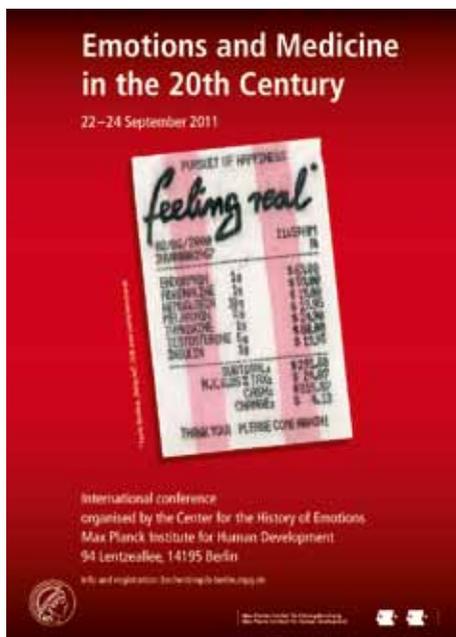
The launch of this new journal reflects the particular attention scholars have paid to the history of the body during the past 20 years. The research team on *Emotions and the Body* has widely contributed to this emerging field.

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www.bodypolitics.de/en



Researcher

Margrit Pernau

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Space and emotion:
Building to feel. *History
Compass*.

Space and Emotion

Emotions are mediated through the senses and the body, and hence situated in space. Landscapes, building styles, and urban settings evoke emotions—people draw on a different register of emotions when traveling through a wild mountainous region or strolling through a garden, when walking through the lanes of their neighborhood or visiting a shrine. At the center of the project is the question of how emotions in space are brought about: On the one hand, emotions do not inhere to space itself, but are culturally learned and hence subject to historical change. On the other hand, natural and built spaces also set a certain material frame which is neither wholly malleable, nor devoid of a need for interpretation.

This project focuses on the urban history of Delhi from the foundation of the city of Shahjahanabad from the 17th to the 20th century. In order to explore the processes through which certain spaces are made to evoke certain emotions, it brings together approaches from the history of emotions, art history, cultural geography, and urban studies. Possibilities are currently being explored for linking written, visual, and oral sources to a digital map of Delhi, permitting a reorganization of the historical archive around

localities. Collaboration with the universities of Copenhagen and Aarhus is under negotiation.

Within the history of emotions team, it is linked with the projects of Benno Gammerl and Joseph Prestel. In collaboration with the Centre Marc Bloch in Berlin, the three researchers organized the workshop *Feelings in the City: Emotions and Urban Space* (November 2011).



Figure 22. Details of a map of Delhi (ca. 1840).

Source. British Library.



Figure 23. Divan-i Khass (private audience chamber) at Delhi, part of *Amal-i Salih*, a history of Shah Jahan by Muhammad Salih Kanbu, ca. 1830.

Source. British Library.

Intermediality

This project draws together two other projects which have until now been pursued separately: *Expressing Emotions: Music, Film, and Literature in India*, which brought together a number of guest researchers at the Institute, and an ongoing engagement in the field of the history of concepts, mainly in the institutional framework of the History of Concepts Group (the international association for conceptual history), *Concepta* (the association for the training of young conceptual historians, board member since 2009), and the journal *Contributions to the History of Concepts* (editor 2009–2012, member of the Editorial Board since 2012).

"Intermediality" pursues a twofold goal. First, it aims at overcoming the latent logo-centrism of the history of emotions by systematically focusing on the interface between language, images, films, and auditive media. Possibilities for this were explored in a reading group that brought together scholars from South Asia and Europe. Second, this approach shall lead to a revisiting of some of the basic assumptions of conceptual history by bringing the history of the body and the senses into a dialogue with more language centered approaches. This can lead to the exploration of possibilities of investigating the iconic qualities not only of metaphors, but also of concepts and integrating a new set of sources into conceptual history projects.

In the India group, this project is also central for the work of Yuthika Sharma (postdoctoral fellow 2013) and Imke Rajamani (predoctoral fellow, financed by Studienstiftung des Deutschen Volkes). Shweta Sachdeva (Max Planck Junior Research Fellow, New Delhi) is presently on maternity leave, but will join the group again in 2014.

Imke Rajamani (Dissertation Project)

Angry Young Man: The History of Anger in Popular Indian Films, ca. 1970–1990

The "angry young man" conquered the Indian cinema screens in the 1970s. The underdog hero, who fought in action-packed films against a criminal and corrupt establishment, is still remembered today as the most prominent cinematic icon of the 1970s and

1980s. This dissertation project explores the change in the concept of anger in Indian popular discourse by means of Hindi and Telugu films and other film-related media such as film magazines. First results on how the knowledge, moral evaluation, bodily expressions, and aesthetics of anger were changed in the audiovisual mode and in the interplay of different media in cinema as a cultural circle have been published in an article. A methodological approach for the analysis of cinema as a site of doing emotions and emotion concepts as multimedial semantic nets has been formulated in a chapter for the dissertation. The work for the main analytical chapter on the change of the angry male body in popular Hindi and Telugu films has been completed. Further research will focus on the conceptual change of anger from vice to virtue in the course of its politicization, the social implications of this moral reframing and the meaning of anger's changing audiovisual aesthetics. A paper on how anger in popular Indian cinema facilitated notions of political mobilization was presented at CEIAS (Centre d'Études de l'Inde et de l'Asie du Sud)/EHESS in Paris in May 2013. The research of anger as a concept linking electoral politics and popular culture in India to the present day will further be pursued in the context of the international research project EMOPOLIS: Emotions and Political Mobilizations in the Indian Subcontinent, based at CEIAS.

Researchers

Margrit Pernau
Imke Rajamani

Key Reference

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Figure 24. The Angry Young Man as an Indian working class hero: Famous actor Amitabh Bachchan as Iqbal in *Coolie*.

Source. Film still from the Hindi movie *Coolie* (1983).

Researcher

Magdalena Beljan

Key Reference

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Ambivalent Emotions: Conflicts and Convergences in Dealing With HIV/AIDS

Being diagnosed with AIDS in the early 1980s meant being diagnosed with a fatal disease. There was no hope, no efficient therapy, and almost no knowledge about the disease, the infection, and its transmission. Official politics seemed to ignore the problem, while mass media reported in a dramatic way about the unknown and "scary" disease. Much has been said in scientific research about the "AIDS hysteria" in the 1980s in Western countries. The common underlying assumption is that mass media had a huge impact on emotions—that is, on forming and producing emotions—and that they fostered an atmosphere of fear. But instead of reproducing this idea, this research project questions it and discusses the ambivalence of emotions. During the last 30 years, the AIDS issue has undergone a radical change in Western countries, which can be described as a process of normalization. It is no longer a mortal threat, but a treatable though not curable infection. How did this shift happen? And what role did emotions play in this process?

Though this project concentrates on Germany in the 1980s and 1990s, the analysis also includes a wider perspective on the history of the body, on the self, on self-help organiza-

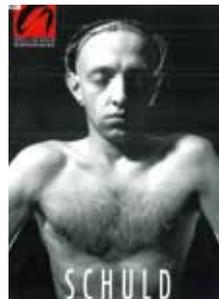


Figure 25. The magazine *aktuell* provided a portrait of the German artist Jürgen Baldiga (1959–1993), gay and HIV positive, who documented his suffering from the disease in his art.

Source. Cover of *aktuell—das Magazin der Deutschen AIDS-Hilfe*, No. 8, Nov. 1994, special issue on guilt.

tions, on the sexual revolution, and on developments related to the public health system. Major sources for the project are different print media and publications of self-help organizations (Deutsche AIDS Hilfe e.V.), but also material from the prevention work of the German Federal Centre for Health Education (Bundeszentrale für gesundheitliche Aufklärung). Furthermore, the project includes and ana-

lyzes popular books written by politicians, scientists, journalists, and AIDS activists. In addition, it integrates archive material of the AIDS movement organization ACT UP, movies, documentaries, and ego documents.

The project shows how the media was part of a system that constructed different groups of victims. "Risk groups," especially gay men, were blamed for the infection and for the quick spread of the disease. They were described as promiscuous and careless, while hemophiliacs and children were pictured as "innocent victims." Gay magazines also picked up the question of whether gay men should change their sex life and partnerships. Nonetheless, they still made it clear that homosexuals were victims and not guilty.

The turn in the late 1980s from looking at "risk groups" to focusing on "risk practices" seemed to de-emotionalize the discourse about the spread of the infection. But as the project explores, even this shift did not entirely expel the notion and model of guilt. The liberal AIDS policy in Germany, with its concept of responsibility and its idea of "you don't get AIDS—you catch it" ("AIDS bekommt man nicht, man holt es sich"), reinforced the notion that people were responsible for their own fate.

This idea of being responsible for one's own disease may not be new. But AIDS, in contrast to other diseases, was an "embarrassing" disease, not only because it has been characterized as a "gay disease" but also because of its classification and description as a "sexually transmitted disease" (STD). People were ashamed at being diagnosed HIV positive because being infected meant one had too much sex; or at least the "wrong" kind of sex. Nevertheless, a central strategy in official HIV/AIDS politics and prevention was to produce the feeling of responsibility and of being concerned (*Betroffenheit*) about HIV/AIDS in the population. Rita Süßmuth, German Federal Minister of Health (1985–1988), described this in 1987 as "producing the feeling that AIDS bothers everybody" (AIDS. *Wege aus der Angst*, 1987, p. 76). The project finally shows the rise and decline of this concept and its crucial role in normalizing and emotionalizing HIV/AIDS.

The Love of Animals

Animals play a much larger role in the research on emotions than one would initially suspect. Not only within scientific and psychological research are feelings or affects considered something that connects humans and certain animals on an evolutionary level, and which points to a collectively acquired ability of the body and especially of the brain. Emotions (particularly fear or anger) have long appeared in cultural studies' research as virtually ahistorical; they were seen as eruptive, and in this sense animalistic.

This research project attempts by contrast to show how the attribution of feelings to certain animals should be historicized and contextualized. The notion that animals possess feelings (and not merely sensations) is a conception that took hold both scientifically and within society at large, in the case of Europe and North America, only over the course of the last 150 years. In this regard it is essential to address a somatization of emotions and thereby an emotionalization of animals.

Furthermore, the project attempts to show how what one would generally term the "love of animals" emerged and disseminated within this emotionalization process. The attribution of feelings to certain animals increasingly led to showing these animals feelings of love and affection, empathy and compassion. The history and presence of mutual cohabitation with so-called "pets" is only conceivable within the framework of the emotionalization of human-animal relations.

Thirdly, the attribution of feelings to animals not only went hand in hand with the consequential emotionalization of human-animal-relations, mainly in the framework of the family; from the 19th century (in Great Britain, Germany, France, and the United States) this attribution headed strongly toward a moralization and politicization of human animal relations and led to the rapid development of an internationally linked animal-protection movement. Meanwhile, in Germany, animal welfare had even attained constitutional status.

In this sense the project at hand traces multidimensional transformation of emotional

and political-historical questions, while at the same time delving into the booming interdisciplinary realm of human-animal studies; a sphere which continues to probe the emotionalization and politicization of animals and human-animal relations without reflecting upon its historical origins and its understanding of the body.

Over the past 5 years, this project has developed these three aspects relating to the past 200 years, basing itself on Germany and undergoing comparisons with Great Britain, France, and the United States, and is founded on a broad resource framework (sources from advice literature and lexicons, to films and pictures, novels, children's literature, scientific studies, legal legislation, and animal welfare literature). The first results were put up for discussion in the form of articles and essays.

The project is presently in its final stages and now turns itself to the concluding question of whether one can actually historically substantiate and adequately analyze (with the help of which sources?) the acquisition of certain feelings in certain animals against the background of this comprehensive emotionalization process (and not by nature!). Though this question can easily be sentimentally misinterpreted, it should still be understood heuristically. Indeed, if one conceives feelings as not simply given, but rather from the perspective of the history of the body as acquired, incorporated, and capable of alteration then this as yet unsolved question should be examined. The project will be completed in 2014 in the form of a monograph.

Researcher

Pascal Eitler

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Figure 26. 1972 German Yearbook on Animal Protection (Vol. 17).

Source. Tierschutzverlag (Buberl und Co.), Munich.

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Pascal Eitler

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Emotion and Religion in the New Age Movement

Since their beginnings in the 19th century, the social sciences have analyzed or postulated a close connection between religion and emotions. However, within the framework of secularization (*Säkularisierungsthese*), this assumed connection was rarely brought under unbiased investigation. This project examines one of the most recent religious histories: the New Age movement of the 1970s and 1980s. Even today, this movement is often rashly marginalized as *cultish*, rather than seriously reconstructed as a part of *culture*, due to its alleged irrational—and indeed, emotional—foundations.

The project explores the emotionalization of religious practices and discourses in the West German New Age movement, emphasizing the importance of the body and focusing on four different spheres. (1) The project first addressed the crucial significance of emotions within the much-discussed "new" gender order of the New Age movement, especially concerning the so-called "New Man". (2) Based on this research, the project pro-

ceeds to question the relevance of feelings within the multifaceted politicization of the New Age movement as a social movement, elucidating the affirmative relationship to the so-called "alternative milieu" of the Women's Movement and the Green Party. (3) Over the past 3 years, the project has closely examined from an emotional-historical perspective esoteric discourses on health and alternative medicine in the 1970s and 1980s, particularly within the framework of the long-lasting success

of Yoga and the more short-lived boom in so-called Biofeedback therapy. The New Age movement was, in this sense, not simply an important component of an "alternative" lifestyle; it rather drastically promoted a type of body-centered "therapeutization" that affects virtually all lifestyles across the board. "Holistic" medicine and emotional "self-realization" have, if nothing else, evolved more and more into the standard benchmark of a "fulfilled" life, be it private or public, in relationships or in careers.

The project could put its research findings up for a variety of discussions in its numerous contexts. Stemming from diverse guidebooks to keynote texts, from illustrated pictures in esoteric trade magazines to the reception in the mass media, it is possible to reconstruct the central role of the body in each different sphere—not only regarding the *acquisition* of feelings but also for their *preservation* and *assessment*. From the perspective of the history of the body, the developments within the New Age movement indicate that "real," "deep" feelings must not only be advertised or explained; they must rather be gradually incorporated and rehearsed. And they are by no means always successfully realized. Against this background, the project also undertakes a historically sharpened, critical reflection of the ever-increasing emphasis on "authentic" feelings and "self-realization."

In this context, the New Age movement first illustrates that such a multifaceted emotionalization process harkens back to specific foundations and diverse resources. In this case, so-called "oriental" techniques of the body and religions, or philosophies like Buddhism or Hinduism, played a critical role. Additionally, the New Age movement thereby emerged not as an allegedly irrational cult, but rather as a historical, highly interesting prism, which allows for the observation of the rapidly changing meaning of emotions in the 1970s and 1980s. (4) Finally, the project will turn to the spacial dimension of the New Age movement and the media's imparting of "sacred" feelings. The project is to be completed in 2015 in the form of a small monograph.



Figure 27. Advice manual (Know yourself: Your health and your body) published in Munich in 1987.

Source. Wilhelm Goldmann Verlag.

Oncomotions: New Perspectives on the History of Cancer in the 20th Century

"Illness is the night-side of life, a more onerous citizenship. Everyone who is born holds dual citizenship, in the kingdom of the well and in the kingdom of the sick. Although we all prefer to use only the good passport, sooner or later each of us is obliged, at least for a spell, to identify ourselves as citizens of that other place". (Susan Sontag, 1978)

Throughout the 20th century, countless citizens of Sontag's kingdom of the sick had to live with, and more often die of cancer. But the encounter with cancer also shaped debates and experiences of talking about, explaining, enduring, and acting upon disease and dying, the vulnerable body and our Selves. These debates not only spoke to the emotions of many people, but emotions were frequently at their center. Thus, in discussing and implementing cancer awareness campaigns, treatment options and coping strategies, as well as palliative and terminal care, people also reasoned about the meaning and moral value of emotions, about the way to express, talk, or keep still about them, and, ultimately, about the potential impact of these emotions on the body.

This history of what could be termed as *oncomotions* focuses on Germany from the 1910s until the 1990s. The following two short paragraphs sum up some of the findings. First attempts at raising cancer awareness in Germany started around 1900. While these campaigns were constructed upon the conviction that spreading knowledge was sufficient, fear soon became a topic of heated debate. As notions of fear oscillated between its motivating and its paralyzing effects, public health workers tried to promote a form of rationalized concern. This trend toward blocking fear in favor of a feeling of concern and duty gained momentum during the National Socialism era. Easy-access detection procedures and condemning cancer fear as cowardice and irresponsibility toward one's own children and the *Volk* served this purpose. But experienced against the backdrop of exterminating chronically ill people, this strategy nevertheless used an underlying logic of fear. In the postwar era, evoking fear was anxiously avoided since it was perceived as a dangerous, irrational,

and harmful emotion. This changed during the 1960s in the wake of a larger reevaluation of emotions. Fear gained new currency as a powerful means to deter people from an unhealthy lifestyle until the 1980s when cancer education favored the conviction that people had to be encouraged through the use of positive images, feelings, and hope. The emotion models employed by cancer awareness campaigns were informed by psychological and medical theories that also played a role in explaining and treating cancer. While older humoral cancer etiologies claimed that there was a close connection between melancholy and cancer growth, emotions vanished from oncology in the late 19th century as a result of the commitment to cellular pathology. The new psychosomatic medicine that first emerged during the 1920s reintroduced emotions into oncology. Personality studies tried to substantiate the assumption that specific ways to handle emotions made people prone to cancer. This model of a cancer personality soon found its way into popular self-help books. Moreover, it influenced and modified the way in which cancer patients were treated and cared for by establishing the new discipline of psycho-oncology that emphasized the role of emotions in curing cancer or enhancing a patient's quality of life.



Figure 28. Cover of a German magazine dedicated to the topic *Cancer: A Disease of the Soul?*

Source. Der Spiegel 45/1977.

Researcher

Bettina Hitzer

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Researcher

Uffa Jensen

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Feelings Against Jews: The Emotional History of Modern Anti-Semitism

Anti-Semitism is an emotionally laden phenomenon. Ever since Richard Wagner in his infamous *Judaism in Music* (1850, reissued in 1869) spoke of an "unconscious feeling," "a rooted dislike of the Jewish nature," even an "involuntary repulsion" against Jews, such emotionalized language has appeared in anti-Semitic discourse. Anti-Jewish texts, speeches, slogans, films, images, etc., quite frequently relied on various emotions like hatred, anger, fear, disgust, resentment, envy, pride, etc. These forms of communication could have social effects, mainly through group formation by emotional synchronization. Moreover, violence against Jews was often coordinated by complex forms of emotional mobilization. Finally, Jewish reactions to anti-Semitism habitually included an emotional involvement, among them moral feelings of condemnation and indignation, but also fear, anger, pride, etc.

Consequently, the French philosopher Jean-Paul Sartre (1905–1980) described anti-Semitism, in *Anti-Semite and Jew* (1946), as "something quite other than an idea": as a

"passion." Yet much of the literature in the social sciences and in history has focused on cognitive aspects of racism and anti-Semitism. Indeed, many European languages imply cognitive connotation with words like *prejudice*, *préjugé*, or *Vorurteil*. Ultimately, such an understanding of anti-Semitism relies on the persuasiveness of rational arguments to oppose such phenomena. This project argues, however, that important aspects like the endurance, strength, and intensity of

modern anti-Semitism can more easily be comprehended by using the tools that the recent literature on emotions and their history has developed.

In this context, two theoretical developments prove to be profitable for historical research on modern anti-Semitism. Firstly, by challenging the distinctions between cognition and emotion as historically and culturally dependent, it becomes possible to move beyond them and to investigate their interplay in the formation of anti-Semitism. Secondly, this interplay takes place within the human body, which recent proposals for the history of emotions put at the heart of their endeavor. In this way, anti-Semitism can be shown to mobilize the body in particular ways. However, the argument is not that the body of the anti-Semite harbors essentialized anti-Jewish emotions, but that historical anti-Semitism relies upon specific bodily practices in the form of emotions.

The project intends to reopen and refocus historical and conceptual discussions about modern anti-Semitism by using the historical, sociological, psychological, and neurological scholarship on emotions. It also proposes to investigate the available historical sources anew by focusing on their emotional aspects: What kind of emotions were involved when historical actors, groups, or institutions embraced anti-Semitic notions, for example, fear, anger, resentment, envy, etc.? How and when did an emotionalized language of anti-Semitism emerge? What kind of emotional styles or even different emotional habitus are visible in these sources? How did the emotional synchronization within groups work and to what effects? Along these lines, the project will result in a wealth of new data, insights, and historical arguments, which promises to substantially enrich the historical research on modern anti-Semitism. As a starting point, the project has led to an extensive conceptual, theoretical, and historiographical essay which introduces the volume *Feelings Against Jews* in the leading German journal *Geschichte und Gesellschaft* that Uffa Jensen has coedited together with Stefanie Schüler-Springorum, the director of the Center for Research on Anti-Semitism (Berlin).



Figure 29. Feelings Against Jews: Richard Wagner's "Judaism in Music" (1869).

Source. Verlag J. J. Weber.

History and Feeling: Foundations of the History of Emotions

This book grew out of the Thyssen Foundation funded Diltthey Fellowship project *Fear: Soldiers and Emotion in Russia, 1800–2000* (funding period: 2008–2012). While working on soldierly fear in Russia and on general multidisciplinary research on fear (Plamper & Lazier, 2012), conceptual problems began piling up so fast that at some point a pause seemed warranted in order to think some of them through: The result is the prize-winning *Geschichte und Gefühl*. The book has a dual function. On the one hand, it synthesizes the history of emotions, including relevant research in adjacent fields, such as philosophy, anthropology, sociology, linguistics, and the life sciences. It attempts to present as broad and as balanced as possible an overview of—highly complex—thinking about the emotions, from Plato to the latest affective neuroscience in user-friendly language and in the form of narrative exposition. On the other hand, *Geschichte und Gefühl* intervenes in a rapidly expanding field of research. It makes plain its skepticism about facile borrowings from the neurosciences, without ruling out the usefulness of such borrowings per se. Its argument is that historians who do borrow need to develop a deeper familiarity with the universalizing neuroscience findings on which they base their histories. Specifically and firstly, these historians should ask how robust a finding is: For instance, at the time of this writing in fall 2013, it looks like none of the three neuroscientific hypotheses about emotions most popular in the humanities, Joseph LeDoux et al.'s two roads to fear, Antonio Damasio et al.'s Somatic Marker Hypothesis (SMH), and Giacomo Rizzolatti et al.'s mirror neuron hypothesis will stand the test of time. Secondly, historians who do use neuroscience findings should do so in full awareness of their specific epistemology, which includes reductionist experimental designs, iron distinctions between true/false, and universal claims to truth. At the same time, *Geschichte und Gefühl* sketches promising areas of a future history of emotions, thereby showing how several areas of neuroscience—functional integration, neuroplasticity, and social

neuroscience—seem promising for a genuine cooperation with historians.

The book, especially its chapter on experimental psychology/life science, has benefited enormously from the multidisciplinary setup of the Institute through institute-wide conferences, advice on literature, and critical readings of drafts by colleagues from the other research centers. A placement in the January 2013 NDR list for the best nonfiction (place 5–6), significant media attention, an invitation to participate in an *American Historical Review* conversation on the emotions (Nicole Eustace, Eugenia Lean, Julie Livingston, Jan Plamper, William M. Reddy, and Barbara H. Rosenwein, 2012), an April 2013 *Geisteswissenschaften International* prize to fund the translation into English (rights acquired by Oxford University Press), as well as a license sold to Il Mulino publishers for an Italian translation, show that *Geschichte und Gefühl* accomplishes the mission of the Institute to produce internationally visible multidisciplinary basic science that, at its best, manages to bridge the natural sciences/humanities divide.

Researcher

Jan Plamper

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Researcher

Monique Scheer

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Religious Enthusiasm: Emotional Practices Among Revivalist Protestant Groups in the United States and Germany

The works of early 20th-century sociologists, such as Max Weber and Norbert Elias, have taught generations of students of German culture to view the Reformation and the development of Protestant pieties as an important step along the road to rationalization. Progressively, Christian belief was becoming not only less supernatural but also less emotional. This study offers a different view: Emotions are central to modern Protestantism and, for this reason, they are hotly contested, highly regulated, and constantly cultivated. The reason why emotions are so central lies in the core tenet of Protestant spirituality: the elimination of mediators between God and the individual soul. The Protestant doctrine of universal priesthood, its rejection of the veneration of the saints, and its reduction of the number of sacraments and symbolic interpretation of Communion meant that far less was allowed to generate or support the experience of God's presence. But that was indeed the point: Communication with God was not to be dependent on media, it was to be direct. God looks directly into people's hearts and they interact or communicate with Him directly, from the heart.

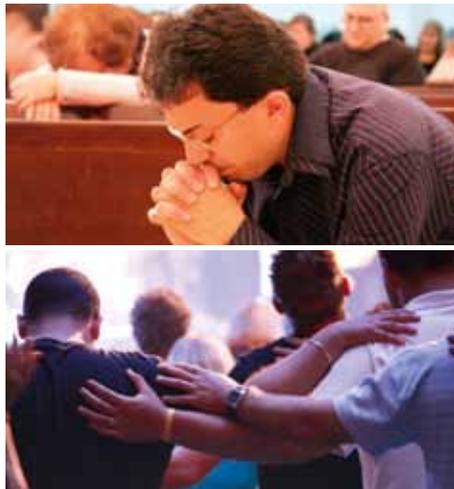


Figure 30. Bodily postures shape the emotions which mediate interaction with God in Protestant settings.

Source. Open Doors Deutschland e.V.

© Adam Rozanas

The central claim of this study is that this interaction, and with it the experience of God's presence and the knowledge (or hope) that He exists, is mediated for Protestants at least as much by feelings as it is by the word. Because of this, Protestant emotions have been the object of intense scrutiny and policing as part of the process of discernment: that is, determining whether feelings are actually mediating the supernatural or not. The study combines anthropological and historical methods in a comparative approach. Fieldwork among neo-Pentecostals—known for the intensity of their emotional practices—and among mainline Protestants focuses on how they talk about emotions in relation to their religious practice. This information is situated in broader historical contexts through the examination of sources that deal with the same issues in the 19th century, including polemics against revivalist groups, apologetic writings defending the cultivation of intense emotional states in church, and first-person conversion accounts that discuss religious experience in terms of emotions. A theoretical foundation for the study was laid in the development of the concept of "emotion as practice" and a methodological outline for studying "emotional practices." Rather than viewing religious feelings as "arising" when they are "triggered" by religious practices, such as singing a hymn, murmuring a prayer, or listening to a sermon, this approach assumes that emotions (and their absence) are learned and practiced as a "technique of the body" (M. Mauss) and stored as overlearned habits in the "habitus" (P. Bourdieu). The religious practices of a particular group are bound up with the emotional practices they cultivate; they are designed to produce certain feelings, which are nevertheless experienced as involuntary, adding to their persuasive force. The practice-theory approach provides a vantage point from which both the "folk theory" as well as the scientific discourse of the protagonists can be analyzed. From this perspective, the primacy of interiority that they share is not only shown to have its roots in Protestant practice, but also to engage moral dimensions of selfhood.

Visual Culture of Hindustani Entertainments in Early Colonial India 1748–1858

Pictures of Hindustani entertainments in early colonial India embodied an artist/viewer exchange of a homogenized idea of pleasure, the visual and sensorial codes of which were accessible by a wide segment of North Indian society. This research offers a historical trajectory of the visual culture of *rag'o rang*, the Indo-Persian concept of "pleasurable entertainment," from its fairly aristocratic sensibility of a connoisseurship-based appreciation of the arts in the 18th century to its communal interactive format as popular entertainment in 19th-century India. Entertainment pictures thus offer a unique perspective into the making of mass culture at the fundamental juncture when courtly pleasures were disseminating into the public realm.

Literature review summary: The project is an interdisciplinary investigation that aims at exploring the role of emotions as a tool of cultural analysis. The relationship between emotion and cultural practice remains an area of fruitful beginnings in the context of South Asia (Lynch, 1990; Kaviraj, 2000; Ali, 2002; Orsini, 2007; Dehejia, 2002), even as its methods are in the process of being defined by scholars (Matt, 2011; Rosenwein, 2006; Stearns, 1985; Reddy, 2001). This study especially benefits from a recent scholarship on the relationship between emotions and the arts, particularly painting and music, using an interdisciplinary approach to the study of emotions in history (Couk & Mills, 2005). In particular, recent work on the role of pleasure as a signifier of power in French court culture (Coward, 2008; Frevert, 2012) offers useful parallels for this research on the relationship between power and politics of pleasure in Anglo-Mughal India.

Methodology and source material: Through a study of two foundational texts and accompanying images from the late Mughal court and the Anglo-Indian public sphere, this project charts transitions within popular culture and taste in Delhi society. It proposes a *longue durée* analysis of the performance and visual culture of *rag'o rang*, under two Mughal rulers Muhammad Shah "Rangila" (r. 1719–1748)

and Shah Alam II (r. 1759–1806), whose reigns span the transitional era of the Mughal State (18th and early 19th century) as it came under the control of the British East India Company.

Research outcome: This research foregrounds the role of visual culture in mediating collective thought and suggest ways to reinterpret the political and intellectual history of this period through the lens of emotions. The aim here is to contextualize pleasure in elite performance culture in order to demonstrate its changing structure as a form of public entertainment. Overall, this study contributes to the intellectual history of the modern South Asia by considering the role of pleasure, a central category of emotion, and visual culture in writing history.

Researcher

Yuthika Sharma



Figure 31. Muhammad Shah and female companions on a terrace at night (ca. 1720–1725).

Source. V&A Museum, IS.133:64/B-1964.

Researcher

Gian Marco Vidor

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Vidor, G. M. (in press-f). Satisfying the mind and inflaming the heart: Emotions and funerary epigraphy in nineteenth century Italy. *Mortality*.

Grieving for Children in Italy in the Long 19th Century

During the long 19th century, Italian middle and upper classes allowed for more and more space for the communication of emotions linked to the loss of infants, children, and young adults. The final event was often accompanied by a plethora of written texts of different kinds that were occasionally collected, printed, and distributed. In the new cemeteries, which were perceived and used as important public and social spaces, an ever-increasing number of monuments were dedicated to children. Grieving had manifold public dimensions that were considered crucial in the long and complex process of what may be regarded as the formation of a collective emotional community, in a historical period marked by efforts of the elites—in particular after the unification of the country in 1861—to construct a shared Italian culture. Communicating the feelings for the loss of a loved one, even when this happened to be a child, was perceived as a learning experience. Emotions were deemed an important element in enabling the transmission of certain values, especially through funerary epigraphy. At the same time, sharing feelings as well as reading about the feelings of others was supposed to help the living cope with their own grief.

In 19th-century Italy, death also had an important educational function for children, particularly when it struck a member of the peer group, both in real life and in literary fiction. What specifically characterized the emotional repertoire linked to the death of a child was the influence of certain elements, which had a great importance in soothing the negative feelings caused to the family by the tragic event: the “metamorphosis” of the dead child into an angel, the peace achieved by the cult of memories, and the very strong albeit not quite dogmatic belief in a reunion in the afterworld. Furthermore, these elements seem to play a significant role in shaping what emerged as a homogeneous emotional style of dying for some of these children. Described in the texts as a good Christian death, written accounts of sickness, including the final event of dying, followed a common hagiographic narrative in which the body played an important role. Through their gestures, their way of looking and speaking with the people surrounding them, these children showed a sense of serenity, of patience, and a spirit of resignation, without too much apprehension about their destiny, but with great empathy for their family. In addition to the consolatory and pedagogical function of such descriptions and this sort of postmortem emotional “embellishing,” it seems plausible that, at a certain level, some of these children performed or tried to perform a set of positive emotions perceived as normative, through the control of their body language and the avoidance of any excess. Finally, working on the funerary material culture for children offered the opportunity to explore *postmortem* photography; a historiographical topic that has been neglected in Italy. Focused specifically on children, this research relates to Moritz Buchner’s wider analysis of the mourning culture of liberal Italy.



Figure 32. Treatises and manuals for writing various types of inscriptions and printed anthologies of epitaphs (19th–20th century).

© Gian Marco Vidor

A Genealogy of Science of Emotion, 1860–2000

This project investigates the genealogy of contemporary terminology of emotion from a historical perspective. The term *emotion* is used here as a shortcut to encompass emotional, affective, and feeling states. The project makes two claims: Firstly, that *emotion* was understood in the late 19th century as a cognitive concept that united mind and body, rather than dichotomizing them, and secondly, that we need to consider *emotion* as an international concept rather than a "British term." Indeed, the German *Gefühl* and the French *émotion* provided crucial elements in the conceptualization of *emotion* in psychology at the turn of the 20th century. This history of science traces the genealogy of our contemporary terminology of emotion back to two contexts: Firstly, to the mid-19th century German psychophysiological literature and its reception and transformation in French psychological writings and, secondly, to the debate about "the nature of emotion" that revolved around William James' "theory of emotion" after the publishing of the *Principles of Psychology* (1890). Widening the perspective both beyond the Anglo-American context and beyond laboratory procedures shows that the understanding of *emotion* in physiological psychology was much more complex and less exclusively concerned with bodily aspects of emotion than was hitherto assumed. Indeed, physiological psychologists not only worked out fundamental features of the body's physiology, which were unknown at the time, they also studied *emotion* as a cognitive concept. Analyzing the cognitive aspects of emotions, such as the role of *emotion* in cognition, volition, and decision making, was just as essential to them as studying the regulation of the physiological changes in the heart's rhythm and in respiration. Most importantly, central to their aims was to comprehend *emotion* in terms of brain function, like vision and language. This research thus laid the groundwork for numerous themes that emotion research in the neurosciences has taken up once more today. Framing *emotion* as an international concept informed by German and French research is

crucial for understanding the contemporary debates both in the late 19th century and today. Not only were the paths laid out for the ways in which psychology, medicine, and psychoanalysis, respectively, have treated and studied the emotions throughout the 20th century, but experimental methods were also developed that anticipated the formats used in psychological laboratories today. For instance, French research provided fine case studies of "depressed patients" and introduced the term "depression" long before it became a diagnosis in the Diagnostic and Statistical Manual of Mental Disorders (DSM). And German psychophysicists and pedagogues invented complex designs for the experimental study of emotions in the laboratory that made innovative use of pictorial images, photography, and film. In light of these reasons, this project argues that the concept of *emotion*, as it is framed by the natural sciences, cannot be explained by British and American sources only, as do recent studies on this aspect of the history of science. Because the German and French language literature from the 19th century has received comparably little attention in historiography, the project gives voice to these sources. It also widened the scope to include applied research on emotion in pedagogy in France and Germany at the turn of the 20th century.

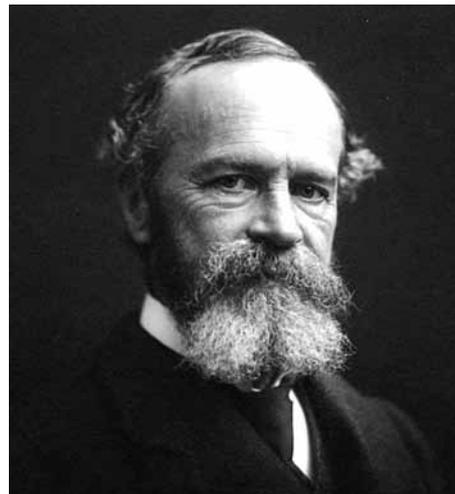


Figure 33. William James (1842–1910), author of the epoch-making article *What is an emotion?*, reprinted in *The principles of psychology*, 1890.

Source. Wikimedia Commons/Public Domain.

Researcher

Claudia Wassmann

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Researcher

Moritz Buchner

Grief and Mourning in Middle-Class Italy (1860–1915)

This research project explores the practices of grief and mourning in liberal Italy before World War I. The project argues that, in the late 19th century, a characteristically bourgeois culture of mourning was established and became more clearly defined, but was soon contested by new social dynamics. Methodologically, grief and mourning are considered social and emotional practices of the upper and middle classes that deliberately set them apart from the traditions of other groups; specifically, the lower social classes, the population of southern Italy and the countryside, as well as those whose practices were perceived as outdated. These “wrong” ways of grieving were closely connected to body language considered as excessive and

repugnant. In contrast, “modern” and “civilized” styles were characterized by the control of mimics, gestures, and voices. Main sources include scientific and literary texts, obituary publications, newspaper articles, advice literature, public instructions, as well as letters and diaries. They testify to grief being strongly identified with the loss of interpersonal relations. According to bourgeois ideas, these bonds were essentially founded on emotional affection. In the moment of death, the “pleasurable” feelings of sympathy converted into “painful” emotions like sorrow and anguish. These sentiments were highly appreciated because they reinforced bourgeois values and, beyond that, the social order. However, not every expression of love and sorrow was “right.” Bourgeois emotional styles tended to contain emotions, implying a nonimpulsive and nonphysical way of conduct. Mourning practices tended to disembodify feelings. For instance, women and men were ascribed different emotional spaces, and hygienic measures were intended to prevent physical agitation. Additionally, emotional practices were outsourced to professionals, and feelings were expressed through texts and objects. Finally, the aesthetic expression of emotions was crucial. “Wrong” practices were judged as ugly, either because they were “excessive” or because they lacked “proper” emotionality. Only expressions that were moderate and empathic were considered “decent.” This was relevant for bodily expressed emotions but also for the shaping of graveyards or funeral processions. By investigating those rites and practices, the project is closely related to Gian Marco Vidor’s work in this research team.



Figure 34. Funeral service for Guido Visconti di Modrone, 18 November 1902 in Milan (Italy).

Source. Archive of the Visconti di Modrone family, Milan (Italy).

Research Area: Emotions and Power



Figure 35. Engraving by Daniel Chodowiecki.

Source. Kupfersammlung zu J. B. Basedows Elementarwerke für die Jugend und ihre Freunde, Berlin/Dessau, 1774, Tab. XXXIV. /SUB Göttingen.

We often talk about powerful emotions—emotions that overwhelm us, that prompt us to do things and act in a certain way. Much less frequently though do we talk about how power is emotionally cast, how it utilizes, elicits, and manipulates emotions. The why, when, and where are as important as the how. The projects sharing this research focus explore the interrelations between power and emotions in two major fields: politics and the economy. They analyze crucial emotional concepts of national and international policy (such as honor and shame, or loyalty and trust), and they investigate how the carefully observed and controlled importance of feelings unfolded in the world of human capital management and the consumer society.

Collaborative Research Activities (selected)

The major conference within this research team took place on 28–30 June 2012 on *Emotions and Capitalism*. It was organized by Sabine Donauer and Anne Schmidt in cooperation with Christoph Conrad (University of Geneva). Ute Frevert and the Center's visiting researchers Helena Flam (Leipzig University) and Daniela Saxer (University of Zurich) participated as chairs and speakers. The timeliness and importance of the topic is evident in the large number of proposals (140) responding to the call for papers.

While it seems easy to affirm the interconnection of emotions and capitalism, the questions of how capitalist cultures are shaped through emotional discourses and practices, and how emotions have been shaped through capitalist cultures, are rarely explored in detail. In their introduction, Anne Schmidt and Sabine Donauer outlined the different ways in which capitalist and emotional practices are mutually constituted and changed, using examples from advertising and debates about the meaning of emotions at the industrial workplace.

Researchers

Ute Frevert
Dagmar Ellerbrock
Daniel Brückenhaus
Joachim C. Häberlen
Philipp Nielsen
Anne Schmidt
Sabine Donauer
Joseph Ben Prestel
Maritta Schleyer



Figure 36. Devotional objects of emotional power: Pipe bowl with portraits of Marx and Lassalle.

© Deutsches Historisches Museum, Berlin/A. Psille

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Frevert, U. (in press-a). Passions, preferences, and animal spirits: How does Homo Oeconomicus cope with emotions? In F. Biess & D. M. Gross (Eds.), *Science and emotions after 1945: A transatlantic perspective*. Chicago: University of Chicago Press.

Karin Knorr Cetina (University of Chicago), who gave the opening talk, examined the strong emotional attachment of currency traders to the market. By closely analyzing the everyday practices on the trading floors, she provided deep insights into the structures of today's financial capitalism.

The following 17 talks were grouped into four panels: *Financial and Trade Markets, Habitus and Consumption, Workplace, and Postsocialism as a Capitalist Laboratory*. Historians, sociologists, and economists, among them Avner Offer, Thomas Welskopp, and Anna Temkina, discussed numerous case studies. The talks explored, for example, how the privatization of multiple liferisks brought about a "speculative habitus" in neoliberal Australian society, how a new emotional type emerged with the advent of capitalism in the Russian urban middle class, and how the inmates of World War II prisoner-of-war camps organized their daily material exchanges according to the emotional economy they had acquired in their country of origin.

This broad range of empirical material opened up fruitful perspectives on how to overcome the ahistorical analytical categories of capitalist "rationality" and "interests." Moreover, they suggested ways of systematically connecting the macro- and microlevel of capitalist practices, such as linking the history of production and consumption regimes, wealth and income distribution with the lived experience of class, subjectivity, and ways

of becoming an emotional being in different stages of capitalism.

The organizers are currently editing a volume with English and German contributions to be published by Mohr Siebeck in 2014.

From 14–15 November 2013, Philipp Nielsen organized an interdisciplinary conference on *I, the People: Negotiating Individual and Collective Emotions in Democratic Societies*. In recognition of the fact that emotions are social practices, just as democracy, and considering the breadth of both domains, the conference brought together scholars from five fields: political theory, law, sociology, history, and architecture/media studies. The participants discussed the meaning of emotional practices and regimes for democratic settings in the 20th and 21st centuries. They queried the ways in which the borders between individual identity and public politics are produced, shaped, or destroyed. Here, the conference built on new research of the last decade that has moved beyond the dictum that emotions are primarily harmful for a supposedly rational democratic discourse. This new research has instead stressed their importance for social movements, political participation, and collective identity. Alongside experts from six countries, Sarah Zalfen from the Institute's Max Planck Research Group Felt Communities gave a talk, and the Center's Minerva Research Group leader Dagmar Ellerbrock chaired a panel on *Emotions, Democracy, and Identity in Law*.



Figure 37. Opening remarks by Philipp Nielsen for the conference *I, the People: Negotiating Individual and Collective Emotions in Democratic Societies* (November 2013).

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Emotional Citizens: Love, Loyalty, and Trust in Politics

Building on earlier publications on trust, research carried out between 2011 and 2013 focused on three projects:

- (1) the early modern structure of politics and its notions of love and loyalty,
- (2) emotional politics during the long 19th century, and
- (3) trust as a political promise/challenge in modern politics (19th and 20th centuries).

As to the structure and practice of politics in the absence of modern, constitutional, and parliamentary regimes of power sharing, research concentrated on the reign of the Prussian king Frederick II (1740–1786), whose 300th birthday was celebrated in 2012. As an absolutist ruler, Frederick had no reason to try to win his subjects' hearts and campaign for their love, trust, and loyalty. Subjects had no share in government, and they obeyed orders from above rather than taking initiative from below. Still, the king was not content with gaining his subjects' obedient compliance: He also sought their reverence, gratefulness, and kind feelings. As an "enlightened" ruler, he was well aware that this kind of positive emotions could turn passive "slaves" into active and productive citizens who would work



Figure 38. Ring commemorating Frederick II.

Source. Gleimhaus Halberstadt.

eagerly to enhance individual and national wealth. This rather modern notion of citizenship did not translate into political rights and power sharing; it did, however, bring forth a type of "emotional politics" that tried to form a personal bond between the king and his subjects. The project examined how that politics was designed and applied, as well as the way that it was received, challenged, and demanded by different groups of subjects. It was not so much words and texts that were studied in this regard, but rather practices, rituals, and performances. Although words and texts were a central element of political communication, images, celebrations, and direct encounters were ultimately much more influential in translating political goals into visible action.

Unsurprisingly, emotional politics received a huge boost after the French Revolution that introduced political power sharing into the European agenda. As subjects became citizens, they gradually learned to voice political interests. Yet, they remained susceptible to a language of emotions that directly influenced their relationship with the monarchy. They framed their demands in terms that built an emotional bridge toward the king and queen. But they also became accustomed to voicing dissent, making claims and threatening to withhold their emotional support should those claims not be met. At the same time, the monarchy intensified its emotional approach and eagerly presented itself as a close friend, approachable and concerned about the needs and woes of the citizens. In this instance, too, words were insufficient to convey the message: Personal appearances, media images, and symbolic actions became increasingly important in the efforts of the monarchy to appear close to the people. On another note, the emotional lexicon of politics underwent a number of crucial shifts and transformations. Loyalty, the key notion of premodern political communication, gradually lost its relevance, although it remained present well into the 20th century. Concomitantly, trust gained in symbolic weight and actual importance: as a conditional offer and as one that demanded reciprocity. Trust talk abounded during the

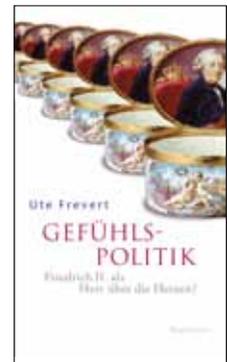
Researcher

Ute Frevert

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1848 revolution when citizens challenged the royal monopoly of power. From then on, trust gradually crept into the language of politics and found multiple expressions both in constitutional procedures and in power negotiations.

The reason why trust became such a powerful political concept during the 19th and 20th (and 21st) centuries has been explored in greater depth in the third research project under this heading. It started in the 18th century when trust emerged as an affective state that gained more and more approval. In addition to institutions like family and friendship, trust was also introduced as a governing principle in political and economic relations. This was explored both through texts and social practices, ranging from love and courtship to social bonding experiences in youth groups and associations, from teacher–student relations to factory councils, from sending poems to honor the Emperor’s birthday to promising trust (and confidence) on election posters.

Honor and Shame: An Emotional History of Power

In continuation of a long-standing interest in the micro- and macropolitics of honor and shame, research has mainly concentrated on three aspects:

- (1) the role of honor in preparing and negotiating World War I,
- (2) the gradual delegitimation of honor talk and practices in Europe during the 20th century, and
- (3) the importance of shame and shaming practices in premodern and modern times.

In contrast to present-day popular notions about honor, former generations of Europeans were convinced about honor’s emotional thrust since they had experienced it in manifold ways. Honor and the accompanying sense of pride and self-assurance were firmly built into the self-perception and self-fashioning of the upper classes (nobility and educated middle classes). Honor was also crucial for artisans, journeymen, and workers, and it increasingly pervaded international relations, as could be witnessed during the 19th century. As much as nations replaced monarchs as the primer bearers of sovereignty, national honor (rather than royal or princely honor) became a major token of foreign and imperial/colonial politics. National honor was at stake when conflicting interests had to be sorted out, and it was deliberately and strategically invoked to gather popular support for government policies.

The July 1914 crisis highlights how honor was called upon in order to legitimize, make sense of, and give credence to each stance. All major players referred to national honor as that which had compelled them to go to war. Honor here was generally linked to notions of chivalry that prompted a large power (e. g., Russia or Great Britain) to rescue smaller powers (Serbia, Belgium) from the violating hands of others. Gender images were paramount in ordering the landscape of European politics. The language spoken in July 1914 (and during the war) thus borrowed heavily from the language of honor as it had been inscribed in common social practices since the late 18th century. This is what made it easily comprehensible by wider



Figure 39. Election posters, 1946.

Source. Bundesarchiv Koblenz.

parts of the national public. But it would be misleading to conclude that this language contributed to the inevitability of war. Honor and its practices were much less aggressive than generally assumed. On the contrary, they offered options of peaceful deliberation and conflict solution. The fact that these options were not explored and used in 1914 can be attributed to the power of a different language that had become popular from the 1880s: the language of radical competition and enmity favored by nationalist circles. In contrast to the proponents of honor, those radicals no longer acknowledged equality as a basic principle of the European state system. Instead, they applied the logic of "my gain, another's loss," that is, the logic of destruction and annihilation. Within this logic, respectful, honor-based politics was a matter of the past.

While this project focused on 1914 as a case study, the second project examined honor more broadly as a "lost" emotion, that is, as an emotional style and practice that lost its appeal in Europe during the 20th century. Re-kindled by the powers that had lost the war in 1918, it experienced a propagandistic revival during the 1930s and early 1940s. The way in which the next war was fought, however, completely discarded older concepts of honor and was rather oriented toward the logic of annihilation. After 1945, the language of national honor largely disappeared alongside notions of masculine or family honor that had been prominent in earlier times, mainly as a result of changes in gender relations. It is interesting to note, however, that this development has been challenged in recent years by the so-called crimes of honor occasionally committed by male members of immigrant (Muslim) communities. Further research predominantly in the field of criminal law and jurisprudence will shed light on how this challenge has been conceptualized and negotiated.

The third project examined the opposite of honor: shame. It explored how shame figured on the list of predominantly female virtues, becoming one of women's most valued assets: Whereas men lost their honor through dishonest and cowardly behavior, women were

dishonored if they behaved in a shameless fashion. A survey of lexicon articles on shame published between the mid-18th and the early 21st century revealed that the meaning of shame has changed significantly. While it had initially been considered as a complex social emotion, it was increasingly tied to sexual and bodily shame and, as such, heavily feminized. This was radically challenged by the second wave of feminism, with slogans such as "shame was yesterday." At the same time, shaming processes that had been commonly used in legal and educational practices were called into question as they contradicted the notion of human dignity (that was increasingly invoked and referred to from the 1960s onward). While public shaming experienced a politically orchestrated upheaval in the 1930s and 1940s, it later retreated to the classroom (and is currently experiencing a new revival in the legal practice of the United States).



Figure 40. Propaganda campaign, 1917.

Source. Library of Congress.

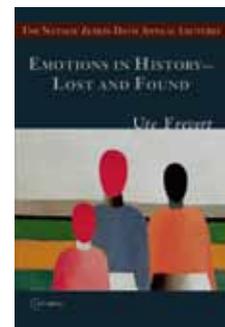
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Researcher

Daniel Brückenhaus

Key Reference

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Imperial Passions: The Role of Emotions in Modern Colonial Conflicts

The goal of this project was to study how emotions influenced the relationships between colonizers and colonized in the European colonial empires during the 19th and 20th centuries. This question was pursued in the context of three case studies. They focused on fear, compassion, and honor/shame, respectively, and were each related to a broader academic undertaking.

The first case study was conducted in the context of revisions for an existing book manuscript on the surveillance of anticolonialists in the 20th century. It demonstrated how British and French anxieties about the possibility of anticolonialists cooperating with German

left-wing activists and government officials shaped the expansion of state surveillance in the early 20th century. The resulting fears about "Germano-Bolshevik colonial intrigues" were of central importance in exacerbating inner-European political tensions and in leading the Western colonial powers toward reconceptualizing their colonial strategies in a more transnational and transimperial manner.

The second case study was part of a cooperative research project on the history of emotions in modern childhood literature. It resulted in a book chapter, which analyzed how "compassion" among Europeans toward non-Europeans was described and judged in 19th- and 20th-century children's books in Britain and Germany. As the chapter argued, a late 19th-century positive reevaluation of "going native" among European children allowed these children to express their emotions more freely, without, however, undermining prevailing notions of European superiority over "natives."

The third case study was conducted as part of the initial planning for a future book project on the role of dignity, honor, and shame in a colonial context. It focused on analyzing how laughter and ridicule as an emotional strategy could undermine another person's feeling of personal and social self-worth. The research demonstrated how laughter and ridicule could turn into an important means by which colonizers could deny the colonized entry into a European "circle of honor." Meanwhile, the frequently expressed fears of colonizers about "being laughed at" point to the fact that the colonized could, in turn, make use of laughter to subvert colonial hegemonies.

Together, these three case studies show that emotions were not just a by-product or surface phenomenon of colonial relationships, but that they influenced and structured these relationships in decisive ways. This research can thereby help us understand how sentiments that, at first view, might seem to work on the individual and personal level only, were in fact intertwined deeply with large-scale historical change over time.



Figure 41. Illustration from R. M. Ballantyne, Gascoyne, *The Sandal Wood Trader: A Tale of the Pacific*. London 1864.

Source. Project Gutenberg.

Trust and Politics in Everyday Life

A revised version of Joachim C. Häberlen's 2011 University of Chicago PhD thesis, entitled *Vertrauen und Politik im Alltag: Die Arbeiterbewegung in Leipzig und Lyon im Moment der Krise, 1929–1933/38* [Trust and Politics in Everyday Life: The Working-Class Movement in Leipzig and Lyon at the Moment of Crisis, 1929–1933/38] is a comparative study of the working-class movement's struggle against the rise of the radical right at the end of the Weimar Republic and the Third French Republic. Based on local case studies, the book analyzes the dynamics of political mobilization at the rank-and-file level. It begins with the observation that the organizationally and numerically strong German working-class movement failed to offer effective resistance against the rise of Nazism, whereas the French working-class movement succeeded in mobilizing hundreds of thousands of workers against a perceived fascist threat in February 1934. To explain this difference, the book first investigates the role of trust and distrust within the local working-class movements of Leipzig and Lyon. Building upon sociological theories of trust, as for example developed by Niklas Luhmann, the book suggests that trust enables people to judge whether their interlocutors are telling the truth or not; especially in situations in which this cannot be verified. After examining a variety of practices that functioned as "proof of (dis-) trust," the book then shows how trust collapsed within Leipzig's working-class movement, whereas Lyon's workers succeeded in building relations based upon trust. The book thus provides an empirical example for how the micro-dynamics of creating trust and distrust can be studied historically in the context of grassroots politics.

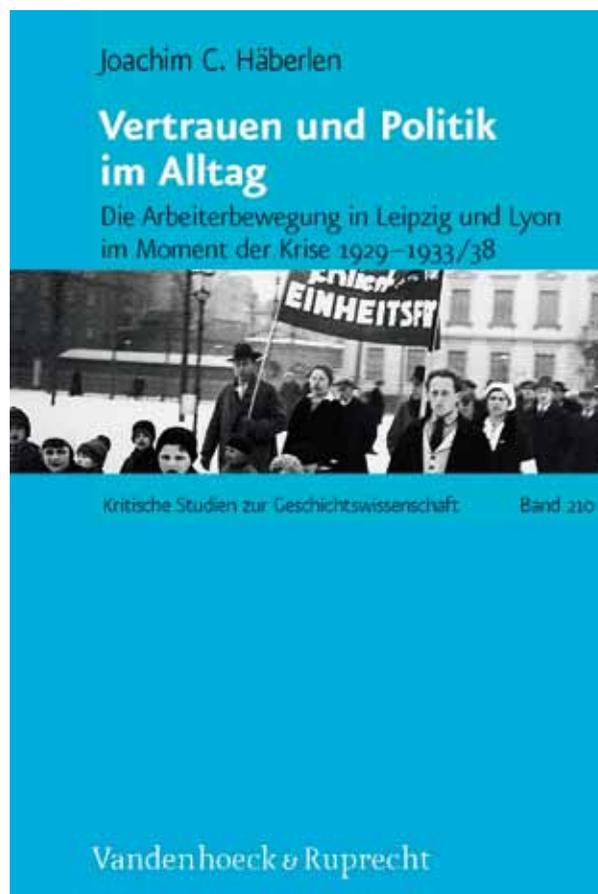
Furthermore, the book examines the role of politics and politicization within the local working-class movements. In Leipzig, it argues, a deep politicization of the local working-class movement turned into an impediment for political mobilization. Particularly in the face of communist attempts to politicize all aspects of social life, political activists, and even members of the Communist Party, began to long for spaces such as swimming pools or sport associations that remained free of politics. The overpoliticization of everyday life thus resulted in a turning away from politics altogether. In Lyon, by contrast, the relatively small importance of party politics paradoxically constituted a precondition for the successful mobilization of its workers. Unlike in Leipzig, party politics had never turned into a "nuisance," which is why politics could mobilize and unite formerly hostile workers during a profoundly political crisis in 1934.

Researcher

Joachim C. Häberlen

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Researcher

Joachim C. Häberlen

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Politics of Emotions: The New Left in West Germany From the 1960s to the 1980s

This research project examines the role of emotions within the West German alternative left in the post-1968 years. Drawing in part upon earlier cultural critics and theorists, such as Wilhelm Reich and Herbert Marcuse, these alternative leftists developed a critique of urban, capitalist society that put emotions at the center. Capitalism, they argued, produced only fear, frustration, loneliness, and boredom, leaving little space for any positive and intense feelings. One might read these texts as a critical analysis of what could be called with William Reddy the “emotional regime” of capitalism, that is, the possibilities and limitations of emotional expression under capitalism. However, the knowledge that leftist authors produced about feelings in capitalist society was not only descriptive but also highly normative. Although ostensibly meant to *explain* to readers why they would feel bored, afraid, or frustrated, texts like Duhm’s *Fear in Capitalism* also suggested to readers how they *should* feel in capitalism. In a sense, such normative texts helped to produce the very “emotional regimes” they sought to describe. Leftist authors, the project argues, not

only provided an analysis of the “emotional regime” of capitalism but effectively created one themselves.

Importantly, this is not to argue that the “emotional suffering” (Reddy) under capitalism was only imagined. Rather, the project argues that the discursive analysis and practical enactment of negative emotions created these feelings of boredom, frustration, and fear within leftist social milieus. Building upon Monique Scheer’s work on “emotions as practices,” the project explores the ways in which these emotions were practiced and thereby created. Even though the project for the most part analyzes texts—primarily a broad range of radical leftist journals from large and small cities in West Germany, such as *Info BUG*, *Pflasterstrand*, *Das Blatt*, or *radikal*—the analysis of how actors performed emotions moves beyond the unfruitful distinction between “true” inner feelings and mere “expressions” of feelings. Enacting and expressing emotions was, the project proposes, itself a productive act—whether through ostensibly objective descriptions of these emotional states, discursive analyses of one’s own imbrication in these emotional regimes, or more straightforward performances of resistance such as street protests.

But radical leftists did not stop at merely criticizing capitalism for the emotional void it allegedly produced. By naming specific features of capitalism—including the built environment, work, and consumption under capitalism—as responsible for negative feelings, they also created possibilities for generating alternative emotional practices, which would yield intense emotions outside and beyond the “emotional regimes” imposed by capitalism. Such practices could include acts of violence but also other bodily practices like collective cuddling, experimental communicative practices, or novel forms of living together. Analyzing both how radical leftists critically interpreted the feelings capitalism produced and the alternative emotional practices they developed, the project examines alternative leftist activists made *feelings* a central political concern.

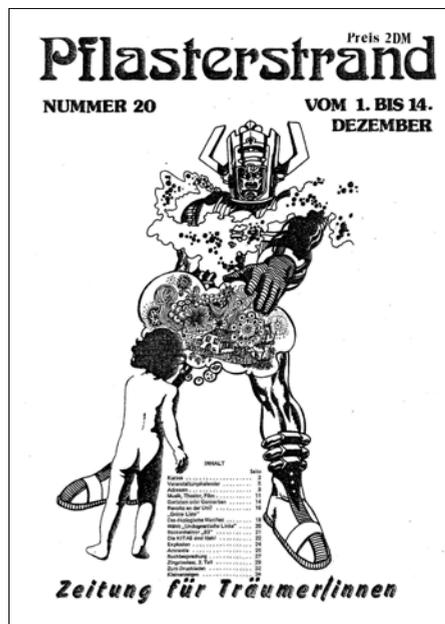


Figure 42. Leftist magazine.

Source. Pflasterstrand, 1977.

Democratic Emotions: Compromise and Parliamentary Culture in German History

The goal of this project is to investigate the emotional attitudes toward compromise in German parliamentary culture(s) and their evolution over the course of the 19th and 20th centuries. This is not meant as a teleological history toward an ideal democratic consciousness. Rather, it is an investigation into the role of emotions in democratic politics and the various ways in which they supported and undermined the political process. The project provides a history of political culture in Germany that goes beyond a dichotomy of rational democracy and emotional dictatorship. By focusing on compromise, it offers an account of the changing emotions surrounding what is arguably the centerpiece of parliamentary politics. Which feelings dominate in relation to compromise has crucial implications both for constitutional theory and for practical politics. Whether compromise is hailed or reviled, celebrated or condemned, influences the shape of and conduct within political systems.

Attitudes toward compromise are culturally determined. They vary across time and milieu. The debates between the constitutional theorists Carl Schmitt and Hans Kelsen in the 1920s and 1930s, for example, are well known and historically coded as quintessentially "Weimar." For Kelsen, compromise alone ensured the peaceful resolution of differences of opinion, the slow and tedious creation of social harmony. For Schmitt, on the other hand, compromise meant selling out, all dead form and no feeling. The debates about compromise in the Weimar Republic were themselves emotionally charged. Kelsen worried about the "dismissive, even contemptuous" attitude of opponents of compromise. In March 1919, the publicist Kurt Tucholsky, for example, sarcastically wrote of the "little compromise" he saw between left and right, conspiring behind the back of and against the people.

In the early postwar years, there were fewer theoretical disputes about compromise. Yet this did not make references to it any less emotional. In a speech to parliament in 1953, Federal Chancellor Adenauer stressed the

importance of compromise in all government agreements and beseeched the Social Democratic opposition "with all [his] heart" to agree. "No one would be happier [about this] than (...) the German people." The second aspect of the project eschews the theoretical debates for the political routines of parliamentarians and other elected officials. Here, the dynamics of budget negotiations across German history are analyzed. Not only are budgets at the heart of parliamentary politics but they also must be passed in regular intervals and cannot be delayed indefinitely or be shelved. As such, they are sites at which compromises need(ed) to be found on a regular basis. In addition, as budgets are inherently forward looking, they reveal not only a societal present but also expectations and aspirations about the future that are intimately linked to emotions. These debates form an important counterpart to the debates in constitutional law that equally reflect on an ideal and future order. The project, thus, sees emotions as a way to link theoretical with practical aspects of political culture in general, and democratic culture in particular.

Researcher

Philipp Nielsen

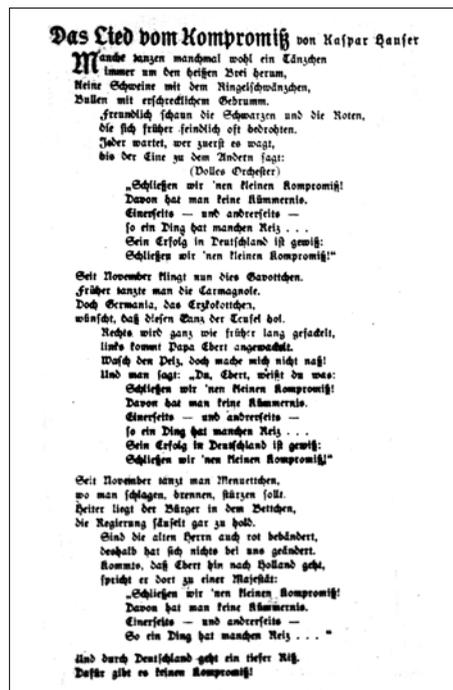


Figure 43. Text of the satirical "Song of Compromise."

Source. Kurt Tucholsky, *Das Lied vom Kompromiss*. *Weltbühne*, 15(12), 13.3.1919, p. 297.

Researcher

Anne Schmidt

Key Reference

König, G., & Schmidt, A. (in press). *Moderne Ambivalenzen: Konsumkultur und Propaganda im Ersten Weltkrieg*. In T. Schleper (Ed.), *Aggression und Avantgarde*. Essen: Klartext-Verlag.

Advertising Emotions

This research project examines how advertisers and consumers were generated within the 20th-century network-like advertising culture. Additionally, the project is interested in the consequences of the process of the "making up" of advertisers and consumers for the development of advertising and marketing practices. Finally, the project examines the repercussions of these practices for the advertisers and consumers. In doing so, the attention will primarily focus on the analysis of emotions.

Specific forms of emotional conduct (dispositions, experiences, qualities, capabilities, stances, manners, behavior patterns, gestures, facial expressions) constitutively belong to the morals and ethics, to the capacities and qualities, which were expected and demanded of advertisers. They were generated in the advertising culture, incorporated, and thereby modified and changed.

Emotional dispositions and modes of experience and behavior were equally inscribed in the circulating consumer versions. These consumer versions operated in the network-like

advertising culture and generated, together with other entities and developments, changing advertising practices.

With the help of new light technologies, selected materials and colors, cleverly devised product arrangements, and much more, new rooms were, for example, created at the beginning of the 20th century by means of which perceptions, sensations, feelings, desires, and consciousness of the consumers were newly animated, linked, regulated, and instrumentalized for sales—and namely in ways that consumer versions suggested. The changing advertising practices urged for the realization of generated consumer versions. The advertising practices were thusly based not merely on certain consumer versions but rather both suggested them and made them possible.

The analysis concentrates on the time period between the end of the 19th and the beginning of the 21st century and primarily follows developments in Germany, though from a transfer history perspective. The root sources are comprehensive and multilayered: relevant professional journals, textbooks and handbooks, teaching and education material, guidebooks for advertisers written by advertisers, internet portals, blogs, and other related sources. The analysis of these materials allows for the exploration of the roles and demands placed on advertisers, the institutional arrangements and technologies for the regulation of behavior, as well as different consumer versions. The question of whether and how the discourses, logics, and rationalities in the daily life of the advertisers were translated, and how they were interpreted, utilized, modified, or even ignored and rejected, was inspected with the help of three case studies (advertising department of Kaffee HAG; Frankfurt office of the advertising agency J. W. Thompson; advertising agency Scholz & Friends).

Project status: The source research is completed; for portions of the job a detailed analysis of the materials still remains. The writing of the first part of the investigation has begun.



Figure 44. Gustav Grossmann's advice manual "Sich selbst rationalisieren" offered advertisers tips on managing their emotions.

Source. Book cover from 1927.

Emotions at Work—Working on Emotions, Germany 1870–1970

The research project pursues the question of how labor scientists and corporate players conceptualized the connection between work performance and work-related emotions in 20th-century Germany. The project looks at the period around 1900 and explores the cultural, social, and economic reasons why employees' emotions turned into an object of labor scientific inquiry. At this time, the problematization of "class hatred" as well as the seemingly widespread aversion of industrial workers toward their tasks can be viewed as two driving powers for the efforts to turn monotonous and highly repetitive industrial labor into a more likeable experience. This was the point of departure for the emergence of disciplines like labor physiology, labor pedagogy, and psychology, as well as industrial sociology, which all aimed at making employees more productive and content.

The study identifies five overarching developments for the 20th century. First, labor scientific sources and corporate practices show a tendency toward *desomatization*, that is, positive and negative emotions at work are increasingly less framed as an outcome of material and bodily working conditions. Rather, the willingness of the employee to motivate him- or herself (i. e., to generate positive emotions by oneself), irrespective of actual workload or work hours, is expected. The second key development is the tendency toward *dematerialization*. This means that the financial remuneration for industrial labor is cast as gradually less important while the "immaterial" rewards such as finding personal satisfaction in work contents become more strongly emphasized.

Third, the study outlines a trend toward *dynamization* in dealing with emotions at work. While around 1900 it was taken for granted that a worker had a preexisting amount of joy in work (which could only be troubled by unfavorable working conditions), in the 1970s, the Human Resource paradigm promoted a different conceptualization based on Abraham Maslow's "pyramid of needs." It claimed that job satisfaction was an unstable psychological state which could only be

temporarily reached by making the employee master ever new and challenging tasks. After fulfilling certain goals at work, new "stretch goals" must be given to create a new field for generating positive emotions and self-realization (*Selbstverwirklichung*).

Fourth, the project argues that, throughout the 20th century gainful employment turned from a means of making a living into a source of *transcendent meaning-making*. Not only work-related advice literature but also corporate public relations present work as a field in which personal fulfillment and private happiness can (and must) be found.

The fifth claim of the study is that labor scientific and corporate efforts worked toward an *individualization* of the employment relationship. While around 1900 the key problematization in dealing with emotions at work were "class-based emotions" (such as class hatred and workers' solidarity), the ensuing efforts tried to bring about a disaggregated ("post-social") work personality. This understands employment not in terms of an irreconcilable class antagonism, but as a means to satisfy personal emotional needs.

The thesis was handed in at the Freie Universität Berlin on 29 August 2013, and successfully defended on 18 December 2013.

Researcher

Sabine Donauer

The PhD project, supervised by Ute Frevert and integrated in the Center's research program, was part of the Cluster of Excellence "Languages of Emotion" (Freie Universität Berlin).

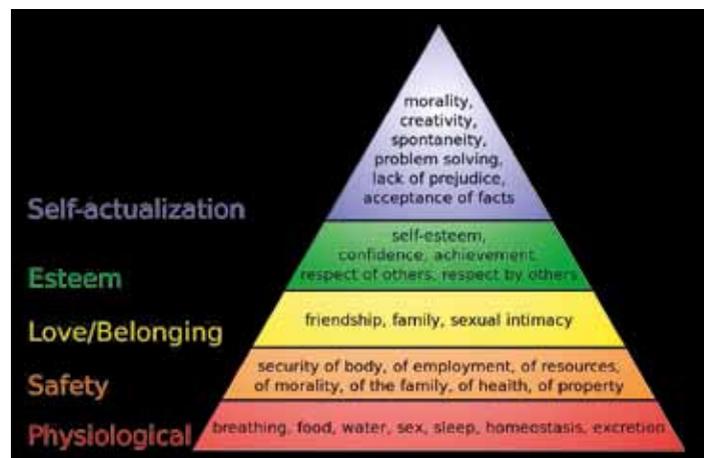


Figure 45. Maslow's hierarchy of needs.

Source. J. Finkelstein/Wikimedia Commons/CC-BY-SA 3.0.

Researcher

Joseph Ben Prestel

Key Reference

Prestel, J. B. (2013). Die Reform der Stadtmänner: Urbaner Wandel und Körperpolitik in Kairo am Ende des 19. Jahrhunderts. *Body Politics: Zeitschrift für Körpergeschichte*, 1(2).

Urban Emotions: Debates on the City and Emotions in Berlin and Cairo, 1860–1910

During the second half of the 19th century, Berlin and Cairo went through a process of profound transformation. Dynamics such as growth of population, technical innovations, and social change during this period not only affected their cityscape; contemporaries also discussed the impact of these changes on urban dwellers. The present project traces the role of emotions in debates about urban change in Berlin and Cairo from a comparative perspective. Were changes in these cities debated in terms of emotions? How did shifting power relations affect these debates? Was urban change in both cities negotiated in a comparable way?

In order to address these questions, the project draws on two different groups of sources. Published writings that offered an "expert" knowledge about the two cities, such as government publications, medical literature, or newspaper articles, constitute the first group of sources. Claims stemming from these pub-

lications about the impact of city changes on emotions are to be traced in the second group of sources, which are made up of police and court records. In analyzing the two different groups of sources together, the project aims at a combined study of conceptual knowledge about emotions and emotional practices. Several research stays in archives in Cairo, Berlin, and London allowed for the identification of contemporary debates about the city and emotions. These debates, which range from the fostering of rationality through newspaper reading to the detrimental effects of excitement in dancehalls, regularly linked intellectual discussions about feelings to shifts in things people did in the city. One preliminary finding lies in the observation that, while common tropes and topics related to the impact of urban change on emotions can be found in both cities, the terms and concepts in which these debates were embedded are specific to Berlin and Cairo. Although different in its conceptual framing, the idea of specific "urban emotions," which were the result of recent changes in the two cities, thus became a common currency in the German and Egyptian capitals. This currency was particularly used by middle classes, who sought to reify their hold on power in the changing urban environments of Berlin and Cairo.

One shared aspect between debates in Berlin and Cairo was the claim that certain spaces in the city gave rise to changes in the emotions of urban dwellers. The development of entertainment areas downtown and the building of new suburbs far away from the city center, for instance, produced heated arguments about emotions in both cities. In conversation with other research projects at the Center, the project seeks to further investigate the nexus between space, power, and emotions. Drawing on insights from the work of Margrit Pernau and Benno Gammerl, it will pay special attention to the interrelation between particular emotional practices, social distinction, and spaces. The question of whether the creation of seemingly similar spaces, such as dancehalls or suburbs, gave rise to similar debates in Berlin and Cairo will be at the forefront of further investigation.



Figure 46. Illustration in a Cairo magazine.

Source. al-Mushir, 1896.

**Khwaja Hasan Nizami (1878–1955):
Emotions for the Sufi Shrine, Emotions for
the Nation, and Emotions for the Muslim
Community**

Khwaja Hasan Nizami (1878–1955) was an influential and controversial figure in the public life of Delhi and northern India in the first half of the 20th century. He became famous as a religious teacher, reformer, and missionary. Furthermore, he was a highly prolific Urdu journalist and author of books and pamphlets on historical, religious, and political themes. In his writings and conversations, Nizami participated in various discourses in the context of anticolonial community formation and was acquainted with the political and cultural Indian elite. The historical backdrop of Nizami's activity was marked by the variegated Indian nationalist movement against the British colonial power. During those days, a variety of religious and cultural reform movements flourished and the tensions between Hindus and Muslims grew. The thriving field of journalism and cheap book print provided a major platform for the multitudinous contemporary debates. This research project looks at the role of emotions in processes of modern community formation. Designed as a biographical case study, the dissertation assumes that the focus on emotions provides crucial insights into constructions of meaning by historical actors. In an analysis of Khwaja Hasan Nizami's imagination of the Sufi, the Muslim, and the Indian national communities, this study argues that Nizami allotted specific sets of feelings to them as their main identifiers. Thus, he intervened in current negotiations of the identity of the forming Indian nation and of Indian Muslims. Additionally, the project sheds light on particular ways in which protagonists of devotional Islam responded to the changing political and religious landscape of early 20th-century India and fashioned a space for themselves in society. In the period under consideration, research results were presented at several academic conferences in the field of South Asian Studies. Among others, in October 2011, a paper entitled *City of Love and Pain: Khwaja Hasan Nizami's Delhi* was read at the University of

Wisconsin–Madison. The paper argues that, against the backdrop of the nationalist movement in late colonial India, Nizami's representations of the city of Delhi were imbued by an attitude of compassionate love, a nostalgic longing for the precolonial era, and a memory of suffering. They offer an alternative vision of national unity in the contemporary identity discourses and a perspective for the future of the political community based on emotional belonging.

In July 2012, the paper *Between "Muslim" and "Cultures": Khwaja Hasan Nizami's Negotiations of Being Sufi* was presented at the Berlin Graduate School Muslim Cultures and Societies. By analyzing the nexus of emotions and mass mobilization in Nizami's rhetoric of "Islamic love" and a localized civility of Delhi in the context of the community politics of late colonial India, it destabilizes binary categories deployed in existing studies of South Asian communalism.

The dissertation will be submitted in 2014.

Researcher

Maritta Schleyer

Key Reference

Schleyer, M. (2012). Ghadr-e Dehli ke Afsane. *Annual of Urdu Studies*, 27, 34–56.



Figure 47. Khwaja Hasan Nizami.

Source. <http://www.tahadilam.8k.com/catalog.html>.

Researcher

Dagmar Ellerbrock

Key References

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Minerva Research Focus: Emotions, Violence, and Peace

General Introduction of the Research Focus

Violence can be pleasurable, it can give you a kick; alternatively, it can be profoundly frightening. Violence may be acted out in blind rage or in cold blood. Obviously, violence can be rooted in very different emotional states. Taking this into account, the research starts with the assumption that emotional studies and violence research can be mutually beneficial. Are emotions instrumental in bringing about violent actions or is it the experience of violence that triggers these emotions? Are emotions always responsible for the escalation of violence or can they also lead to deescalation? In other words, how are emotions linked to the dynamics of violent actions and of peacekeeping/peace-building processes?

Since a great variety of emotions are involved in violent actions—from anger and aggression to fun and joy, solidarity, and sympathy—it is necessary to pay intense attention to historical as well as to situational context. Which feelings are generated by violence and which feelings are important regarding these brutal practices is always dictated by the specific situations as well as by the historical and cultural framework. Therefore, it is important to ask, what are the significant factors in triggering emotions? What kind of circumstances support violent actions? At the same time, it is important to comprehend what kind of structures can develop emotions that help to minimize violence.

Taking the different kinds of affects as well as diverse effects in mind, it becomes obvious that emotions can serve to increase violence as well as potentially function as a tool to decrease violence. Understanding this complex relation in its historical dimensions is one of the main aims of this research.

It is not only the person engaged in violent acts that has feelings. The victims of violence experience a wide range of emotions—fear and shame, helplessness and anger. Even bystanders undergo different feelings. Emotions are perceived as an interpersonal phenomenon linking people, things, and memories.

To understand this webbed character of emotions, one must compare violence by crowds and by individuals. Are there any differences between crowd violence and violence committed by an isolated, lonely perpetrator? All kinds of violent action have the capacity to change power relations profoundly within a few seconds. This potential fuses power and emotions in a basic, formative way. At the same time, power relations may evoke emotions which trigger violent behavior. This action may support political power relations or contest them—in any case, violence suffuses the political space with emotions.

In order to find out how structural, cultural, and social conditions influence the emergence of emotions that are significant in violent actions, a close reading of different contexts, as well as a comparative analysis of different historical settings, are placed at the center of the research. Violent settings of World War I will be compared with violent settings of World War II in order to look for differences and similarities in the emotional framing of violence. Societies experiencing aftermath of extreme violence will be compared from a transnational perspective. Specific acts of violence, for example school shootings, will be analyzed in order to find out why they suddenly became of interest and gained emotional qualities never previously attributed to them.

Emotions can be seen as a container, preserving memories of violence; a force that triggers action and drives people to unknown places; and a longed-for condition, for which violence appears the only path.

In detail the research is concerned with the following areas.

From Shame to Violence? Experiences of World War I and the Emotional Aftermath
This project focuses on the experiences of World War I. It questions the emotional framing of wartime violence and follows the emotional effects of its recollection in the aftermath of the war. Following the theories of Thomas Scheff—that shame can lead to violence—the historical investigation tests whether the dishonor felt in some parts of Germany due to defeat in World War I trans-



Figure 48. Brawl between members of the pro-democratic Reichsbanner paramilitary and communists.

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lated into the political violence of the Weimar era. Thereby, it investigates the relation between the violence of war, emotions, and political protest in the aftermath of war. This project is in collaboration with colleagues from the Goethe University Frankfurt a. M. The first results of the research were presented at an international conference at the Institute in June 2013.

Don't Trust the Perpetrators: Networks and Interactions After the Experience of Extreme Violence and Genocide in World War II.

The second project concentrates on the period after World War II, when emotions were connected with experiences of extreme violence and even genocide, but were translated into democracy and peace. Using the example of the interactions between representatives of the American Rockefeller Foundation and their new German partners, it investigates the emotional setting of the path that lead from violence to peace.

The project scrutinizes the decision-making processes within the Rockefeller Foundation. What kind of information did the Rockefeller Foundation staff gather? Who did the trustees talk to and by which criteria did they evaluate their German colleagues? Clearly, it was not only hard facts that political decisions were based on, but also emotional credibility, sympathy, and empathy. How did these emotions grow in daily interaction? What role did the recent violence have on future emotional evaluation and how did the preceding violence impact the Germans' credibility? What was the correlation between individual credibility and collective assessment? In

order to answer these questions, the project discusses the interactions between German and American partners from the perspective of social network theories and tests the thesis that emotions are generated, secured, and legitimized, as well as eroded and obliterated within social networks.

Power relations define what are accepted to be legitimate forms of violence and what kind of violence is held to be illegitimate. In this sense, political power structures are crucial to the creation and stabilization of emotions, which likewise determine power relations. Investigating the connection of emotions and violence in times of political change and reorientation will also offer insights into the connections between power and emotions.

Trigger-Happy Germans

German youth was regularly portrayed as trigger-happy in the headlines of the early 20th century. The indignation underlying this reading is rather remarkable considering that German fathers and teachers as well as politicians hugely promoted young Germans' interest in shooting. The project asks when and why the public emotional framing of once highly respected gunmanship changed and turned negative.

It also follows the emotional experience of this trigger-happiness and asks what feelings were associated with these practices. Why did (especially young) men enjoy shooting and



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Figure 49. End of term: Boys fire off their pistols in front of the rectory (1938).

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what kind of affective state were they longing for when shooting?

Since the emotional perception of shooting practices and shooting desires changed within the analyzed time frame (1900–1979), the project inquires into civil shooting practices and as to whose emotions were able to inform political structures and systems.

School Rampages

School shootings are lonely acts. They are perpetrated in complete social and emotional isolation. At the same time, a school shooting is a fundamentally social event occurring at a highly emotional intensity. School rampages are among the most terrible and feared catastrophes. They shake society to the uttermost. They provoke emotional despair, anger, sorrow, and helplessness. They provoke intense emotional debate and link communities, nations, and even global societies by common—or at least perceived common—emotions. Every school shooting provokes an intense media debate and sometimes triggers political action. This project follows both paths: It investigates the media coverage in order to map the emotional culture of society. Since the project compares different European and

American societies as well as two centuries, it will analyze the similarities and differences of emotional explanations and appraisals within the debates about school shootings. It examines which emotions were regarded as the cause of killing sprees and which emotional reactions were generated by those chaotic incidents. The second stage of analysis is that of political reaction. These differ fundamentally within the various countries. Is this because of emotional differences? Were school killings rated differently in terms of emotional impact in different countries or is it the actual measures which were perceived in different emotional ways?

A third level of analysis concentrates on the role of the media. Has media coverage of school shootings changed during the last two centuries? Did newspapers—and later television and internet—discuss different emotions in relation to school rampages? Is it media images that translate into social action and ultimately provoke school shootings? If so, what role do emotions play in this process of translation? Is it the desire to make headlines that provokes the desire to kill? In order to answer these questions, it is vital to understand the link between violence and emotions.



Figure 50. Effects of gun violence: Evoking despair, horror, fascination, hate, and grief.

Source: Shutterstock.

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(last update: January 2014)

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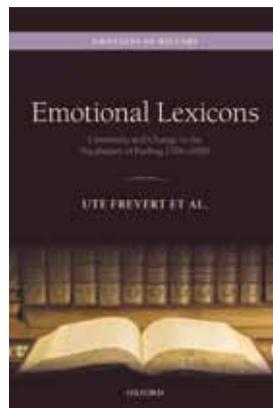
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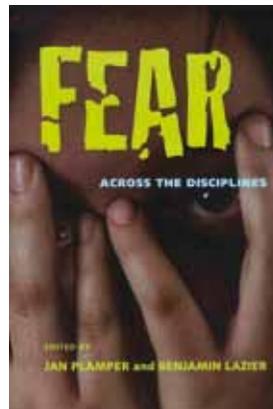
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The Center for Lifespan Psychology

The **Center for Lifespan Psychology (LIP)** (Director: Ulman Lindenberger) has helped to establish lifespan psychology as a distinct conceptual approach within developmental psychology. Work at the Center is guided by three propositions: (1) to study lifespan changes in behavior as interactions among maturation, learning, and senescence; (2) to develop theories and methods that integrate empirical evidence across domains of functioning, timescales, as well as behavioral and neural levels of analysis; and (3) to identify mechanisms of development by exploring age-graded differences in plasticity.



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"But ... its eminent modifiability, and its predisposition to self-initiated action, may it develop little or much, and may it differ in amount between different individuals, is among the immutable features of humankind, which can be found wherever humans exist."
Johann Nicolaus Tetens, 1777, I, p. 766



J. N. Tetens (1736–1807), philosopher of the Enlightenment Era

Introductory Overview

Founded in 1981 by the late Paul B. Baltes, the Center for Lifespan Psychology pursues lifespan psychology as a distinct conceptual approach within developmental psychology. Since 2004, the Center has extended its research program into developmental neuroscience. Work at the Center is guided by three propositions: (1) to study lifespan changes in behavior as interactions among maturation, learning, and senescence; (2) to develop theories and methods that integrate empirical evidence across domains of functioning, timescales, as well as behavioral and neural levels of analysis; (3) to identify mechanisms of development by exploring age-graded differences in plasticity. The Center continues to pay special attention to the age periods of late adulthood and old age, which offer unique opportunities for innovation, both in theory and practice. At the same time, it has continuously increased its research on behavioral development during earlier periods of life.

Three Guiding Propositions

The Center's research agenda can be summarized by three interrelated theoretical propositions (Lindenberger, Li, Lövdén, & Schmiedek, 2007). In line with general tenets of lifespan psychology, these propositions emphasize conceptual and methodological issues in the study of lifespan behavioral development, and thereby provide a general script for formulating research questions in more specific domains of interest.

Proposition 1: Lifespan Changes in the Individual's Behavior as Interactions Among Maturation, Learning, and Senescence

The general goal of developmental psychology is to identify mechanisms that generate invariance and variability, constancy and change, in behavioral repertoires from infancy to old age. By identifying the commonalities, differences, and interrelations in the ontogeny of sensation, motor control, cognition, affect, and motivation, both within and across individuals, developmental psychologists and developmentally oriented neuroscientists attempt to arrive at more or less comprehensive theories of behavioral development. To provide explanations that qualify as psychological and developmental, the effects of agents external to the developing individual, such as par-

ents' affect attunement, teachers' classroom behavior, or a state's retirement policies, need to be mapped onto mechanisms and organizational laws that operate and evolve within the developing person. Hence, as John Nesselroade, Peter Molenaar, and others have emphasized, developing individuals, rather than groups of individuals or domains of functioning within individuals, form the privileged system of analysis and explanation. Individuals organize their exchange with the physical and social environment through behavior (see Figure 1). On the one hand, the changing brain and the changing physical and cultural environment shape behavioral development. On the other hand, behavior alters both the brain and the environment. Hence, environment and brain act as antecedents but also as consequents of moment-to-moment variability and long-term changes in patterns of behavior. The components of this system, brain, behavior, and environment, are constantly coupled and cannot be reduced onto each other, as they jointly condition an individual's life trajectory through recursive self-regulation. In attempts to explain the age-graded evolution of this system, *maturation* and *senescence* denote the operation of age-graded brain mechanisms and their effects on changes in

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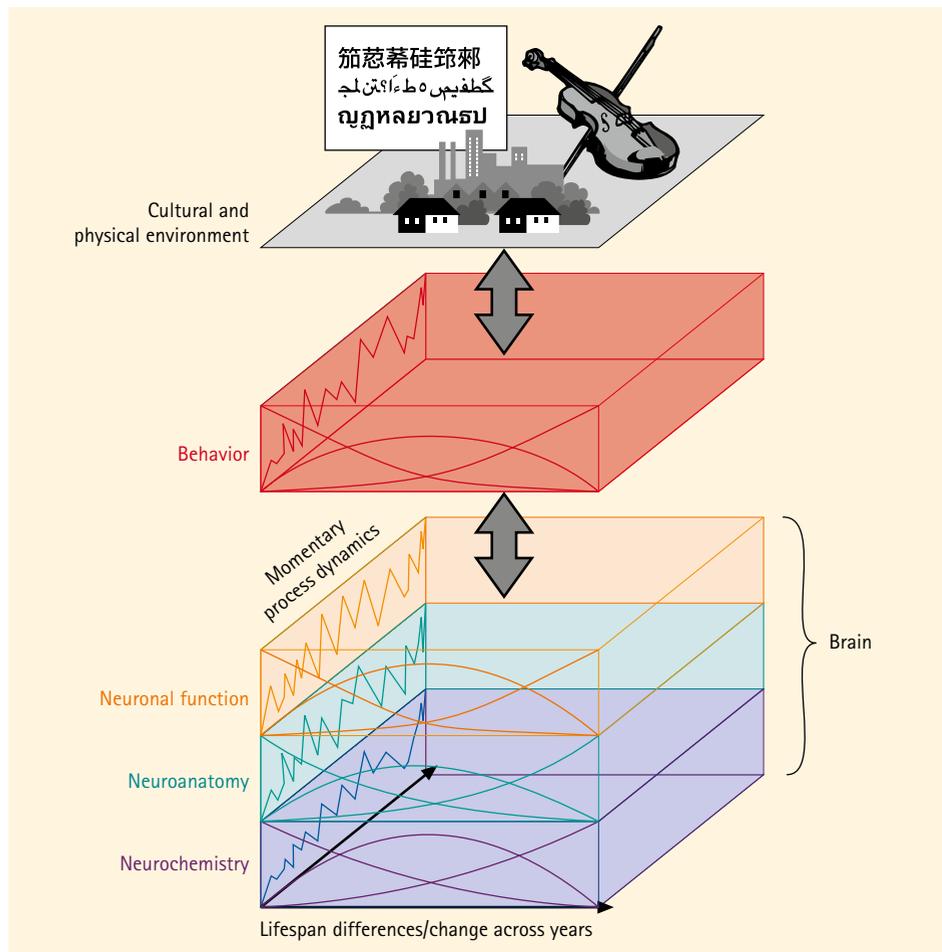


Figure 1. Environment and brain as antecedents and consequents of moment-to-moment variability and long-term changes in patterns of behavior. Lifespan changes in brain-behavior mappings are shaped by interactions among processes related to maturation, learning, and senescence. The identification of key players in the ontogeny of brain-behavior dynamics requires a coalition between formal tools for synthesis across levels of analysis and timescales as well as empirical methods to study variability and change in brain and behavior (adapted from Lindenberger, Li, & Bäckman, 2006).

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behavior, which are especially pronounced early and late in life. In addition, *learning*, at any point during ontogeny, denotes changes in brain states induced by behavior-environment interactions. Note, however, that maturation cannot take place without learning and that learning cannot take place without maturation. Similarly, the ways in which senescence takes its toll on the brains of aging individuals depend on individuals' past and present learning and maturational histories. To complicate matters even more, processes commonly associated with maturation are not confined to early ontogeny, and processes related to senescence

are not restricted to old and very old age. For instance, neurogenesis and synaptogenesis, as expressions of maturation, continue to exist in the adult and aging brain, and declines in dopaminergic neuromodulation, which indicate senescence-related changes in brain chemistry, commence in early adulthood. Thus, maturation, senescence, and learning mutually enrich and constrain each other throughout the lifespan and must be understood and studied as interacting forces driving the brain-behavior-environment system. Psychologists occupy a central position in this endeavor because they possess a rich and adequate repertoire of exper-

imental and methodological tools to describe and modify the organization of behavior. From the perspective of lifespan psychology, direct comparisons between children and older adults help to identify commonalities and differences in the mechanisms that drive child and adult development (e.g., Shing & Lindenberger, 2011).

Proposition 2: Lifespan Theory and Methodology Need to Integrate Evidence Across Domains of Functioning, Timescales, and Levels of Analysis

If the lifespan development of behavior is defined to originate from recursive interactions among maturation, learning, and senescence, with the developing individual as the privileged system of analysis, then developmental psychology is faced with three challenging integrative tasks. First, there is the need to integrate theorizing and research practice across functional domains to attain a comprehensive picture of individual development. For instance, sensorimotor and cognitive functioning are more interdependent in early childhood and old age than during middle portions of the lifespan, and developmental changes in either domain are better understood if studied in conjunction. Similar observations can be made for many other domains of functioning

whose changes have generally been studied in isolation, such as the ontogeny of social interaction and cognition; emotion regulation and motivational states; or of memory, working memory, and attention.

Second, there is a need to understand the mechanisms that link short-term variations to long-term change. Short-term variations are often reversible and transient, whereas long-term changes are often cumulative, progressive, and permanent. Establishing links between short-term variations and long-term changes is of eminent heuristic value, as it helps to identify mechanisms that drive development in different directions. For instance, aging cognitive systems show an increase in maladaptive moment-to-moment fluctuations or a decrease in processing robustness, at both behavioral and neural levels of analysis. These maladaptive changes may signal impending long-term changes in other characteristics of the system (see Figure 2). In contrast, other forms of moment-to-moment variability indicate an individual's ability to bring a wide variety of different strategies to the task and are positively related to long-term change in both childhood and old age. To combine the two propositions, we need to gather multivariate time-series data that

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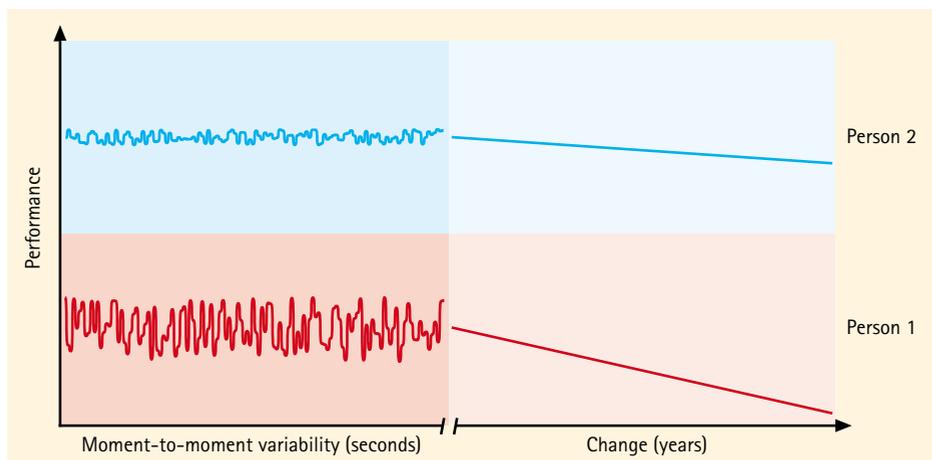


Figure 2. Example for predictions linking moment-to-moment variability to long-term change, and brain changes to behavioral changes. Senescent changes in neuromodulation lead to greater moment-to-moment fluctuations in neural signaling, enhance the prominence of background noise, reduce the distinctiveness of processing pathways and representations, and increase variability of cognitive performance. Aging individuals with greater moment-to-moment process fluctuations at a given point in time are expected to show greater subsequent longitudinal decline in mean levels of functioning than individuals who fluctuate less. Recent empirical evidence supports this prediction (Lövdén, Li, Shing, & Lindenberger, 2007; adapted from Lindenberger et al., 2006).

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capture short-term variability and long-term changes in across-domain dependencies. Third, to arrive at mechanistic explanations of behavioral change, there is the need to integrate behavioral and neural levels of analysis. At any given point in the lifespan, one-to-one mappings between brain states and behavioral states are the exception rather than the rule, as the brain generally offers more than one implementation of an adaptive behavioral outcome. Therefore, ontogenetic changes in behavioral repertoires are accompanied by continuous changes in multiple brain-behavior mappings. Some of these remapping gradients may be relatively universal and age-graded, whereas others may be more variable, reflecting genetic differences, person-specific learning histories, the path-dependent nature of developmental dynamics, or a combination of the three. The resulting picture underscores the diversity and malleability of the organization of brain and behavior as well as the constraints on diversity and malleability brought about by (a) universal age-graded mechanisms associated with maturation and senescence, (b) general laws of neural and behavioral organization, and (c) cultural-social as well as physical regularities of the environment.

Proposition 3: The Exploration of Age-Graded Differences in Plasticity Is a Powerful Tool for Identifying Mechanisms of Development

Both from scientific and societal perspectives, behavioral plasticity, or the alteration of developmental trajectories through experience, is a precious phenomenon (Raz & Lindenberger, 2013). Scientifically, inquiries into the plasticity of human behavior are a rich source of developmental information. Through the assessment of “changes in change,” they offer the promise to observe the operation and proximal consequences of developmental mechanisms. For instance, studies in which research participants of different ages are instructed and trained to perform one or more cognitive tasks come with important validity benefits, such as (a) an increase in experimental control, (b) the identification of age differences near asymptotic performance levels, and (c) the assessment of transfer and maintenance effects. If neuro-

chemical, neuroanatomical, and neurofunctional imaging measures are assessed before, during, and after training, intervention studies also offer new insights into relations between behavioral and neural levels of plasticity. Thus, by partly taking control over behavior-environment interactions, mechanisms of learning can be studied in the context of maturation and senescence (Lövdén, Bäckman, Lindenberger, Schaefer, & Schmiedek, 2010; Lövdén, Wenger, Mårtensson, Lindenberger, & Bäckman, 2013). From the larger perspective of societal evolution, cognitive intervention studies explore the range of possible development, or what could be possible in principle if conditions were different (see Figure 3). The resulting knowledge about the plasticity of developmental trajectories is essential for improving human welfare. Hence, investigations of age changes in the plasticity of development carry the potential to explain and ameliorate human development.

For all of these reasons, age-comparative intervention studies with a focus on behavioral and neural manifestations of plasticity form the core component of empirical research at the Center. The Center has carried out several

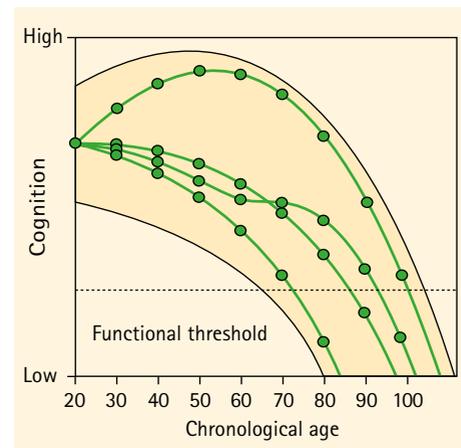


Figure 3. Hypothetical illustration of the zone of possible cognitive development for a given individual, along with four developmental curves indicating specific possible outcomes. Each possible curve starts from the same functional level at age 20, with different trajectories resulting as a function of interactions among behavioral, environmental, and genetic factors that permit movements in the vertical direction within the zone at different points in the lifespan (adapted from Hertzog, Kramer, Wilson, & Lindenberger, 2009).

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pioneering studies on plastic changes in brain and behavior in adulthood, such as the COGITO study (e.g., Raz, Schmiedek, Rodrigue, Kennedy, Lindenberger, & Lövdén, 2013) and the SPACE study (e.g., Lövdén, Schaefer, et al., 2012). Related conceptual work has aimed at identifying distinct features of plasticity in relation to other types of behavioral and neural variability

and change (Lövdén et al., 2010; see Figure 4). In the reporting period, we have launched a new generation of experiments that combine behavioral skill training with repeated functional and structural imaging. Going beyond the canonical pretest–posttest design of intervention studies, these studies seek to observe how plastic changes unfold over time.

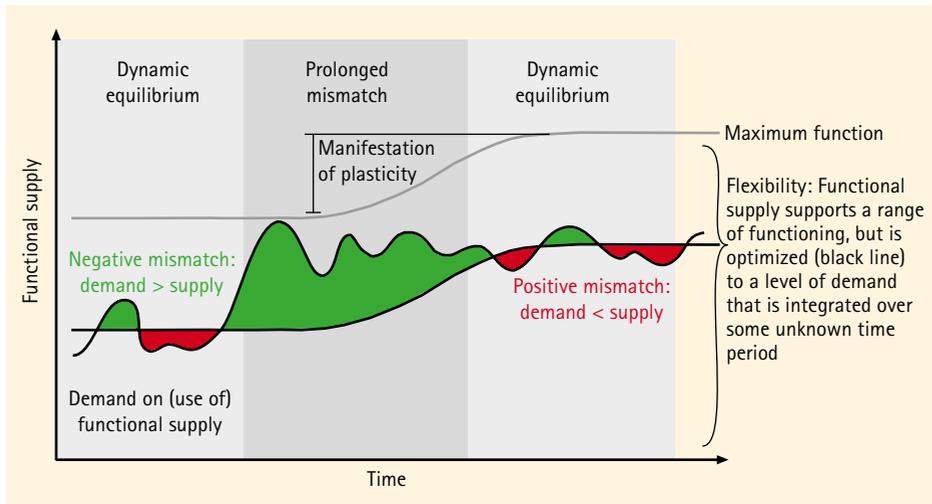


Figure 4. Schematic model of a mismatch between functional supply and experienced environmental demands caused by primary changes in demand (e.g., altered experience through cognitive training). Functional supply (i.e., the structural constraints imposed by the brain on function and performance) allows for a range of performance and functioning. Flexibility denotes the capacity to optimize the brain's performance within the limits of the current state of functional supply. Due to the sluggishness of plasticity, structural supply optimizes its support for function to a level of demand (i.e., use of functional supply) that is averaged over some unknown time period. Mismatches need to be prolonged to overcome the inertia and sluggishness of plasticity, and to push the system away from its dynamic equilibrium. Deviations in demand that are within the current range of functional supply induce the mismatch that constitutes the impetus for plastic change (adapted from Lövdén et al., 2010).

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Figure 5. The MR tomograph (3 Tesla field strength) was installed in December 2011. See also pp. 245–247.

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The installation of a 3 Tesla Siemens TIM Trio magnetic resonance tomograph in 2011, located next to the Institute building, has provided the Center with the imaging infrastructure that is needed to run studies of this sort (see Figure 5; see also pp. 245–247).

Methodological Innovation

Since its foundation in 1981, the Center has sought to promote conceptual and methodological innovation within developmental psychology and in interdisciplinary context. Special attention is paid to methods and research designs apt to integrate (a) multiple domains of functioning, (b) multiple time-scales, and (c) multiple levels of analysis. Random coefficient modeling, latent growth curve modeling, and related statistical techniques have served as versatile tools for the analysis of multivariate data with nested time structures, such as trials, blocks of trials, days, weeks, and years. Neurocomputational modeling, such as the neurocomputational theory on the effects of age-related dopaminergic decline on behavior proposed by Shu-Chen Li and colleagues, has facilitated conceptual integration. Recently, time-delay embedding and clustering methods for time-series data, continuous time structural equation modeling, as well as combinations of classifier and structural equation modeling techniques have been added to the repertoire (see *Formal Methods* project, pp. 248–253). Finally, in collaboration with Gerd Kempermann from the Dresden site of the German Center for Neurodegenerative Diseases as well as other colleagues from Dresden, Münster, and Saarbrücken, the Center has introduced an animal model to explore epigenetic contributions to individual development (Freund et al., 2013). Forty genetically identical mice were kept in one large enclosure offering various activity and exploration options. Though the animals shared the same life space, they increasingly differed in activity levels. These individual differences in behavioral development were associated with differences in the generation of new neurons in the hippocampus, a region of the brain that supports learning and memory. The results of this study underline

a central proposition of lifespan theory: that development itself contributes to differences in adult behavior (for more details, see pp. 251–252).

In several empirical and conceptual papers, researchers at the Center have promoted the view that the preservation and maintenance of “youth-like” structural and functional properties of the brain is a key component of successful cognitive aging (Burzynska et al., 2013; Lindenberger, Burzynska, & Nagel, 2013; Nagel et al., 2011; Nyberg et al., 2012). Together with Ulrich Mayr from the University of Oregon, Ulman Lindenberger took up a longstanding observation in cognitive aging research that was originally formulated by Gus Craik in 1983. According to this observation, memory deficits in old age relative to early adulthood increase when self-initiated processing is required and decrease when the environment provides task-appropriate cues. Lindenberger and Mayr (2014) propose that this observation is not confined to memory, but can be subsumed under a more general developmental trend: In perception, learning or memory, and action management, older adults often rely more on external information than younger adults, probably both as a direct reflection and indirect adaptation to difficulties in internally triggering and maintaining cognitive representations. According to Lindenberger and Mayr, cognitive aging research would benefit from paying closer attention to the developmental dynamics and practical implications of this age-graded shift from internal to external control. Ulrich Mayr has been awarded the Alexander von Humboldt Research Award 2014 and will visit the Center in coming years to collaborate on this and related topics.

Some members of the Center have also worked on developmental issues in applied settings. For instance, Ulman Lindenberger followed Jürgen Baumert as a member of the Board of Trustees of the Jacobs Foundation, one of the world’s leading charitable foundations dedicated to facilitating innovations for children and youth. Also, Lothar Krappmann, who is a member of the United Nations Committee on the Rights of the Child, has continued his research on measures that help

prevent violence against children by strengthening protection programs, systems, services, research, monitoring, evaluation, and reporting (e.g., Svevo-Cianci, Herczog, Krappmann, & Cook, 2011).

Overview of Research Projects at the Center for Lifespan Psychology

Currently, in January 2014, empirical and conceptual work at the Center is structured into eight research projects (see Table 1). The activities pursued in these projects cover a wide array of research areas in human behavioral development. For instance, recent studies have addressed the following ques-

tions: (a) Does playing a commercially available computer game result in structural brain changes? (b) Is there a dark side to providing and using environmental support in old age? (c) Do affective states contribute to trait reports of affective well-being? (d) Why do older adults, with great confidence, remember episodes that have not occurred?

During the reporting period, research at the Center has profited from the Gottfried Wilhelm Leibniz Award 2010 of the German Research Foundation (DFG) given to Ulman Lindenberger and from continued support from the Innovation Fund of the Max Planck Society.

Table 1
The Center for Lifespan Psychology: Current Overview of Research Projects

<i>Name of project</i>	<i>Researchers, including postdoctoral fellows</i>	<i>Postdoctoral fellows</i>
Intra-Person Dynamics Across the Lifespan	Douglas D. Garrett**, Manuel C. Voelkle**, Annette Brose°, Ulman Lindenberger, Martin Lövdén°, Florian Schmiedek°	Janne Adolf, Charles Driver
Cognitive and Neuronal Dynamics of Memory Across the Lifespan (ConMem)	Yee Lee Shing**1, Markus Werkle-Bergner**, Yvonne Brehmer², Yana Fandakova*, Ulman Lindenberger, Myriam C. Sander*	Nina Becker, Garvin Brod, Thomas H. Grandy, Laurel Raffington
Mechanisms and Sequential Progression of Plasticity	Simone Kühn**, Elisa Filevich*, Ulman Lindenberger, Martin Lövdén°	Nina Lisofsky, Elisabeth Wenger
Sensorimotor-Cognitive Couplings	Sabine Schaefer**, Julius Verrel**, Ulman Lindenberger	Maike Kleemeyer
The Berlin Aging Studies (BASE)	Sandra Düzel**, Ulman Lindenberger**, Julia A. M. Delius, Shu-Chen Li°, Tian Liu*, Ana Sofia Morais*, Katrin Schaar	
Interactive Brains, Social Minds	Viktor Müller**, Ulman Lindenberger, Timothy R. Brick*, Dionysios Perdikis*	Cathleen Bache, Caroline Szymanski
Imaging Methods in Lifespan Psychology	Nils C. Bodammer**, Ulman Lindenberger	
Formal Methods in Lifespan Psychology	Andreas M. Brandmaier**, Manuel C. Voelkle**, Timothy R. Brick*, Ulman Lindenberger, John J. Prindle*, Timo von Oertzen°	Janne Adolf, Charles Driver, Julian David Karch
Max Planck UCL Centre on Computational Psychiatry and Ageing Research	Ray Dolan***, Douglas D. Garrett, Ulman Lindenberger** (see p. 206)	

Note. Research manager of the Center: Imke Kruse. The table refers to projects and project members as of January 2014; for updates, visit www.mpib-berlin.mpg.de. The *Neuromodulation of Lifespan Cognition* project was terminated at the Center in 2013 and is continued by Shu-Chen Li at the Technische Universität Dresden. **principal investigator, *postdoctoral fellow, °adjunct researcher (primary affiliation with another institution). ¹Yee Lee Shing leads a Minerva Research Group. ²Yvonne Brehmer leads an Otto Hahn Research Group in close collaboration with the Aging Research Center at the Karolinska Institutet, Stockholm.

The Max Planck UCL Centre on Computational Psychiatry and Ageing Research

The behavioral neurosciences and related disciplines have seen spectacular scientific advances that make them rich in scientific opportunity. The combination of functional neuroimaging with sophisticated computational modeling of cognitive processes has revolutionized our understanding of fixed and variable properties of human mental processes. These advances now make it possible to work toward a mechanistic understanding of behavioral aging and psychopathology, two empirically overlapping fields of great importance to science and society. In both fields, it is of key importance to take a computational, personalized lifespan approach by identifying neural and behavioral parameters that predict more or less favorable trajectories, with the intent to intervene in time when undesirable outcomes are expected.

In 2011, the Max Planck Society and University College London (UCL) launched an Initiative on Computational Psychiatry and Ageing Research. This initiative, which was jointly financed by the Max-Planck-Förderstiftung, University College London, and the Gottfried Wilhelm Leibniz Prize awarded to Ulman Lindenberger in 2010, organized a Symposium and Advanced Course at Ringberg Castle in summer 2012, and prepared the ground for the establishment of a new collaborative Max Planck UCL center, the Max Planck UCL Centre on Computational Psychiatry and Ageing Research. The Max Planck Society and University College London have provided initial funding for a period of five years. The Center is co-directed by Ray Dolan, director of the Wellcome Trust Centre for Neuroimaging at UCL, and Ulman Lindenberger. The Center will be located in London and Berlin. The opening ceremony is scheduled to take place in London at the Royal Society on 1 April 2014.

Understanding and ameliorating psychiatric disease and cognitive aging have important commonalities and, in some cases, are associated with overlapping etiologies. Both endeavors are of formidable complexity and must be approximated by focusing on key players at the neural level, such as the neurovascular unit, white matter, dopaminergic neurotransmission, variability of neural signaling, and striatal-cortical circuits, and on key players in behavior, such as working memory, learning, and decision making. Computational methods connect structure to function and behavior. By applying these methods to experimental and, critically, longitudinal data, the Max Planck UCL Center will seek to derive testable predictions about key determinants of psychiatric syndromes and cognitive aging and provide a more solid empirical and theoretical basis for the attenuation and amelioration of psychopathology and cognitive decline through personalized interventions.



Figure 6. First Symposium and Advanced Course on Computational Psychiatry and Aging at Ringberg Castle, 2012.

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Research Project 1: Neuromodulation of Lifespan Cognition (Concluding Report)

Conceptual Overview

The central goal of this project is to understand how maturational and senescent changes in neurotransmitter systems influence neural and behavioral development across the lifespan. To this end, the project has used an integrated array of conceptual tools and empirical paradigms, encompassing neurocomputational studies aimed at theory formation, behavioral studies informed by genetics that examine the relations between neurally relevant genotypes and cognitive phenotypes, and genomic and pharmacological imaging studies that explore age-related as well as other individual differences in brain-behavior relations.

Neurotransmitters regulate neural processing from moment to moment and contribute to age-graded changes in the dynamics of neural networks (Li, 2013). A major focus of the project is on the relationship between *dopaminergic* neuromodulation and lifespan changes in brain and behavior. Formal models and empirical evidence suggest that suboptimal dopamine modulation, as observed early and late in ontogeny, contributes to greater random processing variability in neural and cognitive information processing (Li, Lindenberger, & Sikström, 2001). This, in turn, has effects on cognition, including greater trial-to-trial performance fluctuations and process dedifferentiation. In particular, the function that relates dopamine signaling to cognitive performance is generally assumed to follow an inverted *U*-shape. This nonmonotonic relationship implies that constant amounts of genetic variation in genes relevant for neuromodulation result in increasingly large differences in performance as normal aging moves individuals' neuromodulatory efficacy away from the apex of the curve. Hence, normal aging is expected to magnify the effects of genetic variation on individual differences in behavior (Lindenberger et al., 2008). During the reporting period, the project has continued to test this proposition with behavioral and electrophysiological data across a wide range of cognition-relevant genes and cognitive functions. As is true for candidate gene studies in general, the observed genotype effects need to be replicated in independent samples to substantiate the genotype-phenotype associations that have been observed thus far.

Dopamine Genotype Effects on Performance Variability and Memory Dedifferentiation in Old Age

When assessing individuals' performance on a visual perceptual selection task, we found that the reaction times of individuals carrying a greater number of beneficial alleles of the dopamine transporter (the *DAT1* gene) and receptor genes (the dopamine *DRD2* and *DRD3* genes) fluctuated less than the reaction times of individuals carrying a lower number of beneficial alleles. This effect was only observed in older adults. Moreover, older carriers of fewer beneficial alleles also exhibited a greater tendency to forget memory items encoded 1 week ago (Papenberg, Bäckman, et al., 2013). In a related study (Papenberg et al., in press), we investigated the effect of a genotype relevant for prefrontal dopamine signaling on the dedifferentiation of memory processes as a means of addressing the dedifferentiation hypothesis of cognitive functioning in old age. The results of this study showed that the correlation between working memory and episodic memory factors was stronger among older individuals whose genotype is associated with lower levels of prefrontal dopamine (Val homozygotes of the *COMT* gene; see Figure 7). Again, these genetic effects were only observed in older adults. Taken together, these results indicate that, in line with our theoretical predictions, suboptimal dopaminergic modulation contributes toward process fluctuations, which may impair multiple facets of cognitive functioning in the course of normal aging. Several studies revealed additional magnification effects. Older adults with the *DAT1* genotype (*DAT1* 9/9), associated with higher levels of extrasynaptic dopamine, and the genotype *DRD2* CC, which is associated with

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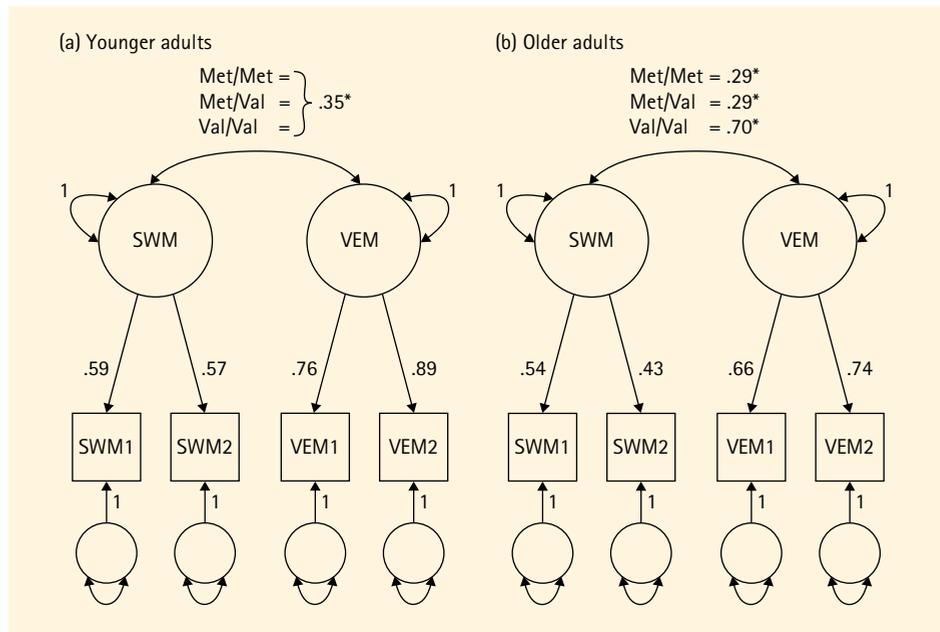


Figure 7. The correlation between spatial working memory (SWM) and verbal episodic memory (VEM) differs by age group and phenotype. The figure shows the results of a multiple-group latent structural equation model for younger (a) and older (b) adults. The two aspects of memory functions are less differentiated (i. e., more highly correlated) among older Val homozygotes of the COMT gene than in any of the three groups (adapted from Papenberg et al., in press).

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higher dopamine D2 receptor density, showed better backward serial recall performance than older adults who did not carry these beneficial alleles (Li, Papenberg, et al., 2013). In a sequence learning task, older adults, in particular those with fewer of the beneficial alleles of dopamine relevant genes, had more difficulty in deriving explicit knowledge through learning than younger adults (Schuck, Doeller, et al., 2013). In both cases, the corresponding genetic effects were only observed in older adults.

Lifespan Age Differences in EEG Theta Coherence and Variability in Inhibitory Control

In a related line of inquiry, we investigated neural correlates of trial-by-trial performance fluctuations across the lifespan (Papenberg, Hämmerer, et al., 2013). Specifically, we used electroencephalography (EEG) to examine age differences in intertrial EEG coherence during a task requiring prefrontal cognitive control of inhibition from middle childhood to old age. We found that theta intertrial coherence

increases from childhood to early adulthood and decreases from early adulthood to old age (see Figure 8a). Moreover, in all age groups, individuals who showed lower EEG coherence (i. e., a greater degree of temporal jitter in EEG signal across trials) also showed greater trial-by-trial reaction time fluctuations (see Figure 8b). Available evidence suggests that control signals in the medial frontal cortex (MFC) are reflected in theta band activity, suggesting that distinct brain areas work in coordinated fashion during tasks that demand executive control. Together with other findings in this field, our findings suggest that less reliable control processes in children and older adults may contribute to the greater degree of performance fluctuations in both age groups relative to adolescents and young adults.

Lifespan Development of Auditory Attention and Dopamine Genotype Effects

The efficacy of attentional regulation changes across the lifespan. Attention involves frontal-parietal networks that are innervated

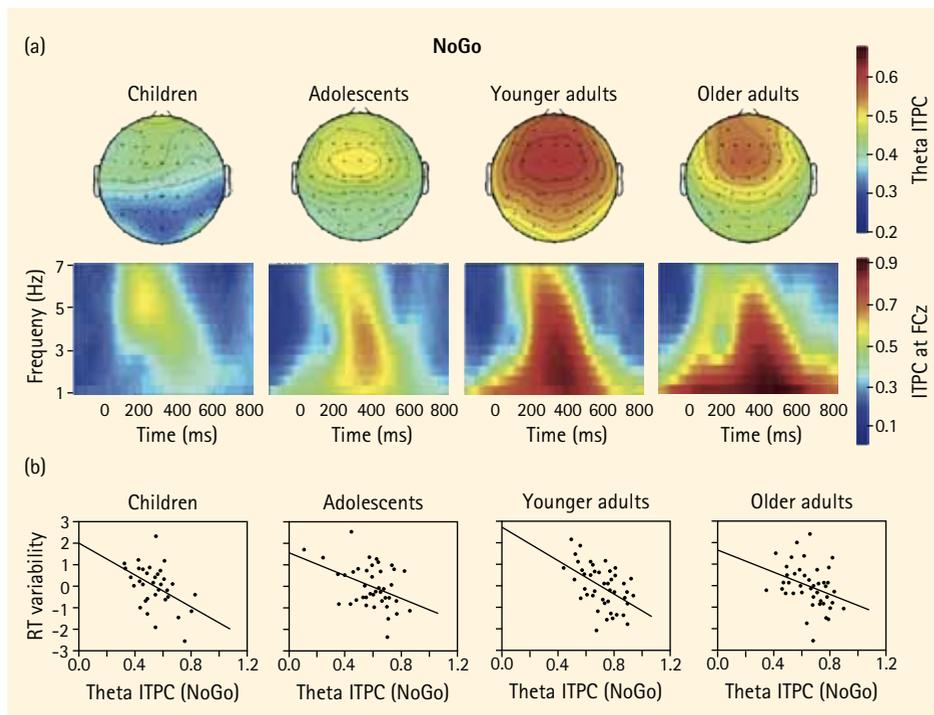


Figure 8. Intertrial phase coherence (ITPC) of the EEG during attentional processing differs by age group. (a) Topographical maps of theta intertrial phase coherence at frontal and central electrodes during the inhibition (NoGo) condition. Children, adolescents, and older adults showed a lesser degree of coherence in comparison to younger adults. (b) Scatterplots of the correlation between peak theta coherence during inhibition and trial-by-trial reaction time fluctuations during Go conditions (adapted from Papenberg, Hämmerer, et al., 2013).

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by dopaminergic and cholinergic pathways. Hence, the third area of research focused on experiments that investigated age-related differences in perceptual and attentional mechanisms. In the domain of auditory attention, we used an intensity-modulated dichotic-listening paradigm to manipulate both top-down attentional control and bottom-up perceptual distinctiveness. This line of research was carried out in collaboration with Kenneth Hugdahl and René Westerhausen from the University of Bergen. Our findings indicate that the top-down control of auditory attention is not fully developed in children and severely compromised in older adults (see Figure 9; Passow et al., 2012, 2013). In line with these age-related differences in behavior, a late fronto-central negativity that peaks around 450 ms after stimulus onset (i. e., the N450 component) reliably discriminates between conditions of high versus low attention-perception

conflict in younger adults, but not in older adults (Passow et al., 2014). Moreover, we found that younger adults with the genotype associated with lower dopamine receptor function (i. e., G carriers of the *PPP1R1B* gene) show less flexible attentional regulation of auditory processing as well as weaker N450 (Li, Passow, et al., 2013).

This project came to a close at the Center when Shu-Chen Li accepted an offer as full professor at the Technische Universität Dresden in August 2012 where the project is being continued and developed further.

A large sample of younger and older adults recruited by this project has formed the backbone of the Berlin Aging Study II, which is carried out at the Center (see pp. 234–238). With its emphasis on neurocomputational modeling of lifespan changes in cognition, the *Neuromodulation of Lifespan Cognition* project has contributed significantly to the scientific agenda of the Center.

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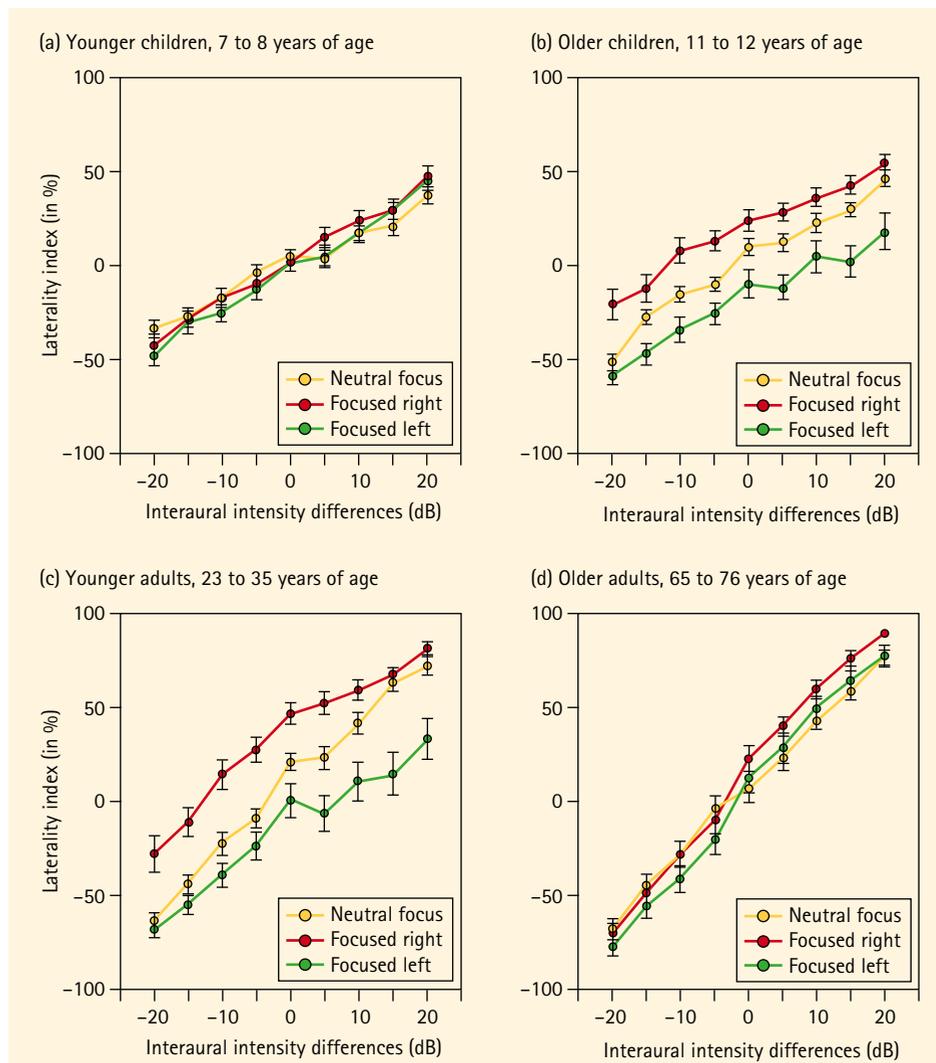


Figure 9. The attentional regulation of auditory processing differs markedly by age. Participants were presented with dichotic pairs of voiced versus unvoiced syllables (e.g., /ba/ vs. /pa/) and were asked to report the syllable heard. Perceptual saliency, shown on the x-axis, was manipulated by decreasing the intensity of either the right- or the left-ear input in 5-dB steps until a maximum difference of 20 dB between ears was reached. Negative values represent conditions in which left-ear stimuli were louder than right-ear stimuli, and positive values represent conditions in which right-ear stimuli were louder than left-ear stimuli. Attentional focus was manipulated by instructing participants to focus on the right ear, on the left ear, or on both ears (neutral focus). Reports are quantified by the laterality index, shown on the y-axis, which expresses the amount of right-ear reports in relation to left-ear reports (i.e., $[(\text{right ear} - \text{left ear}) / (\text{right ear} + \text{left ear})] \times 100$). The laterality index ranges from -100% to +100%, with positive values indicating a right-ear advantage and negative values a left-ear advantage. When the stimulus for the attended ear is louder, then attention is facilitated by saliency; when the stimulus for the attended ear is softer, then the saliency advantage of the stimuli presented to the unattended ear has to be overcome by top-down attentional control. In contrast to younger adults (c), who were capable of flexibly focusing their attention on auditory inputs from either the right or left ear, performance in older adults (d) was driven almost exclusively by perceptual saliency. Children showed rapid development of attentional control from middle to late childhood (adapted from Passow et al., 2013; see also Passow et al., 2012).

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Research Project 2: Intra-Person Dynamics Across the Lifespan

The ontogeny of human behavior comprises both short-term variability and long-term change and is embedded into cultural, environmental, and neural contexts. The overarching objective of the *Intra-Person Dynamics* project is to test theories and explore research designs that articulate human development across different timescales, levels of analysis, and functional domains. The project collaborates closely with the *Formal Methods* project (pp. 248–253) and with the newly established Max Planck UCL Centre for Computational Psychiatry and Ageing Research (p. 206). Currently, the project is structured into two parts, one focusing on neural dynamics and the other on behavioral dynamics.

Neural Dynamics

Various subdisciplines within neuroscience have long shown that the brain is inherently dynamic and variable across moments at every level of the nervous system. Many researchers have typically conceived of variability as either (a) measurement error or (b) neural “noise,” a nuisance factor that presumably interferes with the efficiency of neural processes. With respect to aging, the concepts of “noisy” and inefficient processing were initially discussed between the 1960s and the 1980s (see Garrett, Samanez-Larkin, et al., 2013). However, it is only comparatively recently that directly examining within-subject brain signal variability *in vivo* has been employed as a means of testing the notion of age-related neural noise. Perhaps surprisingly, neural variability may be highly functional for neural systems, indexing important benefits such as increased dynamic range and systemic flexibility/adaptability (see Garrett, Samanez-Larkin, et al., 2013). Viewed from this perspective, it is possible to reframe brain aging as a generalized process of increasing system rigidity and loss of dynamic range that manifests itself in reduced brain signal variability. The project tests this conceptualization by examining EEG/fMRI brain signal variability and dynamics in relation to lifespan development, cognition, neurochemistry, network dynamics, and brain structure. A summary of our recent findings and research approaches can be found below.

Aging, Cognition, and Brain Signal Variability

We began establishing links between adult age and brain signal variability 3 years ago (Garrett, Kovacevic, McIntosh, & Grady, 2010).

Within a sample of young and older adults, we first investigated age differences between younger and older adults in fMRI-based blood oxygen level-dependent (BOLD) signal variability (i. e., within-region temporal standard deviation of BOLD signal, or SD_{BOLD}) during fixation blocks. Results indicated that older adults showed a smaller degree of variability than younger adults. The SD_{BOLD} pattern was not only highly robust ($R^2 = .81$) but also virtually orthogonal in comparison to that obtained using a typical mean BOLD signal approach, thus revealing a distinctive subset of age-relevant brain regions that could not have been discovered using mean-based measures. In Garrett, Kovacevic, McIntosh, and Grady (2011), younger, faster, and more consistent performers were revealed to exhibit substantially higher SD_{BOLD} on three different tasks (perceptual matching, attentional cueing, and delayed match-to-sample; see Figure 10). Thus, signal variability indexes individual differences in behavioral efficacy beyond its relations to adult age. Interestingly, younger, better performing adults not only exhibited greater signal variability within regions but also displayed a greater range of variability magnitudes across regions; older, less effective performers' variability levels were far less differentiated from region to region.

Garrett, Kovacevic, McIntosh, and Grady (2013) have recently investigated the relationship between SD_{BOLD} and changing cognitive demands. We hypothesized that neural variability may yield adaptability in the presence of stimulus uncertainty such that signal variability would be greater when there is greater stimulus uncertainty (e. g., on task) compared to conditions in which there is less

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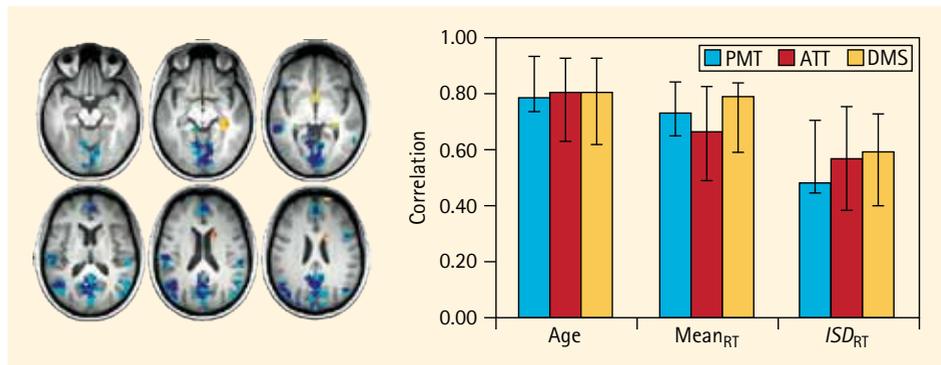


Figure 10. Greater BOLD signal variability in blue regions (compared to lower variability in yellow regions) was associated with younger age and faster and more stable task performance across perceptual matching (PMT), attentional cueing (ATT), and delayed match-to-sample (DMS) tasks. RT: reaction time; ISD_{RT} : intraindividual standard deviations (SD) of RTs (adapted from Garrett et al., 2011).

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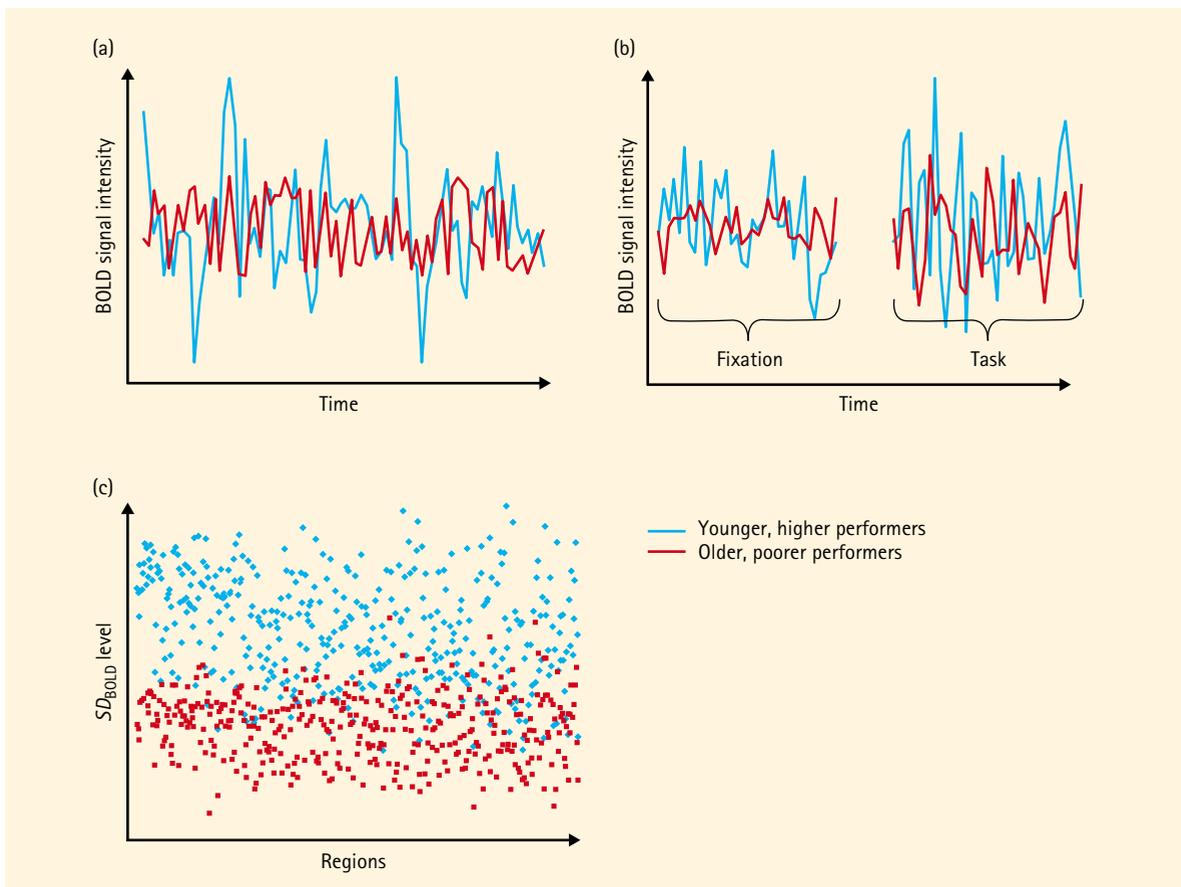


Figure 11. Three dimensions of age-/performance-related group differences in SD_{BOLD} supported by research from the *Intra-Person Neural Dynamics* project. (a) Within region, within condition: Brain signals are generally less variable across moments in older, less effective performers. (b) Within region, across conditions: Older, less effective performers show fewer differences in SD_{BOLD} as the brain transitions from fixation to task. (c) Between region, within task: Older, less effective performers exhibit less region-to-region differentiation in SD_{BOLD} magnitude for any given task (adapted from Grady & Garrett, in press).

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stimulus uncertainty (e. g., at fixation, when no stimulus parameters change). Given the importance of neural variability for state-to-state transitions (see Garrett, Samanez-Larkin, et al., 2013), and the fact that older adults exhibited less signal variability both at fixation and on task in our first two studies (Garrett et al., 2010, 2011), we expected that any variability-based *transition* from fixation to task may be also more subtle in older adults. Results revealed that signal variability increased broadly on task (using the same tasks as in Garrett et al., 2011) compared to fixation, particularly in younger and faster performing adults. Increases in signal variability on task may thus represent both a high-functioning system capable of greater dynamic range between brain states as well as an enhanced ability to efficiently process varying and unexpected external stimuli.

It is now becoming apparent that the concept of age-related dedifferentiation (postulated years previously by LIP scientists; Baltes & Lindenberger, 1997) can be conceptually expanded into the realm of age- and performance differences in brain signal variability (Grady & Garrett, in press). Based on the results outlined above, there are at least three possible dimensions governing how older, less well performing adults exhibit reduced BOLD variability (and thus, greater self-similarity in signal properties) compared to younger, more effective performers: (a) within region, within condition (Figure 11a); (b) within region, across conditions (Figure 11b); and (c) between region, within condition (Figure 11c). A fourth dimension may involve change in signal variability over time (within and across regions and tasks), a direction we hope to explore further.

The Importance of Parametric Examinations When Linking Signal Variability and Task Performance

If signal variability is to form a useful tool for the cognitive and developmental neuroscience communities, we first need to establish whether signal variability responds to *precise* levels of environmental demand. Our ability to ask specific cognitive questions

of SD_{BOLD} requires demonstrating whether such measures can be subtly task-modulated within persons in lifespan samples. In an initial sample of young adults (Garrett, McIntosh, & Grady, in press), we showed that within-person SD_{BOLD} levels responded to incremental adjustments in task difficulty on a face processing task. Using mixed modeling, we also found that difficulty-related reductions in signal variability predicted reduced accuracy and longer reaction times within persons. These findings suggest that SD_{BOLD} provides a systematic signal of interest within persons that is task-driven and from which an understanding of the dynamic function of the human brain can be gleaned.

Ongoing Work/Future Directions

We also continue to examine brain signal variability from a series of other angles, three of which are highlighted here. (1) *Neurochemistry: Dopamine*. We are analyzing independent data sets employing dopamine agonists and antagonists to test the hypothesis that known age-related reductions in dopamine may provide a mechanistic explanation for lower signal variability levels in older adults. (2) *Brain Structure: White Matter Integrity*. We recently established a model to statistically estimate links between whole brain white matter integrity and BOLD signal (Burzynska et al., 2013). We now plan to link white matter integrity to whole brain signal variability as a means of determining the various limits that white matter may place on signal dynamics in younger and older adults. (3) *Methods: Relationships Between Signal Variance and Entropy*. There are no clear methods for distinguishing between variance and "information content/structure" (or, more formally, entropy) in brain signals, largely because entropy measures typically require that brain signals be normalized by their variance. This creates a potential for variance and entropy to show a methodologically undesirable forced inverse relation. Along with Thomas Grandy and Markus Werkle-Bergner from the *ConMem* project (pp. 217–222), we are exploring new approaches to disentangle variance and entropy that may circumvent a host of estimation issues.

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Behavioral Dynamics

This part of the project is based on the premise that a comprehensive understanding of behavioral development across the lifespan requires a person-oriented, multivariate, and longitudinal approach. Only a high density of observations within individuals allows researchers to distinguish among different forms and functions of variability and change, with the goal of delineating the dynamic properties of human behavior (e. g., flexibility, plasticity, fluctuation, and adaptability). The availability of data sets that fulfill these requirements offers great opportunities for new insights but also poses new theoretical and methodological challenges. The project meets these challenges by a strong emphasis on *methodology*, understood as the productive interplay between substantive research questions and method development. During the reporting period, the project focused on three domains of inquiry, which are summarized below.

Studying Age-Related Differences in Intraindividual Variability at Different Timescales

People often attribute poor cognitive performance to having "bad days." As aging leads to lower average performance and more moment-to-moment behavioral variability, one might expect older adults to also show greater day-to-day variability. As both researchers and members of the public typically only sample one performance of a given activity each day, the empirical basis for concluding that cognitive performance substantially varies from day to day is actually inadequate. By using data from nine cognitive tasks completed by younger and older adults

in 100 daily sessions (see Box 1: COGITO), Schmiedek, Lövdén, and Lindenberger (2013) were able to show that the contributions made by systematic day-to-day variability to overall observed variability are reliable, but small. What appear to be good versus bad days can thus largely be put down to fluctuations at faster timescales. Most interestingly, despite lower average levels of performance, older adults actually showed more consistent levels of performance. The finding that older adults show fewer performance fluctuations can potentially be explained by a number of factors that were assessed in COGITO. These include the setting of lower goals regarding performance levels and less variability in cognitive strategy use (Shing, Schmiedek, Lövdén, & Lindenberger, 2012), more stable levels of motivation (Brose, Schmiedek, Lövdén, & Lindenberger, 2012), as well as lifestyles and circumstances that are characterized by fewer stressful events (Brose, Scheibe, & Schmiedek, 2013) and consequently produce a reduced need to engage in cognitively demanding self-regulatory efforts (Brose, Schmiedek, Lövdén, & Lindenberger, 2011).

Within-Person Variability as a Means of Understanding Functional Relationships Across Different Psychological Domains

Analyzing within-person variation and covariation provides new insights into how people differ from one another, such as the distributions or persistence of behaviors across time. These differences cannot be revealed using conventional trait measures that capture between-person differences. Furthermore, the study of within-person variability can reveal functional relationships existing within individuals across domains.

In the COGITO study, 101 younger adults (20–31 years of age) and 103 older adults (65–80 years of age) participated in 100 daily sessions, working each day on a set of 12 cognitive tasks measuring perceptual speed, episodic memory, and working memory, as well as various self-report measures. In addition, all participants completed comprehensive pretests and posttests with baseline measures of cognitive abilities and transfer tasks for the practiced abilities. Brain-related measures were also taken from subsamples of the group, including structural magnetic resonance imaging (MRI), functional MRI, and electroencephalographic (EEG) recordings.

Box 1. COGITO.

In searching for the potential causes of within-person variation in cognitive performance, we focused on volitional components of task performance, attention, and emotion, all measured in the COGITO study. We found that performance was reduced on days when negative affect was above average and improved when motivation, attention, and positive affect were above average (Brose et al., 2012). This finding challenges previous evidence regarding associations between affect and performance that were based on

experimental approaches. Such approaches often revealed increased performance in tasks requiring cognitive effort following negative mood inductions and decreased performance following positive ones, potentially because of an analytic versus heuristic processing mode associated with these two states. Furthermore, our findings point to the importance of volitional constraints on task performance in a day-to-day context. This challenges the view that capacity limitations in affectively charged situations may

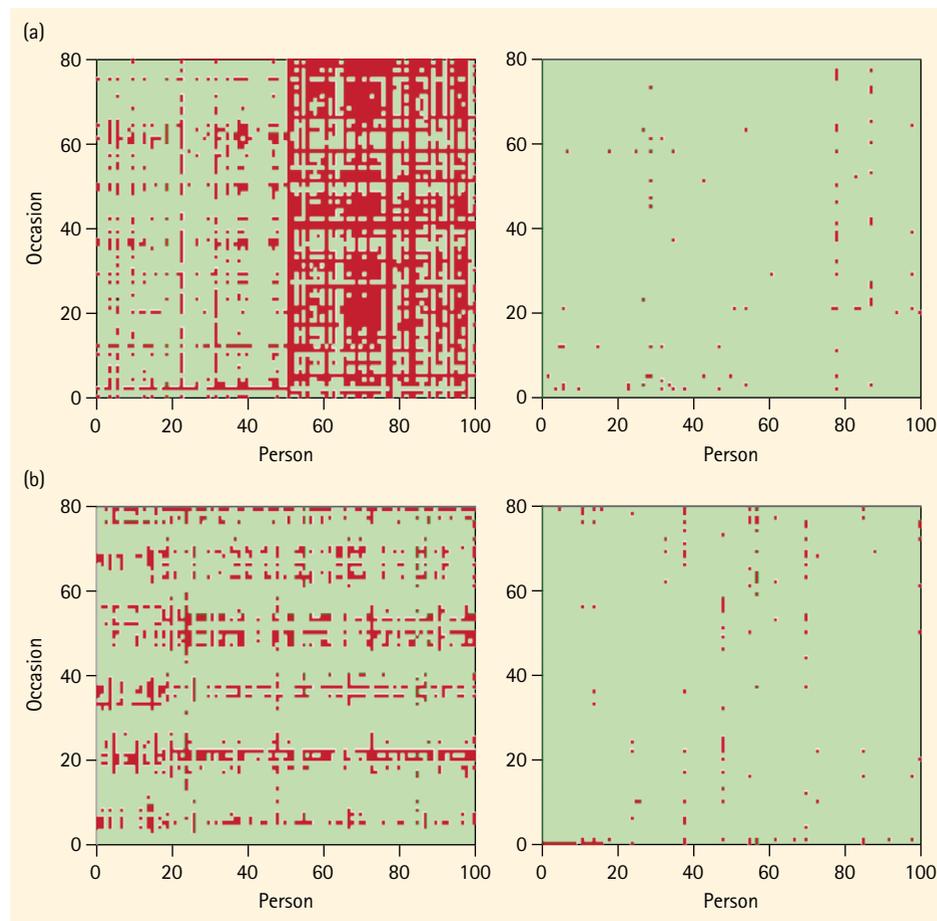


Figure 12. Two-dimensional likelihood planes resulting from tests for conditional equivalence of between-person and within-person factor structures. Each dot represents the comparison between the factor structure of a single person across occasions and the factor structure of many individuals at a single occasion. A green dot indicates that the two structures do not differ significantly from one other, whereas a red dot indicates a significant difference (significant likelihood ratio). (a) Group differences in factor variance may result in large degrees of nonequivalence (left side). Controlling for such differences (i.e., establishing conditional equivalence) reduces the number of significant comparisons to the level of chance (right side). (b) Cyclic trends at the within-person level may result in large degrees of nonequivalence (left side), while controlling for them reduces the number of significant comparisons to the level of chance (right side) (adapted from Voelkle et al., in press).

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hamper cognitive performance. As a whole, the pattern of findings differs from previous experimental and correlational research and thus reveals the importance of a within-person approach.

Formalizing the Relationship Between Within-Person and Between-Person Variation

Most empirical research in psychology is based on analyzing between-person variation. In contrast, much of applied psychology is concerned with analyzing variation within individuals. In addition, the mechanisms specified by psychological theories generally operate within, rather than across, individuals. For example, we would like to make statements such as "because she is so intelligent she can solve the equation," that imply that the counterfactual statement is also true. Usually, however, there is little empirical evidence for such a conclusion because all we are typically observing are *other people* who are or are not able to solve the equation.

This disconnect between research practice, applied demands, and psychological theories constitutes a major threat to the conceptual integrity of the field. Based on a newly developed approach for testing the equivalence of within-person and between-person factor structures (Voelkle, Oud, von Oertzen, & Lindenberger, 2012), we thus introduced the concept of *conditional equivalence*. Conditional equivalence is a way of studying the commonalities of between-person and within-person structures in the presence of unconditional nonequivalence by controlling for factors that may only affect the between-person or within-person structure (Voelkle, Brose, Schmiedek, & Lindenberger, in press). Figure 12 illustrates this approach. In principle, the approach allows the causes (such as age-graded changes) and consequences of structural nonequivalence to be identified empirically and may contribute to the development of better research, theory, and interventions in the behavioral sciences.

Research Project 3: Cognitive and Neural Dynamics of Memory Across the Lifespan (ConMem)

Memory Development as the Interplay of Strategic and Associative Components Across Multiple Levels

The brain operates and changes with age in a distributed and parallel fashion. Mechanisms related to maturation, learning, and senescence affect different regions of the brain on multiple levels, dimensions, timescales, and trajectories that also interact with one another. Behavioral and neural evidence suggests that memory functioning requires oscillatory interactions to occur within a distributed network whose components include the prefrontal, medio-temporal, and parietal regions. The overarching objective of the *Cognitive and Neural Dynamics of Memory Across the Lifespan (ConMem)* project is to provide mechanistic and process-oriented explanations for developmental changes in memory function. Our aim is to gain insights into the dynamic structure–function dependencies that underlie memory processes and related neural mechanisms.

The project proceeds on the assumption that lifespan changes in memory functioning can be mapped onto the interacting contributions of two components, one *associative* and the other *strategic*. The associative component of memory refers to those mechanisms during encoding, consolidation, and retrieval that bind different aspects of an event into a cohesive memory representation. This associative component can be linked to medio-temporal functions (especially the hippocampus) and posterior association areas. It is assumed that synchronized activity within and between neural networks acts as a binding mechanism in the service of episodic memory. The strategic component, on the other hand, refers to control processes that aid and regulate memory functions at encoding and retrieval. These processes may include the elaboration and organization of memory content at encoding, and the specification, verification, monitoring, and evaluation of relevant information at retrieval. The functioning of this strategic component is closely related to the attentional and control mechanisms that are mainly supported by prefrontal regions.

The project further posits that maturational, experience-dependent, and senescent forces, as well as their interactions shape the relative contributions of associative and strategic processes during memory encoding, consolidation, and retrieval. As both components rely on partially overlapping and interactive neural circuitries, they each

function with a high degree of interdependence, which poses a complicated challenge for empirical investigations (e.g., Shing et al., 2010). We assume that the protracted maturation of prefrontal regions and associated neural pathways limits the efficiency of the strategic component in children relative to young adults. In contrast, the associative component, which primarily involves the medio-temporal lobes, is close to fully functional by middle childhood. For old age, however, the framework postulates deficiencies in both components relative to early adulthood, reflecting senescent alterations in prefrontal and medio-temporal regions of the brain and related circuits. The predicted lifespan dissociation between the two components provides a starting point for identifying mechanisms of lifespan changes in various forms of memory.

The brain regions supporting episodic and working-memory functioning strongly overlap. Hence, we recently extended the two-component framework from episodic to working memory (Sander, Lindenberger, & Werkle-Bergner, 2012). The benefits of distinguishing between associative and strategic components as a means of understanding lifespan age differences in working memory were empirically validated in a series of behavioral and electroencephalographic (EEG) studies (Sander, Werkle-Bergner, & Lindenberger, 2011a, 2011b, 2012).

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(as of 11/2013)

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False Memory and Age Differences in Retrieval Processing

Episodic memory is not always perfect; for instance, people sometimes remember episodes that they never experienced. In a series of experiments (Dissertation Yana Fandakova), we described lifespan age differences in the likelihood of memory errors being committed and investigated the behavioral and neural mechanisms that underlie the occurrence of such false memories. In one study, a sample of children, younger adults, and older adults worked on a repeated continuous recognition task (Fandakova, Shing, & Lindenberger, 2013a). Participants saw the same set of word pairs over three consecutive runs and were instructed to identify any reoccurrences of word pairs within each run. We showed that the correct detection of pair repetitions

decreased across runs in children, whereas older adults were increasingly likely to falsely indicate that they had already seen a familiar pair that was shown for the first time in a given run (Figure 13a). In addition, children demonstrated a more pronounced decrease in memory errors across runs than older adults, suggesting that their functional associative component benefited from repeated presentation of the word pairs.

To gain a better understanding of the neural mechanisms of these age differences in false memory, we also used functional neuroimaging to test younger and older adults on the same task (Fandakova, Lindenberger, & Shing, in press-a). We showed that there was increased activity in the left anterior prefrontal cortex in younger adults as demands on memory monitoring processes rose across runs.

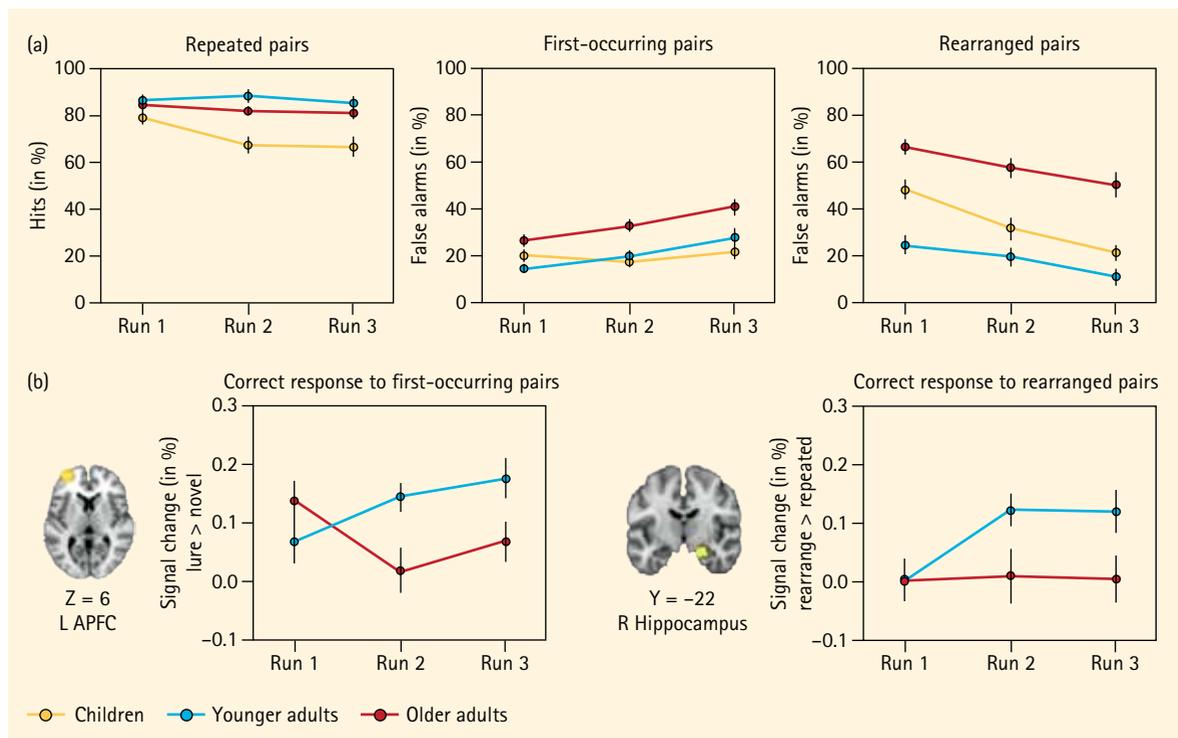


Figure 13. False memories differ by age. (a) Percentage of correctly recognized pair repetitions and falsely recognized lure and rearranged pairs across the different runs of the repeated continuous recognition task. Children recognized significantly fewer pair repetitions than the other age groups in Run 2 and Run 3 (left panel). Older adults falsely endorsed a significantly higher number of lure pairs than the other age groups in Run 2 and Run 3 (middle panel). Children showed a trend for more pronounced decreases in false recognition of rearranged pairs across runs relative to older adults (right panel). (b) Age differences in task-related activations between younger and older adults. During the correct recognition of lure pairs, activation in the left anterior prefrontal cortex (APFC) increased across runs for younger adults, but not for older adults (left panel). During the correct recognition of rearranged pairs, older adults reliably showed lower levels of hippocampal response relative to younger adults (right panel) (adapted from Fandakova, Lindenberger, & Shing, in press-a; Fandakova, Shing, & Lindenberger, 2013a).

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Such an increase was absent in older adults (Figure 13b). Older adults also showed a more pronounced increase in false memory for lure pairs across runs than younger adults (see also Fandakova, Shing, & Lindenberger, 2013a). These findings suggest that memory monitoring deficits due to impaired involvement of prefrontal regions contribute to greater levels of false memory in old age. Older adults also demonstrated reduced levels of activation in the right anterior hippocampus, indicating that the ability to recognize novel associations of familiar information may be reduced in old age due to neural deficits in hippocampal functioning (see also Shing et al., 2011).

Mechanisms and Limits of Working Memory Across the Lifespan

This part of the project focuses on age differences in oscillatory neural mechanisms of

information processing as indicators for the local representation and controlled processing of contents in working memory. Working memory refers to the ability to selectively attend to and maintain information in mind for a short period of time and undergoes a similar rise and fall across the lifespan as episodic memory. Inspired by the striking similarity of the neural circuits involved in working memory and episodic memory, we extended our two-component framework to working memory by exploring the contributions of top-down control and binding processes (see the review by Sander, Lindenberger, & Werkle-Bergner, 2012). We conducted a series of EEG studies with lifespan samples to understand how electrophysiological markers of top-down control, thus referring to the strategic component, are related to age-dependent changes in working-memory

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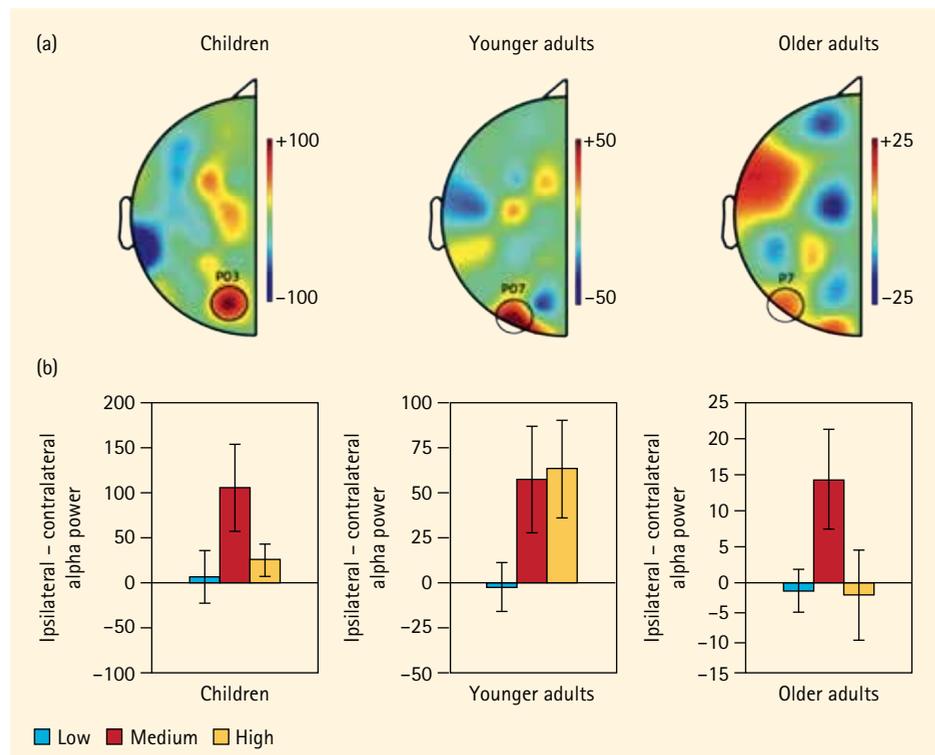


Figure 14. Alpha power during working-memory performance differs by task load and age. (a) Lateralized age differences in posterior alpha power (ipsilateral – contralateral hemifield), indicating differences in inhibiting distracting information during working-memory encoding. (b) For increases from low to medium task load, all age groups modulate hemispheric differences in alpha power. However, under high working-memory load, when individual capacity limits are reached, the alpha power response inverts in children and older adults (adapted from Sander, Werkle-Bergner, & Lindenberger, 2012).

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performance (Dissertation Myriam C. Sander). In particular, we investigated age-related changes in rhythmic activity in the alpha frequency range (7–13 Hz) as a neural marker for the inhibitory control of working-memory contents (Sander, Werkle-Bergner, & Lindenberger, 2012). Participants worked on a cued change-detection task with age-adapted task difficulty. During the retention interval, alpha power was higher ipsilateral to the attended hemifield and increased with the number of items in all age groups (Figure 14). This change in lateralized local alpha power indicates that performance-relevant selection mechanisms are functional in all age groups. However, under task conditions that overly challenged individual working-memory capacity limits, alpha power lateralization broke down in children and older adults, revealing age-related differences in top-down control processes, as postulated by the two-component framework (Sander, Werkle-Bergner, & Lindenberger, 2012).

Another line of research in this area explored adult age differences in large-scale dynamics of neural networks during the selection and maintenance of information in working memory. Participants saw a series of items mixed at random that were either supposed to be maintained in working memory (REM) or discarded (NREM) from further processing. Increased oscillatory activity in lower frequency ranges (~5–15 Hz) was related to the successful suppression of NREM items (Figure 15). At the same time, increased phase synchronization of brain oscillations in response to REM items was selectively related to successful working-memory performance in younger adults, but not older adults (Werkle-Bergner et al., 2012).

To increase our understanding of lifespan changes in oscillatory brain dynamics, we also explored the reliability and stability of neural markers within individuals across time, cognitive interventions, and extended practice (Dissertation Thomas H. Grandy). Using structural equation modeling, we found that peak individual alpha frequency is related to intelligence at a general rather than at an ability-specific level (Grandy, Werkle-Bergner, Chicherio, Lövdén, & Lindenberger, 2013). The

association between individual peak frequency and general intelligence was substantial and of similar magnitude in both younger and older adults. Furthermore, an investigation of a massive cognitive intervention revealed that individual alpha frequency was highly stable in healthy adults up to 80 years of age and not easily modifiable by cognitive training alone (Grandy, Werkle-Bergner, Chicherio, Schmiedek, & Lindenberger, 2013). This finding qualifies individual alpha frequency as a stable neurophysiological trait marker. Our ongoing work seeks to link cognitive process models of working-memory functioning to EEG markers of neural activity at the individual level.

Age Differences in the Influence of Prior Knowledge on Memory

Knowledge based on experience accumulates during the life course. This knowledge, in turn, guides future experiences, including the formation of memories. Initial findings suggest that knowledge structures are less elaborate in children than in adults and that children use knowledge differently than adults (for a review, see Brod, Werkle-Bergner, & Shing, 2013). However, little is known about the cognitive and neural mechanisms that underlie age-graded changes in the deliberate use of knowledge for memory. To disentangle knowledge usage from knowledge availability, we recently developed a paradigm that induces new knowledge in both young adults and children within an experimental setting (Dissertation Garvin Brod). The setting comprises a racing game within which participants first acquire an artificial hierarchy of the stimuli to be used before being presented outcomes of racing events that are either congruent or incongruent with this hierarchy. Age-comparative behavioral and imaging studies with this paradigm are underway.

In a line of research that started at the end of 2013, the project has begun to examine associations between stress, brain maturation, focusing on medio-temporal and prefrontal regions, and memory in the early school years (Dissertation Laurel Raffington in collaboration with Christine Heim, Charité Universitätsmedizin Berlin). The

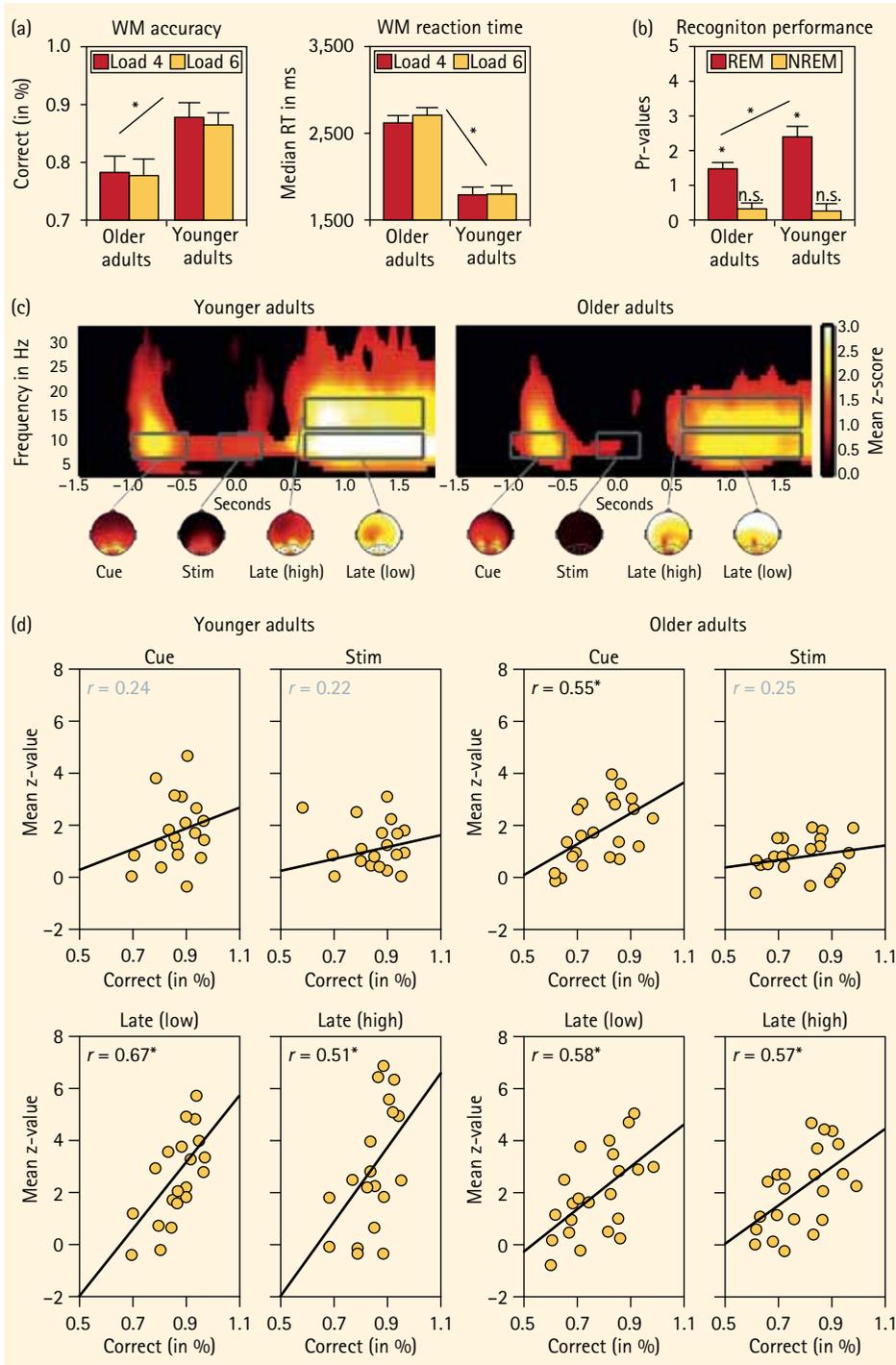


Figure 15. In a sequential visual working-memory (WM) task, participants were cued to remember some scenes (REM) while ignoring others (NREM). (a) WM performance was higher in younger than in older adults. (b) In a subsequent recognition memory test, REM items were remembered in both age groups, while memory of NREM items was at chance levels. (c) Posterior alpha/beta activity was larger in response to NREM compared to REM items, and (d) the difference predicted individual WM performance; * $\alpha < 0.05$ (adapted from Werkle-Bergner, Freunberger, Sander, Lindenberger, & Klimesch, 2012).

Minerva Group (led by Yee Lee Shing)**Nature–Nurture in Brain Development: Separating Effects of Maturation Versus Schooling**

The Minerva Group led by Yee Lee Shing was established in 2012. The group examines the role of maturational versus environmental influences on cognitive development, with a focus on memory. The transition from kindergarten to elementary school is a salient environmental transition. Nevertheless, little is known about the effects of schooling on brain and behavioral development, including academic outcomes. The ongoing *HippoKID* study longitudinally examines the cognitive and neural development in a sample of children born close to the cutoff date (i. e., within 4 months) for school entry. Half of them just met the cutoff date and will thus start school 1 year earlier than their age peers who just missed it. The resulting data set will allow the group to investigate the interactive effects of age and experience on neural and cognitive development. Collaborators include Sascha Schroeder (Head of the Max Planck Research Group “REaD”; see pp. 315–339) and Florian Schmiedek (German Institute for International Educational Research [DIPF], Frankfurt a. M.).

Box 2.

Otto Hahn Group (led by Yvonne Brehmer)

This group was established in 2012 and is funded by the Otto Hahn Award of the Max Planck Society, which was presented to Yvonne Brehmer for her dissertation on episodic memory plasticity across the lifespan. Nina Becker joined the group in August 2013 as a predoctoral fellow. The group explores mechanisms associated with individual differences in associative binding among older adults. The group's work is primarily based on data from the Swedish National Study on Aging and Care (SNAC-K), which is coordinated by the Aging Research Center (ARC) at the Karolinska Institutet in Stockholm, Sweden. Ongoing analyses address the following questions: Which cognitive, social, health, and lifestyle factors contribute to individual differences in associative binding? What are the functional and structural brain characteristics of older adults who show well-preserved associative binding skills?

Box 3.

Research Project 4: Mechanisms and Sequential Progression of Plasticity

This project addresses the questions of *whether and how* plasticity contributes to adult development. Special attention is given to the relationship between neural and behavioral manifestations of plasticity. The project continues the research agenda of the Sofja Kovalevskaja Research Group on the Plasticity of Brain and Behavior in Adulthood and Old Age (see Research Report 2009–2010). Simone Kühn joined the project as principal investigator in 2012.

Current research indicates that the human brain has a significant capacity to adapt to changing demands by altering its function and structure (see Lövdén, Wenger, Mårtensson, Lindenberger, & Bäckman, 2013). The project is based on the assumption that plasticity is induced by a mismatch between environmental demands and the individuals' current behavioral and neural resources (Lövdén, Bäckman, Lindenberger, Schaefer, & Schmiedek, 2010; see Figure 4 on p. 203). The project is interested in plastic changes induced by mismatches in either direction. Thus, it examines situations in which current demands exceed supply (e.g., cognitive interventions) but also situations in which supply exceeds current demands (e.g., immobilization and sensory deprivation).

Given that the mechanisms and the sequential progression of plastic changes in adult humans are largely unknown, the central goals of the project are to delineate the *mechanisms* and the *sequential progression* of behavioral and neural plasticity in adulthood. Cognitive interventions involving training regimes that target the specific brain regions and circuits that hypothetically support particular skills provide a powerful means to this end. Another fruitful approach is studying plasticity as it naturally occurs in environments for which a mismatch between demand and capacity can be assumed. Moreover, examining individuals who are experts in particular skills represents a promising avenue to investigate consequences and correlates of plasticity.

The project's definition of plasticity is fairly restrictive (Lövdén et al., 2010): Changes are only considered plastic if they are accompanied by (a) structural changes of the brain and (b) a change in behavioral repertoire. In light of this emphasis on brain structure, and in close collaboration with the *Brain*

Imaging Methods project (see pp. 245–247), the project carries out methodological work to better understand, calibrate, and refine magnetic resonance imaging (MRI) protocols. For instance, in a series of ongoing studies, we have been taking measures of brain structure and function on a day-to-day basis within the same individuals to explore whether daily fluctuations in brain imaging parameters are related to fluctuations in physiological and affective states, such as physical activity, blood pressure, sleep, caffeine intake, mood, and so on. In the following, we provide a selective summary of completed studies and ongoing work.

Spatial Navigation

In a series of studies using a virtual-reality equipped treadmill setup, we found that spatial navigation training protects the

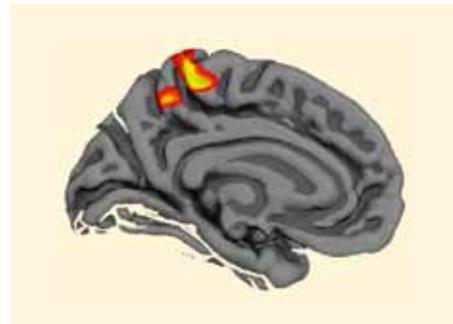


Figure 16. Further results from the SPACE study: Spatial navigation training is associated with an increase in cortical thickness. In the study, younger and older adults practiced spatial navigation in a virtual zoo while walking on a treadmill. The practice period included 42 one-hour sessions administered every other day over a period of about 3.5 months. Control groups walked on a treadmill without navigating for a comparable amount of time. Training was associated with attenuated hippocampal shrinkage in both younger and older adults (see Lövdén, Schaefer, et al., 2012) and with thickness increases in the left precuneus and the left paracentral lobule, shown here, in younger adults only (adapted from Wenger et al., 2012).

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(as of 02/2013)

Nina Lisofsky
(as of 01/2013)
Elisabeth Wenger

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Wenger, E., Schaefer, S., Noack, H., Kühn, S., Mårtensson, J., ... Lindenberger, U., & Lövdén, M. (2012). Cortical thickness changes following spatial navigation training in adulthood and aging. *NeuroImage*, 59, 3389–3397. doi:10.1016/j.neuroimage.2011.11.015

hippocampus against age-related shrinkage (Lövdén, Schaefer, et al., 2012), increases cortical thickness in the left precuneus and the left paracentral lobule (Wenger et al., 2012; see Figure 16), and is associated with increases in a metabolite suggestive of hippocampal neuro- or synaptogenesis (i. e., N-acetylaspartate) in Val homozygotes of the brain-derived neurotrophic factor gene (Lövdén et al., 2011). We also reported data showing that frequent video gaming is associated with grey matter increases in the brain (Kühn & Gallinat, in press-a; Kühn et al., 2011). In a recent experimental study continuing this line of work, we asked adults with no prior experience of video games to practice a commercially available video game. The game required navigating an avatar through a 3D world. The participants practiced the game for at least 30 minutes per day over a period of 2 months. After training, we observed

grey matter increases in the right prefrontal cortex, the right hippocampal formation, and in both hemispheres of the cerebellum (Kühn, Gleich, Lorenz, Lindenberger, & Gallinat, 2014; see Figure 17). These results confirm cumulative evidence that the hippocampal formation contributes to spatial navigation (Kühn & Gallinat, in press-c). The sort of video game training used in this study might be helpful in counteracting hippocampal and cortical volume losses in posttraumatic stress disorder and neurodegenerative disease.

An ongoing study examines a group of scientists who are spending 15 months at the Neumayer Station of the Centre of German Research in Antarctica. Before the scientists left for their extended stay in an environment that is generally devoid of spatial cues, we invited them to our laboratory in the fall of 2012 to assess their spatial abilities and to acquire high-resolution structural images

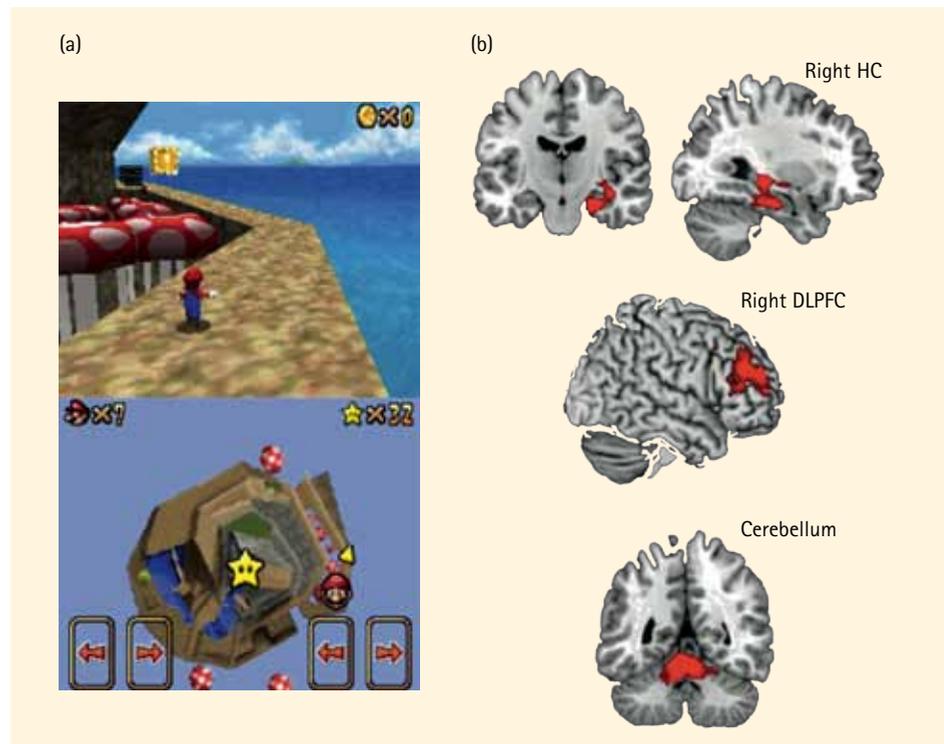


Figure 17. (a) Screenshot of the video game Super Mario 64 with the avatar navigating through a virtual environment, seen from a realistic perspective at the top, and from a bird's eye view at the bottom. (b) Brain map of the significant interaction between group (video gaming group vs. passive control group) and time (before vs. after training interval). Grey matter increases in the experimental group relative to the control groups which are displayed in red. Hippocampus (HC), dorsolateral prefrontal cortex (DLPFC) (adapted from Kühn et al., 2014).

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of the hippocampus. MRI assessment will be repeated after the scientists have returned from Antarctica. During their stay, the participants are being tested on a monthly basis with a battery of cognitive tests. It will be of interest to find out whether the spatially poor environment in Antarctica is associated with declines in spatial abilities and related brain structures and whether these declines are reversible. Initial results are expected in 2014.

Skilled Motor Performance

Skilled motor performance provides a rich testing ground for exploring the mechanisms and the progression of plasticity. In one recently completed study, the project aims at delineating the course of plasticity during training to write and trace with the left hand in young right-handed adults (Dissertation Elisabeth Wenger). The project conducted 20 structural MRI scans during a training phase of 7 weeks, in the course of which participants learned in daily practice sessions how to draw and write with their left hand on tablet computers. The imaging protocol comprised both structural MRI (e.g., MPRAGE, diffusion tensor imaging) and functional MRI (resting state, writing, finger tapping). Task-related functional activation patterns will allow us to focus on brain regions that are activated during training. Initial results will be presented at conferences in 2014.

We also carried out structural MRI scans on individuals who were wearing an orthosis that restrained movement of the dominant right hand while perceiving graspable objects in the scanner. The visual presentation of objects is known to elicit the preparation of corresponding grasping movements. We found that short-term immobilization of the right hand leads to a reduction in right-hand grasp preparation relative to a control group without orthosis and to a concomitant activity increase in brain regions involved in regulating left-handed grasping (Kühn, Werner, Lindenberger, & Verrel, in press; see Figure 18). In the future, we plan to explore whether this form of instantaneous functional reorganization provides a neural trigger for plastic change.

Hormonal Influences on Brain Plasticity

As an organ of the body, the brain is subject to hormonal influences, which may affect plasticity. Hence, the project has begun to investigate the influence of gonadal hormones, in particular estrogen and progesterone, on brain structure and brain function in women (Dissertation Nina Lisofsky). Our interest in this topic is also methodological: It is problematic to assess structural changes in response to experience (e.g., cognitive training) if natural cyclic fluctuations that occur at a similar timescale are not ascertained and taken into account. In a quantitative sum-

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Kühn, S., Werner, A., Lindenberger, U., & Verrel, J. (in press). Acute immobilization facilitates premotor preparatory activity for the non-restrained hand when facing grasp affordances. *NeuroImage*. Advance online publication. doi:10.1016/j.neuroimage.2014.02.003

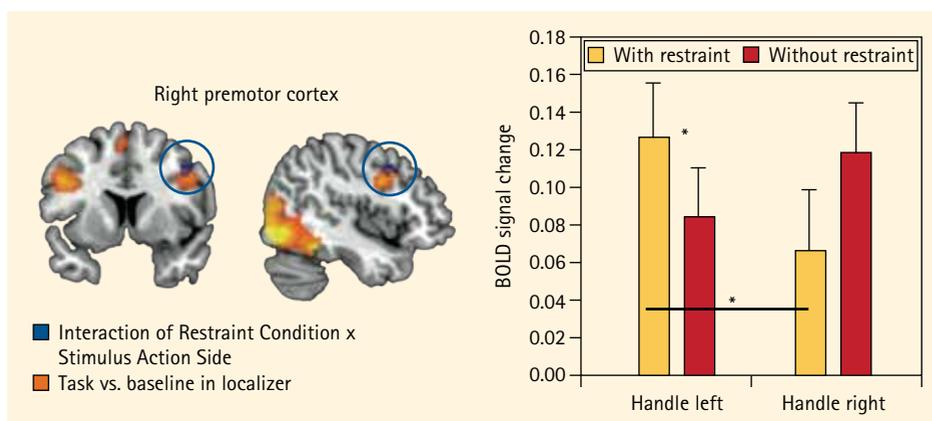


Figure 18. Right premotor cortex (depicted in blue) shows rapid functional reorganization when participants wear an orthosis that restrains movement of their right hand. When seeing objects with handles oriented toward the left hand while the right hand is restrained, right premotor cortex activity preparing left-hand grasping is up-regulated (adapted from Kühn, Werner, et al., in press).

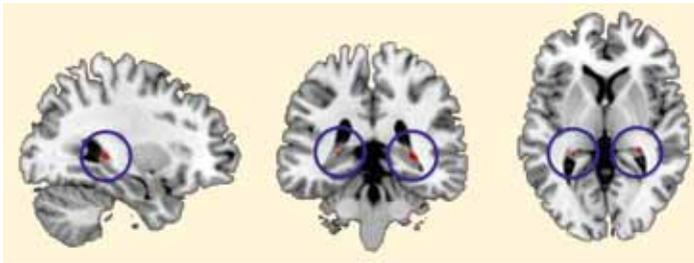


Figure 19. Hormone levels change over the course of the female menstrual cycle and influence hippocampal volumes. Hippocampal volume increases during the late follicular phase when estrogen levels are at their peak, relative to the early follicular phase when estrogen levels are low.

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many of functional MRI studies comparing neural activity during the follicular and luteal phases of the menstrual cycle, we reported hemispheric differences in the activation of the amygdala/hippocampal complex. To explore the existence of corresponding structural changes, we carried out scans at four time points distributed over the menstrual cycle. In preliminary analyses, we observed a bilateral increase in posterior hippocampal volumes during the late follicular phase when estrogen is at its peak, relative to the early follicular phase when estrogen is low (Figure 19).

A second study currently in progress explores the effects of pregnancy on brain and behavior in pregnant women, with an emphasis on the hippocampus. The study will start with a cross-sectional comparison between women wanting to become pregnant and women who have just given birth. In the longitudinal part, we plan to follow women planning to get pregnant over time and compare those who get pregnant with those who do not.

Brain Structure and Metacognition

In a separate line of research, Elisa Filevich and colleagues are investigating the association between brain structure and higher order cognitive functions. Here, the project is particularly interested in metacognition, or the ability to know what one knows, and how this knowledge is related to introspection and interoception. In this context, we examine lucid dreamers as putative experts, as these individuals appear to be aware while dreaming.

Further Collaborations

In the context of Maxnet Cognition (see p. 368), researchers at the MPI for Cognitive and Brain Sciences at Leipzig, the MPI for Psycholinguistics at Nijmegen, and the MPI for Human Development have agreed on a core imaging protocol that includes functional magnetic resonance imaging of the default network as well as structural magnetic resonance imaging of grey matter volume and white matter tracts. Together with other researchers from the Center for Lifespan Psychology, Simone Kühn and Sandra Düzel have begun to administer an expanded version of this protocol, which also includes high-resolution imaging of the hippocampus, to participants in the Berlin Aging Study II (BASE-II; see pp. 234–238). By January 2014, 200 BASE-II participants have been scanned.

In collaboration with Torsten Schubert from Humboldt-Universität zu Berlin and Jürgen Gallinat from Charité Universitätsmedizin Berlin, the project compares simultaneous interpreters with consecutive ones and with translators to identify the functional and structural neural correlates of dual-task performance.

In collaboration with Martin Dresler from the MPI for Psychiatry, Munich, Dimitris Repantis from Charité Universitätsmedizin Berlin, and Kathrin Ohla from the German Institute of Human Nutrition, Potsdam, we are directly comparing cognitive and neural changes in response to various substances or interventions, such as glucose, caffeine, methylphenidate, modafinil, caffeine pills, and memory training.

Finally, in collaboration with Jürgen Gallinat from Charité Universitätsmedizin Berlin and with Peter Zimmermann and Gerd Willmund from the Bundeswehr Krankenhaus Berlin, we have begun a prospective longitudinal study on posttraumatic stress disorder. Soldiers being deployed to areas such as Afghanistan, Mali, and Kosovo are assessed before and after their mission on a range of psychological and brain imaging measures. A specific aim of the study is to find out whether alterations in the structure or function of the hippocampus are a risk factor for, or a consequence of stress and trauma.

Research Project 5: Sensorimotor–Cognitive Couplings Across the Lifespan

Everyday life often requires the integration and coordination of perception, action, and thought. Examples include walking while trying to memorize a shopping list or maintaining one's balance on a bus while trying to read an advertisement. Similarly, the successful execution of complex movements requires anticipation of future states and coordination of task-specific movements. For instance, safely carrying a glass of water requires predictive temporal and spatial coordination of body parts. Everyday observations suggest that older adults and young children need to invest more attention in sensorimotor aspects of their behavior than teenagers and young adults and that they have a reduced ability to flexibly adapt their movements to external demands. For example, when facing an obstacle on a narrow path, older adults may tend to stop talking and resume their conversations once the obstacle has been overcome, whereas the same obstacle will affect younger adults' conversation to a lesser extent. How do individuals of different ages or with different levels of expertise adapt to multiple sensorimotor and cognitive demands? How does the interaction between the sensorimotor and cognitive dimensions of behavior develop across the lifespan?

The *Sensorimotor–Cognitive Couplings* project seeks to provide answers to these questions by focusing on motor aspects of behavior, both in isolation and in relation to cognition. The project investigates lifespan differences in interactions between sensorimotor and cognitive aspects of behavior (e.g., Schaefer & Schumacher, 2011) as well as lifespan differences in movement organization and coordination (e.g., Verrel, Lövdén, & Lindenberger, 2012a). In late 2013, the project has begun to expand its research interests to movement

development in early childhood. Initial studies on this topic, including longitudinal assessments, are in preparation.

The Movement Lab

The project's laboratory is equipped with a motion capture system capable of measuring the 3D positions of reflective markers attached to a participant's body with a high degree of temporal and spatial accuracy (Figure 20). The resulting data are postprocessed according to biomechanical models



Figure 20. A young participant walking on the treadmill through a virtual world. Reflective markers and a system of infrared cameras enable gait characteristics to be analyzed and treadmill speed to be adaptively regulated.

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to investigate body coordination during movement performance. The motion capture system can also be combined with devices for measuring ground reaction forces, muscle activity, or electrical brain activity (Figure 21). To investigate locomotion under conditions that more closely approximate everyday behavior, we developed a virtual environment setup in which computer-generated scenery is projected in front of a treadmill. The treadmill and scenery are synchronized to create a sense of immersion into virtual reality. Online feedback from the motion capture system can be used to adjust the speed of the treadmill or to signal participants to constrain their movements (e.g., to remain within the boundaries of a narrow virtual track).

In 2013, our facilities moved to a larger laboratory space, which offers new possibilities for investigating whole-body motor behavior, such as examining locomotion on level ground rather than on the treadmill. This is of particular importance for studies on early motor skills.



Figure 21. A young adult fitted with EEG sensors and reflective motion capture markers participating in an experiment investigating the neural correlates of the visual stabilization of balance. The red and blue dots presented on the screen flickered at different frequencies to analyze the entrainment of cortical activity to central and peripheral visual stimuli under various conditions of postural stability.

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The Coordination of Cognitive and Motor Performance in Dual-Task Situations

In earlier work, we showed that older adults invest more cognitive resources into motor aspects of behavior than younger adults, presumably to attenuate the adverse effects of sensorimotor decline. Accordingly, older adults show higher dual-task costs than younger adults when a cognitive and a motor task need to be performed concurrently (for a review, see Schaefer & Schumacher, 2011). For instance, Krampe, Schaefer, Lindenberger, and Baltes (2011) observed 9- and 11-year-olds as well as younger adults (mean age 25 years) and older adults (mean age 65 years) who had to walk on a narrow track while coming up with exemplars of a semantic category (e.g., dog for animals). Performance levels in both domains followed an inverted *U*-shape function with age (see Figure 22). Dual-task costs were computed to express the relative decrease in performance from single- to dual-task as a percentage of individual single-task performance. For walking, these costs also showed a *U*-shape, with the largest decreases being observed in children and older adults. For fluency, only the 9-year-olds showed reliable dual-task costs, suggesting that they had greater difficulties in retrieving exemplars from long-term memory under taxing performance conditions than individuals in the other age groups.

In addition to developmental influences, individual differences in task-relevant experience may also influence performance in a cognitive-motor dual-task situation. We investigated such influences by asking middle-aged women with either a great deal or very little experience in walking in high heels to walk on a treadmill while performing a demanding working-memory task (Schaefer & Lindenberger, 2013). Each participant performed the two tasks while wearing either gym shoes or high heels. Surprisingly, neither group showed any reduction in working-memory performance when walking compared with sitting, irrespective of shoe type. However, in the walking task, high-heel expertise was associated with more flexible adjustments in movement patterns: Experts reduced the variability of time spent in the single-support

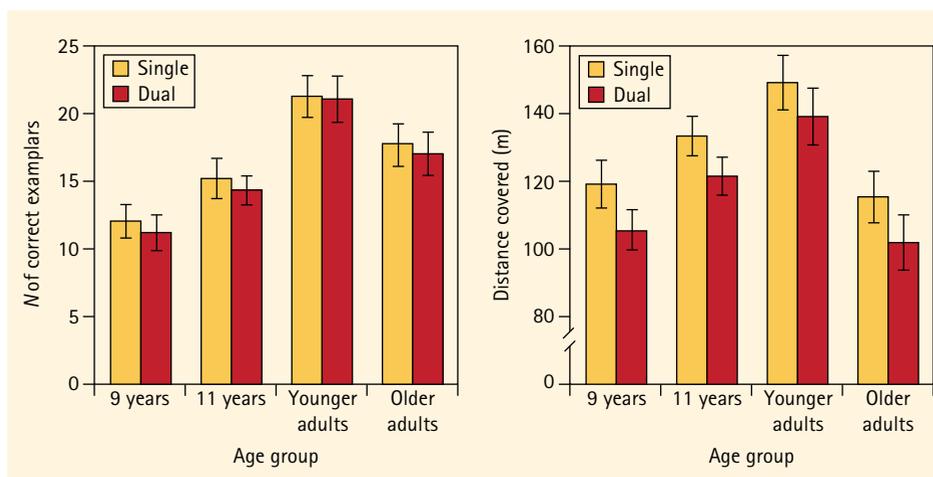


Figure 22. Mean number of category exemplars retrieved in the semantic fluency task (left) and the average distance covered in the walking task (right) as a function of age group and task context. The error bars represent 95% between-group confidence intervals (adapted from Krampe, Schaefer, Lindenberger, & Baltes, 2011).

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phase of the gait cycle under cognitive load while wearing high heels, resulting in a more stable gait.

Cognitive Aspects of Movement Behavior

The project has also investigated links between cognitive and motor aspects of behavior in actions that involve sensory integration, motor planning, or decision making. In collaboration with Sascha Schroeder (Max Planck Research Group "REaD," pp. 315–339), we investigated lexical decisions in children and adults (Schroeder & Verrel, in press). Spatiotemporal analysis of response movements allowed for a fine-grained analysis of developmental differences and revealed age-specific dissociations between prereponse and movement phases. Together with Markus Werkle-Bergner (*ConMem*, pp. 217–222), we combined EEG and motion capture to investigate the influence of postural stability on the use of visual information (Figure 21). The role of sensory feedback was also investigated in the haptic modality, where we were able to demonstrate, for the first time in healthy adults, that self-touch information is automatically integrated with motor control (Verrel, Hagura, Lindenberger, & Haggard, 2013). In collaboration with Simone Kühn (*Mechanisms and Sequential Progression of Plasticity*, pp. 223–226), we are currently

using experimental paradigms inducing automatic action preparation to investigate mental representations of the body and of body movements.

Effects of Aerobic Exercise on Brain and Behavior

Physical fitness appears to have beneficial effects on cognitive functioning in old age, but the physiological mechanisms underlying this effect remain unclear. The project has examined this issue in an exercise intervention study (Dissertation Maïke Kleemeyer). Fifty-two older adults aged 59–74 years were randomly assigned to either a high-intensity or a low-intensity aerobic training regimen. For 6 months, individuals exercised three times a week for 1 hour on stationary bicycles. Participants' fitness was assessed before, immediately after, and 6 months after termination of training. Assessments at the three time points also comprised brain-related and cognitive measures. For example, the structural part of the magnetic resonance imaging (MRI) protocol included diffusion tensor imaging and arterial spin labeling, and the functional MRI protocol included assessments of working memory and the passive viewing of faces and houses. Data collection ended in 2013 and initial results will be presented in 2014.

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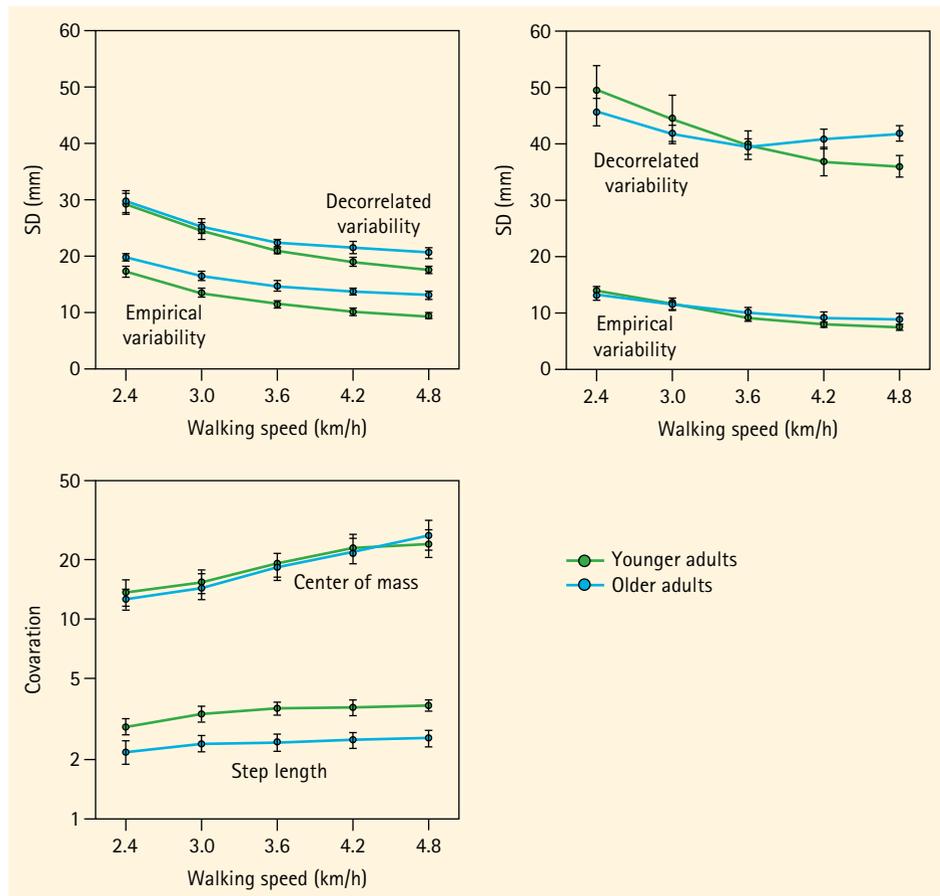


Figure 23. Results from a study on age-related differences in the motor-equivalent stabilization of balance and step patterns during treadmill walking. Stabilization is assessed by comparing the variability of task variables between empirical data and decorrelated data from which the covariation between joint angles has been removed. A covariation index is defined as the quotient of decorrelated variability divided by empirical variability, with larger values indicating a greater degree of motor-equivalent stabilization. In both age groups, stabilization is greater for the center-of-mass position than for step length, but step-length stabilization is reduced in older compared to younger adults. Error bars represent between-subject standard errors (adapted from Verrel, Lövdén, & Lindenberger, 2012b).

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Movement Variability and Coordination

Functional motor behavior requires the coordination of multiple degrees of freedom of the body (e.g., joint angles) in such a way that appropriate task outcomes can still be ensured in the presence of internal and external perturbations. An important aspect of this process is motor-equivalent stabilization, that is, organizing movement variability in such a way as to allow for task-equivalent variability while minimizing task-relevant deviations.

We investigated the organization of movement variability in age-comparative stud-

ies, predicting age-associated reductions in motor-equivalent stabilization. In a study on manual pointing, older and younger adults showed similar performance accuracy (Verrel, Lövdén, & Lindenberger, 2012a). However, the older adults made less use of task-equivalent variability, suggesting that they were relying on a compensatory strategy (reduction in execution variability) to ensure end point accuracy. As a more complex motor activity, stable walking requires the continuous stabilization of multiple task constraints. Using a measure of motor-equivalent covariation in a study with young adults, we found evidence for sta-

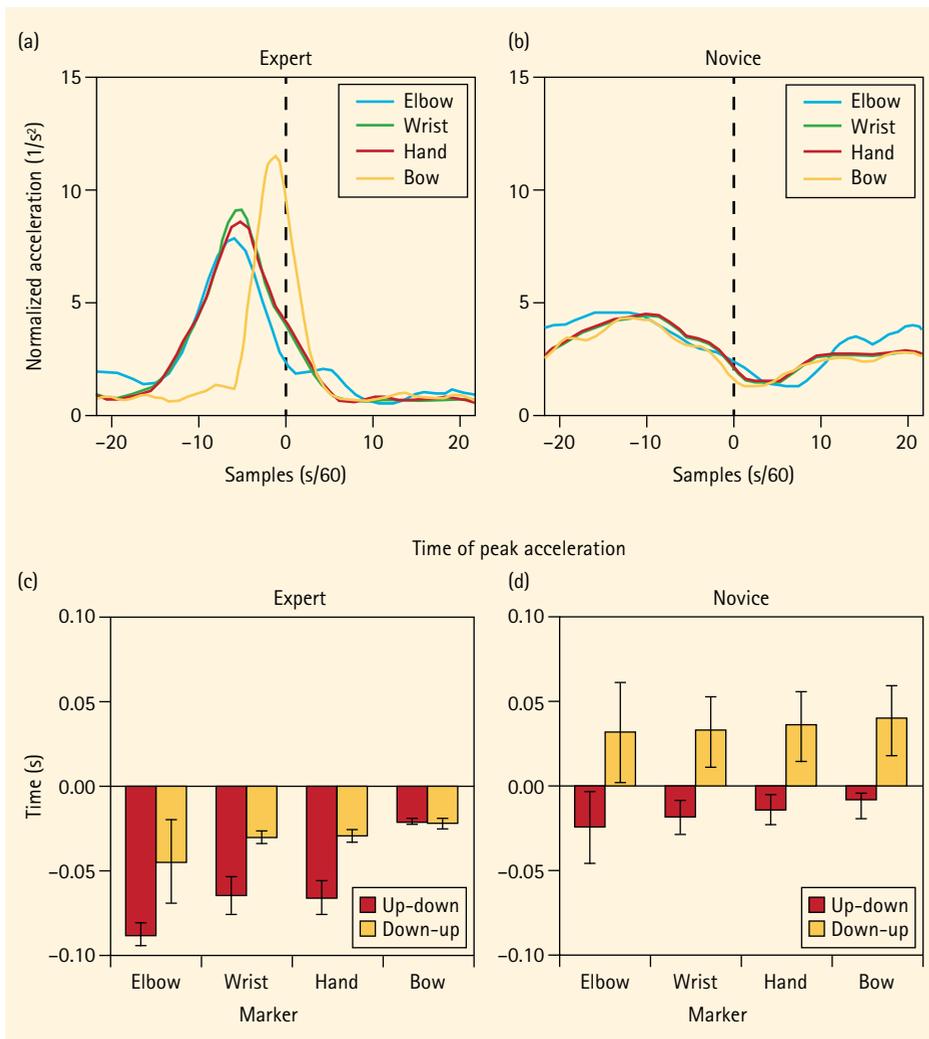


Figure 24. Example data from a study on movement coordination during cello bowing. Lower panel: Acceleration pattern of right arm and bow at the time of bow reversal for an expert (a) and a novice (b) cello player. The sample data suggest marked differences between experts and novices, in particular in terms of temporal consistency and differentiation of the arm and the bow movement. This is confirmed by the statistical analysis at the group level (lower panel), showing a proximal-to-distal gradient in the timing of acceleration peaks in the experts (c), but not in the novices (d) (adapted from Verrel, Pologe, Manselle, Lindenberger, & Woollacott, 2013b).

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bilization of both whole-body balance and the step pattern (Verrel, Lövdén, & Lindenberger, 2010). Moreover, stability indices were larger for balance- than for step-related measures. Results from an age-comparative study indicate that high-performing older adults show preserved balance control, but impaired step length control (Figure 23), which may reflect selective prioritization of the functionally most important task variables (Verrel, Lövdén, & Lindenberger, 2012b).

Motor-equivalent coordination was also studied during bipedal upright standing. We demonstrated the differential effects of a proprioceptive perturbation (neck vibration) on various task-relevant variables (Verrel, Cuisinier, Lindenberger, & Vuillerme, 2011). In a study on prolonged standing, we introduced a novel analysis combining temporal and motor-equivalent measures (Verrel, Pradon, & Vuillerme, 2012). The results confirm the prediction, derived from computa-

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tional motor control, that task-equivalent fluctuations for specific task variables show higher amplitude *and* greater temporal persistence compared to task-relevant fluctuations. The project also made some methodological contributions to ascertaining the formal properties of variability-based measures of motor-equivalent coordination (Verrel, 2010, 2011).

Two studies investigated task-specific coordination in expert motor performance. By comparing advanced or professional cello players to novices (Verrel, Pologe, Manselle, Lindenberger, & Woollacott, 2013a, 2013b), we found that skilled cello bowing is characterized by the successful stabilization of bow parameters and the recruitment of distal degrees of freedom *during continuous bow movements* and temporally differentiated coordination of the arm *at bow reversals* (Figure 24).

Future research will extend our work on adult age-related differences, addressing in particular the effects of normal aging on the temporal and motor-equivalent structure of movement variability. In addition, we are starting to investigate early developmental changes in movement coordination during locomotion (e. g., crawling) and other complex

motor tasks requiring the concurrent stabilization of multiple motor constraints.

Biophysical Signals for Assistive Technologies

The *Sensorimotor-Cognitive Couplings* project also investigates assistive technology in adulthood and old age (Lindenberger, Lövdén, Schellenbach, Li, & Krüger, 2008). Michael Schellenbach and colleagues sought to identify empirical criteria for net resource release by examining how navigation aids with differing cognitive demands improve or reduce gait stability in younger and older participants trying to find their way through a virtual environment while walking on a treadmill. From April 2009 until September 2012, the project participated in SmartSenior (www.smart-senior.de), a large-scale consortium of research institutions and companies funded by the German Ministry of Education and Research. Within the consortium framework, the subproject examined how older adults interact with new technologies in general. In summer 2012, the consortium carried out a real-life intervention study with over 30 older adults in Potsdam to examine the effectiveness of the assistive prototypes developed in the participants' own households.

Research Project 6: The Berlin Aging Studies (BASE)

During the 20th century, average life expectancy nearly doubled. More and more individuals in current generations of older individuals experience additional years of life between the ages of 70 and 100+. What do these added years mean in terms of levels of functional capacity and quality of life? What are the constraints on mental and physical capacities in the last years of life? Given the heterogeneity of aging trajectories and outcomes, longitudinal studies of individual development are crucial in providing answers to these questions (Nyberg, Lövdén, Riklund, Lindenberger, & Bäckman, 2012). For over two decades, members of the Center for Lifespan Psychology have been investigating age- and death-related changes in psychological functioning in the context of the Berlin Aging Study (BASE; Baltes & Mayer, 1999; Lindenberger, Smith, Mayer, & Baltes, 2010). Recently, the Berlin Aging Study II (BASE-II; Bertram et al., 2013) has been launched to address antecedents of healthy aging. Both BASE and BASE-II are collaborative, multidisciplinary studies that involve collaborators from other institutions inside and outside Berlin. In the following, we summarize recent developments in both studies.

The Berlin Aging Study (BASE): Very Old Age and the End of Life

To date, longitudinal data in BASE are available for eight measurement occasions spanning more than 18 years, and mortality-related information is updated at regular intervals. Most of the 516 individuals who participated in the 14-session multidisciplinary assessment at the first measurement occasion about 20 years ago are no longer alive. At the eighth (and probably final) measurement occasion in 2008–2009, 22 surviving participants were reexamined, with a focus on psychological, geriatric, and dental assessments. Data from the Berlin Aging Study continue to provide the basis for new original publications on individual differences in late-life development. Furthermore, DNA specimens, derived from blood collected about 24 years ago, have been retrieved and analyzed for about 380 BASE participants. Adding genetic information to the BASE data set allows researchers to explore and test genetic contributions to individual differences in late-life development.

Genetic Contributions to Individual Differences in Late-Life Cognitive Development

The brain-derived neurotrophic factor (BDNF) promotes activity-dependent synaptic plasticity and contributes to learning and memory. Ghisletta et al. (in press) investigated whether a common Val66Met missense polymorphism (rs6265) of the *BDNF* gene is associated with

individual differences in cognitive decline in old age. A total of 376 participants in the Berlin Aging Study with a mean age of 84 years at first occasion were assessed longitudinally up to 11 times across more than 13 years on the Digit Letter Test, a marker of perceptual speed. As shown in Figure 25, Met carriers ($n = 123$, 34%) showed steeper linear decline than Val homozygotes ($n = 239$, 66%). This effect was not moderated by sex or socioeconomic status and was also observed when individuals at risk for dementia were excluded from the analysis. This finding is in line with the hypothesis that normal aging magnifies the effects of common genetic variation on cognitive functioning (see also the concluding report from the *Neuromodulation of Lifespan Cognition* project, pp. 207–210).

Trajectories of Change: Age Versus Time-to-Death

Mortality-related processes are known to modulate late-life change in cognitive abilities, but it is an open question whether precipitous declines with impending death generalize to other domains of functioning. Denis Gerstorf and colleagues used 13-year longitudinal data from 439 now-deceased BASE participants to compare changes as a function of time since birth (i.e., age models) with changes as a function of time to death (i.e., mortality models; Gerstorf, Ram, Lindenberger, & Smith, 2013). Across a large range of functional domains, mortality models revealed reliably steeper average rates of

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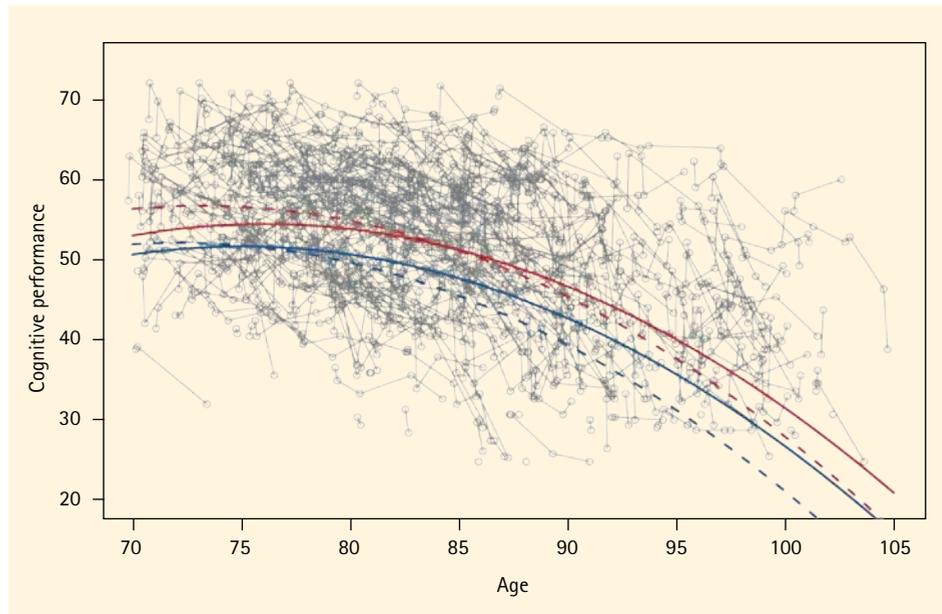


Figure 25. The Val/Met polymorphism of the brain-derived neurotrophic factor (BDNF) gene predicts cognitive decline in older adults. Cognitive performance was assessed with the Digit Letter Test, a measure of perceptual speed. Grey dots are individual measurements, connected by continuous grey lines. Continuous colored lines represent expected sample trajectories for Val-homozygous individuals, whereas dashed lines represent Met carriers. The red lines represent estimated sample trajectories for individuals not diagnosed to be at risk for dementia, while the blue lines are for diagnosed individuals (adapted from Ghisletta et al., in press).

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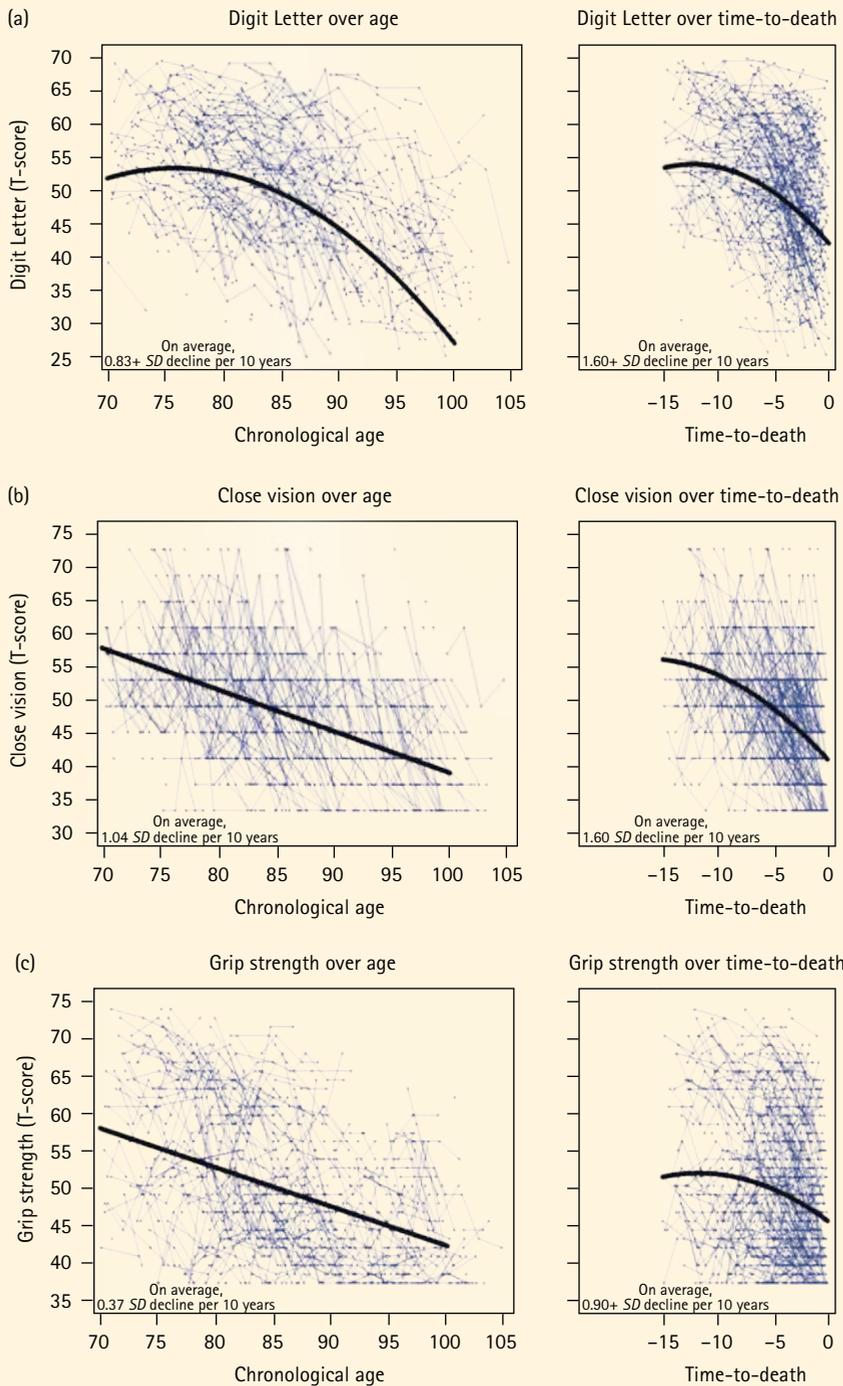
change than age models (see Figures 26 and 27). These findings underscore the pervasive presence of processes leading toward death in old age. Multivariate analyses with more closely spaced multidomain measurements are needed to identify the temporal dynamics and dimensionality of this end-of-life cascade.

The Berlin Aging Study II (BASE-II): Understanding Heterogeneity in Aging

One of the most salient aspects of aging is its heterogeneity. Some individuals maintain their health and preserve their cognitive abilities into advanced ages, whereas others show precipitous and early decline. To understand the mechanisms that produce this diversity of outcomes, we need to follow the trajectories of aging individuals over time. With this goal in mind, researchers from Berlin and Tübingen initiated the Berlin Aging Study II (Bertram et al., 2013). Like BASE, BASE-II was set up as a multidisciplinary and multi-institutional longitudinal study that captures a wide range

of different functional domains. Geriatrics and internal medicine as well as immunology, psychology, genetics, sociology, and economics are among the disciplines involved. The study received financial support from the Federal Ministry of Education and Research (BMBF; Förderkennzeichen BASE-II 16SV5837). The recruitment of the BASE-II cohort, which was completed in 2013, resulted in a consolidated baseline sample of 1,600 older adults aged 60 to 75 years and of 600 younger adults aged 20 to 35 years (Bertram et al., 2013). Data from this baseline sample can be linked to the German Socio-Economic Panel Study (SOEP), a longitudinal panel survey that is representative of the German population, to estimate sample selectivity.

After extensive piloting, a comprehensive battery of cognitive tests and a psychological questionnaire were added to the baseline protocol in March 2013. The cognitive test battery is distributed across two testing sessions. It includes various facets of episodic memory as well as measures of working



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Figure 26. Across cognitive, sensory, and motor domains, decline is steeper as a function of time-to-death than as a function of chronological age. In each panel, the thin lines represent individual trajectories and the thick lines represent sample estimates. The left-hand panels display the data as a function of chronological age, whereas the right-hand panels show the same data as a function of time-to-death. (a) Cognitive functioning (Digit Letter), (b) Sensory functioning (close visual acuity), (c) Motor functioning (grip strength) (adapted from Gerstorf et al., 2013).

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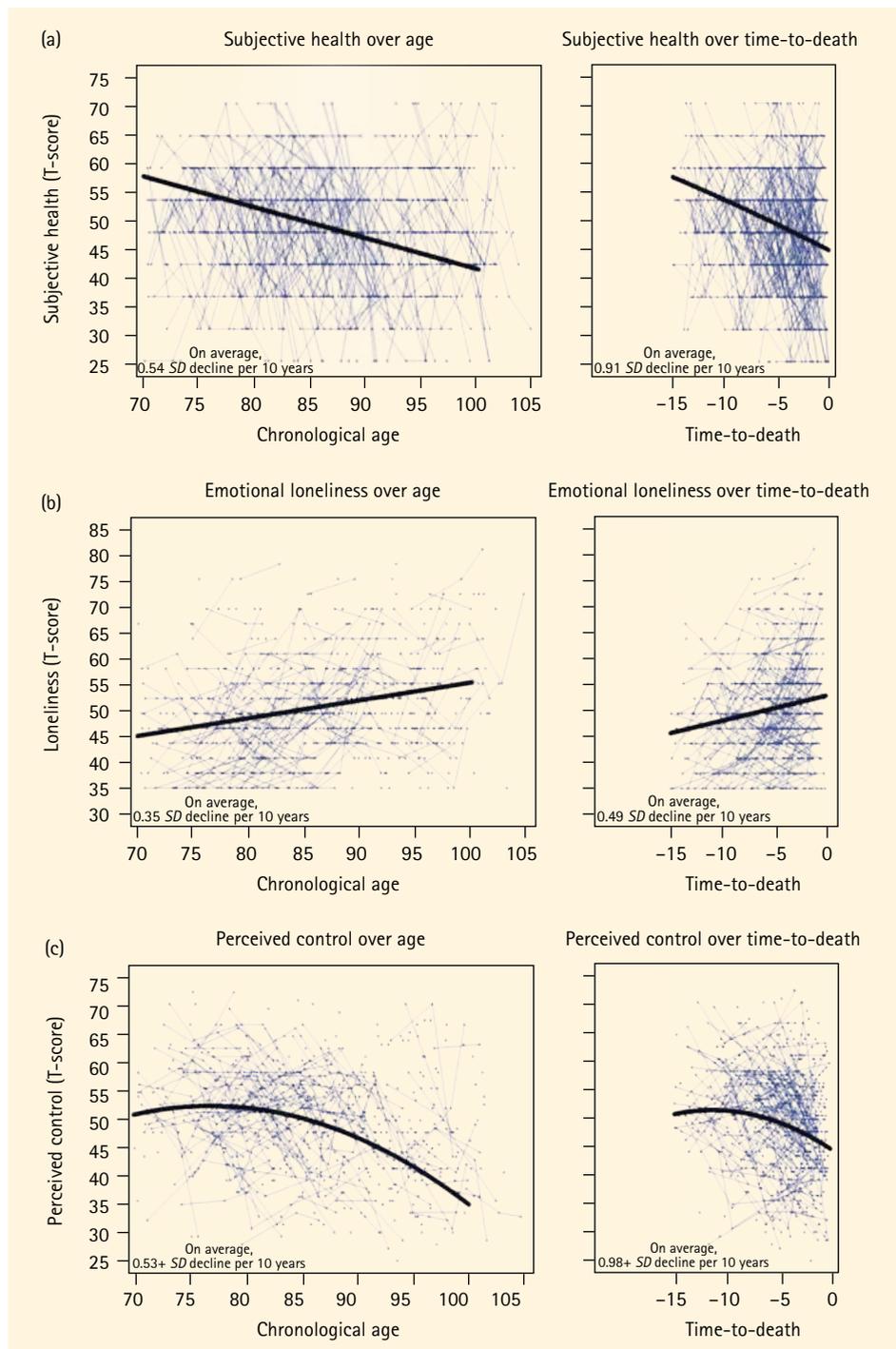


Figure 27. Across a range of psychological variables, decline is steeper as a function of time-to-death than as a function of chronological age. In each panel, the thin lines represent individual trajectories and the thick lines represent sample estimates. The left-hand panels display the data as a function of chronological age, whereas the right-hand panels show the same data as a function of time-to-death. (a) Subjective health, (b) Emotional loneliness, (c) Perceived control (adapted from Gerstorf et al., 2013).

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memory, cognitive control, fluid intelligence, reading skills, and decision making. It also includes a newly developed measure of subjective health, the *subjective health horizon (SHH)*, to assess participants' motivation to engage in explorative and novel activities. The psychological questionnaire was assembled in collaboration with Denis Gerstorf from the

Humboldt-Universität zu Berlin. It contains measures of self-reported health, well-being, personality, stress, coping, and of attitudes toward aging (see Figure 28). In January 2014, about 1,100 of the 2,200 BASE-II participants had been assessed. We expect that data collection for the first wave of measurements (T1) will be complete in fall 2014.

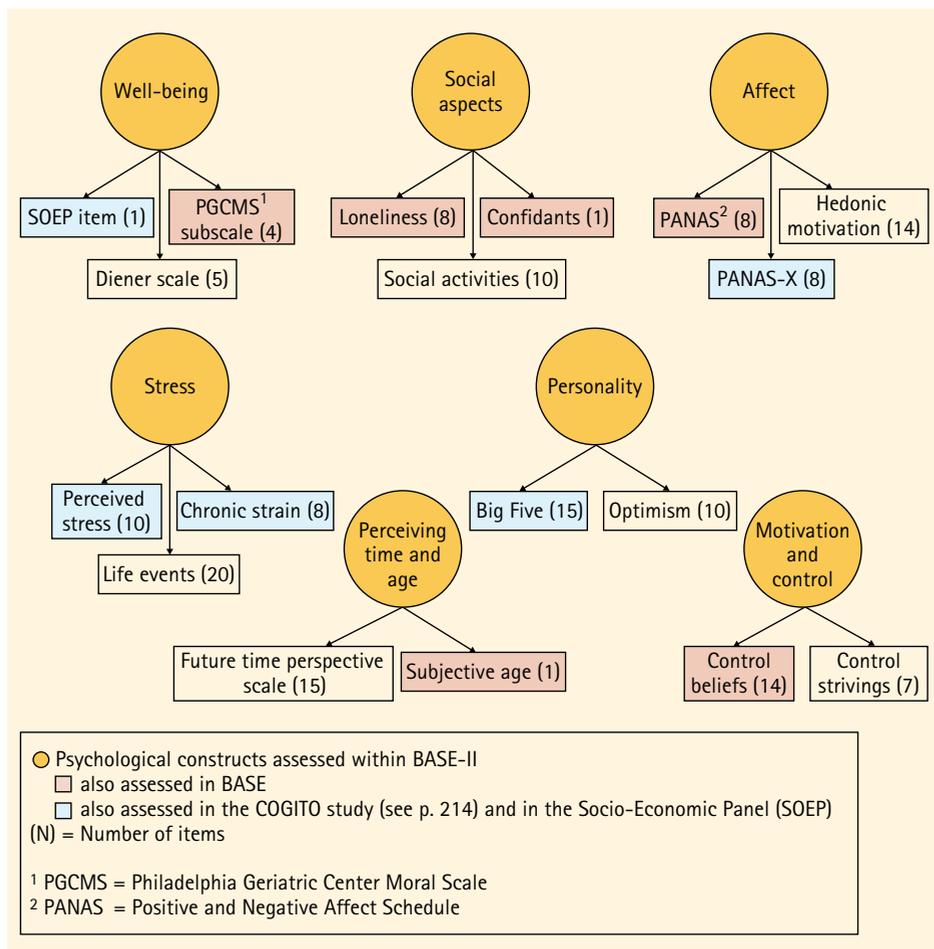


Figure 28. The psychological questionnaire of BASE-II. Measures marked in red were also assessed in BASE. Measures marked in blue were also assessed in the COGITO study (see p. 214), in the Socio-Economic Panel Study, or in both, to facilitate comparisons across studies and the estimation of sample selectivity. The number of items per construct is in parentheses.

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Overview of the Berlin Aging Study (BASE)

The multidisciplinary Berlin Aging Study (BASE), initially directed by the late Paul B. Baltes and Karl Ulrich Mayer, was started in 1989 under the sponsorship of the former West Berlin Academy of Sciences and Technology and its Committee on Age and Societal Development. Later, the study came under the auspices of the Berlin-Brandenburg Academy of Sciences. Ulman Lindenberger heads the current BASE core group at the MPI for Human Development.

The study involves eight measurement occasions spaced over 18 years. In addition, several subsamples have been recruited for intensive study. The distinguishing features of BASE include (1) a focus on the very old (70 to 100+ years); (2) a locally representative sample, stratified by age and sex; and (3) a broad-based interdisciplinarity (originally involving two research units from the Freie Universität Berlin, Internal Medicine and Psychiatry, and two from this Institute, Sociology and Psychology). In addition to discipline-specific topics, four integrative theoretical orientations guide the study: (1) differential aging, (2) continuity versus discontinuity of aging, (3) range and limits of plasticity and reserve capacity, and (4) aging as a systemic phenomenon.

The initial focus of BASE (1990–1993) was to obtain a heterogeneous sample, stratified by age and sex, of individuals aged 70 to 100+ years who completed a 14-session Intensive Protocol that involved detailed measures from each of the four participating disciplines. The original sample participating in this initial Intensive Protocol consisted of 258 men and 258 women from the western districts of Berlin. Seven longitudinal follow-ups of the survivors from this initial sample involving different depths of assessment have been completed at approximately 2-yearly intervals. A single-session multidisciplinary assessment was collected in 1993–1994 ($N = 359$), reduced versions of the Intensive Protocol (six sessions) were collected in the periods 1995–1996 ($N = 206$) and 1997–1998 ($N = 132$), and a repeat of parts of the Psychology battery together with multidisciplinary outcome variables (e. g., screening for dementia, assessment of well-being) in 2000 ($N = 82$), 2004 ($N = 46$), 2005 ($N = 37$), and 2008–2009 ($N = 22$; with an additional medical and dental focus). In addition, mortality information about the entire BASE sample is updated at regular intervals. The initial sample of 516 individuals formed the basis of the cross-sectional analyses reported in two monographs (in German: Mayer & Baltes, 1996, 1999; cf. Lindenberger, Smith, Mayer, & Baltes, 2010; in English: Baltes & Mayer, 1999, 2000). Current interests of the Psychology Unit of BASE include issues of sample selectivity and representativeness; intraindividual variability and change; terminal decline; cognitive aging; mortality prediction; self-related change, well-being, and antecedents of successful aging; and genetic predictors of individual differences in cognitive and self-related change in old age.

The Berlin Aging Study: International Research Group

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Research Project 7: Interactive Brains, Social Minds

In everyday life, people often need to coordinate their actions. Common examples include walking with someone at a set pace, playing group sports, dancing, playing music in a duet or group, as well as a wide range of social bonding behaviors, such as gaze coordination between mother and infant or between partners. The developmental and social significance of these interpersonally coordinated behaviors is undisputed, but little, if anything, is known about the brain mechanisms that regulate their temporal dynamics. The *Interactive Brains, Social Minds* project investigates lifespan changes in the behavioral and neural mechanisms that permit individuals to coordinate their behavior in time and space (see Figure 29). During the reporting period, the project was structured into two parts, one specializing on infant development and the other seeking to develop experimental paradigms to study neural correlates of interpersonal action coordination.

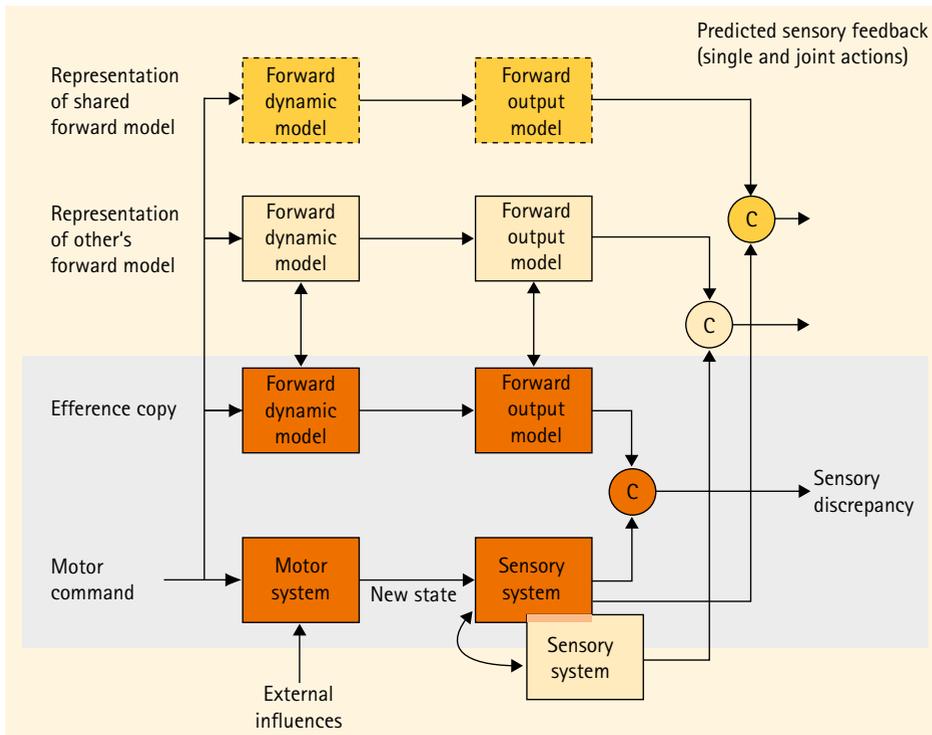


Figure 29. A forward model of interpersonal action coordination. Drawing on the work of Steven M. Boker, Wolfgang Prinz, Daniel Wolpert, and others, our model assumes that interpersonal action coordination is based on a set of linked representational layers. The single-person layer is shaded in gray. Individuals acting together attempt to synchronize their forward model regarding their own actions with their forward model regarding the other person's actions. Highly skilled individuals, such as dancers or musicians, may represent jointly performed activities as a unified suprapersonal action with a joint forward model and partially joint sensory feedbacks. The various representational layers of the actors are intertwined by sensorimotor feedback loops (see also Sängler, Lindenberger, & Müller, 2011).

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The Interactive Brains BabyLab

From early on, infants learn from their conspecifics and perceive them as social partners. The research focus of the BabyLab is on the behavioral and physiological indica-

tors of social interaction processes and on the perceptual and cognitive mechanisms related to these processes, such as memory (Kopp & Lindenberger, 2012) and multisensory integration (Kopp & Dietrich, 2013).

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Key Reference

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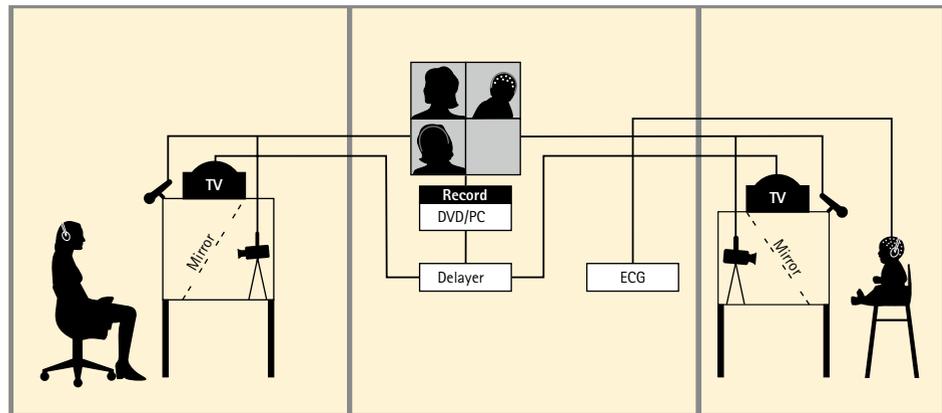


Figure 30. The double-screen setup used to study infants' sensitivity to social contingency and audiovisual temporal integration. The setup allows manipulation of the timing of audiovisual responses of one or both interaction partners.

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The neural dynamics of audiovisual synchrony and asynchrony perception were studied in 6-month-old infants using event-related brain potentials (ERP; Kopp & Dietrich, 2013). Movies of a woman clapping her hands were presented to the infants with the visual and auditory input synchronized in one condition and with a visual delay of 400 ms in the other condition. Behavioral results from an experiment using a habituation-test paradigm indicated that the infants were able to detect the 400-ms asynchrony. ERP revealed latency shifts in the auditory components N1 and P2 between synchronous and asynchronous events despite auditory input having occurred at the same point in time in both experimental conditions. This result suggests that the infant brain processes and represents the temporal relation between visual and auditory stimuli. Moreover, neural processing was already affected prior to the auditory onset (infant ERP components Pb and Nc), suggesting that the infant anticipates multimodal temporal relations between two sensory events. In a follow-up experiment, the magnitude of the visual delay was set to 200 ms, a delay which is known to correspond to simultaneity perception in infants in the first year of life. In line with this, 6-month-old infants indeed failed to show any behavioral signs of being able to detect the 200-ms delay, suggesting the presence of perceptual fusion. Nevertheless, brain activity differed

significantly between synchronously presented and perceptually fused items; N1 and P2 latency delays were not observed for fused stimuli. The visual recognition components Pb and Nc were once again modulated prior to sound onset, emphasizing the importance of anticipatory visual events for predicting auditory signals. The ERP results point to neural mechanisms that permit young infants to predictively adjust their ongoing neural activity to the temporal synchrony relations between the auditory and visual modalities. Second, we studied infants' ability to process auditory and visual signals in a live social interaction with their mothers in a context in which the two sensory modalities are not in perfect temporal alignment. In this experiment, 3- and 5-month-old infants interacted with their mothers via a double-screen setup (see Figure 30). Critically, the mothers' visual presentation was either synchronized or temporally delayed with respect to the auditory signal. The magnitude of the delay was manipulated parametrically (250 ms, 350 ms, 450 ms) to reflect the various different perceptual states ranging from simultaneity to asynchronous perception as previously ascertained in infancy research. Ongoing analyses focus on the behavior and the heart rate of the infant and the mother and their interrelations as a function of temporal delay. In a third line of research, the BabyLab investigates mechanisms of action prediction

and action simulation in infants (Dissertation Cathleen Bache). In a first experiment, we used EEG and eye-tracking to study the neural dynamics of human movement versus object movement processing before, during, and after visual occlusion in 10-month-old infants. Stimulus predictability was manipulated by presenting continuous versus noncontinuous movement prior to the occlusion. From an internal simulation point of view, the neural signature of action prediction should differ between continuous human movement and all other types of movement. Frequency analyses of the EEG data revealed that frontal theta activity was higher for noncontinuous compared to continuous movement both before and after the occlusion as well as for object movement compared to human movement during occlusion, suggesting that attentional processes provide support for keeping track of the movement being observed. Importantly, central alpha power did not differ between the experimental conditions, rendering it unclear as to whether internal simulation contributes to the processing of occluded movements. Hence, we conducted a follow-up experiment to further examine whether 10-month-old infants mentally simulate continuous human movement in real time. The infants were again presented with short video clips of human movement. This time, movement prior to the occlusion was manipulated, but the visual input during and following the occlusion was kept constant. Relative to the preocclusion phase, the stimuli were continuous, delayed, or shifted forward following occlusion. Analyses of EEG frequency patterns and eye-tracking data are currently underway.

The Interactive Brains LifespanLab

During the reporting period, the LifespanLab continued to develop experimental paradigms that may be suitable for the study of interpersonal action coordination. A major emphasis was placed on analyzing the EEG of skilled musicians playing music together (see Figure 31). In the initial study with guitar duets, Lindenberger, Li, Gruber, and Müller (2009) had found that interpersonally coordinated actions are preceded and accompanied by



Figure 31. To identify the neural correlates of interpersonal action coordination, the *Interactive Brains, Social Minds* project recorded the EEG of musicians playing together under a variety of experimental conditions.

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within-brain synchrony and between-brain oscillatory couplings. To further probe the functional significance of these couplings, we refined the experimental paradigm and the data-analytic tools (e. g., Müller, Sänger, & Lindenberger, 2013; Sänger, Müller, & Lindenberger, 2012, 2013; Dissertation Johanna Sänger). In one study, Sänger et al. (2012) alternated the musical roles of leader and follower between musicians playing a duet. The connection strengths within and between brains increased at frontal and central electrodes during periods that placed particularly high demands on musical coordination (e. g., at the onset of playing and during tempo changes). Phase locking was modulated in relation to the musical roles of leader and follower, thus corroborating the functional significance of synchronous oscillations in dyadic music performance (see Figure 32). In further analyses, we observed that directed coupling measures between the two brains were associated with the functional roles of leader and follower (Sänger et al., 2013). In a further study, we conducted single-trial analyses of EEG signals recorded from eight pairs of guitarists engaged in musical improvisation (Müller, Sänger, & Lindenberger, 2013). We found that the intrabrain connections primarily involved higher frequencies (e. g., beta), whereas interbrain connections primarily operated at lower frequencies (e. g., delta and theta). Taken together, this series

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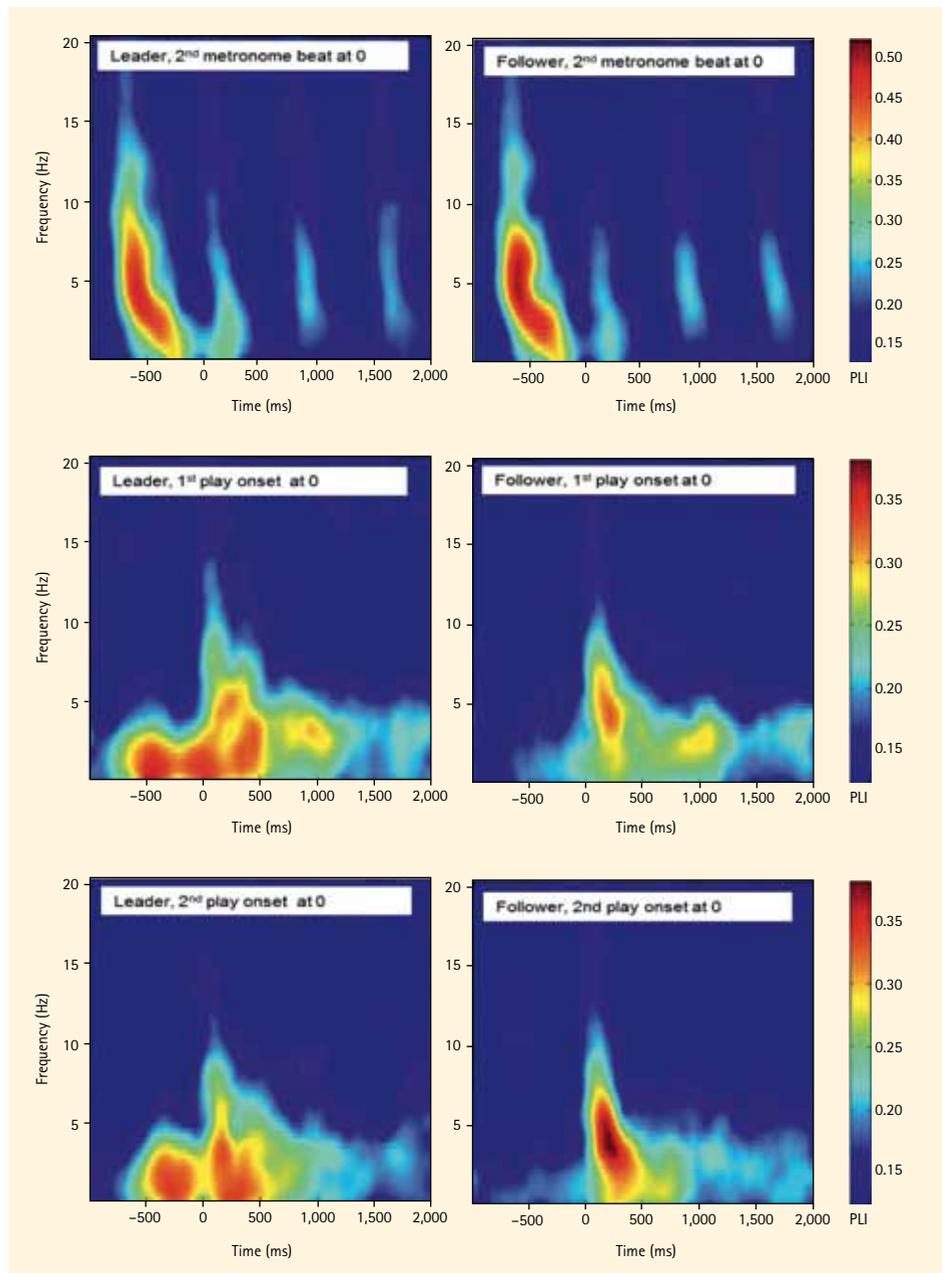


Figure 32. Time–frequency diagrams of the grand average of the phase-locking index (PLI) reveal differences between leader and follower in two musicians playing a duet. In each plot, time is displayed on the X-axis and frequency on the Y-axis. Colder colors represent lower PLI values and warmer colors higher values. The plots display the grand average PLI across frontal electrodes (Fp1, Fpz, Fp2, F7, F3, Fz, F4, F8) of the *leader* (plots on the left) and of the *follower* (plots on the right). The upper two panels focus on the second metronome beat before play onset, whereas the middle and lower panels focus on the first and second play onset, respectively (adapted from Sanger, Lindenberger, & Muller, 2012).

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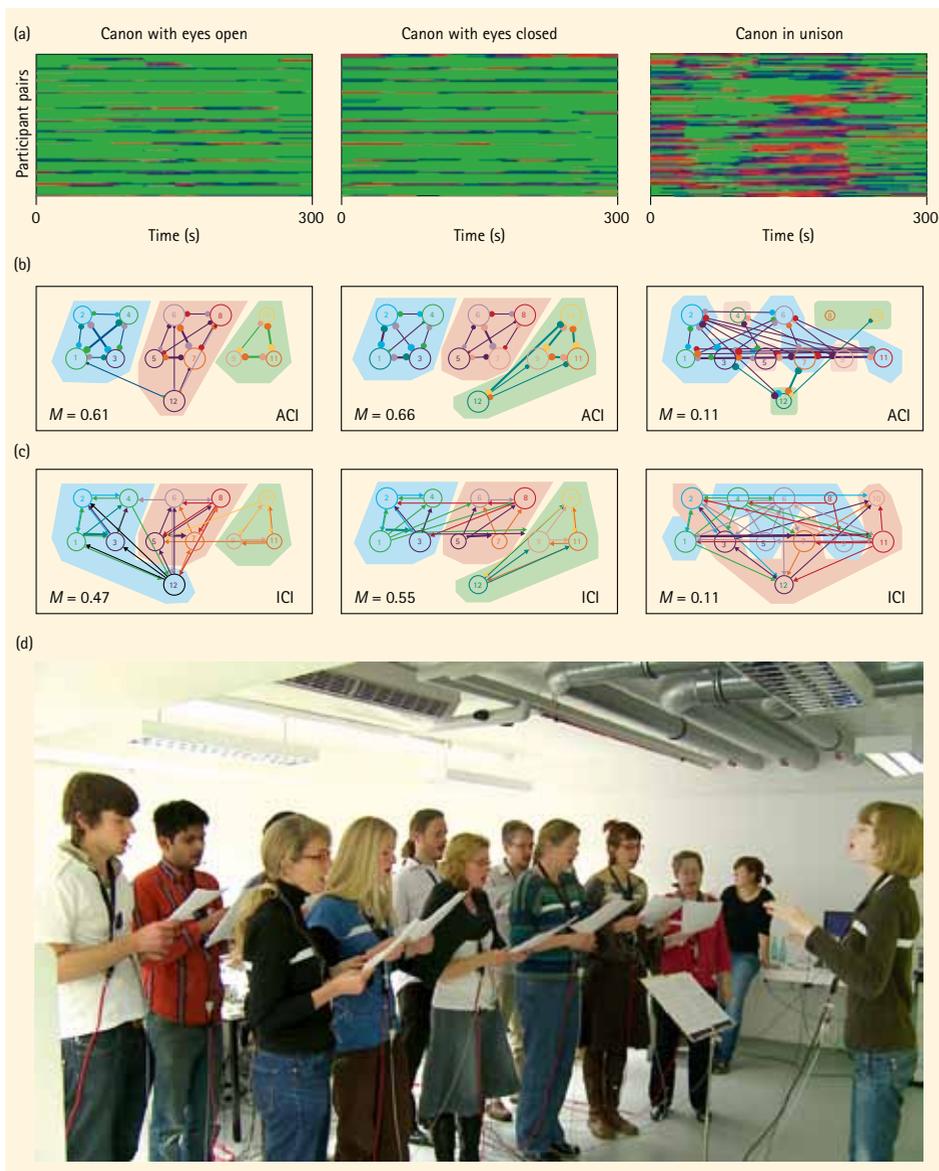


Figure 33. Phase synchronization patterns, connectivity networks, and modularity effects during different canon-singing conditions. (a) Pair-wise phase synchronization patterns of the entire choir for the three canon-singing conditions: canon singing with eyes open (left column), canon singing with eyes closed (middle column), and canon singing in unison (right column). Each diagram contains 132 lines displaying a synchronization pattern of all possible participant pairs in the choir. In the case of two persons, A and B, a red line indicates that the phase of person A precedes the phase of person B, whereas a blue line indicates that the phase of person B precedes the phase of person A; a green line represents absence of synchronization. (b) Networks for the three conditions based on the Absolute Coupling Index (ACI), an undirected coupling measure. (c) Networks for the three conditions based on the Integrative Coupling Index (ICI), a directed coupling measure. ACI and ICI were determined at the low frequency of 0.03 Hz. The circles represent individual singers, except for the circle placed in front, representing the conductor. Colored areas indicate the partition of the networks into modules. Modularity was more pronounced when singing the canon in three different voices than when singing the canon in unison. (d) The Institute choir during the experiment. The choir was established in summer 2008 and is directed by Juliane Oppelt (see also Müller & Lindenberger, 2011).

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Müller, V., & Lindenberger, U. (2011). Cardiac and respiratory patterns synchronize between persons during choir singing. *PLoS ONE*, 6(9): e24893. doi:10.1371/journal.pone.0024893.

of studies has replicated and extended the original findings reported by Lindenberger et al. (2009) and will guide our search for mechanisms that enable individuals to engage in temporally coordinated joint action. In a related line of research, we used simultaneous electrocardiogram and respiration measures to investigate between-person synchronization in 11 singers and 1 conductor engaged in choir singing (Müller & Lindenberger, 2011). We found that phase synchronization both in respiration and heart rate variability increased significantly during singing relative to a rest condition. Synchronization was higher when singing in unison than when singing pieces with multiple voice parts. Directed coupling measures suggested the presence of causal effects of the conductor on the singers. Finally, network analyses of cardiac and respiratory activity based on graph theory were able to recover the different voices of the choir (see Figure 33). The results of this study suggest that the physiological signature

of interpersonal action coordination is not confined to brain activity but also includes cardiac and respiratory patterns. Finally, together with colleagues from the MPI for Biological Cybernetics, Dionysios Perdakis, Timothy R. Brick, and other members of the project have taken a close look at the neural mechanisms in the perception of static and dynamic facial emotional expressions. We presented three different forms of facial emotional expressions: static pictures, videos based on natural dynamics (i. e., short clips of actors performing angry and happy expressions), and videos based on "unnatural" dynamics (i. e., clips of shuffled movement dynamics). EEG analyses suggest that facial emotional expressions based on natural movement dynamics are processed differently than static pictures or videos based on unnatural dynamics, pointing to potential validity benefits associated with the use of experimental stimuli with intact natural dynamics.

Research Project 8: Brain Imaging Methods in Lifespan Psychology

Research on human development seeks to delineate the variable and invariant properties of age-graded changes in the organization of brain-behavior-environment systems. Magnetic resonance imaging (MRI) and magnetic resonance spectroscopy (MRS) have become indispensable tools for the noninvasive assessment of brain function, anatomy, microstructure, and metabolism. The *Brain Imaging Methods* project seeks to ascertain and improve the measurement quality of standard brain imaging protocols and to complement the standard repertoire by additional methods that carry promise for understanding the ways in which brains change as a function of maturation, learning, and senescence.

Central questions in lifespan psychology often are about the range and direction of change and variability, be it longitudinal change observed over years and decades, intervention-induced change over weeks and months, or fluctuations that occur from day to day and from moment to moment. Random measurement error and systematic drifts can compromise the reliable measurement of change. Hence, the project takes a special interest in exploring, safeguarding, and improving the precision and temporal stability of measurement.

Structural MRI is particularly important for lifespan research as the structural properties of brains, including their volumes, change with age and experience. Therefore, structural methods occupy a central place in the project. Examples include high-resolution T_1 -weighted imaging to obtain estimates of volume or thickness of specific substructures of the brain; diffusion imaging to obtain maps of tissue integrity of white and gray matter; susceptibility-weighted imaging to obtain maps of mineralization, especially for the brain's deep gray matter structures; and magnetization transfer imaging to map the exchange of magnetization between water protons and macromolecule protons, which serves as an estimate of cell membrane density.

Functional MRI is used to provide maps of brain activity under various conditions, such as during task performance or at rest. Here, the project takes special interest in high-resolution functional imaging of the hippocampus and is working (a) on the interleaved use of functional MRI and transcranial magnetic stimulation to experimentally test the contribution of specific brain regions to task

performance and (b) on arterial spin labeling to assess cerebral blood perfusion.

The Magnetic Resonance Imaging Laboratory

The planning phase for the MR Lab started in 2010. Construction work and installation took place in the course of 2011. For various reasons, including the homogeneity of the magnetic field, we opted for a Siemens TIM Trio tomograph, which has a field strength of 3 Tesla. The MR Lab (see Figure 34) is located in the basement of a building adjacent to the Institute. To avoid measurable field distortions, the tomograph was placed more than 10 meters away from moving masses of iron, such as cars or elevators. The tomograph was ramped up in December 2011. After an extensive test phase, the first empirical study was conducted in April 2012.

The Institute's tomograph is equipped for proton (^1H) MRI and MRS with a 32-channel receive system, two 12-channel and two 32-channel head radio frequency coils, and a circularly polarized birdcage headcoil. Instrumentation for phosphorus (^{31}P) MRS, that is, a dual-tuned circularly polarized head coil, a dual-tuned surface coil, and an additional high-frequency amplifier working at the resonance frequency of phosphorus, is also available. Additional components include a transcranial magnetic stimulation system with an MR-suited stimulation coil; an MR-suited EEG system; an audio/video stimulus presentation system using headphones and goggles; a visual presentation system based on video projection, mirrors, and a screen; an MR-compatible eye-tracking system; and a variety of hand-held response boxes for children and adults.

Researchers

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Ulman Lindenberger

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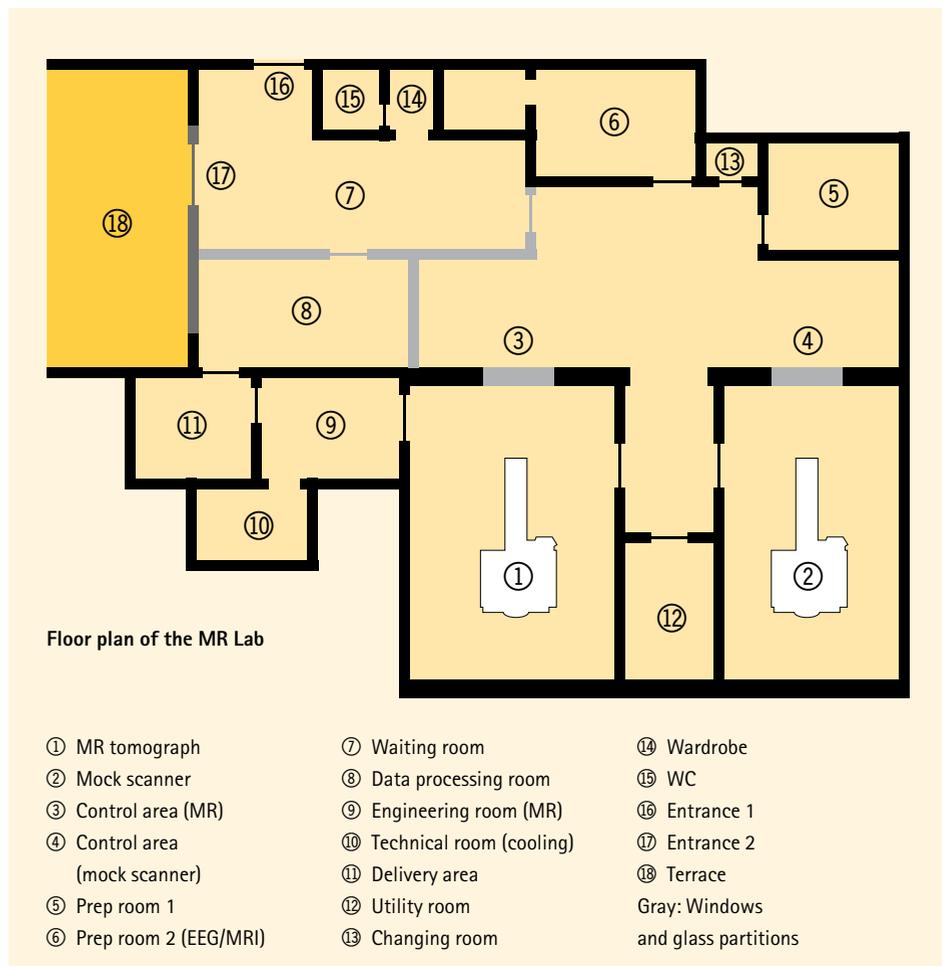


Figure 34. The MR Lab is located in a building adjacent to the Institute that also houses the Movement Lab and rooms for behavioral testing. It consists of the MR tomograph room, the mock (i. e., fake) scanner room, the conjoint operating area, a data processing room, prep rooms, a waiting area, and engineering and utility rooms.

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The laboratory also houses a mock (i. e., fake) scanner that looks identical to the real scanner. The mock scanner is used to familiarize research participants, in general, and children, in particular, to the scanning environment.

As of January 2014, the core MR team (see Figure 5 on p. 203) consists of Sonali Beckmann (head technical assistant), Nils C. Bodammer (physicist, head scientist), Thomas Feg (technician), Sebastian Schröder (technician, head MR manager), and Nadine Taube (technical assistant). The team provides scientific and technical support for all MR imaging activities at the Institute.

Imaging Methods of Special Interest

The project has begun to explore a range of imaging modalities that are of particular relevance for lifespan research. Two of these methods are described below.

Diffusion Imaging. Diffusion imaging captures the movement of water molecules, termed diffusion. Diffusion in tissue is hindered by cell membranes. Therefore, the orientation-dependent diffusion profiles provide information about tissue microstructure. For instance, when water molecules are observed in myelinated neuronal fibers, their diffusion is less hampered along than across fiber tracts. Diffusion within a voxel (i. e., a three-

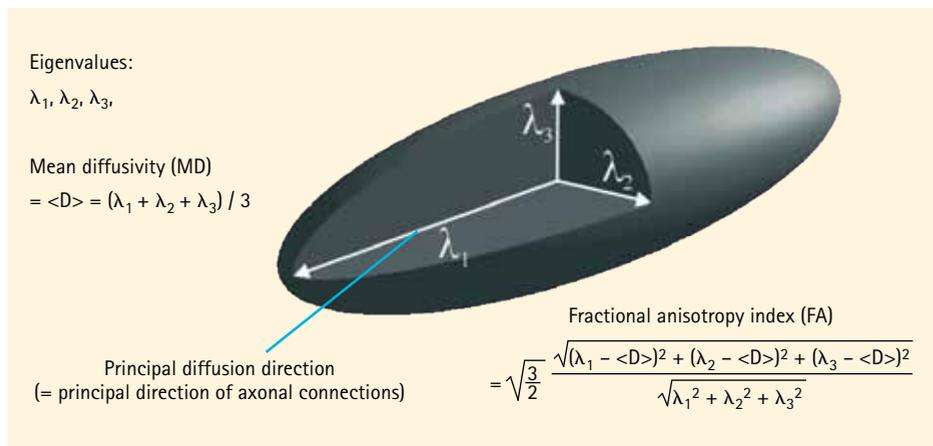


Figure 35. Diffusion imaging captures the movement of water molecules, termed diffusion. In biological tissue, diffusion is hindered by cell membranes. Diffusion is often expressed in terms of a tensor or ellipsoid. This yields two primary measures: (1) mean diffusivity, which is defined as the average of all three eigenvalues, and (2) fractional anisotropy, a measure of the relative lengthiness of the ellipsoid.

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dimensional data point) is often captured by a tensor (i. e., ellipsoid) model. For each voxel, a tensor is fitted to the diffusion data. This method, termed diffusion tensor imaging (DTI), yields two independent scalar measures, both derived from the three eigenvalues of the tensor (see Figure 35): (1) the mean diffusivity, which is defined as the average of all three eigenvalues; and (2) fractional anisotropy, a measure of the relative lengthiness of the ellipsoid. DTI provides information about the spatial orientation of the main diffusion direction and is sometimes used as the basis for tractography, which seeks to reconstruct the fiber connections of the brain based on local orientation information. However, by providing only one directional description per voxel, DTI provides an impoverished, and at times inaccurate, picture of histological reality. For instance, the crossing of fibers may go unnoticed. To enhance the microstructural veridicality of diffusion imaging, the project is working on methods that combine information derived from diffusion imaging with information derived from two other imaging modalities, magnetization transfer saturation imaging and short-T2 relaxation-time mapping. The project is also working on Q-ball imaging, a method suited to model more complex diffusion profiles. The combined use of these data acquisition and data analysis

protocols will provide a more realistic picture of age changes and age differences in the brain's structural connectivity.

³¹Phosphorus MRS. The mitochondria are organelles in eukaryotic cells that provide energy for the cell's metabolism through glycolysis (i. e., the releasing of energy stored in glucose). Adenosine triphosphate (ATP) is generated during glycolysis for high-energy short-time storage. ATP concentration levels are stabilized by the creatine kinase (CK) reaction, which buffers ATP. This means that, even when ATP is metabolized in the brain, the decrease in its concentration is usually very small. However, phosphocreatine (PCr) and inorganic phosphate (P_i), two other metabolites connected to ATP concentration via the CK reaction, markedly vary with energy metabolism. ³¹Phosphorus MRS can be used to estimate the brain's energy metabolism by simultaneously measuring the concentrations of ATP, PCr and P_i . In collaboration with Naftali Raz and Jeff Stanley from Wayne State University and Florian Schubert and Ralf Mекle from the Physikalisch-Technische Bundesanstalt, the project is working on establishing ³¹phosphorus MRS as a technique at the Institute. ³¹Phosphorus MRS will allow researchers at the Center to chart the ranges of cerebral energy consumption from childhood to old age.

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Research Project 9: Formal Methods in Lifespan Psychology

Since its foundation by the late Paul B. Baltes in 1981, the Center for Lifespan Psychology has sought to promote conceptual and methodological innovation within developmental psychology and in interdisciplinary context. Over the years, the critical examination of relations among theory, method, and data has evolved into a distinct feature of the Center. The temporal resolution of data relevant for lifespan research varies widely, from the millisecond range provided by behavioral observations to the small number of occasions spread out over several years provided by longitudinal panel studies. The *Formal Methods* project is dedicated to developing multivariate mathematical, statistical, and computational research tools that accommodate complex research designs with multimodal assessments collected over a wide range of timescales. It seeks to provide practical solutions to the methodological challenges of lifespan research and to other fields of scientific inquiry. Its main goals are to critically examine the link between theory and data and equip researchers with means to improve the efficiency of data acquisition and data analysis. During the reporting period, the project has expanded its substantive and methodological scope and has attracted a new cohort of predoctoral students.

The project is particularly interested in analyzing and classifying patterns of variability and change. Hence, the project has further broadened its interest in Structural Equation Modeling (SEM) methods. SEM integrates a wide range of different multivariate analysis techniques by modeling the relationship between latent and observed variables. During the reporting period, project members have shown how SEM as a formal language can assist researchers in: (a) finding the optimal constellation of resource investments when planning a longitudinal study, (b) refining or modifying prior hypotheses through exploratory data mining, (c) treating time as a continuous variable in longitudinal research, (d) modeling the emergence of individuality and its relationship to brain plasticity, (e) analyzing and classifying high-dimensional time series. The project members have also worked on Onyx, a freely available, new statistical package for SEM. Below, we provide summaries of research from each of these areas.

Optimal Study Design

Longitudinal panel studies are a key empirical method to chart between-person differences in behavioral and neural development. Such studies often require a large investment of resource funds and are often characterized by a relatively large number of individuals, a range of more or less reliable measurement instruments, and a relatively small number of measurement occasions. The statistical power

to detect a particular effect, that is, the probability that a statistical test will reject a false null hypothesis of no effect, intuitively or explicitly informs the research design of longitudinal panel studies. In the past, computational tools have been used to approximate or simulate the statistical power for a given effect and research design. However, the full spectrum of trade-off relations between the parameters of different, potentially implementable research designs has been difficult to examine with available statistical theory and tools. It was very tedious for a researcher to find out, for instance, how much he or she would need to increase measurement reliability to capture individual differences in linear change with the same power, but a shorter study duration, fewer measurement occasions, or a combination of both.

To overcome this impasse, Timo von Oertzen has proposed the general notion of power equivalence in SEM (von Oertzen, 2010). The guiding idea behind this notion is to formalize the trade-off relations in statistical power between design parameters in SEM. As a result, researchers can inspect "iso-power contours," that show, for instance, how measurement reliability trades off with the number or with the spacing of measurement occasions. Inspection of these iso-power contours allow researchers to optimize their study design with respect to a specific outcome, such as monetary cost or participant strain.

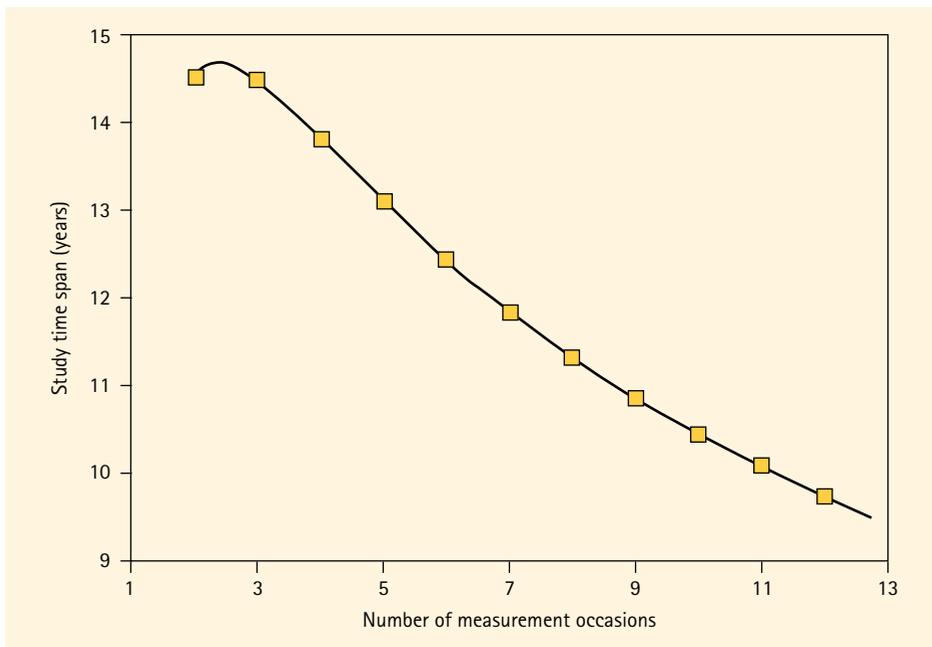


Figure 36. BASE followed 516 older participants aged 70 to 103 years at the beginning of the study for up to 13 years with 6 occasions of measurement in this period (i.e., one initial in-depth measurement followed by further assessments after approximately 2, 4, 6, 8.5, and 13 years). The graph shows designs that are identical in the power to detect between-person differences in change under the assumption of no attrition. The number of occasions equally distributed over time is shown on the X-axis and the total duration of the study is shown on the Y-axis. Researchers can read from the graph that observing individuals about ten times over 11 years has the same statistical power as observing individuals about three times over 14.5 years (adapted from von Oertzen and Brandmaier, 2013).

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Von Oertzen and Brandmaier (2013) illustrated this approach to statistical power with data from the Berlin Aging Study (BASE; cf. pp. 233–238). They modeled interindividual differences in cognitive and sensory decline using a latent growth curve model with a linear component of change and then assessed the statistical power to detect variance in change as a function of study design parameters (see Figure 36). They also noted that longitudinal aging studies are characterized by attrition, which is often mortality-related and selective, and showed how calculations of power equivalence can take attrition into account.

To enable researchers to calculate alternative study designs that are power-equivalent using linear latent growth curve models, the project members have written a computer program with a graphical user interface. The program allows users to change study parameters interactively and obtain alternative study

designs. For a beta version of this program, see www.powerequivalence.com.

Exploratory Data Mining

Brandmaier, von Oertzen, McArdle, and Lindenberger (2013) introduced Structural Equation Model Trees as a multivariate statistical method that combines the benefits of confirmatory and exploratory approaches to data analysis. SEM Trees are grounded in two well-established paradigms, SEM as a confirmatory method and recursive partitioning or decision trees as an exploratory method. SEM Trees add an exploratory dimension to SEM by offering a data-driven yet hypothesis-constrained exploration of the model space. The project addressed a number of methodological questions in the application of SEM Trees, such as variable selection bias and overfitting. It also extended the paradigm to encompass Hybrid SEM Trees, which allow for subgroup differences in model struc-

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ture. Instead of selecting the single “best” hypothesis for the total sample, Hybrid SEM Trees generate a set of different hypotheses for subgroups that have been identified by covariates of interest. In initial applications, we have demonstrated the benefits of SEM Trees for various data sets, including data from the Berlin Aging Study. John J. Prindle has been working on ways of alleviating the considerable computational burden that SEM Trees can impose. He has also joined Andreas M. Brandmaier in developing SEM Trees as a package for the *R Project for Statistical Computing*.

At the same time, the project members continued to work on model-free tree structures for clustering time series. We proposed Permutation Distribution Clustering as a new clustering scheme that encodes dissimilarity between time series as dissimilarity between their permutation distributions and thus as differences in the complexity of the observed process.

Continuous Time Structural Equation Modeling

Longitudinal data analysis is an essential task of developmental research. However, choosing the most suitable model to address a particular research question is not always easy. Manuel C. Voelkle and colleagues have

been working on developing, adapting, and evaluating new methods to analyze change. Special attention was paid to the use of dynamic models that model the mechanisms of change instead of merely describing them (Voelkle & Oud, in press).

Most dynamic models that are currently in use in psychological research, including the popular autoregressive cross-lagged panel models, assume that measurement occasions are equally spaced in time. The failure to account for unequal spacing of measurement occasions may seriously bias parameter estimates, thereby leading to design-specific results that do not generalize across studies and prevent the generation of cumulative scientific knowledge. SEM-based continuous time modeling ameliorates this problem because study findings are expressed in continuous time, which does not depend upon the choice of specific time intervals (Voelkle, Oud, Davidov, & Schmidt, 2012). In this context, the project has shown that using individually varying time intervals can improve the identification of oscillating processes when the overall sampling rate is low (see Figure 37; Voelkle & Oud, 2013). As demonstrated by Voelkle and Oud (in press), SEM-based continuous time models are closely related to latent change score models, which represent a well-known approach to study-

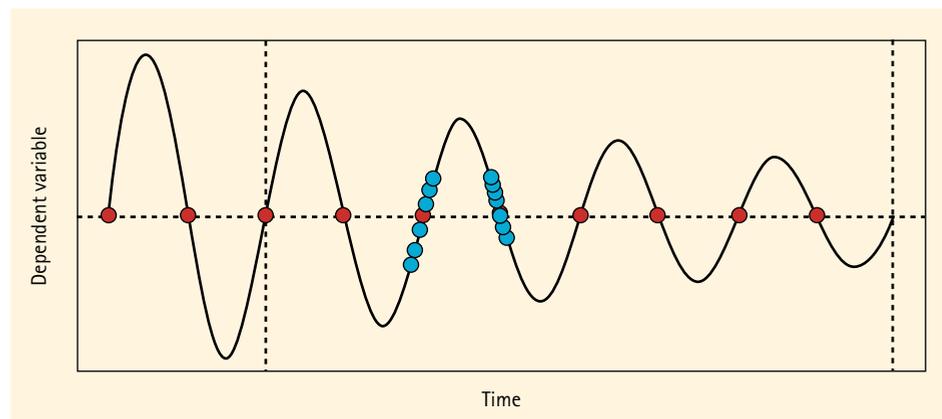


Figure 37. Damped oscillating process with a frequency of just under 1 Hz. The red dots correspond to discrete time observations with a sampling rate of 2 Hz. Although it would be possible to reconstruct the generating process from the discrete sampling points (according to the so-called Nyquist-Shannon sampling theorem), this is often difficult in practice (just as the reader would have difficulty in seeing that the red dots are not located along a straight line). Individuals (represented by blue dots) that deviate from the average sampling points (here at assessment wave 5 and 6) may help to identify the generating process (adapted from Voelkle & Oud, 2013).

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ing change. However, some of the formal and practical restrictions that exist in latent change score SEM are absent in continuous time SEM. This opens up new possibilities for dynamic models of normal cognitive aging, which are currently being explored by John J. Prindle and colleagues using data from the ACTIVE study.

Together with Han Oud from the University of Nijmegen, Manuel C. Voelkle and Charles Driver are currently developing CT-SEM, a user-friendly R package for continuous time analyses. Building upon these recent methodological advances, in related work, the project will further investigate theoretical principles and methodological strategies that integrate between-person and within-person perspectives in psychological research (Dissertation Janne Adolf).

Brain-Behavior Relations and the Emergence of Individuality

Together with colleagues from the DFG-Center for Regenerative Therapies Dresden—Cluster of Excellence at the Technische Universität Dresden (CRTD) and the Dresden site of the German Center for Neurodegenerative Diseases (DZNE), Andreas M. Brandmaier and Ulman Lindenberger examined how organisms evolve into individuals that differ from each other (Freund et al., 2013). Specifically, the researchers observed 40 genetically identical mice that were kept in an enclosure offering a great variety of different options for exploration. The mice were equipped with tiny radio-frequency identification chips that emitted electromagnetic signals whenever they came across any of the antennas distributed throughout the cage. The researchers hypothesized that, despite their identical genetic makeup and exposure to a nominally identical environment, the mice would end up showing different behaviors, and that these differences would increase over time. To quantify individual differences in exploration behavior, Andreas M. Brandmaier suggested the measure of roaming entropy. Roaming entropy was defined as the Shannon entropy of the roaming distribution, which is a spatial distribution describing the probability of finding a mouse at a particular location in the

cage. Mice with low roaming entropy typically have local roaming distributions, that is, they restrict themselves to staying within certain limited areas of the enclosure. By contrast, mice with high roaming entropy make full use of the complex environment and show less preference for certain areas of the cage (see Figure 38).

Interindividual differences in how roaming entropy changed over time were modeled with a latent growth curve model. The observed individual differences in behavioral trajectories were large and statistically reliable. Even more intriguingly, there was a correlation between roaming entropy and brain plasticity: Mice that explored their habitat more thoroughly also grew a greater number of new neurons in the hippocampus. Thus, with the help of advanced information-theoretic and statistical methods, including structural equation models, it was possible to show that personal experiences and individual behavior contribute to the individualization of the brain. Together with Gerd Kempermann and members from his group in Dresden, we will continue working with this animal model to address whether and how epigenetic mechanisms contribute to the emergence of individual differences.

Analysis and Classification of High-Dimensional Time Series

During the reporting period, Timothy R. Brick has been working on the expansion and application of a graphical user interface for face models. This involved collaborations with other research groups at the Institute, the University of Virginia, and the University of Zurich. He has also been studying the way in which emotions are perceived and expressed on the face, especially in conversations. In a related line of research, the project members are adapting methods and algorithms from machine learning for use in psychology and neuroscience (Dissertation Julian David Karch). One focus is on ensemble learning, a technique that creates multiple hypotheses about data and applies a voting scheme to create a metahypothesis that, ideally, describes the data best. Julian David Karch is working on several statistical and

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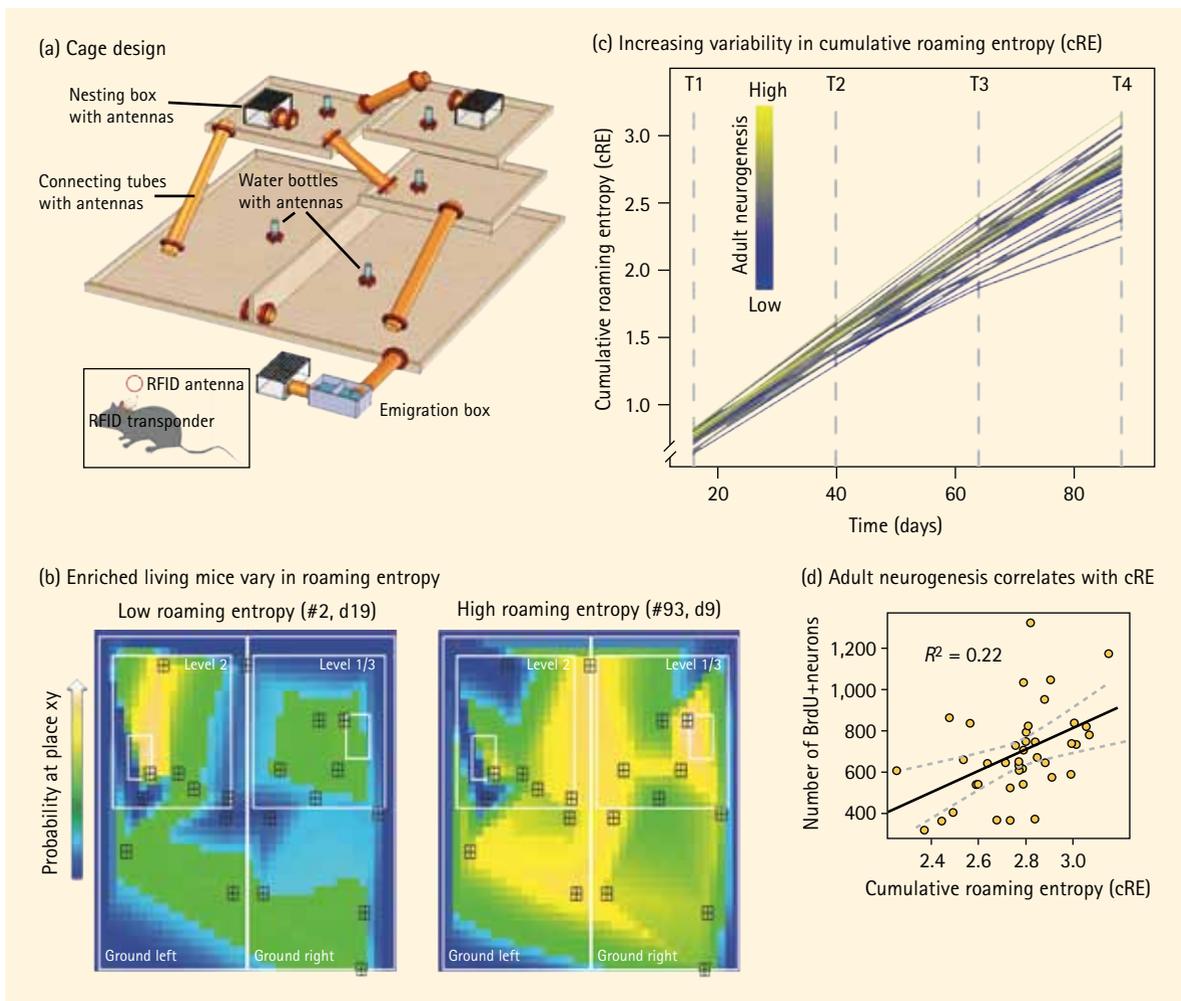


Figure 38. The emergence of individuality in genetically identical mice living in a nominally identical environment. (a) Shows a schematic illustration of the enclosure that housed 40 female mice. (b) Illustrates roaming entropy, which quantifies the coverage of space for a given individual. The heatmaps depict the probability of a mouse being at a specific location in the cage. Low probabilities are shown in blue, medium probabilities in green, and high probabilities in beige (see the arrow on the left). The boundaries of the cage, levels, and nesting boxes are indicated in white. The antenna positions are shown in black. The left panel shows a mouse with low roaming entropy (Animal No. 2 at day 19) and the right panel shows a mouse with high roaming entropy (Animal No. 93 at day 9). (c) Measurements of roaming entropy were aggregated into four adjacent time periods to obtain an index of cumulative roaming entropy (cRE). Each line displays the cRE for a single mouse. Corresponding levels of neurogenesis are continuously color coded from low (blue) to high (yellow). The mice differed reliably in rates of linear change in roaming entropy. (d) Individual differences in cumulative roaming entropy are associated with individual differences in adult hippocampal neurogenesis. The number of new neurons correlated significantly with cumulative roaming entropy at T4, $r = 0.46$ ($t = 3.227$, $P = 0.0026$) (adapted from Freund et al., 2013).

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information-theoretic potential improvements to the application of ensemble analysis to EEG data. In addition, he is working on establishing a link back from high-dimensional, nonlinear models to the sort of simple hypotheses researchers can make sense of. A second line of research focuses on exploring relevant combinations of time frames,

frequency bands, and electrodes in EEG recordings of working-memory tasks. While traditional hypothesis-driven approaches typically fail because of the sheer quantity of data and possible hypotheses, machine learning may help researchers to identify what is relevant in the context of a specific research question.

Graphical Modeling With Onyx

Onyx is a freely available software environment for creating and estimating SEM. It offers a graphical user interface to facilitate the generation of models, and includes a powerful back-end for performing maximum likelihood parameter estimation. Andreas M. Brandmaier and Timo von Oertzen, together with Siny Tsang from the University of Virginia, started developing Onyx in 2012 (see www.onyx.brandmaier.de).

Onyx utilizes a graphical approach to modeling that offers an easy transition between matrix- and script-based model definitions without introducing yet another algebraic or script-based SEM notation itself. Apart from its graphical representation, Onyx also provides access to RAM-based matrix notation, model-implied correlations, and model-implied covariance matrices, as well as script-based model definitions for other software

packages, which currently include OpenMx, lavaan, and Mplus. One major difference between Onyx and other SEM programs is that it already starts computing solutions while the user is constructing the model. Furthermore, Onyx employs a multiagent algorithm for estimating parameter values; instead of starting the optimization at a single point in likelihood space, optimization starts at multiple points in parallel, which renders the specification of starting values obsolete in most cases.

During the reporting period, Timothy R. Brick has continued to be involved in developing OpenMx. The Onyx development team added capabilities to the program, such as joint analysis of continuous and ordinal variables and the ability to parallelize large computations. The testing of other features, such as Weighted Least Squares fitting and fast analytic gradient computation (see von Oertzen & Brick, in press), has been completed.

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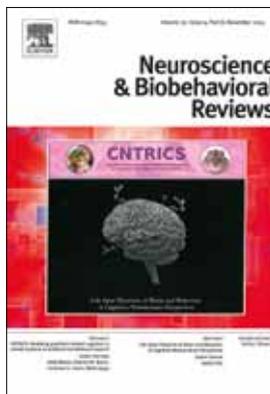
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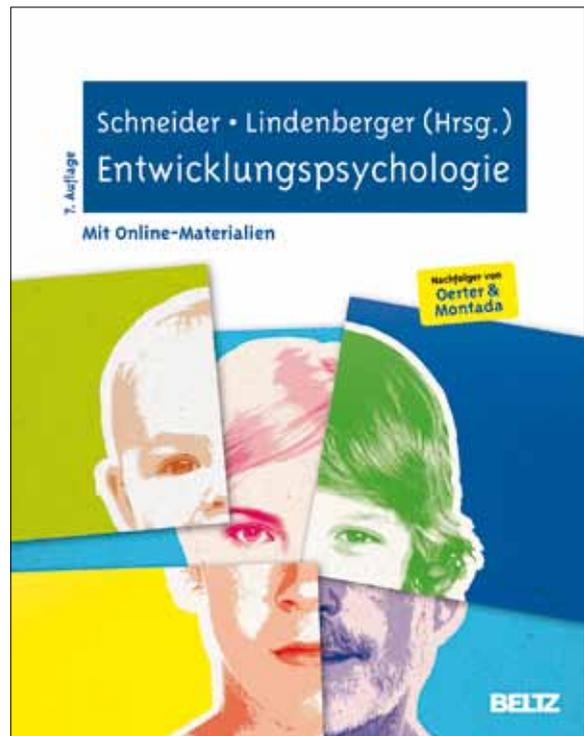
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Max Planck Research Group

Affect Across the Lifespan

Max Planck Research Group

The **Max Planck Research Group "Affect Across the Lifespan"** (Head: Michaela Riediger) investigates age differences in affective experiences and competencies from adolescence to old age. A first research emphasis on affect dynamics involves investigations on age differences in the inner experiences, outward expressions, and physiological processes associated with affective experiences and on their underlying mechanisms. A second research emphasis on affective competencies focuses on age differences in abilities related to understanding and managing emotional aspects of life.



Research Team 2011–2013

Antje Rauers, **Michaela Riediger**, Cornelia Wrzus (as of 09/2013: Johannes Gutenberg University Mainz, Germany)

Postdoctoral Fellows

Gloria Luong, Markus Studtmann (until 06/2012)

Predocctoral Fellows

Elisabeth Blanke (MaxNetAging Research School), Kathrin Klipker (LIFE)

Visiting Researcher

Michael Boiger (University of Leuven [KU Leuven], Belgium)

Introductory Overview

How do emotional experiences change from adolescence to old age? And how does the ability to understand and deal with affective experiences develop across the lifespan? The Max Planck Research Group "Affect Across the Lifespan" seeks to contribute to a better understanding of these questions. Without the abilities to experience, express, understand, and control affective states—such as anger or joy—we would not succeed in many life tasks, from forming and maintaining social relations to successfully pursuing a career. The purpose of this Research Group is to provide new insights on age-related differences in these various facets and competencies of affective functioning, focusing primarily on the age range from adolescence to old age. Unique features of our research approach are the combination of a mobile-phone-based experience-sampling technology with psychophysiological monitoring and controlled experimental paradigms, and the consideration that affective functioning takes place in, and is influenced by, the individual's social and ecological context.

Overview of Research Emphases

Our work is characterized by two interrelated research emphases. A first emphasis on *affect dynamics* involves empirical investigations on age-related differences in the inner experiences, outward expressions, and physiological processes associated with affective experiences from adolescence to old age and on the mechanisms underlying these age-related differences, such as motivational and cognitive processes. A second research

emphasis on *affective competencies* is characterized by empirical investigations on age-related differences in abilities related to understanding and managing emotional aspects of life. This report gives an overview of our research activities regarding both research emphases between 2011 and 2013. We start out with our research on affect dynamics and then turn to our second research emphasis on age-related differences in affective competencies.

Research Emphasis 1: Age-Related Differences in Affect Dynamics

Our investigations of affect dynamics involve various studies, age groups, and methodological approaches. Below, we briefly summarize our core research activities on this topic during the report period from 2011 to 2013.

The Multi-Method Ambulatory Assessment (MMAA) Project

This project is a longitudinal research endeavor that we have been conducting since 2007 in cooperation with Max Planck Research Fellow Gert G. Wagner and the Center for Lifespan Psychology. Five measurement phases in a total sample of about 600 participants ranging in age from adolescence to old age have been completed (see Figure 1). Most participants have completed two or more of these measurement waves. The main goal of this project is to chart various aspects of affective functioning and their interrelations with motivational and cognitive processes over time, as they naturally occur in the daily lives and natural environments of individuals

from various age groups. To meet this aim, we combine several ambulatory assessment methodologies, which allow measurements of experiences, cognitive capacity, and physiological processes in daily-life contexts, with interview techniques and well-controlled experimental paradigms. Ambulatory assessment methods include mobile-phone-based experience sampling and ambulatory bio-monitoring of cardiac activity (assessed via 24-hour electrocardiography), physical activity (assessed via 24-hour accelerometry), and hormonal processes (assessed via repeated ambulatory saliva samples).

A comprehensive summary of all research activities within the MMAA project during 2011 and 2013 is beyond the scope of this report.

Core Research Team

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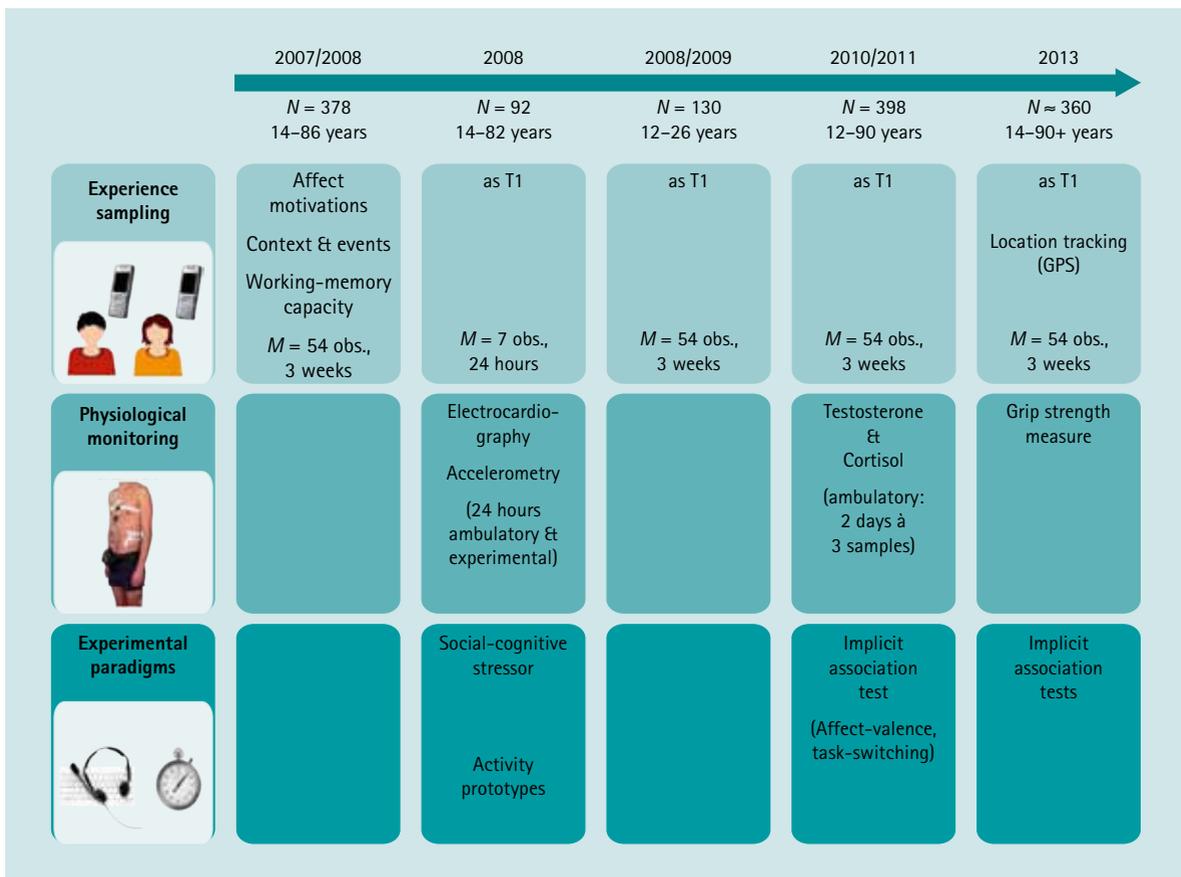


Figure 1. Overview of the longitudinal MMAA project. Since 2007, five assessment waves have been conducted in a sample ranging in age from adolescence to old adulthood. New participants, and young adolescents in particular, have been regularly recruited to maintain the age composition of the sample. The measurement approach combines various ambulatory assessment techniques, which allow the measurement of affective, physiological, and cognitive functioning in participants' daily lives and natural environments, with well-controlled experimental paradigms and interviews conducted in the participants' homes. The ambulatory assessment techniques include mobile-phone-based experience sampling as well as various ambulatory biomonitoring devices.

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Key Reference

Riediger, M., Wrzus, C., Klipker, K., Müller, V., Schmiedek, F., & Wagner, G. G. (in press). Outside of the laboratory: Associations of working-memory performance with psychological and physiological arousal vary with age. *Psychology and Aging*.

In the following sections, we will therefore describe a selection of exemplary findings pertaining to age differences in (a) everyday affect-regulation motivation, (b) associations between sleep quality and emotional well-being, and (c) affective and physiological responding to daily hassles and uplifts. Further analyses have focused, for example, on age differences in associations between affective and physiological arousal and working-memory capacity (Riediger, Wrzus, Klipker, Müller, Schmiedek, & Wagner, in press) and on implications of individual differences in appreciation of negative affective experiences for health and well-being.

Seeking Pleasure and Seeking Pain: Age Differences in Everyday Affect-Regulation Motivation

Evidence is accumulating that day-to-day emotional experiences differ between individuals from different age groups. Adolescence, for example, is typically characterized by relatively more emotional turmoil and a relatively higher prevalence of negative emotionality than adulthood. Across adulthood, there are also general patterns of age-related differences. When repeatedly asked to report their momentary feelings, older adults typically report higher emotional well-being in their daily lives than younger adult age groups, and

this difference cannot be explained by age-related differences in daily activities and time use (Riediger & Rauters, in press). The psychological mechanisms underlying these age-related differences in daily-life affective experiences are not yet well understood. Using data from the first assessment wave of the MMAA project, we demonstrated in our earlier work that considering the proactive aspects of affective experience provides new insights in this respect (Riediger, Schmiedek, Wagner, & Lindenberger, 2009). Among other things, participants had reported, on average 54 times throughout 3 weeks, how they momentarily felt and whether they currently wanted to dampen, enhance, or maintain each of six positive and negative affect facets (i. e., feeling angry, downcast, anxious, interested, joyful, and content). Participants further completed two trials of a numerical memory-updating task assessing momentary working-memory capacity on each measurement occasion. Consistent with evidence from prior studies, we found an age-related increase in day-to-day emotional well-being. Interestingly, these age differences largely corresponded to differences in how people wanted to influence their feelings. As expected, contra-hedonic orientations did not occur frequently in the daily lives of most participants. Across the entire sample, contra-hedonic orientations were reported in 15% of the measurement occasions on average and were thus considerably less prevalent than prohedonic orientations, which were reported in 92% of the measurement occasions on average. There were, however, pronounced age-related differences: Contra-hedonic orientations to enhance or maintain negative affect, or to dampen positive affect, were most prevalent among adolescents and decreased with age. Prohedonic orientations, in contrast, were most prevalent in later adulthood. Importantly, the age differences in pro- and contra-hedonic orientations could not be attributed to age-related differences in daily-life emotional experiences, activities, or social partners. Instead, they suggest that part of the negative emotionality that is characteristic of adolescence, and part of the positive emotionality that is characteristic of older adulthood,

might be intentionally sought and maintained by the individual. Why should this be the case? From an instrumental-affect perspective, one could speculate, for example, that age differences in regulatory orientations arise because affective states differ in how instrumental they are for dealing with the developmental tasks of different life phases. For example, seeking negative mood might help adolescents to establish emotional autonomy from parents and other adults, to develop a sense of identity, or to train their self-regulatory competences. Seeking positive mood in old age, in contrast, might facilitate the pursuit of affiliative or generative interests. A complementary explanation derives from the mixed-affect perspective, namely, the idea that people might occasionally seek apparently negative affective experiences because they are accompanied or followed by positive experiences (e. g., because they enjoy feeling sad). Consistent with this account, we indeed found that the contra-hedonic motivation of wanting to maintain one's current negative affect was associated with a higher likelihood of mixed affect, that is, a higher likelihood of a co-occurrence of positive and negative affect that were both above the individual's average. Furthermore, the pattern of age-related differences in the prevalence of mixed affect mirrored that of contra-hedonic orientation, whereby both were most prevalent among adolescents and least prevalent among older adults. Irrespective of participants' age, more recent analyses regarding within-person associations between pro- and contra-hedonic orientations and within-person fluctuations in working-memory capacity were in line with the view that contra-hedonic orientations come at a cost (Riediger, Wrzus, Schmiedek, Wagner, & Lindenberger, 2011). We assume that this is the case because contra-hedonic orientation is the exception rather than the rule and requires the effortful overriding of the prevailing prohedonic orientation. While prohedonic orientation was only weakly associated with within-person fluctuations in working-memory performance, the association of contra-hedonic orientation and working-memory performance was substantially more pronounced: The more contra-

Key References

- Riediger, M., & Rauters, A. (in press). Do everyday affective experiences differ throughout adulthood? A review of ambulatory-assessment evidence. In P. Verhaeghen & C. Hertzog (Eds.), *The Oxford handbook of emotion, social cognition, and everyday problem solving during adulthood*. New York: Oxford University Press.
- Riediger, M., Wrzus, C., Schmiedek, F., Wagner, G. G., & Lindenberger, U. (2011). Is seeking bad mood cognitively demanding? Contra-hedonic orientation and working-memory capacity in everyday life. *Emotion, 11*, 656–665. doi:10.1037/a0022756

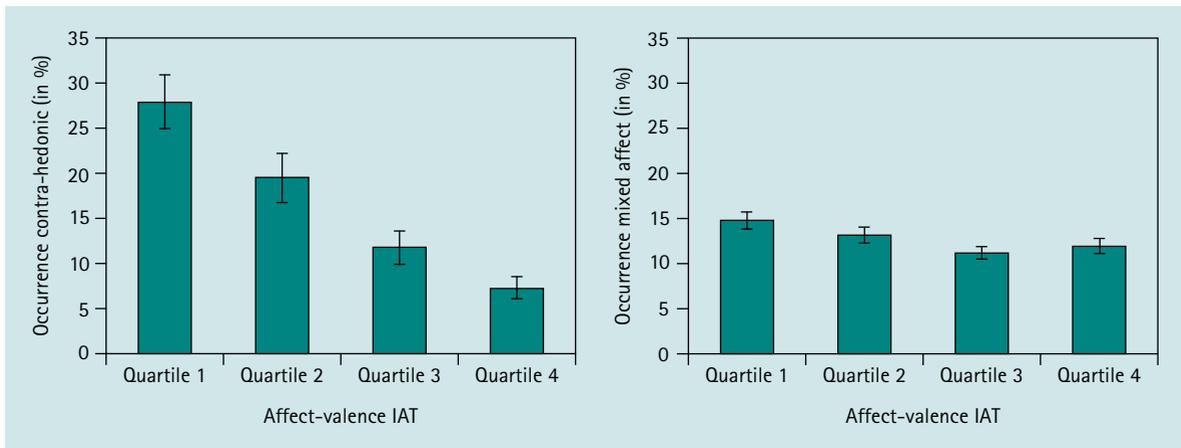


Figure 2. Prevalence of contra-hedonic orientation (left panel) and mixed affect (right panel) varies depending on participants' mental representations of affect valence. The four groups represent the quarters of the distribution of the affect-valuation Implicit Association Test (IAT). Quartile 1 includes the 25% of the participants with the lowest, and quartile 4, the 25% with the highest, affect-valuation IAT scores. Higher scores indicate more distinctive associations of happiness with pleasantness (rather than unpleasantness) and unhappiness with unpleasantness (rather than pleasantness). The more distinctively participants associated happiness with pleasantness and unhappiness with unpleasantness, the less likely they were to report contra-hedonic motivation and mixed affect in their daily lives. Error bars: ± 1 standard error.

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hedonic orientation participants reported, the lower their momentary working-memory performance was, and this was independent of the participants' momentary affective experience. This effect of contra-hedonic orientation on working-memory performance was about ten times larger than that of prohedonic orientation. These results demonstrated that occurrences of contra-hedonic orientation were associated with within-person fluctuations in momentary working-memory performance. In addition, participants who reported more contra-hedonic orientation on average showed lower average working-memory performance across all measurement occasions, which may partly reflect the aggregated effect of momentary occurrences of contra-hedonic orientation. Average prohedonic orientation, in contrast, was not significantly related to between-person differences in average working-memory performance. These findings were stable after controlling for participants' age and perceptual-motor speed, as well as for the time of day, momentary activity, presence of social partners, and for trend-related effects, in addition to momentary positive and negative affect. Furthermore, the reductions in working-memory performance accompanying contra-hedonic orientation were not merely due to nonadher-

ence to the task. Instead, the negative effects of contra-hedonic orientation on momentary working-memory capacity were also evident when only performance ranges that required meticulous effort to solve the task were taken into consideration. The effects of contra-hedonic orientation on working-memory performance could thus not be attributed to a lack of effort or to differences in other individual or situational characteristics. Rather, they are consistent with the idea that contra-hedonic orientation is more strongly associated with momentary decrements in available working-memory capacity compared to prohedonic orientation.

Overall, these analyses demonstrated that taking into account motivational aspects of how people want to influence their feelings contributes to our understanding of age-related differences in affective functioning from adolescence to old age. Up to this point, however, we had exclusively relied on participants' self-reported affect-regulation motivation, that is, could only assess information that was accessible to participants' introspection and not rule out the possibility of response biases. In the fourth assessment wave of the MMAA project, and guided by the mixed-affect perspective alluded to above, we therefore additionally implemented an experimental approach to as-

ness associations with mental representations of affect valence using the Implicit Association Test (IAT) paradigm. Again, we found a similar pattern of age-related differences, with adolescents and older adults standing out: Compared to adults from various age groups, adolescents paired positive affect least distinctively with pleasantness (vs. unpleasantness) and unhappiness least distinctively with unpleasantness (vs. pleasantness). The older the participants were, however, the more differentiated were their representations of the valence of affective states. Furthermore, the less differentiated people's mental representations of affect valence were, the more likely they were to report mixed-affect and contra-hedonic motivation in their everyday lives (see Figure 2). Although causal conclusions are not possible given the correlational nature of these studies, these findings are in line with the mixed-affect perspective. The comparatively higher prevalence of mixed-affective experiences in adolescence thus could be among the factors that contribute to a comparatively higher prevalence of self-reported contra-hedonic motivation in that age group. This seems to be associated with relatively more undifferentiated mental representations of the valence of affective states in adolescence.

Feeling Good When Sleeping In? Age Differences in the Association Between Sleep and Affective Well-Being

Another area of investigation within the MMAA project has addressed age-related differences in the association between sleep and affect. It is undisputed that sleep fulfills important functions, such as allowing physical repair or facilitating memory processes. Less is known about how sleep relates to affective well-being. So far, the respective knowledge largely stems from sleep deprivation or clinical studies. In contrast to this prior focus on extreme lack of sleep or on associations with affective processes in mental pathology, our aim was to investigate how naturally occurring variations in sleep duration relate to daily affect in psychologically healthy individuals. Survey studies show that sleep duration and quality decrease with age. In contrast, everyday affective well-being becomes more

positive throughout adulthood, at least into young-old age. We therefore hypothesized that, in older age, the association between sleep duration and affect should be decoupled; that is, older adults' affective well-being should be less affected by short sleep. As a first step toward investigating this idea, we used data from the 24-hour ambulatory biomonitoring phase of the MMAA project where 92 participants aged 14 to 92 years had worn an ambulatory biomonitoring system continuously for 24 hours and answered questions on the mobile phones during that time. The biomonitoring system continuously recorded, among other things, participants' physical posture and movements via acceleration sensors attached to the sternum and right thigh. Participants' momentary reports on six affect adjectives at the last assessment in the evening and the first assessment in the morning served as indicators for evening and morning affective well-being. Together with colleagues from the Center for Lifespan Psychology, we used the physical activity data collected between 8 p.m. in the evening and 11 a.m. the next morning to determine objective indicators of sleep duration and quality in addition to self-reports. Nightly activity, body posture, and change in body posture during the night were determined using a newly developed classification algorithm based on angular changes of body axes. The duration of supine posture and objective indicators of sleep quality showed convergent validity with self-reports of sleep duration and quality as well as external validity regarding expected age differences (Wrzus et al., 2012a). We continued this investigation, which had focused on data from just one night in the lives of the participants, in a second step using self-report data from an average of nine nights from the fourth experience-sampling wave of the MMAA project (Wrzus, Wagner, & Riediger, in press). For adolescents, affective well-being in the morning was worse the shorter they had slept the previous night. For adults aged over 20 years, however, affective well-being was worse following nights with much shorter or longer than average sleep duration. This effect was more pronounced the older the participants were (see Figure 3). These age differences were not related to age

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Wrzus, C., Brandmaier, A. M., Oertzen, T. von, Müller, V., Wagner, G. G., & Riediger, M. (2012a). A new approach for assessing sleep duration and postures from ambulatory accelerometry. *PLoS ONE*, 7(10): e48089. doi:10.1371/journal.pone.0048089

Wrzus, C., Wagner, G. G., & Riediger, M. (in press). Feeling good when sleeping in? Day-to-day associations between sleep duration and affective well-being differ from youth to old age. *Emotion*.

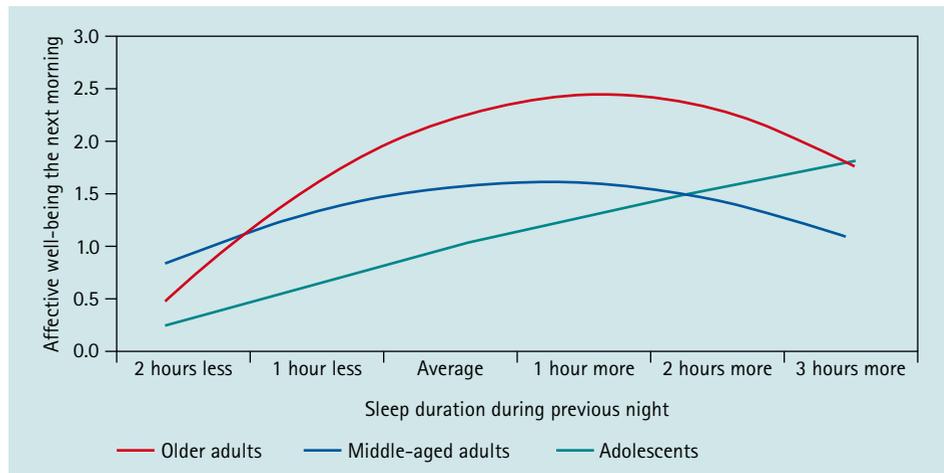


Figure 3. Affective well-being the next morning varied with the amount of sleep during the previous night—and differently so for people of different ages. On average on nine mornings, people reported their affective well-being and how long they had slept the previous night. For adolescents, affective well-being in the morning was worse the shorter participants had slept the previous night. For adults aged over 20 years, however, affective well-being was worse following nights with much shorter *or* longer than average sleep duration. This effect was more pronounced the older the participants were (adapted from Wrzus et al., 2012).

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differences in waking times or in times of assessments in the mornings. Also, the effects were highly similar for weekdays and weekends. The mechanisms driving the stronger coupling between longer-than-average sleep duration and lower affective well-being in the morning for older compared to younger adults, and the absence of this effect among adolescents, remain to be investigated. Exploratory analyses on health and sleep deficits/surplus on previous nights suggest that other factors play a role, for example, sleep quality or appraisals of sleep. Perhaps older adults are more likely to sleep longer when sleep quality is low, which in turn influences affective well-being in the morning; or they appraise longer-than-average sleep more negatively than younger people and are dissatisfied with the “wasted” time. Especially among adolescents, the observed average sleep durations of slightly more than 7 hours might be insufficient to satisfy their sleep need.

Keeping One’s Cool: Affective and Physiological Reactivity to Daily Hassles and Uplifts

Yet another area of investigation within the MMAA project has addressed age-related differences in how people affectively respond to unpleasant and pleasant daily-life events, that

is, to daily hassles and uplifts. People typically respond with an increase in negative affect to the experience of daily hassles, which is often also accompanied by physiological changes. Regarding age-related differences in such affective responses, there are two prevailing, but opposing, theoretical positions. Some researchers argue that emotional responsiveness should decrease throughout adulthood because life experience and higher motivation to maximize emotional well-being should contribute to an improved ability to control affective reactions to hassles. Other researchers, in contrast, claim that emotional responsiveness should increase across adulthood because age-related declines in fluid-cognitive capacity should diminish people’s ability to regulate their affective experiences when facing hassles. To bridge this disagreement, we derived the overpowering hypothesis that older adults react more strongly to hassles than younger individuals when the event is highly resource demanding and overtaxes older adults’ capacity to successfully control affective responses. In less resource-demanding situations, older adults should exhibit equal or even lower affective responsiveness compared to younger individuals, due, for example, to age-related increases in the motivation to feel good (Wrzus, Müller,

Wagner, Lindenberg, & Riediger, 2013). We tested this hypothesis with the data from the first experience-sampling wave and the subsequent 24-hour biomonitoring wave of the MMAA project (see Figure 1). During the experience-sampling data collection, 378 participants in the age range from adolescence to old age reported their momentary negative affect and occurrences of hassles on average 54 times over 3 weeks. Several months later, a subsample of 92 participants wore an ambulatory psychophysiological monitoring system for 24 hours while pursuing their daily routines and additionally completed an average of seven mobile-phone-based experience-sampling reports. Affective responsiveness was analyzed by comparing, within persons, affective states in situations without and with preceding hassles. The results supported the overpowering hypothesis (see Figure 4): When dealing with complex hassles that affected multiple life domains (i.e., situations that are highly resource demanding), older age was associated with more pronounced psychological and cardiovascular responsiveness. When dealing with circumscribed hassles that affected only one life domain (i.e., situations that

are less resource demanding), however, no age differences in psychological responding were observed, and cardiovascular responding was even less pronounced the older the participants were. These findings suggest that the ability to effectively regulate affective and cardiovascular responses to everyday hassles may be maintained into older adulthood as long as the resource demands (i.e., the complexity) of the event do not overtax the older adults' available resource capacity (Wrzus et al., 2013). Another set of analyses emphasized the temporal dimension of affective reactivity. Here, we studied reactivity and recovery processes under controlled experimental conditions using data on a stress induction experiment during the 24-hour biomonitoring wave. Standardized emotional strain was elicited in 92 participants, 14 to 83 years of age, with an adaptive social-cognitive stress task. Participants' negative affect and heart rate were measured throughout the task. The results showed no significant age differences in reactivity and recovery regarding activating (e.g., feeling nervous) and deactivating (e.g., feeling downhearted) negative affect. We found, however, that older age was associated with

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Wrzus, C., Müller, V., Wagner, G. G., Lindenberg, U., & Riediger, M. (2013). Affective and cardiovascular responding to unpleasant events from adolescence to old age: Complexity of events matters. *Developmental Psychology, 49*, 384–397. doi:10.1037/a0028325

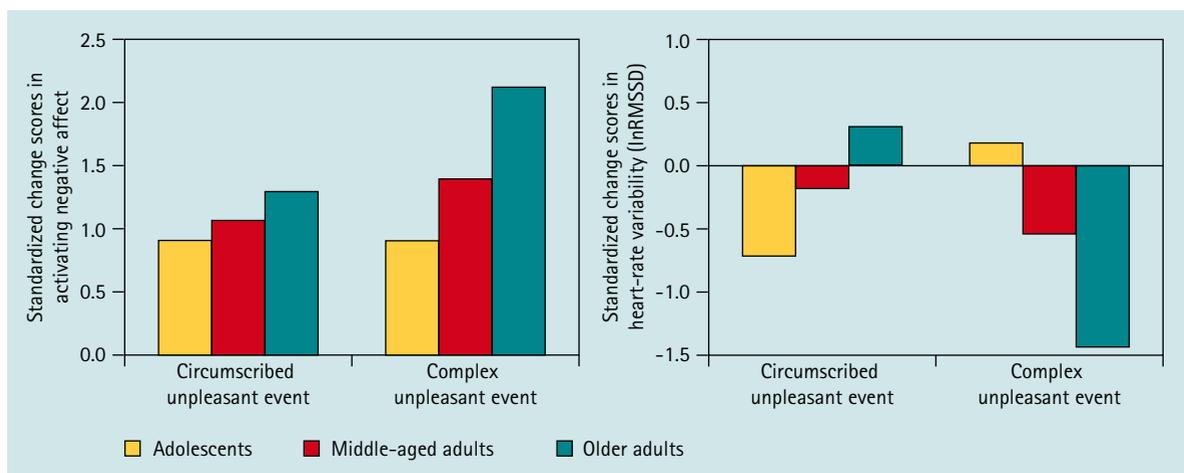


Figure 4. Age differences in psychological and physiological reactivity to adverse events depends on the complexity of the situation. Several times a day throughout 3 weeks, participants reported the occurrence of hassles and their momentary negative affect. In a separate assessment wave, participants' heart rate was continuously recorded throughout 24 hours while they pursued their normal daily routines. After experiencing circumscribed hassles that concerned only one life domain (i.e., situations that are less resource demanding), no age differences in psychological responding (increase in negative affect relative to situations without preceding hassles) were observed (left panel), and cardiovascular responding was even less pronounced the older the participants were (right panel), more negative values indicate stronger cardiovascular responding. However, when dealing with complex hassles that affected multiple life domains (i.e., with situations that are highly resource demanding), older age was associated with more pronounced responding both on the psychological (left panel) and cardiovascular level (right panel) (adapted from Wrzus et al., 2013).

decreased heart-rate reactivity (i. e., smaller increases in heart rate from baseline to the stress task compared to younger individuals) as well as increased heart-rate recovery time (i. e., longer time to return to baseline heart rate following the stress task compared to younger individuals). In other words, although heart rate increased less strongly with age, it took longer to recover, that is, to return to baseline. Importantly, heart-rate reactivity and recovery during the stress task were not significantly related to heart-rate reactivity and recovery during a nonemotional physical task, suggesting that the observed age differences in heart-rate reactivity and recovery were specific to the social-cognitive stressor. Affective experiences, however, do not only fluctuate in response to unpleasant experiences, thoughts, or events. Uplifts or pleasant everyday events, such as receiving good news, also influence affective experiences by promoting greater positive affect and lower negative affect. Although researchers have posited that uplifts may buffer or reduce the aforementioned detrimental effects of hassles on emotional well-being, few studies have tested this possibility in daily life. Furthermore, buffering effects may vary with age. For example, during adolescence, affect variability is greater than in other periods of the lifespan. Thus, while adolescents may show large decreases in emotional well-being in response to hassles, they may also show large increases in response to uplifts, thereby cancelling out the negative effects of co-occurring hassles. In addition, most previous studies on emotion regulation and aging have found that older adults are more adept at avoiding negative emotional experiences relative to younger individuals, but there is limited evidence that older age is associated with optimizing positive experiences. We therefore examined age differences in buffering effects, that is, when uplifts and hassles occurred concurrently on activating (e. g., feeling angry) and deactivating negative affect (e. g., feeling downhearted) in the fourth assessment wave of the MMAA project. Buffering effects were tested by examining age-related differences in the increase in negative affect in response to hassles-only situations compared to situations whereby

uplifts and hassles were reported concurrently. Multilevel analyses revealed that there were age differences in buffering effects on deactivating negative affect, but not on activating negative affect. The interaction shows that when a hassle was reported in the absence of an uplift, there were no age differences in deactivating negative-affect reactivity (i. e., increases in deactivating negative affect in response to the hassle). In contrast, when an uplift and hassle were reported concurrently, all individuals generally showed buffering effects such that their hassle reactivity was attenuated compared to hassle situations without a co-occurring uplift. This buffering effect was less pronounced, however, with older age. In other words, older adults benefited less (i. e., exhibited smaller decreases in deactivating negative affect) when experiencing both uplifts and hassles within the same assessment period compared to younger individuals. Altogether, these findings support the notion that affective aging consists of a complex pattern of gains and losses. Across adulthood, the ability to maintain affective states in the presence of circumscribed stressors shows stability or even improvements, but older adulthood is characterized by slower recovery from physiological arousal associated with stressors, stronger affective and physiological reactivity to complex stressors, and by lesser capitalization on positive experiences when they coincide with stressors. The analyses reported so far focused on cross-sectional age differences in everyday affective reactivity, which, however, do not necessarily correspond to within-person change in reactivity over time. The finalization of the fifth longitudinal assessment wave of the MMAA project, which is currently under way, will make it possible to investigate within-person change throughout 6 years in everyday affective experiences. These longitudinal data analyses will be among our core research endeavors in the coming year and accompany initial analyses on change in hassle reactivity throughout 3.5 years, which indicated pronounced age-related differences and are described next. Greater affect reactivity to stressors is typically believed to signify poorer affect

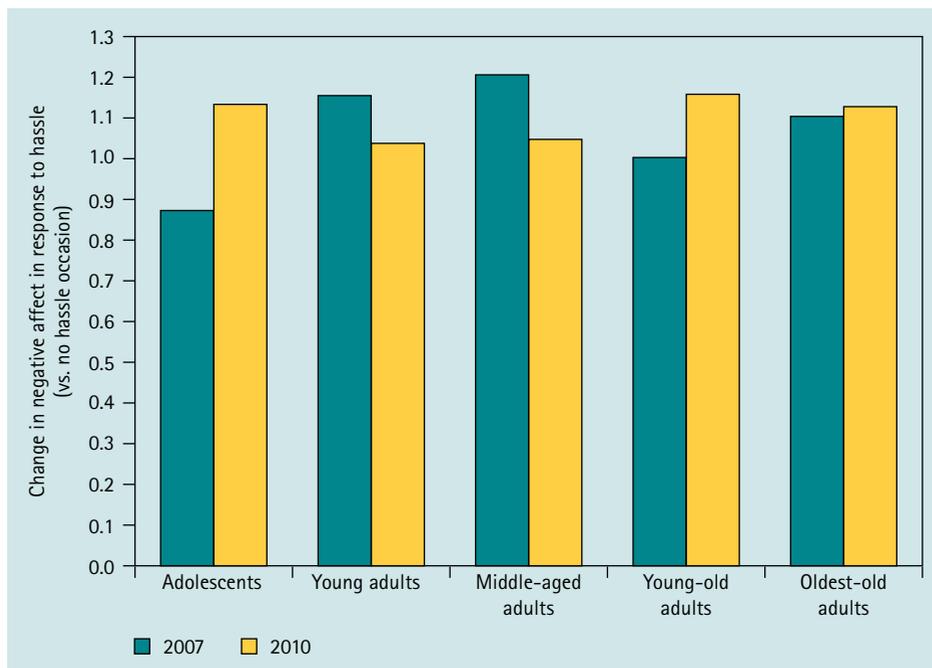


Figure 5. Age-moderated longitudinal change in negative-affect reactivity to hassles. Participants between 12 and 88 years of age reported their momentary emotional experiences and the occurrence of hassles in their daily lives twice, about 3.5 years apart. Bars represent hassle reactivity (i. e., increases in negative affect in response to a hassle, relative to occasions in which no hassles occurred). Adolescents and young-old adults exhibited increases in hassle reactivity, whereas younger and middle-aged adults showed decreases across the two assessment waves. In later life, the oldest adults showed stability in hassle reactivity over time.

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regulation, that is, poorer abilities to control one's affective reactions. Researchers have predicted that there are two periods in which emotion regulation drastically changes: (1) as adolescents transition into adulthood and (2) as individuals move from the third age to the fourth age (into the eighth decade of life and beyond). Adolescence represents a period of substantial physiological, cognitive, and social changes that are coupled with relative inexperience in coping with hassles. Together, these components contribute to highly variable emotional responses in adolescence. As individuals transition into adulthood, they gain more experience with emotion regulation and greater agentic control, which are believed to help downregulate affective reactivity to hassles. In addition, although the third age (encompassing the sixth and seventh decades of life) is associated with comparatively high levels of emotional control and stability, it is unclear whether these gains will outweigh losses, such as declines in

cognitive functioning, in late life. Few studies to date have been able to test these possibilities because they primarily relied on cross-sectional data with limited age ranges. Using longitudinal data from MMAA assessment waves during the time period from 2007 to 2010, we examined possible age differences in longitudinal change in affect reactivity to hassles throughout a period of about 3.5 years. We found that change in affect reactivity to hassles varied with baseline age. Both adolescents and young-old adults (third age) exhibited increases in negative-affect reactivity to hassles across the waves (see Figure 5). Interestingly, however, young and middle-aged adults decreased in their negative-affect reactivity to hassles across the waves, while the oldest-old adults show a pattern of stability across the waves. These findings corroborate and extend the current literature. Affect reactivity to hassles declines during early and middle adulthood, but shows increases again in the third age and stability in later life.

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Back in the Laboratory: Emotion Elicitation Using Film Clips

One advantage of using experience sampling is that it captures emotional events and responses to these events as they occur in people's natural living environments, which enhances ecological validity. A natural limitation of this method is, however, that the events people encounter in their daily lives may differ between age groups (e.g., regarding their valence, importance, or frequency). When investigating age differences in affective responding, it is therefore important to consider the type of events that people are exposed to. Following this imperative, we have been complementing the data from the MMAA project that we obtained in daily life with well-controlled experimental paradigms. In one of these studies, we conducted an experiment in which we confronted participants of different age groups with standardized emotional events in the laboratory, namely, with emotional film clips. In the following, we will exemplarily introduce two research foci within this comprehensive investigation.

Emotional Reactivity to Controlled Emotional Events

In this research, we preselected 66 emotional film clips for their potential to strongly and specifically induce one of the following emotions: joy, anger, fear, sadness, disgust, and no emotion (i.e., emotionally neutral films) as a control condition. Different from past research that investigated age differences in responses to emotional film clips, we did not restrict our sample to a narrow age range, nor did we focus on one or two target emotions or on a small number of film stimuli, as selectiveness regarding these factors may limit the generalizability of the findings. Instead, we included a broad age range from 12 to 80 years in a lifespan sample of 99 individuals and considered various target emotions, each of which were represented by an average of 11 film clips. The results can be seen in Figure 6. Affective responses increased with age for most emotions, namely, for joy, fear, sadness, and anger, with only minor differences across individual films for a given target emotion. In contrast, there were no age differences in responses

to disgusting and neutral films—again with only minor differences across individual films. Importantly, no emotion evinced an age-related decrease in emotional responding. In essence, these findings suggest that controlled exposure to emotional events involves an age-related increase in emotional responding for most emotions. These results seem incompatible with the theoretical notion that older adults are more adept in general at regulating their responses to emotional events. In contrast, the present results provide preliminary support for theoretical positions maintaining that affective responses should increase with age if a given emotional event is sufficiently intense and cannot be avoided. These findings may furthermore imply that it can be adaptive to avoid intense emotional stressors in old age, as one's regulatory capacities in the face of intense events may become increasingly limited.

That's Not Funny! Enjoyment of Others' Misfortunes Decreases Across the Adult Lifespan

The emotions of joy, anger, sadness, disgust, and fear from the research example above are among a group of emotions that some psychologists have considered the "basic emotions." Whereas there is an ongoing debate regarding the criteria that qualify an emotion as "basic," some researchers use this term to acknowledge that expressions of these emotions occur very early in ontogeny and have been observed in multiple cultures around the world. Furthermore, these emotions may be understood as responses to a specific appraisal (e.g., sadness typically accompanies one's realization of a loss without any hope for amendment). In contrast, researchers have emphasized that some affective responses are elicited through more heterogeneous pathways, with one example being amusement. This emotional response typically involves an enjoyable tension arising from some form of cognitive incongruence. However, the types of incongruences people respond to vary considerably across individuals. Past research has related these individual differences to people's cultural background, their cognitive capacities, or the salience of a topic. In this research example, we investigated the role

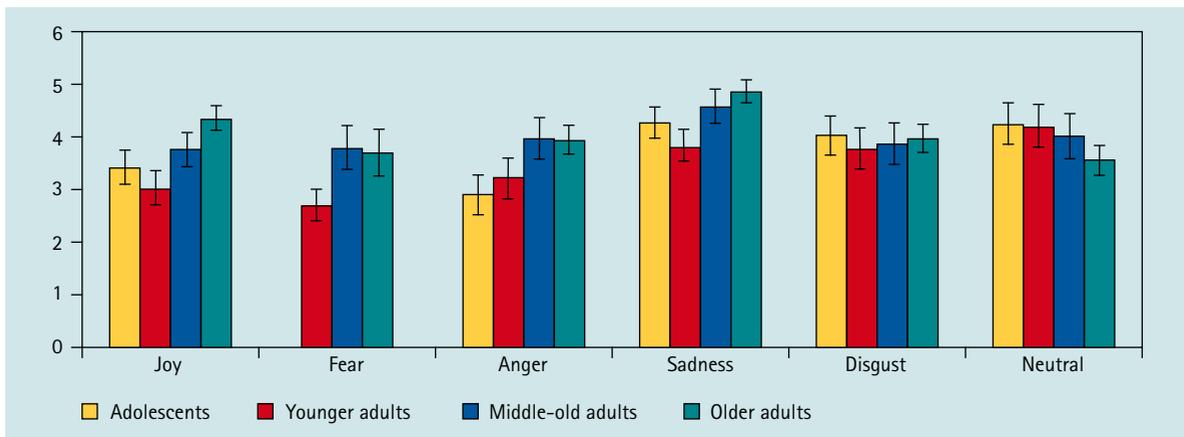


Figure 6. For emotional films eliciting joy, fear, anger, or sadness, subjective-affective responses were stronger with age, whereas responses to disgusting or neutral films were age invariant. Participants aged 12 to 80 years rated their subjective responses to 66 emotional film clips. (Adolescents did not rate fear stimuli.) Bars show participants' mean ratings on the target emotion in four different age groups, averaged across all films for a given target emotion. Error bars show two standard errors from estimated subsample means. Participants' stronger responses with increasing age, as evident for most emotions, support the theoretical notion that older adults will respond stronger to intense, emotional stimuli if those are held constant across participants. Age differences in affective responses to events in everyday life, in contrast, may diverge from the reported pattern, as individuals differ regarding the events that they are exposed to.

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of values for people's responses to amusing stimuli. We assumed that age differences in amusement could be understood in terms of age differences in values. Amusement has been suggested to depend on a delicate balance between tension (e.g., incongruence) and relief (e.g., resolution of the incongruence). If people are confronted with threats to particularly salient values, this balance may be shifted toward uncomfortable levels of tension, which counteracts the experience of amusement. Here, we focused on values regarding two assets, namely, moral and physical integrity. Moral integrity may become increasingly valued with age as people develop a growing sense of generativity—a motivation to give to subsequent generations and pass on values and morals. Likewise, physical integrity may become increasingly valued as age-related frailty brings about more serious implications of physical injuries (e.g., resulting from a fall). In sum, older people may value moral and physical integrity more strongly than younger people. We therefore hypothesized that, with age, stimuli involving threats to moral or physical integrity—that is, films involving potential psychological or physiological harm—would be appraised with lessened amusement.

To investigate this hypothesis, we used data from two independent lifespan samples. In a first step, we conducted a rating study with the aim to obtain a group of film clips that involved varying degrees of threat to moral and physical integrity—in short, films that varied on the dimension of harm. We used 12 film clips, preselected for their potential to elicit amusement, and showed them to a sample of 143 participants aged 10 to 84 years. Directly after having watched each film, participants responded to five items measuring the extent to which each film involved threats to moral values (e.g., "someone acted mean") or physical integrity (e.g., "someone could have got hurt"), using a scale from zero to six. Averaging across all items and rating-study participants, we obtained a measure of perceived harm for each film. This measure was then used to predict experiences of amusement in a second, independent lifespan sample. In a next step, we presented the same 12 film clips to the lifespan sample introduced earlier (99 participants aged 12 to 80 years). Directly after having watched each film, participants rated the intensity of their amusement on a scale from zero to six. Results supported our prediction (see Figure 7): Whereas younger participants' amusement was independent of

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Key Reference

Riediger, M., & Klipker, K. (2014). Emotion regulation in adolescence. In J. J. Gross (Ed.), *Handbook of emotion regulation* (2nd ed., pp. 187–202). New York: Guilford Press.

the harm involved by the films, older participants' amusement was lower for harmful films than for harmless films. These results provide support for the notion that individual differences in emotional responding may be best understood when considering both characteristics of the person and characteristics of the stimulus or situation. Individual differences in people's emotional responses were not explained by participants' age alone, nor by the harm implied by the stimulus alone. Instead, the data pattern derived from an interaction of the two characteristics. Furthermore, the study introduces a potential explanatory mechanism for the observed effect: Threats to the people's values may counteract the experience of amusement. Future research needs to investigate if this mechanism is also true for additional values that were not in the focus of the present research example.

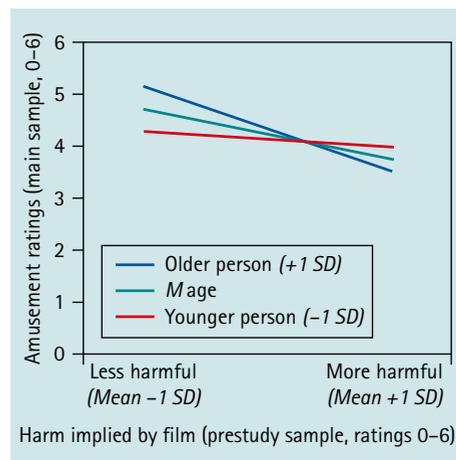


Figure 7. Participants' emotional responses to amusing films depended on the interplay of participants' age and the harmfulness of a given film clip. A lifespan sample aged 10 to 84 years watched 12 amusing film clips and rated them regarding their harmfulness—that is, the degree to which a protagonist in the film was exposed to either moral violations, physical harm, or both. A different lifespan sample aged 12 to 80 years then rated their amusement as they watched the same films. Estimates from multilevel regression showed that harmful films elicited less amusement than harmless films—but not for everybody: The older the participant, the more his or her amusement was diminished if a film stimulus involved moral violations, physical harm, or both. These results may be understood in light of past research suggesting that both moral and physical integrity, which were threatened by some of the films, become increasingly valued across the adult lifespan.

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Up One Minute, Down the Next: Affective Variability Across Adolescence

Compared to late childhood and adulthood, adolescence is a developmental period of enhanced affective instability, that is, of more rapidly changing affective experiences (Riediger & Klipker, 2014). There is, however, also substantial variation between adolescents regarding their affective instability. Lay views often attribute these observations to hormonal changes during adolescence. Empirical evidence, however, shows that hormonal changes alone cannot explain the unique emotional lives of adolescents. Indeed, relatively little is known to date about the factors that contribute to the typical increase in affective variability in adolescence and to interindividual differences therein. We conducted a longitudinal study to provide new insights into this area of research (Dissertation Kathrin Klipker). The objective of this project is to investigate the proposition that a temporary increase in affective variability in adolescence results from a transient developmental imbalance between pubertal and cognitive development, rather than from one or the other influence alone.

Pubertal development (i.e., the bodily transition from being a child to being an adult) is caused by changes in the concentration of steroid hormones. Pronounced increases in the levels of steroid hormone concentrations occur particularly in early puberty and are accompanied by the emergence of diurnal patterns of steroid hormone concentrations. These hormonal changes are thought to have an activating effect on the central nervous system, especially in affect-relevant brain regions. Individuals, however, are not only passive recipients of affect-relevant signals from the brain. Affective experiences can often be moderated and controlled (i.e., regulated) to some extent by the individual. Many affect-regulation strategies (e.g., cognitive disengagement, behavioral inhibition, or attentional deployment) draw on cognitive-control processes, which develop remarkably throughout childhood and adolescence. We therefore expected that adolescents who show large changes in hormone concentration and diurnal rhythms, but have not yet fully

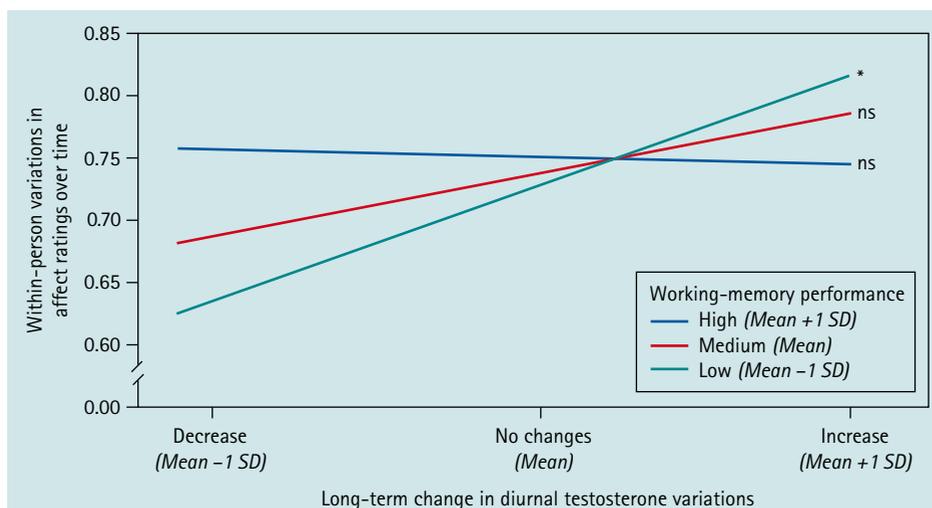


Figure 8. Change in diurnal testosterone variations predicts affect variability only in adolescents with low working-memory capacity. Male participants aged 10 to 20 years provided eight saliva samples for the analyses of testosterone concentrations, each on two measurement occasions about 9 months apart. Their working-memory capacity was assessed with an extensive battery during the second occasion. Affect variability was assessed throughout 2 weeks and as participants pursued their normal daily routines, using mobile-phone-based experience sampling. Results indicate that an increase in diurnal testosterone variation predicted higher affective variability only in participants with low working-memory capacity. This finding is consistent with the idea that a temporary increase in affective variability in some adolescents is associated with an imbalance between hormonal and cognitive development.

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developed the cognitive control capacity to regulate their increasing affective responsiveness, should show high variability in affective experiences, whereas this should not be the case to the same extent for adolescents with more developed cognitive control capacities. To investigate this prediction, we conducted a longitudinal project with two measurement waves, 8 months apart. On both occasions, 148 male participants aged 10 to 20 years provided, among other things, eight saliva samples for the analysis of testosterone concentrations. During the second measurement wave, participants also worked on a battery of working-memory tasks and took part in a mobile-phone-based experience-sampling phase. Over a period of 2 weeks, participants provided on average 46 reports of their momentary affective experiences. Derivative estimates of participants' affect ratings (i. e., slope of change) were used as a measure for affect variability. In line with our predictions, we found that an increase in diurnal testosterone fluctuations during the study interval was related to higher affective variability only in adolescents

with low, but not in adolescents with high working-memory capacities (see Figure 8). This was the case irrespective of participants' age. Results are robust to controlling for several demographic (e. g. type of school, parents' socioeconomic status) and social (e. g. predictability of activities, interaction partners, and locations) control variables. Taken together, this study not only replicates the available empirical evidence of a relation between puberty and emotional experiences, but further differentiates between several developmental processes within puberty: The investigation of the joint contribution of an individual's hormonal and cognitive development allows addressing the question of large individual variations within adolescence.

Tune Yourself In: Age Differences in Music Preferences in an Affectively Relevant Situation

Results from the MMAA study summarized above had shown pronounced age-related differences in self-reported regulatory motivations, with older adults reporting more frequently prohedonic motivations and

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adolescents more frequently contra-hedonic motivations than the other age groups. In these analyses, however, we had exclusively focused on the valence dimension of affective experiences, that is, on how pleasant or unpleasant they are. However, the arousal dimension—how activating or deactivating affective experiences are—may be equally important for understanding age differences in affect-regulation motivation because an age-related decrease of physiological flexibility makes recovery from activated states more difficult in older adulthood. In addition, our reliance on self-reported affect-regulation motivation in the MMAA study entails the possibility of response biases. We addressed these limitations in this study by observing participants' behavior in an

affectively relevant situation with regard to both the valence and the arousal dimensions of regulatory preferences, choosing music listening as an experimental paradigm. Music listening was well suited for our study aims because the affective nature of a given music piece can be characterized with regard to its valence and arousal, and it can elicit corresponding affective experiences in the listener. In a first step of this investigation, we developed an age-fair music-browsing paradigm as a means to observe people's regulatory preferences in an affectively relevant situation. We asked 50 participants aged 12 to 74 years to rate 471 preselected songs from different genres on various dimensions, including valence and arousal. Based on these ratings, we selected 128 music pieces with unambiguous

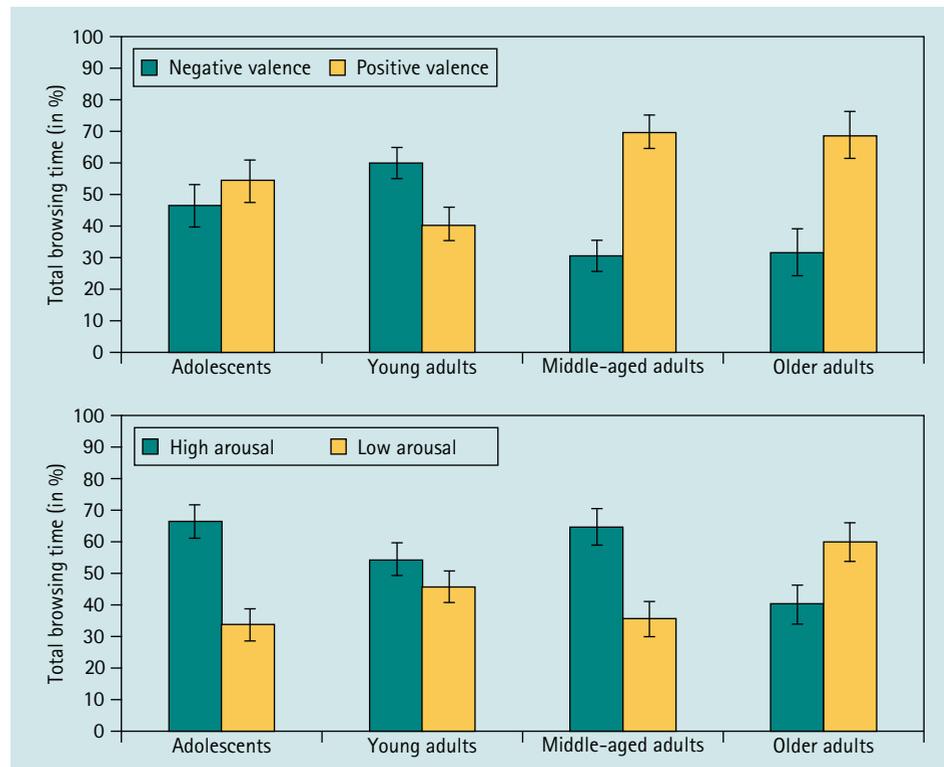


Figure 9. Age differences in music preferences in an affectively relevant situation. Individuals from different age groups freely browsed music pieces varying in valence and arousal while expecting to engage soon in a discussion of a difference in opinion with a stranger. Middle-aged and older adults listened longer to positively than to negatively valenced music (upper panel). They differed from each other, however, in their arousal preferences (lower panel): Middle-aged adults listened longer to high-arousing music than to low-arousing music. Older adults listened longer to low-arousing music than the other age groups. These findings suggest that shifts in valence preferences may occur earlier throughout the adult lifespan than shifts in arousal preferences. Error bars: ± 1 standard error.

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and relatively age-homogeneous valence and arousal ratings, making sure that the selection was comparable across different genres. We then programmed a music browser that allows participants to freely browse through this selection of songs, listening to each of them for as long or short as they like, and records their browsing behavior.

We expected to find an age-related increase in the preference for positively valenced and for calm, relaxing music in affectively relevant situations. We investigated this prediction in a sample of 73 participants from four age groups: adolescents, young, middle-aged, and older adults. We created an affectively relevant situation by making participants believe that they were about to discuss a difference in opinion with a stranger. We then told participants that their interaction partner was not yet ready for the discussion and asked them to participate in an allegedly unrelated study on listening preferences to bridge the time to the discussion. Participants freely browsed our music selection for

10 minutes and we recorded their browsing behavior.

Consistent with our prediction, we found a clear preference for positively valenced music in middle-aged and older adults (see Figure 9, upper panel). The preference pattern, however, was different with regard to the arousal dimension of music pieces. Adolescents and middle-aged adults showed a clear preference for high-arousing music, whereas older adults spent less time listening to high-arousing music and more time listening to low-arousing music than the other age groups (see Figure 9, lower panel).

Taken together, this study further confirmed that age differences in regulatory preferences are not only evident in self-report but also in what people actually do in an affectively relevant situation, and that it is important to consider both the valence and the arousal dimension of regulatory preferences. It also suggests that shifts in valence preferences may occur earlier in the adult lifespan than shifts in arousal preferences.

Research Emphasis 2: Age-Related Differences in Affective Competencies

The second emphasis of our research is on age-related differences in abilities related to understanding and managing emotional aspects of life. Between 2011 and 2013, we focused much of our respective work on processes related to affect communication. Here, we are interested in both how affective experiences are expressed by individuals of different age groups and how these expressions are recognized by other people of various ages.

While empirical evidence on age-related differences in affect expressions is still rare, several investigations are available that suggest that the ability to read other people's affective expressions declines with age throughout adulthood (e.g., Riediger, Voelkle, Ebner, & Lindenberger, 2011). The reasons for this apparent age-related decline, however, are not yet well understood. Surprisingly, age-related declines in fluid-cognitive functioning and face perception could not account for these findings. To date, however, adult age differences in the ability to identify affective expressions have most frequently been investigated using photographs depicting faces of persons posing prototypical expressions of highly intense emotions. This "traditional" paradigm has two important

methodological shortcomings that we sought to address in several recent studies. One limitation is a *lack of age fairness* of most studies, which used expressions of younger or middle-aged, but not older, adults as stimulus material. The second concern pertains to the fact that the traditional paradigm is quite different from affect-recognition demands in daily-life contexts and thus lacks *ecological validity*. Below, we elucidate our recent empirical attempts to address these concerns. We first sketch out a series of studies that attempted to enhance ecological validity by investigating age-related differences in identifying different types of smiles. Subsequently, we describe several studies on different aspects of spontaneous affective communication in social relationships.

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No Smile Like the Other—Adult Age Differences in Reading Smiles

Our first approach toward enhancing ecological validity involved smiles instead of posed expressions of intense basic emotions. Smiles are facial displays well suited for our purposes because they are subtle expressions of high ecological relevance that can be accompanied by different emotional experiences: People smile when they experience positive emotions, for example, when they are amused or happy. They also smile to conform to social conventions, for example, to be polite, even when not experiencing any particular emotions. People also occasionally smile while experiencing negative feelings, for example, during social conflicts when they want to appease their interaction partner.

We were interested in whether younger and older adults differ in how well they are able to identify different emotional experiences accompanying smiles. Based on the assumption that interpreting different types of smiles is a more ecologically valid task than interpreting posed facial expressions in the traditional paradigm, and as such allows older adults to draw on their accumulated experiences in understanding other people's expressions, we expected a performance advantage of older as compared to younger adults in understanding smile expressions.

To investigate this prediction, we produced videos of positive, negative, and nonemotional smiles. Positive and nonemotional smiles were elicited from 42 younger (20–30 years of age) and 48 older adults (70–80 years of age). Positive smiles were spontaneously shown while watching amusing video clips and cartoons. Nonemotional smiles were elicited by asking participants to smile. Together, more than 2,000 smile episodes were videotaped. Participants reported their feelings for each of these episodes. We selected positive smiles that had been accompanied by intense amusement and no other feelings, and nonemotional smile episodes that had not been accompanied by particular emotions. In addition, we extracted negative smile episodes from video footage of young adults who were the target of unfair accusations during an experiment conducted by Weber and Wiedig-Allison at the Ernst Moritz

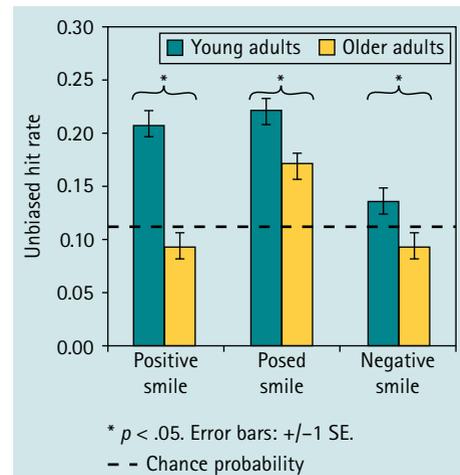


Figure 10. Younger adults are better in reading smiles than older adults. Younger and older adults rated short video clips of smile expressions that were shown while the smiling person either felt amused while watching a funny videoclip, felt upset while being the target of an unfair accusation, or did not feel any particularly strong emotion while being asked to pose a smile. Younger adults were more accurate than older adults in identifying emotional experiences accompanying positive, nonemotional, and negative smiles. Error bars: ± 1 standard error.

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Arndt University of Greifswald. These negative smiles had been accompanied by intense anger or other negative emotions.

In a first study, we presented 48 smile videos (16 per category, all of younger adults) to 48 younger (20–30 years of age) and 52 older (70–80 years of age) participants. Participants were asked to indicate which emotional experience they thought had accompanied the smile (positive feelings, negative feelings, or no particularly intense feelings).

Contrary to our predictions, older adults' emotion-recognition accuracy did not profit from the more ecologically valid smile paradigm. As in the traditional paradigm, younger adults were more accurate in identifying emotional experiences accompanying smiles than older adults (see Figure 10). In fact, older adults' recognition accuracy for positive and negative smile videos was not better than chance. Furthermore, older adults were less likely to attribute positive emotions to smiles, but more likely to assume that a given smile was posed than younger adults. This finding was unexpected as it is not in line with

theoretical claims that older adults are more motivated to attend to and process positive information.

In a second study, we investigated whether older adults' accuracy in reading smiles profits when the smiling persons stem from their own group as compared to a younger age group. We presented positive and nonemotional smiles of younger and older adults to 48 young (20–30 years of age) and 49 older (70–80 years of age) participants. Results indeed confirmed an own-age advantage for older (but not younger) participants: Older participants could identify the accompanying emotional states best when the smiling persons were older adults as well. Although this selective gain in recognition accuracy attenuated the performance difference between younger and older participants when reading older adults' smiles, the overall pattern of age differences remained. Even when the smiling persons were older adults, younger adults' accuracy of identifying emotional experiences accompanying smiles was higher than that of older adults. This replicates the findings from our earlier studies.

Taken together, this line of research replicated that younger adults attribute affective states more accurately to emotional expressions than older adults, even after enhancing the ecological validity compared to the previously used traditional paradigm. Also, the smiles paradigm, however, differs from affect-recognition demands that people encounter in their daily lives. It employs isolated and monosensory cues, while emotional information in everyday life is often multisensory and embedded in a communicatory context. Based on these considerations, our further attempts toward enhancing ecological validity pertained to affective competencies as evident in authentic interactions and social relationships.

Everyday Affective Competencies in Romantic Partnerships

Extending our earlier research on mutual understanding among dyads of various age groups (Rauers, Riediger, Schmiedek, & Lindenberger, 2011; Riediger & Rauers, 2010), we have been conducting a longitudinal multimethod investigation of affective competencies in social relationships. This

project focuses on romantic partnerships as a particularly common social context across adulthood and has two core foci: First, we investigated age-related differences in affective competencies—both in the couples' daily lives and during interactions in controlled laboratory contexts. Second, we investigated the implications of such affective competencies for individual and relationship development in early and late adulthood. The project includes two multimethodological assessment waves. The first wave used dyadic experience sampling as a means to assess emotion understanding and affect-related interpersonal dynamics in younger and older couple's daily-life contexts, which we complemented by experimental paradigms and self-report data. The second wave comprised experimental paradigms, observational measures, and self-report data. Here, the primary focus was on age differences in the verbal and nonverbal communication of affective states. In the following, we describe one research example from this project in more detail, focusing on age differences in the ability to correctly judge how one's partner is feeling in daily life. When judging another person's current emotions, people do not exclusively rely on that person's emotional expressions. People also use additional information, such as knowledge about a given situation and about the particular person. We assumed that this knowledge is more robust to aging than the ability to read emotional expressions—meaning that conventional laboratory tasks may have systematically underestimated older adults' empathic competencies. To investigate this, we assessed empathic accuracy in younger and older couples' daily-life contexts (Rauers, Blanke, & Riediger, 2013). We used the experience-sampling method to compare two everyday scenarios: empathic judgments while the partners were spending time together and situations in which the partners were temporarily apart during their daily routines. In both situations, people can use their knowledge about the partner to judge his or her current affect (e.g., they may know about the partner's typical mood at a particular time of day or the partner's typical mood while engaging in a specific activity). We assumed

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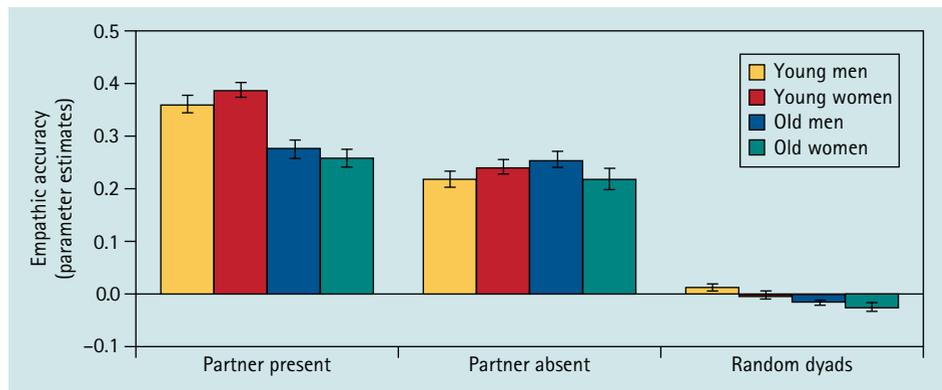


Figure 11. Age differences in empathic accuracy—the ability to correctly judge another person’s current feelings—depend on the presence or absence of the partner. Experience-sampling data were obtained from cohabitating couples’ daily lives. Participants simultaneously rated their own and their partner’s current affect. Bars show multilevel-model estimates of empathic accuracy, separately for younger and older men and women, measured as the correspondence of participants’ ratings of their partners with the partners’ actual self-reports. Higher bars indicate higher empathic accuracy across all measurement occasions. Younger adults were more accurate in rating their partner’s current affect when the partner was present. When the partner was absent, however, younger and older adults’ accuracy in rating their partner’s affect was comparable, and both age groups’ ratings were better than chance. Error bars: ± 2 standard errors.

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that such knowledge would be equally available to younger and older couples. However, additional sensory cues about the partner’s current affect (e.g., facial or verbal information) are available when the partner is present. In these situations, people may thus use sensory cues to adjust their empathic judgments. In contrast, during a person’s absence, empathic judgments needed to rely exclusively on knowledge acquired before the time of the judgment. Sensory-information processing has been shown to decline with age. We therefore hypothesized that, when their partners were present, younger adults would be more accurate than older adults. However, we expected younger adults’ advantage over older adults to decrease during the partners’ absence. In short, we expected to find greater age differences when the partner was present than when the partner was absent. To investigate these predictions, we used the mobile-phone-based experience-sampling technology developed in the MMAA project. The sample consisted of 50 younger (20–30 years of age) and 50 older (70–80 years of age) cohabitating, heterosexual couples (i.e., 200 individuals). Participants provided 87 experience samples on average while pursuing their normal daily routines. Measurement

occasions for both partners of a couple were scheduled simultaneously. Among other questions, participants were asked to report their own momentary affective experiences (self-ratings) and to judge their partners’ momentary affective experiences (judgments). Self-ratings and judgments were made for four positive and four negative affect facets each (happy, enthusiastic, balanced, content, angry, downcast, disappointed, and anxious). Correspondence between participants’ judgments of their partners’ affect and the respective partners’ self-rated current affect was used as an indicator of participants’ insight into their partners’ momentary subjective experience. That is, we used the partners’ own self-rating as criterion for empathic accuracy. Consistent with our assumptions, age differences in empathic accuracy depended on the presence or absence of the partner. During the partner’s presence, younger adults’ empathic accuracy was higher than that of older adults. During the partner’s momentary absence, however, there were no age differences (see Figure 11). Importantly, empathic accuracy when the partner was absent was significantly better than chance for both age groups—both when the partner was present and when he or she was absent.

This is also illustrated by an additional analysis for which we randomly swapped partners within age groups, thus creating artificial age-homogeneous, cross-gender dyads. In these random dyads, there was no empathic accuracy (see Figure 11). This indicates that the partners did not just engage in random guessing when their partner was absent, nor did they merely use stereotypes about an average person's fluctuations in affective states across the day. Instead, people's specific knowledge about their partners served as a valid basis for empathic judgments.

In sum, our findings show that people can judge a familiar person's current affect without using any sensory information (such as facial emotions or verbal statements) and exclusively based on their knowledge about that person. This important ability contributing to understanding others' feelings should be considered more thoroughly in future research, which has mostly focused on the ability to interpret others' emotional expressions. Moreover, our results suggest that such knowledge is an important resource

that remains available well into late adulthood. In daily life, older adults' empathic competencies may thus be better than would be expected from their performance in most conventional laboratory emotion-recognition tasks.

Nice to Meet You—Empathic Accuracy and Social Outcomes in Zero-Acquaintance Dyads

Empathic skills are important for an individual's adjustment in everyday life, especially for the success of his or her social interactions. For example, children who are better at knowing the thoughts and feelings of others have been found to have better peer relationships; and adults who are better able to read the emotions of others are known to report higher satisfaction in their romantic relationships. There is, however, only little research concerning the association between empathic skills and socioemotional adjustment in older age groups. The purpose of the ongoing dissertation project by Elisabeth Blanke, therefore, is to fill in this void by investigating the role of empathic accuracy

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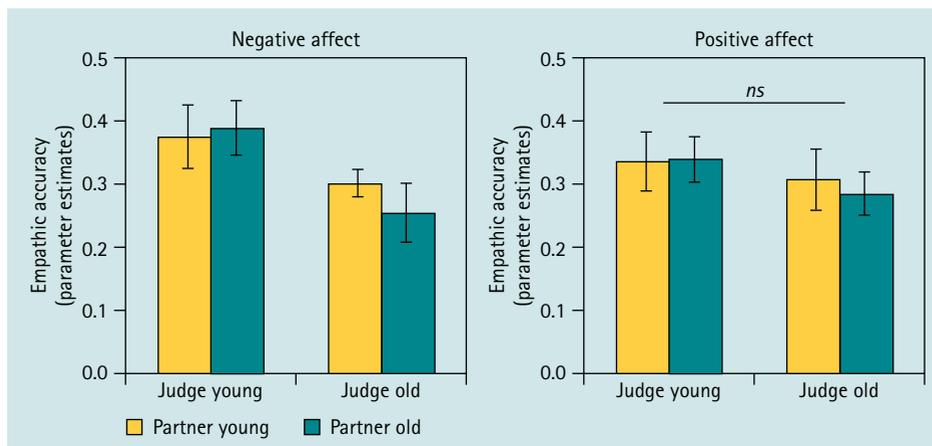


Figure 12. Younger women were better than older women in judging negative—but not positive—feelings of an unacquainted female interaction partner. Unacquainted younger and older female participants had a videotaped conversation with a partner from either their own or the other age group. Participants watched the videotape afterward and rated their own affect and the assumed affect of the interaction partner during the conversation at eight time points. Bars show multilevel-model estimates of empathic accuracy (the ability to judge other people's feelings) separately for younger and older judges and partners. The left panel represents empathic accuracy for negative, the right panel for positive affect. Empathic accuracy is measured as the correspondence of participants' ratings of their partners with the partners' actual self-reports. Higher bars indicate higher empathic accuracy across all measurement occasions. Only for negative, but not for positive, affect were younger women more accurate than older women in judging their interaction partners' affect. The age of their partners did not influence empathic accuracy. Error bars: ± 2 standard errors.

between strangers for social adjustment in young and old adults in an ecologically valid context.

We invited 208 young (20–31 years of age) and old (69–80 years of age) women to our laboratory and paired the women, who did not know each other before, in 104 age-homogeneous or age-heterogeneous dyads. Participants engaged in a conversation with each other in which they discussed recent personal emotional events, one positive and one negative. Among other things, both partners evaluated how much they liked the conversation. Then, they were asked to review the video twice and to report their own and their partner's inferred feelings during the conversation at eight time points, respectively. By comparing the self- and other-provided emotion ratings, we yielded a measure of empathic accuracy.

First findings from this study again demonstrate age differences in the ability to infer the interaction partner's affect, but only for negative and not for positive feelings: Older women were less accurate than younger women in judging their interaction partners' negative affect, but did not differ reliably from younger women with regard to their empathic accuracy regarding positive affect (see Figure 12). This might be due to the fact that positive emotions are highly socially desirable and therefore may be more readily displayed and more easily recognized. It is also possible that older adults were less motivated to infer the negative feelings of their partners. In addition, empathic accuracy in this study was associated with the perceived quality of the social interaction. Participants reported to have liked the conversation more the higher their empathic accuracy was, and this was the case irrespective of participants' age and of the valence of the evaluated affect facets.

These results support the assumption that empathic accuracy in a social interaction is associated with perceptions of the social quality of this interaction. In future analyses, we will investigate associations of empathic accuracy with self- and other-reported measures of socioemotional adjustment.

Outlook: Ongoing and Future Research

One emphasis in our ongoing and future research will be to further analyze, also in collaboration with other researchers at the Institute, the rich longitudinal data set of the MMAA project. These analyses will address a variety of research questions regarding age-related differences in affective processes and their associations with cognitive, motivational, and physiological processes. A primary focus of these analyses will be on analyses of within-person change over time and on the predictive value of affective experiences and processes assessed for the later assessed longer term developmental adaptation (as indicated, e.g., by changes in health, social integration, or educational or professional adjustment), and of possible age-related differences therein.

We also plan to extend our research on music preferences in different age groups and on the effectiveness of music listening as an affect-regulatory strategy. In addition, we are also currently investigating, in cooperation with the MPI for Empirical Esthetics, possible age-related differences in associations between objective music characteristics (e.g., regarding mode, tempo, etc.) and subjective perceptions and listening preferences by lay and expert listeners.

Another ongoing project addresses questions regarding age-related differences in interpersonal affect dynamics. For example, are romantic partners' affective responses to daily uplifts and hassles interdependent? Are there feedback loops between romantic partners' affective experiences, and do they play a role in interpersonal affect regulation within couples? In cooperation with the University of Leuven (KU Leuven) and the Kyoto University, we are also planning to investigate possible dissimilarities in these phenomena between Germany and Japan, two cultures with profound differences in desired affective experiences. Finally, we will also continue our investigation on social implications of age-related differences in affective competencies and, in particular, in empathic accuracy. We will explore, for example, the mechanisms by which empathic accuracy influences social outcomes in different age groups.

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Max Planck Research Group

Felt Communities? Emotions in
European Music Performances

Max Planck Research Group

The **Max Planck Research Group "Felt Communities? Emotions in European Music Performances"** (Head: Sven Oliver Müller) investigates the historical development of the emotions triggered by music in the 19th and 20th centuries. Focusing on emotions as a public form of communication, the Research Group aims to decipher the emotional structure of communities: What role did and does music play in the development and cohesion of communities? The focus is less on the physiological effects of music than on how they are appropriated by groups. Musical performances have the power to connect diverse individuals within a community—or to create social and political enemies. The Research Group aims to analyze the historical patterns and contexts of these effects. The Research Group began its work in 2010.



Research Team 2011–2013

Sven Oliver Müller, Sarah Zalfen

Postdoctoral Fellows

Luis-Manuel Garcia, Marie Louise Herzfeld-Schild, Yael Sela-Teichler (as of 09/2013: University of Pennsylvania, USA)

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Introductory Overview

Does music create *felt communities*—and if so, how? This is the basic question of the research group. The Max Planck Research Group “Felt Communities? Emotions in European Music Performances” analyses the historical development of the emotions in musical life in the 19th and 20th centuries. In November 2010, a team of researchers, postdoctoral fellows, and PhD students began its work. This group now consists of 10 historians, musicologists, political scientists, and ethnologists who discussed social and cultural issues from various perspectives. What role music plays as a performative practice for the cohesion of social groups in various historical contexts was analyzed, and examinations focused not only on single musical pieces but on Western music as a performance. Music production, reception, and the social formation of taste were also investigated. No distinction between “serious” and “popular” and “classical” and “modern” music was made. The field of relevant problems and approaches ranges from music-sociological inspired analyses of musical work to social historical research on the audiences of so-called classical music to the point of studies about sounds and noise in the most different contexts.

This research group works with the assumption that emotional communities are not communities of their own—but an aspect of every social group. Focusing on emotions as a public form of communication, the aim is to decipher the emotional structure of communities: What role did and does music as an emotional mode play in the development and cohesion of communities? The concept is a history of social and cultural relations in musical life. Instead of defining boundaries between the three categories that are being investigated, the relationship and the interaction between music, emotions, and communities are being examined. In recent years’ research, every single project was guided by the hypotheses that emotions vary over time and place and are historically, culturally, and socially contingent. Not only emotional expressions, such as culturally diverging gestures of grief or happiness, are subject to change but also emotional experiences. Consequently, the relation between music and emotions is considered as deeply socially structured and therefore dependent on the historical and cultural context. Four guiding assumptions and fields of this research are presented in the following: (1) reception, (2) performances and audiences, (3) negotiation by cultural practices, and (4) transfers in Europe. (5) Subsequently, the conferences, colloquia, and cooperations demonstrated the validity of the research assumptions. (6) Finally, promising perspectives about how to write

on the history of emotions in musical life by analyzing parallel changes and similarities are presented.

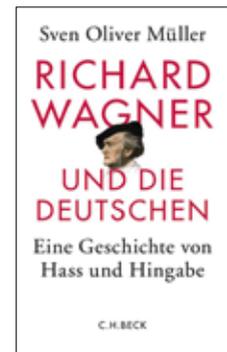
Reception

We are pursuing a change of perspective, moving away from the study of musical works to an investigation of actual participant practices. An important guiding assumption was that the meaning of music is the result of interpretational processes on the audience’s part. The same piece of music could evoke different public reactions at different concerts in relation to different contexts of the performances. The emotions evoked by music cannot be expressed as those felt and vented by composers. These phenomena require an altered research focus: Not the musical piece itself, but the dispositions of listeners should be the central object of analysis. History in its form as a modern social science might be a promising approach in order to examine the public handling of musical performances in different contexts and times.

We are pursuing a change of perspective, moving away from the study of musical works to an investigation of actual participant practices. This research group substitutes a *works-based* with an *event-based* approach. By utilizing these considerations, our research is not only an interdisciplinary approach of explaining the emotional and community-related dimension of music and its relation to emotions. It is also a promis-

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ing perspective on cultural learning and human development. It was found that the behavior of listeners' and audiences' actions sometimes depended on the movement they heard in music. The progress of this motion is experienced as possessing a pattern of tension and relaxation.

Performances and Audiences

We assume that the practices of musical performances structured public communication and, in this way, frequently created new relations in societies. Communication in musical life develops between various actors, and their relationship could be defined as a chain of communication where the composer and the artist influence the listener and the listener decodes the message. Especially public performances in musical culture can be regarded as specific patterns of communication. The point is to demonstrate how public performances trigger the formation of communities. The performative nature of music makes it a perfect vehicle for music consumers to place themselves in an imagined community. The musical performance conjures up collective memories with an intensity rarely matched by any other social activity. Music's potential as a medium of imagining communities is twofold, however. It can both induce submersion into the mainstream or can construct spaces of difference. Music performances create elements of exchange and demarcation simultaneously. If and how performances reflected, or even created, social, cultural, and political relations was investigated. To call music a performing art is not only to say that performances are being analyzed, it is to say that music performs meaning. As a category, audiences became crucial for this research. Up to now, only small case studies shed light upon the question of whether music enhances or decreases communication between and inside groups. Audiences were as much social objects as subjects of emotional assessments. Learning to enjoy a certain musical taste meant, therefore, observing social, political, and cultural ideals of others. This reveals the development of public behavior and actions of social and cultural groups.

The concept was to analyze the connection between different expressions of emotions, on the one hand, and the coincidence of simultaneous expressions of two or more emotions at the same time. The point was to examine the priority of certain emotions to analyze how one feeling gains or loses importance in audience behavior.

Negotiations by Cultural Practices

The group regards the public consumption of music as a cultural practice that shapes the behavior of a social group. Music should be therefore reintegrated into history as a cultural practice. There is a significant amount of habitualized behavior among concert audiences that indicates the relevance of debates, fashion and star admiration as cultural practices. Through complex interconnections and repetitions of practices, audiences established their specific lifestyles. Taste, practically displayed, served as a mean of distinction in order to maintain and sustain borders and distances within society and in order to label oneself as an individual or a social group. Hence, it is important to connect the social challenges in modern Europe with the feeling rules of musical audiences. Negotiation processes of the public's different taste and contrasting emotional preferences were observed. There was a negotiation between people in favor of expressing their emotions loudly (e. g., workers) and the educated middle class and entrepreneurs fighting against audible emotional expressions. The mutual perception in the auditorium triggered feelings of pride and honor within one group—in contrast to the "wrong" or negative emotions of other people, such as distress, anger, and anxiety. In fact, different social groups started to learn habitualized forms of behavior; they formed around current emotions, around certain preferences and dislikes. The history of emotions can be read as an excellent case study of an interaction between "elite" and "popular" manners. Everybody who did not follow the expected aesthetic parameters of musical communication was easily identified and excluded. When people talk about "our music," they mean that this music is not so much owned

as shared. "Our music" derives its social power from its ability to instantiate community, polity, and history. Listeners have the potential to hear different things in the same music, but the fact that many of them do not is an indication of the degree to which groups of listeners share a common environment and experience common perceptual learning and adaptation.

Mobility in Europe

Music-generated emotions meant exchange and imitation as well as resistance and exclusion. Participating in musical performances or criticizing them not only reflected existing political and cultural values but also generated them. The rise of the increasing similarity of the repertoire of music consumption, and of the aesthetic preferences in European musical life since the late 19th century, meant that a supposedly specific national phenomenon could also increasingly be read as a commonly shared European convention. This conflict of cultural transfers was not at all limited to classical music, the impact of a certain musical genre, or the rise of new audiences.

The trend toward cultural convergence triggered demarcation. It is, therefore, quite misleading to write about the history of relations between societies and cultures along the allegedly separate axes of transfer, on the one hand, and antagonism, on the other. The point is, however, to realize that cultural convergence and divergence did not constitute antithetical poles of modern European history. Conflicts and concurrence in musical culture can also be regarded as specific patterns of communication. An important task remains, therefore, to investigate the relation of exchange and demarcation, of processes of Europeanization and Nationalization in musical life.

Conferences, Colloquia, and Cooperation

The topics of the group's conferences demonstrate how their research is a result of a fruitful scientific exchange with many colleagues inside and outside the Institute. The weekly research group meeting, also giving presentations and holding debates with distinguished

national and international scholars, is an important medium for academic communication. The variety of conferences, workshops, and cooperation projects reveals the outcome of these research activities among the disciplines of history, musicology, political sciences, and ethnology.

The first conference on *Hegemonic Structures of Music Politics of Occupation, Emotions and Their Transfer: Europe of Two World Wars, 1914–1949* took place in March 2011, and was organized by Sarah Zalfen and Sven Oliver Müller. The purpose was to draw attention to the political dimensions of apparently purely cultural practices. The aim was to show if and how contacts in music constituted a highly contested field of emotional exchange during the two World Wars. Cultural interactions and transfers did not run in parallel with the military antagonism, but were its "harmonious" counterpart. Contacts in "popular" and "serious" music, therefore, fostered processes of emotional understanding that helped to stabilize politics.

A fruitful result of the cooperation between this research group and the Leibnizpreis-Forschungsstelle "Global Processes" in Konstanz was the international conference *Ambiguities of Communication. Musical Life and the Emergence and Fragmentation of Social Relations in the Twentieth Century*, conceptualized by Jürgen Osterhammel and Sven Oliver Müller in January 2013. The project brought together leading scholars in cultural history and musicology, including Celia Applegate, Hans-Joachim Hinrichsen, Detlef Siegfried, and William Weber. The assumption was that the practices of musical performances structured public communication and, in this way, frequently created new relations in societies. Musical places and topics that are so important that they allow for a historical generalization were investigated, where the focus lies on comparable cultural performances at different cultural places.

Yael Sela-Teichler initiated a project pertaining to the music and poetics of memory in German Jewish experience in modernity. This project examines questions about the mechanisms where music's emotional imports have served to delineate, negotiate, or

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undermine boundaries of identity, participation, and distinction. The first result of this project was the international symposium *Music, Memory, and Emotions in the German Jewish Experience of Modernity* that was co-organized with Philip V. Bohlman (University of Chicago) in Berlin-Wannsee in March 2013. The symposium—a cooperation between this research group and the American Academy in Berlin; The Center for Jewish Studies at the University of Chicago; Universität Hildesheim; and the Hochschule für Musik, Theater und Medien, Hanover—brought together leading scholars in cultural history, musicology, and Jewish thought, including Paul Mendes-Flohr, Leora Auslander, Michael P. Steinberg, and Ruth HaCohen. The speakers addressed the role of music as a practice and as a literary figure in the construction and deconstruction of memory and Jewish subjectivities, forms of musical commemoration, and the experience of exile in the 20th and 21st centuries. In 2013, the research group, led by Sarah Zalfen and Iris Törner, developed the summer school *Emotions_Learning_Music*. With a faculty of renowned international and interdisciplinary scholars and practitioners (among them were Ian Cross, Eckart Altenmüller, Adam Ockelford, and Dietmar Wiesner), the summer school provided a framework where PhD students from the history of emotions, musicology and sociology, psychology and neuroscience, as well as young musicians and music educationists worked together on the question of what is exactly learned “through music.” This question linked themes such as the improved processing of information in the brain while being “supported” by music to those of the acquisition of values and appreciation via musical practices or to the tracing of historical emotional states by interpreting music. Hereby, the summer school opened new perspectives on the interrelation of music, education, and emotions to the young researchers. Luis-Manuel Garcia organized the truly pluralistic and interdisciplinary conference *Resonances: Music, Affect and the City*, about the feeling of urban life. This collaboration with Harvard’s Sawyer Seminar *Hearing Modernity* explored the ways in which emotional,

embodied experience intersects with sound and the urban landscape. Ingrid Monson was the symposium’s keynote speaker. Although this conference placed a special emphasis on Berlin’s local music scenes, scholarly presentations ranged as widely as devotional music in India, indigenous music in Canadian public schools, and European jazz festivals. Using “music,” “affect,” and “the city” as keywords, this conference created and captured resonances between a diverse, international array of scholars and music-industry professionals. In addition to scholarly presentations, this event featured roundtable discussions with professionals from Berlin’s local music scenes. The research group became a member of the roundtable *Music Research and Education in Berlin* and participated in initiating a new project together with the Berlin Music Council: *Jugend forscht Musik*. This invites pupils and teachers to cooperate with research institutions in the field of music. Professional researchers help the students to conceptualize and conduct a one-school-year-long research project on a music-related topic. The research group is the contact partner for projects on music and emotions, youth culture, and politics. Additionally, the group also participates with the *Jour fixe Musikwissenschaft* in order to increase the scientific cooperation between the many researchers and students working on music in different Berlin institutions. Since this group was created, close research contacts have been established in international research partnerships. The Society for the Promotion of Science sponsored a transnational research project with various Japanese universities. This project, led by Naoko Morita (Tokyo), aims to examine the impact of emotions in modern German history. External collaborations often resulted in building contacts with important scholars, such as the musicologists and psychologists at the conference *Music & Emotion* in Jyväskylä, Finland, in June 2013. The symposium *In Search for Emotional Orders—Music and Emotions in History* was presented to strengthen the historical dimension of the relation between music and emotions. By looking at practices and discourses closely

related to emotions in different historical situations of music production and reception in the 19th and 20th centuries, the researchers as well as the PhD students in this group elaborated patterns of different emotional orders in European music life.

Changes and Similarities in History— New Perspectives

The research focus lies on the *historic* development of emotions in musical life from the 19th to the 20th centuries. Musical movement and the paradigm of space and times are crucial for this research. We assume that the emotional side of the production and reception of music has changed over time as much as the music and its practices of performance and perception. By analyzing emotions as a mode of social communication in different music productions, it is helpful to use one key term: *change*. Music is about changes: It takes place in time. These feelings are not only transitory per se; they are also transitory in the historical sense and there are feelings that have nowadays become largely foreign to us, but which held significance for audiences, for example, in the 1950s. We investigated the feeling rules of middle-class audiences in symphonic concerts in the 1840s and of fans of Beat music in the 1960s to explain why and how they changed their public behavior. But the other important objective and a fruitful perspective for future research is not only to observe the changes and the differences but to investigate the similarities of the audiences' feeling rules and the parallels of the cultural practices. Although different people perceive the same event in different ways, it is important to question if individual differences are the specific manifestations of the same general principles of perception.

The second key term is *similarity*. An attempt will be made to find the similarities of emotions and feeling rules in musical life. The point of this difficult task is to state the limits of a purely constructivist approach and accept the methodological deficits of focusing only at different receptions of emotions in musical life. The assumption that most of the artists and listeners recognize the possibility of a teleological movement of the

music played can give guidance. It should be queried if these judgments are intersubjective and not purely personal reflections, even if they are neither universal nor independent of a familiarity with the musical conventions governing musical receptions. Thus, within the framework of social and cultural conventions, it is a promising approach for analyzing common emotional evaluations of music beyond the differences. It would be too easy to avoid any experiment in future research from this observation. An attempt will be made to find the similarities of emotions in musical life and observe the common feeling rules present during a dance festival, a jam session, or a visit to the opera house. It is possible to concentrate on six or eight time slots in musical life in the 19th and 20th centuries.

This research group has to contemplate the impact of a general perceptual history of emotions in musical life. The first guiding assumption comes from the fact that people need time to consume the flow of the music itself. The search for common emotional styles in music could be made by analyzing the perception of harmonic tension, rhythm, melodic process, tonality, and the awareness of surplus aesthetic impulses. Discovering more about the duration of a sound that is required for audiences to identify different musical styles would be helpful. It might be interesting to compare the expressive properties of the performance building of, and reinterpreting of, a great deal of previous work that has been carried out within different conceptual frameworks. We are happy to welcome two musicologists in our group, Marie Louise Herzfeld-Schild and



Figure 1. Fans at a rock concert.

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Lena van der Hoven (as of 03/2014), whose experiences in 19th-century music give us a surplus methodological impulse.

The second guiding assumption is to connect the infinite varieties of musical amenities with the characteristic, maybe even unique, reception of music in the public sphere. There are similarities not only in structure and movement of the compositions but also in the groups' and individuals' communication about music. The findings on the impact of this communication process might help to detect the similarities in the cultural practices and common patterns of negotiation. The point is to investigate how cultural transfers between time, places, and people can become social modes and frame conditions for societies. We have to analyze the evolution of the settings of emotions.

Our third guiding assumption is the sensibility of the peculiarities of music life in Western Europe. In order to write a history of common emotional perceptions in musical life in modern Europe, it is crucial to consider that the peculiarities of Western music tradition (division of musical labor, e.g., specialist performers, entrepreneurs, and listeners) are promising tools to compare classical and popular music performances, and the choir at wedding ceremonies with the fan chorus in a football stadium. This approach could be tackled empirically by interpreting the emotional reception of music as an integral part of human development. The hypothesis is that, because musical expressiveness depends on such patterns, people from different social contexts and cultural backgrounds might develop common emotional skills to identify



Figure 2. Single records from the 1970s.

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the expressive character of the performance in order to maintain and sustain borders and to acquire chances within society.

In Search of Musical Politics—Emotions in the Reception of Richard Wagner in Modern Germany

Up to the present, Richard Wagner is the only German composer still provoking dispute in Germany's society. Wagner's reception is a history about his appropriation as a cultural mean of German politics. Wagner has been adapted in an interplay between affirmative reenactments and controversial new creations. The Wagner myth could be easily retold and adapted to cultural and political changes within the alterations of German society. The numerous publications about Wagner usually focus on facets of his biography or his compositions only, but rarely and less differentiated on his impact on German society beyond the period of National Socialism. This project opened up new perspectives on the aftermath and myth of Richard Wagner as a part of German history in the "long" 20th century (1883–2013). In the latest book

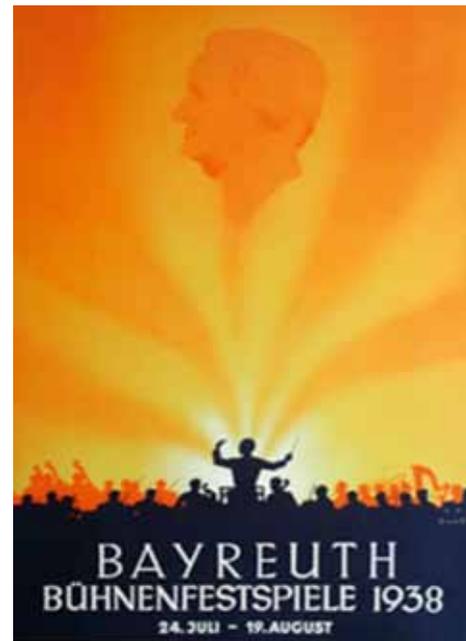


Figure 3. Jupp Wiertz Bayreuth Festival Poster.

Source. *Das Dritte Reich und die Musik*, ed. by the Stiftung Schloss Neuhardenberg in cooperation with the Cité de la Musique, Berlin 2006, p. 58.

Richard Wagner und die Deutschen the ideals of his admirers and enemies from Imperial Germany to the Federal Republic were analyzed. The following topics are especially relevant: the political meaning of Wagner's music at state and national ceremonies, the representational function of the Bayreuth festival and the Wagner family, the social function of associations and monuments, the commercial function of recordings and fanmerchandise, the meaning of (new) media in textbooks, films and press.

The cult of the genius is an indicator of the great importance of music as an emotional practice. Its success is caused by the availability of the genius as a projection of emotions. Wagner's reception happened within a public space in which contested emotions could be communicated and emotional orders negotiated. Wagner's style of interminable compositions and his silent, dark, ordered conception of the musical event controlled the emotional experiences and expressions of the audience, which were gradually inscribed into the minds and bodies of the bourgeois habitus. One important result was to demonstrate how the interpretations of his musical works and philosophical concepts changed more than the public presence of Richard Wagner in the period between 1883 and 2013, with its huge political, social, cultural, and economic upheavals. The history of Wagner was a history of emotional controversies and nationalistic politics. Preparations are under way for the presentation of this analysis to become a small part of the new exhibition of the Wahnfried Villa in Bayreuth.

The Power of Audiences—Musical Reception in Berlin, London, and Vienna in the 19th Century

Concerts of symphonic music and opera performances were an integral part of the leisure time of the European aristocracy and the bourgeoisie in 19th-century Europe. Unlike any other kind of high culture, the opera houses and the great concert halls are the ideal places to analyze the social practices and cultural values of the European elite. This research project concentrated on the social influence, cultural practice, and political



Figure 4. Satirical painting "The Boxes" from Thomas Rowlandson.

Source. Victoria and Albert Museum, London, Museum number: S. 4724–2009.

significance of leading musical productions in Berlin, London, and Vienna. In a transnational perspective, it compared the development of common cultural practices and forms of public representation in three major European capitals of music. The point was to reveal the primarily social and political function of those forms of entertainment by analyzing the behavior of audiences, rather than by looking at the music itself. What do the conditions of participation, for example, dress codes, tell us about the values of the audience? How did a more or less inattentive audience turn into "listeners" during the second quarter of the 19th century?

To answer the question why the behavior of audiences changed dramatically and people disciplined their behavior in the course of the 19th century, one has to look at the emotional habits of listeners. Educated patrons in concert halls and opera houses started to debate over what is allowed to feel and what not. The task of educated middle classes was to decide about appropriate ways of expressing emotions in public. One could observe a negotiation between groups of people in favor of expressing their emotions loudly and the educated middle classes and entrepreneurs condemning audible expressions of emotions. In fact, different social groups started to learn habitualized forms of behavior; they formed around

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Researcher

Sven Oliver Müller

current emotions, around certain preferences and distastes.

The emergence of a transnational style of cultural practices and feeling rules can be observed in 19th-century Europe. In Berlin, London, and Vienna, the productions of opera houses, the repertoires of concert halls, and first of all the audience behavior became increasingly similar. Despite severe political conflicts within and between each of the countries above, it is crucial to state that a German bourgeois and an English aristocrat at the beginning of the 20th century behaved similarly during a concert and cultivated similar aesthetic preferences. The transfer of cultural practices and social habits demonstrates the emergence of a common European culture of music.

The Infinite Varieties of Feelings— Conductors as Producers of Musical Meaning

Conductors have to advise the members of an orchestra by testing the technical abilities of the musicians, on the one hand, and by demonstrating the cultural meaning of a composition for a wider public, on the other. Therefore, conductors are interested in emotions as a cultural practice. We are now starting a new project with a focus on the conveyance of music via emotions incorporated in the work of conductors. The aim is to find out how conductors are familiar with employing feelings in order to share their visions with the musicians through emotional imagery, gestures and anecdotes. We believe that conductors especially make emotions visible and tangible through music. But what exactly are emotions from the perspective of a conductor, and where do they become vital? We are asking, for instance, how conductors translate music into emotional language during practices. It is interesting to discover the metaphors, gestures and jokes, through which they manage to captivate not only the musicians but also their audience.

Our aim is to compare highly controlled forms of behaviors with highly expressive facial gestures and body movements. It will be interesting for the impact of emotions in musical life to analyze how conductors

try to model feelings during a rehearsal to produce, for example, an “ugly” sound in a certain passage in which he believed it suited the expressive meaning of the music. We hope to find out how emotionally charged art pieces acquire meaning among musicians, entrepreneurs, and audiences. We finished the first interviews with Nikolaus Harnoncourt and Christian Thielemann, several others will follow soon. It is our goal to use some of these interviews as source material for our publications and try to reach a broader audience in public discussions.

Musical Education in the British Empire— Feeling Rules for the Colonies Around 1900

The triumphal procession of European music and Western aesthetic ideals since the late 19th century coincided with a growing interests of politicians, entrepreneurs, and the middle classes in foreign cultures. The elites in Britain were eager to detect the cultural and habitualized differences between the civilized rulers and the noble savages in the colonies. This very recent project shall investigate how political and social elites intended to change the “premodern” musical culture in the colonies by establishing a “proper” Western repertoire and “good” emotions among the local listeners. How certain emotional habits served as cultural strategies of communication, integration, and domination will have to be examined/explored. The mission of civilizing the colonies was by no means in direct relation to political power. But it could develop as an uneven political exchange with the imperial establishment and the British canons, habits, and tastes. The proverbial “burden” of the white man was indeed a venture which featured its own soundscape. It is important to discover the aesthetic ideals and cultural practices of white, educated men that went into the making of a colonialist society. What was the impact of the protocols of the colonial offices, articles in musical magazines, missionary’s initiatives, and instructions for military bands? It will be interesting not only to analyze the rare performances of classical music, but even more the concert reports of military bands and the songs during church service. The goal is to discover how the com-

munication about appropriate emotional tastes and habits in musical life within the British elite became the blueprints of an educational program intended to civilize "ignorant" native people in the colonies. The talk about "good" emotions in musical life and the invention of new repertoires and tastes were a superficially humanistic, but nonetheless imperial strategy. The focus lies on the concepts and values of the rulers, artists, and the consumers in London, and on the ways they perceived the reception of the population in the colonies. The "emotional imperialism" around 1900 was probably less brutal, but more coercive than former cultural strategies. One might ask if an embourgeoisement of imperialism, if the domestication of the exotic stood forth as a model, not only for the people in a certain colony, but for Great Britain itself.

Tuning Politics? The Formation of Emotional Communities on Party Conferences in 20th-Century Germany

While visual and spatial strategies of political representation and display were well scrutinized in recent year's research, their sounds remain rather inexplicit. This research project focuses on the importance of music for the consolidation of political communities, showing how these processes are associated with emotions. It examines party conferences and their role in music throughout the 20th century and throughout all parts of the political spectrum. The study questions, how joint music production and reception are becoming features of emotional communities in the political sphere. This hereby sheds new light on the processes of political will-formation, opinion building, and decision making. The long investigation period opens the topic to the perspective of a history of emotions, as it reveals the variability of the relation of music and emotion in different historic contexts (Zalfen, 2013; Zalfen & Müller, 2012). Music in this political context demands a different approach than focusing on the autonomous artistic domain divided in piece, performance, perception, and their political or emotional "impact." Applying Turinos differentiation between *participatory music*

and *presentational music*, music becomes something active and interactive, embedded in social norms and processes. The analysis parameters shift from aesthetic quality, interpretation, and artist-audience relation to bodily practices, performativity, and ritualized communication. On the empirical level, music is no longer only the orchestral work played for the ceremonial opening of a party conference and singer-songwriter's performance in the intermission. It is also the joint singing of the national anthem or a party hymn, the fanfare and rataplan announcing the appearance of a party leader, or hurrah shouting and the rhythmic clapping celebrating a great speech or a newly elected person.

Emotions have been frequently seen as individual and strictly internal, whereas new research encourages focusing more on the collective factors of emotions. Therefore, in this approach, music is not seen as a language of emotions, but as a social and emotional practice. While in the first model—rooting in romantic aesthetics (Brunner & Zalfen, 2011)—music is thought of as an expression of somehow preexisting inner emotions, the latter understands music as a mode of "doing emotions" by addressing specific emotions and, at the same time, mobilizing, modulating, regulating, and communicating them. Through the practical engagement with each other through music, *shared emotions* that mark the belonging of the subject to a community can develop into *collective emotions* that are created by a group or crowd. This does, however, not mean that everybody is feeling exactly the same. Comparisons with psychological research findings in similar contexts suggest that it is one explicit quality of music that it could provide a framework for communicative interaction, giving participants the sense that their experiences are in alignment—although the individual interpretation of meaning may diverge widely. Singing together plays a particular role in this process. The active involvement of the body, the mutual synchronization within a group, and the wide range of meaning accumulated in mostly traditional hymns and songs is a widely used means of emotional community building in many political groups and parties.

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Researcher

Sarah Zalfen

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At the same time, singing allows for the production and representation of community—it *performs* belonging and community (Zalfen, in press-b). Close collaboration with Juliane Brauer from the Center for the History of Emotions helped to build up a broad knowledge on repertoires, practices, and political contexts of collective singing in Germany.

For example, the National Socialism regime was rife with music at almost every level. It was an integral part of propaganda, named by Goebbels as “the science of the human soul.” Thus, it is not surprising that the NSDAP party conventions, developing into the six propaganda shows of the Nuremberg Rallies between 1933 and 1938, followed a clear musical script. In a similar pattern, the six events presented a dramaturgy, where specific pieces of music were related not only to certain procedures (Hitler appearing always with the Badenweiler March, the Song of the Banner introducing the public ceremony, the Horst Wessel Song as finale) and bodily practices (marching, dancing, singing, saluting, etc.) but also to emotions. Grief over dead comrades, pride about the victory of “the national movement,” and almost randomly repeated expressions of joy were among the feelings that were addressed, motivated, and modulated by specific musical performances. Through the music, the rally was not only a show to watch,

like sport or military parades, but something to participate and to be physically and emotionally involved in, making the Nuremberg Rally an exciting emotional experience for the majority of participants. The case makes also clear that music does not somehow induce emotions into people who are exposed to it, but emotional practices were related to the trained knowledge of the participants' minds and bodies.

Further case studies in the monograph that will result, among other publications from this project, include exemplary party conferences from all historical periods and political systems in 20th-century Germany.

The research so far has built up a broad overview and database of music on party conventions throughout the 20th century. Minutes, programs, pictures, recordings, and official or press reports were scrutinized to obtain information on the kind of music performed and musical repertoires created in certain times and by diverse political camps to learn about the performative styles, including the type of participants and their individual or collective bodily activity, and to identify how this music is dealt with in speeches, writings, pictures, and videos. Finally, these sources reveal why certain music was performed and on whose direction at a party conference.

Among the preliminary results of the study, some confirm other perspectives on aesthetic and affective processes in politics and politics: Democratic parties use less music than autocratic parties, although left-wing parties have more diverse repertoires than moderate and right-wing parties. Some emotions addressed or performed through music do change over time, others do not: While dignity and national pride seem to lose their importance, fun and spontaneity but also nostalgia enters the emotional repertoire. Feelings, appropriate to collectively perform in a musical context at a party gathering, were neither the same in 1900 as in 1940 and again different in 1980, nor was their musical form of performance or expression. Yet, community-related feelings, such as solidarity and sociability, reigned supreme in the past as it does today. It becomes obvious that music is not “a mere disguise of reality,” but rather a means to shape and cre-



Figure 5. Matthias Platzeck, chairman of Germany's Social Democrats, center, sings together with a coal miners' chorus at the end of the last day of the 3-day party congress of Germany's Social Democrats in Karlsruhe, Germany, 16 November 2005.

© AP Photo/Herbert Knosowski

ate realities; musical performances of political communities can hereby create a wide range of feelings of belonging and togetherness. But the field of music shows also distinct differences: Characteristics and rules of modern political theatricality, like personalization and privatization, vicissitude, and the dependency on media attention, have been—unlike in the iconic and spatial strategies of politics—strongly declining in recent years. In further research, the collected archive will be surveyed to identify specific emotional styles and regimes in particular historical and party contexts as well as critically revise the findings in order not only to fully comprehend processes of emotional community building but also their constraints and failings.

Minerva Fellowship

Soundscapes of Emancipation: Musical Negotiations of German Jewish Modernity 1760–1829

The role of music as cultural and discursive practice in the formation of Jewish modernity during the decades around 1800 has largely remained unexplored. Scholars of music history have tended to focus on 19th-century climactic instances in the lives and works of acknowledged Jewish musicians, such as Felix Mendelssohn Bartholdy or Giacomo Meyerbeer. The 1829 performance of Johann Sebastian Bach's *St. Matthew Passion* at Berlin's Sing-Akademie, a formative event in the rise of German nationalism that was initiated and conducted by the Jewish-born Felix Mendelssohn Bartholdy, has traditionally been treated as a historiographical watershed marking the admission of Jewish musicians into the public sphere of German music. Yet, the key role that Jews (and Jews by birth) played in the 1829 performance as patrons of the Sing-Akademie, as amateur musicians, or as commentators—parallel to the appearance of music for the synagogue in the German lands—raises questions about how music had become a mode of cultural participation and negotiation of modern German Jewish self-consciousness in the latter third of the 18th century. The emergence of music as cultural practice and as discourse among Jews in the German lands, particularly in Prussia, as early as the

1760s, was without precedence in the history of central European Jewry and all the more extraordinary in light of the deep-rooted "music libel" against the Jews—a medieval Christian notion that rendered Judaism and the Jews unmusical and thus immoral—that continued to color attitudes to Jews well into the modern period. Excluded from musical professions, on the one hand, and restricted by traditional rabbinic decrees, on the other, Jews' access to musical knowledge, practices, and spaces essentially demarcated as Christian was anything but straightforward.

The project focuses on Berlin, where in the decades leading up to 1800 music was gradually becoming an integral part of everyday life of a newly emergent Jewish upper class, a social group that had embraced the values of the *Aufklärung* and the ethics of *Bildung* conspicuously represented by Moses Mendelssohn. The project seeks to show how in the specific ideational, religious, and sociocultural formations that marked the late German *Aufklärung* and Jewish Enlightenment (*Haskalah*), music could become an increasingly porous "border zone" that ultimately permitted Jews to enter the European arena as participants in the negotiation and coconstitution of the soundscapes of

Researcher

Yael Sela-Teichler

The Minerva Fellowship Program enables German and Israeli scientists and researchers to spend long-term research residencies at institutions in the host country.



Figure 6. Rahel Varnhagen von Ense and Markus Levin.

Source. bpk/Staatsbibliothek in Berlin.

Researcher

Luis-Manuel Garcia

modernity. The fervor of the enlightened Jewish bourgeoisie and upper class for everything aesthetic must be considered within a broader context: Jews' ethical, educational, and cultural improvement was tightly linked with the public debate about Jewish civic emancipation in Prussia at least since Christian Wilhelm von Dohm's 1781 seminal essay *Über die bürgerliche Verbesserung der Juden*, which provided a heuristic basis for the Jewish question well into the 19th century. The project explicates the intertwinements of musical practices and aesthetic discourses with the debate about Jewish civic improvement and the politics of Jewish emancipation in the decades around 1800. By engaging with 18th- and early 19th-century theories of music, aesthetics, and ethics by Christian and Jewish writers alike, men as well as women, the central role ascribed to emotions in these mutually embedded areas of thought is underscored in order to highlight the ways in which new concepts of the sentiments (*Empfindungen*) opened up hitherto unknown possibilities for Jewish participation in European culture, especially through music. Methodologically, the project draws on historical snapshots of musical encounters in public and private settings, civic and religious institutions, and through aesthetic and critical discourses. My notion of encounters is based on a concept of music both as a dividing boundary that demarcates difference and distinction and as a permeable border region in which identities and difference can be negotiated, challenged, and redefined. This notion is particularly relevant to the ontology of music in mid-18th-century Germany and the rise of new aesthetic theories that rendered music more inclusive than ever before. Through thick description of such musical encounter—from musical works to public concerts to discussions in private letters and published essays—I explore how music operated as a mode of participation and negotiation of Jewish subjectivities and Christian-Jewish relations in interreligious and cross-regional networks. The primary sources include records of the textual and material dissemination of music in Jewish circles, performances, institu-

tional memberships, and patronage. Drawing on literary and philosophical texts as well as letters and personal texts on aesthetics, ethics, emotions, and music by Jews, both men and women (in German, Jüdisch-Deutsch, and Hebrew), including the letters of Rahel Levin-Varnhagen and Dorothea Schlegel, the formulation of participatory and inclusive aesthetic regimes is analyzed. The first results of this project, which have appeared in peer-reviewed articles and will be expanded in a monograph (in preparation), bring to light a little-known cantata from 1786 in memory of Moses Mendelssohn, a singular and fascinating piece that encapsulates, as is shown, the aesthetic, cultural, and political dilemmas that ultimately shaped modern Jewish experience, constituting a rare moment of Christian-Jewish intertwinement at the outset of German modernity.

"Can You Feel It, Too?": Music, Affect, and Intimacy in Contemporary Urban Electronic Dance Music Scenes

In 1988, as Chicago's postdisco "house music" was just beginning to reach European audiences, Larry Heard released a track under the moniker Fingers Inc. entitled *Can You Feel It?* (Jack Trax JTX-20, vinyl EP). This track features a vocal performance by Robert Owens, using the declamatory style of an African-American preacher to describe house music and its corresponding dance floors as a utopia of universal belonging, mediated through the corporeal, affective experience of the music itself. Interspersed with this speech is a sample of a concert performance of the soul group The Jacksons, where someone yells *Can you feel it?* and the crowd answers in roaring, euphoric cheering. Repeatedly and through multiple channels, this house-music anthem staged a utopian fantasy of affective belonging for an emergent, international audience of listener-dancers in the late 1980s. On the dance floors of nightclubs, loft parties, and raves, partygoers engage in forms of stranger intimacy that short-circuit conventional narratives of intimacy and transgress normal, "daylight" decorum. This stranger intimacy taps into the sort of bond that theorists from Georg Simmel to Gemma

Seltzer imagine binding mass society; but the face-to-face and erotic aspects of this dance floor encounter alter the strangeness of strangerhood, too, finding new meaning in Simmel's play of distance and proximity. But how does such intense stranger intimacy arise and endure? In what registers is it felt and articulated?

The project addresses these questions through an intertwining of: ethnographic research in the electronic dance music scenes of Paris, Chicago, and Berlin; the analysis of these scenes' musical aesthetics; and an engagement with current scholarship on themes of affect, touch, and intimacy. This multisited project is based on ethnographic fieldwork conducted across three cities and between the years of 2006 and 2010.

The project aims to impact the fields of music and dance studies, anthropology, popular culture/cultural studies, sexuality studies, and critical geography—particularly those subfields that take interest in music scenes and live events. Publication goals include a monograph (provisional title: *Together, Somehow: Music, Affect, and Intimacy on the Dancefloor*) as well as two articles drawing from the monograph's materials.

Most partygoers seem to want fluid and capacious forms of belonging that are loosely held together by musical affinities and by the dance floor's affective intensities, but they must contend with the contradictions inherent in embedding such imagined worlds in one that is already striated with exclusions. They want distinction without discrimination—belonging beyond the categorical exclusions of identity—and they sustain the fragile *sense* of such a utopian world through a sort of socially operative vagueness, routed through aesthetics and affect rather than identity. But these fluid practices of vague belonging are not entirely buoyant: Beneath these utopian fantasies of open belonging, the testimony of participants as well as fieldwork observations reveal fissures, inequities, and exclusions that often go unexamined. This project is dedicated to exploring how such scenes can support transient but real world-making projects by striking an ambivalent bargain with vagueness, which both enables

these worlds to *feel* imminently possible and provides cover for their underlying contradictions. By focusing on contemporary dance events, this project also brings spatiality and corporeal copresence to the fore, reconceptualizing stranger intimacy through relays between space, affect, and music. It engages with current research in urban studies and critical geography that theorize the connections between stranger sociability, affect, and built environment.

Although writing about electronic dance music has been growing steadily for the past decade, most scholarly monographs have been dedicated to writing the history of its scenes and genres, profiling prominent artists, and analyzing musical practice. Some ethnomusical and anthropological literature—particularly on ritual—has traced the connection between group musical activity and collective belonging, but this has largely been studied in the context of ethnic, national, or kinship communities. Recent theoretical work on nonidentitarian forms of belonging have primarily been elaborated out of archives of cultural texts and political movements. This project, by contrast, builds upon ethnographic fieldwork to study the emergence of stranger intimacy and musical-affective collectivity outside of solid identity forms. Furthermore, it does so by focusing on the experiences of "ordinary" partygoers and highlighting themes rarely explored in electronic dance music

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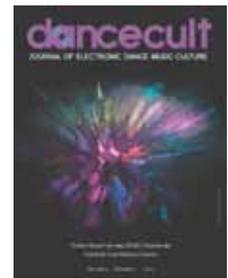


Figure 7. Audience at a music event.

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studies: intimacy, touch, and affect. In the process, it develops new concepts and models to describe how these themes intertwine on the dance floor.

This project aims to produce and publish research that traces the links between musical aesthetics and social forms, that seriously takes the political stakes of “fun,” and that is alive to the affective dimensions of contemporary music, dance, and nightlife. With regard to social and cultural theory, it offers a range of new concepts while contributing to current ethnographic research. For example, the primary focus here is on nonconventional, primarily tactile forms of stranger intimacy; touch remains under researched in music studies (as well as in most other disciplines), and there is even less research that focuses on tactility between strangers. This project’s findings on the importance of vaguely defined, fluid relationships offer a substantial contribution to this scholarship. Results from this research show that the complexities and contradictions of modern collective belonging are both lubricated and mystified by an appeal to feelings and emotions: For these actors, the feeling of shared musical experience comes to stand in for collectivity—especially when such belonging is incoherent or fragile. Furthermore, these utopian fantasies of belonging are often indexed affectively both in the aesthetics of the music itself as well as in the experience of collective dancing. This project is thus one of the few that closely traces the connections between musical aesthetics, affective experience, and the sense of sociability between strangers. Also, the eyewitness accounts of inclusion and exclusion collected from scene participants provide a detailed and textured model of how a nominally open affinity group (such as Maffesoli’s “neo-tribe” or Hitzler and Niederbacher’s “post-traditional community”) actually creates obstacles to membership while presenting a self-image of diversity and inclusion. This project intertwines with a second, newer research project that is currently in the data-collection/fieldwork stage. This postdoctoral research project, entitled *The Techno Jetset: Mobility, Tourism, and the Creative Class in Berlin’s Electronic Dance Music Scenes*, examines the recent emergence of

“techno tourism” in Berlin as both a cultural and commercial phenomenon as well as its entanglement with various forms of spatial and social mobility. The first year of fieldwork has already revealed that many “techno tourists” also make the decision to move to Berlin for longer stays, thus expanding this project’s scope to consider not only tourism but also migration, which in turn raises issues concerning the economic and working conditions of “creative class” industries as well as the impact of gentrification on urban music scenes. Of particular relevance to this research group’s theme is the role that feelings and emotions play in grounding both tourists’ and migrants’ sense of belonging to their adopted city; in particular, music plays a central role in creating affective points of connection between those invested in these musical genres, which helps them sustain a sense of musical community as well as of belonging to a local, spatially grounded music scene.

Researcher

Tim Biermann

Emotion and Music Reception as Indicators of Change Within Societies: Germany and Great Britain From 1950–1970

The 1950s and 1960s brought significant change to the popular musical landscape. This project examines the emotional phenomena in musical communities that coincided with these changes. Outbursts of violence at Rock ‘n’ Roll concerts, the liberating bodily movements of twist in the early 1960s, the screaming fans at Beatles concerts, and the rise of club culture: when Rock ‘n’ Roll and Beat music surged into the realm of public attention, they were much more than simply new forms of entertainment. Bands and artists like Bill Haley, Elvis Presley, The Beatles, or the Rolling Stones helped to reshape the musical world. New technologies made music more accessible, and the emergence of media like music magazines, radio, and TV distributed knowledge regarding latest trends amongst readers, listeners, and viewers of a growing mass market. These factors helped to establish a new youth culture that questioned the paradigms of social order associated with their parent generation. Surprisingly, the findings also reveal that seemingly conservative music genres like the German *Schlager*

were incorporated in this culture. Accordingly, new ways of expressing and coping with emotions for both fans and bands alike were developed, creating new musical communities in the process while established practices coexisted without resulting in contradictions in youth identity constructions. These new youth cultures became increasingly influential; their emergence and development coincided with various forms of social change during these times—this is hardly coincidental. The key assumption is that—despite the temporal and cultural duality of new and established emotional and musical practices in the realm of Beat and youth culture—the emergence of Beat- or Rock 'n' Roll-based communities with mixed sets of common and new practices pushed the boundaries of what could be nonetheless said, done, and felt, thus changing society in the process. These practices shaped emotional styles that were an important part of these communities and fostered new forms of identity construction. The project aims at the identification of these emotional styles in musical communities in Germany and Great Britain. But, sources also show that the new musical styles were subject to change themselves. They were picked up by other artists and fans, challenged by conservatives, and integrated into the musical mainstream, thus influencing the very same social formations by which they were coined and influenced themselves. These communities enacted emotions like joy, passion, and “feeling alive,” but also anger in specific ways. This played a vital role in changing processes, and thus this project examines emotions as relevant indicators of social change, showing how they were connected to the specific style of musical communities: Rock 'n' Roll made “the whole mixed up world [seem] to be put right, alive and new” (*New Musical Express*, 1956) as one fan claimed.

Regarding its analytical framework, this project draws heavily on the methodological concept of emotional styles that are influenced by and allocated in cultural spaces. Findings indicate that these emotional styles are used by fans and bands to express their identity and social distinction. Thus,



Figure 8. Outside Buckingham Palace when the Beatles received their MBEs, London, 26 October 1965.

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they became an important part of community building, enabling the creation of “felt communities.” Emotional styles manifest themselves in various forms in the sources examined for this project: They can be found in interviews, recordings, lyrics, and concerts, but also in newspapers, magazines, and TV shows about musical phenomena. The analysis of these sources does not only grant insight into the emotional practices of bands and listeners but also into how they were developed and distributed. Emotional styles as analytic categories are particularly useful in the context of this project because they help to acquire a new perspective upon the youth cultures of the 1950s and 1960s, which explains the social conflicts and changes of the period without disregarding or ignoring the coexistence of new and established emotional and social practices in the same cultural space and timeframe. The juxtaposition of German and English cultural phenomena and sources allows, on the one hand, for a broader image of the 1950s' and 1960s' youth culture, outlining to which extent the English and the German varieties of youth culture shared common features but, on the other hand, also enable the project to highlight and reveal national complexities and differences—especially with regard to the German *Schlager* music for which the English music market lacked a fitting counterpart.

Researcher

Anabelle Spallek

"Lisztomania" in the Musical Life of 19th-Century Europe: Emotions and Community in the Reception of Liszt as a Genius

"Lisztomania"—the enthusiasm for the piano virtuoso Franz Liszt (1811–1886) was characterized in the 19th century. From 1838 until 1847, Liszt went on his famous concert tours throughout Europe. The former *wunderkind* became a well-known star: The audiences adored him as a genius and the press reported excessively about Liszt and the behavior of his admirers.

The interest in this project is the connection between emotions, music, and subject formation in the historical context of prerevolutionary Europe before 1848. This period—called the age of the virtuoso in music history—was also a transitional phase for music culture. Musical life was transforming into a professionalized and differentiated musical market. Liszt invented the romantic piano virtuoso and the piano recital in the 1830s and 1840s. According to the aesthetics of feeling, developed in the age of sensibility and romanticism, music was understood as an authentic expression of emotions, created and conveyed

by the subjectivity of the musical genius. In the concert, the audience saw emotions embodied in Liszt's performing style, heard and felt emotions listening to him playing, and observed emotions expressed in the behavior of the other listeners. Emotions are thus the key for understanding the Liszt reception.

This research has shown how the listener became a feeling subject in a Liszt concert. This is analyzed in three levels, informed by a cultural-historical and praxeological approach: emotional epistemologies, emotional spaces, emotional practices. Written and visual sources, such as concert reviews and caricatures, are used for the analysis.

First, the emotional epistemologies are analyzed in regard to how emotions, in relation to music and subjectivity, were conceptualized and how ideas of emotions were negotiated in the Liszt reception. Second, the Liszt concert is analyzed as an emotional space showing how Liszt and the audience produced feelings in a concert. Third, the emotional practices based on emotional epistemologies are examined on how the listener experienced feelings in a Liszt concert.

Liszt wanted to move the audience emotionally. Therefore, he developed his own unique performing style. This analysis has revealed how Liszt produced a new emotional space by reinventing the virtuoso concert. Liszt transformed the relationship between the virtuoso and the audience in a concert and thereby transformed the emotional experience of the listener. He accomplished this effect with different means. Liszt made use of the developments in piano construction to produce new sound effects. In order to concentrate the audience's whole attention entirely on himself, he was the first musician to give solo concerts and positioned the piano in a new way so that the audience could see his face when he played. Liszt called this new type of concert *recital*. In the concert, the listener had to appropriate Liszt's new emotional space concept. The impact on the audience while Liszt was playing was described with powerful metaphors in concert reviews and letters. Especially Liszt's body language and facial expression impressed the spectators. In the concert, the audience expressed their



Figure 9. Liszt in the concert hall, 1842. Drawing by Theodor Hosemann.

Source. Klassik Stiftung Weimar.

feelings with applause and bravos. Some even collected objects that Liszt had touched to keep as devotional items. Liszt's performing style and his admirers' behavior were ridiculed in caricatures.

These findings show how the listener experienced the concert as a hierarchical emotional community. In this community, Liszt was imagined at the top, controlling the feelings of the audience. Some imagined Liszt as a musical high priest leading the audience through a catharsis, and some imagined him as a military leader subduing the piano and the audience. Although music critics acknowledged Liszt's playing technique, some criticized his habitus as well as the behavior of his admirers according to middle-class ethics of gender and nation.

Music was an important medium for emotional socialization: that is becoming a feeling subject in the 19th century when music became "the language of feeling." By analyzing and contextualizing the emotional epistemologies, emotional spaces, and emotional practices in the Liszt reception, this approach reveals new insights into the modern Western history of subjectivity and social groups by focusing on the interface between the history of the self and cultural and social history.

Angry Communities—Emotions and Community Building in Recent Music Culture From Punk to Grunge

With the emergence of punk music and punk culture in the mid-1970s, a new phenomenon can be observed in modern popular music culture: publicly displayed and intensely acted out anger. Indeed, already in the 1960s, some rock group performances exhibited a rather angry habitus, but with the advent of punk music a qualitative and quantitative turn took place in the performative expression and the musical (re-)presentation of emotions, such as anger, rage, or wrath.

From that point on, a whole variety of music styles evolved that established an aesthetic field centrally organized around the performance and the extroverted acting out of dismissive, accusatory, or rebellious emotions. Following this, a variety of new communities came into existence, forming new music-centered scenes, subcultures, and movements, for example, punk, hardcore punk, grunge, and parts of the heavy metal scenes. The main task of this dissertation project is to examine these processes of community building, the decisive characteristics of the different scenes, and the role that emotions, especially anger, and music played for their establishment and consistency. Geographically, the main focus is on

Researcher

Henning Wellmann

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Figure 10. Sid Vicious at a concert of the Sex Pistols in 1978.

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Figure 11. Henry Rollins at a concert of Black Flag in 1981.

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Germany and the United Kingdom, allowing a comparative approach.

Methodically, the project concentrates on identifying and analyzing discourses and social practices circulating among the aforementioned scenes that suggest, promote, or object to, and thereby shape, certain kinds of self-relations and relations to others. The central assumption here is that the scenes develop specific models of subjectivity that include the promotion of certain understandings and ways of interpreting and thereby shape subjective emotions, modes of their expression and their experience, as well as varying forms of community building.

The empirical basis for this project is primarily composed of three different kinds of sources: (1) texts and materials produced by the communities/artists themselves (e.g., fanzines, interviews, musical performances, lyrics, music or concert reviews), (2) materials produced to document or describe these communities/artists (e.g., movies, documentaries, pictures, concert broadcasts, interviews, popular secondary literature), (3) scientific publications concerning relevant issues, mainly works on youth or subcultures. Focusing not only on written but also on acoustic and visual materials, the combination of these sources provide a comprehensive insight into the different emotional discourses and practices of the scenes.

As an exemplary illustration, there are two photographs above that show famous and influential punk/hardcore punk musicians. The first photograph, taken at a concert in 1978, shows Sid Vicious, the bassist of The Sex Pistols, one of the most important bands in the formation phase of the punk scene. The second photograph, taken at a concert around 1982, shows Henry Rollins, singer of the band Black Flag, a very influential band since the first years of hardcore punk.

What can be observed here is a change in the way the body is presented and treated as well as in the facial expressions and the bodily gestures.

In the early years of the punk movements, an image of the body prevailed in which it was staged as a rather fragile entity that could and should embody the rage, anger, and protest directed at the mainstream culture and

society as well as at the self. A more or less self-destructive or auto-aggressive attitude toward the own body, as shown by the cuts and blood in Figure 10, was fairly widespread. In contrast, the hardcore punk scenes, as exemplified here in Figure 11, tended to dissolve this tensed relation between the inward and outward directedness of their anger and rage in favor of directing it more and more to the outside. This change coincides with the staging of the body as a strong, muscular, ready-to-fight instrument to be placed as a symbol of the readiness to struggle for a cause.

Considering the results of this research, including an inquiry of the manifold shifts between punk and hardcore punk, it is possible to interpret these photographs as displays of a change in the repertoire of emotional expressions and experiences between these two styles. Whereas in the early punk movement anger could and should be directed at the self as well as at the outside world, hardcore punk established a far more aggressive and outward-directed form of anger, considering the whole life as a fight against wrong and unjust circumstances. Further findings suggest that similar transformative and mutually influencing processes can also be observed in the interplay of the other scenes researched here, although the impacts on emotional repertoires differ from case to case.

Riots, Rock, and Moral Panics: Youth and Pop Culture After 1945 From a Transnational Perspective

After the World War II, new musical styles, which were predominantly developed in the United States and Great Britain, became a global phenomenon. Rooted in African-American culture and especially jazz, rock and beat music were adopted by young people worldwide. After a series of incidents at concerts that became notorious as so-called Rock 'n' Roll riots, an intense debate began in which musical styles became the target of conservative cultural pessimists from both the political right and left. At the center of these debates were not only sexually explicit song lyrics but emotional and bodily practices as expressed in new dances, hair and fashion styles, as well as on-stage musical performances—all of which had judicial,

Researcher

Bodo Mrozek

political, and legislative consequences. Nevertheless, an international youth-pop culture was gradually established which involved new media, new spaces, and new practices. Whilst pop culture is one of the more obvious fields of globalization, most of the scholarly work focuses on national models of explanation such as "Americanization" or the underlying political conflict of the Cold War. These explanations do indeed apply to German society, but this work focuses on the emergence of a specific German youth culture from a transnational perspective. Case studies were examined from Great Britain, France, the United States, and both East and West Germany in the "uneven decade" from 1956 to 1966. Bringing together models from cultural studies such as the analysis of "moral panics" (Stanley Cohen) and historiographical source analysis, this work also uses approaches that have been applied in the history of emotions. Media reports, audio-visual sources, and documents from the archives such as police reports and records from cultural departments and youth authorities were analyzed. During tenure at the Institute, concentration was on the interrelations between "emotional practices" and musical technics. Throughout history, performing and listening to music has always shaped these specific bodily practices in expressing and creating emotions (Figure 12). Both emotions and the body are not static and absolute terms, but products of social discourse, communication, and therefore historical processes. They can be studied through the analysis of conflicts that arose from the historical change in emotional practices such as those that were part of "Beatlemania." This catchphrase was coined in 1963 when new practices again became the target of a "moral panic." Five years after the so-called Rock 'n' Roll riots that linked music and the juvenile delinquency of male youths, girls were now at the center of the debates. Reports of young girls crying, screaming, and fainting dead away peppered the newspaper headlines in that year. Disturbing reports about wet seats after concerts led to a new debate regarding the correlation between popular music, sexual intensity, and public morality. Music like that of The Beatles was seen as an emotional stim-

ulus which was in clear conflict with accepted forms of established emotional practices in concert halls. The unexpected success of dance music in concerts had already begun with jazz in the 1920s and continued through the 1950s. Unable to cope with crowds that desired to dance and otherwise move around in concert halls, ushers as well as managers and finally the police tried to maintain established ideas of emotionally controlled crowd behavior by using physical force.

The emotional expressions during the Beatlemania were linked to accusations of mass hysteria that were rooted in older concepts of gendered disease-mongering. The term Beatlemania itself had its origins in other manias (most prominently in the "Lisztomania" of the early 19th century) but also referred to the phenomenon of female "hysteria." Psychologists, criminologists, and musicologists contributed to the scientific underpinning of a phenomenon that was originally coined by mass media. As a consequence, ideas as to what were suitable emotional practices were shaped and debated and had transnational effects. After disturbances at a Rolling Stones' concert in Berlin's Waldbühne, the GDR placed restrictions on and even banned certain guitar bands. By analyzing the underlying values and beliefs that were expressed in these discourses about the "correct way" of performing and consuming music, changes in the ideas of accepted emotional and bodily practices emerge as historically specific in their various political and cultural contexts. The work shows how "emotional performances" were slowly established and transnationally spread, also shaping youth into an internationally more coherent group which developed their own practices in contrast to the traditional emotional regimes of the older generation. The work thereby integrates concepts of the history of emotions into the history of a transnational pop culture.



Figure 12. Fan mania.
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Max Planck Research Group

Reading Education and
Development (REaD)

Max Planck Research Group

The **Max Planck Research Group "Reading Education and Development" (REaD)** (Head: Sascha Schroeder) investigates the underlying structure of reading skills and their development across the lifespan. To this end, the Research Group assesses the component processes of reading longitudinally and analyzes their interactions. This approach will allow the researchers to provide a more detailed description of the various subprocesses of reading and to analyze their conditions and consequences. These insights, in turn, will enable the Research Group to identify the processes that should be targeted by effective remedial programs in reading education. The group started its work in July 2012.



Research Team 2012–2013

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Introductory Overview

Reading is one of the most important but also one of the most complex inventions in human history. In our modern, information-oriented society, it is vital to be able to read texts accurately and efficiently. People who lack these skills are at serious risk of marginalization: Adults with functional illiteracy often find themselves socially isolated; adolescents who are unable to write a letter of application fail to find a job.

In contrast to learning to talk, children do not learn to read spontaneously but need instructional help and support. Yet, many children have problems with reading acquisition and remain unable to understand even simple texts by the end of their compulsory education. How can we help these children?

Reading is a cognitive skill that involves a number of interacting component processes located at different levels within a general hierarchy. It is unclear which of these processes are important for children's reading development and how they interact. Furthermore, it is likely that different groups of struggling readers have different types of deficits and thus need different kinds of support.

The Max Planck Research Group "REaD" was launched in summer 2012 with the aim of investigating the underlying component processes of reading skills and their development over childhood and adolescence. This approach will provide a more detailed description of the various subprocesses of reading, their conditions, and consequences. These insights, in turn, will enable us to identify the processes to be targeted by effective remedial programs in reading education.

A distinctive characteristic of the "REaD" group is that it takes a holistic and integrative approach to the investigation of reading: Theoretically, we combine elements from linguistics, psychology, and education. Empirically, we are interested in the reading process as a whole—from lexical processes on the word level via syntactic processes on the sentence level up to discourse processes on the text level. Methodologically, we combine cross-sectional and longitudinal designs as well as corpus studies and experiments. In all of our studies, we are interested in connecting our data to computational models of reading. The research agenda of the "REaD" group is structured around four main projects:

(1) In the *childLex* project, we have established a linguistic corpus of German-language writing for children. *childLex* is complemented by the *InLex* project (*Individual Lexicon in Reading Acquisition*), which investigates inter-individual differences in the size and quality of the mental lexicon. Establishing such norms is an essential basis for the design of experimental studies and training programs in German.

(2) In the *Developmental Lexicon Project (DeveL)* we are collecting behavioral data for a selected set of words from children at different stages of reading development as well as from adult samples across the lifespan. These data are urgently needed to create the next generation of computational models of visual word recognition.

(3) The *Developmental Eye-Tracking Study (DevTrack)* investigates reading processes using eye-tracking techniques. This approach allows us to analyze children's reading of connected text beyond the decoding of single words, as well as the associated syntactic and semantic processes, and the preprocessing of upcoming words.

(4) Two interconnected longitudinal studies will investigate interindividual differences in reading development. The *OPeRA* project (*Orthographic Processing in Reading Acquisition*) focuses on children's use of different orthographic grain sizes during reading development in school. The complementary *PLAiT* project (*Prerequisite Language Abilities in the Transitional Phase*) concentrates on the transition from kindergarten to grade 1 and investigates which precursor abilities predict children's later reading achievement.

At present, most projects are in the starting or data collection phase. In this report, we therefore demonstrate the general aims of the projects by providing results from pilot studies that are currently being published or from preliminary analyses of the main studies.

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childLex: A Corpus of German Read by Children

childLex is a linguistic corpus that has been collected from a large number of children's books in order to investigate German-language writing for children. The project is being conducted in collaboration with the Berlin-Brandenburg Academy of Sciences and the University of Potsdam and was initiated in summer 2012. The complementary InLex project was launched in fall 2013 and will focus on interindividual differences in the structure of children's mental lexicon.

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Linguistic databases for children are important tools for developmental studies of reading and have a long history in educational psychology. They are important for selecting stimulus materials for experimental studies and for investigating children's written and spoken language skills. For adults, a wide selection of corpora is now available, such as the German *DWDS* corpus (Digital Dictionary of the German Language). Unfortunately, these databases may not be adequate for children.

In order to account for potential differences between adult and child print exposure, specialized corpora of writing for children have been collected in some languages. In English, for example, researchers can draw on *The Educator's Word Frequency Guide* or the *Children's Printed Word Database*. Similar databases have been collected for other

European languages (e. g., French, Spanish, Italian). For German, however, there was previously no electronic database of materials intended to be read by children. Although some frequency counts for children have previously been published, they are based on small corpora and outdated materials. In addition, they provide no linguistic information beyond simple frequency counts and cannot be accessed electronically. To close this gap, we have compiled the *childLex* corpus to investigate German-language writing for children and to establish an online database that gives users access to a wide selection of linguistic variables.

A first version of the *childLex* database was made available to the scientific community in late 2013 (www.childlex.de). At present, we are working on several analyses investigating the differences between writing for children

What Do Children Actually Read?

The *childLex* corpus was compiled from books intended to be read by children by themselves. As a consequence, it mainly comprises narrative, informal texts but also some expository texts (science books, etc.). Books were selected from several sources: First, we analyzed children's self-reports (as published in newspapers, etc.) and the 2012 sales figures of online stores (as provided, e. g., by www.amazon.de). Second, a huge public library in Berlin provided us with the loan statistics for children's books for the years 2010 to 2012. Finally, responses to a teacher questionnaire implemented in a large educational study investigating reading in elementary schools were used to select school textbooks. Three observations are immediately apparent from these materials: First, most of children's print exposure stems from informal settings outside school. For example, a typical grade 3 textbook comprises only 30,000 words—the approximate equivalent of one book in the *Diary of a Wimpy Kid* series, which children typically read within a week. Second, children like to read series of short books (such as the *Three Investigators* series). "Classic" children's books such as *Pippi Longstocking* or *The Neverending Story* are underrepresented in their self-directed reading. Third, children's books vary substantially with regard to content and genre ("horse books," "vampire books," etc.) as well as length and complexity (from short, easy books such as the *Beast Quest* series to elaborated text forms such as poems). Thus, huge differences in children's actual reading experience can be expected.

Box 1.

and adults and comparing German with other European languages. Further analyses will not only focus on theoretical questions, such as lexical development during childhood, but will also address more applied issues, such as how to assign text difficulty levels to books.

Establishing a Corpus

childLex provides separate norms for children aged 6 to 8 (beginning readers, grade 1 to grade 2), 9 to 10 (intermediate readers, grade 3 to grade 4), and 11 to 12 years (experienced readers, grade 5 to grade 6). The most recent version of *childLex* (0.08 January 2014) comprises 500 books that vary widely in terms of length and content (see Box 1). For example, a typical book for beginning readers comprises approximately 5,000 words, a book for intermediate readers 15,000 words, and a book for experienced readers 50,000 words. In order to maximize the number of words in each age group, we oversampled books for beginning and intermediate readers.

Books were scanned manually and converted into text using optical character recognition software. In addition, the corpus was processed and annotated using several algorithms: First, the text was divided into distinct words and sentences (tokenization). Next, the base form of each word was determined (lemmatization). Finally, words were assigned a syntactic category (noun, etc.).

childLex comprises approximately 11 million words (tokens). These are distributed over 170,000 different types (distinct word forms) and 110,000 lemmas (base forms). *childLex* distinguishes between variables from two levels of analysis: (1) lexical variables (e.g., frequency, length, and neighborhood size) and (2) sublexical variables (e.g., letter and syllable frequencies).

Differences Between Children and Adults

One of the most important questions is how the language of children's books differs from that of adult texts. *childLex* was deliberately designed to be comparable to the *DWDS* corpus, which comprises 120 million words (distributed over 1.8 million types and 1.3 million lemmas) and is the largest print corpus for adults in German.



Figure 1. *childLex* comprises 500 children's books.

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Overall, *childLex* and the *DWDS* corpus share about 77,000 lemmas. This corresponds to 70% of *childLex*, but only 6% of *DWDS*. Thus, most words found in children's books are also found in texts for adults, but not vice versa. Words used only in children's books include verbs such as "pupsen" or "hicksen" (children's words meaning "to fart" and "to hiccup," respectively), while verbs such as "vereidigen" (to swear in) or "charakterisieren" (to characterize) are only used in texts for adults. The distribution of different syntactic categories (noun, verb, adjective, etc.) provides further insights into the differences between writing for children and adults (Figure 2a). Both corpora show the typical distribution across syntactic categories; there are only few function words, most words are nouns, etc. However, there are also differences between the two corpora. For example, verbs are overrepresented and nouns are underrepresented in children's books. This is a typical indicator of spoken rather than written language and indicates that the language of the children's books represents a mixture of written and spoken language.

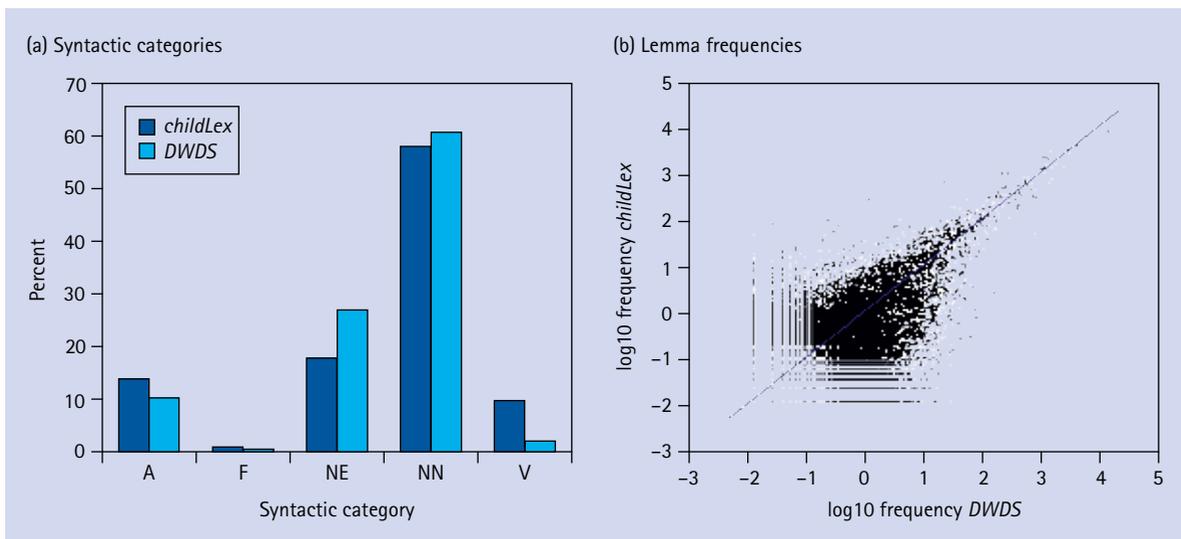


Figure 2. (a) Distribution of syntactic categories in *childLex* and *DWDS* (A = adjective, F = function word, NE = proper noun, NN = noun, V = verb); (b) correspondence of lemma frequencies in the two corpora.

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Finally, we investigated whether the words featured in both *childLex* and *DWDS* are used with similar frequencies. Figure 2b shows the correspondence between the frequency measures of the two corpora. As can be seen, there are substantial discrepancies and the overall correlation is rather modest, at $r = .63$. Moreover, the strength of the association clearly depends on the overall level of frequency: For high-frequency words (e.g., "time"), children's and adults' frequency measures are well aligned with $r = .78$; for very low-frequency words (e.g., "jerkin"), this value declines to $r = .19$. Most of the differences between children's and adults' vocabularies are related to the use of specific words that are very infrequent in one corpus and modestly frequent in the other (see Box 2).

Comparing German With Other European Languages

Cross-linguistic comparisons—that is, studies that contrast reading development in different languages—constitute an emerging approach in developmental reading research. As languages differ substantially in their linguistic properties, it is unclear whether lexical norms are comparable across languages and how materials can be matched.

For example, German is a morphologically rich language. Relative to English, its inflectional system is quite sophisticated. For example, a regular verb such as "lachen" ("to laugh") has 13 different inflectional forms depending on the person, tense, and mode ("ich lache," "du lachst," "er lacht," etc.). In English, by contrast, there are only 4 distinct word forms ("laugh," "laughs," "laughed," and "laughing"). The same holds for nouns and adjectives, which are inflected according to number and case in German (resulting in 5 to 8 inflectional forms for nouns and 17 to 24 for adjectives).

Indeed, we have shown that lexical and morphological diversity is much higher in children's print language in German than in English, French, or Spanish. Figure 4a plots the number of types against the number of tokens in samples of 50,000 to 5 million words in four different child corpora. It is evident that the type/token ratio differs substantially between languages. English is the least diverse language and saturates very early: Once they have read approximately 1 million words, children are unlikely to encounter many new words. The type/token curve in German, by contrast, is rather steep: German children have to process a larger

Are "Child" and "Adult" Words Processed Differently by Children and Adults?

Do the differences in children's and adults' linguistic input affect their behavior in visual word recognition tasks? To investigate this issue, we chose 20 "child" words (that are frequent in *childLex* but infrequent in the *DWDS* corpus; e.g., "pirate," "fairy," etc.) and 20 "adult" words (that are frequent in the *DWDS* corpus, but not in *childLex*, e.g., "tax," "culture," etc.). Four age groups (children, adolescents, younger adults, older adults) with 50 participants each performed a lexical decision task involving these words. Their response accuracies are shown in Figure 3: Children showed a clear processing advantage for "child" words, adolescents performed similarly on both types of words, and adults showed a processing advantage for "adult" words. Importantly, the adults' processing advantage was driven not by decreasing performance on "child" words, but by increased accuracy on "adult" words.

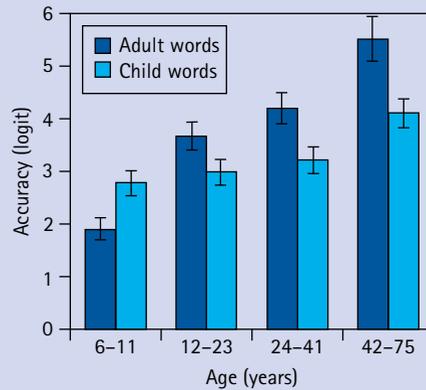


Figure 3. Response accuracy for "child" and "adult" words in different age groups.

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Box 2.

number of different word forms when reading new materials and constantly encounter new words that have to be decoded. French and Spanish lie in between these two extremes. As Figure 4b shows, the same pattern can be observed for adults, but is less pronounced. For this reason, it is difficult to compare the lexical norms of German directly with those

of other European languages. As words have more inflectional variations in German, each word form is used less often, is longer, and has more potential neighbors. This makes the analysis of a German linguistic corpus a particularly challenging task because it is necessary to derive frequency counts for the base forms of the words.

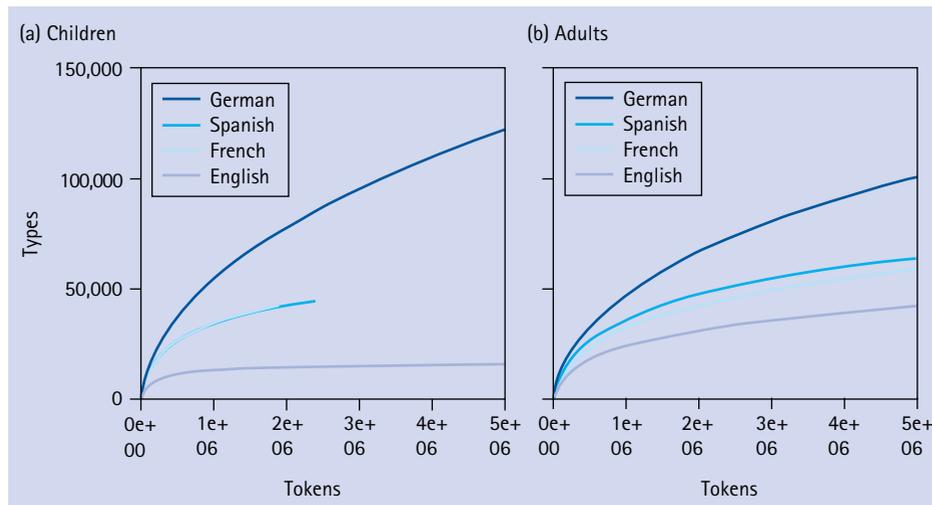


Figure 4. Type/token ratio in different (a) child and (b) adult corpora.

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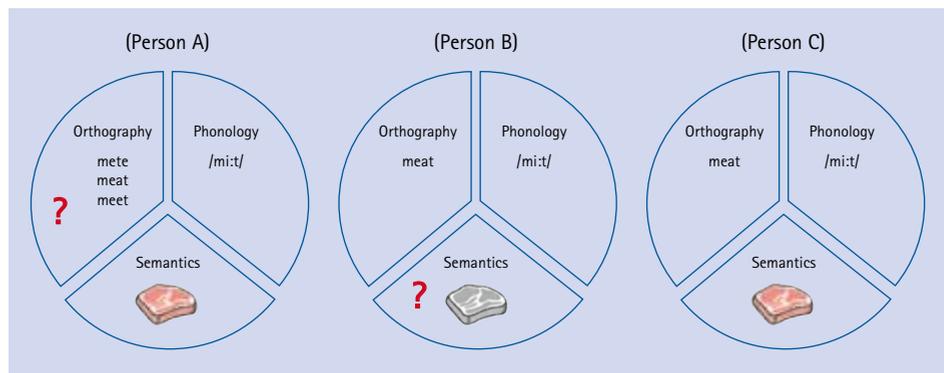


Figure 5. Lexical entries for the word "meat" for three different people.

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InLex: The Individual Lexicon in Reading Acquisition

How many words has a child actually read? And how many are stored in his or her mental lexicon? What do these lexical representations contain and how are they connected? Based on the *childLex* corpus, the *InLex* project will address these issues and their impact on children's word recognition. The size and structure of the mental lexicon varies between individuals. However, it is difficult to obtain reliable estimates of a single person's vocabulary. This is unfortunate because both the quantity of entries in the lexicon and their quality (i. e., their composition and connections) are important factors in reading acquisition.

A person's mental lexicon consists of lexical representations of every word that person knows. According to the Lexical Quality Hypothesis, each representation contains information about three different aspects of a word: phonological knowledge about its pronunciation, orthographic knowledge about its spelling, and semantic knowledge about its meaning. The amount and specificity of the knowledge within these three areas varies between individuals. Figure 5 shows the lexical entry for the word "meat" for three different people. For person A, the phonological and semantic knowledge is fully specified: He or she knows how to pronounce the word (/mi:t/) and understands its meaning (e. g., "something to eat, flesh of an animal ..."). The orthographic domain is underspecified, as

indicated by different spellings of the word ("meet," "mete"). That is, person A is not sure how the word "meat" is spelled correctly. Person B, in contrast, has fully specified phonological and orthographic knowledge of the word "meat," but his or her semantic knowledge of the word is incomplete; that is, person B is not aware of the correct meaning of the word. This may cause problems in understanding the word when hearing or reading it. For person C, the entry is fully defined in all three areas; this person has a clear idea of the phonology, orthography, and semantics of "meat."

During language development, children build up word representations, initially consisting of mostly phonological and semantic information. As they learn to read and write at school, they add orthographic knowledge as well. But how do interindividual differences in lexical quality affect word recognition? The first aim of the *InLex* project is to measure children's phonological, orthographic, and semantic knowledge of a specific set of words and to assess their performance in different word recognition tasks. This will allow us to investigate the impact of lexical quantity and quality on word recognition performance.

Another question is how these interindividual differences in lexical quality can be explained. Several internal and external factors may impact the individual lexicon. One is children's print exposure, that is, the time they spend reading outside school. Previous studies

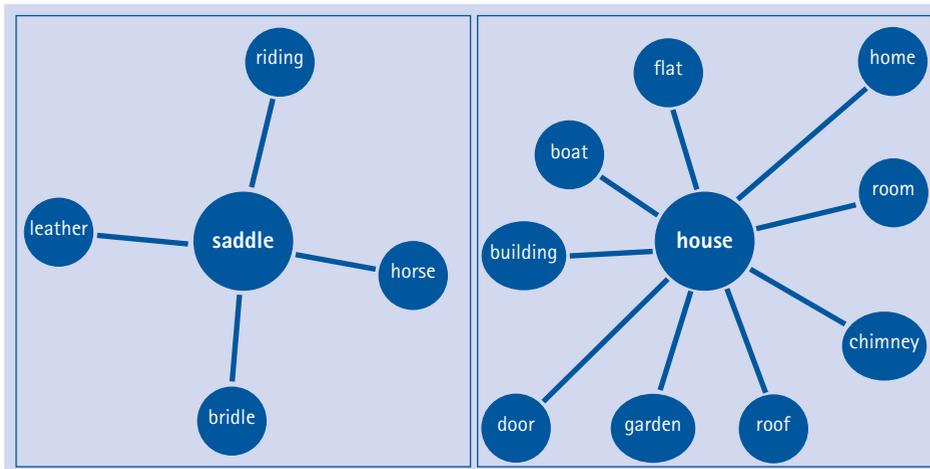


Figure 6. Lexical networks for "saddle" (low diversity) and "house" (high diversity).

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have shown that the amount of reading influences reading ability in children and adults. These effects are presumably mediated by print-related differences in the quantity and quality of lexical entries. Apart from spoken language, reading is an important source for children to learn new words and to expand their knowledge of familiar words. This is particularly true in later childhood, at which stage new words are increasingly unlikely to occur in spoken language. Another aim of this project is therefore to measure the influence of children's print exposure on their lexical quantity and quality and thereby its influence on word recognition.

Investigating children's exposure to specific words in print raises further issues: In which semantic contexts did a child read a certain word and does this affect the quality and connections of the lexical entry? Contextual diversity is a linguistic variable that has been proposed as an important factor for lexicon development. It has been hypothesized that words encountered in more contexts and in more diverse contexts exhibit higher connectivity, especially in the semantic domain (Figure 6).

A word with low contextual diversity such as "saddle" is associated with only a small set of other words; its occurrence is generally limited to contexts involving horses and riding. A word with high contextual diversity such as "house," in contrast, has more links to other words as it occurs in print in many different contexts. Higher connectivity is thought to be associated with faster and more robust lexical retrieval. This prediction will be tested empirically in the *InLex* project using association tasks and contextual diversity measures derived from *childLex*.

In summary, in a series of studies, the *InLex* project will investigate the interrelationships between the quality and quantity of the individual lexicon and its impact on word recognition performance. Furthermore, it will explore the impact of children's print exposure and contextual diversity on the size and structure of the lexicon. Findings will inform theories of reading acquisition by shedding light on the relationship between reading and the mental lexicon and thus help to explain interindividual differences in reading. First results will be published in summer 2014.

DeveL: The Developmental Lexicon Project

The *Developmental Lexicon Project (DeveL)* was launched in spring 2013 to provide new data on how visual word recognition processes change during reading development and across the lifespan. These data will be used to extend existing computational models of visual word recognition.

Key References

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The process of word recognition, in which print is converted into linguistic information, is fundamental for reading. The impact of most word characteristics (length, frequency, etc.) on this decoding process is likely to change over time. However, none of the current models of visual word recognition explicitly includes a developmental dimension. One reason is that few studies have systematically compared the impact of linguistic variables on word processing across different age groups. For example, the *English Lexicon Project*, which was a multi-university effort to provide a database for the processing of 50,000 English words, investigated only adult readers. The aim of the *DeveL* project is to close this gap by providing first data on word recognition in German for the same words across the lifespan.

To this end, we selected 1,152 German words according to specific linguistic characteristics that are considered crucial in developmental theories of written language acquisition. In a cross-sectional study, these words were presented to participants of different age groups, including children at different stages of reading acquisition, younger adults, and older adults. In a first phase of data collection, data from 430 students (grade 2, 4, and 6) were

collected in computerized single sessions. In a second phase, which is scheduled for winter 2013/14, younger (20–30 years) and older adults (65–75 years) will be assessed. Word recognition performance was measured using lexical decision and naming paradigms, which are commonly used in psycholinguistic research to assess lexical processing. To further investigate the impact of different reader variables on processing, we implemented measures of reading speed, vocabulary knowledge, and nonverbal intelligence. The study's central questions are (1) which linguistic features affect German word recognition, (2) how their influence changes over time, and (3) whether these developmental patterns show interindividual differences.

To illustrate the aims of the project, in the following we focus on the impact of word length (number of letters), which is especially prone to developmental changes.

According to the Dual-Route Model (see Box 3), length effects vary depending on how much the sublexical route, which operates serially, is involved in processing. The amount of sublexical processing, in turn, depends on several factors.

First, the impact of word length can be expected to vary with the transparency of a



Figure 7. Reading speed and accuracy improve considerably across the lifespan.

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The Dual-Route Model of Visual Word Recognition

A widely accepted computational model of visual word recognition is the Dual-Route Model. It postulates two ways by which print can be converted into meaning (see Figure 8). First, words can be decoded via a sublexical route using grapheme–phoneme rules that are applied serially from left to right, letter by letter. Second, words can be processed via a lexical route. Here, the meaning and pronunciation of a word as a whole are retrieved from the mental lexicon. This process is assumed to happen quickly and in parallel.

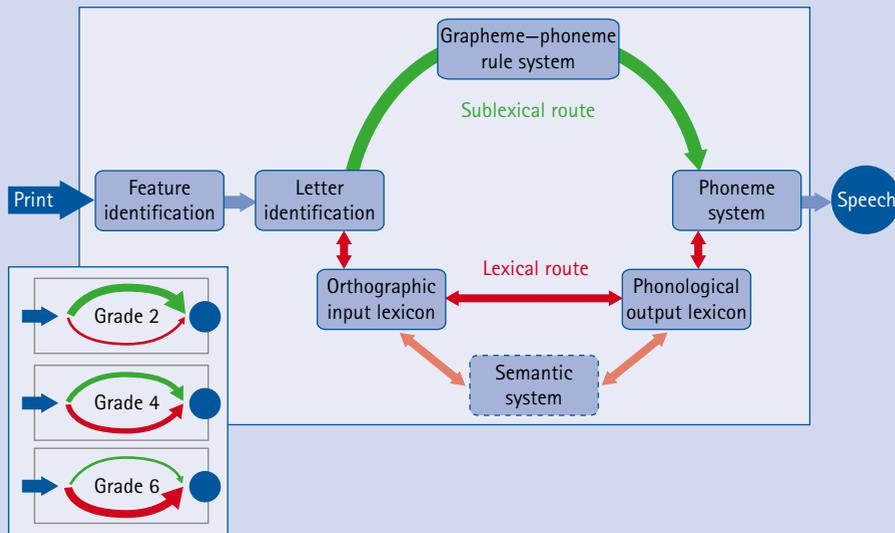


Figure 8. The Dual-Route Model of visual word recognition, extended to include a developmental trajectory for the transition from sublexical to lexical processing (adapted from Coltheart et al., 2001).

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Box 3.

language. Orthographically transparent languages, such as German, are characterized by relatively consistent mappings between single letters and sounds. In contrast, in orthographically intransparent languages, such as English, the same letter usually has multiple pronunciations (see Figure 9).

Grapheme	Phoneme	
	German	English
a		
Park	[paʁk]	[pa:(j)k]
Ball	[bal]	[bɔ:l]
Band	[bant]	[bænd]

Figure 9. The correspondence between letters and sounds in orthographically transparent (German) and intransparent (English) languages.

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Because grapheme–phoneme conversion is more reliable in transparent orthographies, German words are more likely to be processed sublexically, whereas English words typically require processing via the lexical route. As a consequence, results of studies on English cannot be directly compared with those of studies on German, and it can be assumed that length effects are generally stronger in German. Second, the impact of word length can be expected to vary as a function of lexicality (word vs. nonword). By definition, nonwords (such as “hurk”) have no entry in the mental lexicon and thus require serial processing via the sublexical route. Words (especially high-frequency words), in contrast, are likely to be processed lexically and in parallel. As a consequence, length effects should be more pronounced for nonwords than for words.



Figure 10. A 12-year-old performing the naming task.

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Third, and most importantly, the effect of word length can be expected to vary with lexical development. For beginning readers, all words are functionally nonwords and thus have to be decoded using the sublexical route. Once children become acquainted with a specific word, however, it can be processed via the fast-track lexical route as its representation in memory becomes increasingly elaborated and accessible. Thus, fading susceptibility to word length is evidence for a gradual shift from sublexical to lexical processing throughout reading development (see Figure 8). Taken together, the Dual-Route Model predicts a rather complex pattern of re-

sults: In a transparent orthography, such as German, length is generally expected to be a strong predictor of reading time. However, length effects should be more pronounced for nonwords than for words. Furthermore, length effects for words should decrease slowly during reading development as words are increasingly processed via the lexical route. In contrast, length effects for nonwords should not benefit from increased reading experience.

In order to demonstrate how such complex predictions can be investigated, Figure 11 presents some preliminary data from the *DeveL* project. The plots show lexical decision latencies as a function of stimulus length separately for words and nonwords and for children in grade 2 (beginning readers), grade 4 (intermediate readers), and grade 6 (experienced readers). Overall, the pattern is in line with the predictions made by the Dual-Route Model: In German elementary school children, word length generally had a strong and linear impact on word recognition latency. As expected, nonwords needed more time to be processed and revealed a stronger length effect than words. Ultimately, there was a clear developmental pattern: In grade 2, children showed similar length effects for words and nonwords. For words, length effects declined gradually across grades (by 41% from grade 2 to grade 4 and by an additional 18% from grade 4 to grade 6). Length effects for nonwords, in contrast, decreased only minimally during reading development (28% overall).

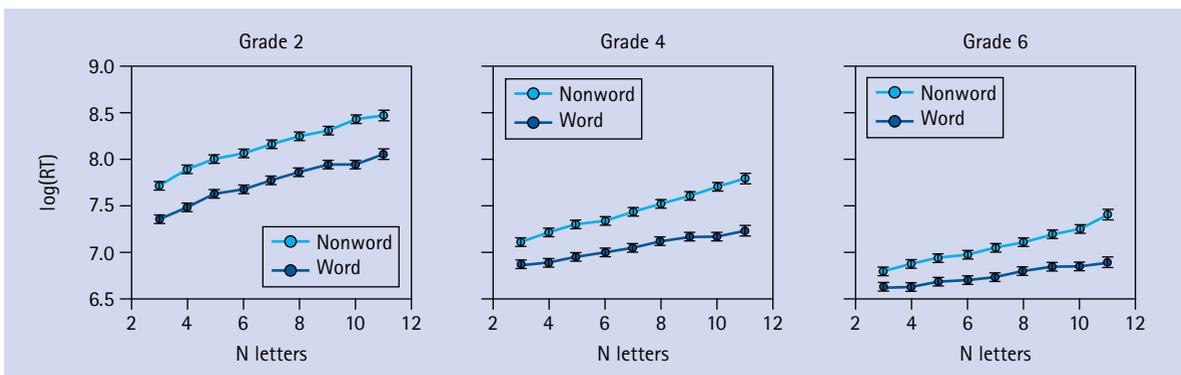


Figure 11. Length effects for words and nonwords at different grade levels.

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Similar analyses will be carried out for the effects of other linguistic variables (e.g., word frequency, orthographic neighbors). We will also investigate whether the effects observed generalize to paradigms such as naming. As we assessed large samples of children in each age group, we are able to dissociate the impact of age from the impact of lexical development. Findings such as these not only provide further knowledge on reading development in German but are needed to expand existing models of visual word recognition in general. At present, for example, it is unclear whether and how computational models such as the Dual-Route Model can accommodate developmental changes in marker effects. One particular question is whether various

effects observed in different age groups can be explained on the basis of a shared mental architecture—for example, by changing parameter settings. Alternatively, structural changes may be necessary in order to fit the developmental patterns observed. To foster the development of new computational models, we will make data from the *Devel* project available to the scientific community through an online platform. Future research can then be conducted by means of virtual experiments, enabling international scientists to perform investigations directed at refining current models. In the long term, such explanatory approaches are needed to address the problems of beginning readers more specifically and to further improve the design of reading training programs.

Decomposing the Lexical Decision Task

Most tasks used to investigate visual word recognition, such as the lexical decision task, are cognitively complex. Apart from lexical processing, they afford attention, perceptual processing, and some form of motor response. In a separate set of studies, we investigated which processing components are involved in these tasks and whether they develop differentially across the lifespan.

In one of the studies, for example, children and adults performed a lexical decision task and a naming task using the same set of words. Their task performance was decomposed using the Diffusion Model. In this model, separate parameters represent different cognitive processes such as speed of information uptake (v), response caution (a), and time for response execution (T_{er}). The results of fitting this model to children's and adults' lexical decision data revealed that children had deficits in all processing components (Figure 12a). However, in the naming task (Figure 12b), children showed deficits only in lexical processing, but not in any of the nonlexical processing components. This indicates that different tasks afford a different mixture of cognitive processes, which develop differentially over time. The same deficit observed in overt task behavior might therefore be driven by different cognitive processes in different age groups.

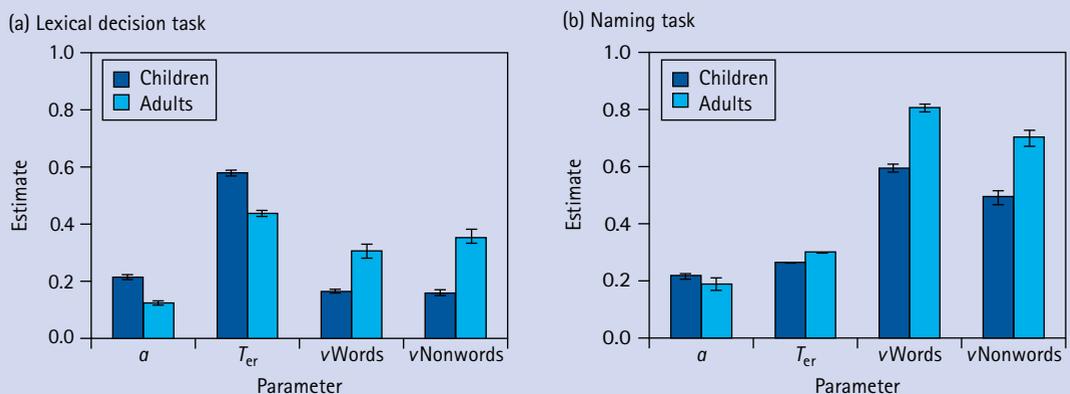
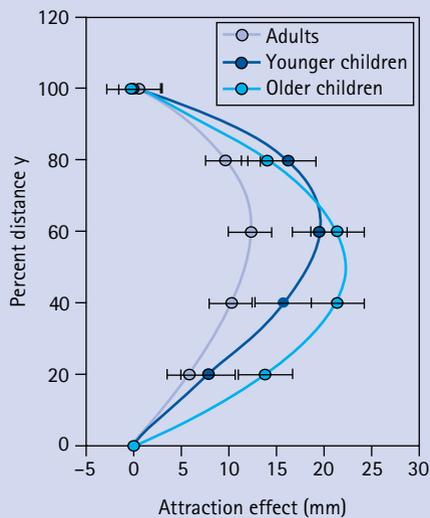


Figure 12. Diffusion model parameters for children and adults in (a) the lexical decision task and (b) the naming task.

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Box 4 (continued on next page).



In another study, we investigated children's and adults' response behavior more closely using a motion capture system. Children and adults performed a simple pointing task and a lexical decision task by pressing a response button 30 cm in front of them while their hand movements were recorded. Compared with their performance in the pointing task, children's movements in the lexical decision task were slower and more hesitant. In addition, they showed substantial attraction effects, that is their movements to the correct response were "attracted" by the other response option (see Figure 13). This indicates that lexical decision and response movement processes might be more intertwined in children than in adults.

Figure 13. Attraction effects in lexical decision movements in younger children, older children, and adults (adapted from Schroeder & Verrel, in press).

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Box 4 (continued).

DevTrack: The Developmental Eye-Tracking Study

Reading is more than decoding single words. With the *Developmental Eye-Tracking Study (DevTrack)*, which started in fall 2012, we aim to add depth to our understanding of children's natural reading processes by tracking their eye movements as they read continuous texts.

Eye movements have long been used to track cognitive processes during complex tasks such as visual search, scene perception, and read-

ing (Box 5). The eye-tracking research of the early 20th century established much of what we know today about typical eye movements;



How Do We Know Where Someone Is Looking?

Modern eye-tracking methods use an infrared light source to shine light off of the reader's eye. A small camera is used to pick up two areas of the eye: the center of the pupil (in blue) and a reflection off the surface of the eye (the light dot immediately below the pupil). These two points are used to calculate where a participant is looking on the screen. A chin rest helps to steady the participant's head while reading. The high spatial (1 letter) and temporal (1 ms) resolution of such techniques is critical for this kind of research.

Figure 14. A typical setup for an eye-tracking study.

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Box 5.

What Do Readers' Eye Movements Look Like?

The eye movements of beginning readers differ markedly from those of skilled adult readers. Children typically show shorter saccade lengths and refixate the same word multiple times before moving on to the next word. In contrast to adults' reading, words are not skipped and there are more saccades back to earlier parts of a text (regressions), which suggest rereading of passages that were not completely understood. Figure 15 illustrates the differences in the typical eye movements of beginning and skilled adult readers.

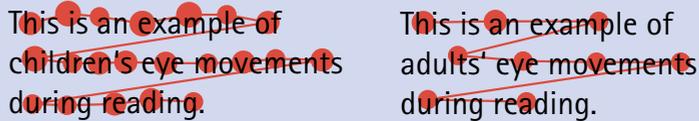


Figure 15. Eye movements of a beginning reader (left) and a skilled adult reader (right).

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Box 6.

for instance, that the eyes move in a series of jumps (saccades) and pauses (fixations) and that information is processed only during fixation periods. Reading is a particularly complex task in which words must be decoded, their meaning extracted, and inferences generated to connect words, phrases, and sentences. During reading, adult eye movements generally consist of saccades of 7 to 9 characters and fixations of 200 to 250 milliseconds. The characteristics of eye movements are also subject to developmental changes, however, and the efficiency of eye movements during

reading has been shown to be strongly related to the skill of the reader. Skilled adult readers generally make long saccades, fixate words for short durations, and skip over short, predictable words. For children, however, we find a different pattern (Box 6).

We know that the eye movements of skilled adult readers and beginning readers differ substantially. We also know that individuals differ in their reading skill. Longitudinal designs, as employed in *DevTrack*, are therefore vital to capture both individual differences in the reading skill of beginning readers

Foveal Versus Parafoveal Processing

The center of a reader's field of vision, the foveal region corresponding to the central 2° of the visual field, is where visual acuity is highest. The acuity of the fovea is essential for the processing of letter features. However, readers can also make use of information in the parafovea, which extends out to about 5° to either side of the point of fixation. Little can be derived from the outermost peripheral region. In writing systems that are read from left to right, the parafoveal and peripheral visual fields develop a skew to the right in the direction of reading. Conversely, in scripts such as Hebrew and Arabic they develop a skew to the left.

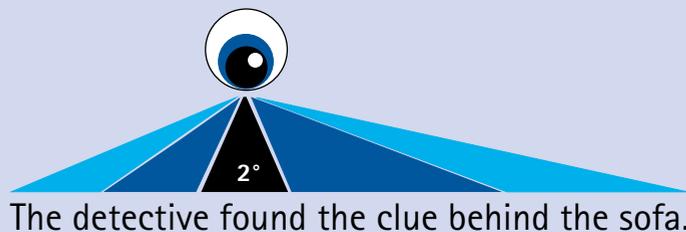


Figure 16. Foveal, parafoveal, and peripheral visual fields during reading.

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Box 7.

and the development of reading skill over time. *DevTrack* will be one of the very few longitudinal studies that have attempted to tease apart the individual and developmental aspects of reading acquisition at the German elementary school level.

Two mechanisms are known to drive the efficiency and development of eye movements. Foveal reading processes are involved when a word is focused directly; parafoveal processes are relevant when information about letters and words to the right of the fovea is extracted (see Box 7). *DevTrack* will focus on the development of foveal and parafoveal processes in reading using eye-tracking paradigms specifically developed to tap into these processes.

Foveal Processes in Reading

DevTrack will investigate the development of children's foveal processes by analyzing their reading behavior as they read age-appropriate short stories and sentences that have been developed to create a natural reading setting. Materials will contain embedded target words that are systematically manipulated on characteristics that are known to reliably affect word recognition time: word length and word frequency (see Figure 18). Preliminary study results suggest that effects of frequency and length can be found in the fixation duration measures of elementary school children at the end of grade 3. The main study will examine how these two variables and their interaction affect children's eye movements during read-

Comparing Eye Movements Across Orthographies

In a separate study, conducted in cooperation with the University of Southampton, UK, and the University of Turku, Finland, we investigate whether children's eye movements are influenced by the transparency of the orthography in which they are reading. To this end, we have translated 48 sentences from German (which has an intermediate level of transparency) into English (which is very intransparent) and Finnish (which is very transparent).

English	The trip	to the zoo	was	funny	because	the goat	had	run into	the teacher.
German	Der Ausflug	in den Zoo	war	lustig,	denn	die Ziege	hatte	den Lehrer	umgerannt.
Finnish	Retki	eläintarhaan	oli	hauska	koska	vuohi	oli	juossut	opettajaa päin.

In each sentence, there was one target word that was long or short and either frequent or infrequent. We expected to find that frequent words can be processed in parallel, whereas infrequent words have to be decoded sequentially. However, this pattern was expected to be moderated by reading skill. Indeed, this is the pattern we found in our German data (see Figure 17).

We are currently collecting data in the United Kingdom and Finland to test whether this interaction varies with the transparency of the language that children are learning: We expect the observed pattern to be more pronounced for English children, but less pronounced for Finnish children, as the orthographic characteristics of their languages foster more lexical versus sublexical processing, respectively.

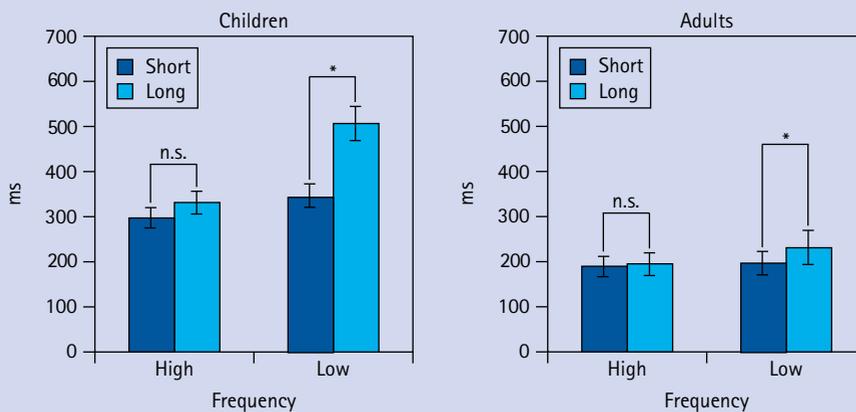


Figure 17. Mean gaze duration for long versus short high- versus low-frequency words for children and adults reading German.

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Box 8.

Frequent: 67/million	Infrequent: 10/million
Short: 4 letters	Short: 4 letters
Der Fischer Max arbeitet schon lange als Fischer. Er fährt mit seinem Boot am großen Fels vorbei und wirft sein langes Netz aus, um Fische zu fangen. In der Ferne sieht er manchmal am Abend Wale. Das Geheimnis , wo er die Perle in einer Muschel gefunden hat, hat er nie erzählt.	
Long: 7 letters	Long: 9 letters
Infrequent: 18/million	Frequent: 67/million

Figure 18. Example story: The fisherman.

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ing and how their influence changes over the elementary school years.

In addition, *DevTrack* will investigate children's higher level processing of connected discourse, which is important in many educational settings. For example, we will analyze how inferences are generated during reading and how relationships between elements of the text are processed by the reader. In Figure 18, for instance, the pronoun "er" in the second sentence has to be connected to its antecedent "Max" in the first sentence, who is also the "Fischer" referred to in the title. Children who do not make these connections will have difficulty understanding the story.

In addition to assessing children's comprehension of the story, we will track their eye movements to investigate the underlying online processes.

Parafoveal Processes in Reading

In a different line of research, the *DevTrack* project will investigate how children's processing of information in the parafovea changes during reading development. Studies have found that adults extract different types of linguistic information (orthographical, phonological, morphological, semantic) from the parafovea. This information can then be integrated when the word is fixated foveally, facilitating the word recognition process. This facilitation has been shown to manifest itself in shorter fixation durations. How much and what kinds of information can be processed parafoveally by beginning readers remains unclear, however. This question can be addressed using the boundary paradigm illustrated in Box 9, which is a technique specifically developed to assess parafoveal processes.

In *DevTrack*, we will concentrate on two marker effects that are particularly disposed to show developmental effects. According to the Dual-Route Model (see Box 3 above), words are processed both via a sublexical and a lexical route. During sublexical processing, grapheme—phoneme correspondence rules are

Investigating Parafoveal Processing: The Boundary Paradigm

In the boundary paradigm, sentences are presented as a single line of text, each with an embedded target word. These targets are presented as manipulated previews until the reader's eyes move to bring them into focus. An invisible boundary directly before the target word triggers when the first saccade crosses it. At this point, the preview is exchanged with the target word (see Figure 19). As the display change happens during the saccade onto the target word, the reader never actually sees the preview other than in his or her parafovea. By manipulating the preview, we can assess whether fixation durations on the target word differ, depending on whether the target word or a similar sounding nonword was present in the parafovea. In the example above, the preview "clew" is a phonologically similar nonword (pseudohomophone) to the target word "clue."

The detective found the | clew behind the sofa.
 The detective found the | clue behind the sofa.

Figure 19. Preview and display change to target word after the reader's gaze crosses the invisible boundary in the boundary paradigm.

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Box 9.

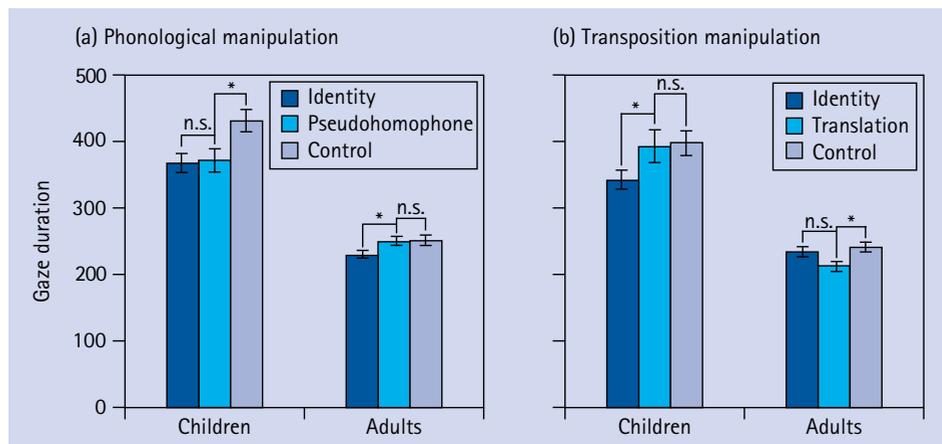


Figure 20. Findings on the parafoveal preview benefit.

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used to convert print into sound. This process may be facilitated by phonological information extracted from the parafovea, which can be investigated using pseudohomophone previews. Here, either a nonword that is pronounced similarly to the target word (e.g., "clew" for the target word "clue") or an orthographically matched control word (e.g., "clon") is shown in the parafovea. If the target word is processed faster in the pseudohomophone condition than in the control condition, this indicates that phonological information has been accessed. By a similar logic, transposition preview effects can be used to quantify the amount of lexical processing in the parafovea. As lexical processing becomes more parallel during reading development, the encoding of the exact position of a letter becomes less important, and words with transposed letters (e.g., "bnad") are frequently mistaken for the real target word (e.g., "band"). Again, by comparing the parafoveal preview benefit of transposed letter primes with orthographically matched control words (e.g., "bord"), we can assess the amount of lexical preprocessing in the parafovea. As an extensive amount of research suggests that children are initially more reliant on sublexical processing, we might expect greater phonological preview effects and weaker transposition benefit effects for children than for skilled adult readers. To test these assumptions, we conducted a pilot experiment in which children and adults

read single sentences with embedded target words in three different preview conditions (identity vs. pseudohomophone/transposition vs. control). First results indicate that children, but not adults, showed phonological preview benefit effects (Figure 20a). This suggests that children rely more on phonological decoding processes during parafoveal processing than adults. By contrast, adults, but not children, showed transposition preview benefit effects (Figure 20b). This indicates that children do rely more on the exact position of letters within a word than adults. Taken together, both findings are consistent with a developmental trend from sublexical to lexical processing during parafoveal preview. In the *DevTrack* project, we will investigate how foveal and parafoveal processes develop by following 100 children from grade 2 to grade 4. This will allow us to describe developmental changes in eye-movement behavior over the first years of elementary school and their relation to other skills such as lexical access, phonological ability, and oculomotor efficiency. Combining controlled experimental manipulations and natural reading of age-appropriate texts, *DevTrack* will investigate the interactions between foveal and parafoveal processes, which are as yet largely unexplored in children. The first round of data collection will be conducted in spring 2014; first results from the main study will be published in summer 2014.

Investigating Reading Longitudinally: OPeRA and PLAIiT

What are the developmental mechanisms underlying reading acquisition and which precursor abilities are needed? Two interconnected longitudinal studies initiated in 2013 will investigate the preconditions and consequences of children's initial reading ability.

The *OPeRA* project (*Orthographic Processing in Reading Acquisition*) focuses on children's use of different orthographic grain sizes (see Box 10) during reading development in school from grade 1 to grade 4. The complementary *PLAIiT* project (*Prerequisite Language Abilities in the Transitional Phase*) concentrates on the transition from kindergarten to school and

investigates which precursor abilities are linked to children's later reading acquisition. By using a similar theoretical framework and identical outcome measures, *OPeRA* and *PLAIiT* will be able to provide a unified picture of the processes needed in the initial steps of reading acquisition and their consequences for children's later development in school (see Figure 21).

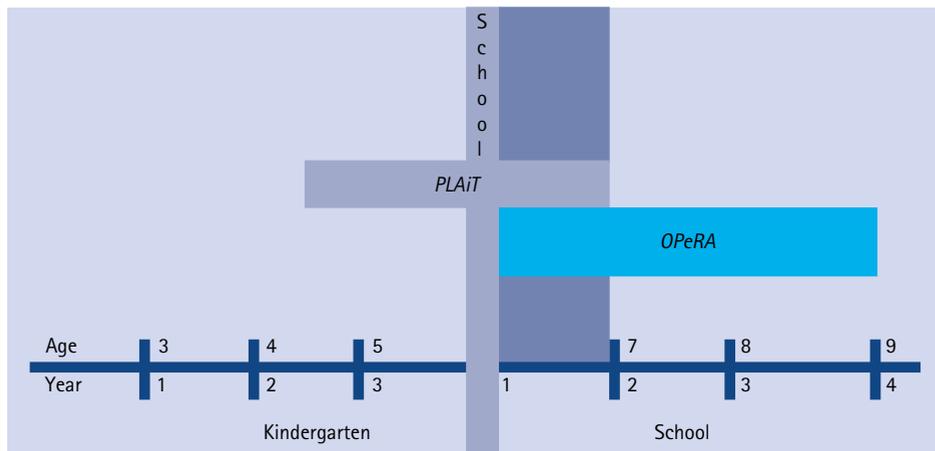


Figure 21. Time frame and overlap of the *PLAIiT* and *OPeRA* projects.

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Fine- and Coarse-Grained Orthographic Processing

After initial perception of the visual input, readers can process orthographic information by using location-specific coding of letters, namely fine-grained processing. This mode makes information about the neighbors of letters and their sequence necessary. It is thus especially useful for recognizing co-occurring letter combinations. However, it is more demanding with regard to spatial attention. Alternatively, letters can be processed in a coarse-grained mode, independent of specific letter position information. Due to its holistic nature, this processing mode is assumed to be faster in accessing whole word representations.

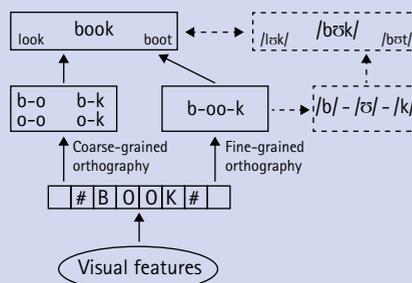


Figure 22. A model of reading incorporating two different modes of orthographic coding: coarse-grained and fine-grained.

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Box 10.

OPeRA: Orthographic Processing in Reading Acquisition

Modern theoretical models of reading assume a distinction in the mode of coding relevant orthographic features, namely, between fine- and coarse-grained orthographic processing (Box 10).

Fine-grained orthographic processing operates using orthographic units of different sizes, referred to as grain sizes (Box 11). Which grain sizes readers rely on is believed to vary across languages as well as individuals. In general, it is thought that beginning readers start with smaller grain sizes such as single phonemes and, by means of chunking, proceed to use increasingly bigger units such as syllables or morphemes.

Language-specific characteristics impose special constraints on the units of analysis used in reading. One such specific characteristic of German is its morphological richness. Many German words are composed by systematically concatenating morphemes (e.g., "blau-es," "Fahr-er," "Krank-heit," "glück-lich," "Tee-tasse"). Thus, using morphemes as a grain size may be especially useful for German readers. From a developmental perspective, it is theorized that, after an initial stage of phonology-based, sequential decoding, readers adopt a more parallel, fine-grained decoding strategy.



Figure 24. Children use different grain sizes in reading and writing.

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This is attained by chunking letters into increasingly larger units such as multiletter graphemes (e.g., "ch") or morphemes (e.g., plural "-s," suffix "-er"). Fine-grained processing, using morphological units as a grain size, allows children with a small lexicon to access complex words more efficiently. The coarse-grained lexical route makes fewer demands

Orthographic Grain Sizes in Reading

Grain sizes are linguistic units with correspondences in orthography. Various grain sizes are hypothesized to be used in reading, depending on the individual and the language. Figure 23 depicts the word "BOOKS" divided into units of different sizes, namely, morphemes, syllables, onset and rime, nucleus and coda, and phonemes. Morphemes are the smallest units of meaning. In this case, "BOOK" refers to the object, while the "S" indicates the plural. Syllables divide words into sequences of sounds. The onset-rime distinction further subdivides a syllable into the consonant at the word beginning and the cluster of vowels and consonants at the end of the syllable. The rime is the element that is usually similar-sounding when rhyming (e.g., "BOOKS"-"LOOKS"). The nucleus is the vowel of a syllable which, together with the coda, makes up the rime. Phonemes are the different sounds that make up a word.

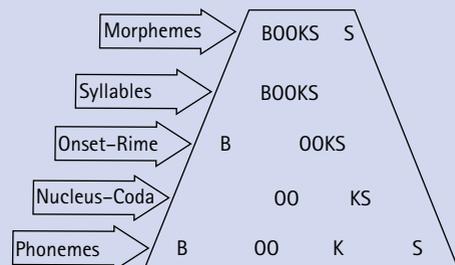


Figure 23. The word "BOOKS" divided into units of different grain sizes.

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Box 11.

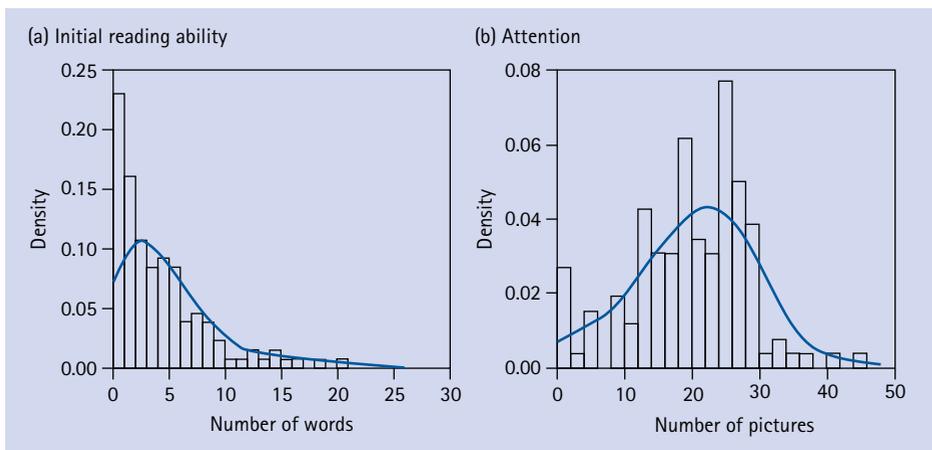


Figure 25. Interindividual differences at the beginning of grade 1.

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on spatial attention and may thus benefit reading. Due to the morphological richness of the language, however, it may not be as crucial for reading in German. The *OPeRA* project aims to track the development of orthographic processing in German and to identify the grain sizes used by children at different developmental stages. To this end, we recruited 120 grade 1 students from elementary schools in Berlin. Assessments of precursor skills such as general motoric and cognitive abilities as well as specific linguistic competencies began in October 2013. Although most children at the

beginning of grade 1 were not yet able to decode simple words (Figure 25a), there were remarkable interindividual differences in children's cognitive abilities at school entrance (Figure 25b).

How will these initial differences in reading skill develop over time? Are they related to the use of different grain sizes and decoding strategies? To address these questions, we will track students' development through extensive individualized test sessions implemented at the end of each grade. Specifically, we will examine the effects of marker variables such as length and frequency. Furthermore, effects



Figure 26. Most processes involved in reading are influenced by the amount of children's reading behavior.

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The Masked Priming Paradigm

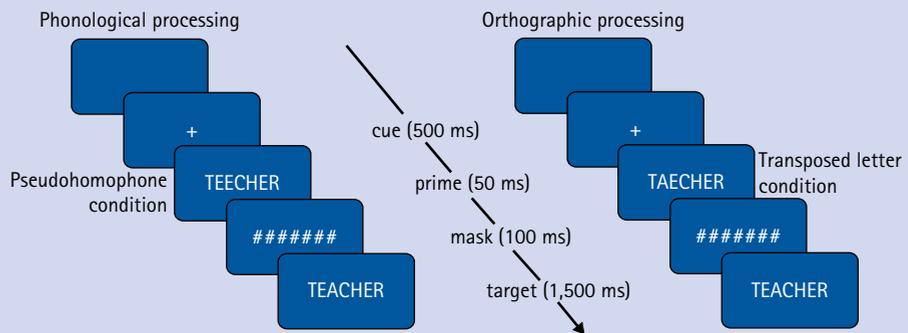


Figure 27. Schematic depiction of the sequence of a trial in the masked priming paradigm with a pseudohomophone and a transposed letter manipulation.

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Masked priming is a well-established paradigm for distinguishing fine-grained, phonology-based processing from coarse-grained, holistic processing in visual word recognition. It uses manipulations that comply with either fine- or coarse-grained processing to prime a target word (Figure 27). In the pseudohomophone condition, the prime is phonologically similar to the target, but does not conform to the standard spelling. In the transposed letter condition, two letters in the prime are interchanged. Participants are required to decide whether or not the target is a word. The priming benefit relative to a control condition indicates the mode of processing.

Box 12.



Figure 28. Masked priming in the lexical decision task.

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of different reading strategies will be investigated to discern fine-grained phonology-based from coarse-grained holistic processing. Younger readers are expected to show effects based on fine-grained decoding, as the coarse-grained route is not yet established at this stage of development. With increased reading experience, the pattern is expected to reverse, with children showing less marker effects of phonology-based processing and more marker effects of holistic processing. These questions will be addressed using the masked priming paradigm (Box 12). The same paradigm can be applied to examine the use of other grain sizes such as morphemes. First results from this study are expected to be published in summer 2014.

PLAiT: Prerequisite Language Abilities in the Transitional Phase

The longitudinal *PLAiT* project aims at closing the gap between language acquisition studies in early childhood and reading research at school age. *PLAiT* will investigate the cognitive development of children in the transitional phase between kindergarten and school. This will allow us to relate the development of orthographic representations to the general dynamics of language acquisition. The project will track 50 children from the 2nd year of kindergarten until the end of grade 1 of elementary school (4–7 years of age). We will closely monitor the children's linguistic abilities by testing them in individual sessions at equal time intervals of 6 months. The main focus of *PLAiT* lies on the lexical quality of word representations at different developmental stages. The Lexical Quality Hypothesis claims that the speed of retrieval of a lexical entry, that is, the mental representation of a word, depends on the quality of various linguistic dimensions: orthogra-

phy, semantics, phonology, and (although not explicitly mentioned) morphosyntax. The hypothesis assumes that children with detailed representations of words on different linguistic dimensions are able to access words in the lexicon faster than children with underspecified or missing representations. In addition, more elaborated lexical representations are assumed to foster the acquisition of new words. Thus, children with better and interconnected representations are expected to be more successful in the acquisition of reading and writing. The Lexical Quality Hypothesis was derived on the basis of studies of participants who were already able to read and write. The *PLAiT* project, in contrast, will focus on the development of phonological and semantic representations that are fundamental for later orthographic processes. To this end, the project will examine the development and interrelations of phonological, semantic, and morphosyntactic skills in the kindergarten years. Furthermore, it will explore their impact

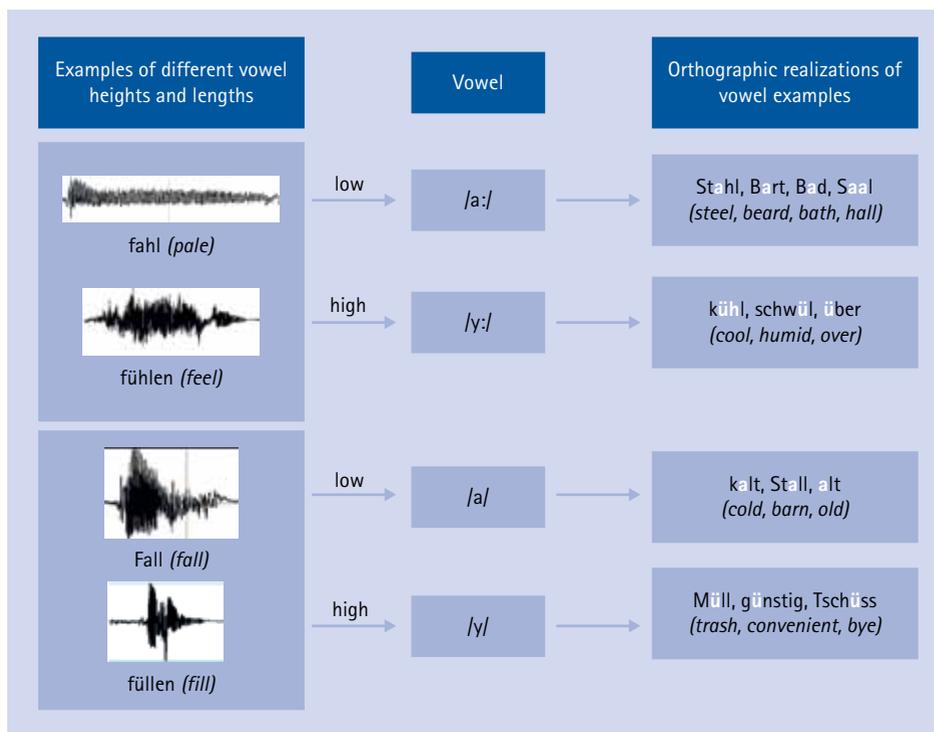


Figure 29. Examples of different vowel length realizations in German.

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Figure 30. The acquisition of linguistic abilities before school is important for later reading development.

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on the orthographic lexicon at school entry and investigate the differential effects of distinct precursor abilities on children's reading fluency or comprehension. By combining reaction time and accuracy measures, *PLAiT* will be able to provide a detailed picture of children's lexical retrieval. *PLAiT* will also pay particular attention to the language-specific challenges of German, such as the perception of vowel lengths in phonology and irregularities in morphosyntax. To give an example from phonology, one way to measure phonological perception is to look at children's ability to identify different vowel lengths. In German, the correct perception of vowel lengths is crucial to successfully activate semantic information (Figure 29). A child who cannot differentiate between "fahl" (pale) and "Fall" (fall) will misunderstand the meaning of the word and will not be able to identify its function within a sentence (adjective vs. noun). Furthermore, words with the same vowel length can be realized using different spellings. Without the ability to distinguish between vowel lengths, children will find the decoding and writing of similar words difficult. Vowel length perception is therefore an important prerequisite skill for reading and writing acquisition. Phonetically, both words in the example ("fahl" and "Fall") contain vowels with similar spectral profiles (low frequency), which are perceptually more salient than high-frequency vowels (such as the /y/ in "füllen" and "fühlen"). Vowel length discrimination may thus be easier for low than for high vowels. At the same time, there may be substantial interindividual differences. For children

with better phonological representations, it should be easier to distinguish between different vowel lengths independently of their spectral features.

Phonology, or more precisely phonological awareness, has been identified as an important predictor of reading and writing. It can be measured using various operationalizations. Vowel length discrimination or rhyming tasks, which are primarily perceptual tasks, are one possibility. Alternative options are productive tasks (e.g., nonword repetition) or transfer tasks (e.g., sound deletion tasks, which involve perception, transformation, and production of stimuli). However, it is unclear whether the nature of the task (e.g., cognitively more vs. less demanding) impacts the predictive power of these measures. Children, as investigated in the initial stages of the *PLAiT* project, are not yet proficient language producers, but proficient language perceivers. Against this background, *PLAiT* will investigate whether the type of task (perceptual, productive, transfer) impacts the predictive power of these measures at different stages of reading development.

In summary, the general aim of *PLAiT* is to identify valid predictors of reading acquisition. Additionally, the project seeks to provide information about which types of phonological tasks are best suited to identify children at risk of becoming poor readers at an early stage of development. The project thus focuses on the typical development of young children, while monitoring potential risk factors. *PLAiT* was launched in August 2013; data collection will begin in spring 2014. First results are expected in summer 2014.

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(last update: January 2014)

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Research Programs of the Directors Emeriti

With the support of the President of the Max Planck Society, the **Directors emeriti Jürgen Baumert** and **Wolfgang Edelstein** continue to pursue their research programs at the MPI for Human Development. Jürgen Baumert's work focuses on the reform of the Berlin secondary school system, the relationship between students' educational resources and their life course, the development of teachers' professional competence, and the potential of bilingual alphabetization in multicultural societies. Wolfgang Edelstein's work focuses on sociomoral development, democracy education, and democratic school reform. With support from the Jacobs Foundation, a Masters course focusing on these topics for teacher education has been developed at the Freie Universität Berlin.



Jürgen Baumert (Director emeritus), **Wolfgang Edelstein** (Director emeritus)

Jürgen Baumert's Research Team 2011–2013

Researchers

Swantje Dettmers, Nicole Nagy (until 06/2011)

Predocctoral Fellow

Axinja Hachfeld (as of 10/2012: Freie Universität Berlin, Germany)

Visiting Researcher

Ulrich Trautwein (University of Tübingen, Germany)

Jürgen Baumert's Research Program

Jürgen Baumert's work focuses on the reform of the Berlin secondary school system, the relationship between students' educational resources and their life course, the development of teachers' professional competence, and the potential of bilingual alphabetization in multicultural societies. These research projects are being conducted in cooperation with the University of Potsdam and the German Institute for International Educational Research (DIPF; Kai Maaz), the Leibniz Institute for Science and Mathematics Education at the University of Kiel (IPN; Olaf Köller), the Goethe University Frankfurt a. M. (Mareike Kunter), the Christian-Albrechts-Universität zu Kiel (Jens Möller), and the Mercator Institute at the University of Cologne (Michael Becker-Mrotzek).

Reform of the Secondary School System in Berlin and Its Impact on Academic and Vocational Careers (BERLIN Study)

This study aims to evaluate the recent reform of the Berlin secondary school system and its long-term effects on students' individual development and career patterns. The study has a quasi-experimental, longitudinal design. It is being conducted in cooperation between the MPI for Human Development, the DIPF, and the IPN, and is jointly funded by the state of Berlin and the Jacobs Foundation.

Over the past few years, the secondary school systems of many German federal states have undergone major reforms. The traditional three-track system consisting of vocational-track *Hauptschule*, intermediate-track *Realschule*, and academic-track *Gymnasium* is currently no longer implemented in any of the 16 states. Instead, most states have switched to a two-track system with just one type of secondary school alongside the academic-track *Gymnasium*. Students at these new "integrated secondary schools" can work toward a basic or an intermediate school-leaving certificate. In many states, integrated secondary schools also offer a direct route to the *Abitur*, the general higher education entrance qualification that was previously accessible only to *Gymnasium* students. The main reasons for the reforms were a steady decline in the appeal of the *Hauptschule* track and a marked decline in student numbers in many states, which necessitated changes in the structure of the secondary system.

The state of Berlin implemented structural reforms of its secondary system at the start of the 2010/11 academic year. Existing vocational-track, intermediate-track, and

comprehensive schools were fused to become integrated secondary schools. Students at this new school type can work toward all school-leaving qualifications, including the *Abitur*. The new integrated secondary schools provide compulsory full-day education, place a stronger emphasis on career orientation (dual learning in day-release programs), and do not implement grade retention. The goals of the structural reforms are primarily to increase the number of students graduating with an intermediate school-leaving certificate or an *Abitur* and to reduce the number of those leaving school without qualifications. At the same time, the reforms were intended to weaken the link between family background and educational outcomes. The procedures for transition from elementary to secondary school have also been modified. The main change concerns procedures for admission to individual secondary schools. In principle, parents in Berlin have a free choice of secondary schools. If demand for places at a school exceeds supply, up to 10% of places are allocated to students with special needs. The school itself selects 60% of its students on the basis of, for example, their primary school grades or entrance examinations. The remaining 30% of places are allocated by lottery. These new rules are intended to allow schools to develop stronger profiles; at the same time, the lottery component is intended to ensure a minimum level of heterogeneity in the composition of the student body.

Design of the BERLIN Study

The BERLIN Study was designed to investigate the effects of these structural reforms on students' learning outcomes and educational careers. It investigates a specific group of

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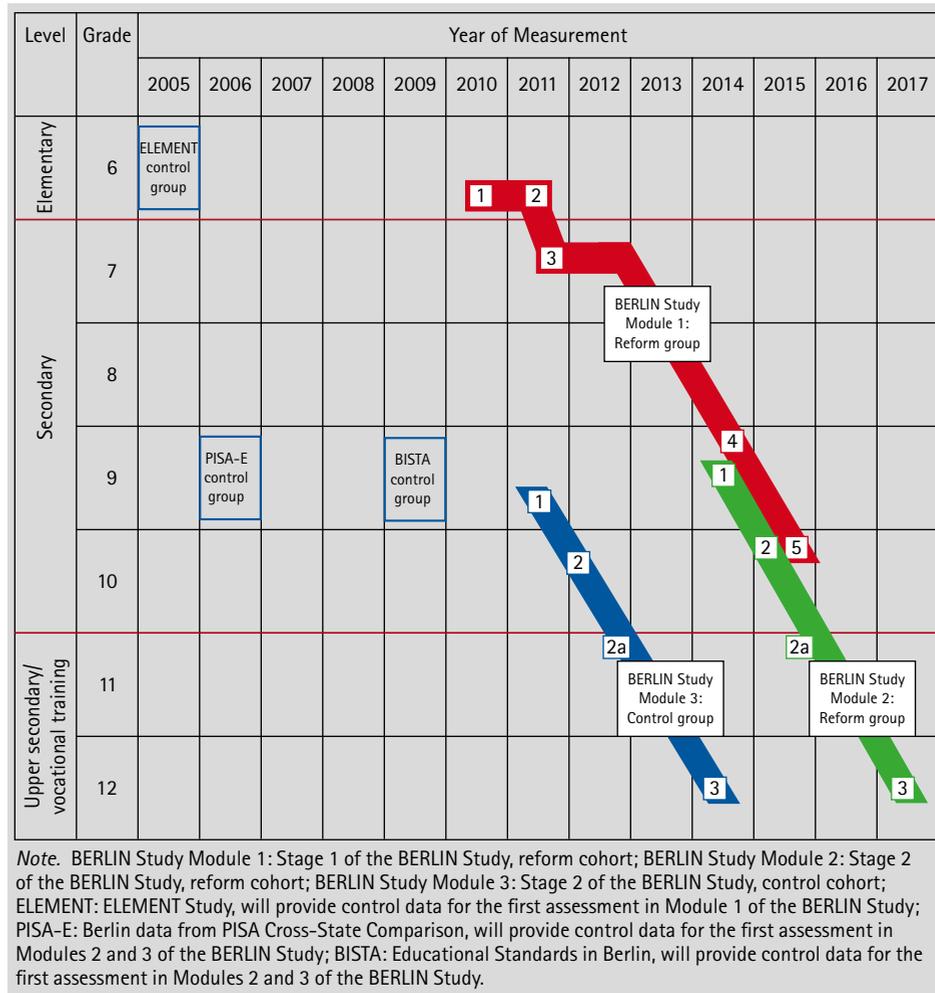


Figure 1. Design of the BERLIN Study.

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students: the second cohort to be educated within the new structures and, at the same time, the first to have experienced the new transition procedures. The study will track these students from the end of elementary school (grade 6) until the transition to vocational or upper secondary education. The study comprises two stages: Stage 1 (Module 1) focuses on the transition from elementary school to lower secondary education; Stage 2 (Modules 2 and 3) examines educational outcomes at the end of lower secondary education and the transition to vocational and upper secondary education. Both stages will involve an experimental and a control group, with the two experimental

groups overlapping at the end of lower secondary education (see Figure 1).

Initial Findings of the BERLIN Study

The first report on the BERLIN Study's findings focused on three main questions:

(1) *Stakeholders' Evaluations of the Reforms.* The move to a two-track system was welcomed by the large majority of teachers and school principals and by the majority of parents. All stakeholders applauded the fact that both tracks now offer the same qualifications (including the *Abitur*). The same applied to the stronger focus on career orientation and dual learning and to the provision of full-day education in all integrated secondary

schools. Opinions on the abolition of grade retention at integrated secondary schools were mixed, with some respondents voicing strong disagreement with this aspect of the reforms. Overall, respondents' evaluations of the new transition procedure and most of its individual elements were positive. The majority of parents were pleased or very pleased with their child's secondary school. Opinions on the allocation of places by lottery were very negative, however. This corrective measure is evidently regarded by all stakeholders—with the exception of principals at integrated secondary schools—as representing a loss of control and an incalculable risk.

(2) *Social Disparities at the Transition From Elementary to Secondary Education.* The alarming impact of social background at the transition from elementary to secondary education in Germany has been a topic of considerable debate. To what extent is the choice of secondary school type impacted not only by a student's academic achievement but also by family background characteristics (what Boudon termed "secondary background effects")? Our analyses revealed comparatively positive results for the state of Berlin. In contrast to many other assessments, the BERLIN Study found that social background did not have any effect above and beyond academic achievement (grades and test scores) on the secondary school track recommendation. Likewise, academic achievement was the decisive factor in the actual choice of secondary track. However, social background did have small additional effects here, which were fully mediated by parents' educational aspirations.

(3) *The Choice of Individual Secondary School in the New Transition System.* Findings showed that 84% of students were offered a place in the school of their choice (92% of those at *Gymnasium* schools, 79% of those at integrated secondary schools). Whether a student was offered a place at the school of his or her choice depended solely on his or her academic achievement (in terms of grade point average at elementary school); family background proved to have no additional effect. The results also revealed marked variations in demand for places at individual

schools, with more pronounced differences in the demand for places at integrated secondary schools than at *Gymnasium* schools. Of the integrated secondary schools, those with an on-site upper secondary center were in highest demand. There was less demand for places at integrated secondary schools that were previously a *Hauptschule* or had been formed by the fusion of a *Hauptschule* and *Realschule*. Parents of higher achieving students were particularly likely to choose oversubscribed schools. These results indicate that the old structures continue to resonate beneath the surface of the newly structured secondary system.

Looking Ahead

Questions to be addressed in future analyses include the effects of the Berlin reforms on students' achievement levels at the end of secondary education and on the transition to vocational and upper secondary education.

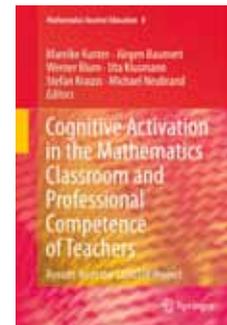
Professional Competence of Teachers and Cognitive Activation in the Classroom (COACTIV)

The COACTIV research program was initiated in 2002 and was systematically developed within the Institute's former Center for Educational Research. In the period under review, the program's work was continued in cooperation with the Goethe University Frankfurt a. M. (Mareike Kunter), where COACTIV is now based, the University of Duisburg-Essen (Detlef Leutner), and the University of Münster (Ewald Terhart). It has received funding from the German Research Foundation (DFG), the Strategic Innovation Fund of the President of the Max Planck Society, the Federal Ministry for Education and Research (BMBF), and the state of North Rhine-Westphalia.

The research program is dedicated to the study of the structure, development, and impact of teachers' professional competence (see Table 1). The first main study in the program was *COACTIV*, a research project embedded in the longitudinal extension of PISA 2003. Within this first main study, we first developed a theoretical model of teachers' professional competence as well as instru-

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Table 1
Overview of the COACTIV Research Program

Main studies	Design	Focus
COACTIV	<ul style="list-style-type: none"> • 194 mathematics teachers • Embedded in PISA 2003/2004 • Repeated measurement (1 year) 	<ul style="list-style-type: none"> • Development of measures • Links between teacher competence/instruction/students
COACTIV-R	<ul style="list-style-type: none"> • 856 mathematics teacher candidates • Repeated measurement (1 year) 	<ul style="list-style-type: none"> • Validation of competence model • Description of development during teacher training • Identification of individual and institutional conditions for development
BilWiss	<ul style="list-style-type: none"> • Approx. 3,500 graduates of university teacher education programs • Test of educational knowledge • Subsample: Repeated measurement (1 year) 	<ul style="list-style-type: none"> • Analysis of the structure of pedagogical knowledge • Comparison of students in different teacher education programs
Smaller studies	<ul style="list-style-type: none"> • COACTIV Construct Validation Study • COACTIV-Students • COACTIV-International (Taiwan) • BELE (Stress and Burnout in the Teaching Profession) 	

ments for its assessment. The opportunity to link the COACTIV teacher data to longitudinal data obtained from their students in the PISA 2003/04 assessment allowed us to test the practical relevance of this professional competence for the quality of teachers' instruction and for student learning outcomes.

The second main study in the COACTIV research program was *COACTIV-Referendariat* (COACTIV-R), which started in 2007. COACTIV-R investigated teacher candidates' acquisition of professional knowledge during the obligatory 2-year phase of teaching practice (i.e., the *Referendariat*) that is required to become a fully licensed teacher in Germany. COACTIV-R investigated the development of professional competence during this second phase of teacher education using a longitudinal study design with two points of measurement and two cohorts of teacher candidates in consecutive years. A focus of the study was on the development and testing of new instruments to assess the generic pedagogical/psychological knowledge of beginning teachers.

The third main study was entitled *Acquisition of Generic Pedagogical Knowledge* (BilWiss) and was conducted in cooperation between the MPI for Human Development, the Goethe

University Frankfurt a.M., the University of Duisburg-Essen, and the University of Münster. This study, which ran from 2009 to 2012, focused on the university-based component of teacher training.

During the period under review, our research focused on three main areas:

(1) Analyzing the development of teachers' professional competence in the classroom-based induction phase of their teacher education, the *Referendariat* (COACTIV-R). The particular focus of this research was on the development of teacher candidates' pedagogical/psychological knowledge. The main findings were that pedagogical/psychological knowledge increased during the *Referendariat* and that candidates' scores in this domain of knowledge predicted the quality of their instruction—especially in terms of classroom management, teacher feedback, and constructive support.

(2) Reconstructing, by means of a Delphi study, the normative structure and content of the generic pedagogical knowledge that teacher candidates are expected to acquire at university and during the *Referendariat* (BilWiss). The participants in the Delphi study were university faculty members who are responsible for teacher education as well as

established teachers who act as trainers and mentors during the *Referendariat*. The major finding was a remarkable level of agreement both among university faculty and between university faculty and trainers during the *Referendariat* with respect to the normative structure of the curriculum that should be covered in teacher education.

(3) Developing and validating a multidimensional test assessing the generic pedagogical knowledge of teacher candidates, based on the findings of the Delphi study. The test has been implemented in a cohort of candidates completing the first, university-based phase of their teacher education at all universities in the state of North Rhein-Westphalia. A representative sample of this cohort is being tracked longitudinally during the *Referendariat* period.

Schooling and Individual Development in Adolescence and Adulthood (BIJU)

This longitudinal study, which was initially entitled *Learning Processes, Educational Careers, and Psychosocial Development in Adolescence and Young Adulthood*, was initiated in 1991. The seventh wave of data

collection took place in 2009/10, when most participants were 32 years old. The longitudinal study is now being continued in cooperation with the DIPF (Kai Maaz), the IPN (Olaf Köller), and the University of Michigan at Ann Arbor (Kai S. Cortina). The study is funded by the Strategic Innovation Fund of the President of the Max Planck Society.

The BIJU study comprises five components:

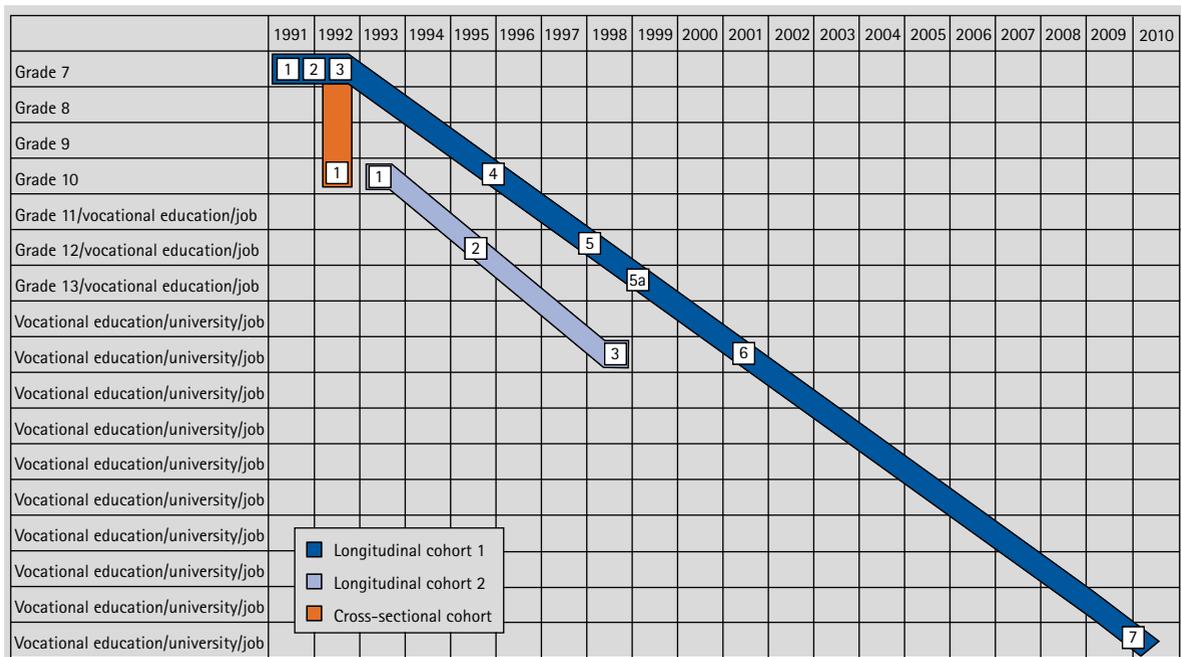
- (1) providing institutional and individual baseline data on the integration of the East and West German educational systems since 1991;
- (2) analyzing domain-specific learning as a function of personal resources and institutional opportunity structures;
- (3) analyzing long-term trajectories of psychosocial development in adolescence and young adulthood;
- (4) analyzing the transition from school to vocational training or university;
- (5) analyzing the transition to the labor market and to starting a family.

Data collection began with a survey of the main cohort (longitudinal cohort 1) in the 1991/92 school year (see Figure 2), during

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which data were gathered from grade 7 students at three measurement points. The first point of measurement coincided with the transformation of the unitary school system of the former East Germany to the tracked system adopted from West Germany. The fourth wave of data collection was conducted in spring 1995, when the main cohort students were in the final grade of lower secondary school. The fifth wave took place in spring 1997, when participants were either in vocational or upper secondary education. The sixth wave of data collection, conducted in 2001, focused on how students had mastered the transition from school to university or from vocational education to the labor market. A seventh wave of data collection took place in 2009/10. The sample of school classes comprises some 8,000 students from 212 secondary schools of all types in the states of Berlin, Mecklenburg-West Pomerania, North Rhine-Westphalia, and Saxony-Anhalt. A second longitudinal cohort and a cross-sectional add-on study complement the BIJU data set. Our analyses are currently focusing on components (3), (4), and (5).

Bilingual Alphabetization in Multicultural Societies: Evaluation of Berlin's State Europe Schools (EUROPA Study)

The key objective of this new study, which was initiated in 2013, is to examine whether bilingual alphabetization in so-called two-way immersion is a suitable instrument for reducing the educational disadvantage of immigrant children. Drawing on a longitudinal, extended evaluation of the Berlin's State Europe Schools (SESB), we aim to derive benchmarks for the outcomes of two-way immersion for children from German-speaking and non-German-speaking families. In addition, we will test the assumption that positive transfer occurs from the first to the second language as long as a critical threshold of language proficiency has been reached, and the assumption that children who learn to read and write in two languages are at a general advantage in terms of the development of executive functions. The study has a quasi-experimental design and includes a longitudinal component at elementary school level. It is being conducted in cooperation with the Christian-Albrechts-Universität zu Kiel (Jens Möller), the IPN (Olaf Köller), and the Mercator Institute for Language Training and German as a Second Language (Michael Becker-Mrotzek). It is funded by the state of Berlin and the Mercator Foundation.

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(last update: January 2014)

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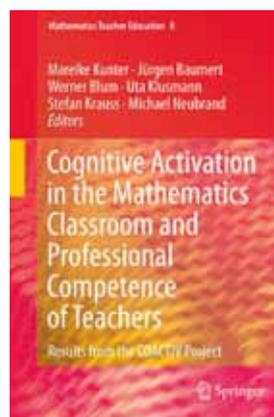
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This graduate program on the life course is one of the Max Planck Society's International Max Planck Research Schools (IMPRS). It was established in 2002 as a collaboration between the MPI for Human Development, Berlin, the Humboldt-Universität zu Berlin, the Freie Universität Berlin, and the University of Michigan, Ann Arbor. The University of Virginia, Charlottesville, joined in October 2004 and the University of Zurich followed suit in October 2008.

Studying the development of human behavior from infancy to old age is at the heart of the LIFE graduate program. LIFE takes an integrative and interdisciplinary approach to identifying, understanding, and improving the mechanisms and conditions that shape the human life course. It actively promotes international networking and communication as an integral part of graduate training. The Berlin-based fellows are recruited from all over the world (e. g., Azerbaijan, Bulgaria, Iran, Israel, Malaysia, Turkey, etc.) In addition, four LIFE sites in three countries (Germany, the United States, Switzerland) located on either side of the Atlantic guarantee a graduate education with a strong emphasis on international exchange and collaboration. The target groups of the Research School are graduate students who have completed

their Master or Diploma, share an interest in the human life course, and intend to pursue a doctorate in one of the disciplines represented in LIFE (biology, computer science, economics, educational science, neuroscience, psychology, and sociology). As a collaborative Research School, LIFE offers students a unique educational experience: academic training in their area of specialization and academic discipline that is enriched by interdisciplinary and international perspectives. The training program comprises seminars at the participating institutions, a series of fall and spring academies, and the supervision of research training by members of the LIFE faculty. The program also provides opportunities for research to be carried out abroad at one of the cooperating institutions. Eighteen fellows (9 from Berlin, 2 from the University

www.imprs-life.mpg.de

Co-Chairs

Ulman Lindenberger,
MPI for Human
Development
Clemens Tesch-Römer,
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Lorenz*,
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Angeline S. Lillard,
University of Virginia,
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Alexandra M. Freund,
University of Zurich

Coordinators

Imke Kruse,
MPI for Human
Development
(10/2011–03/2012
and since 08/2012)
Julia A. M. Delius,
MPI for Human
Development
(01/2011–09/2011,
04/2012–07/2012)
Linda Durham,
University of Michigan
Juanita L. Geer,
University of Virginia



Figure 1. Participants from all four LIFE sites during the LIFE Spring Academy 2013 at the University of Michigan.

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of Virginia, 2 from the University of Michigan, and 5 from the University of Zurich) made use of this international research option in the 2011–2013 period.

The key components of the LIFE program are weeklong academies attended by fellows and faculty from each site. Each year, one academy takes place in spring and the other in fall; hence, six such academies took place during the period of reporting. The LIFE Spring Academy 2011 was organized by the University of Michigan, while the Fall Academy 2011 took place in the mountain village of Bergün, Switzerland. In 2012, the Spring Academy was held at the MPI for Human Development with the Fall Academy taking place at the University of Virginia. The 2013 Spring Academy was held at the University of Michigan while the Fall Academy was organized by the University of Zurich at Schloss Marbach, Germany, near Lake Constance. The next academy is scheduled to take place in Charlottesville in May 2014. Each fellow participates in four academies. Typically, 25–30 fellows attend a given academy, and most of them present their dissertation research either as a poster or as a paper presentation. Roughly 20 faculty members from all sites also participate in each academy, in addition to a possible one to two guest speakers from other institutions. During the spring academies, the graduating alumni join the group to celebrate their LIFE Commencement.

Table 1
International LIFE Community
(as of December 2013)

	<i>Berlin</i>	<i>Michigan</i>	<i>Virginia</i>	<i>Zurich</i>
Faculty	31	29	17	11
Fellows	23	7	11	9
Alumni	64	32	21	14

In 2011, LIFE received the APA Board of Educational Affairs Award to Advance Interdisciplinary Education and Training in Psychology. This award recognizes education and training programs in psychology that advance interdisciplinary, multidisciplinary, or interprofessional teaching, research, or practice. In 2012, the IMPRS LIFE received a highly positive evaluation from a board of four external reviewers appointed by the Max Planck Society. In their report, the reviewers particularly highlighted the international focus of the program, the breadth of the interdisciplinary research agenda, the high methodological quality of doctoral training and research, and the sound balance between a more formal academic training structure and less formalized options for exchange and cooperation. The report provided the basis for the Max Planck Society's decision to continue to support the LIFE program for a third funding period until the end of 2019.



Figure 2. Berlin Fellows at a LIFE Seminar taught by Ulman Lindenberger.

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In addition to the academies, each participating site also offers special courses reflecting the specific profile of its graduate program. In Berlin, this comprises weekly seminars at the MPI for Human Development that are taught throughout the academic year by a diverse group of faculty members from the three participating Berlin institutions as well as additional workshops with a particular focus on methods. Several courses take place simultaneously with the other LIFE sites via advanced video-conferencing technology (Access-Grid).

LIFE Seminars and Workshops 2011–2013, Berlin

<i>Semester</i>	<i>Topic</i>	<i>Lecturer(s)</i>
Winter 2010/11	Lifespan and Plasticity	Ulman Lindenberger (MPIB) and guests
Winter 2010/11	Academic Presentation Training	Steve Weir (FU)
Summer 2011	Fellows' Project Presentations	Chaired by Berlin LIFE Alumni
Summer 2011	Multilevel Modeling	Tanja Lischetzke (FU)
Winter 2011/12	Defining, Assessing, and Predicting Educational Achievement	Hans Anand Pant, Dirk Richter, Petra Stanat (HU), and guests
Winter 2011/12	Dynamical Systems Analysis	Steve M. Boker (UVa) via AccessGrid
Winter 2011/12	Academic Presentation Training	Steve Weir (FU)
Summer 2012	Foundations of Lifespan Research	Berlin Faculty and guests
Summer 2012	Equilibrium Dynamics and Latent Differential Equations	Steve M. Boker (UVa)
Summer 2012	Fraud, Integrity, and Responsible Conduct in Science	Georg W. Kreutzberg (MPI for Neurobiology, Martinsried)
Summer 2012	Modern Missing Data Handling: Planning for the Unplanned and Including the Planned	Todd D. Little (University of Kansas)
Winter 2012/13	Health Psychology Across the Lifespan	Ralf Schwarzer (FU) and guests
Winter 2012/13	Academic Presentation Training	Steve Weir (FU)
Summer 2013	Introductory Workshop "Foundations of Lifespan Research"	Ulman Lindenberger (MPIB) and guests
Summer 2013	Academic Writing	James Murphey (FU)
Summer 2013	Fellows' Project Presentations	Chaired by Berlin LIFE Alumni
Summer 2013	Introduction to R	Jana Mahlke (FU)
Summer 2013	Latent Change Score SEM Analysis	Jack McArdle (USC)
Winter 2013/14	Social and Behavioral Gerontology	Clemens Tesch-Römer (DZA) and guests
Winter 2013/14	Academic Presentation Training	Steve Weir (FU)
Winter 2013/14	Introduction to Mplus	Andrea Hildebrandt (HU)

Note. Freie Universität Berlin (FU), Humboldt-Universität zu Berlin (HU), German Centre of Gerontology (DZA), MPI for Human Development (MPIB), University of Southern California (USC), University of Virginia (UVa).

LIFE Faculty 2011–2013 (as of January 2014)

MPI for Human Development

Jürgen Baumert, Education
Gerd Gigerenzer, Psychology
Ralph Hertwig, Psychology (since 01/2012)
Simone Kühn, Neuroscience (since 01/2012)
Ulman Lindenberger, Psychology
Martin Lövdén, Psychology
Michaela Riediger, Psychology
Lael S. Schooler, Psychology
Sascha Schroeder, Psychology & Education (since 04/2012)
Yee Lee Shing, Psychology (since 01/2012)

Freie Universität Berlin

Martin Brunner, Psychology & Education (since 03/2013)
Michael Eid, Psychology
Hauke R. Heekeren, Neuroscience
Arthur M. Jacobs, Psychology
Herbert Scheithauer, Psychology
Ralf Schwarzer, Psychology & Health
Clemens Tesch-Römer, Psychology & Gerontology

Humboldt-Universität zu Berlin

Jens B. Asendorpf, Psychology
Hans Bertram, Sociology
Peter A. Frensch, Psychology
Denis Gerstorff, Psychology (since 04/2011)
Peter Hammerstein, Biology
Oliver Lüdtke, Psychology & Education (since 06/2011)
Hans Anand Pant, Education
Petra Stanat, Education
Arno Villringer, Neuroscience

Other Faculty Affiliated With LIFE Berlin

Gerd Kempermann, Neuroscience, Center for Regenerative Therapies Dresden
Shu-Chen Li, Psychology, Technische Universität Dresden & MPI for Human Development
Florian Schmiedek, Psychology, Deutsches Institut für Pädagogische Forschung Frankfurt a. M. & MPI for Human Development
C. Katharina Spieß, Economics, Deutsches Institut für Wirtschaftsforschung & Freie Universität Berlin
Gert G. Wagner, Economics, Deutsches Institut für Wirtschaftsforschung & MPI for Human Development

University of Michigan

Toni C. Antonucci, Psychology
Don Brown, Psychology
Cleopatra Howard Caldwell, Psychology
Kai S. Cortina, Psychology & Education
Pamela Davis-Kean, Psychology & Education
Jacquelynn S. Eccles, Psychology & Education
Robin S. Edelstein, Psychology
Richard Gonzalez, Psychology
L. Rowell Huesmann, Psychology & Communication Studies
James S. Jackson, Social Psychology
Daniel Keating, Psychology

Shinobu Kitayama, Psychology
Daniel Kruger, Psychology & Public Health
Bobbi S. Low, Evolutionary & Behavioral Ecology
Cindy Lustig, Psychology
Kevin F. Miller, Psychology & Education
Maria Muzik, Psychiatry
Randolph M. Nesse, Psychology & Psychiatry
Sheryl Olson, Psychology
Thad Polk, Psychology
Patricia A. Reuter-Lorenz, Cognitive Psychology & Neuroscience
Arnold Sameroff, Psychology
John Schulenberg, Psychology
Rachael Seidler, Psychology & Kinesiology
Priti Shah, Psychology
Jacqui Smith, Psychology
Abigail Stewart, Psychology
Twila Tardif, Psychology
Henry M. Wellman, Psychology

University of Virginia

Steven M. Boker, Cognitive & Quantitative Psychology
Gerald L. Clore, Social Psychology
James Coan, Clinical Psychology (since 04/2011)
Judy DeLoache, Developmental Psychology
Chad Dodson, Cognitive Psychology
David L. Hill, Psychobiology
Vikram K. Jaswal, Developmental Psychology
Angeline S. Lillard, Developmental Psychology
James P. Morris, Social Neuroscience (since 04/2011)
John R. Nesselroade, Quantitative & Developmental Psychology
Brian Nosek, Cognitive, Quantitative, & Social Psychology
Timo von Oertzen, Quantitative Psychology (since 02/2012)
Robert C. Pianta, Educational Science
Timothy Salthouse, Cognitive Psychology
Bethany Teachman, Clinical & Social Psychology
Eric Turkheimer, Quantitative & Clinical Psychology
James H. Wyckoff, Educational Science

University of Zurich

Moritz Daum, Developmental Psychology (since 12/2012)
Simon Forstmeier, Psychopathology & Clinical Intervention
Alexandra M. Freund, Applied Psychology: Life Management
Lutz Jäncke, Neuropsychology
Andreas Maercker, Psychopathology & Clinical Intervention
Mike Martin, Gerontopsychology
Urs Maurer, Cognitive Neuroscience (since 08/2011)
Martin Meyer, Neuropsychology (since 04/2011)
Jana Nikitin, Applied Psychology: Life Management (since 04/2011)
Friedrich Wilkening, General & Developmental Psychology
Jacqueline Zöllig, Gerontopsychology (since 04/2011)

LIFE Doctoral Fellows 2011–2013

MPI for Human Development

Janne Adolf, Psychology
Cathleen Bache, Psychology
Garvin Brod, Psychology
Yana Fandakova, Psychology
Anika Josef, Psychology
Maike Kleemeyer, Psychology
Kathrin Klipker, Psychology
Nina Lisofsky, Psychology
Johanna Sanger, Psychology
Nicolas W. Schuck, Psychology
Viola S. Stormer, Psychology
Elisabeth Wenger, Psychology

Freie Universitat Berlin

Milena Barz, Psychology
Maryam Gholami, Psychology
Judith Mangelsdorf, Psychology
Anja Schultze-Krumbholz, Psychology

Humboldt-Universitat zu Berlin

Johanna Drewelies, Psychology
Fidan Gasimova, Mathematics
Nicole Haag, Education
Aleksander Kocaj, Education
Camilla Rjosk, Education
Stefan Schipolowski, Education
Nina Vogel, Psychology

Other Institutions Affiliated With LIFE Berlin

Miray Erbey, Neuroscience, Berlin Neuroimaging Center, Charite Universitatsmedizin Berlin
Julia Freund, Neuroscience, Center for Regenerative Therapies Dresden
Fivos Iliopoulos, Neuroscience, Berlin Neuroimaging Center, Charite Universitatsmedizin Berlin
Anita Kottwitz, Sociology, Deutsches Institut fur Wirtschaftsforschung
Bettina Sonnenberg, Sociology, Deutsches Institut fur Wirtschaftsforschung

University of Michigan

Joshua Carp, Psychology
William J. Chopik, Psychology
Alanna D. Epstein, Education & Psychology
Lynn Ossher, Psychology
Xingyu Pan, Education & Psychology
Lauren Reed, Psychology
Wylie Wan, Psychology

University of Virginia

Riana Elyse Anderson, Psychology
Christopher Beam, Psychology
David Dobolyi, Psychology
Geneva T. Dodson, Psychology
Laura Marie Getz, Psychology
Jennifer Green, Psychology
Erin E. Horn, Psychology
Felicity F. Miao, Psychology
Eric D. Smith, Psychology
Thomas Talhelm, Psychology
Siny Tsang, Psychology

University of Zurich

Rachel Bachem, Psychology
Julia Binder, Psychology
Jessica Carolyn Buhler, Psychology
Sarah Hirsiger, Psychology
Kathrin Krause, Psychology
Andreas Kuffer, Psychology
Katharina Rufener, Psychology
Kathrin Schaffhuser, Psychology
Josua Schmeitzky, Psychology



International Max Planck Research School for Moral Economies of Modern Societies (Moral Economies)

The International Max Planck Research School for Moral Economies of Modern Societies was established in 2013. The research school is a collaboration of the MPI for Human Development with Freie Universität Berlin, Humboldt-Universität zu Berlin, and Technische Universität Berlin. A close cooperation with the University of Chicago and the University of California, Berkeley, is currently being organized. It will include joint conferences/summer schools and an exchange program for PhD students and faculty.

Spokesperson

Ute Frevert,
MPI for Human
Development

Research Coordinator

Monika Freier,
MPI for Human
Development

Research at the IMPRS Moral Economies focuses on values, emotions, and habits that informed and inspired social formations in Europe, North America, and South Asia from the 18th to the 20th century. Moral economies are perceived as being dynamic and contested rather than static and harmonious. As a consequence, the term is used in the plural rather than in the singular. It encompasses "economy" not only in a literal sense but also in a broader sense that positions it within other societal spheres and systems. Moral economies are effectuated and practiced by people who embrace them both as individuals as well as members of larger social, ethnic, age, and other groups. The IMPRS Moral Economies thus studies the ways in which values and emotions reinforce or contradict each other in modern societies, both on the level of major ideas and concepts as well as on the level of social interaction and institutional settings. The IMPRS Moral Economies offers an international PhD program to a small group of doctoral students from all over the world. The students benefit from being part of a cohesive

group and from the close ties between the Institute and the universities. Cooperation with international partners promotes intellectual exchange between students and senior academics.

The research school targets outstanding international students with a Master's degree in History. Candidates from related interdisciplinary fields, such as Anthropology, Sociology, or Literary and Cultural Studies, are also encouraged to apply for admission to the program. Students choose their individual research topics independently in consultation with faculty members. This leads to a broad spectrum of topics.

Each year, six new doctoral candidates are admitted with a stipend that can be extended for up to 4 years. The maximum number of PhD students studying simultaneously is limited to 18, thus ensuring close relationships between students and faculty advisers. The program's curriculum is the subject of continuous evaluations and faculty review. It offers discipline-based training through specialized courses on historical theories and methodologies as well as tailor-made

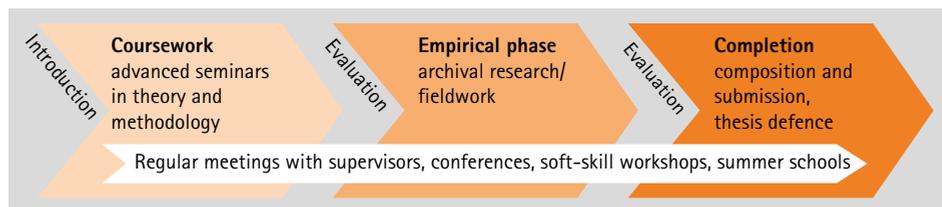


Figure 1. The structured PhD program of the IMPRS Moral Economies runs over a period of 4 years. Seminars on theory and methodology during the coursework phase (semesters 1-3) provide a common context for students from different academic backgrounds. Further seminars and workshops on different aspects of moral economies enable the PhD students to refine their research interests. The empirical phase (semesters 4-5) is primarily devoted to the collection of source material from archives and libraries and/or to fieldwork. PhD students then compose their dissertations during the completion stage (semesters 6-8). Detailed comments by peers and supervisors help them to fine-tune their texts and prepare for the thesis defence.

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Figure 2. Research on connections between morality, emotions, and market economies is a key focus of the IMPRS Moral Economies.

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seminars on moral economies. PhD students benefit from the close collaboration with researchers at the Center for the History of Emotions at the Institute. At the same time, the topics the students choose to investigate will have an impact on the direction of further research into connections between morality, emotions, and societal systems.

The IMPRS Moral Economies was launched in October 2013 with its first cohort of PhD students. The official inauguration of the research school took place on 20 November 2013 with a keynote lecture by Prof. David Nirenberg (University of Chicago) and presentations of the PhD projects by the doctoral fellows. The engagement with moral economies as a theoretical and methodological research approach was also the focal point of the academic retreat in March 2014, attended by the doctoral students, members of the IMPRS Moral Economies' faculty, as well as researchers from the Center for the History of Emotions.

In the coming years, the program of the IMPRS Moral Economies will be enriched by academic exchange with our partner universities, conferences in cooperation with the University of Chicago and the University of California,

Berkeley, regular summer schools, as well as exchange with other graduate schools and research groups working in similar fields.



Figure 3. The structured program of the IMPRS Moral Economies provides guidance and full financial support to PhD candidates in order to help them climb the ladder of academic excellence.

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IMPRS Moral Economies Faculty 2011–2013

MPI for Human Development, Center for the History of Emotions

*Ute Frevert
Margrit Pernau*

Freie Universität Berlin, Department of History and Cultural Studies, Friedrich–Meinecke–Institut

*Sebastian Conrad
Paul Nolte*

Humboldt–Universität zu Berlin, Department of History

*Birgit Aschmann
Alexander Nützenadel*

Technische Universität Berlin, Center for Research on Anti–Semitism

Stefanie Schüler–Springorum

IMPRS Moral Economies Doctoral Fellows 2011–2013 (Cohort I, as of October 2013)

Yaara Bengier (Israel)

The right to relax: Holiday-making as an expression of work-leisure moral frameworks in 20th century Great Britain

Tobias Bernet (Switzerland)

Moral economies of urban dwelling: Non-profit housing in Germany, Austria, and Switzerland in the 20th and 21st centuries

Timon De Groot (Netherlands)

False shame and the civil hierarchies of the 19th and early 20th century

Thomas Rohringer (Austria)

Spaces and emotional styles: War victims in Great Britain and Austria in the interwar period

Marie Schubenz (Germany)

Contested solidarity: Moral economies in the trade union movement of the 1970s and 1980s

Fabian Steininger (Germany)

Community concepts of Turkish nationalist networks in the late Ottoman Empire



Figure 4. Inauguration of the IMPRS Moral Economies on 20 November 2013. Group picture with the 2013 cohort of doctoral students, IMPRS faculty, scientific coordinator and Prof. Nirenberg (speaker for the keynote lecture).

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International Max Planck Research School Adapting Behavior in a Fundamentally Uncertain World



This graduate program is part of the Max Planck Society's framework of International Max Planck Research Schools (IMPRS). The school is a collaboration featuring the MPI for Human Development (Berlin), the MPI for Research on Collective Goods (Bonn), the MPI of Economics (Jena), the University of Bonn, the Friedrich Schiller University (Jena), the University of Trento, the Hebrew University (Jerusalem), and Indiana University (Bloomington). It was established in 2007 and, based on an external review process, in 2011 the school was extended for an additional 6 years.

The goal of the school is to provide advanced training in doing research on explaining and predicting human decision making under uncertainty and designing institutions that improve this decision making. Research ideas and methods from various disciplines are used, such as psychology, economics, and law. Students come in with a master's degree (or equivalent) and are awarded a doctoral degree from one of the partner universities or from other universities in Berlin. Besides having access to a thesis advisor, students also take advantage of three annual events: In the 1-week-long thesis workshop, students present a research project and receive feedback from other students and faculty; in the 4-week-long summer school, the emphasis is

on teaching condensed courses on state-of-the-art research areas, by faculty in the partner institutions and guest faculty from leading institutions across the world, as well as the initiation of a research project that includes students from other institutions; finally, in the 1-week-long topics workshop, there is a mix between research-based lectures, roundtable discussions, and hands-on activities, such as learning a new software for running behavioral experiments. Student participation in the program is ensured through the use of a system of credit for the various activities, courses, and projects. So far, 27 students have completed the program and graduated with a doctorate degree. Currently, 30 students are enrolled.

Spokespersons

Christoph Engel,
MPI for Research on
Collective Goods
Oliver Kirchkamp,
Friedrich Schiller
University Jena

Research Coordinator

Susanne Buechner,
MPI of Economics



Figure 1. Participants of the 7th IMPRS Uncertainty Summer School 2013 in Jena.

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IMPRS Uncertainty Faculty 2011–2013

MPI for Human Development, Center for Adaptive Behavior and Cognition

Gerd Gigerenzer
Mirta Galesic
Konstantinos V. Katsikopoulos
Henrik Olsson
Lael J. Schooler

MPI of Economics, Strategic Interaction Group

Werner Gueth
Federica Alberti
Anna Conte
Paolo Crosetto
Astrid Gamba
Mitesh Kataria
Rene Levinsky
Astrid Matthey
Natalia Montinari
Tobias Regner
Michael Trost
Ori Weisel

MPI for Research on Collective Goods

Christoph Engel
Andreas Gloeckner
Niels Petersen
Emmanuel Towfigh

Hebrew University, Center for the Study of Rationality

Menahem Yaari
Yaakov Kareev

Indiana University, Department of Brain and Psychological Sciences

Peter Todd
Jerome Busemeyer
Robert Goldstone

University of Jena, School of Economics and Business Administration

Uwe Cantner
Andreas Freytag
Oliver Kirchkamp
Hans-Walter Lorenz
Markus Pasche

Friedrich Schiller University Jena, Department of Social Psychology

Thomas Kessler
Peter Noack
Klaus Rothermund

University of Bonn, Institute of Commercial and Economic Law

Daniel Zimmer

IMPRS Uncertainty Doctoral Fellows 2011–2013

Gulnaz Anjum (Pakistan)
Daniel Barkoczi (Hungary)
Nadine Blaaser (Germany)
Astrid Buba (Austria)
Stojan Davidovic (Serbia)
Christiane Ehses-Friedrich (Germany)
Mike Farjam (Germany)
Andre Grimes (USA)
Yoon Hermstruewer (Germany)
Jana Jarecki (Germany)
Lin Jing (China)
Magdalena Kaczmarek (Poland)
Serhiy Kandul (Ukraine)
Marco Kleine (Germany)
Carlos Kurschlingen (Spain)

Laura Lyhs (Germany)
Isabel Marcin (Germany)
Laxmi Natarajan (India)
Olexandr Nikolaychuk (Ukraine)
Ayu Okvitawanli (Indonesia)
Marian Panganiban (Philippines)
Pantelis Pipergias Analytis (Greece)
Henning Proempers (Germany)
Jolene Tan (Singapore)
Andra Toader (Germany)
Stephan Tontrup (Germany)
Benedikt Werner (Germany)
Lilia Zhurakhovska (Ukraine)
Monika Ziolkowska (Poland)

MaxNetAging Research School



The Max Planck International Research Network on Aging (MaxNetAging) was founded in 2004 by the late Paul B. Baltes. The MaxNetAging Research School (MNARS) was launched by MaxNetAging in October 2007 (Director: James W. Vaupel). This stipend program provides funding for doctoral and postdoctoral students. PhD students can obtain funding for up to a maximum of 3 years, postdocs for up to a maximum of 2 years. The MPI for Human Development is involved in this training program along with 20 further Max Planck Institutes as well as many other international research institutions.

At the beginning of their term, the PhD students and postdocs spend an initial period of 6 months at the MPI for Demographic Research in Rostock. During this time, they spend 6 hours each week in a course program designed to introduce them to various aspects of aging research. Thereafter, the

PhD students and postdocs continue their PhD education and research projects at the Max Planck Institutes they are affiliated with. During this period, the students are invited to multifaceted MaxNetAging workshops attended by MaxNetAging faculty representing many disciplines and institutions.

MaxNetAging Faculty at the MPI for Human Development

Jürgen Baumert
Ute Frevert
Wolfgang Gaissmaier
Gerd Gigerenzer
Shu-Chen Li
Ulman Lindenberger
Michaela Riediger
Lael J. Schooler

MNARS Fellows at the MPI for Human Development

Elisabeth Blanke (PhD student, MNARS: 2012–2014)
Hanna Bettine Fechner (PhD student, MNARS: 2011–2014)
Anna Sofia Morais (Postdoc, MNARS: 2012–2014)
Susanne Passow (PhD student, MNARS: 2007–2011)
Julia K. Wolff (PhD student, MNARS: 2008–2011)
John Wong (PhD student, MNARS: 2011–2014)



Figure 1. Participants in the MaxNetAging Conference 2012 "Reflections on Living and Dying in Aging Societies" held in Bad Kohlgrub.

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Max Planck Research Network on Cognition (Maxnet Cognition): Concluding Report

The Max Planck Research Network on Cognition (Maxnet Cognition) was started in 2009. Its substantive focus is on cognitive neuroscience with an emphasis on human cognitive performance, structural and functional brain circuitry, and computational algorithms. The strategic goals of Maxnet Cognition have been to increase cooperation and improve coordination between institutes and to foster cross-disciplinary insights and collaboration. The network's activities include research coordination and research collaboration. As a result of two initial workshops, *Genetics and Cognition* as well as *Face Perception* were identified as two thematic clusters of common research interest. Most of the network's activities have taken place within these thematic clusters.

Steering Committee

Peter Hagoort,
MPI for Psycholin-
guistics, Nijmegen
Ulman Lindenberger,
MPI for Human
Development, Berlin
Arno Villringer,
MPI for Human
Cognitive and Brain
Sciences, Leipzig

Collaborative research within the *Face Perception* cluster focused on dynamic facial expressions, multisensory integration, and action prediction. Scientists from the MPI for Biological Cybernetics, Tübingen, the MPI for Human Cognitive and Brain Sciences, Leipzig, the MPI for Human Development, Berlin, and the MPI for Psycholinguistics, Nijmegen, were involved in this work. At the Institute, the *Interactive Brains, Social Minds* project at the Center for Lifespan Psychology (pp. 239–244) participated in the activities of this cluster. Collaboration within the *Genetics and Cognition* cluster aimed at establishing a common measurement protocol as well as a common software platform for imaging data. In the meantime, both of these goals have been attained. First, the MPI for Cognitive and Brain Sciences at Leipzig, the MPI for Psycholinguistics at Nijmegen, and the MPI for Human Development in Berlin have agreed on a core imaging protocol that includes functional magnetic resonance imaging of the default network as well as structural

magnetic resonance imaging of grey matter volume and white matter tracts. By agreeing on this protocol, the participating institutions have increased their joint potential for discovery and replication of relations among genes, brain, and behavior. Second, the same three Institutes have agreed on the use and installation of *XNAT*, an open-source imaging software platform for importing, archiving, processing, and securely distributing imaging and related data (see www.xnat.org). The latter activity was undertaken in collaboration with the Max Planck Digital Library and financially supported by a grant from the Federal Ministry of Education and Research (BMBF; Förderkennzeichen BASE-II 16SV5837). The Innovation Fund of the Max Planck Society has supported Maxnet Cognition financially from 2009 to 2013. It is likely that the Network will have a lasting positive effect on research coordination and collaboration among several institutes of the Max Planck Society, including the MPI for Human Development.



Max Planck Fellow

In June 2008, **Gert G. Wagner**, was appointed a Max Planck Fellow at the Institute. Gert G. Wagner is professor at the Technische Universität Berlin and since 2011 Member of the Executive Board of the German Institute for Economic Research (DIW Berlin). The Max Planck Society established the Fellow Program to further strengthen research cooperation between its institutes and neighboring universities and other research institutions. The cooperation with Gert G. Wagner, one of the leading researchers running the German Socio-Economic Panel Study (SOEP), allows researchers at the Institute to link their experimental work, such as cognitive interventions, to longitudinal observations from the SOEP. In addition, innovative survey technologies, such as mobile-phone-based cognitive testing in real-life settings, can be explored and validated. Ulman Lindenberger and Gert G. Wagner are two out of five Co-Principal Investigators of the Berlin Aging Study II (BASE-II).



Research Team 2011–2013

Gert G. Wagner, Cornelia Wrzus (as of 09/2013: Johannes Gutenberg University Mainz, Germany)

Postdoctoral Fellow

Gloria Luong

Predocctoral Fellows

Anita Kottwitz (LIFE), Bettina Sonnenberg (LIFE; as of 01/2013: University of Tübingen, Germany)

Max Planck Fellow Gert G. Wagner

As a Max Planck Fellow, I bring my experience from the large-scale longitudinal study German Socio-Economic Panel (SOEP) into various research groups of the MPI for Human Development. I am especially interested in the (late) life course (Lang, Baltes, & Wagner, 2007; Headey, Muffels, & Wagner, 2010) and in the analysis of one particular personal trait: risk aversion (an important personal characteristic for an economist; Dohmen et al., 2011; Vischer et al., 2013). In 2013, I began working with Ralph Hertwig, who is interested in the different dimensions of risk aversion. In his department, the analysis of the dynamics of risk aversion is an initial project based on regular SOEP data. We are also planning to develop special survey questions and behavioral experiments for inclusion in the *SOEP Innovation Sample*.

I started my collaboration with researchers in the Institute on a project with Ulman Lindenberger on the terminal decline in life satisfaction (Gerstorf et al., 2008) and am still working on this issue with Denis Gerstorf (Humboldt-Universität zu Berlin) and Nilam Ram (Pennsylvania State University). This line of research is embedded in my work for the Berlin Aging Study II (BASE-II; Bertram et al., in press), which is in collaboration with Ulman Lindenberger, Lars Bertram (MPI for Molecular Genetics, Berlin), Graham Pawelec (Immunology, University of Tübingen), and Elisabeth Steinhagen-Thiessen (Charité Universitätsmedizin Berlin) (see Center for Lifespan Psychology, pp. 233–238).

My most intensive involvement with the Institute is my work in Michaela Riediger's Research Group "Affect Across the Lifespan." Together, we established a special longitudinal study, the Multi-Method Ambulatory Assessment (MMAA) project, which allows measurements of experiences, cognitive capacity, and physiological processes in daily-life contexts. We apply SOEP-like interview techniques and well-controlled experimental paradigms (SOEP = German Socio-Economic Panel Study). Ambulatory assessment methods include mobile-phone-based experience sampling (Sonnenberg, Riediger, Wrzus, & Wagner, 2012) and ambulatory biomonitoring of cardiac activity, physical activity, and hormonal processes (Wrzus, Müller, Wagner, Lindenberger, & Riediger, 2013). One field of research is sleep.

Interest in the effects of sleeping behavior on health and performance is continuously increasing—both in the scientific community and with the public at large. To ensure

the ecologically valid investigation of this research topic, sleep must be measured within people's natural living contexts (Wrzus, Wagner, & Riediger, in press).

By means of MMAA, we have gathered evidence that our new approach to ambulatory accelerometry data offers a convenient, reliable, and valid measurement of both sleeping duration and sleep quality in people's natural sleeping environments. A subsample of 92 participants in MMAA (14–83 years of age) spent a night in their natural environment wearing acceleration sensors on the sternum and right thigh (see Figure 1) and following their normal routine. Physical activity, body posture, and changes in body posture during the night were classified using a newly developed classification algorithm based on angular changes of body axes. The duration of supine posture and objective indicators of sleep quality showed convergent validity with self-reports of sleep duration and quality as well as external validity regarding expected age differences. The algorithms for classifying sleep postures and posture changes very reliably distinguished postures with 99.7% accuracy. Thus, our new algorithm based on body posture classification using ambulatory accelerometry data offers a feasible and ecologically valid approach to monitor sleeping behavior at home in sizable and heterogeneous samples.

In a recent study that tested the "overpowering hypothesis" (Wrzus et al., 2013), we combined the full MMAA sample (378 participants, 14–86 years of age) with a subsample of participants who wore the ambulatory psychophysiological monitoring system. All participants reported their

www.diw.de/soep-is/en

www.base2.mpg.de/

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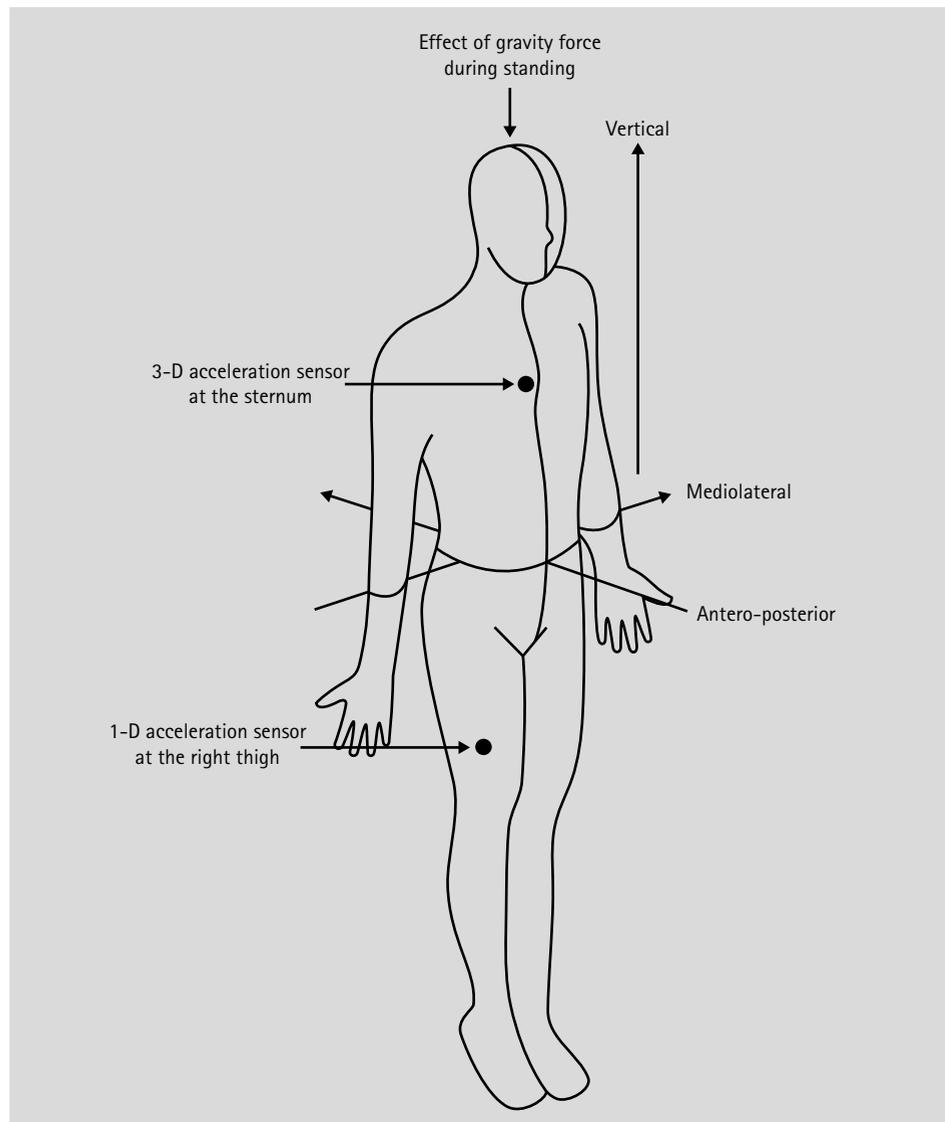


Figure 1. Labeling of body axes and placement of acceleration sensors.

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momentary negative affect and occurrences of unpleasant events on average 54 times over 3 weeks. Affective responding was analyzed by comparing—within persons— affective states in situations with and without preceding unpleasant events. Results support the overpowering hypothesis: When dealing with complex unpleasant events that affected multiple life domains, both psychological and cardiovascular responses to unpleasant events were more pronounced the older the participants were. When dealing with

circumscribed unpleasant events, however, no age differences in psychological responding were observed, and cardiovascular responding was even less pronounced the older the participants were. These findings are consistent with the notion of preserved affect regulation throughout adulthood, as long as the resource demands exerted by an event do not overtax the individual's capacities. We concluded that the overpowering hypothesis can bridge previously opposing positions regarding age differences in affective responding.

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(last update: January 2014)

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Scientific Services

Professional Staff (2011–2013)

Library and Research Information Unit: Nicole Engelhardt, Ursula Flitner

Central IT Unit: Wolfgang Assmann

Library and Research Information Unit

Rapid access to printed and digital information is a decisive prerequisite for successful studies and for internationally renowned research.

The Library and Research Information Unit of the MPI for Human Development aims to anticipate, determine, and respond to the Institute's needs for information in the areas of education, history, psychology, sociology, and neighboring disciplines. To support the research, teaching, and publishing activities of the Institute's researchers, we seek to provide an environment and facilities conducive to the efficient and independent use and dissemination of information.

The Library's collection currently comprises around 212,000 printed volumes, 150 printed journals, microforms, and an extensive selection of electronic resources. Comprehensive intranet services include online access to electronic journals, to major bibliographic and full text databases, as well as to document delivery and table of contents services. From 2011 to 2013, the range of available electronic full texts was extended to include more than 20,000 periodicals from all fields of science, thus facilitating interdisciplinary research.

The cancellation of 380 subscriptions to printed journals in 2012 was both an effective measure against dramatically increased journal prices that were burdening the stagnating Library budget and an overdue step toward providing online-only information wherever possible. In 2013, the Library added around 240,000 e-books to its collection from the National Licenses, a program financed by the German Research Foundation (DFG).

Collection development was adapted to new fields of research. With the appointment of Ralph Hertwig as the Director of the Center of Adaptive Rationality (ARC) in 2012, new needs of literature and information were to be met. Likewise, the Max Planck Research Groups "Felt Communities? Emotions in European Music Performances" and "REaD" brought new discerning clients, and provision of basic information was additionally built up in anticipation of the International Max Planck Research School "Moral Economies of Modern Societies" who commenced their work in 2013.

Library users' demand for consulting services relating to copyright, open access, bibliometric impact, e-publishing, use of databases, as well as research assignments have increased noticeably during the period under review. In 2011 and 2012, the Library and Research Information Unit participated in a 2-year project dedicated to the development of research infrastructure, funded by the Max



Figure 1. Periodical room.

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Figure 2. For the bookbinder.

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Planck Society's Strategic Investment Fund. Together with the Bibliotheca Hertziana in Rome, the Kunsthistorisches Institut in

Florenz, the MPI for European Legal History in Frankfurt, and the Max Planck Digital Library in Munich, we developed the publication platform Digital Libraries Connected (DLC) for digital works and collections from the MPis and cooperating institutions (<http://dlc.mpd.l.mpg.de/dlc/>). Beyond serving as a portal, DLC offers web-based tools to support the publication and editing of digitized copies on the internet; scans and full text. Data- and collection-spanning search functions and stable citation links facilitate the scientific use of digitized copies. The software is currently undergoing final tests and is scheduled for public launch in spring 2014.

Following two retirements and filling one long-standing vacancy, the Library was able to acquire three highly qualified employees who will focus on journals, acquisition/licenses, and electronic service development. The Library staff continually undergo further training to keep abreast of dynamic changes in information management and, last but not least, also continue to train apprentices in Library and Information Science.

Central IT Unit

The central facilities of the Central IT Unit support the individual research centers and other service units at the Institute. For variable services, such as internet/intranet, the website, software, e-mail, etc., central servers with MS Windows, Mac OS X, and Linux operating systems are installed in the Institute.

Several powerful servers build a Citrix server farm. They allow the users to run programs (SPSS, SAS, MATLAB, R, etc.) on the server CPUs from their own workstations (Windows or Mac OS) or tablet computers worldwide, from any location, at any time. "Server-based computing" helps to overcome the different workstation constraints, such as CPU power and local storage.

More and more servers and desktops are being virtualized to realize a consolidation concept that will save resources and provide simplified deployment. The decentralized computing capacity comprises more than 500 personal computers. Apple computers operate with Mac OS X; PCs are operating on Microsoft Windows or a Linux distribution. A wide array of software is available for the desktop systems. In the storage area network (SAN), there is more than 700 TByte storage capacity available to store data. A central backup service is provided for all persistent data. To provide the necessary security, a Cisco ASA firewall system is installed. Central antivirus software Sophos—continuously

updated via internet—monitors all servers and personal workstations to avoid data loss caused by viruses and malware. The integration of all desktop computers in the Local Area Network (LAN) provides access to central resources and cluster capacity. In 1998, the traditional standard- and thin-wire Ethernet was replaced with a new network based on fiber-optic cables. Since 2007, desktop systems are directly connected with a maximum speed of 1 Gbit/s. The network backbone has been upgraded to 10+ Gbit/s in 2012. A wireless LAN is available for users with mobile devices throughout the entire Institute. The Research Network (WIN) of German Telekom and the German Research Network Association (Deutsches Forschungsnetz [DFN]) provide the Institute's connections to Wide Area Networks (internet, etc.). An important component of the new web presence of the Institute is the CMS Drupal. It allows many editors within the Institute to update their web pages at the same time. A staging system separates editorial content from public content.



Figure 1. Server, storage, and network infrastructure.

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The IT Center's services include:

- operating, optimizing, and developing the central server and network equipment;
- updating and mending Windows and Mac OS operating systems on workplace computers;
- centralized printing capacity, including high-speed and color printers;
- integration of workplace computers in the LAN and WLAN;
- making national and international connections (Wide Area Network) available;
- Citrix Terminal services;
- internet services;
- data storage and backup strategies;
- preventive security measures;
- management of the central telephone system, including the voice-mail server;
- user support and troubleshooting for workplace computers and notebooks;
- software acquisition.

The Center offers:

- general design and coordination of the Institute's information technology equipment;
- documentation of the Institute's existing computer and network inventory;
- an overview of market developments;

- advice for the Institute's research centers and Board;
- development of new concepts for the Institute, for example, with WLAN, SAN, Access Grid, video conference, computer and storage virtualization, etc.

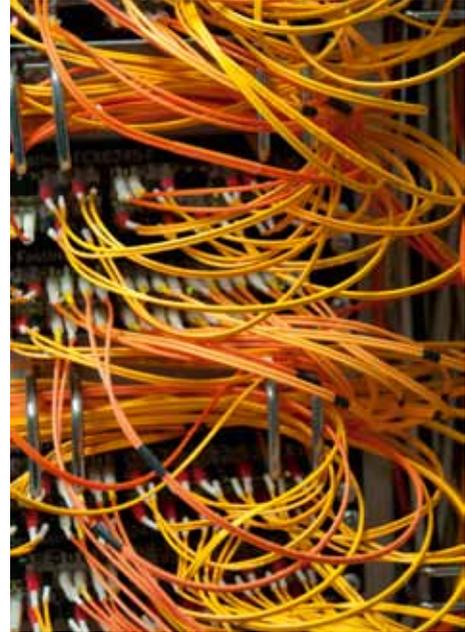


Figure 2. Optical fiber cabling to the workplace.

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Appendix





Last update: January 2014

1. Honors and Awards 2011–2013

- Baumert, Jürgen** Honorary Professor, Christian-Albrechts-Universität zu Kiel, 2011; Carl Friedrich von Weizsäcker Prize, German Academy of Sciences Leopoldina, 2012.
- Blanke, Elisabeth** Poster Award (shared), Scientific Meeting for Autism Spectrum Disorders (WTAS), 2012.
- Brückenhaus, Daniel** Frank Turner Prize, Yale University, 2012.
- Burzynska, Agnieszka Zofia** Otto Hahn Medal 2011, Max Planck Society.
- Düzel, Sandra** Aging and Work Award of the Marie-Luise und Ernst Becker Stiftung, 2011.
- Edelstein, Wolfgang** Theodor Heuss Prize, Theodor Heuss Stiftung, 2012.
- Fandakova, Yana** Otto Hahn Medal 2012, Max Planck Society.
- Fechner, Hanna Bettine** Award for Best Final Degree of Graduation Cohort 2011, Humboldt-Universität zu Berlin, 2012.
- Feufel, Markus A.** Human Factors Prize (Runner-up), Human Factors and Ergonomics Society, 2011.
- Frevert, Ute** Corresponding Fellow of the British Academy for the Humanities and Social Sciences, 2013.
- Gaissmaier, Wolfgang** Fellow of the German Young Academy, Berlin-Brandenburg Academy of Sciences and Humanities & German Academy of Sciences Leopoldina, 2012; Rising Star, Association for Psychological Science, 2013.
- Galesic, Mirta** Jane Beattie Scientific Recognition Award, European Association for Decision Making, 2013.
- Gammerl, Benno** Wolfgang J. Mommsen Prize, German Historical Institute London, 2012.
- García-Retamero, Rocio / Cokely, Edward T.** Raymond S. Nickerson Best Paper Award, Journal of Experimental Psychology: Applied, 2012.
- Gigerenzer, Gerd** Deutscher Psychologie-Preis, 2011; Outstanding Paper Award, International Journal of Forecasting, 2011; Honorary Fellow of the Institute of Risk Management, UK, 2011; Marsilius Medal, Heidelberg University, 2011; Communicator Award, German Research Foundation & the Donor's Association for the Promotion of Sciences and Humanities, 2011; Fellow of the Cognitive Science Society, 2012; Patten Lecturer, Indiana University, 2013.
- Gigerenzer, Gerd / Brighton, Henry** Featured New Hot Paper, Thomson Reuters ScienceWatch, 2012.
- Hertwig, Ralph** Fellow of the Association for Psychological Science, 2011; Elected Member of the Wilhelm Wundt Society, 2012; Honorary Professor, Humboldt-Universität zu Berlin, 2013.
- International Max Planck Research School on the Life Course (LIFE)** APA Board of Educational Affairs Award to Advance Interdisciplinary Education and Training in Psychology, 2012.
- Jenny, Mirjam A.** Emilie Louise Frey Prize, University of Basel, 2013; Cognitive Science Society Award for the Best Student Paper at the Annual Summer Interdisciplinary Conference, 2012.
- Lindenberger, Ulman** Mentoring Award, German Psychological Society, 2011; Berlin Aging Study (BASE) awarded by the Initiative "Germany—Land of Longevity," 2012.
- Luong, Gloria** GSA Dissertation Award, Gerontological Society of America, 2012; 2012–2013 James McKeen Cattell Award for Outstanding Dissertation in Psychology, The New York Academy of Sciences.
- Moussaïd, Mehdi** Prix Le Monde de la Recherche Universitaire, Le Monde, 2011.
- Olsen, Stephanie** Children's Literature Association Edited Book Award, 2011.
- Pernau, Margrit** Extraordinary Professor, Freie Universität Berlin, 2012.
- Sander, Myriam C.** Margret and Paul Baltes Award for Outstanding Dissertations in Developmental Psychology, German Psychological Society, 2013.
- Scheer, Monique** Walter-de-Gruyter Prize, Berlin-Brandenburg Academy of Sciences, 2011.
- Schroeder, Sascha** Poster Prize, European Conference of Eye-Movement Research (ECEM), 2013.
- Shing, Yee Lee** Heinz Maier-Leibnitz Prize, German Research Foundation, 2012.
- Sela-Teichler, Yael** Renaissance Studies Article Prize, The Society for Renaissance Studies, 2013.
- Suter, Renata S.** 2012 Steven Karger Prize of the Faculty of Psychology, Karger Medical and Scientific Publishers.
- Wegwarth, Odette** Early Career Investigator Award, Society of Behavioral Medicine, 2013.

Grants and Stipends

- Artinger, Sabrina** Small Research Grant for Project "Group size effects in online cooperation," Saïd Foundation, 2013.
- Brehmer, Yvonne** Research Grant for Study "Associative memory in old age," Stiftelsen för Gamla Tjänarinnor, 2013.
- Burzynska, Agnieszka Zofia** Changing Viewpoints Career Grant, Robert Bosch Stiftung, 2013.
- Ellerbrock, Dagmar** Funding for Conference "Emotions and violence in 20th century Europe," German Foundation for Peace Research, 2013.
- Fechner, Hanna Bettine** DAAD Stipend for Carnegie Mellon University, Pittsburgh/PA, German Academic Exchange Service, 2013.
- Gaissmaier, Wolfgang** Funding for Project "Effective communication about cancer screening when inviting the general public to participate/EFFEKTIV," Federal Ministry of Health, 2012–2015.
- Gigerenzer, Gerd** Funding for "Summer Institute on Bounded Rationality," Volkswagen Foundation, 2011/2012; Funding of the Harding Center, Winton Capital Management.
- Gigerenzer, Gerd / Gaissmaier, Wolfgang** Funding for Project "Förderung guter medizinischer Entscheidungen," Bertelsmann Stiftung, 2013–2014.

- Hämmerer, Dorothea** International Research Funding, University College London, German Research Foundation, 2012.
- Hertwig, Ralph** Funding for Project "The description-experience gap: Its robustness, its causes and consequences," Swiss National Science Foundation, 2010–2013.
- Hertwig, Ralph / Hills, Thomas** Funding for Project "Search in space and minds: Dynamics in structure in recall from long-term memory search," Swiss National Science Foundation, 2010–2014.
- Hertwig, Ralph / Pachur, Thorsten** Funding for Project "Algebraic models of heuristics of risky choice: Irreconcilable foes or useful allies?" as part of the DFG Priority Program "New frameworks of rationality," German Research Foundation, 2012–2015.
- Hertwig, Ralph / Rieskamp, Jörg / De Quervain, Dominique / Papassotiropoulos, Andreas** Funding for Project "Biological foundations of risk taking," Swiss National Foundation, 2012–2015.
- Herzog, Stefan / Hertwig, Ralph** Funding for Project "Dialectical bootstrapping: A new paradigm to improve individual judgment," Swiss National Science Foundation, 2011–2014.
- Kämmer, Juliane E. / Bos, Gerhard / Fiebig, Anika / von Grundherr, Michael** Funding for Workshop "Personal and shared intentions," Volkswagen Foundation, 2012.
- Katsikopoulos, Konstantinos V.** Marie Curie International Outgoing Fellowship, European Commission, 2013–2016.
- Kühn, Simone / Callard, Felicity / Fitzgerald, Des** Funding for Workshop "Experimental entanglements in cognitive neuroscience," Volkswagen Foundation, 2012.
- Laukötter, Anja** Research Fellowship, German Historical Institute, Washington D.C., 2012.
- Laukötter, Anja / Bonah, Christian / Cantor, David** Funding for Conference "Communicating good health: Movies, medicine and the cultures of risk in the twentieth century," Brocher Foundation, 2011.
- Lindenberger, Ulman** Funding for Collaborative Research Project "Berlin Aging Study II (BASE-II)," Federal Ministry of Education and Research, 2011–2014; Funding for Collaborative Research Project with University College London "Computational psychiatry and ageing research," Max Planck Foundation, 2011–2014.
- Marewski, Julian N. / Gigerenzer, Gerd / Schooler, Lael J.** Funding for Project "Strategy selection," Swiss National Science Foundation, 2013–2016.
- Meder, Björn** British Academy Visiting Scholarship for Queen Mary University London, 2011.
- Nelson, Jonathan D. / Meder, Björn / Martignon, Laura / Crupi, Vincenzo** Funding for Project "Models of information search: A theoretical and empirical synthesis" as part of the DFG Priority Program "New frameworks of rationality," German Research Foundation, 2011–2014.
- Rajamani, Imke** Stipend of the German National Academic Foundation, 2011–2014.
- Ruggeri, Azurra** Marie Curie International Outgoing Fellowship, European Commission, 2013–2016.
- Schroeder, Sascha / Hyönä, Jukka / Liversedge, Simon** Funding for Symposium "Developmental eye-tracking research in reading," Volkswagen Foundation, 2013.
- Sela-Teichler, Yael** Minerva Fellowship, Minerva Foundation, 2011–2013; Rose and Henry Zifkin Teaching Fellowship, The Herbert D. Katz Center, University of Pennsylvania, 2013.
- Shing, Yee Lee / Brehmer, Yvonne** Funding for Project "Neural mechanisms of lifespan age differences in episodic memory formation: Separating associative and strategic components," German Research Foundation, 2011–2014.
- Şimşek, Özgür** Funding for Project "Rationality of heuristics in a changing environment" as part of the DFG Priority Program "New frameworks of rationality," German Research Foundation, 2011–2014.
- Verrel, Julius** International Research Funding, University College London, German Research Foundation, 2011–2012; International Research Funding, University of Queensland, German Research Foundation, 2012.
- Voelkle, Manuel C. / Beauducel, Andre / Klein, Christoph** Funding for Project "Development of intraindividual variability of processing speed-basic modul," German Research Foundation, 2012–2015.
- Wassmann, Claudia** Marie Curie Intra-European Fellowship for Career Development, European Commission, 2013–2015.
- Wong, John** DAAD Stipend for Human Development, German Academic Exchange Service, 2011–2014.
- Zalfen, Sarah / Müller, Sven Oliver** Additional Funding for the Publication "Besatzungsmacht Musik: Zur Musik- und Emotionsgeschichte im Zeitalter der Weltkriege," German Research Foundation, 2012.
- Zalfen, Sarah / Törmer, Iris** Funding for Summer School "Lernen—Emotionen—Musik," Ernst Schering Foundation & Hertie Foundation, 2013.

Professorship Offers

- Blankenburg, Felix** Professor of Experimental Functional Imaging in Psychiatry and Psychotherapy, University of Lübeck, Germany (declined); Professor of Neurocomputation and Neuroimaging, Freie Universität Berlin, Germany (accepted).
- Brückenhaus, Daniel** Assistant Professor of Modern European History, Beloit College, USA (accepted).
- Eppinger, Ben** Assistant Professor of Neurocognitive Development of Motivational Mechanisms, Technische Universität Dresden, Germany (accepted).
- Fific, Mario** Assistant Professor of Psychology, Grand Valley State University, USA (accepted).
- Gaissmaier, Wolfgang** Full Professor of Social Psychology, University of Konstanz, Germany (accepted).

Häberlen, Joachim C. Assistant Professor of Modern Continental European History, University of Warwick, Coventry, UK (accepted).

Katsikopoulos, Konstantinos V. Reader (Associate Professor), School of Management and Mathematics, University of Southampton, UK (declined).

Kia, Mana Assistant Professor of Indo-Persian Studies, Department of Middle Eastern, South Asian, and African Studies, Columbia University, New York, USA (accepted).

Li, Shu-Chen Full Professor of Lifespan Developmental Neuroscience, Technische Universität Dresden, Germany (accepted).

Marewski, Julian N. Assistant Professor of Organizational Behavior, University of Lausanne, Switzerland (accepted).

Mata, Rui Assistant Professor of Cognitive and Decision Sciences, University of Basel, Switzerland (accepted).

Plamper, Jan Professor of History, Goldsmiths University of London, UK (accepted).

Sajjad, Mohammad Assistant Professor of History, Presidency University, Kolkata, India (accepted).

Scheer, Monique Assistant Professor of Historical and Cultural Anthropology/Cultures of Knowledge, University of Tübingen, Germany (accepted).

Schooler, Lael J. Full Professor of Psychology, Syracuse University, USA (accepted).

Sela-Teichler, Yael Assistant Professor of Music, The Open University, Tel Aviv, Israel (accepted).

Stevens, Jeffrey R. Assistant Professor of Psychology, University of Nebraska-Lincoln, USA (accepted).

Wrzus, Cornelia Assistant Professor of Personality Psychology, Johannes Gutenberg University Mainz, Germany (accepted).

2. Research Colloquia 2011–2013

- Abele, Susanne**
Miami University, Oxford, USA
Social processes in tacit coordination
26.09.2012
- Alfieri, Fernanda**
Fondazione Bruno Kessler Istituto Storico Italo-Germanico, Trento, Italy
In the devil's presence? The role of emotions in medical and theological interpretations of convulsive phenomena (18th–19th centuries)
05.02.2013
- Allen, Colin**
Indiana University, Bloomington, USA
Models, mechanisms, and animal minds
02.02.2011
- Arkes, Hal**
Ohio State University, Columbus, USA
When is deliberation helpful and when is it harmful?
06.04.2011
- Arkes, Hal**
Ohio State University, Columbus, USA
On what kind of tasks does intuition help?
01.06.2012
- Arkes, Hal**
Ohio State University, Columbus, USA
Brainstorming: A reply to exasperated anesthesiologists
13.06.2012
- Aronowitz, Robert**
University of Pennsylvania, Philadelphia, USA
The social and scientific efficacy of cancer interventions
31.05.2011
- Askew, Kelly**
University of Michigan, USA
Drivers of emotion, drivers of change: Poetic politicking in Tanzania
16.04.2013
- Barbalet, Jack**
Hong Kong Baptist University, China
Trust, assurance, face, and gossip: The mechanisms of Guanxi networks
09.07.2013
- Battal, Ceren**
Center for Integrative Neuroscience, Tübingen, Germany
I guess I know the answer: Neural correlates of feeling of knowing in memory-based inferences
30.05.2012
- Baucells, Manuel**
Universitat Pompeu Fabra, Barcelona, Spain
Probability and time trade-off
16.03.2011
- Bénéï, Véronique**
Centre National de la Recherche Scientifique, Paris, France
Toward reconciling anthropologies: Emotions, bodies, languages in India
12.11.2013
- Besser-Eichler, Ina**
Society of Friends of Bayreuth, Germany
Leidenschaft für Richard Wagner: Freunde und Feinde von Bayreuth erzählen
22.11.2012
- Blom, Amélie**
Institut d'Etudes de l'Islam et des Sociétés du Monde Musulman, Paris, France
The emotions of re-Islamization amongst the Pakistani youth
15.11.2011
- Boewe, Sabrina**
Humboldt-Universität zu Berlin, Germany
Coordination under exogenous uncertainty
30.03.2011
- Boiger, Michael**
University of Leuven (KU Leuven), Belgium
The situational affordance of anger and shame in four cultures
23.11.2012
- Bollen, Kenneth A.**
University of North Carolina, Chapel Hill, USA
A general panel model with random and fixed effects: A structural equations approach
04.09.2012
- Bonz, Jochen**
University of Bremen, Germany
Die mimetische Erfahrung der ungekannten Stimme in der expressive culture der Popmusik (Autotune etc.)
30.04.2013
- Born, Jan**
University of Tübingen, Germany
The memory function of sleep
15.11.2011
- Borteletto, Ana Paula**
University of Sheffield, UK
Heuristics for waste management
01.07.2012
- Borteletto, Ana Paula**
University of Sheffield, UK
How can heuristics make a difference in engaging people on environmental policies?
31.07.2012
- Bösch, Frank**
Zentrum für Zeithistorische Forschung Potsdam, Germany
Disziplinierung der Gefühle? Krieg und Film im 20. Jahrhundert
12.12.2013
- Bossan, Benjamin**
Institute of Theoretical Biology, Berlin, Germany
The evolution of social learning strategies
22.11.2011
- Bourgeois-Gironde, Sacha**
Université Paris 2 & Institut Jean Nicod, Paris, France
Lay perceptions of the 2008 financial crisis
16.10.2012
- Brand, Matthias**
Universität Duisburg-Essen, Germany
Decision making from a neuropsychological perspective
18.04.2013
- Brick, Tim**
University of Virginia, Charlottesville, USA
In your face: What computer-generated facial avatars can do for psychology
04.11.2011

- Bröckling, Ulrich**
Martin Luther University Halle-Wittenberg, Germany
Governing (by) emotions: Zur Gouvernementalität der Gefühle
20.01.2011
- Bromley, Dan**
University of Wisconsin-Madison, USA
Arriving at settled belief: Volitional pragmatism in the service of rules to live
21.11.2012
- Brophy, James**
University of Delaware, Newark, USA
Critical distance: Irony in popular political culture in nineteenth-century Central Europe
26.11.2013
- Cooper, Frederick**
New York University, USA
Citizenship and difference in French Africa, 1945–60
01.02.2011
- Dean, Carolyn J.**
Brown University, Providence, USA
Erasures: Writing history about Holocaust Trauma
07.05.2013
- Denrell, Jerker**
University of Oxford, UK
Are the best performers the most impressive?
06.09.2011
- Dolan, Raymond J.**
Wellcome Trust Centre for Neuroimaging, University College London, UK
Multiple decision systems in the human brain
25.10.2011
- Dörner, Dietrich**
University of Bamberg, Germany
Errors in complex domains
27.05.2013
- Ebbersmeyer, Sabrina**
Ludwig-Maximilians-Universität Munich, Germany
Die (Ohn-)Macht des Geistes über die Gefühle: Philosophie und Therapie im 17. Jahrhundert
13.12.2011
- Eckert, Astrid M.**
Emory University, Atlanta, USA & American Academy in Berlin, Germany
Curiosity, anxiety, and the Cold War: The Iron Curtain as a tourist attraction
03.05.2011
- Egermann, Hauke**
Technische Universität Berlin, Germany
Musik und Emotionen in der Musikpsychologie: Wirkungsweisen grundlegender Mechanismen und ihre empirischen Überprüfungen
05.12.2013
- Egmond, Marieke van**
Jacobs University Bremen, Germany
Mind and virtue: A cross-cultural perspective on the meaning of academic learning
24.01.2012
- Ehrmann-Hämmerle, Christa**
University of Vienna, Austria
Writing (about) love in times of total war
01.11.2011
- Eldem, Edhem**
Boğaziçi University, Istanbul, Turkey
Sorrow carved in stone: Expressions of grief and suffering in Ottoman Muslim epitaphs
18.10.2011
- Erickson, Kirk I.**
University of Pittsburgh, USA
Physical activity, brain plasticity, and aging
01.11.2011
- Erickson, Paul**
Wesleyan University, Middletown, USA
Mathematics' loss is psychology's gain: Game theory and postwar behavioral science, or why choose rational choice?
07.03.2012
- Essbach, Wolfgang**
University of Freiburg, Germany
Religiös erforschen: Versuch einer Methodik und Typologie
17.01.2012
- Falk, Ruma and Raphael**
Hebrew University of Jerusalem, Israel
Some mathematical, logical, and probabilistic challenges
07.08.2012
- Fernandez, Juan Pablo**
Dartmouth College, Hanover, USA
Simple heuristics to discriminate UXO
16.05.2012
- Fernández, Guillén**
Radboud University, Nijmegen, Netherlands
New vistas on system level consolidation in humans
31.01.2013
- Fischer, Martin**
University of Potsdam, Germany
Numerical cognition: Grounded, embodied, and situated
01.02.2012
- Fischinger, Timo**
University of Kassel, Germany
Kognitionspsychologische Grundlagen musikalischer Wahrnehmung: Erwartung, Emotion, Antizipation und Handlungssteuerung
10.05.2012
- Flam, Helena**
Leipzig University, Germany
Identity and emotions
30.10.2012
- Freund, Alexandra**
University of Zurich, Switzerland
Age-related changes in the sensitivity toward losses
28.02.2013
- Friedrich, Sven**
Richard Wagner Nationalarchiv, Bayreuth, Germany
"Wir müssen Wissende werden durch das Gefühl": Richard Wagner und die Bayreuther Festspiele
24.10.2012
- Friston, Karl J.**
Wellcome Trust Centre for Neuroimaging, University College London, UK
The Bayesian brain, surprise, and free-energy
09.03.2011
- Fuhrmann, Wolfgang**
Humboldt-Universität zu Berlin, Germany
Über die Schönheiten und den Ausdruck der Leidenschaft: Joseph Haydn und sein Publikum
14.11.2013
- Gazzaley, Adam**
University of California, San Francisco, USA
Top-down modulation and the aging brain: The crossroads of attention and memory
31.05.2011

- Geyer, Michael**
University of Chicago, USA & American Academy in Berlin, Germany
Rage against empire: Humiliation, victimization and the semantics of national liberation
22.05.2012
- Ghetti, Simona**
University of California, Davis, USA
Development of episodic memory during childhood
19.06.2012
- Giloi, Eva**
Rutgers University, Newark, USA
Emotional investments in imperial Germany: Gift-giving as a gauge of political attachment
11.12.2012
- Goldstone, Rob**
Indiana University, Bloomington, USA
Patterns of innovation and imitation in human collective behavior
28.02.2011
- Gonzalez, Cleotilde**
Carnegie Mellon University, Pittsburgh, USA
Emergence of cooperation with increased information: Explaining the process with an instance-based learning mode
09.04.2013
- Gould, Deborah**
University of California, Santa Cruz, USA
Becoming coalitional: The strange and miraculous coalition between queer to the left and the Jesus people, USA
02.07.2013
- Gray, Wayne**
Rensselaer Polytechnic Institute, Troy, USA
Tetris, extreme expertise in Tetris, and eye tracking extreme experts in Tetris
14.02.2012
- Gray, Wayne**
Rensselaer Polytechnic Institute, Troy, USA
Contributions of body-bound and brain-bound resources, and control processes to cognitive workload
28.03.2012
- Guercini, Simone**
Università degli Studi Firenze, Italy
Heuristics in the textile industry
02.07.2012
- Gumbrecht, Hans Ulrich**
Stanford University, USA & Wissenschaftskolleg zu Berlin, Germany
Presence, Stimmung, latency: About the objectivity of past feelings and how to describe them
24.04.2012
- Halpern-Felsher, Bonnie L.**
University of California, San Francisco, USA
Adolescent health-related perceptions and decision making: From theory to evidence to intervention
20.07.2012
- Halpern-Felsher, Bonnie L.**
University of California, San Francisco, USA
Adolescent development: A primer
24.07.2012
- Halpern-Felsher, Bonnie L.**
University of California, San Francisco, USA
Adolescents' tobacco-related decision making
25.07.2012
- Hand, David**
Imperial College London, UK
Deconstructing statistical question
03.06.2013
- Hariskos, Wasilios**
University of Erfurt, Germany
The technion prediction competitions
30.11.2011
- Hartmann, Sophie**
Lufthansa, Germany
Der Umgang mit Fehlern und warum wir sie akzeptieren müssen, um die Zukunft zu erleben
12.06.2013
- Haupt, Heinz-Gerhard**
European University Institute, Florence, Italy
Threat and emotions: Anarchist bombings in 19th-century Paris
07.02.2012
- Haupt, Heinz-Gerhard**
Bielefeld University, Germany & European University Institute, Florence, Italy
Gewalt und Kommunikation: Methodische Überlegungen zur Gewalt in Europa im 19. und 20. Jahrhundert
10.01.2013
- Heinemann, Elizabeth**
University of Iowa, USA
Scholarship, historical fiction, and emotion: A family history of the Holocaust
04.06.2013
- Helbing, Dirk**
ETH Zurich, Switzerland
Why humans are social, and how to model their behavior
29.11.2013
- Hensch, Takao**
Harvard University, Cambridge, USA
Lifting brakes on brain activities
30.05.2013
- Herzfeld-Schild, Marie Louise**
Freie Universität Berlin, Germany
Gemeinschaftsgefühl durch religiöse Musik: Diskurse im 19. Jahrhundert
25.06.2013
- Heschel, Susannah**
Dartmouth College, Hanover, USA & Wissenschaftskolleg zu Berlin, Germany
The Aryan Jesus: Affinities between German Protestantism and racial theory during the Third Reich
19.06.2012
- Hills, Thomas**
University of Warwick, UK
Search amplified risk in decisions from experience
06.08.2013
- Hogarth, Robin M.**
Universitat Pompeu Fabra, Barcelona, Spain
What are the chances of winning? Exploring the ecology and psychology of competitions
17.10.2012
- Huber, Mathis**
Styriarte, Graz, Austria
Nikolaus Harnoncourt—Ein Festival der Gefühle?
06.12.2012
- Hunt, Nancy Rose**
University of Michigan, Ann Arbor, USA
Colonial nervousness or a nervous state
19.04.2011

- Janata, Petr**
University of California, Davis, USA
Sensorimotor coupling in music and being "in the groove"
11.09.2012
- Jarnebrant, Peter / Myrseth, Kristian**
European School of Management and Technology, Berlin, Germany
Morality beliefs distorted: Magnifying the risk of dying young
05.06.2013
- Jarzebowski, Claudia**
Freie Universität Berlin, Germany
"Will we ever meet again?" Emotions across the ocean during the 18th century
10.12.2013
- Jensen, Ole**
Radboud University, Netherlands
How the phase of the alpha rhythm might serve to prioritize neuronal processing
09.04.2013
- Jirsa, Viktor**
University of Marseille, France
On the resting state of the human brain: Is it really interesting?
06.11.2012
- Johansen-Berg, Heidi**
University of Oxford, UK
Changing brain connections with experience, learning, and recovery
04.05.2011
- Joshi, Sanjay**
Northern Arizona University, Flagstaff, USA
What makes a community? Emotions, expediency, and the politics around overseas travel in early twentieth-century Kumaon (North India)
12.07.2011
- Kaivanto, Kim**
Lancaster University Management School, UK
Choice without preference: The asymmetric dominance effect across taxa
23.11.2011
- Khader, Patrick**
Ludwig-Maximilians-Universität Munich, Germany
The neural correlates of cognitive search in memory-based decision making
14.03.2013
- Kia, Mana**
Harvard University, Cambridge, USA
Emotions as moral substance and virtuous conduct in late-Mughal Persiana India
11.06.2013
- Koehncke, Arnulf**
Humboldt-Universität zu Berlin, Germany
Optimal decision making in ovipository insects
06.12.2011
- Koschorke, Albrecht**
University of Konstanz, Germany
Liminalität im Biedermeier: Das Volk und die Hausmärchen der Brüder Grimm
15.02.2011
- Kreutzberg, Georg W.**
MPI for Neurobiology, Martinsried, Germany
Fraud, integrity, and responsible conduct in science
05.06.2012
- Kubovy, Michael**
University of Virginia, Charlottesville, USA
Episodes
17.07.2012
- Leys, Ruth**
Johns Hopkins University, Baltimore, USA
The disappearance of shame?
06.12.2012
- Lifschitz, Avi**
University College London, UK
Between the wild child and the speaking ape: Emotions and cognition in Enlightenment debates on the boundaries of humanity
23.04.2013
- Lu, Zhong Yi**
East China Normal University, Shanghai, China
The effect of self-esteem on risky behavior in an auction task
01.11.2011
- Lui, Chengwei**
University of Warwick, UK
Exceptional performance: Skill or luck?
07.09.2011
- Lütteken, Laurenz**
University of Zurich, Switzerland & Wissenschaftskolleg zu Berlin, Germany
Zum Musikbegriff von Richard Strauss
21.11.2013
- Mark, Seymour**
University of Otago, New Zealand
Feeling Italian? Emotional styles between province and capital in 1870's Italy
14.06.2011
- Martignon, Laura**
Ludwigsburg University of Education, Germany
Fast and frugal: From phronesis to episteme
03.04.2013
- McConway, Kevin**
The Open University, Milton Keynes, UK
Statistics as reported in the British mass media
14.09.2011
- McIntosh, A. Randy**
Rotman Research Institute, Toronto, Canada
Thinking about brain and behavior links in aging
20.08.2013
- Meel, Caspar van**
Musician, Netherlands
Thinking about meaning in musik: A history
31.10.2013
- Mercado, Eduardo**
University at Buffalo, New York, USA
Perceptual training and transfer: Why does progressing from easy to harder tasks help?
14.06.2011
- Mintzker, Yair**
Princeton University, USA
Hateful empathy: The curious case of Joseph Suss Oppenheimer ("Jew Suss")
15.10.2013
- Miron-Shatz, Talya**
University of Pennsylvania, Philadelphia, USA
Miscomprehension, false expectations, and forgotten risk assessments: The case of medical information
20.04.2012

- Monson, Jamie**
Macalester College, St Paul, USA
Emotion and memory in a Cold War China-Africa development project
15.05.2012
- Morrow, William Ross**
Iowa State University, Ames, USA
Heuristics, product design, and energy policy
22.08.2012
- Moscoso, Javier**
Spanish National Research Council, Madrid, Spain
The topics of pain and the historical epistemology of experience
03.07.2012
- Mrozek, Bodo**
University of Potsdam, Germany
Geschmacksgemeinschaften: Fankulturen als Avantgarden der Internationalisierung
15.11.2012
- Muchlinski, Elke**
Freie Universität Berlin, Germany
Central bank policy as a language analogy
19.01.2012
- Naimark, Norman M.**
Stanford University, USA & American Academy in Berlin, Germany
Human emotions in mass killing: How perpetrators think about their victims
17.05.2011
- Nehring, Holger**
University of Sheffield, UK
German Angst—The West German peace movement of the 1980s and the memory of the Second World War
31.01.2012
- Newmark, Catherine**
Freie Universität Berlin, Germany
What passions show: Emotion and expression in premodern affect theory
10.07.2012
- Nirenberg, David**
University of Chicago, USA
Moral economies: A love story
20.11.2013
- Okan, Yasmina**
University of Granada, Spain
How people with low and high graph literacy understand graphs: An eye tracking study
31.01.2012
- Orquin, Jacob L.**
Aarhus University, Denmark
Eye movements in decision making: Revealing or concealing heuristics?
14.05.2013
- Ortmann, Andreas**
Australian School of Business, University of New South Wales, Sydney, Australia
To be prosocial or antisocial (or both)? That's the question ...
04.12.2012
- Oyserman, Daphna**
University of Michigan, Ann Arbor, USA
Culture as situated cognition
11.05.2011
- Park, Denise C.**
University of Texas, Dallas, USA
Fragile minds: The scaffolding theory of aging and cognition
14.08.2012
- Peters, Ellen**
Ohio State University, Columbus, USA
Multiple numeric competencies in judgment and decision making
13.08.2013
- Pope, Robin**
University of Bonn, Germany
SKAT, the stages of knowledge ahead theory of decisions under risk and uncertainty illustrated with mental health benefits from particular risks
27.04.2011
- Präger, Ulrike**
Boston University, USA
Between longing and belonging: Music and emotion in the expulsion of Germans from the Bohemian Lands
17.10.2013
- Pulvermüller, Friedemann**
Freie Universität Berlin, Germany
How neurons make meaning: Brain mechanisms for embodied and abstract-symbolic semantics
27.08.2013
- Raaijmakers, Jeroen**
University of Amsterdam, Netherlands
A critical analysis of the inhibition account of forgetting
20.09.2012
- Rahut, Heiko**
ETH Zurich, Switzerland
How social influence can undermine the wisdom of crowd effect
08.02.2012
- Ranganath, Charan**
University of California, Davis, USA
Two cortical systems for memory-guided behavior
13.11.2012
- Ratcliff, Roger**
Ohio State University, Columbus, USA
Introductory lecture to diffusion models for perceptual and cognitive decisions
08.08.2013
- Raykov, Tenko**
Michigan State University, Lansing, USA
Introductory and intermediate structural equation modeling
21.05.2013
- Reichmann, Daniel**
Weizmann Institute of Science, Rehovot, Israel
Complexity: A theoretical analysis with implications to self-regulation and goal pursuit
18.04.2012
- Reyna, Valerie**
Cornell University, Ithaca, USA
Explaining framing and fallacies in fuzzy-trace theory: A different dual-process approach
16.05.2011
- Rojas, Raul**
Freie Universität Berlin, Germany
Autonomous driving: State of the art and challenges ahead
27.02.2013

- Rora, Constanze**
Hochschule für Musik und Theater, Leipzig, Germany
Aspekte der Zwischenleiblichkeit musikalischer Praxis im Klassenverband
28.11.2013
- Roth, Camille**
Centre National de la Recherche Scientifique, Paris, France
Sociosemantic networks: A perspective on social cognition
26.10.2011
- Rothermund, Klaus**
Friedrich Schiller University Jena, Germany
The automatic basis of self-regulation: Motivational control over valence
25.07.2013
- Rubba, Fabiana**
Federico II University Hospital, Naples, Italy
Fast and frugal heuristic to decide diagnosis and to consent sepulture
16.08.2011
- Ruffman, Tedd**
University of Otago, New Zealand
Social understanding in older adults
17.10.2011
- Sabiwalsky, Ralf**
Freie Universität Berlin, Germany
Overview over the principal agents of financial decision making and basic types of financial contracts
04.11.2011
- Sarangi, Sudipta**
Louisiana State University, Baton Rouge, USA
Perspectives on decision making: The role of aging and groups
19.07.2011
- Scheibehenne, Benjamin**
University of Basel, Switzerland
Bayesian methods of comparing adaptive toolboxes against alternative models of cognition
17.03.2011
- Schröter, Juliane**
University of Zurich, Switzerland
Abschied und Affekt: Zur Bekundung von Gefühlen bei Verabschiedungen im 19. und 20. Jahrhundert
08.01.2013
- Schürmer, Anna**
Justus Liebig University Giessen, Germany
Klingende Skandale—laute(r) Emotionen und Ritual(brüch)e
06.06.2013
- Schwarz, Norbert**
University of Michigan, Ann Arbor, USA
Embodiment in judgment and decision making: Of fishy smells, sticky luck, and balanced minds
10.05.2011
- Selart, Marcus**
Norwegian School of Economics, Bergen, Norway
The application of heuristics as social tools in transformational and transactional leadership
17.04.2012
- Spiliopoulos, Leonidas**
University of Sydney, Australia
Beyond fictitious play beliefs in strategic games
12.09.2011
- Spiliopoulos, Leonidas**
Australian School of Business, Sydney, Australia
Model comparisons using prediction tournaments: Likes and "dislikes"
12.09.2012
- Stark, Craik**
University of California, Irvine, USA
Pattern separation in the human hippocampus
13.09.2011
- Stasser, Garold**
Miami University, Oxford, USA
Missing link problems in collective choice
19.09.2012
- Stearns, Peter N.**
George Mason University, Fairfax, USA
Obedience and emotion: A challenge in the emotional history of childhood
29.11.2012
- Stenning, Keith**
University of Edingburgh, UK
Relations between an interpretative approach to reasoning and the ecological rationality approach to decision making
27.11.2012
- Stephan, Klaus Enno**
University of Zurich, Switzerland & University College London, UK
Neurocomputational models of (mal)adaptive cognition and psychiatric disease
09.11.2011
- Stojic, Hrvoje**
Universitat Pompeu Fabra, Barcelona, Spain
Strategy selection without feedback
16.07.2012
- Strough, JoNell**
West Virginia University, Morgantown, USA
Aging and decision making: Older and wiser?
02.05.2013
- Taleb, Nassim N.**
New York University, USA
A single heuristic for the distinction of risk and model error
23.06.2011
- Tamir, Maya**
Hebrew University, Jerusalem, Israel
Starting at the beginning: Motives in emotion regulation
12.08.2013
- Taylor, Brian**
University of Ulster, Londonderry, UK
Decisions and risk in social work
22.05.2013
- Timm, Annette**
University of Calgary, Alberta, Canada
Mothers, whores, or sentimental dupes? Emotion and race in historiographical debates about women in the Third Reich
29.10.2013
- Trivellato, Francesca**
Yale University, New Haven, USA
Early modern European merchants between rational calculation and anger: Can we trust that we understand trust?
28.05.2013

- Trivers, Robert L.**
Rutgers University, Newark, USA
The logic of self-deception in human life
22.01.2013
- Trümpi, Fritz**
Vienna, Austria
Die Wiener und Berliner Philharmoniker während
des Nationalsozialismus
16.06.2012
- Vieider, Ferdinand**
Social Science Research Center Berlin, Germany
Risk attitudes, development, and growth
24.10.2012
- Vögele, Claus**
Université du Luxembourg, Luxembourg
Can one think too much? Cognitions, cognitive
style, and health
20.11.2013
- Wagner, Kim**
University of London, UK
"A legacy of fear": The 1857 uprising and the
colonial imagination
29.11.2011
- Waldmann, Michael**
University of Göttingen, Germany
Agents and causes: Markov violations in causal
reasoning
06.12.2012
- Walhovd, Kristine B.**
University of Oslo, Norway
Dynamics of brain and cognition through the
lifespan: Markers of plasticity and change
28.11.2011
- Wallot, Sebastian**
Aarhus University, Denmark
Nonlinear dynamics in reading time data
21.05.2013
- Watanabe-O'Kelly, Helen**
University of Oxford, UK
Feeling bad, feeling sad: The representation of
emotions in the 17th-century picaresque novel
13.11.2012
- Werner, Frank**
Dewezet, Hameln, Germany
Krieg, Massenmord und Männlichkeit. Zwischen
Stolz und Scham: Selbstbilder deutscher Soldaten
im Vernichtungskrieg 1941–1944
11.07.2013
- Wheeler, Gregory**
New University of Lisbon, Caparica, Portugal
Tracking confirmation and association through
causal structure
09.02.2011
- Whitmore, Jean Czerlinski**
University of Chicago, USA
What are simple heuristics?
13.02.2013
- Wilke, Andreas**
Clarkson University, Potsdam, USA
Sequential decision making and illusionary pattern
detection
09.05.2012
- Wintle, Bonnie**
University of Melborn, Australia
Improving scientific and geopolitical intelligence
judgments with the wisdom of crowds
12.09.2013
- Wood Uribe, Patrick**
Boston University, USA
Adolph Bernhard Marx und sein Text "Die Sinfonia
Eroica und die Idealmusik"
24.05.2012
- Zimmer, Hubert**
Saarland University, Germany
Visual working memory capacity is confined by
selection efficiency and representation parsimony
14.11.2013

3. Conferences, Workshops, and Seminars 2011–2013

New Approaches to the Study of Religion in Germany and Canada

DAAD/PhD student workshop of HoE, jointly organized with University of Toronto
18.02.2011

4th Thesis Workshop Berlin

Workshop of IMPRS Uncertainty
21.02.–24.02.2011

Hegemonic Structures of Music

Conference of MPRG Felt Communities, jointly organized with the European University Institute Florence
11.03.–13.03.2011

LIFE Fellows' Project Presentations

Seminar (weekly sessions)
April–July 2011

LIFE Spring Academy 2011

International conference
18.05.–23.05.2011

Foundations of an Interdisciplinary Decision Theory

10th Summer Institute on Bounded Rationality of ABC
21.06.–28.06.2011

Empathy and the Blocking of Empathy

International conference of HoE
01.07.–02.07.2011

Emotionen und historisches Lernen revisited: Geschichtsdidaktische und geschichtskulturelle Perspektiven

Conference of HoE, jointly organized with the Arbeitsbereich Didaktik der Geschichte (Freie Universität Berlin)
06.07.–08.07.2011

Multilevel Modeling

LIFE workshop
15.07.–16.07.2011

LIFE Fall Academy 2011

International conference
18.09.–22.09.2011

Emotions and Medicine in the 20th Century

International conference of HoE
22.09.–24.09.2011

Defining, Assessing, and Predicting Educational Achievement

LIFE seminar (weekly sessions)
October 2011–February 2012

ABC Finance Reading Group

Financial risk tutorial
04.11.2011

Feelings in the City: Emotions and Urban Space

Workshop of HoE
04.11.2011

Emotions and the History of Modern Anti-Semitism

International conference of HoE, jointly organized with Center for Research on Antisemitism (Technische Universität Berlin) and the Leo Baeck Institute London
16.04.–18.04.2012

LIFE Spring Academy 2012

International conference
09.05.–14.05.2012

Personal and Shared Intentions

Interdisciplinary workshop of ABC
03.05.–05.05.2012

Modern Missing-Data Handling

LIFE workshop
21.05.2012

Bayesian Models in Cognitive Science

Discussion of ABC
05.06.2012

Fraud, Integrity, and Responsible Conduct in Science

LIFE lecture
05.06.2012

Emotions and Capitalism

International conference of HoE
27.06.–30.06.2012

Foundations of Lifespan Research

LIFE seminar (weekly sessions)

June–July 2012

Decision Making in the Wild

11th Summer Institute on Bounded Rationality of ABC

03.07.–10.07.2012

Testing Theories of Choice Behavior

Workshop of ABC, jointly organized with University of Illinois at Urbana–Champaign and University of Nebraska–Lincoln

18.07.–20.07.2012

Equilibrium Dynamics and Latent Differential Equations

LIFE workshop

21.08.–22.08.2012

MPS–UCL Symposium and Advanced Course on Computational Psychiatry and Ageing Research

Symposium of LIP in cooperation with University College London

16.09.–22.09.2012

4th Midterm Conference of the ESA RN Sociology of Emotions

International conference of HoE, jointly organized with the Cluster of Excellence "Languages of Emotion" at Freie Universität Berlin

11.10.–13.10.2012

LIFE Fall Academy 2012

International conference

15.10.–19.10.2012

Experimental Entanglements in Cognitive Neuroscience

Workshop of LIP in cooperation with Durham University, UK & Des Fitzgerald, London School of Economics & University of Basel

25.10.–26.10.2012

Stochastik in der Schule

Autumn conference of ABC in cooperation with the Arbeitskreis Stochastik

26.10.–28.10.2012

Health Psychology Across the Lifespan

LIFE seminar (weekly sessions)

November 2012 – February 2013

Kognitive Strategien von Allgemeinärzten

Workshop Harding Center & Philipps–Universität Marburg

03.12.2012

Shame and Shaming in Twentieth–Century Europe

Conference of HoE, jointly organized with University College London, Department of German

06.12.–07.12.2012

The Center for Adaptive Rationality Introduces Itself

Presentation of the Director and 17 snap talks

13.12.2012

Gefühlsräume—Raumgefühle: Zur Verschränkung von emotionalen Praktiken und Topografien der Moderne

Conference of HoE, jointly organized with the DFG research group "Kulturen des Wahnsinns" (Charité Universitätsmedizin Berlin)

10.01.–11.01.2013

Fragmentierung sozialer Beziehungen durch Musik im 20. Jahrhundert

Conference of MPRG Felt Communities

24.01.–26.01.2013

Schülersymposium zum Thema Risiko

Workshop of ABC

22.02.–24.02.2013

Academic Writing

LIFE seminar (weekly sessions)

April–July 2013

Foundations of Lifespan Research

LIFE workshop

09.04.–11.04.2013

Introduction to "R"

LIFE workshop

19.04.–20.04.2013

MEMORY

Interdisciplinary colloquium of the Institute

07.05.2013

LIFE Spring Academy 2013

International conference

08.05.–14.05.2013

- The Bias–Variance Dilemma**
Workshop of ABC
15.05.2013
- Decision Making in a Social World**
12th Summer Institute on Bounded Rationality of ABC & ARC
18.06.–25.06.2013
- Wissenschaftliches Bloggen**
Workshop of MPRG Felt Communities
21.06.2013
- Emotions and Violence in the 20th–Century Europe: Historical Perspectives on Violence Prevention and Peace Education**
International conference of HoE, jointly organized with Goethe University Frankfurt a. M. & Bielefeld University
26.06.–28.06.2013
- Latent Change Score SEM Analysis**
LIFE workshop
20.06.–21.06.2013
- Reworking Affect**
Workshop of HoE, jointly organized with the ICI Berlin & Zentrum für transdisziplinäre Geschlechterforschung
27.06.2013
- LIFE Fellows' Project Presentations**
Seminar
11.07.–12.07.2013
- Summer School LERNEN_EMOTIONEN_MUSIK**
Workshop of MPRG Felt Communities
01.07.–05.07.2013
- 6th JDM Workshop for Young Researchers**
Workshop of ARC
17.07.–19.07.2013
- Gefühle in Gewaltprävention und Friedenserziehung**
Transfer workshop of HoE, jointly organized with Goethe University Frankfurt a. M. & Bielefeld University
07.10.–08.10.2013
- 50 Years of Research on Human Development**
Scientific symposium on the occasion of the Institute's anniversary
09.10.2013
- LIFE Fall Academy 2013**
International conference
12.10.–17.10.2013
- Developmental Eye–Tracking Research in Reading**
International symposium of MPRG REaD
23.10.–26.10.2013
- I, the People: Negotiating Individual and Collective Emotions in Democratic Societies**
International conference of HoE
14.11.–15.11.2013
- Finding Foundations for Bounded and Adaptive Rationality**
Workshop of ARC
22.11.–24.11.2013
- Social and Behavioral Gerontology**
LIFE seminar (weekly sessions)
November 2013 – February 2014
- Workshop "Concepts of Emotions in South Asia" as Part of EMOPOLIS (Emotions and Political Mobilizations in the Indian Subcontinent)**
International conference of HoE, jointly organized with Centre d'Etude de l'Inde et de l'Asie du Sud (CEIAS, Paris) & IMPRS Moral Economies
06.12.–07.12.2013
- Feeling Differently: Emotional Nonconformism in the 20th Century**
International conference of HoE, jointly organized with Warwick University & Humboldt-Universität zu Berlin & University of Tübingen & University of Bayreuth
13.12.–14.12.2013

4. Political Delegations and Guests 2011–2013

Bahr, Marianne

Press and Information Office of the Federal Government (visit of a delegation of press officers from German universities)
November 2011

Gan, Kim Yong

Minister for Health of the Republic of Singapore with delegation
October 2012

Karakaşoğlu, Yasemin

Member of Peer Steinbrück's "competence team" for Education and Science with other members of the Social Democratic Party (SPD)
September 2013

Lauer, Christoph

Parliamentary Group The Pirate Party of Germany from the Berlin Chamber of Deputies, regular monthly meeting with ABC
as of January 2013

Nevermann, Knut

State Secretary for Science and Research, Berlin Senate, on the occasion of the Institute's anniversary
October 2013

5. Visiting Researchers 2011–2013

Abele, Susanne

Miami University, Oxford, USA
September–November 2012; September–December 2013

Alfieri, Fernanda

Fondazione Bruno Kessler Istituto Storico Italo-Germanico, Trento, Italy
January–March 2013

Arkes, Hal R.

Ohio State University, Columbus, USA
April–December 2011; June–August 2012

Bäckman, Lars

Karolinska Institutet, Stockholm, Sweden
May 2011

Barbalet, Jack

Hong Kong Baptist University, China
June–July 2013

Bielby, Clare

University of Hull, UK
February–August 2013

Blasco, Marta Gil

University of Valencia, Spain
April–June 2013

Bohn, Annette

Aarhus University, Denmark
January–March 2011

Boiger, Michael

University of Leuven (KU Leuven), Belgium
October 2013 – December 2014

Boker, Steven M.

University of Virginia, Charlottesville, USA
July 2011

Bunge, Silvia

University of California, Berkeley, USA
September 2011

Cabeza, Roberto

Duke University, Durham, USA
November 2012

Dolan, Ray

Wellcome Trust Centre for Neuroimaging, University College London, UK
August 2012

Draganski, Bogdan

Centre Hospitalier Universitaire Vaudois, Lausanne, Switzerland
December 2011

Ehrmann–Hämmerle, Christa

University of Vienna, Austria
August 2011 – January 2012

Feest, Uljana

Technische Universität Berlin, Germany
September 2013 – July 2014

Feltz, Adam

Schreiner University, Kerrville, USA
July–August 2011

Flam, Helena

Leipzig University, Germany
September 2012 – March 2013

Flückiger, Lavinia

University of Basel, Switzerland
October 2013 – January 2014

Gama, Fabienne

Institut Interdisciplinaire d'Anthropologie du Contemporain, Paris, France
April–May 2013

Gazzaley, Adam

University of California, San Francisco, USA
May, December 2011; April 2013

Ghisletta, Paolo

University of Geneva, Switzerland
June, November 2011

Giloi, Eva

Rutgers University, Newark, USA
July 2012 – August 2013

Gluck, Kevin A.

Air Force Research Laboratory, Wright–Patterson Air Force Base, Ohio, USA
August 2010 – July 2011

Gould, Deborah

University of California, Santa Cruz, USA
June–July 2013

Gray, Wayne

Rensselaer Polytechnic Institute, Troy, USA
January–June 2012

Grüne–Yanoff, Till

Royal Institute of Technology, Stockholm, Sweden
July–December 2013

Guercini, Simone

Università degli Studi Firenze, Italy
February, June 2011; February–June 2013

Halpern–Felsher, Bonnie L.

University of California, San Francisco, USA
June–August 2012

Hertzog, Christopher

Georgia Institute of Technology, Atlanta, USA
June–July 2011

Hintze, Arend

Michigan State University, USA
January–March 2013

Hofer, Daniel

University of Basel, Switzerland
June–July 2013

Hogarth, Robin M.

Universitat Pompeu Fabra, Barcelona, Spain
June 2013

Horn, Andreas

Bernstein Center for Computational Neuroscience, Berlin, Germany
February 2012 – July 2013

Janata, Petr

University of California, Davis, USA
September 2012

Keitz, Ursula von

University of Bonn, Germany
March–July 2012

Kellen, David

University of Freiburg, Germany
October–December 2013

Keller, Niklas

Charité Universitätsmedizin Berlin, Germany
July 2013 – June 2014

Khader, Patrick

Ludwig–Maximilians–Universität Munich, Germany
August–September 2013

Kounine, Laura

University of Cambridge, UK
April–September 2013

- Krüger, Antonio**
Deutsches Forschungszentrum für Künstliche
Intelligenz, Saarbrücken, Germany
February 2011
- Little, Todd D.**
University of Kansas, Lawrence, USA
May 2012
- Mayr, Ulrich**
University of Oregon, Eugene, USA
May–June 2012
- McArdle, John J.**
University of Southern California, Los Angeles, USA
June–July 2012; June 2013
- McConway, Kevin**
The Open University, Milton Keynes, UK
September–December 2011
- McIntosh, A. Randy**
Rotman Research Institute, Toronto, Canada
August 2013
- Mercado, Eduardo**
University at Buffalo, New York, USA
June 2011
- Moses, Julia**
University of Sheffield, UK
February 2013 – January 2014
- Naveh-Benjamin, Moshe**
University of Missouri, Columbia, USA
July 2011
- Ofen, Noa**
Wayne State University, Detroit, USA
May 2012
- Oliver, Sophie Anne**
University of Konstanz, Germany
January–August 2012
- Olsson, Henrik**
Berlin, Germany
August 2012 – January 2014
- Osselaer, Tine van**
University of Leuven (KU Leuven), Belgium
May–June 2011
- Oyserman, Daphna**
University of Michigan, Ann Arbor, USA
May 2011
- Park, Denise C.**
University of Texas, Dallas, USA
August 2012
- Pearman, Ann**
Georgia State University, Atlanta, USA
June–July 2011; August 2012
- Polk, Thad**
University of Michigan, Ann Arbor, USA
October–December 2011
- Prescott, Carol**
University of Southern California, Los Angeles, USA
July 2012; June 2013
- Ram, Nilam**
Pennsylvania State University, USA
December 2011
- Ratcliff, Roger**
Ohio State University, Columbus, USA
August 2013
- Raz, Naftali**
Wayne State University, Detroit, USA
March, June–August, December 2011
- Reuter-Lorenz, Patricia A.**
University of Michigan, Ann Arbor, USA
April–May 2012
- Roper, Timothy James**
University of Sussex, UK
February–December 2013
- Samanez-Larkin, Gregory**
Yale University, New Haven, USA
June 2011
- Saxer, Daniela**
University of Zurich, Switzerland
January 2011 – December 2012
- Schmidt, Timo Torsten**
Bernstein Center for Computational Neuroscience,
Berlin, Germany
February 2012 – September 2013
- Schneider, Wolfgang**
University of Würzburg, Germany
January 2012
- Schwarz, Norbert**
University of Michigan, Ann Arbor, USA
May 2011
- Seymour, Mark**
University of Otago, New Zealand
June 2011
- Sydow, Momme von**
Heidelberg University, Germany
August–September 2013
- Stasser, Garold**
Miami University, Oxford, USA
September–November 2012; September–
December 2013
- Stephan, Klaus Enno**
University of Zurich, Switzerland
November 2011
- Streck, Danilo**
Universidade do Vale do Rios dos Sinos,
São Leopoldo, Brasil
August–December 2012
- Taylor, Brian**
University of Ulster, Londonderry, UK
May–June 2013
- Trautwein, Ulrich**
University of Tübingen, Germany
October 2011 – September 2012
- Vallgarda, Karen Asta Arnfred**
University of Copenhagen, Denmark
March–May 2012
- Watanabe-O'Kelly, Helen**
University of Oxford, UK
October 2012 – January 2013
- Wheeler, Gregory**
New University of Lisbon, Caparica, Portugal
January–April, August–December 2011
- Woollacott, Marjorie**
University of Oregon, Eugene, USA
June–July 2013
- Wrzus, Cornelia**
Johannes Gutenberg University Mainz, Germany
October 2013 – September 2014
- Zhu, Wei**
Tongji University, Shanghai, China
September 2010 – August 2012
- Ziegler, Johannes**
Aix-Marseille Université, Marseille, France
January 2011

6. Other Professional Activities 2011–2013

- Assmann, Wolfgang** – Ausbildungsverbund Fachinformatik Berlin-afib (Coordinator)
- Baumert, Jürgen**
- Association of Berlin Merchants and Industrialists (VBKI): "Bürgernetzwerk Bildung" (Advisory Board)
 - Baden-Wuerttemberg Ministry of Culture, Youth, and Sports: Expert Committee on Background and Educational Success (Chair)
 - Baden-Wuerttemberg Ministry of Science, Research and Arts: Expert Group on the Development of Teacher Education (Member)
 - Berlin Senate Administration for Education, Youth, and Science: Teacher Education Committee (Chair)
 - Carina Foundation, Herford (Board of Trustees)
 - Dahlem Conferences, Freie Universität Berlin (Advisory Board)
 - Deutsche Telekom Stiftung: Selection Committee, National Center for Teacher Education (Chair)
 - Federal Ministry for Education and Research (BMBF), "House of Little Scientists" Initiative for Preschool Children (Board of Trustees)
 - German Association for Empirical Educational Research (GEBF) (Vice-President)
 - German Children and Youth Foundation, Berlin (Board of Trustees)
 - Institute for Education Progress of the States of the Federal Republic of Germany (IQB), Humboldt-Universität zu Berlin (Governing Board)
 - Institute for School Quality in Berlin and Brandenburg (ISQ) (Chair of Advisory Board)
 - Jacobs Center on Lifelong Learning and Institutional Development, Jacobs University Bremen (Advisory Board)
 - Jacobs Foundation, Zurich (Board of Trustees)
 - Knowledge Media Research Centre, Tübingen (Board of Trustees)
 - "Lebenswelt Schule"—A joint program of the German Children and Youth Foundation and the Jacobs Foundation (Advisory Board)
 - Leibniz Association: German Institute for Adult Education (DIE), Bonn (Evaluation Committee)
 - Programme for the International Assessment of Adult Competencies (PIAAC) (Advisory Board)
 - Ruhr University of Bochum, Professional School of Education (Advisory Board)
 - Steering Committee of the Joint Commission of the German Federal and Länder Governments on Monitoring the Performance of the German Education System in accordance with Art. 91b (2) of the German Basic Law (Chair of the Advisory Board)
 - Technische Universität München, Center for International Educational Comparison Studies (ZIB) (Board of Trustees)
 - The Research Council of Norway, Oslo: "Norwegian Educational Research Towards 2020" (Panel Member)
 - Zeitschrift für Erziehungswissenschaft (Coeditor)
 - Zeitschrift für Pädagogische Psychologie (Advisory Board)
 - Zeitschrift für Unterrichtswissenschaft (Coeditor)
- Beljan, Magdalena** – Body Politics: Zeitschrift für Körpergeschichte (Coeditor)
- Bongrand, Philippe** – French Scientific Society for the History of Education (ATRHE) (Founding Member)
- Bos, Wouter van den** – Journal of Open Psychology Data (Editorial Board)
- Brighton, Henry**
- Annual Conference of the Cognitive Science Society (Program Committee)
 - Berlin School of Mind and Brain (Faculty Associate)
 - European Conference on Machine Learning (Program Committee)
 - Journal "Frontiers in Cognitive Science" (Associate Editor)
- Düzel, Sandra** – Equal Opportunities Representative of the MPI for Human Development

- Edelstein, Wolfgang**
- Buddy e.V. (Advisory Board)
 - Deutsche Gesellschaft für Demokratiepädagogik (German Association for Democratic Education) (Member)
 - Institut für angewandte Familien-, Kindheits- und Jugendforschung e.V., Potsdam (Scientific Advisory Board)
 - Journal "New Directions for Youth Development" (Editorial Board)
- Eitler, Pascal**
- Body Politics: Zeitschrift für Körpergeschichte (Chief Editor)
- Ellerbrock, Dagmar**
- Verband Historiker und Historikerinnen Deutschlands (Board Member)
- Feufel, Markus A.**
- Federal Ministry of Education and Research (BMBF), "Public Dialogue: High Tech Medicine—What Kind of Health Do We Want?" (Scientific Advisory Board)
- Flitner, Ursula**
- Training Cooperation with the Technische Universität Berlin (Coordinator)
- Frevert, Ute**
- Alexander von Humboldt Foundation, Berlin (Advisory Board)
 - American Academy in Berlin (Selection Committee)
 - Berlin-Brandenburg Academy of Sciences and Humanities (Member)
 - British Academy for the Humanities and Social Sciences, London (Corresponding Fellow)
 - Centre Marc Bloch, Berlin (Advisory Board)
 - Dahlem Conferences, Freie Universität Berlin (Advisory Board)
 - Deutsche Bahn Foundation, "Bildung und Kultur" (Education and Culture) (Board of Trustees)
 - Einstein Forum, Potsdam (Advisory Board)
 - European Research Council (Panel Member)
 - Foundation Deutsches Hygiene Museum, Dresden (Board of Trustees)
 - German Academy of Sciences Leopoldina (Member)
 - German Historical Institute, Washington D.C. (Advisory Board)
 - German History Competition organized by the Kurt-A.-Körber Foundation (Board of Trustees)
 - German-Israeli Foundation for Scientific Research and Development (GIF) (Member)
 - Geschichte und Gesellschaft—Journal of Historical Social Sciences (Coeditor/ Managing Director)
 - Humboldt-Viadrina School of Governance, Berlin (Board of Trustees)
 - Institute for Human Sciences, Vienna (Advisory Board)
 - International Max Planck Research School for Moral Economies of Modern Societies (Spokesperson)
 - Jacobs University Bremen (Board of Governors)
 - Journal of Contemporary History (Editorial Board)
 - Journal "European Studies Review" (Advisory Board)
 - Journal "Genèses: Science Sociales et Histoire" (Advisory Board)
 - Journal "L'Homme: Zeitschrift für Feministische Gesellschaftswissenschaft" (Advisory Board)
 - Journal of Modern History (Advisory Board)
 - Ludwig Boltzmann Institute for the History and Theory of Biography, Vienna (Advisory Board)
 - Scientific Council of the Max Planck Society (Deputy Chairperson)
 - Zentrum für Zeithistorische Forschung, Potsdam (Board of Trustees)
 - Zukunftskolleg, University of Konstanz (Advisory Board)
- Gaissmaier, Wolfgang**
- Journal "Frontiers in Quantitative Psychology and Measurement" (Review Editor)
 - Journal "Medical Decision Making" (Editorial Board)
- Galesic, Mirta**
- Journal "Medical Decision Making" (Editorial Board)
- Garcia, Luis-Manuel**
- Special Issue, Dancecult: Journal of Electronic Dance Music Culture, "Doing Nightlife and EDMC Fieldwork" (Guest Editor)

- Gigerenzer, Gerd**
- American Institute for Behavioral Research and Technology (AIBRT) (Scientific Advisory Board)
 - Berlin-Brandenburg Academy of Sciences and Humanities (Member)
 - BERLIN.MINDS (Advisory Board)
 - BfR Federal Institute for Risk Assessment (Advisory Board)
 - Board of the APS Policies (Advisory Committee of International Scholars)
 - Deutscher Bundestag, Hearing on the capital requirements of banks (Expert Testimony)
 - European Society for Philosophy and Psychology (ESPP) (Advisory Board)
 - Frankfurt Institute for Advanced Studies Forum (Advisory Board)
 - German Academy of Sciences Leopoldina (Fellow)
 - Inspire2Live Foundation, Amsterdam (Member)
 - International Herbert A. Simon Society (Founding Member)
 - Journal of Behavioral Decision Making (Editorial Board)
 - Journal "Decision" (Editorial Board)
 - Journal "Evolution and Human Behavior" (Editorial Board)
 - Journal "Organizational Behavior and Human Decision Processes" (Editorial Board)
 - Journal "Psychological Inquiry" (Editorial Board)
 - Journal "Theory and Psychology" (Advisory Editor)
 - National Academy of Sciences Leopoldina Taskforce "Wissenschaft, Öffentlichkeit und Medien" (Member)
 - Risk and Security, Technische Universität München (Advisory Board)
 - Summer Institute on Bounded Rationality in Psychology and Economics (Codirector)
- Hämmerer, Dorothea**
- Max Planck PhDNet (Survey Working Group)
- Hertwig, Ralph**
- Association for Psychological Science (Fellow)
 - German Academy of Sciences Leopoldina (Member of Section 26 "Psychology and Cognitive Sciences")
 - Journal of Behavioral Decision Making (Editorial Board)
 - Journal "Experimental Psychology" (Editorial Board)
 - Journal "Thinking & Reasoning" (Editorial Board)
 - Max Wertheimer Minerva Center for Cognitive Processes and Human Performance, Haifa (Advisory Board)
 - MobileMed: Mobile Consultation and Learning System (Advisory Board)
 - Steering Committee of the DFG Priority Program "New Frameworks of Rationality" (Member)
 - Summer Institute on Bounded Rationality in Psychology and Economics (Codirector)
 - Wilhelm Wundt Society (Member)
- Horn, Andreas**
- Charité Universitätsmedizin Berlin, Neurology Department, Movement Disorders Group (Research Fellow)
- Jensen, Uffa**
- Journal "Culturas Psy/PsyCultures" (Editorial Committee)
 - Mailing List H-Soz-u-Kult (Review Editor)
- Keller, Monika**
- American Field Service (Board Member)
 - International Journal of Developmental Science (Editorial Board)
 - Journal "Erwägen, Wissen, Ethik" (Editorial Board)
- Laukötter, Anja**
- Equal Opportunities Representative of the MPI for Human Development
 - Internet Portal "History of Emotions: Insights into Research" (Coeditor)
- Li, Shu-Chen**
- APA Journal Developmental Psychology (Associate Editor)
 - Faculty of Science, Technische Universität Dresden (Faculty Board)
 - Journal "NeuroImage" (Editorial Board)
 - Journal "Neuroscience and Biobehavioral Reviews" (Editorial Board)

- Lindenberger, Ulman**
- Alexander-von-Humboldt-Stiftung (Member and Selection Committee for Humboldt Research Awards)
 - American Psychological Association (Fellow)
 - Association for Psychological Science (Fellow)
 - Centre for Population Studies (CPS), Umeå University, Sweden (Board of Ageing and Living Conditions Programme, ALC)
 - European Journal of Developmental Science (Editorial Board)
 - German Academy of Sciences Leopoldina (Member of Section 26 "Psychology and Cognitive Sciences")
 - German Institute for International Educational Research (DIPF), Frankfurt a.M. (Scientific Advisory Board)
 - German Research Foundation (DFG), Review Board 110 "Psychology," Sub-Division 110-02 "Developmental Psychology and Educational Psychology" (Member)
 - Gerontological Society of America (Fellow)
 - GeroPsych: The Journal of Gerontopsychology and Geriatric Psychiatry (Editorial Board)
 - Interdisciplinary Wolfgang Köhler Research Centre on Conflicts in Intelligent Systems, Humboldt-Universität zu Berlin (Scientific Board)
 - International Journal of Behavioral Development (Editorial Board)
 - International Society for the Study of Behavioural Development (ISSBD) (Executive Committee)
 - Jacobs Foundation, Zurich (Board of Trustees)
 - Jacobs University Bremen (Scientific Board of the Jacobs Center on Lifelong Learning and Institutional Development)
 - Journal "Aging, Neuropsychology, and Cognition" (Editorial Board)
 - Journal "Psychology and Aging" (Editorial Board)
 - LIVES National Centre of Competence in Research, funded by the Swiss National Science Foundation (International Scientific Committee)
 - Margret M. and Paul B. Baltes Foundation for the Advancement of Research in Developmental Psychology and Gerontology (Member of the Board)
 - Rotman Research Institute, Toronto (Scientific Advisory Committee)
 - Wilhelm Wundt Society (Deputy Chair)
 - Working Group on Aging in Germany, launched by the German Academy of Sciences Leopoldina and the acatech-Council for Engineering Sciences at the Union of the German Academies of Science and Humanities (Member)
 - Zeitschrift für Entwicklungspsychologie und Pädagogische Psychologie (Advisory Board)
- Luan, Shengua**
- Journal "Frontiers in Cognitive Science" (Review Board)
 - Journal "Frontiers in Psychology: Evolutionary Psychology" (Review Board)
- Marewski, Julian N.**
- Journal "Judgment and Decision Making" (Guest Editor of Special Issues)
 - Journal of Organizational Moral Psychology (Editorial Board)
- Mata, Jutta**
- BfR Committee for Risk Research and Risk Perception 2014–2017, elected in 2013 (Member)
 - Journal of Obesity (Guest Editor)
 - University of Basel, Dissplus (PhD Mentoring Program) (Mentor)
 - University of Basel, Step (M.Sc. Mentoring Program) (Mentor)
- Müller, Sven Oliver**
- Interdisciplinary publication series "Die Gesellschaft der Oper: Die Musikkultur europäischer Metropolen im 19. und 20. Jahrhundert" (Coeditor)
 - Special Issue, Geschichte und Gesellschaft, "Musikalische Kommunikation" (Coeditor)
- Neth, Hansjörg**
- International Conference on Cognitive Modeling (ICCM) (Program Committee)
- Nielsen, Philipp**
- Network H-Antisemitism (Review Editor)
- Pachur, Thorsten**
- Journal of Behavioral Decision Making (Editorial Board)
 - Journal of Experimental Psychology: Learning, Memory, and Cognition (Consulting Editor)

- Pernau, Margrit**
- Concepta (International Research School in Conceptual History and Political Thought) (Advisory Board)
 - Faculty of MA Global History, Freie Universität Berlin (Member)
 - Geschichte und Gesellschaft: Journal of Historical Social Sciences (Editorial Board)
 - International Max Planck Research School for Moral Economies of Modern Societies (Principal Investigator)
 - Internet Portal "History of Emotions: Insights into Research" (Coordinator)
 - Journal "Contributions to the History of Concepts" (Editorial Board)
- Riediger, Michaela**
- Ethics Committee of the MPI for Human Development (Head)
 - German Institute for Economic Research (Research Affiliate)
 - Journal "Cognition and Emotion" (Guest Editor of Special Section)
 - Journal "Emotion" (Consulting Editorial Board)
 - Journal "Psychology and Aging" (Consulting Editor)
 - University of Bamberg, feRNet female Researcher Network (Mentoring Program) (Mentor)
- Scheer, Monique**
- International Society for Ethnology and Folklore (Executive Board)
 - Body Politics: Zeitschrift für Körpergeschichte (Editorial Board)
 - Material Religion (Book Reviews Editor)
 - Tübinger Vereinigung für Volkskunde (Advisory Board, Coeditor of Book Series)
- Schooler, Lael J.**
- Journal "Frontiers in Cognitive Science" (Associate Editor)
 - Journal "Psychological Review" (Consulting Editor)
 - Journal "Topics in Cognitive Science" (Senior Editor)
 - Semantic Web Journal's forthcoming Special Issue, "Cognitive Science and the Semantic Web" (Guest Editor)
 - U.S. National Science Foundation, Program on Decision, Risk, and Management Science (Advisory Panel)
- Schroeder, Sascha**
- Berlin Education Interdisciplinary Network (BIEN: Co-Coordinator)
 - Ethics Committee of the MPI for Human Development (Member)
- Schulte-Mecklenbeck, Michael**
- European Association for Decision Making, Ethics Committee (Steering Committee and Newsletter Editor)
- Sela-Teichler, Yeal**
- International Research Project "Jewish Sacred Musical Spaces," Hebrew University of Jerusalem & the Hochschule für Musik, Theater und Medien, Hannover (Coordinator)
- Şimşek, Özgür**
- International Conference on Machine Learning (ICML) (Program Committee)
- Stevens, Jeffrey R.**
- Journal "Frontiers in Comparative Psychology" (Editor-in-chief)
- Tiffin-Richards, Simon P.**
- College for International Educational Research (CIDER) (Fellow)
- Vidor, Gian Marco**
- Association of Significant Cemeteries in Europe (ASCE) (Scientific Committee)
- Wagner, Gert G.**
- Deutscher Bundestag, Study Commission "Growth, Wealth, Quality of Life" of the German Parliament (Member)
 - DIW Berlin (Executive Board)
 - DIW Berlin Graduate Center of Economic and Social Research (Faculty Member)
 - German Data Forum (RatSWD) (Head)
 - Journal of Applied Social Science Studies ("Schmollers Jahrbuch") (Editor-in-chief)
 - National Academy of Science and Engineering (acatech) (Elected Member)
- Wassmann, Claudia**
- Swiss Center for Affective Sciences (Associate Member)

7. Academic Degrees 2011–2013

Habilitations

Gaissmaier, Wolfgang (2013). Decision making under risk and uncertainty: A cognitive-ecological perspective. Heidelberg University.

Kühn, Simone (2012). The neural basis of ideomotor action control: Correlates of the link between perception and action. Humboldt-Universität zu Berlin.

Müller, Sven Oliver (2013). Die Gesellschaft macht die Musik: Das Opern- und Konzertpublikum in Berlin, London und Wien im 19. Jahrhundert. Bielefeld University.

Pachur, Thorsten (2012). Modeling bounded rationality. University of Basel.

Riediger, Michaela (2011). Adult development at the intersection of motivation, behavior, and subjective experience. University of Zurich.

Schroeder, Sascha (2011). Modellierung und Erfassung kognitiver Prozesse beim Textverstehen von Schülerinnen und Schülern. Freie Universität Berlin.

Doctoral Dissertations

Artinger, Florian (2012). Psychological mechanisms in strategic interaction under uncertainty. Technische Universität Berlin.

Brandmaier, Andreas M. (2011). Permutation distribution clustering and structural equation model trees. Saarland University.

Bodemer, Nicolai (2012). Transparency in information about health: Improving medical decision making. Humboldt-Universität zu Berlin.

Donauer, Sabine (2013). Emotions at work—working on emotions: Germany, 1870–1970. Freie Universität Berlin.

Fandakova, Yana (2012). Age and individual differences in true and false memory across the lifespan. Humboldt-Universität zu Berlin.

Fleischhut, Nadine (2013). Moral judgment and decision making under uncertainty. Humboldt-Universität zu Berlin.

Freier, Monika (2013). Cultivating emotions—Hindi advice literature in late Colonial India. Freie Universität Berlin.

Frey, Renato (2013). In the twilight of uncertainty: Decisions about monetary risks, life, and death. University of Basel.

Gresch, Cornelia (2011). Der Übergang von der Grundschule in die Sekundarstufe I bei Kindern mit Migrationshintergrund: Schulische Voraussetzungen, Bildungsaspiration und die Bildungsentscheidung vor dem Hintergrund rechtlicher Regelungen. Humboldt-Universität zu Berlin.

Hachfeld, Axinja (2012). Cultural beliefs and professional competences of teacher candidates for teaching in culturally diverse classrooms. Freie Universität Berlin.

Jenny, Mirjam (2013). Modeling how people judge, choose, and change their mind: The cognitive processes underlying probability judgments and belief revisions. University of Basel.

Kämmer, Juliane E. (2013). How people make adaptive decisions with (the help of) others: Studies from an ecological rationality perspective. Humboldt-Universität zu Berlin.

Martin, Shirley Ann (2011). Grounding tools that travel: Ideology, research style, and imagined community in the circulation of inferential statistics, 1918–1966. University of Chicago.

Multmeier, Jan (2012). Representations facilitate Bayesian reasoning: Computational facilitation and ecological design revisited. Freie Universität Berlin.

Noack, Hannes (2012). Limits in spatial cognition: Probing behavioral and brain plasticity in aging. Humboldt-Universität zu Berlin.

Papenberg, Goran (2012). Contributions of intra-individual variability and dopaminergic modulation to episodic memory in old age. Freie Universität Berlin.

Passow, Susanne (2012). Attentional control of auditory perception: Age-related differences and genetic modulation. Freie Universität Berlin.

Ruggeri, Azzurra (2012). Opening up the cuebox: A developmental perspective. Humboldt-Universität zu Berlin.

Sajjad, Mohammad (2012). Loving the master? The debate on appropriate emotions in North India (ca. 1750–1830). Freie Universität Berlin.

Sander, Myriam C. (2011). Lifespan age differences in working memory: Insights from behavioral and electrophysiological markers of capacity and selectivity. Humboldt-Universität zu Berlin.

Sänger, Johanna (2013). Within- and between-brain synchronization phenomena as neural correlates of interpersonal action coordination in guitar duets. Humboldt-Universität zu Berlin.

Schuck, Nicolas W. (2013). Aging and functional reorganization of striatum- and medial-temporal lobe-dependent memory system. Humboldt-Universität zu Berlin.

Sonnenberg, Bettina (2013). Unemployment and social involvement: Dependencies and mechanisms. Findings from the Socio-Economic Panel Study (SOEP). Freie Universität Berlin.

Störmer, Viola S. (2011). Adult age differences in visual attention and working memory: Neural and behavioral evidence on early selection and updating. Humboldt-Universität zu Berlin.

Suter, Renata (2012). Utilitarian and non-utilitarian models of risky and moral choice. University of Basel.

Volstorf, Jenny (2013). Against all noise: On noise-robust strategies in the emergence of cooperation. Humboldt-Universität zu Berlin.

Wichert, Frank (2012). Illusion of certainty: Gewissheitssuche und kognitive Fehleinschätzungen aus evolutions-psychologischer Perspektive. Freie Universität Berlin.

Wolff, Julia K. (2011). Social support and subjective health as within-person processes: Adult age differences in intraindividual variability and in associations between social support measures and physical and emotional well-being. Humboldt-Universität zu Berlin.

Master's and Diploma Theses

Berwald, Julian (2011). Der Einfluss des Sprachhintergrundes auf die orthographische Verarbeitung. Freie Universität Berlin.

Blanke, Elisabeth (2011). Ich weiß, was du fühlst: Empathische Akkuratheit in Paarbeziehungen junger und älterer Erwachsener. Freie Universität Berlin.

Brünger, Aline Carina (2013). Diffusion MRI of motor plasticity after writing training of the non-preferred hand. Freie Universität Berlin.

Cordi, Maren (2011). Memory belief: Lifespan age differences and its relation to episodic memory performance. University of Tübingen.

Czienskowski, Paul (2012). Qualitätsgewinne von Quelllokalisation im EEG durch individuelle Hirnmodelle in altersvergleichenden Studien. Technische Universität Berlin.

Delfino, Alexia (2013). Enticed by popularity: Decision making with social cues in the internet era. Sant' Anna School of Advanced Studies of Pisa.

Divjak, Bojana (2011). Erste Kompetenzen im Umgang mit Information und Informationssuche: Kopf oder Bauch. Ludwigsburg University of Education.

Frisch, Simon (2013). Instrumentelle Affektregulation durch Musik über die Lebensspanne. Technische Universität Dresden.

Gaca, Maike (2013). Context-dependency of action perception in infants. Freie Universität Berlin.

Großmann, Julia (2011). Geschlechtsspezifische Differenzen in Gruppeninteraktionen: Ein Vergleich von Diktatorspielen in unterschiedlichen Altersgruppen. Freie Universität Berlin.

Hoffmann, Timm (2012). Die Demokratisierung der Schule: Die West-Berliner Schülerproteste zwischen 1967 und 1971. Humboldt-Universität zu Berlin.

Jakobs, Perke (2013). A competitive test of heuristics for choice from serially dependent sequences. Tilburg University.

Josef, Anika (2013). Age-differences in memory-based decisions: A task complexity manipulation. University of Basel.

Karch, Julian David (2012). Combination of classifiers to increase accuracy of EEG classification. Freie Universität Berlin.

Kastner, Hanna S. (2013). Neuronal correlates of symptoms of delusion. Humboldt-Universität zu Berlin.

Meyberg, Susann (2011). The microsaccadic lambda response as an attentional probe: A study using simultaneous ERP and eye-movement recordings. Humboldt-Universität zu Berlin.

Müller, Maike (2011). Child development of perceptual and attentional influences on auditory processing in dichotic listening. Humboldt-Universität zu Berlin.

Schilling, Florian (2012). Entwurf eines verteilten Systems für die Klassifikation multivariater Zeitreihen im psychophysiologischen Kontext. Freie Universität Berlin.

Schmidt, Dominique (2011). The effect of temporal outcome delay on the voluntary provision of public goods. Freie Universität Berlin.

Siegler, Sebastian (2013). Sieben Werkzeuge aus dem Leben berufstätiger Elternpaare: Eine Untersuchung zum Spillover von psychischer Befindlichkeit von der Arbeit in die Freizeit. Freie Universität Berlin.

Sievers, Gianni (2012). Time and place in the Musaddas-e Hali: Romanticism in late 19th c Delhi. Freie Universität Berlin.

Volhard, Jakob A. (2013). Brain synchronization and phase locking during perception of static and dynamic facial emotional expressions. Freie Universität Berlin.

Westphal, Andrea (2011). Mehr als nur ein Lächeln: Alterseffekte in der Erkennung von Emotionen in Lächelausdrücken. Leipzig University.

8. Research and Professional Staff 2011–2013



Assmann, Wolfgang
(Diploma in Business Informatics, 1973, Freie Universität Berlin; Diploma in Pedagogy, 1978, Freie Universität Berlin; Head of Central IT Unit): Service management in re-

search institutions; information technology in the social and behavioral sciences.



Bodammer, Nils C.
(Dr. rer. nat. in Physics, 2005, Otto-von-Guericke-Universität Magdeburg; Head of MR Physics): Diffusion imaging and other quantitative MR methods in neuroscience and aging research. (LIP)



Bos, Wouter van den (M.A. in Philosophy, 2004, University of Amsterdam; M.Sc. in Cognitive Science, 2006, University of Amsterdam; PhD in Psychology, 2011, Leiden University):

Development; decision making; learning; neuroimaging; computational modeling; connectivity analyses; social behavior. (ARC)



Brandmaier, Andreas M.
(Diploma in Computer Science, 2008, Technische Universität München; Dr. rer. nat., 2012, Saarland University):

Brain-behavior relations across the lifespan; multivariate developmental methodology; formal models of behavioral change; machine learning and data mining; statistical and algorithmic modeling. (LIP)



Brauer, Juliane
(M.A. in History and Musicology, 2001, Humboldt-Universität zu Berlin; Dr. phil. in Politics, 2007, Freie Universität Berlin):

Music making as an emotional practice; music education and singing in Germany; his-

tory of education; music and torture; emotions and learning history; culture and practices of remembrance in European contexts; popular history culture. (HoE)



Brehmer, Yvonne
(Diploma in Psychology, 2003, Saarland University; Dr. rer. nat., 2006, Humboldt-Universität zu Berlin; Otto Hahn Research Group Leader):

Cognitive plasticity in childhood and old age; memory training across the lifespan; neural correlates of age-related cognitive changes. (LIP)



Brighton, Henry
(B.Sc. [Hons.] in Artificial Intelligence and Computer Science, 1996, University of Edinburgh; M.Sc. in Cognitive Science, 1997, University of Edinburgh; PhD in Cognitive Science, 2003, University of Edinburgh):

Formal and computational models of inference, decision making and language evolution. (ABC)



Conradt, Larissa
(Diploma in Biology, 1993, University of Tübingen; PhD in Behavioural Ecology, 1998, University of Cambridge):

Animal collective decisions; conflict resolution; evolution of decision behaviors. (ARC)



Czienskowski, Uwe
(Diploma in Psychology, 1990, Freie Universität Berlin; Dr. phil. in Psychology, 1995, Freie Universität Berlin; Diploma in Computer Science, 2007, University of Applied

Sciences, Trier): Software development for scientific research; experimental design and analysis; meta-analysis; general statistics; philosophy and history of science. (ABC)



Delius, Julia A. M.
(Dr. med., 1993, Goethe University Frankfurt a. M.; Editorial Coordinator, Interim LIFE Program Manager; Online-Editor BASE, LIFE):

Interdisciplinary gerontology. (LIP)



Dettmers, Swantje
(Diploma in Psychology, 2006, University of Münster; Dr. phil. in Educational Sciences, 2010, Freie Universität Berlin):

National and international school achievement research; quality assurance and quality improvement in the educational system; effects of homework assignment on academic achievement. (Emeritus Group Baumert)



Düzel, Sandra
(Dr. rer. nat. in Psychology, 2010, Otto-von-Guericke-Universität Magdeburg; Diploma in Health Science, 2001, Magdeburg-Stendal University of Applied Sciences):

Memory and lifestyle in normal and successful aging; subjective health; brain structure and cognitive aging; structural neuroimaging. (LIP)



Eitler, Pascal (M.A. in History, 2001, Bielefeld University and E.H.E.S.S. Paris; Dr. phil. in Modern History, 2008, Bielefeld University):

Human-animal relationships in modern history; history of the body and the emotions of the 19th and 20th century; history of religion in West Germany. (HoE)



Ellerbrock, Dagmar
(M.A. in History, Public Law, English Literature and Language, 1993, University of Freiburg; Dr. phil. in Modern History, 1999, Bielefeld University; Habilitation in Modern and

Recent History, 2011, Bielefeld University;

Minerva Research Group Leader): Modern German and European history; history of European gun culture; history of violence and peace; international relations, German-American relations; history of emotions; gender history; history of law and society. (HoE)



Engelhardt, Nicole (M.A. in Cultural Anthropology, 2001, University of Cologne; Information Specialist, Subject Librarian, 2003, University of Applied Sciences, Potsdam; Research Librarian):

Scientific electronic information systems, classification, bibliometrics.



Filimon, Flavia (B.A. [Hons.] in Psychology and French, 2001, University of Auckland; M.Sc. in Cognitive Science, 2004, University of California, San Diego; PhD in Cognitive Science, 2008, University of

California, San Diego): Functional neuroimaging, sensorimotor and higher cognitive functions of the human brain; decision making; uncertainty. (ABC)



Flitner, Ursula (M.A. in American Studies and German Literature, 1991, Freie Universität Berlin; State Examination in Library and Information Science, 1995, Senatsverwaltung für Kulturelle Ange-

legenheiten Berlin/Cologne; Head of the Library and Research Information Unit): Information management; electronic resources and networked information systems; digital humanities, virtual research environments.



Fox-Kuchenbecker, Petra (Dr.rer.nat. in Biology, 1995, Humboldt-Universität zu Berlin; Public Relations Specialist, 2003, PR Kolleg Berlin; Communication and Social Skills Trainer, 2011, Freie

Universität Berlin; Head of Public Relations Unit).



Frevert, Ute (Dr.phil. in History, 1982, Bielefeld University; Habilitation in Modern History, 1989, Bielefeld University; Scientific Member of the Max Planck Society; Co-

director of the Institute; Honorary Professor of History, Freie Universität Berlin): Modern social, political, and cultural history; history of emotions, gender history. (HoE)



Gaissmaier, Wolfgang (Diploma in Psychology, 2002, Freie Universität Berlin; Dr.phil. in Psychology, 2007, Freie Universität Berlin; Habilitation in Psychology, 2013, Heidelberg University):

Judgment and decision making; individual differences in decision making; risk perception and communication; memory-based decision making; medical decision making; ecological rationality; models of heuristics. (ABC/Harding Center)



Galesic, Mirta (PhD in Psychology, 2004, University of Zagreb; M.Sc. in Survey Methodology, 2005, Joint Program in Survey Methodology, University of Maryland and University of Michigan):

Judgment and decision making; sampling approaches to cognition; risk communication; survey methodology. (ABC/Harding Center)



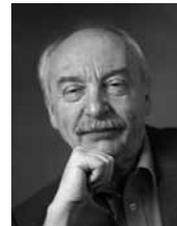
Gammerl, Benno (M.A. in Cultural History, 2000, University of London; M.A. in History, 2003, Freie Universität Berlin; Dr.phil. in Modern History, 2008, Freie Universität Berlin):

History of emotions; contemporary history of homosexuality in Germany; oral history; imperial history; citizenship and nationality. (HoE)



Garrett, Douglas D. (M.A. in Psychology, 2007, University of Toronto; PhD in Psychology, 2011, University of Toronto; Fellow [MPS-UCL Initiative for Computa-

tational Psychiatry and Ageing Research]): Brain signal variability in relation to lifespan development; cognition; neurochemistry; network dynamics; brain structure. (LIP)



Gigerenzer, Gerd (Dr.phil. in Psychology, 1977, Ludwig-Maximilians-Universität Munich; Habilitation in Psychology, 1982, Ludwig-Maximilians-Universität Munich; Fellow of the Max

Planck Society; Co-director of the Institute; Director of the Harding Center for Risk Literacy; Honorary Professor of Psychology, Freie Universität Berlin and Humboldt-Universität zu Berlin; Batten Fellow at the Darden Business School, University of Virginia): Bounded rationality and social intelligence; decisions under uncertainty and time restrictions; competence in risk and risk communication; decision-making strategies of managers, judges, and physicians. (ABC/Harding Center)



Grigull, Britta (M.A. in Art History, Psychology, German Literature, 1999, Christian-Albrechts-Universität zu Kiel; Dr.phil. in Art History, 2004, Christian-Albrechts-Universität zu Kiel; Head of

Public Relations Unit).



Hertwig, Ralph (Diploma in Psychology, 1991, University of Konstanz; Dr.rer.soc. in Psychology, 1995, University of Konstanz; Habilitation in Psychology, 2003, Freie

Universität Berlin; Co-director of the Institute; Honorary Professor of Psychology, Humboldt-Universität zu Berlin): Bounded and social rationality; experience-based decision making; methodology of the social sciences. (ARC)



Herzog, Stefan M.
(B.Sc. in Psychology, 2003, University of Basel; M.Sc. in Psychology, 2005, University of Basel; Dr.phil. in Psychology, 2009, University of Basel): Judgment and decision making;

bounded rationality and heuristics; wisdom of crowds, the crowd within and dialectical bootstrapping; medical decision making, risk communication, and risk perception. (ARC)



Hitzer, Bettina
(First State Examination in History and French, 1999, Freie Universität Berlin; Dr.phil. in History, 2004, Bielefeld University): History of emotions; history of migration; history of religion; history of medicine. (HoE)



Horn, Andreas
(State Examination for Medicine, 2011, University of Freiburg; Dr.med., 2012, University of Freiburg): Cognitive neuroscience; neuroimaging (fMRI and DTI); connectomics; movement disorders. (ARC)



Jensen, Uffa (M.A. in History and Philosophy, 1998, Technische Universität Berlin; Dr.phil. in Modern History, 2003, Technische Universität Berlin): History of emotions; history of knowledge

and human sciences; transnational history; history of psychoanalysis; history of anti-Semitism. (HoE)



Katsikopoulos, Konstantinos V.
(PhD in Industrial Engineering and Operations Research, 1999, University of Massachusetts, Amherst): Theory: models of decision making (prescriptive and descriptive); applications: economics, management, health and safety. (ABC)



Keller, Monika
(Dr.phil. in Psychology, 1974, Heidelberg University; Habilitation in Psychology, 1996, Freie Universität Berlin; Honorary Professor of Psychology, Freie Universität Berlin):

Social rationality; development of perspective taking and theory of mind; socio-moral cognition and emotions in cultural context; moral negotiations in experimental games; socio-moral competence in educational context. (ABC)



Kopp, Franziska
(Diploma in Psychology, 1999, Leipzig University; Dr.rer.nat. in Psychology, 2006, Leipzig University): Social and cognitive development in the first year of life; EEG

in infancy; timing mechanisms of social interaction processes in infants and adults; multisensory perception; memory processes; joint attention; action simulation. (LIP)



Krappmann, Lothar
(Dr.phil. in Sociology, 1969, Freie Universität Berlin; Honorary Professor of Sociology of Education, Freie Universität Berlin): Socialization theory; social and moral development

of children in middle childhood; children's peer interactions, relationships, and groups; links between family and peer relationships; day-care institutions; child rights and children's participation; observational research methodology. (LIP)



Kruse, Imke (Dr.phil. in Political Science, 2005, Freie Universität Berlin; Research Manager, Center for Lifespan Psychology; LIFE Program Manager): Adult development and migration. (LIP)



Kühn, Simone
(Diploma in Psychology, 2006, University of Potsdam; Dr.rer.nat. in Psychology, 2009, Leipzig University; Habilitation in Psychology, 2012, Humboldt-Universität zu

Berlin): Structural and functional neuroimaging; brain plasticity across the lifespan; quantitative meta-analyses. (LIP)



Laukötter, Anja
(M.A. in Modern History, 2001, Humboldt-Universität zu Berlin; Dr.phil. in Modern History, 2006, Humboldt-Universität zu Berlin): Cultural history and the history

of knowledge in the 19th and 20th century; history of emotions; history of ethnology/anthropology and medicine; history of human experiments; history of (post)colonialism; media and cultural theories; history of visualization; history of medical films. (HoE)



Lejarraga, Tomás
(B.A. in Economics, 1999, Washington College; M.Sc. in Management, 2003, Universitat Pompeu Fabra, Barcelona; PhD in Management, 2009, Universitat Pompeu Fabra, Barcelona): Individual and group judgment and decision making under risk and uncertainty; experience-based choice; learning. (ARC)



Lindenberger, Ulman (Dr.phil. in Psychology, 1990, Freie Universität Berlin; Habilitation in Psychology, 1998, Freie Universität Berlin; Fellow of the Max Planck Society; Co-director of the

Institute; Honorary Professor of Psychology, Saarland University, Freie Universität Berlin, and Humboldt-Universität zu Berlin; Chair of the Humanities Section of the Max Planck Society, 2010–2013): Lifespan psychology: theories and methods; behavioral and neural manifestations of plasticity from childhood to old age; sensorimotor and cognitive development; multivariate measurement of change and variability. (LIP)



Luan, Shenghua
(B.A. in Psychology, 1999, Peking University; M.Sc. in Cognitive Psychology, 2002, University of Florida; PhD in Cognitive Psychology, 2004, University of Florida): Heuristics in

judgment and decision making; group decision processes; organizational and managerial decision making; behavioral economics; moral decisions; applied signal detection theory. (ABC)



Mata, Jutta
(Diploma in Psychology, 2004, Humboldt-Universität zu Berlin; Dr. rer. nat. in Psychology, 2008, Humboldt-Universität zu Berlin): Decision making; health; affect; behavior change. (ARC)



Mata, Rui (Licenciatura in Psychology, 2002, University of Lisbon; Dr. phil. in Psychology, 2006, Freie Universität Berlin): Lifespan development of decision making; individual differences in risky

choice under risk and uncertainty. (ARC)



Meder, Björn
(Diploma in Psychology, 2003, University of Göttingen; Dr. rer. nat. in Psychology, 2006, University of Göttingen): Causality and causal cognition; information search; categorization; inductive learning; judgment and decision making; bounded rationality; heuristics. (ABC)



Moussaïd, Mehdi
(M.A. in Behavioral and Cognitive Science, 2007, University of Toulouse; PhD in Ethology, 2010, University of Toulouse/ETH Zurich): Crowds; collective behaviors; self-organization;

complex systems; wisdom of crowds; group decision making; social influence; imitation; herding; pedestrians. (ABC/ARC)



Müller, Viktor
(Dr. rer. soc. in Psychology, 1996, University of Tübingen): Lifespan psychology and aging mechanisms; psychophysiology of social interactions; complexity and brain dynamics;

cortical synchronization: local and global networks; graph-theoretical approach. (LIP)



Müller, Sven Oliver
(M.A. in Modern and Ancient History, 1994, Bielefeld University; Dr. phil. in History, 2001, Bielefeld University; Habilitation in History, 2014, Bielefeld University): History of

emotions; comparative history in Europe; cultural history of the 19th and 20th centuries; behavior of the audience in musical life; history and theories of the nationalism; war of extermination of the Wehrmacht in Eastern Europe, field post letters as communication media. (MPRG Felt Communities)



Nagy, Nicole (Diploma in Psychology, 2004, Bielefeld University; Dr. phil. in Psychology, 2007, Freie Universität Berlin): Development of life goals and self-concepts in educational systems; national and international school achievement

research. (Emeritus Group Baumert)



Nelson, Jonathan D.
(M.Sc. in Cognitive Science, 2002, University of California, San Diego; PhD in Cognitive Science, 2005, University of California, San Diego): Human information search and

learning; philosophy of science and artificial intelligence approaches to experiment selection; judgment and decision making; relationship of perception and cognition. (ABC)



Neth, Hansjörg (PhD in Psychology, 2004, Cardiff University, UK): Heuristic decision making, ecological rationality, rational analysis; judgment under risk and uncertainty, risk perception; multitasking, cognitive foraging, memory search; im-

mediate interactive behavior, embodied and embedded cognition. (ABC)



Olsson, Henrik (PhD in Psychology, 2000, Uppsala University): Computational modeling; judgment and decision making; categorization, estimation, and causal learning; adaptiveness of cognitive

mechanisms to environmental structures; working-memory capacity. (ABC)



Ostwald, Dirk
(First State Examination for Medicine, 2003, Universität Hamburg; M.Sc. in Neural and Behavioral Sciences, 2006, University of Tübingen; PhD in Psychology, 2010,

University of Birmingham; B.Sc. in Mathematics, 2012, FernUniversität in Hagen): Neurocognition. (ARC)



Pachur, Thorsten
(M.Sc. in Health Psychology, 2002, University of Sussex; Diploma in Psychology, 2002, Freie Universität Berlin; Dr. phil. in Psychology, 2006, Freie Universität Berlin; Habilitation in

Psychology, 2012, University of Basel): Decision making; heuristics; computational modeling; memory; risky decision making; individual differences; information search. (ARC)



Pernau, Margrit
(Dr. phil. in Modern History, 1991, Heidelberg University; Habilitation in Modern History, 2007, Bielefeld University; Extraordinary Professor of History, Freie Universität Berlin): Modern Indian history (18th–20th century); history

of emotions; history of modern Islam; transnational history; history of entanglement; historical semantics; comparative studies; translation studies; conceptual history. (HoE)



Plamper, Jan (B.A. in History, 1992, Brandeis University; PhD in History, 2001, University of California, Berkeley; Dilthey Fellow [Fritz Thyssen Foundation]): Russian history (19th–20th century);

history of emotions. (HoE)



Quesada, José (M.A. in Psychology, 1997, University of Granada; PhD in Cognitive Science, 2003, University of Colorado, Boulder/University of Granada): Judgment and decision making; statistical semantics;

predictive modeling; customer lifetime value (CLV); conversion optimization; AB testing; database marketing. (ABC)



Rauers, Antje (Diploma in Psychology, 2005, Freie Universität Berlin; Dr.phil. in Psychology, 2008, Freie Universität Berlin): Affective competencies across adulthood; affective dynamics

between social interaction partners; collaborative cognition. (MPRG Affect)



Riediger, Michaela (Diploma in Psychology, 1997, Humboldt-Universität zu Berlin; Dr.phil. in Psychology, 2001, Freie Universität Berlin; Habilitation in Psychology, 2011, University of Zurich):

Lifespan changes in the interplay of affect, motivation, and cognition; development of affective experiences and competencies; social aspects of motivational and affective processes. (MPRG Affect)



Schaar, Katrin (Diploma in Pedagogy, 1992, Technische Universität Berlin; Dr. phil. in Education, 1997, Freie Universität Berlin; Coordinator BASE-II; Online-Editor BASE-II website): Interdisciplinary gerontology; website design. (LIP)



Schaefer, Sabine (Diploma in Psychology, 2001, Freie Universität Berlin; Dr.phil. in Psychology, 2005, Freie Universität Berlin): Cognitive-sensorimotor coordination across the lifespan; behavioral and neural plasticity; ontogenetic changes in behavior regulation; spatial navigation. (LIP)



Scheer, Monique (B.A. in History, 1989, Stanford University; M.A. in Historical and Cultural Anthropology, 2000, University of Tübingen; Dr. rer. soc. in Historical and Cultural Anthropology, 2006, University of Tübingen): Historical ethnographies of religious groups; emotions and practice theory; visual and material cultures in religious contexts; history of the human sciences, esp. of ethnic diversity. (HoE)



Schellenbach, Michael (Diploma in Computer Science, 2004, Saarland University): Ambient assisted living; spatial cognition; ambulatory assessment. (LIP)



Schmidt, Anne (First State Examination in History and German Language and Literature Studies, 1998, Freie Universität Berlin; Dr. phil. in Modern History, 2004, Bielefeld University): Cultural, economic, and political history; media studies; history of emotions; public history. (HoE)



Schooler, Lael J. (M.Sc. in Cognitive Psychology, 1989, Carnegie Mellon University; PhD in Cognitive Psychology, 1993, Carnegie Mellon University): Adaptation of human memory to the sta-

tistical structure of past and present environments; computational models of human memory; memory's role in judgment and prediction tasks. (ABC)



Schroeder, Sascha (M.A. in Musicology, 2002, University of Cologne; Diploma in Psychology, 2006, University of Cologne; PhD in Psychology, 2008, University of Cologne; Habilitation in Psy-

chology, 2011, Freie Universität Berlin): Cognitive processes in language and text comprehension; reading literacy: assessment of micro- and macrostructural reading skills; research in instruction and learning; quantitative and qualitative methods in empirical research. (MPRG REAd)



Shing, Yee Lee (M.A. in Educational Psychology, 2003, University of Georgia, Athens; Dr. rer. nat. in Psychology, 2008, Humboldt-Universität zu Berlin; Minerva Research Group Leader): Life-

span and developmental psychology theories; development and plasticity of cognitive mechanisms over the lifespan; multivariate analyses of change and variability; neural correlates of cognitive developmental and aging processes. (LIP)



Şimşek, Özgür (M.Sc. in Industrial Engineering and Operations Research, 1997, University of Massachusetts, Amherst; M.Sc. in Computer Science, 2004, University of Massachusetts, Amherst; PhD

in Computer Science, 2008, University of Massachusetts, Amherst): Machine learning; artificial intelligence; decision heuristics; complex networks. (ABC)



Skork, Kerstin (M.A. in German Literature, Psychology, and Sociology, 2005, Goethe University Frankfurt a. M.; Acting Head of Public Relations Unit): Integrated communications; scientific communication; corporate publishing; event management.



Tiffin-Richards, Simon (B.Sc. in Psychology, 2006, University of Reading; M.Sc. in Methods in Psychology, 2007, University of Reading; Dr.phil. in Psychology, 2011, Freie Universität Berlin):

Reading acquisition and comprehension; eye movements during reading; English as a foreign language; validity issues in educational research. (MPRG REaD)



Verrel, Julius (DEA in Mathematics, 2001, Jussieu, Paris; M.Sc. in Cognitive Neuroscience, 2006, Radboud University, Nijmegen; Dr. rer. nat. in Psychology, 2011, Humboldt-Universität zu Berlin):

Motor development and aging; movement variability and coordination; cognitive aspects of motor behavior; neural representation of body and action. (LIP)



Voelkle, Manuel C. (Dr. rer. soc., 2008, University of Mannheim): Longitudinal research methods; structural equation models; learning and skill acquisition; various aspects of differential psychology; evaluation research. (LIP)



Wegwarth, Odette (Diploma in Psychology, 2003, University of Potsdam;

Dr. rer. nat. in Psychology, 2007, Humboldt-Universität zu Berlin):

Medical decision making; risk communication in medicine; patients' and doctors' understanding of risk; influence of transparent medical statistics on patients' and doctors' decision. (ABC/Harding Center)



Werkle-Bergner, Markus (Diploma in Psychology, 2004, Saarland University;

Dr. rer. nat. in Psychology, 2009, Humboldt-Universität zu Berlin):

Lifespan development of memory and cognitive control functions; neuronal correlates of lifespan plasticity and change; EEG methods in lifespan research; multivariate statistical models of variability and change. (LIP)



Woike, Jan K. (Diploma in Psychology, 2001, Ruhr-Universität Bochum; Dr. phil. in Psychology, 2008, Ruhr-Universität Bochum):

Ecollogical rationality; human cognition and heuristics; behavioral economics; development of online applications for interactive group research; destructive competition; distributive fairness; decision making in economic contexts; personal identity; philosophy of biology. (ARC)



Wrzus, Cornelia (Diploma in Psychology, 2005, University of Potsdam; Dr. phil. in Psychology, 2008, University of Potsdam):

Development and individual differences in affect and affect regulation; physiological correlates of affective experiences; assessment and analysis of intraindividual variability. (MPRG Affect/Max Planck Fellow)



Zalfen, Sarah (Diploma in Politics, 2004, Freie Universität Berlin; Dr. phil. in Politics, 2010, Freie Universität Berlin):

Music and emotions in community building processes in the 20th century; German political parties; new developments in music education; challenges and new strategies of cultural policy in Europe. (MPRG Felt Communities)

Emeritus Members of the Max Planck Society



Baumert, Jürgen
(State Examination for Teachers, 1968, Universität Hamburg; Dr. phil., 1968, University of Tübingen; Habilitation in Educational Sciences, 1982, Freie Universität Berlin; Fellow of

the Max Planck Society; until 2010 Co-director of the Institute; Honorary Professor of Educational Sciences, Freie Universität Berlin and Humboldt-Universität zu Berlin; Vice President of the Max Planck Society, 2006–2008): Research in learning and instruction; development of cognition and motivation during adolescence and young adulthood; teachers' professional competence; large-scale assessment and international comparison; dynamics of institutional change.



Edelstein, Wolfgang
(Dr. phil. in Medieval Studies, 1962, Heidelberg University; Fellow of the Max Planck Society; until 1997 Co-director of the Institute; Dr. h. c. in Social Science, University of Iceland;

Honorary Professor of Educational Science, Freie Universität Berlin and University of Potsdam): Development and socialization; social-cognitive and moral development and education; democratic competences and citizenship learning; conditions of successful school transformation; developmental and school-related conditions of successful learning.



Roeder, Peter M. (†)
(Dr. phil., 1960, Philipps-Universität Marburg; Habilitation in Educational Science, 1966, Philipps-Universität Marburg; Fellow of the Max Planck Society; until 1995

Co-director of the Institute; Special Professor of Educational Sciences, Freie Universität Berlin): Educational sciences; school research; history of educational science.

Max Planck Fellow



Wagner, Gert G.
(Diploma in Economics, 1978, Goethe University Frankfurt a. M.; Dr. rer. oec. in Economics, 1984, Technische Universität Berlin; Habilitation in Economics, 1992, Technische

Universität Berlin): Behavioral economics; survey methodology; aging; welfare state.

Adjunct Researchers



Artinger, Florian (B.A. [Hons.] in Politics and Economics, 2002, University of Newcastle; M.Sc. in Economics and Management, 2006, Humboldt-Universität zu Berlin; PhD in Economics, 2012, Technische Universität Berlin): Valuation under uncertainty; interaction of decision strategy and environment. (ABC)



Blankenburg, Felix (Medical Degree [Approbation], 1998, Charité/Humboldt-Universität zu Berlin; Dr. med., 2001, Freie Universität Berlin): Cognitive neuroscience; neuroimaging; neurocomputation. (ARC)



Boddice, Rob (B.A. [Hons.] in History, 1999, University of York; M.A. [Dist.] in Modern History, 2003, University of York; PhD in History, 2006, University of York): History of science and medicine; Darwin and evolution; gender history; history of masculinities; history of human-animal relations; history of emotions; modern British history. (HoE)



Bortoleto, Ana Paula (M.Eng., 2006, University of Tokyo; PhD in Engineering, 2009, University of Tokyo): Life cycle assessment; municipal solid waste management; waste prevention; environmental urban issues; environmental behavior modeling; behavioral change policies. (ABC)



Cokely, Edward T. (PhD in Cognitive Psychology, 2007, Florida State University): Psychology of superior decision making; specializing in assessment and modeling of individual differences (e.g., cognition, abilities, biases); applica-

tions in health, finance, and education (e.g., decision support, risk literacy, consumer protection, usability, training). (ABC)



Feufel, Markus A. (Diploma in Engineering [FH] in Audiovisual Media, 2003, Stuttgart Media University; M.Sc. in Human Factors and Psychology, 2006, Wright State University, Dayton);

PhD in Human Factors and Psychology, 2009, Wright State University, Dayton): Bounded rationality; influence of technology on cognitive and social functions; transparent communication practices and informed (medical) decision making. (ABC/Harding Center)



García-Retamero, Rocio (B.A. in Psychology, 2000, University of Jaén; PhD in Psychology, 2005, University of Granada): Risk perception and communication; shared decision making; physician trust;

medical decision making; group decision making; learning. (ABC)



Heekeren, Hauke R. (Dr. med., 2000, Humboldt-Universität zu Berlin; License for the practice of medicine, 2000): Neuro-biology of perceptual decision making; motivation and affect in

decision making; cognitive and affective components in normal and disturbed social cognition; multimodal neuroimaging. (LIP)



Li, Shu-Chen (B.Sc. in Psychology, 1990, Oklahoma City University; M.Sc. in Cognitive Psychology, 1991, University of Oklahoma; PhD in Cognitive Psychology, 1994, University of Oklahoma; Habilitation in Psychology, 2006, Freie Universität Berlin): Neuromodulation of perception, cognition, and motivation; behavioral and brain plasticity; computational neuroscience; stress, brain, and cognition; biocultural co-construction of development. (LIP)



Lövdén, Martin (B.Sc. in Psychology, 1998, Lund University; PhD in Psychology, 2002, Stockholm University): Cognitive neuroscience; brain and cognition in adulthood and aging; plasticity; cognitive neuroscience; brain and cognition plasticity in adulthood and aging; intervention studies of interactions among behavior, brain, and cognition. (LIP)



Marewski, Julian N. (Diploma in Psychology, 2005, Freie Universität Berlin; Dr. phil. in Psychology [Decision Sciences], 2009, Freie Universität Berlin): Decision making, memory, and quantitative methods in business and beyond; decision making, memory, the environment, and other aspects of cognition; quantitative (e.g., ACT-R) modeling. (ABC)



Martignon, Laura (Licenciatura en Matemática, 1971, Universidad Nacional de Colombia; Diploma in Mathematics, 1975, University of Tübingen; Dr. rer. nat., 1978, University of Tübingen; Habilitation in Neural Information Processing, 1998, Ulm University): Mathematics education; decision making; neuroinformatics. (ABC)



Mousavi, Shabnam (PhD in Economics, 2002, Virginia Polytechnic Institute; PhD in Statistics, 2006, Virginia Polytechnic Institute): Managerial and market irrationalities; behavioral decision theory; axiomatization of bounded rationality; alternative solution concepts; statistical process control; nature of uncertainty; wisdom as a heuristic; characterizing known and unknown; less-is-more phenomena. (ABC)



Multmeier, Jan (Diploma in Psychology, 2008, Bielefeld University; Dr. phil. in Psychology, 2011, Freie Universität Berlin): Delivery science; judgment and decision making; risk literacy. (ABC/Harding Center)



Oertzen, Timo von (Diploma in Computer Science, 1999, Saarland University; B.A. in Psychology, 2001, Saarland University; PhD in Computer Science, 2003, Saarland University; Habilitation in Psychology, 2013, Humboldt-Universität zu Berlin): Optimization of the translation of resources into scientific information by (1) developing methods to optimize study designs, and (2) extracting a maximum of information from existing data. (LIP)

University in New South Wales): Projects in economics, finance, botany, zoology, physics, psychology, mental health; Stages of Knowledge Ahead Theory. (ABC)



Pope, Robin (B.A. [Hons.] in Economics, 1961, University of New England; M.A. in Economics, 1969, Monash University; M.A. in Econometrics, 1972, Ohio State University; PhD in Economics, 1987,

University in New South Wales): Projects in economics, finance, botany, zoology, physics, psychology, mental health; Stages of Knowledge Ahead Theory. (ABC)



Schmiedek, Florian (Diploma in Psychology, 2000, University of Mannheim; Dr. phil. in Psychology, 2003, Freie Universität Berlin): Cognitive lifespan psychology; intraindividual variability and plasticity of cognitive performance; models for response times; multivariate models for developmental processes; structural equation modeling, multilevel modeling, time series analysis. (LIP)



Schuurman, Jan Gerrit (M.A. in Psychology, University of Groningen; PhD in Educational Technology, Technical University of Twente): decision making in health care. (ABC)



Stevens, Jeffrey R. (B.Sc. in Biology, 1996, Baylor University; PhD in Ecology, Evolution, and Behavior, 2002, University of Minnesota): Animal cognition; cooperation; evolution of decision making; intertemporal choice, social networks. (ABC)



Sela-Teichler, Yael (B.Mus. in Music, 1999, Hebrew University of Jerusalem; M.St. in Historical Musicology, 2003, University of Oxford; Dr. phil. in Historical Musicology, 2010, University of Oxford):

Sociocultural history of music (16th–19th century); German-Jewish history; emotions in aesthetic theories of the Enlightenment; cultural memory; theories of performativity; music as discursive practice. (MPRG Felt Communities)



Taleb, Nassim N. (MBA, University of Pennsylvania; PhD in Management Science, University of Paris): Decision making under opacity; epistemology of probability; mathematical expressions

of model errors and metaprobability; ancient heuristics and Mediterranean systems of ethics. (ABC)



Todd, Peter M. (B.A. in Mathematics, 1985, Oberlin College; M.Phil. in Computer Speech and Language Processing, 1986, Cambridge University; M.A. in Psychology, 1987, UC San Diego; PhD in

Psychology, 1992, Stanford University): Simple heuristics for decision making; evolution of behavior; food choice; mate choice; search behavior and cognition. (ABC)



Wheeler, Gregory (M.A. in Philosophy, 1995, Colorado State University; PhD in Philosophy and Computer Science, 2002, University of Rochester): Probability theory (foundations, causal and statistical

reasoning); logic (philosophical, computational, applied); cognitive science (judgment and decision making, bounded rationality. (ABC)

Postdoctoral Fellows



Artinger, Sabrina (M.Sc. in Economics and Management Sciences [Dist.], 2007, Humboldt-Universität zu Berlin; PhD in Economics, 2011, Humboldt-Universität zu Berlin): Judgment and decision

making; behavioral economics; social rationality; entrepreneurship; leadership. (ABC)



Bartling, Karen (Drs. in Psychology, 2006, Maastricht University; Dr. rer. nat. in Psychology, 2010, Humboldt-Universität zu Berlin): Social and cognitive development in infancy; physiological correlates of early

social interaction (ECG, EEG). (LIP)



Beljan, Magdalena (M.A. in Literature Studies, History, and Text Technology, 2006, Bielefeld University; PhD in Literature, 2010, University of Luxembourg): History of emotions and of the body; gender

and literary theory; media history. (HoE)



Bergert, Bryan (PhD in Psychology, 2008, Indiana University): Empirical and theoretical studies of classification and decision making; improvement of mathematical modeling techniques. (ABC)



Bodemer, Nicolai (Diploma in Psychology, 2009, University of Mannheim; Dr. rer. nat. in Psychology, 2012, Humboldt-Universität zu Berlin): Risk perception/risk communication; risk literacy;

medical decision making; consumer behavior; meta-analysis. (ABC/Harding Center)



Bongrand, Philippe (B.A. in Sociology, 2001, Université Paris 5; M.A. in Political Science, 2001, Université Paris 1; M.A. in Social Sciences, 2002, Université Paris 5; PhD in Political Science, 2009, Uni-

versité de Picardie/CNRS, CURAPP): Emotions in the schooling process; educational systems; public policies; governmentality; affirmative action policies. (HoE)



Brick, Timothy R. (M.Sc. in Computer Science and Engineering, 2007, University of Notre Dame; PhD in Psychology, 2011, University of Virginia): Synchronization and nonverbal communi-

cation in conversation; affect and facial expression; sensory integration; structural equation modeling; multilevel modeling; machine learning and data mining. (LIP)



Brose, Annette (Diploma in Psychology, 2006, Freie Universität Berlin; Dr. rer. nat. in Psychology, 2009, Humboldt-Universität zu Berlin): Intraindividual variability and intraindividual

change; linkages between emotion, motivation, and cognition; stress reactivity and affective dynamics. (LIP)



Brückenhaus, Daniel (M.A. in History and Sociology, 2004, Bielefeld University; PhD in History, 2011, Yale University): History of the European colonial empires; history of government surveillance;

history and social theory; history of emotions. (HoE)



Burzynska, Agnieszka Zofia (B.Sc. in Biotechnology, 2005, University of Perugia/University of Gdansk; M.Sc. in Neuroscience, 2007, University of Göttingen; LIFE Fellow; Dr. rer. nat. in Psy-

chology, 2010, Humboldt-Universität zu Berlin): Effects of physical exercise on the brain; neural mechanisms of brain aging and plasticity; diffusion tensor imaging; resting state and structural MRI. (LIP)



Eppinger, Ben (Dr. phil. in Psychology, 2008, Saarland University): Lifespan development; goal-directed learning and decision making; neural and computational systems of motivation and control. (LIP)



Erol, Merih (B.Sc. in Electric and Electronics Engineering, 1997, Boğaziçi University; M.A. in Sociology, 2001, Boğaziçi University; PhD in History, 2009, Boğaziçi University): The modern Middle

East and the Balkans; empire and nationalism studies; history of Southeastern Europe; Ottoman cultural history; history of emotions in late Ottoman Empire. (HoE)



Fandakova, Yana (Diploma in Psychology, 2008, Humboldt-Universität zu Berlin; LIFE Fellow; Dr. rer. nat. in Psychology, 2012, Humboldt-Universität zu Berlin): Memory development and its

neuronal correlates; age differences in episodic memory; episodic memory development across the lifespan; multivariate modeling of variability and change; functional and structural neuroimaging. (LIP)



Fific, Mario (Joint PhD in Cognitive Psychology and Cognitive Science, with Certificate in Mathematical Modeling, 2005, Indiana University): Development of a general information processing model of human cognition; process tracing techniques; selection of decision strategies; visual and memory search and perceptual categorization. (ABC)



Filevich, Elisa (M.Sc., Licenciada in Biological Sciences, 2008, University of Buenos Aires; PhD in Neuroscience, 2013, University College London): Metacognition across perceptual and cognitive domains; individual differences; links between brain structure and high order meta-cognitive functions. (LIP)



Fleischhut, Nadine (M.A. in Analytical Philosophy, 2006, Freie Universität Berlin; Dr. rer. nat. in Psychology, 2013, Humboldt-Universität zu Berlin): Social judgment and decision making; modeling decision making in social interaction; social and ecological rationality; moral judgment and decision making. (ABC/ARC)



Freunberger, Roman (Diploma in Psychology, 2006, University of Salzburg; Dr. rer. nat. in Psychology, 2009, University of Salzburg): Cognitive neuroscience; functional meaning of brain oscillatory behavior for memory processes; psychometrics. (LIP)



Frey, Renato (M.Sc. in Psychology, 2008, University of Basel; Dr. phil. in Psychology, 2013, University of Basel): Decision making under risk and uncertainty; computational modeling of cognition; experienced-based decisions making;

reinforcement/temporal-difference learning; medical decision making, e.g., surrogate decision making. (ARC)



Garcia, Luis-Manuel (B.Mus. in Music History and Culture, 2002, University of Toronto; M.A. in Music, 2004, University of Toronto; Dr. phil. in Music, 2011, University of Chicago): Electronic dance music; urban music scenes and tourism; affect, touch, and intimacy in music and dance; stranger-sociality in crowds/audiences; sexuality and queer theory. (MPRG Felt Communities)



Häberlen, Joachim C. (M.A. in History, 2006, University of Chicago; PhD in History, 2011, University of Chicago): History of emotions in 20th-century European protest movements. (HoE)



Hämmerer, Dorothea (Diploma in Psychology, 2005, University of Freiburg; Dr. rer. nat. in Psychology, 2009, Humboldt-Universität zu Berlin): Lifespan age differences in performance monitoring and cognitive control; lifespan age difference in reinforcement learning; behavioral plasticity following noninvasive brain stimulation; comparability of EEG measures in different age groups. (LIP)



Harikos, Wasilios (B.A. in Philosophy and Economics, 2005, University of Bayreuth; M.A. in Philosophy and Economics, 2009, University of Bayreuth; PhD in Economics, 2013, University of Erfurt): Heuristics; learning from experience; stochastic game theory; social preferences. (ABC)



Herfeld-Schild, Marie Louise (M.A. in Musicology, Philosophy, and Law, 2007, Heidelberg University; Dr. phil. in Musicology, 2013, Freie Universität Berlin): Music and emotion; sacred music; ancient, 19th- and 20th-century music, music theory and aesthetics; music and mathematics, philosophy and psychology; film music. (MPRG Felt Communities)



Horn, Sebastian S. (Diploma in Psychology, 2007, University of Freiburg; Dr. rer. nat. in Mathematical and Cognitive Psychology, 2012, Heinrich Heine University Düsseldorf): Development of decision making and memory across the lifespan; modeling of elementary psychological processes (multinomial models, diffusion models); cognitive aging. (ARC)



Jenny, Mirjam A. (M.Sc. in Psychology, 2009, University of Basel; Dr. phil. in Psychology, 2013, University of Basel): Judgment and decision making; subjective probability judgment; decision aids in medical decision making; computational cognitive modeling; scientific publication processes. (ARC)



Kämmer, Juliane E. (Diploma in Psychology, 2009, Humboldt-Universität zu Berlin; Dr. rer. nat. in Psychology, 2013, Humboldt-Universität zu Berlin): Heuristics in group decision making; social and ecological rationality; determinants of the perception of expertise. (ABC/ARC)



Kia, Mana (B.A. in International Studies, 1997, Vassar College; M.A. in Near Eastern Studies, 2001, New York University; PhD in History and Middle Eastern Studies, 2011, Harvard Uni-

versity): Social and cultural history; Iran; India; emotions; gender; early modern history; modern history; literary studies; Indian Ocean; transregional mobility; ethics; intellectual history. (HoE)



Kothiyal, Amit (M.A. in Statistics, 2005, Indian Statistical Institute, Kolkata; PhD in Economics, 2012, Erasmus University, Rotterdam): Decision making under risk and uncertainty. (ABC)



Kouline, Laura (B.A. [Hons.] in History, 2006, University of Exeter; M.Phil. in Early Modern History, 2007, University of Cambridge; PhD in History, 2013, University of Cambridge): Personhood, identity, self-narratives, and emotions in early modern Europe; history of law; gender history; religion. (HoE)



Liu, Tian (B.Sc. in Applied Mathematics, 2001, Fudan University, Shanghai; M.Sc. in Statistics, 2004, University of Florida; PhD in Statistics, 2007, University of Florida): Genome-wide association studies (GWAS); assessment of gene-gene and gene-environment interactions; longitudinal and cross-sectional data analysis; applications of Bayesian modeling in statistical genetics. (LIP)



Luong, Gloria (B.A. in Psychology, 2006, University of California, Riverside; M.A. in Social Ecology, 2008, University of California, Irvine; PhD in Psychology and Social Behavior, 2012, University of California, Irvine): Emotion regulation; social relationships; health and well-being; aging. (MPRG Affect/Max Planck Fellow)



Mårtensson, Johan (M.A. in Social Science, 2007, Lund University; PhD in Psychology, 2012, Lund University): Experienced-dependent brain plasticity; language learning. (LIP)



McDowell, Michelle (B.A. in Psychology, 2005, Griffith University, Brisbane; Dr. phil. in Philosophy/Psychology, 2011, Griffith University, Brisbane): Risk perception; decision making; judgment; heuristics; rationality. (ABC/Harding Center)



Morais, Ana Sofia (M.Sc. in Psychology, 2004, University of Lisbon; Dr. rer. nat. in Psychology, 2010, Humboldt-Universität zu Berlin): Information search in internal and external environments; judgment and decision making under uncertainty; lifespan development of cognitive abilities; computational modeling in cognition. (LIP)



Nielsen, Philipp (B.Sc. [First Class Hons.] in International Relations and History, 2005, School of Economics and Political Science, London; M.Sc. [Dist.] in History of International Relations, 2006, School of Economics and Political Science, London; PhD in History, 2012, Yale University): Political and cultural history; politics and emotions, constitutional theory and law; history of architecture and design; Jewish history; gender studies. (HoE)



Noack, Hannes (Diploma in Psychology, 2007, University of Potsdam; PhD in Psychology, 2012, Humboldt-Universität zu Berlin): Behavioral and brain plasticity; lifespan development of spatial cognition. (LIP)



Olsen, Stephanie (B.A. [Hons.] in International Studies, 2001, York University; M.A. in History, 2003, University of British Columbia; PhD in History, 2009, McGill University): Modern social and cultural history of Britain and Empire; history of emotions; gender and family history; history of childhood and youth; history of education and religion. (HoE)



Papenberg, Goran (Diploma in Psychology, 2009, Humboldt-Universität zu Berlin; Dr. phil. in Psychology, 2012, Freie Universität Berlin): Neuromodulation of episodic memory; intraindividual variability; interindividual variability in cognitive aging; functional and structural neuroimaging. (LIP)



Pedersen, Arthur Paul (B.A. in Philosophy, 2005, University of Wisconsin-Madison; B.A. in Mathematics, 2005, University of Wisconsin-Madison; M.Sc. in Logic, Computation, and Methodology, 2009, Carnegie Mellon University; PhD in Logic, Computation, and Methodology, 2012, Carnegie Mellon University): Epistemology; normative and behavioral decision theory; game theory; cognitive heuristics; probability theory. (ARC)



Perdakis, Dionysios (Diploma in Electrical and Computer Engineering, 2006, Aristotle University of Thessaloniki; PhD in Theoretical Neuroscience, 2011, University of Mediterranean Marseille): Theoretical and cognitive neuroscience; social and affective neuroscience; cognitive science; nonlinear dynamics; complex systems (brain, cognitive, social). (LIP)



Prindle, John J. (B.A. in Economics, 2006, University of California, San Diego; B.Sc. in Psychology, 2006, University of California, San Diego; M.A. in Psychology, 2008, University of Southern California; PhD in

Psychology, 2012, University of Southern California): IRT response time modeling; CART analyses with SEM; continuous time modeling with change scores; diffusion modeling. (LIP)



Ruggeri, Azzurra (B.A. in Philosophy, 2008, University of Pisa; M.A. in Philosophy, 2008, University of Pisa; Dr.rer.nat. in Psychology, 2012, Humboldt-Universität zu Berlin): Development of search

for information and inquiry strategies across the lifespan; children's decision making; processes of hypothesis generation, evaluation, and testing. (ABC)



Sander, Myriam C. (Diploma in Psychology, 2007, Humboldt-Universität zu Berlin; Dr.rer.nat. in Psychology, 2011, Humboldt-Universität zu Berlin): Development of perception and memory across the lifespan;

neural correlates of developmental change and brain plasticity; EEG methods. (LIP)



Schuck, Nicolas W. (Diploma in Psychology, 2010, Humboldt-Universität zu Berlin; LIFE Fellow; Dr.rer.nat. in Psychology, 2013, Humboldt-Universität zu Berlin): Learning; memory; cognitive

control; dopamine; aging. (LIP)



Schulte-Mecklenbeck, Michael (M.A. in Psychology, 1998, University of Salzburg; PhD in Psychology, 2005, University of Fribourg): Process tracing; food choice; heuristics; decision processes;

information acquisition. (ARC)



Sharma, Yuthika (MLA, 2002, University of Illinois, Urbana-Champaign; DDes in Landscape Studies, 2005, Harvard University; M.Phil., 2006, Columbia University; PhD in Art History,

2013, Columbia University): Entertainment and pleasure in visual culture; nostalgia and the souvenir; vision in early modern and modern painting, music, and iconography. (HoE)



Studtmann, Markus (Diploma in Psychology, 2003, Bielefeld University; Dr.phil. in Psychology, 2009, Ernst Moritz Arndt University of Greifswald): Facial expressions of emotions;

emotional development across the adult lifespan; perceived versus actual emotional behavior; emotion recognition. (MPRG Affect)



Suter, Renata S. (M.Sc. in Psychology, 2008, University of Basel; Dr.phil. in Psychology, 2012, University of Basel): Computational modeling of cognition; theory integration; decision making under

risk and uncertainty; intertemporal choice; moral decision making. (ARC)



Vagharchakian, Laurianne (PhD in Physics, 2003, Université Paris 6): Cognitive sciences; neuroimages (fMRI); social heuristics and decision making. (ABC)



Vidor, Gian Marco (Joint PhD in Modern History and Anthropology, 2008, Université de Versailles/Saint-Quentin-en-Yvelines/Scuola Internazionale in Scienze della Cultura, FSCO, Modena): History of emotions; history and anthropology of dying, death, and grief; history of childhood; history of the body; social history; history of law; history of religions. (HoE)



Wassmann, Claudia (Dr.med., 1990, Heinrich Heine University Düsseldorf; PhD in History, 2005, University of Chicago): Scientific concepts of emotion in experimental psychology and medicine (19th and 20th century). (HoE)

Predocctoral Fellows



Adolf, Janne
(Diploma in Psychology, 2013, Humboldt-Universität zu Berlin): Theoretical and methodological approaches to integrate the intra- and the interindividual perspective on psychological phenomena; measurement invariance. (LIFE/LIP)



Bache, Cathleen
(Diploma in Psychology, 2008, Humboldt-Universität zu Berlin): Sociocognitive development in infancy; physiological correlates of early social interaction (EEG, ECG); joint action in infants and adults. (LIFE/LIP)



Barkoczi, Daniel
(B.A. [Hons.] in Psychology and Sociology, 2010, University of Westminster; M.Sc. in Cognitive and Decision Sciences, 2011, University College London): Social learning; information sampling; ecological rationality; evolution and cognition. (ABC)



Becker, Nina
(Diploma in Psychology, 2012, Freie Universität Berlin): Interindividual differences in memory functioning in adulthood and old age; neural correlates of age-related memory changes. (LIP)



Bengner, Yaara (B.A. in Jewish Studies and International Relations, 2011, Hebrew University of Jerusalem; M.A. in Sociology, 2013, Hebrew University of Jerusalem): Production and commodification of relaxation in tourism; history and sociology of emotional capitalism; history of tourism. (IMPRS Moral Economies/HoE)



Bernet, Tobias (M.A. in Cultural Anthropology and History, 2011, University of Zurich): 19th-/20th-century European and German history; history of urban planning, housing, and social movements; anthropological theories and methods in historical research. (IMPRS Moral Economies/HoE)



Biermann, Tim (M.A. in History, 2010, Bielefeld University): History of music and emotions; cultural studies; theory of history. (MPRG Felt Communities)



Blanke, Elisabeth
(Diploma in Psychology, 2011, Freie Universität Berlin): Empathic processes across the lifespan (with a focus on empathic accuracy); (dyadic) social interaction. (MPRG Affect)



Brink, Tila Tabea
(Diploma in Psychology, 2011, Freie Universität Berlin): Reading development; reading disorders; morphology in reading. (MPRG REaD)



Brod, Garvin
(Diploma in Psychology, 2012, Saarland University): Development of learning and memory; effects of prior knowledge; brain and learning. (LIFE/LIP)



Buchner, Moritz
(M.A. in History, Italian Philology, and Political Science, 2008, Freie Universität Berlin): Cultural history of death, grief, and mourning; nationalism and national movements in Europe; modern history of Germany and Italy. (HoE)



Davidovic, Stojan
(B.Sc. in Economics, 2007, Belgrade University; M.Sc. in Operational Research, 2011, Belgrade University): Economics as a complex system science; resilience concepts and their application to economic system; economic crisis; decision making; different rationality concepts. (ABC)



Donauer, Sabine
(B.A. in European Cultural History, 2006, University of Augsburg; M.A. in European History and Civilization, 2007, Leiden University; M.A. in Higher Education, 2009, Harvard University): History of science; cultural history (19th and 20th century); history of emotions; history of capitalism. (HoE)



Driver, Charles (B.A. in Psychological Science [Hons.], 2012, University of Queensland): Time-series; continuous time modeling; cross-lagged panel design; structural equation modeling; causality; longitudinal data analysis; panel design; inter- and intraindividual differences; intraindividual changes. (LIFE/LIP)



Fechner, Hanna Bettine (Diploma in Social and Economic Communication, 2005, Universität der Künste Berlin; Diploma in Psychology, 2011, Humboldt-Universität zu Berlin): Memory and deci-

sions; computational models of cognition; connections to neural correlates; individual and age-associated differences. (ABC)



Freier, Monika (M.A. in German Literature and South Asian Studies, 2005, Universität Hamburg; Coordinator IMPRS Moral Economies; Research Coordinator): History of emotions; moral economies; advice literature in Hindi; modern South Asian history; languages and literatures. (HoE)



Gerlach, Philipp (B.Sc. in Social Sciences and Psychology, 2011, University of Cologne; M.Phil. in Social and Developmental Psychology, 2012, University of Cambridge): Heuristics in social interaction; social rationality; collective outcomes of individual choices; framing effects; social norms; behavioral game theory. (ARC/ABC)



Grandy, Thomas H. (Diploma in Psychology, 2006, Freie Universität Berlin): Oscillatory networks in the human EEG across the lifespan; EEG methods; neuronal correlates of lifespan plasticity and change; identification of cognitive and neural processes at the individual level. (LIP)



Groot, Timon de (M.A. in Philosophy, 2012, University of Amsterdam; M.A. in History, 2013, University of Amsterdam): History of emotions; history of the self; false shame; ethics and practical philosophy. (IMPRS Moral Economies/HoE)



Hachfeld, Axinja (Diploma in Psychology, 2006, Freie Universität Berlin; Dr. phil. in Educational Science, 2012, Freie Universität Berlin): Early childhood education; professional competences of pedagogical staff; professional and cultural be-

liefs; educational equality; home learning environment; educational aspirations. (Emeritus Group Baumert)



Hasenäcker, Jana (M.A. in Linguistics, 2013, Humboldt-Universität zu Berlin): Processes in early reading development; visual word recognition. (MPRG REaD)



Jacobs, Perke (B.Sc. in Economics, 2011, Maastricht University; M.Sc. in Behavioral Science, 2013, Tilburg University): Heuristics for sequential choice; meta-analysis. (ABC)



Jarecki, Jana (B.Sc. in Economics, 2012, Ludwig-Maximilians-Universität Munich; M.Sc. in Psychology, 2012, Ludwig-Maximilians-Universität Munich): Classification learning; evolutionary psychology; philosophy of science. (ABC)



Jednoralski, Dominik (M.Sc. in Computer Science, 2010, Saarland University): Lifespan technologies; ubiquitous and pervasive computing; artificial intelligence. (LIP)



Josef, Anika (B.Sc. in Psychology, 2011, University of Basel; M.Sc. in Psychology, 2013, University of Basel): Lifespan development of decision making; memory-based decisions; risky decision making; neuronal correlates of age differences in decision making. (LIFE/ARC)



Karch, Julian David (Diploma in Informatics, 2012, Freie Universität Berlin): Artificial intelligence; machine learning; knowledge discovery; pattern classification; multivariate statistics; neuroimaging; lifespan psychology. (LIP)



Kause, Astrid (M.Sc. in Psychology, 2012, University of Klagenfurt): Environmental uncertainty and human behavior; risk communication; social heuristics and fairness. (ABC/Harding Center)



Keller, Niklas (B.Sc. in Psychology, 2003, Goldsmiths University of London; M.A. in International Relations and Diplomacy, 2004, University of London): Medical decision making; military decision making. (ABC)



Kleemeyer, Maike (B.Sc. in Cognitive Science, 2007, Osnabrück University; M.Sc. in Neurosciences, 2010, University of Bremen): Interaction of cognitive and motor skills across the lifespan; neuroplasticity; successful aging. (LIFE/LIP)



Klipker, Kathrin (Diploma in Psychology, 2010, Ruhr-Universität Bochum): Dynamic interplay of affect and cognition over the lifespan; developmental differences in attention and appraisal processes and their relation to the dynamics of affective experiences; individual differences in affective processing as a risk factor for affective disorders. (LIFE/MPRG Affect)



Kottwitz, Anita (B.A. in Social Sciences, 2007, Humboldt-Universität zu Berlin; M.A. in Social Sciences, 2010, Humboldt-Universität zu Berlin): Empirical social research; sociology of health; sociology of the life course; educational research. (LIFE/Max Planck Fellow)



Phillips, Nathaniel (B.A. in Mathematics, 2005, Grinnell College; M.Sc. in Psychology, 2010, Ohio University, Athens): Information search; decisions under uncertainty; mind as a naive statistician. (ARC)



Rajamani, Imke (M.A. in German Language, Literature, and Media, 2011, Universität Hamburg): History of anger and compassion in popular Indian cinema; emotions and multimedia; theorizing emotions in conceptual history. (HoE)



Lisofsky, Nina (B.Sc. in Psychology, 2010, Freie Universität Berlin; M.Sc. in Psychology, 2012, Freie Universität Berlin): Structural plasticity of the brain across the lifespan; influence of hormones on

brain structure; structural plasticity and connectivity of the hippocampus; quantitative meta-analyses of neuroimaging studies. (LIFE/LIP)



Piergias Analytis, Pantelis (M.A. in Cognitive Science, 2009, EHESS Paris): Preference learning; stopping rules; search problems; signaling; metacognition; social influence. (ABC)



Rohringer, Thomas (Mag. phil. in History, 2013, University of Vienna): Gender history; history of emotions; British and Austrian history (19th and 20th centuries). (IMPRS Moral Economies/HoE)



Mrozek, Bodo (M.A. in History, 2007, Freie Universität Berlin): History of youth; history of pop culture; cultural history of the Cold War; urban history; transnational history. (MPRG Felt Communities)



Prestel, Joseph Ben (B.A. in History and Political Science, 2008, Freie Universität Berlin; M.A. in Modern History, 2010, Freie Universität Berlin): History of emotions; urban studies; global history; cities in the 19th century. (HoE)



Rosenauer, Martin (Diploma in Business Administration, 2003, Duale Hochschule Baden-Württemberg Stuttgart; Diploma in Psychology, 2009, Freie Universität Berlin): Decision making, process models, and ecological rationality in the wild; medical and economic decision making; history of finance and money; embodied cognition and the role of sensorimotor learning in numerical cognition. (ABC)



Passow, Susanne (Diploma in Psychology, 2007, Humboldt-Universität zu Berlin; Dr. phil. in Psychology, 2012, Freie Universität Berlin): Age and individual differences in auditory processing and attentional processes; neuromodulation of attention and perception; behavioral measures, EEG, and fMRI. (LIP)



Prinz, Roman (B.Sc. in Cognitive Psychology and Neuroscience, 2011, Maastricht University; M.Sc. in Psychology, 2013, Leiden University): Risk perception and literacy; emotional parameters in patient-physician interactions; decision making and judgment (risky environments); economic behavior. (ABC/Harding Center)



Sajjad, Mohammad (B.A. in Indian History, 2000, Jamia Millia Islamia, New Delhi; M.A. in History of Medieval India, 2002, Jamia Millia Islamia, New Delhi; M.Phil. in History, 2006, Jamia Millia Islamia, New Delhi; PhD in History, 2012, Freie Universität Berlin): Medieval and early modern Indian history; history of emotions and conceptual history; Sufi ideas and practices; history of Islam. (HoE)



Petersen, Malte (Diploma in Psychology, 2009, Freie Universität Berlin; Master of European Studies [M.E.S.], 2011, Humboldt-Universität zu Berlin): Prosocial behavior; fairness; moral decisions; game theory; socialization. (ABC)



Raffington, Laure (B.Sc. in Experimental Psychology, 2010, University of Bristol; M.Sc. in Social, Cognitive, Affective Neuroscience, 2013, Freie Universität Berlin): Developmental association between stress and cognition in childhood using fMRI. (LIP)



Sänger, Johanna (Diploma in Psychology, 2009, University of Konstanz; LIFE Fellow; Dr. rer. nat. in Psychology, 2013, Humboldt-Universität zu Berlin): Synchronization phenomena in interpersonal action coordination. (LIP)



Schleyer, Maritta (M.A. in South Asian Studies, 2006, Heidelberg University): History of Sufism in South Asia; history of Muslims in South Asia; history of Urdu and Hindi literature; Indian nationalism;

history of emotions. (HoE)



Schmitterer, Alexandra (B.A. in Psychology, 2011, University of Erfurt; M.Sc. in Experimental Linguistics, 2013, University of Potsdam): Language acquisition (mono- and multilingual); reading acquisition; cognitive development.

(MPRG REaD)



Schröter, Pauline (B.A. in Psychology, English and American Studies, 2008, TU Dortmund University/University of Newcastle; M.Ed. in Psychology and English Education, 2011, TU Dortmund University; Certificate for Teaching German as a Foreign Language, 2011, TU Dortmund University): German reading acquisition in L2 speakers; visual word recognition and cross-language effects in bilinguals. (MPRG REaD)



Schubenz, Marie (M.A. in Modern History, 2012, Technische Universität Berlin; M.A. in Philosophy, 2012, Freie Universität Berlin): History of emotions; history of social movements; humanist philosophy. (IMPRS Moral Economies/HoE)



Segbers, Jutta (B.Sc. in Clinical Linguistics, 2011, Bielefeld University; M.Sc. in Clinical Linguistics, 2013, Bielefeld University): Input and language acquisition; reading development, vocabulary, and the mental lexicon; print exposure in reading development. (MPRG REaD)



Sinodoru, Hagen (Diploma in Business Administration [FH], 1990, Berlin School of Economics; MBA in General Management, 1995, Anglia Ruskin University, Cambridge): Decision making of institutional investors and heuristic sales strategies. (ABC)



Sonnenberg, Bettina (B.A. in Social Sciences, 2006, Humboldt-Universität zu Berlin; M.A. in Social Sciences, 2009, Humboldt-Universität zu Berlin; LIFE Fellow: Dr. phil. in Sociology, 2013, Freie Universität Berlin): Social inequality, social stratification, empirical education research, applied panel analyses. (Max Planck Fellow)



Spallek, Anabelle (M.A. in History, 2009, Universität Hamburg): Modern European cultural and political history; Western music history. (MPRG Felt Communities)



Steininger, Fabian (M.Ed. in Social Sciences and History, 2013, Freie Universität Berlin): Theories of nationalism; historiology; late Ottoman history. (IMPRS Moral Economies/HoE)



Störmer, Viola S. (Diploma in Psychology, 2008, Humboldt-Universität zu Berlin; LIFE Fellow: Dr. rer. nat. in Psychology/Cognitive Neuroscience, 2012, Humboldt-Universität zu Berlin): Attention; visual attention; visual memory; working memory; multisensory integration; age-related differences in attention and early perceptual processes. (LIP)



Szymanski, Caroline (B.Sc. in Neuroscience, 2008, University of Cologne; M.Sc. in Medical Neuroscience, 2010, Charité/Humboldt-Universität zu Berlin): Interpersonal (action) coordination; EEG hyperscanning. (LIP)



Tan, Jolene H. (Diploma in Mass Communication, 2004, Ngee Ann Polytechnic; B.A. in Business Management with double major in Marketing and Psychology, 2009, Singapore Management University): Social rationality in the moral domain. (ABC)



Wellmann, Henning (Diploma in Political Sciences and Cultural Sciences, 2009, University of Bremen): Music and emotions; cultural studies; poststructuralist theory. (MPRG Felt Communities)



Wenger, Elisabeth (Diploma in Psychology, 2010, Freie Universität Berlin): Brain plasticity across the lifespan; timing and functional nature of anatomical brain changes; structural neuroimaging. (LIFE/LIP)



Wolff, Julia K. (Diploma in Psychology, 2007, Friedrich Schiller University Jena; Dr. rer. nat. in Psychology, 2011, Humboldt-Universität zu Berlin): Intraindividual change and variability; adult development; changes in the interplay of social support and health as well as well-being over the lifespan. (LIP)



Wong, John (B.A. in Cognitive Science, 1999, University of Hong Kong; M.A. in Psychology, 2004, University of Hong Kong; M.Sc. in Cognitive Psychology and Neuroscience, 2009, University of

Pittsburgh): Stopping behavior in information search; eye tracking. (ABC)



Wulff, Dirk U. (Diploma in Psychology, 2010, Philipps-Universität Marburg): Information search; decisions under uncertainty; cognitive modeling; memory. (ARC)

9. Where Have Our Researchers Gone? New Positions 2011–2013

Researchers

Blankenburg, Felix 2013, Freie Universität Berlin, Germany, Professor
Li, Shu-Chen 2012, Technische Universität Dresden, Germany, Professor
Marewski, Julian N. 2011, University of Lausanne, Switzerland, Assistant Professor
Nagy, Nicole 2011, Christian-Albrechts-Universität zu Kiel, Germany, Researcher
Plamper, Jan 2012, Goldsmiths University of London, UK, Professor
Scheer, Monique 2011, University of Tübingen, Germany, Assistant Professor
Schellenbach, Michael 2013, University of Applied Sciences Ruhr West, Germany, Researcher
Stevens, Jeffrey R. 2011, University of Nebraska-Lincoln, USA, Assistant Professor
Wrzus, Cornelia 2013, Johannes Gutenberg University Mainz, Germany, Assistant Professor

Postdoctoral Fellows

Artinger, Florian 2013, University of Warwick, UK, Research Fellow
Bartling, Karen 2012, Stiftung Haus der kleinen Forscher, Berlin, Germany, Consultant for Research and Development
Bongrand, Philippe 2011, Université de Cergy-Pontoise, France, Assistant Professor
Brose, Annette 2013, University of Leuven (KU Leuven), Belgium, Postdoctoral Fellow
Brückenhaus, Daniel 2012, Beloit College, Wisconsin, USA, Assistant Professor
Burzynska, Agnieszka Zofia 2012, University of Illinois, Urbana-Champaign, USA, Postdoctoral Fellow
Eppinger, Ben 2012, Technische Universität Dresden, Germany, Assistant Professor
Erol, Merih 2011, Princeton University, USA, Postdoctoral Fellow
Feufel, Markus A. 2012, Charité Universitätsmedizin Berlin, Germany, Researcher
Fific, Mario 2011, Grand Valley State University, Michigan, USA, Assistant Professor
Freunberger, Roman 2011, BIFIE (Federal Institute for Educational Research), Salzburg, Austria, Researcher
Häberlen, Joachim C. 2013, University of Warwick, Coventry, UK, Assistant Professor
Hämmerer, Dorothea 2012, Technische Universität Dresden, Germany, Researcher
Kia, Mana 2013, Columbia University, New York, USA, Assistant Professor
Noack, Hannes 2013, University of Tübingen, Germany, Postdoctoral Fellow
Papenberg, Goran 2013, Karolinska Institutet, Stockholm, Sweden, Postdoctoral Fellow
Schuck, Nicolas W. 2013, Princeton University, USA, Postdoctoral Fellow
Sela-Teichler, Yael 2013, University of Pennsylvania, USA, Teaching Fellow
Sharma, Yuthika 2013, Goethe University Frankfurt a. M., Germany, International Research Visitor
Wassmann, Claudia 2013, University of Navarra, Spain, Researcher

Predocctoral Fellows

Brink, Tila Tabea 2013, Freie Universität Berlin, Ocuonostics, Germany, Assistant
Donauer, Sabine 2013, Federal Ministry of Education and Research, Bonn, Germany, Consultant
Hächfeld, Axinja 2012, Freie Universität Berlin, Germany, Researcher
Jednoralski, Dominik 2013, TI&M AG, Zurich, Switzerland, Software Engineer
Keller, Niklas 2013, Charité Universitätsmedizin Berlin, Germany, Researcher
Multmeier, Jan 2012, National Association of Statutory Health Insurance Physicians, Berlin, Germany, Statistical Analyst
Passow, Susanne 2011, University of Bergen, Norway, Postdoctoral Fellow
Sajjad, Mohammad 2013, Presidency University, Kolkata, India, Assistant Professor
Sänger, Johanna 2013, Berliner Akademie für Psychotherapie, Germany, Psychotherapy Training
Schleyer, Maritta 2013, University of Bonn, Germany, Lecturer
Sonnenberg, Bettina 2013, University of Tübingen, Germany, Researcher
Störmer, Viola S. 2012, Harvard University, USA, Postdoctoral Fellow
Wolff, Julia K. 2011, German Centre of Gerontology, Berlin, Germany, Researcher

The Max Planck Institute for Human Development, founded in 1963, is a multidisciplinary research establishment dedicated to the study of human development and education. Its inquiries are broadly defined, encompassing evolutionary, historical, social, and institutional contexts of individual human development from infancy to old age. The disciplines of psychology, history, and education, which reflect the current directors' backgrounds, are enriched by the work of colleagues from behavioral and developmental neuroscience, evolutionary biology, economics, mathematics, computer science, sociology, and the humanities.

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The Institute was founded in 1963 by Hellmut Becker, who was joined subsequently by Friedrich Edding (1964), Dietrich Goldschmidt (1964), and Saul B. Robinsohn (1964) as the first generation of scientific directors. In the first decade of its existence, the development of educational research and educational policy was emphasized.

The appointment of a second generation of directors (Wolfgang Edelstein, 1973, and Peter M. Roeder, 1973) added to this framework a commitment to basic research in human development and educational processes.

Since the 1980s and with the appointment of a third generation of senior fellows and scientific directors (Paul B. Baltes, 1980; Karl Ulrich Mayer, 1983; Jürgen Baumert, 1996; Gerd Gigerenzer, 1997), research at the Institute has concentrated more and more on questions of basic research associated with the nature of human development, education, and work in a changing society. At the same time, lifespan developmental and life-course research were added as a signature profile of the Institute's research program.

Latest developments in the succession of generations were marked by the appointment of Ulman Lindenberger as new director of the Center for Lifespan Psychology (2004), adding an emphasis on neural correlates of human behavior and cognitive plasticity, and by the appointment of Ute Frevert as director of the newly established Center for the History of Emotions (2007), adding perspectives from cultural history to the Institute's research agenda on human development.

The appointment of Ralph Hertwig (2012) has further enriched the Institute's research on human decision-making processes, with a special focus on the social environment and changes across the lifespan.

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