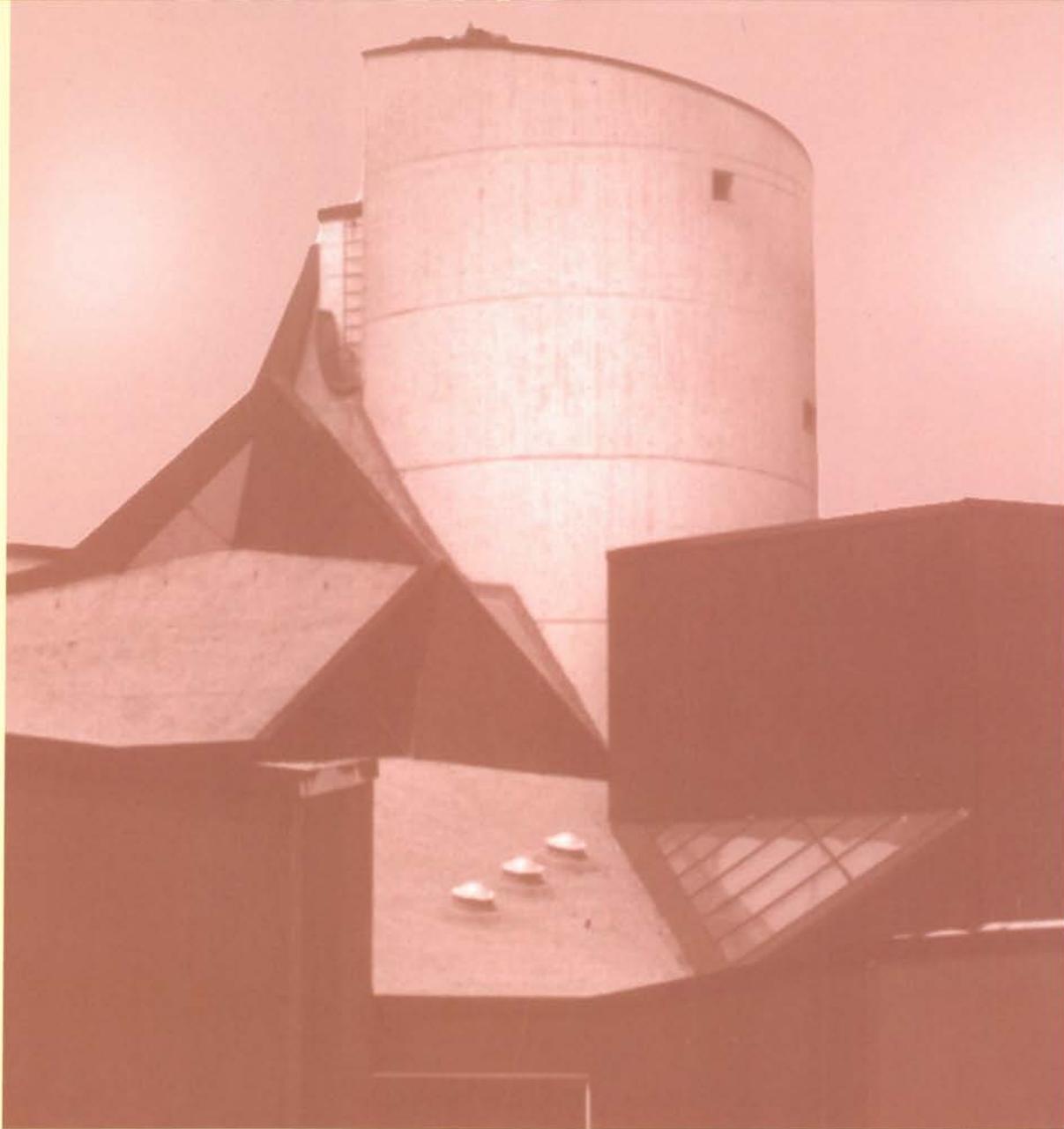




Research Report 2001–2002



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



Impressum

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Introduction





Introduction

The Max Planck Institute for Human Development is a multidisciplinary research establishment dedicated to the study of human development and education. Its inquiries are broadly defined, but concentrate on the evolutionary, social, historical, and institutional contexts of human development, as well as examining it from life-span and life-course perspectives. The disciplines of education, psychology, and sociology reflect the current directors' backgrounds, but the Institute's scholarly spectrum is enriched by the work of colleagues from such fields as mathematics, economics, computer science, evolutionary biology, 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 113, including 37 researchers, supplemented by a varying number of predoctoral, postdoctoral, and affiliate researchers and visiting fellows.

Research Centers

Research into processes of human development is conducted primarily from the theoretical vantage points offered by models of life-span psychology, bounded rationality and adaptive behavior, life-course sociology, and conceptions of social-historical change.

The Institute is organized into 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) bounded rationality, that is, the simple heuristics—cognitive, emotional, and behavioral—that laypeople and experts use to make decisions under constraints of limited time and knowledge, (2) social intelligence in cooperation and competition and (3) risk understanding and uncertainty management in everyday life, including applications

in medicine, law, and education.

Each of these research areas emphasizes the evolutionary foundations of behavior and cognition, in particular their domain specificity and functional adaptiveness.

The **Center for Educational Research** (Director: Jürgen Baumert) examines learning and development from an institutional point of view. Educational settings such as schools offer a variety of developmental op-



portunities, but at the same time exclude others. The impact of such settings is investigated from three perspectives: (1) the long-term consequences of schools' opportunity structures on individual development in terms of cognitive competencies as well as motivational and social resources, (2) international comparison of the outcomes of schooling in the fields of reading comprehension, mathematics and science literacy, and cross-curricular competencies, and (3) improvement of learning and instruction in terms of the cognitive activation of students, mainly in science and mathematics.

The **Center for Lifespan Psychology** (Director: Paul B. Baltes) is characterized by a lifespan perspective and a concern with the optimization of human potential. The studies of children, adolescents, adults, and the elderly concentrate primarily on the development of personality, motivation, selfhood, intelligence, memory, and information processing, as well as on various aspects of life-long socialization including the family. In each of these areas, plasticity of human functioning and the conditions for successful development play an important role in the con-

ceptual and methodological design of the studies. Theory, methodology and history of developmental psychology define an additional area of interest.

In the **Center for Sociology and the Study of the Life Course** (Director: Karl Ulrich Mayer), empirical research is oriented toward the analysis of social structure and institutions in a multilevel, historical and comparative perspective. Currently, this research is organized around four major foci: (1) Education, Training, and Employment; (2) East German Life Courses after Unification (LV-Ost); (3) Welfare State, Life Courses, and Social Inequalities; and (4) Life-Course Research and Analysis: Theory, Methods, and Synthesis. The research centers on the degree of interdependence among the processes of family formation, educational careers, and occupational trajectories in the life histories of members of various birth cohorts that differ in their historical situation as well as in their sociopolitical contexts (e.g., former East vs. West Germany). The methodology of sociostructural analysis and the analysis of dynamic processes provide additional foci of activity.

Fotos: David Ausserhofer.



Governance of the Institute

The Institute is governed by a Board of Directors, currently consisting of the four members of the Institute who are fellows (Wissenschaftliche Mitglieder) of the Max Planck Society (Jürgen Baumert, Paul B. Baltes, Gerd Gigerenzer, Karl Ulrich Mayer). The board is augmented by one member from the Institute's research staff (Ralph Hertwig) and the head of administration (Nina Körner). Each of the directors is elected to serve as managing director for a two-year period on a rotating basis.

Several in-house committees composed of representatives elected by the entire scientific staff or by appointment 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) which is elected by all scientists.

The **International Board of Scientific Advisers** offers an important source of external review and advice to both the directors and the scientific staff on matters of research at the Institute. Members are selected from an international circle of distinguished researchers and appointed by the President of the Max Planck Society to four-year terms. They meet biannually to discuss completed, ongoing, and future research projects at the Institute. A list of the current members can be found on the frontmatter of this report.



Organization of the Annual Report

This research report is organized in the following manner:

- The presentation of each research center begins with an introductory overview summarizing its program.
- The introduction is followed by descriptions of the center's research areas and selected projects along with a list of scientific publications.
- The supportive activities of the service units—library and computing services—are described in a special section at the end of the report.
- The appendix provides information on the research colloquia held at the Institute, the visiting scholars, and the cooperation of the Institute's scientific staff with projects outside the Institute. It also includes an index of the scientific staff and their research interests.

Inquiries about publications should be addressed to the author(s) involved in the individual projects. Copies of the annual reports are available from the Publications Unit (Redaktion) of the Institute upon request.

Berlin, March 2003

For the Board of Directors:
Jürgen Baumert

Highlights



Honors and Awards

Paul B. Baltes Honorary Doctorate, Humboldt University of Berlin

Paul B. Baltes "Großes Bundesverdienstkreuz mit Stern" of the Federal Republic of Germany

Paul B. Baltes 2001 Distinguished Career Contribution to Gerontology Award of Behavioral and Social Sciences Section of The Gerontological Society of America

Jürgen Baumert Honorary Doctorate, University of Fribourg, Switzerland

Jürgen Baumert Franz Emanuel Weinert Prize, German Psychological Association (DGPs)

Felix Büchel Honorary Professor of Sociology, Free University of Berlin

Wolfgang Edelstein 2002 Kuhmerker and Gifts of Time Foundation Award of the Association for Moral Education

Gerd Gigerenzer "Most Informative Book of the Year 2002" by "Bild der Wissenschaft" for "Reckoning with Risk: Learning to Live with Uncertainty"

Gerd Gigerenzer Fellow, Deutsche Akademie der Naturforscher Leopoldina

Lothar Krappmann Member, United Nations Committee on the Rights of the Child

Oliver Vitouch 2002 City of Vienna Science Award

Professional Career Advancements

Eckhard Klieme Full Professor for Educational Science, University of Frankfurt/Main, and Head of the Department of Educational Evaluation, German Institute for International Educational Research (DIPF)

Olaf Köller Full Professor for Educational Psychology, University of Erlangen-Nuremberg

Laura Martignon Professor for Mathematics and Mathematical Education, Teachers College of Ludwigsburg

Markus Raab Junior Professor, University of Flensburg

Students Awards

Barbara Fasolo 2002 Charlotte Hayes Dozier Award for Best Research Record, University of Colorado at Boulder

Barbara Fasolo 2001 Student Poster Prize, Summer Institute on Bounded Rationality in Psychology and Economics

Barbara Fasolo 2001 University of Colorado at Boulder Fellowship

Anne Goedicke The German Sociological Association's Prize for the best doctoral dissertation of the years 2001 and 2002

Yaniv Hanoch MINERVA Fellowship of the Max Planck Society

Anke Höhne Marie Curie Fellowship of the European Commission, Research Directorate-General

Markus Raab 2001 Karl Feige Prize, Sports Psychologists Association (asp)

Tania Singer Otto Hahn Medal of the Max Planck Society

Masanori Takezawa Research Fellowship, Japanese Society for the Promotion of Science

Where have Our Researchers Gone? New Positions 2001–2002

Research Scientists

Michael Corsten 2001, University of Jena, Assistant Professor

Alexandra M. Freund 2003, Northwestern University, Evanston, Assistant Professor

Eckhard Klieme 2001, University of Frankfurt a.M. and DIPF, Full Professor for Educational Science

Olaf Köller 2002, University of Erlangen-Nuremberg, Full Professor for Educational Psychology

Ineke Maas 2002, University of Utrecht, Dept. of Sociology, Associate Professor

Laura Martignon 2003, Teachers College of Ludwigsburg, Professor for Mathematics and Mathematical Education

Oliver Vitouch 2002, University of Vienna, Dept. of Psychology, Associate Professor

Postdoctoral Research Fellows

H. Clark Barrett 2001, University of California at Los Angeles, Dept. of Anthropology, Assistant Professor

Pascale Dorenlot 2001, INSERM–RFR Santé, Vieillesse, Société, Groupe hospitalier Ste Perrine

Paolo Ghisletta 2001, Maître Assistent, Centre Interfacultaire de Gérontologie, University of Geneva

Judith Glück 2002, University of Vienna, Dept. of Psychology, Associate Professor

Yongfang Liu 2002, Shandong Normal University

Barnaby Marsh 2002, Research Fellowship, University of Oxford

Richard McElreath 2002, University of California at Davis, Dept. of Anthropology, Assistant Professor

Markus Raab 2003, University of Flensburg, Junior Professor

Lixia Yang 2003, University of Toronto, Postdoctoral Fellow

Predocctoral Research Fellows

Sanjay Chandrasekharan Carleton University, Ottawa, Doctoral Candidate, Cognitive Science

Carola Fanselow 2002, University of Applied Sciences Eberswalde

Christine Gürtler 2002, Dept. of Educational Science, University of Potsdam

Joseph Johnson, 2002, Indiana University, Doctoral Candidate

Michael Rapp 2002, Mount Sinai School of Medicine, New York

Judith Schrenk 2002, Dept. of Educational Science, University of Potsdam

Christoph Wassner 2002, University of Kassel, Doctoral Candidate

Joachim Wirth 2002, University of Essen, Dept. of Psychology, Assistant Professor

Conferences Organized by Institute Researchers

Overeducation in Europe: What Do We Know?

(MPI for Human Development & ROA at Maastricht University)

November 2002

(Organizers: Felix Büchel & Antje Mertens, together with Andries de Grip)

International Max Planck Research School

The Life Course: Evolutionary and Ontogenetic Dynamics (LIFE)

(MPI for Human Development & University of Michigan)

LIFE Fall Academy 2002, October

(Organizer: Julia Delius; Directors: Paul B. Baltes & Jacquelynne S. Eccles)

Graduate Program "Neuropsychiatry and Psychology of Aging"

(MPI for Human Development & Free University of Berlin)

Fall Academy 2002, October

(Organizer: Jacqui Smith; Directors: Paul B. Baltes & Isabella Heuser)

Summer Institute on Bounded Rationality in Psychology and Economics

Special Focus: Emotions as Foundations of Bounded Rationality

(MPI for Human Development, University of Nottingham, & Universitat Pompeu Fabra)

August 2002

(Organizer: Stephanie Kurzenhäuser; Directors: Gerd Gigerenzer, Chris Starmer, & Robin Hogarth)

Schulen als differentielle Entwicklungsmilieus

November 2001

(Organizers: Eckhard Klieme, Olaf Köller, & Elsbeth Stern)

Graduate Program "Neuropsychiatry and Psychology of Aging"

(MPI for Human Development & Free University of Berlin)

Fall Academy 2001, October

(Organizer: Jacqui Smith; Directors: Paul B. Baltes & Isabella Heuser)

Changing Work and Life Patterns in Western Industrial Societies

(MPI for Human Development, DIW, WZB, Brandeis University, & Murray Research Center at Harvard University)

September 2001

(Coorganizer: Heike Trappe)

Summer Institute on Bounded Rationality in Psychology and Economics

(MPI for Human Development, University of Nottingham, & Universitat Pompeu Fabra)

August 2001

(Organizer: Jörg Rieskamp; Directors: Gerd Gigerenzer, Chris Starmer, & Robin Hogarth)

Xenophobia and Right-Wing Extremism

A Multi-Disciplinary Colloquia Series

May – July 2001

(Organizer: MPI for Human Development Staff Representatives Committee: Felix Büchel, Judith Glück, Ulrich Hoffrage, Petra Stanat, & Joachim Wirth)

Comparative Education Law: A New Approach

(MPI for Human Development & German Institute for International Educational Research, DIPF)

March 2001

(Organizers: Jürgen Baumert & Hermann Avenarius, together with Hans-Peter Füssel)

Lectures on Human Aging

(Ernst Schering Research Foundation, MPI for Human Development, Humboldt University Berlin, Graduate Program "Neuropsychiatry and Psychology of Aging", Free University of Berlin)

May 2002

Leonard Hayflick:

Human Aging, Disease, and Longevity Determination

Cellular Aging, Immortality, and the Telomere Replicometer



Teaching and Academic Degrees

The Institute has always considered its cooperation with universities as very important, especially by participating in teaching activities. Researchers from our Institute teach courses at three universities in Berlin and at the University of Potsdam as well as at many other universities in Germany and abroad.

In the years 2001–2002, more than 100 courses were taught by scientific staff members—directors, research scientists, postdoctoral as well as pre-doctoral fellows—of the Institute.

In addition, Institute members were supported in completing their academic degrees in cooperation with the universities in Berlin and elsewhere. In the years 2001–2002, 5 habilitations and 13 doctoral dissertations were completed by scientific staff members of the Institute. 42 student assistants associated with projects at the Institute completed Master's and diploma theses.

All degrees are listed in the Appendix.



Carolyne Kardia, Sculpture
Installation: Exhibition in
the Institute's entrance
hall.

International Max Planck Research School

The Life Course: Evolutionary and Ontogenetic Dynamics (LIFE)

Max Planck Institute for
Human Development
Humboldt University
Free University



University of
Michigan

This graduate program is part of the Max Planck Society's framework of International Max Planck Research Schools. It was established in 2001 as a collaboration between the Max Planck Institute for Human Development, Berlin, the Humboldt University Berlin, the Free University of Berlin, and the University of Michigan, Ann Arbor, USA. The goal of the Research School is advanced research training in the study of human behavior and institutional systems over evolutionary and ontogenetic time. LIFE will take an integrative and interdisciplinary approach to understanding human development in a changing world, connecting evolutionary, ontogenetic, historical, and institutional perspectives. An added focus is on the evolution and interaction of individual and institutional development. The target group of the Research School are post-diploma or post-master's graduate students who intend to pursue a doctorate in one of the relevant disciplines (biology, psychology, sociology, anthropology, educational science). As a collaborative Research School, LIFE offers students unique training in the dynamics of human behavior and societal institutions linked to the life course on different time scales. It includes opportunities for research abroad at a cooperating institution. The training program involves courses, a series of Fall and Spring Academies, and collaborative supervision of research training.

In 2002, the first cohort of 9 doctoral fellows with diplomas and masters' degrees in anthropology, biology, educational science, sociology, and psychology from Europe and the USA were recruited to begin the program in Berlin. They are studying at one of the three Berlin institutions and are joined by further external fellows (funded by other institutions) also taking part in the program. In parallel, 5 fellows commenced the program at the University of Michigan in Ann Arbor. Further fellows will be recruited annually (see list overleaf). As the opening event, the first LIFE Fall Academy took place at the Harnack House in Berlin from October 10–13, 2002. Participants included LIFE fellows from Ann Arbor and Berlin, along with guest fellows from the Chinese Academy of Sciences in Peking, the University of Warsaw, and other international institutions. The teaching faculty consisted of faculty members from Berlin and Ann Arbor. Weekly courses at the Max Planck Institute for Human Development are taught throughout the academic year. The next Academy is scheduled to take place at the University of Michigan from May 5–10, 2003.

Co-chairs

Paul B. Baltes
Jacquelynne S. Eccles (University of Michigan, Ann Arbor)

Coordinator

Julia Delius

www.imprs-life.mpg.de



**Faculty
2002/2003**

Toni Antonucci, Psychology, University of Michigan
Jens B. Asendorpf, Psychology, Humboldt University Berlin
Paul B. Baltes (Co-chair), Psychology, MPI for Human Development
Jürgen Baumert, Educational Science, MPI for Human Development
Kai Cortina, Psychology & Education, University of Michigan
Jacquelynne S. Eccles (Co-chair), Psychology & Education, Univ. of Michigan
Georg Elwert, Ethnology, Free University of Berlin
David L. Featherman, Sociology & Social Psychology, University of Michigan
Peter A. Frensch, Psychology, Humboldt University Berlin
Alexandra M. Freund (Faculty Associate), Psychology, MPI for Human Development
Gerd Gigerenzer, Psychology, MPI for Human Development
Peter Hammerstein, Biology, Humboldt University Berlin
Martin Kohli, Sociology, Free University of Berlin
Ralf T. Krampe (Faculty Associate), Psychology, MPI for Human Development
Rainer H. Lehmann, Educational Science, Humboldt University Berlin
Shu-Chen Li (Faculty Associate), Psychology, MPI for Human Development
Bobbi S. Low, Evolutionary & Behavioral Ecology, University of Michigan
Betsy Lozoff, Pediatrics, University of Michigan
Karl Ulrich Mayer, Sociology, MPI for Human Development
Hans Merkens, Educational Science, Free University of Berlin
Richard E. Nisbett, Psychology, University of Michigan
Patricia Reuter-Lorenz, Cognitive Psychology, University of Michigan
Ralf Schwarzer, Psychology, Free University of Berlin
Peter M. Todd (Faculty Associate), Psychology, MPI for Human Development
Henry M. Wellman, Psychology, University of Michigan

**LIFE Doctoral
Fellows
2002/2003**

Jaap J. A. Denissen, Humboldt University Berlin
Natalie C. Ebner (external LIFE fellow), MPI for Human Development
Katherine Leigh Fiori, University of Michigan
Jessica Garrett, University of Michigan
Nicole Hess, Humboldt University Berlin
Rainer Heuer (external LIFE fellow), Free University of Berlin
Oliver Huxhold, MPI for Human Development
Christina Karlyn Limbird, Free University of Berlin
Helen Krumme, Free University of Berlin
Rui Mata, MPI for Human Development
Gabriel Nagy (external LIFE fellow), MPI for Human Development
Thorsten Pachur (external LIFE fellow), MPI for Human Development
Christina Röcke, MPI for Human Development
Dennis Rüdiger, Humboldt University Berlin
Sabine Schäfer (external LIFE fellow), MPI for Human Development
Tih-Fen Ting, University of Michigan
Andreas Wilke, MPI for Human Development
Rebecca Utz, University of Michigan
Nicole Zarrett, University of Michigan

The Graduate Program (Graduiertenkolleg) on the Neuropsychiatry and Psychology of Aging



Neuropsychiatry and
Psychology of Aging

www.fu-berlin.de/age

Members of the Center for Lifespan Psychology involved include:

Paul B. Baltes (Co-chair)
Jacqui Smith (Member of the Steering Committee)
Alexandra M. Freund
Paolo Ghisletta (–2001)
Judith Glück (–2002)
Ralf Krampe
Ute Kunzmann
Shu-Chen Li

Predoctoral fellows in the Center for Lifespan Psychology:

Albina Bondar
Natalie C. Ebner
Susanne Ehrhorn
Denis Gerstorf
Daniel Grünh
Michael Rapp
Michaela Riediger
Susanne Scheibe
Florian Schmiedek
Antje Stange

This special program for doctoral training in psychological and psychiatric gerontology located at the Free University of Berlin (FU) was established in October 1998 by the late Margret M. Baltes and Hanfried Helmchen with funding from the German Research Council (DFG). The program was co-chaired by Hanfried Helmchen (Psychiatry, FU) and Paul B. Baltes (Psychology, Max Planck Institute for Human Development) from March 1999 to March 2001. In April 2001, Isabella Heuser (Psychiatry, FU) took over the chair after the retirement of Hanfried Helmchen.

This program represents a cross-discipline collaboration between psychology, psychiatry, and medicine and illustrates an important link between the Center for Lifespan Psychology and the FU in fostering junior researchers. Seven research groups are involved in the program: FU—Department of Psychology (Schwarzer), University Hospital Benjamin Franklin, Psychiatry Clinic (Heuser, Reischies), and ENT Clinic (Scherer); the Max-Delbrück-Centrum for Molecular Medicine (Berlin-Buch); the Neurological Clinic of the Charité, Humboldt University Berlin; as well as the Max Planck Institute for Human Development, Center for Lifespan Psychology. Together, these groups seek to integrate medical, psychiatric, and psychological research on aging and very old age.

In the period 2001–2002, 10 doctoral fellows from the Center for Lifespan Psychology have worked together with 10 fellows (medicine and psychology) from the FU to further their studies in gerontology. In total, 9 dissertations have been submitted from the program, including 7 by fellows from the Center for Lifespan Psychology or supervised by Center researchers (see overleaf).

The Berlin Aging Study (BASE) serves as a context for these graduates to learn about the different theoretical and practice-related perspectives associated with the general field of gerontology (e.g., biology, public health, sociology, demography, history, adult education, economics).

The graduate program involves regular seminars, workshops, and Fall Academies in which international researchers and doctoral fellows from other programs participate.

Dissertations completed

Bondar, A. (2003). *Balance and cognition: Resource allocation and its control in young and older adults*.

Doctoral thesis, Free University of Berlin. Available online:

www.diss.fu-berlin.de/2003/48.

From 2003, postdoctoral fellow at the MPI for Human Development.

Jopp, D. (2003). *Erfolgreiches Altern: Zum funktionalen Zusammenspiel von personalen Ressourcen und adaptiven Strategien des Lebensmanagements*. Doctoral thesis, Free University of Berlin. Available online: www.diss.fu-berlin.de/2003/50 (Thesis supervisors at the Free University of Berlin: Jacqui Smith & Paul B. Baltes).

Lißmann, I. (2002, submitted). *Intraindividuelle Veränderungen von Extraversion und Neurotizismus im hohen Alter: Die Bedeutung sensorischer Beeinträchtigung*. Doctoral thesis, Free University of Berlin (Thesis supervisors at the Free University of Berlin: Jacqui Smith & Paul B. Baltes).

From December 2002, appointment at the University of Marburg.

Rapp, M. (2003). *Dual-task performance in memory and balance: The role of aging and Alzheimer's disease*. Doctoral thesis, Free University of Berlin.

From 2002, postdoctoral fellow at the Department of Psychiatry, Mount Sinai School of Medicine, New York.

Riediger, M. (2001). *On the dynamic relations among multiple goals*.

Doctoral thesis, Free University of Berlin. Available online:

www.diss.fu-berlin.de/2001/266.

From 2003, research scientist at the MPI for Human Development.

Schmiedek, F. (2003). *The structure of cognitive abilities in old and very old age: On the importance of specific group factors in a dedifferentiated factor space*. Doctoral thesis, Free University of Berlin.

From 2003, postdoctoral fellow at the MPI for Human Development.

Singer, T. (2000). *Testing-the-Limits in einer mnemonischen Fähigkeit: Eine Studie zur kognitiven Plastizität im hohen Alter*. Doctoral thesis, Free University of Berlin. Available online: www.diss.fu-berlin.de/2000/78.

From 2002, postdoctoral fellow at the Wellcome Department of Imaging Neuroscience, London.





**Center for
Adaptive Behavior
and Cognition**

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Scientific Staff 2001–2002

Uwe Czienskowski, **Gerd Gigerenzer**, Ralph Hertwig, Ulrich Hoffrage, John M. C. Hutchinson, Monika Keller, Lothar Krappmann (retired in 2001), Laura Martignon (as of 2003: Teachers College of Ludwigsburg), Marianne Müller-Brettel, Jörg Rieskamp, Lael Schooler, Peter M. Todd, Oliver Vitouch (as of 2002: University of Vienna)

Postdoctoral Research Fellows

H. Clark Barrett (as of 2001: University of California at Los Angeles), Barbara Fasolo, Konstantinos Katsikopoulos, Elke M. Kurz-Milcke (Schloeßmann Scholarship), Yongfang Liu (as of 2002: Shandong Normal University), Barnaby Marsh (as of 2002: University of Oxford), Richard McElreath (as of 2002: University of California at Davis), Markus Raab (as of 2003: University of Flensburg), Torsten Reimer, Masanori Takezawa, Annika Wallin

Predocctoral Research Fellows

Sanjay Chandrasekharan (as of 2002: Carleton University, Ottawa), Anja Dieckmann, Thomas Dudgey, Carola Fanselow (as of 2002: University of Applied Sciences Eberswalde), Christine Gürtler (as of 2002: University of Potsdam), Michaela Gummerum, Yaniv Hanoach (MINERVA Fellowship), Joseph Johnson (as of 2002: Indiana University), Stephanie Kurzenhäuser, Rui Mata (LIFE), Thorsten Pachur (LIFE), Judith Schrenk (as of 2002: University of Potsdam), Christoph Wassner (as of 2002: University of Kassel), Andreas Wilke (LIFE)

Long-Term Visitors

Konrad Halupka, Andreas Ortmann, Rocio Retamero-Garcia, Jorge Simão, Szymon Wichary

Introductory Overview

The Center for Adaptive Behavior and Cognition (ABC) investigates reasoning and decision making under uncertainty at the levels of both individuals and social groups. The research group consists of psychologists, mathematicians, computer scientists, evolutionary biologists, economists, and researchers from other fields. With different methodological abilities—such as experimental methods, computer simulation, and mathematical analysis—they cooperate in solving the same problems.

The ABC program combines a strong theoretical focus with practical applications, that is, the research group both develops specific models and explores their applications. Those applications range from using heuristics for stock market investment to teaching statistical thinking and improving statistical reasoning—for instance, of expert witnesses in law courts—by particular representations of numerical information about risks.

The theoretical focus is on rationality and 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. 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 and other 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. 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 strategies 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 people use. There is a variety of goals and heuristics unique to social environments. That is, in

Truth is ever to be found in simplicity, and not in the multiplicity and confusion of things.

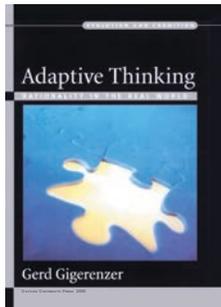
Isaac Newton

In this world nothing is certain but death and taxes.

Benjamin Franklin

Key Reference

Gigerenzer, G. (2000). *Adaptive thinking: Rationality in the real world*. New York: Oxford University Press (344 p.).



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 higher degree than for the purely 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.

These three notions of rationality (according to which the present text is largely structured) converge on the same central issue: to understand human behavior and cognition as adaptations to specific environments, ecological and social, and to discover the heuristics that guide adaptive behavior. In a fourth section we report on work that directly relates to evolutionary psychology, which, as a meta-theoretical framework, lies behind the “adaptive” in our center’s name. The research reported in the last section relates to methodological, historical, and theoretical questions, in particular the influence of methodological preferences—such as linear models—on theories of cognition. Our reflections on methodologies constitute a source of ideas that is of central importance to modeling visions of rationality.

The ABC program is an invitation to take a journey into an exciting territory. The journey ventures into a land of rationality that is different to the familiar one we know from the many stories in cognitive science and economics—tales in which humans with unlimited time and knowledge live in a world where the sun of enlightenment shines down in beams of logic and probability. The new land of rationality we set out to explore is, in contrast, shrouded in a mist of uncertainty. People in this world have only limited time, knowledge, and computational capacities with which to make inferences about what happens in their world. The notions of bounded, ecological, and social rationality are our guides to understanding how humble humans survive without following the heavenly rules of rational choice theory.

Bounded Rationality

Humans and animals do make inferences about unknown features of their world under constraints of limited time, knowledge, and computational capacities. Many models of rational decision making in cognitive science, economics, biology, and other fields, in contrast, tend to ignore these constraints. We, however, 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 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 spark-plug gap gauges to maintain an engine rather than just hit everything with a hammer, different domains of thought require different specialized tools. The notion of a toolbox full of unique single-function devices lacks the beauty of Leibniz's dream of a single all-purpose inferential power tool. Instead, it evokes the abilities of a craftsman, who can provide serviceable solutions to almost any problem with just what is at hand.

The Adaptive Toolbox

This repertoire of specialized cognitive mechanisms, which include fast and frugal heuristics, were shaped by evolution for specific domains of inference and reasoning. We call this collection of mechanisms built into the human mind 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

Fast and frugal heuristics generally consist of three building blocks: simple rules for guiding search (in memory or external search), for stopping search, and for decision making. They are effective when they can exploit the structures of information in the environment. That is, their rationality is a form of "ecological rationality," rather than one of consistency and coherence (Hertwig & Hoffrage, 2001b). During the last two years we have continued to study fast and frugal heuristics, introduced in the last annual report, for pair comparisons (e.g., Take The Best or the recognition heuristic; Goldstein & Gigerenzer, 2002) and

Bounded rationality is what cognitive psychology is all about. And the study of bounded rationality is not the study of optimization in relation to task environments.

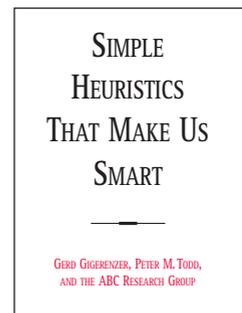
Herbert Simon

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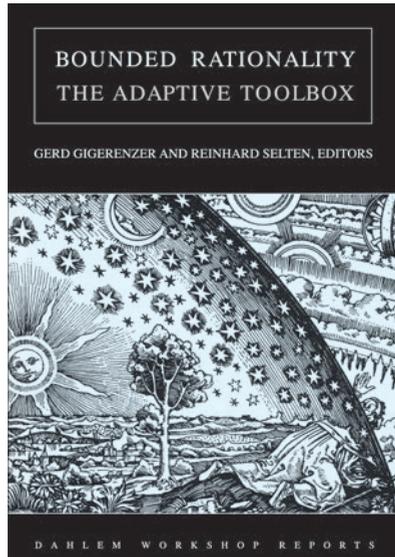
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Goldstein, D. G. & Gigerenzer, G. (2002). Models of ecological rationality: The recognition heuristic. *Psychological Review*, 109, 75–90.



In 1999, a **Dahlem Konferenz** organized by Gerd Gigerenzer and Reinhard Selten focused around Bounded Rationality. A number of internationally well-known social scientists discussed issues such as the adaptive toolbox, fast and frugal heuristics, fiction of optimization, self-esteem, risk taking, Prisoner's Dilemma, social learning, emotions, and norms. The collected background papers and group reports, written by all participants, document the overall goal of the conference: (a) to provide a framework of bounded rationality in terms of the metaphor of the adaptive toolbox, (b) to provide an understanding about why and when the simple heuristics in the adaptive toolbox work, (c) to extend the notion of bounded rationality from cognitive tools to emotions, and (d) to extend the notion of bounded rationality to include social norms, imitation, and other cultural tools.

for numerical estimation (e.g., Quick-Est). In the following we will selectively report on some other heuristics and new areas of applications.

Take The First

Experimental decision-making research often uses tasks in which participants are presented with alternatives from which they must choose. Although tasks of this type may be useful in determining measures (e.g., preference) related to explicitly stated alternatives, they neglect an important aspect of many real-world decision-making environments, namely, the option-generation process. Johnson and Raab (in press) extend previous literature that fills this void by presenting a model that attempts to describe the link between the use of different strategies and the subsequent option-generation process, as well as the resulting choice characteristics. Specifically, they examine the relationship between strategy use, number and order of generated

options, and choice quality. They propose Take The First as a heuristic that operates in ill-defined tasks, and conducted an experiment (involving a realistic sports situation presented to athletes) to test the predictions of the model. Initial results support the model's key predictions: Strategies producing fewer generated options result in better and more consistent decisions.

Fast and Frugal Heuristics in Legal Decision Making

Many legal decisions, such as the decision to bail upon adjourning a case, have major consequences for both defendants and society. In the English legal system, magistrates, most of whom are lay people, are afforded considerable discretion and must work under constraints such as time pressure. Dhami and Ayton (2001) conducted a judgment analysis of the bail decision-making policies of 81 magistrates from 44 courts throughout England and Wales and found intra- and inter-

magistrate inconsistency in bail decisions, discrepancies between stated and elicited cue use, and high levels of post-decisional confidence. Furthermore, magistrates' policies were better described and predicted by a fast and frugal model characterized by noncompensatory cue use than by either of two compensatory integration models. In such compensatory models, the most important cue could in principle be compensated for by other cues such that the decision suggested by that cue could be changed after considering other and less important cues.

Fast and Frugal Heuristics in Medical Decision Making

Following Brunswik, social judgment theorists have long relied on regression models to describe both an individual's judgments and the environment on which such judgments are made. However, the social judgment theory is not synonymous with these compensatory, static, structural models. Dhami and Harries (2001) compared the characterizations of physicians' judgments using a regression model with that of a fast and frugal, noncompensatory process model. They found that both models fit the data equally well. Both models suggest that physicians use few cues, that they disagree amongst themselves, and that their stated cue use is discrepant with the models' stated cue use. However, the fast and frugal model is easier to convey to physicians and is also more psychologically plausible. Therefore, such models of bounded rationality offer an attractive alternative for social judgment theorists to conceptualize the process of vicarious func-

tioning (i.e., adaptively taking different pieces of evidence into account). *Modeling the Hindsight Bias With Fast and Frugal Heuristics*

Some years ago, the work on fast and frugal heuristics was extended to model a well-known phenomenon of memory research, the hindsight bias. Hindsight bias can occur when people make a judgment or choice and are later asked to recall what their judgment had been. If, in the interim, they are told what the correct judgment would have been, their memory of their own judgment tends to become biased toward the new information. To explain this phenomenon, Hoffrage, Hertwig, and Gigerenzer (2000) developed the RAFT model (Reconstruction After Feedback with Take The Best). The core assumption of the model is that new information updates the knowledge base, which, in turn, will be used to reconstruct the initial response.

Recently, Hertwig, Fanselow, and Hoffrage (in press) put this model to a further test. Although typically considered to be a robust phenomenon, the hindsight bias is subject to moderating circumstances. A well-known meta-analysis of the phenomenon has revealed that the more experience people have with the task under consideration, the smaller the resulting hindsight bias is. This observation is one benchmark against which the explanatory power of the process models of hindsight bias can be measured. Can the RAFT model account for this "expertise effect?" Yes. Specifically, using computer simulations of the RAFT model, Hertwig, Fanselow, and Hoffrage observed that the more

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comprehensive people's knowledge is in foresight, the smaller their hindsight bias is. In addition, they made two counterintuitive observations: First, the relation between foresight knowledge and hindsight bias appears to be independent of how knowledge is processed. Second, even if foresight knowledge is false, it can reduce hindsight bias. This work will be included in a special issue on the hindsight bias, to appear in *Memory*, with Ulrich Hoffrage and Rüdiger Pohl as guest editors.

Fast and Frugal Heuristics in Emotional and Cultural Contexts

Fast and frugal heuristics alone do not fully characterize the functioning of our cognitive architecture. Emotions, such as fear or parental love, provide a powerful and effective stopping rule by restricting the range of options contemplated and evaluated and by focusing the agent's attention on specific parameters or aspects of the information (Hanoch, 2002). Similarly, in social species, imitation and social learning serve as mechanisms that enable fast learning and obviate the need for individual calculations of expected utilities. Social norms can also be seen as fast and frugal algorithms that dispense with individual cost-benefit computations and decision making. For instance, culture (as a system of values and beliefs) constrains the number of options we consider when facing real-world decisions.

Satisficing

The adaptive pressures facing humans and other animals to make

decisions quickly can be met both by increasing the internal information-processing speed and by minimizing the amount of information to be used. Dudey and Todd (2001) focused on the latter effect and asked how agents can make good decisions with a minimum of information using two specific tasks as examples. When a choice must be made between simultaneously available options, a minimum of information in the form of binary recognition (whether or not each item is recognized) can be used by the recognition heuristic to choose effectively. When options are encountered sequentially one at a time, a minimum of information (whether or not each option is the best encountered so far) is sufficient to guide agents using a simple search-cutoff rule to high performance along several choice criteria. This simple cutoff rule is even robust to changes in the environment. Both examples have important economic as well as biological applications, and show the power of simple fast and frugal heuristics to produce good decisions with little information.

The Benefits of Cognitive Limits

The premise that human information-processing capacity is limited is usually accompanied by another assumption, namely, that these limitations pose a liability: They constrain our cognitive potential. These limitations bar us from performing feats such as reciting an epic poem from memory. Even more sinister, though, is that these cognitive limits are also suspected of being the culprit behind lapses of reasoning. The link

between cognitive limitations and reasoning errors, more generally, and human irrationality can be found in such disparate research programs as Piaget's theory of the cognitive development of children, Johnson-Laird's mental model theory, and Kahneman and Tversky's heuristics-and-biases program. By bringing together ideas on cognitive limits from a variety of fields, Hertwig and Todd (in press) challenge the seemingly obligatory link between cognitive limitations and human irrationality. While not doubting that limits can exact a price, they question their exclusively negative status. Firstly, the thesis is put forth that decision-making strategies that take limitations into account need not be less accurate than strategies with little

regard for those limitations; in fact, in psychologically important contexts, simple strategies can actually outperform "unbounded" strategies. Secondly, it is argued that limitations in processing capacity can actually enable rather than disable important adaptive functions. Thirdly, it is suggested that some of the reasoning errors produced by the mind's cognitive limits fulfill important adaptive functions. Finally, the assumption is challenged that simple decision-making strategies have evolved in response to the cognitive limitations of the human mind. The reverse causality is suggested and the thesis is submitted that capacity constraints may, in fact, be a by-product of the evolution of simple strategies.

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The ABC Research Group in December 2002



Left to right: (front row) John Hutchinson, Konstantinos Katsikopoulos, Anja Dieckmann, Barbara Fasolo, Yaniv Hanoch, Monika Keller, Laura Martignon, Ulrich Hoffrage, Stephanie Kurzenhäuser; (middle row) Annika Wallin, Michaela Gummerum, Stefan Krauss, Gerd Gigerenzer, Richard McElreath, Peter Todd, Masanori Takezawa, Rui Mata, Joseph Johnson, Thomas Dudey, Ralph Hertwig, Uwe Czienskowski; (back row) Torsten Reimer, Lothar Krappmann, Jörg Rieskamp, Andreas Wilke, Lael Schooler, Thorsten Pachur, Markus Raab, Oliver Vitouch.

Perhaps the organism could be seen as playing the role of the husband and the environment that of the wife, or the reverse may be argued as well.
Egon Brunswik

Human rational behavior (...) is shaped by a scissors whose two blades are the structure of task environments and the computational capabilities of the actor.
Herbert Simon

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Ecological Rationality

In the research on bounded rationality we found that the performance of several fast and frugal heuristics, by and large, matches that of algorithms that involve complex computations. Even if humans had the mental computational power to use such complex algorithms, they would not gain much, if anything at all by using them. The astonishingly high accuracy of these heuristics indicates their ecological rationality; fast and frugal heuristics exploit the statistical structure of the environment and they are adapted to this structure (Martignon & Hoffrage, 2002). Our upcoming group book, the follow-up to *Simple Heuristics That Make Us Smart*, will focus on ecological rationality by exploring the ways that simple decision mechanisms fit with particular information structures in their environment. The book will cover heuristic building blocks and decision trees, social and nonsocial environments, as well as how people structure their own environments for easier cognition, and it will feature decision domains ranging from medical diagnosis to choosing a parking space to children's games of chance. We have pursued the issue of ecological rationality in yet another way, namely, by studying the question of representation. Representational formats constitute environments for cognition. This research has practical relevance in many domains, such as diagnostic inference or risk assessment in legal cases, where the external representation of diagnostic information influences physicians', counselors', and lawyers' performances.

Information Representation

Consider a situation in which a physician needs to infer the probability that an asymptomatic man has colorectal cancer (C) after he received a positive hemocult test result (pos) in a routine screening. In terms of probabilities, the relevant information (concerning a population of men aged 50) is a base rate for colorectal cancer $p(C) = 0.3\%$, a sensitivity $p(\text{pos}|C) = 50\%$, and a false positive rate $p(\text{pos}|\neg C) = 3\%$ (see Fig. 1). Whereas the Bayesian answer is 4.7%, typically most lay people (and also doctors) estimate this probability at approximately 50% or higher. This result has been interpreted as the "base-rate neglect." To evaluate and understand the performance of the human mind, one needs to look at its environment

and, in particular, at the external representation of the information. Probabilities and percentages are representations of uncertainty that were devised only a few hundred years ago. For most of the time during which the human mind evolved, information was encountered in the form of natural frequencies, that is, absolute frequencies as they result from observing cases that have been representatively sampled from a population. The same information represented in terms of natural frequencies is: "Thirty out of every 10,000 people have colorectal cancer. Of these 30 people with colorectal cancer, 15 will have a positive hemocult test. Of the remaining 9,970 people *without* colorectal cancer, 300 will still have a positive hemocult test."

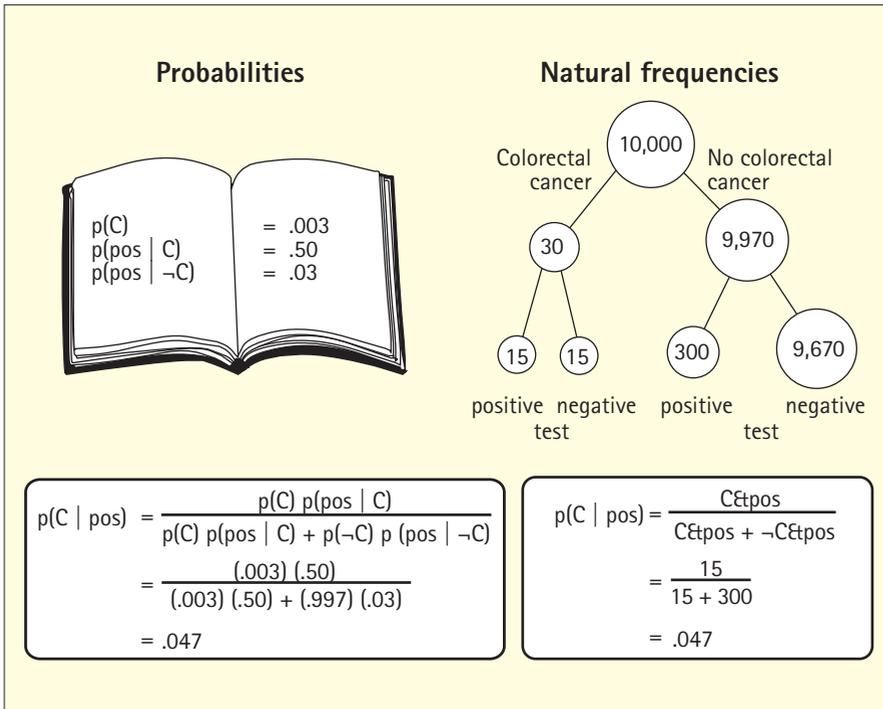


Figure 1. Why natural frequencies facilitate the computation of the probability $p(C|\text{pos})$ of cancer given a positive test. The symbols C and $\neg C$ stand for colorectal cancer and no colorectal cancer, respectively, and pos and neg stand for a positive and negative test result, respectively. One can see that Bayes's rule for probabilities (left side) involves more calculation than for natural frequencies (right side).

Natural frequencies simplify Bayesian computations and, as a consequence, help people gain insight into Bayesian reasoning. This was demonstrated both with lay people (Gigerenzer & Hoffrage, 1995) and recently also in different fields of professional decision making (Hoffrage, Lindsey, Hertwig, & Gigerenzer, 2000).

Representations of Risk Reduction

Natural frequencies are also beneficial for a related problem, namely, to understand the benefit of a therapy or of participation in a screening program. Women are generally informed that mammography screening reduces the risk of dying from breast cancer by 25%. Does that mean that from 100 women who participate in the screening, 25 lives will be saved? Although many peo-

ple believe this to be the case, the conclusion is not justified. This percentage, in fact, means that from 1,000 women who participate in the screening, 3 will die from breast cancer within ten years, whereas from 1,000 women who do not participate, 4 will die. The difference between 4 and 3 is the 25% "relative risk reduction." Expressed as an "absolute risk reduction," however, this means that the absolute benefit is 1 in 1,000, that is, 0.1%. Cancer organizations and health departments typically inform women of the relative risk reduction, which gives a higher number—25% as compared to 0.1%—and makes the benefit of screening appear larger than if it were represented in absolute risks.

Matter-Walstra and Hoffrage (2001) showed that women's willingness

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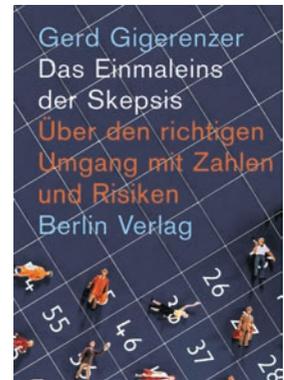
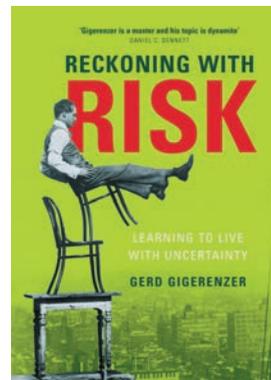
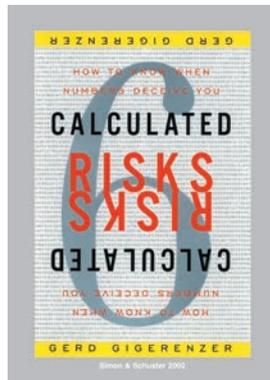
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Calculated Risks / Reckoning with Risk / Das Einmaleins der Skepsis

At the beginning of the 21st century, most children have learned to read and write, but many adults still do not know how to reason about uncertainties and risk. As this book repeatedly demonstrates, physicians or legal experts often do not understand the risks either. This problem has been called *innumeracy* and this book offers a remedy.

The book provides experts and lay people with mind tools for understanding risks and communicating these effectively to others. These tools are easy to learn and can turn innumeracy into insight. They can help reduce the widespread *uninformed consent* in medical, legal, and everyday situations, from mammography screening to understanding the meaning of a DNA match in a legal trial.

The book was published by Penguin in the UK and Simon & Schuster in the US (under the title *Reckoning with Risk: Learning to Live with Uncertainty*). The German translation (*Das Einmaleins der Skepsis: Über den richtigen Umgang mit Zahlen und Risiken*) has been selected the Most Informative Book of the Year by *Bild der Wissenschaft*, a major German science magazine. A Japanese translation is underway.



to participate in a mammography-screening program was considerably lower after both the benefits and the disadvantages of the procedure were explained in terms of natural frequencies. By using natural frequencies that referred to the same reference population, the number of women who gained from screening could be easily compared to those who were harmed. Kurzenhäuser (2003) analyzed 27 brochures that informed women about mammography screening. The main result was that the relevant statistical information about risks and benefits are, for the most part, poorly explained. Even when information is provided, it is frequently given in terms of vague verbal descriptions rather than in precise numbers.

Applications in Law

Judges also must make decisions based on probabilities. Does the representation of numerical information in natural frequencies foster Bayesian reasoning in court? Professionals and law students in Germany evaluated two criminal court case files involving rape and forensic evidence of a DNA match. Expert testimony reported the statistical information of DNA profiles and the rates of technical and human mishaps leading to false-positive results. This information was presented in two different formats, one stated as probabilities and the other as natural frequencies. When these statistics were expressed as probabilities, only 13% of the professionals and less than 1% of the law

students correctly inferred the probability that the defendant was actually the source of the trace. But when the identical statistics were stated as natural frequencies, 68% and 44% of these same participants made the correct inference. Perhaps more significantly, the different ways of expressing the same statistical information altered the verdicts in each case. When the information was presented as probabilities, 45% of the professionals and 55% of the students rendered a verdict of guilty, but only 32% and 33% did so when the same statistics were expressed as natural frequencies (Hertwig & Hoffrage, 2002; Lindsey, Hertwig, & Gigerenzer, in press). When verdicts hinge on statistical evidence, understanding that evidence is crucial, and pursuing such simple methods of fostering statistical insight could contribute to that goal.

Implications for Teaching Bayesian Reasoning

The beneficial effects of natural frequencies on statistical reasoning in the studies reported above occurred without training or instruction. More importantly, systematic train-

ing in the use of natural frequencies can even help people to reason with probabilities. The solution is to teach people how to translate probabilities into natural frequency, representations. Traditionally, however, students are taught routinized procedures how to plug probabilities into mathematical formulae such as Bayes's rule. We evaluated both teaching methods using a computerized tutorial (Sedlmeier & Gigerenzer, 2001) as well as a traditional classroom setting (Kurzenhäuser & Hoffrage, 2002). Note that unlike in the studies reported earlier, all test problems were stated in probabilities. In both settings we found that teaching representations was more effective. For instance, when tested five weeks after training, students who were taught how to translate probabilities into natural frequencies could solve 90% of the new problems, whereas those who were taught rules could only solve approximately 20% (Sedlmeier & Gigerenzer, 2001). Most of the students had probably only forgotten the rules. Teaching representations rather than rules—and expressing statistical information in natural

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Books

How to lower the risk of high anxiety

RECKONING WITH RISK: Learning to Live With Uncertainty
by Gerd Gigerenzer
(Penguin, £14.99)

FRANCIS SPUFFORD

Bad news from your doctor? Don't take it at face value, says a psychologist

THIS book has one idea to impart, but it's an important one. Written by a professor of psychology in Germany, it offers a technique — a "mind

the more often they'll detect it when it isn't. So how likely is it that you really have breast cancer? To



Taking a step into the unknown: comedian Harold Lloyd in a high-rise stunt from his 1921 film *Never Weaken*. Taken from Harold Lloyd: Master Comedian (Abrams, £30)

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Wassner, C., Martignon, L., & Sedlmeier, P. (2002). Die Bedeutung der Darbietungsform für das alltagsorientierte Lehren von Stochastik. In M. Prenzel & J. Doll (Eds.), *Bildungsqualität von Schule. Schulische und außerschulische Bedingungen mathematischer, naturwissenschaftlicher und überfachlicher Kompetenzen* (pp. 35–50). Weinheim: Beltz (Zeitschrift für Pädagogik, 45. Beiheft).

frequencies where appropriate—can help to foster the statistical reasoning needed to make sound decisions.

ABC Goes to School: Classroom Statistics for Everyday Life

Our findings are also relevant for teaching statistics at schools. German school students consider probability theory an extremely appealing branch of mathematics (Wassner, Martignon, & Sedlmeier, 2002). Nonetheless, they find it difficult to understand probability problems and to solve them. Although realistic probability problems are concrete and numerical, they are often presented to students in an abstract and formalized language. We put the hypothesis that humans should be better in understanding probability problems with natural frequencies rather than with probability formats to another test in lab studies with German school students aged 14 to 19 years, whom we divided into two groups with comparable mathematical abilities. One group was working with a new training software (developed by Sedlmeier & Köhlers) based on tree-representations and natural frequencies, the other group used a conventional training software with probabilities. The evolutionary adapted training with frequencies

increased the performance of students dramatically and enabled them to solve Bayesian problems with ease. Depending on the age and pre-skills, the effect of frequency-training was 1.6 to twice as large as with probability-training.

How to Solve the Monty Hall Problem

Base-rate neglect is an example of a so-called bias, typically revealed under conditions that differ from people's natural environments. By representing (statistical) information in a way that better fits the natural environment in which our cognitive system evolved, reasoning becomes not only more accurate, but also more consistent with statistical or probability norms, such as Bayes's rule. Here is another example: Suppose you are on a game show and you are given the choice between three doors. Behind one door is a car; behind the others are goats. You pick, for example, door number 1, and the host, who knows what is behind the doors, opens a different door, say, door number 3, to reveal a goat. He then asks you, "Do you want to switch to door number 2?" Is it to your advantage to switch your choice? What contestants should do in this situation (known as the Monty Hall problem or the

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WISSEN 27

Die fremde Welt der Zahlen

Nicht nur Schüler schneiden in Deutschland beim Rechnen schlecht ab. Selbst viele Mediziner und Juristen schätzen für ihren Beruf wichtige Zahlenangaben völlig falsch ein – mit fatalen Folgen/VON CORNELIA STOLZE

Der Schock saß tief: Ein Skandal, ein Desaster, eine Katastrophe sei das verheerende Abschneiden der deutschen Schüler in der internationalen Pisa-Studie. In seltener Einigkeit prangerten seitdem die ganze Nation das Versagen der heutigen Lehrer und Schulen an.

Manch einer der Landesminister allerdings dürfte froh sein, dass er nicht selbst die Aufgaben für Neundklässler lösen musste, von denen einige auch in der ZEIT veröffentlicht wurden. Denn



bringen." Tatsächlich sei vielleicht alles viel harmloser, als wir befürchten – vielleicht aber auch viel schlimmer. Es gebe vermutlich nicht viele Politiker, die diese Problematik durchschauen. Jede/r: Man muss in soch einer Situation einen Test einführen, beruhigt das die Bevölkerung. Und die Regierung kann zeigen, dass sie etwas getan hat."

Das will offenbar auch die Gesundheitsministerin Ulla Schmidt mit ihrem Vorstoß für ein bundesweites Brustkrebs-Screening. Regelmäßig

three-door problem) sparked a heated public debate. Although it is to the advantage of the contestant to switch, until now, all experimental studies on the *Monty Hall problem* led to similar results: The vast majority of participants believes that switching and staying are equally good alternatives.

Piattelli-Palmarini singled out the Monty Hall problem as the most expressive example of the "cognitive illusions" or "mental tunnels" in which "even the finest and best-trained minds get trapped." Relating this problem to others, he concluded that "no other statistical puzzle comes so close to fooling all the people all the time. (...) The phenomenon is particularly interesting precisely because of its specificity, its reproducibility, and its immunity to higher education." He went on to state "even Nobel physicists system-

atically give the wrong answer, and (...) insist on it, and are ready to berate in print those who propose the right answer."

Krauss and Wang (2003) were able to shed light into this "mental tunnel" by formulating the problem in an ecologically appropriate manner: By asking "In how many of the possible arrangements would the contestant win by switching and in how many would she win by staying?" they allowed their participants to reason in a frequentistic manner (see Fig. 2).

By implementing further manipulations into the problem's wording (e.g., a perspective change from the perspective of the contestant to the perspective of the game show host), they could bring a substantial portion of the participants to a full understanding of the brain teasers' underlying mathematical structure.

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Krauss, S., & Wang, X. T. (2003). The psychology of the Monty Hall problem: Discovering psychological mechanisms in solving a tenacious brain teaser. *Journal of Experimental Psychology: General*, 132, 3–22.

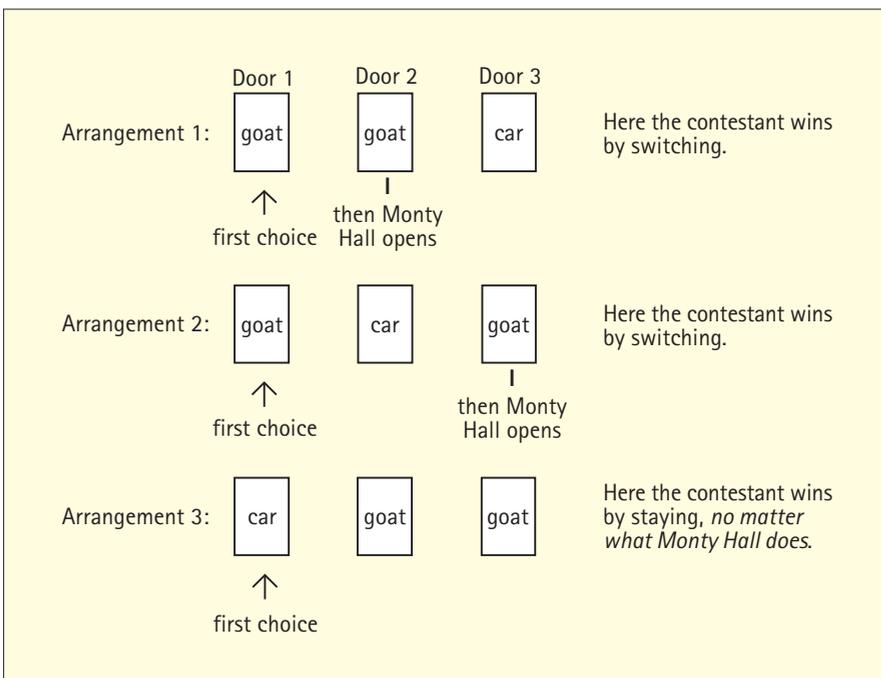


Figure 2. Explanation of the solution to the Monty Hall problem: In two out of three possible car-goat arrangements the contestant would win by switching; therefore she should switch.

Social Rationality

Some of the most ambitious decisions faced by social species are those arising from an environment comprised of the decisions of conspecifics. Social environments are characterized by the speed with which they can change and by the need to consider the decisions being made by others. These two features make social rationality an important and distinct form of ecological rationality.

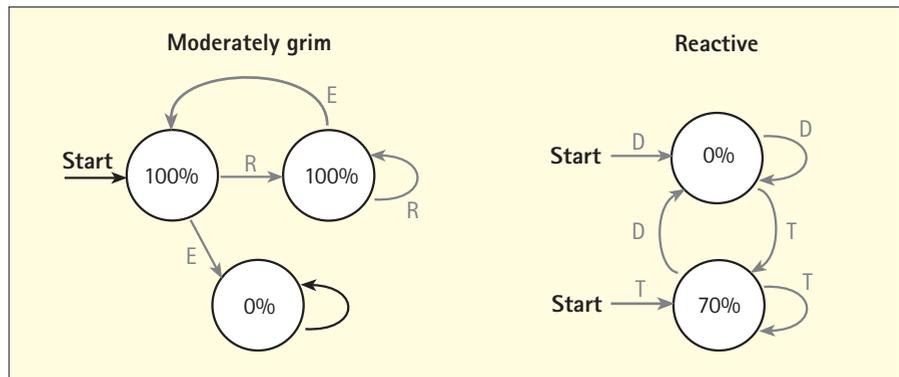
Social Heuristics for Cooperation

A framework that has frequently been used to investigate cooperation is game theory. Following this tradition, Rieskamp (2001) studied people's social heuristics in the indefinitely repeated investment game, which is a two-person sequential bargaining game that has been used to study trust and reciprocity. Two players, A and B, receive an endowment, e.g. \$10. Player A can invest any amount of the endowment, which is then tripled, producing some surplus before it is delivered to Player B. Player B then decides how much of the tripled amount she wishes to return to player A.

The social heuristics developed to predict participants' decisions were more successful than alternative models, including a learning model. The best heuristic for player A, *Moderately grim*

(see Fig. 3), predicted on average 65% of the decisions for a cross-validation sample. The heuristic starts by investing the whole endowment, and if player B reciprocates the trusting investment with a substantial return, the heuristic continues to invest as long as player B makes a substantial return. However, if player B exploits player A with a low return in the first period, or if player B repeatedly exploits player A during the game, *Moderately grim* advances to the third state, in which it will make no investment in all following periods. The best heuristics for player B, *Reactive* (see Fig. 3), predicted on average 52% of the decisions. Depending on player A's decision in the first period, *Reactive* either returns nothing when a low investment was made or makes a return that leads to equal payoffs for both

Figure 3. The best heuristics developed to predict behavior in the indefinitely repeated investment game. R: Reciprocal returns, E: Exploitive returns, T: Trust expressed by substantial investments, and D: Distrust expressed with low or no investments.



players when a substantial investment was made. The combination of these two simple social heuristics demonstrates how people can make cooperative decisions in asymmetric interactions with a minimum of memory and computation.

The Roles of Cognition and Emotion in Cooperation

The details of what cues and algorithms are involved in altruism, friendship, and general good will, as well as the potential functions of emotional states in these algorithms, have been the subject of a good amount of speculation and research. For a recent Dahlem Conference volume, McElreath et al. (in press) reviewed of the empirical evidence and theory about the cognitive nature of heuristics for cooperation, and the role of emotion and affect in regulating such behaviors. This literature has important implications for interpreting natural history (for animals ranging from bats to hermaphrodite fish) and for predicting the effects of institutional design on patterns of human cooperation.

Honor and the Regulation of Conflict

In many societies, people value their public standing or "honor," and other individuals recognize this standing as predictive of how others will behave when threatened or exploited. Such cultures of honor have existed in many places and times, seem to arise quickly, and have enduring properties. Yet the logic of honorable strategies is poorly understood. Social strategies of this type are impossible for individuals to decide upon rationally: When individu-

als pay attention to the behavior of others, the distributed effects of individual actions are very complex. A good amount of speculation and induction from historical and ethnographic cases exists, but deductive analysis of these arguments has been lacking. Thus the function and value of the attitudes that generate cultures of honor are unclear.

McElreath (in press) analyzed a formal model of conflict management strategies that track and value personal honor to explore the material incentives and community structures that might lead to and maintain them. The analyses indicate that, unlike models of public standing for regulating cooperation, simple honor-attentive strategies perform well even when information about the standing of others is poor. The results may also explain the persistence of cultures of honor in situations where the material incentives that may have led to the values arising are no longer present.

Adaptive Foundations of an Egalitarian Social Norm

One of the important problems of social rationality is to explain how a social norm will emerge from the interactions among socially rational agents who adopt their behaviors and cognitions in response to current social environments. As an illustration, we focused on the emergence of an egalitarian distributive norm widely observed in primordial societies. It has been argued that communal sharing has emerged because it is a social device reducing uncertainty that is inherent in resource acquisition, but this cannot explain how the so-called free-rider

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problem is solved. Through a series of evolutionary computer simulations, it was shown that communal sharing norms can emerge and are sustained when there is asynchronous uncertainty on food acquisition (Kameda, Takezawa, & Hastie, 2003). We further extended the results and hypothesized that this environment structure may work as a cue to induce a sharing behavior: When a resource acquisition is framed as uncertain, people may tend to share such a resource with the others. This hypothesis was confirmed in different cultures under different settings (vignette and laboratory experiments in Japan and the U.S.; Kameda, Takezawa, Tindale, & Smith, 2001). In a new project by Keller, Takezawa, and Gummerum, the sharing of resources is studied with children in the context of cooperative games.

Moral Decision-Making and Moral Emotions in a Cross-Cultural Perspective

Over the last two years, we have further explored the question of how children and adolescents from different Western and Asian cultures reason about morally relevant conflict situations in the family and in close friendship. Concerning the developmental levels of socio-moral reasoning in Icelandic and Chinese children and adolescents, the results revealed developmental differences in younger children—Chinese children are more advanced in socio-moral reasoning, for instance. In adolescents, however, such differences were not observed. Furthermore, in decision making and reasoning about the authority dilemma, a complex interaction of ecology

and development can be obtained, which was not the case for friendship (Keller, in press-a). The relationship between structure and content of friendship reasoning in different cultures—including different Western and Eastern cultures—was explored by Gummerum (2002). We have started to analyze the transition from adolescence into young adulthood in friendship reasoning in a cross-cultural perspective (Keller, in press-b). A system for categorizing friendship reasoning was developed based on the integration of cognitive-developmental theories, that is, theories on self, ego, and socio-moral development. The analyses support a transition from adolescent reasoning of close identification with friends into reasoning of young adulthood, which is characterized by individuality and autonomy. While young Chinese adults emphasize the self as part of the societal system, they nevertheless reveal individuality and autonomy.

Development of Moral Emotions in a Cross-Cultural Perspective

Moral feelings in the case of rule violation indicate moral sensitivity. Younger children have been defined as “happy victimizers” because they attribute positive feelings to moral rule violators, while older children tend to attribute moral (guilt) feelings to such a moral violator. However, findings have been inconsistent with regard to the attributional shift in older children. Based on the findings from Chinese children, we tested whether a self-other differentiation may be an explanation for these inconsistent findings. In a cross-cultural study we compared 6- and

9-year-old German and Portuguese children's reasoning about the emotions attributed to a rule violator, both in the role of self and hypothetical other (Keller, Lourenco, Malti, & Saalbach, in press). Younger and older children attributed moral feelings more frequently to themselves as violator than to the hypothetical other. But the findings also revealed a developmental shift in both roles. Thus, a self-other differentiation only partly accounts for inconsistent results in the attribution of emotions to others. Two other studies have been performed to follow up on the phenomenon of moral emotions in different contexts.

Social Support

The submission of the report to the German Parliament on the "Conditions of Growing-up in Germany" (1998), prepared by an expert committee headed by Lothar Krappmann, was followed by a number of activities by which results of research in development and socialization were disseminated to groups and organizations that are active in promoting children's and adolescents' development and education. A special feature of children's social world are their peer networks. Children differ in social standing and influence, although they often claim to be equals and do not accept unilateral determination by a peer. The project "Inequality Among Children" investigates how children's socialization is shaped by the conflicting experiences of functional leadership, disrespectful exertion of power, and mutual negotiation. Analyses of questionnaire and interview data collected from 9- to 11-year-old

children show that children are aware of a hierarchy of influence and that they have conceptions of how influence is exerted by themselves and other.

Parental Investment

A special form of social behavior is behavior among family members. How can simple heuristics, particularly one-reason decision making, be employed in the domain of parental investment? Specifically: How can a parent decide which of several offspring he or she should give resources to first? The equity heuristic is a boundedly rational decision rule specifying that parents should attempt to split resources equally among their children. But, whereas an equity motive produces a fair distribution at any given point in time, it yields a cumulative distribution of investments that is unequal (Hertwig, Davis, & Sulloway, 2002). Which birth rank suffers most from a resource handicap depends on which growth period, and thus, which kind of resource is considered most important. If the total amount of resource is crucial, then the equity heuristic creates a middle-child resource handicap. If, however, the first period is most important, this heuristic creates a later-born resource handicap. If one focuses on resources specific to the last period, then an earlier-born resource handicap occurs. Across all handicaps, middle-born children are never best off. Thus, as Hertwig, Davis, and Sulloway concluded, the equity heuristic can provide an explanation of why the birth-order literature reports notoriously conflicting results and conclusions.

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The tabula of human nature was never rasa and it is now being read.
William Hamilton

Evolutionary Psychology

Evolutionary psychology lies at the heart of many research projects undertaken by the ABC research group, providing a motivation for bounded rationality, supporting the significance of the environment in ecological rationality, and emphasizing the importance of the social interactions that lead to evolutionary change in social rationality. At the same time, evolutionary psychology is grounded in ecological rationality: It assumes that our minds were designed by natural selection to solve practical problems in an efficient and effective manner. While evolutionary psychology focuses specifically on ancestral environments and practical problems with fitness consequences, ecological rationality additionally encompasses decision making in present environments without privileging problems with fitness consequences. Recently, Hoffrage and Vitouch (2002) wrote a chapter on these and other issues involved in the evolutionary psychology of thinking and problem solving for a textbook on general psychology, which is notable for being—to the best of our knowledge—the first account of this topic in such a German textbook. Thus, ABC members are leading the growing interest in Germany toward this relatively new field, also organizing symposia and giving keynote lectures on the subject at major German conferences. In these efforts, we are also taking the opportunity to introduce the discussion of ecological rationality and the “adaptive toolbox” into the realm of evolutionary psychology, adding a new theoretical dimension to this area.

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Evolutionary psychology is the search for the evolved “mental adaptations” that fill our behavioral repertoire. These psychological mechanisms were shaped over millennia of natural and sexual selection to solve the survival and reproduction problems our ancestors faced, and they continue to guide our decisions and preferences today. This does not mean that everything an individual does has been selected for, or even that those traits that have been selected for will necessarily confer some advantage on an individual expressing them in a modern environment. What this does mean is that the behaviors expressed by modern individuals are expected to be a result of the interaction between their evolved psy-

chology and the environment in which they live.

Through the influence of cognitive science, mental adaptations are typically viewed as software modules designed by evolution, specialized to process naturally occurring information about biologically important situations in ways that guide adaptive behavior. Thus, evolutionary psychologists tend to analyze adaptive problems, such as mate choice, foraging, habitat selection, etc., in terms of the structure of the decision maker’s environment, and the types of perception, computation, inference, strategies, and signals that the decision maker uses. Again, because of cognitive science (and particularly the influence of computer models), analyzing the en-

vironment often gets short shrift, while the computations assumed to be occurring inside a person's head are typically intricate and involved. However, ABC's focus on ecological rationality argues that evolution would have produced simple heuristics for decision making in many contexts, mechanisms that enable individuals to make decisions rapidly and efficiently when it is important to do so.

Evolved Mechanism as a Solution to the Frame Problem

Simple fast and frugal heuristics can help individuals make decisions quickly, both by limiting the amount of information they use to choose a course of action and by focusing attention on only the information that will be most useful in making the choice. Thus, these simple evolved inference mechanisms can help organisms overcome one form of the classic frame problem plaguing any information-processing decision maker: How to avoid considering the infinite number of possible real-world options and their unlimited future consequences when choosing a course of action. Ketelaar and Todd (2001) demonstrate how simple satisficing mechanisms that stop search, using an aspiration level, can limit the number of choices considered, and how emotions can focus information gathering on only those cues that will be most useful to the decision maker.

Mate Choice

One of the most evolutionarily important decisions facing sexually reproducing animals, including humans, is mate choice. By definition,

sexual reproduction entails combining one's own genes with another individual's genes to produce offspring. Through mate choice, individuals can influence the quality of the genes passed on to their offspring, and the quality of the parental care their offspring will receive. For many species, including humans, potential mates are not encountered simultaneously, but rather sequentially. When individuals find a potential mate they must decide whether the prospect is good enough to have offspring with. This sequential search problem can be addressed through the use of simple satisficing heuristics, which establish a threshold aspiration level that enables the straightforward judgment of the acceptability of a given potential mate. Simão and Todd (in press) have explored ways in which this aspiration level can be set based on the experience of the individual searching for a mate, finding that simple threshold-adjustment mechanisms can outperform complex optimizing methods in this domain, as in others.

The decision mechanisms that may have evolved to help us solve adaptive problems such as mate choice rely on the structure of the environment to make appropriate choices, and they will not work as well when the environment is different from what they expect (i.e., constantly being confronted with images of beautiful people through mass media may skew our mate preferences in ways that lead to poorer individual choices). But these mechanisms not only exploit environment structure, they also initially help to create it. As an example, mate-choice

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mechanisms affect the population of available mates for others to choose from, which in turn can be seen in population-level measures of mating success, such as the age at which individuals mate. In the human case, demographers have studied patterns of the age at which people first get married, and found that the pattern, a right-skewed bell shape relating percentage of the population getting married against the age at which marriage occurs, is remarkably constant in shape across cultures and historical periods. Could this pattern be the consequence of the individual mate-search strategies that people are using? Todd and

Billari (in press) explored this question by constructing a simulated population of individuals all looking for marriage partners using simple search rules and found that, with appropriate settings, these rules, operating at the individual level, could indeed account for the aggregate population-level outcome commonly observed. Studies such as this (see also Todd & Kirby, 2001) close the loop from environment structure to evolved behavioral mechanisms back to behaviorally influenced environment structure, further strengthening the connection that evolutionary psychology focuses on between the mind and the world.

Methods, Metaphors, and Theory Construction

In spite of the fact that most scientists search for universal truths, scientific "truths" are contingent in important ways on the statistical and experimental tools used to discover and test them. From different starting points and based on different case studies, we converge on the same general issue in this project area, namely, the detection and understanding of the limitations and powers of scientists' tools.

Experimentation in Psychology and Economics

The core method in psychological research is experimentation. Hertwig and Ortmann (2003) observed that the experimental practices in psychology and experimental economics differ. In particular, a frequently used methodological tool in psychological experiments, the deception of participants, is generally taboo in experimental economics. Recently, however, it has been argued that the evidence in social science research suggests that deceiving subjects in an experiment does not lead to a significant loss of experimental control. Based on this assessment, experimental economists have been counseled to lift their de facto prohibition against deception to capture its potential benefits. Ortmann and Hertwig (2002), argue that this recommendation draws on a selective sample of the available evidence. Building on a systematic review of relevant research in psychology, they present two major results: First, the evidence suggests that the experience of having been deceived generates suspicion, which, in turn, is likely to affect the judgment and decision making of a nonnegligible number of participants. Second, they find little evidence for reputational spillover effects that have been hypothesized by a number of authors

in psychology and economics. They conclude that experimental economists' prohibition of deception is a sensible convention that economists should not abandon.

The use of deception, however, is not the only striking difference in the experimental practices of economists and psychologists. Hertwig and Ortmann's (2001a) investigations revealed that, in contrast to psychologists (here they mean researchers in behavioral decision making and related areas in social and cognitive psychology such as social cognition, problem solving and reasoning), economists bring a precisely defined script to experiments and ask participants to enact it, using repeated experimental trials. This allows participants to learn in the task environment, and to be paid on the basis of clearly defined performance criteria. Do these methodological differences matter? Based on a review of empirical evidence, Hertwig and Ortmann argue that the practices in experimental psychology of not providing a precisely defined script for participants to enact, not repeating experimental trials, and paying participants either a flat fee or nothing leaves the social situation "experiment" open to a variety of interpretations. The fact that psychologists are (in)famous for deceiving participants' is likely only

... if the history of human achievement in knowledge proves anything, it is that the all-decisive discovery is that of an effective and fruitful method.

John Dewey

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to magnify participants uncertainty and second-guessing. The typical experimental practices in psychology increase rather than decrease the background of variation against which effects are appraised and thus reduce the replicability of results. Hertwig and Ortmann (2001a) concluded that by improving research designs (e.g., repetition of trials, performance-based payment) psychologists can increase their control of these sources of variation, thus increasing effect sizes and the power of statistical tests. Hertwig and Ortmann (2001b) responded to the comments of 34 psychologists and economists, who discussed their analysis of the different experimental culture in these two neighboring fields. Specifically, they argued that the impact of key methodological variables should not be taken for granted, but experimental practices themselves should be based in empirical evidence. To this end, they proposed that if no evidence about the impact of design variables is available, then the decision about design and implementation ought to be subjected to systematic experimentation. In brief, they argued against empirically blind conventions and against methodological choices based on beliefs, habits, or rituals.

Adversarial Collaboration

A famous example that has often been used to illustrate human irrationality is the conjunction fallacy, that is, violations of the conjunction rule (if A includes B, then the probability of B cannot exceed the probability of A). The classic problem designed to demonstrate violations

of the conjunction rule is the Linda problem, introduced by Tversky and Kahneman:

Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations. Rank the following statements by their probability:

- Linda is a bank teller (T)
- Linda is active in the feminist movement (F)
- Linda is a bank teller and is active in the feminist movement (T & F)

The typical result was that 80% to 90% of participants judged T & F to be more probable than T, a judgment inconsistent with the conjunction rule. With Tversky and Kahneman's norm for rational reasoning, the content of the Linda problem is irrelevant; one does not even need to read the description of Linda. As Hertwig and Gigerenzer (1999) argued, all that counts are the terms "probability" and "and," which Tversky and Kahneman assume must be interpreted as the *mathematical probability* and logical *AND*, respectively. However, as the Oxford English Dictionary shows both words have multiple legitimate meanings in natural language; only few of them correspond to the mathematical probability and logical AND, and therefore need not obey the conjunction rule. Hertwig and Gigerenzer showed that when the polysemy of the English term "probability" is eliminated—for instance, by replacing "probability" with "frequency"—the conjunction fallacy disappears. Kahneman and Tversky (1996), however, devised a frequency version of the Linda problem in

which the conjunction fallacy reappeared.

To debate controversial interpretations of the conjunction fallacy, a new approach called *adversarial collaboration* was then adopted. It requires both parties to agree on a procedure for resolving a dispute and, with the help of an arbiter, conduct empirical tests. Mellers, Hertwig, and Kahneman (2001) began their collaboration with Hertwig's claims that frequencies eliminate conjunction effects and that Kahneman and Tversky's results with frequencies were an artifact of some participants interpreting "and" as an "or." Hertwig proposed two conjunction phrases that avoided this interpretation. Kahneman predicted that conjunction effects would still occur with one of them. Mellers served as arbiter. Frequencies by themselves did not eliminate conjunction effects with any of the phrases, but when filler items were removed, conjunction effects disappear with Hertwig's phrases. Although theoretical disagreements remain, Hertwig and Kahneman agree that joint experiments have yielded theoretical progress and advanced the understanding of conjunction effects that would not have been achieved by working separately.

Tools-to-Theories

Where do new ideas come from? In his earlier work, Gigerenzer (1991) wrote about scientific discovery in terms of heuristics of discovery and proposed that scientists often employ a tools-to-theories heuristic. This thesis predicted that new scientific tools, once entrenched in a sci-

entist's daily practice, suggested new theoretical metaphors and concepts. It also predicted that once proposed by an individual scientist (or a group), the new theoretical metaphors and concepts are more likely to be accepted by the scientific community if the members of the community are also users of the new tools.

A prominent researcher who used the tools-to-theories heuristic was Brunswik. Gigerenzer and Kurz (2001) showed that after Brunswik switched to correlations as his new tool, his concept of the mind also changed. He began to regard the mind as an "intuitive statistician," and he suggested that the intuitive statistician would use the same new tools: correlation and regression. In particular, vicarious functioning, which Brunswik considered the most fundamental principle of the science of perception and behavior, began to be modeled by multiple regression. Gigerenzer and Kurz proposed a radically different way to model vicarious functioning: the framework of fast and frugal heuristics. Simple heuristics are psychologically plausible alternatives to multiple regression and, in addition, are consistent with Brunswik's own ideas. The adaptive value of vicarious functioning is not only in making accurate judgments, but also in being able to make judgments quickly and with limited knowledge. Gigerenzer and Kurz proposed to fill Brunswik's lens model (which provides a language for describing the environment and the cognitive system using the same terms) with fast and frugal heuristics and reported a counterintuitive result: When making inferences

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about real-world criteria, such a fast and frugal lens is not only as accurate as, but is even more accurate than the computationally complex multiple regression model.

Null-Hypothesis Testing

In a discussion of the limitations of (some) statistical tools, Gigerenzer (1998) predicted that future historians of psychology would be puzzled by an odd ritual: null-hypothesis testing. Although this ritual is camouflaged as the sine qua non of scientific methods, Gigerenzer argued that it undermines the theoretical progress in psychology by giving researchers no incentive to specify their hypotheses and by replacing statistical thinking with the application of a mindless statistical procedure. Such a mechanized routine invites diverse misinterpretations. By using a questionnaire developed by Oakes in the year 1986, Haller and Krauss (2002) found typical misinterpretations of a significant test result in 100% of the participating German psychology students. Astonishingly, even among the participating methodology instructors (university teachers who teach psychological methods to psychology students), 80% showed misconceptions about the meaning of a significant test result. Of course, the teaching of null-hypothesis testing can only be justified if students, and their teachers, are able to grasp the meaning of what they are doing. In Gigerenzer, Krauss, and Vitouch (in press), a curious student, who wanted to understand rather than perform the ritual, had the courage to ask questions that seemed naive at first glance and

that others did not care or dare to ask. Krauss and Wassner (2001, 2002) focused on the educational aspect. They provided a pedagogical concept of how to eliminate typical misconceptions when teaching inference statistics. The main aim of their didactical proposal is to foster insight by contrasting different statistical inference paradigms (null-hypothesis testing according to Fisher, alternative hypothesis testing according to Neyman and Pearson, and Bayesian statistics) and to illustrate what can be obtained by each of these paradigms and what cannot. Because the interpretation of the results from all these paradigms is based on the idea of conditional probability, a sound understanding of this core idea is required as a basis for understanding inference statistics (which can be obtained with the "natural frequency" concept, see above). Finally, Gigerenzer and Krauss (2001) focused on the history of significance tests and the development of the various problems and misinterpretations. They illustrated the relevance of eliminating these misinterpretations at an early stage in a student's schooling.

Confusing Predictors and Criterion

In cases in which a criterion is difficult to measure, a proxy may be substituted. For instance, because scientific achievement is hard to assess, the Institute of Scientific Information (ISI) citation rates are often used instead. As a result, citation rates (the frequency of citations in a set of journals) are in danger of becoming an objective measure of scientific quality. Müller-Brettel (2001)

argued that citation analysis will only be a useful tool for measuring scientific relevance as long as there is a consensus in the scientific community that publications in journals with high citation rates are honest indicators of scientific quality. Another example is using self-reports to predict behavior in extreme situations. How reliable are these reports? In a historical analysis of psychological research on war and peace, Müller-Brettel (in press) assessed the failure of militarism/pacifism scales to predict behavior in wartime situations. Among the ma-

jority of citizens, pacifistic attitudes predict pacifistic behavior only in times of peace, while in a concrete conflict situation social influences and attachments are better predictors of behavior than moral values. As these two examples show, one should be careful to distinguish predictors and criteria: A citation rate refers to scientific achievement, but it is not an objective measure for scientific quality, and a particular value on an attitude scale refers to a mental disposition, but may not be a reliable predictor for behavior.

Future Directions

One of the major goals for the near future is to finish our new book on the match between heuristics and environments, thereby promoting and interconnecting research on bounded rationality and ecological rationality. Another major goal is to explore the legal dimensions of (the use of) heuristics and the way information is communicated. To this end, we will (1) extend the existing collaboration with the Max Planck Project Group "*Common Goods: Law, Politics and Economics*," (2) a Dahlem conference on Heuristics and the Law which will be held in June 2004 (organizers Gerd Gigerenzer and Christoph Engel), and (3) the third Summer Institute on Bounded Rationality (to be held 2003), for which we were able to get funding from the VW Stiftung, will focus on applications in the law (the last one focused on emotions, see box).

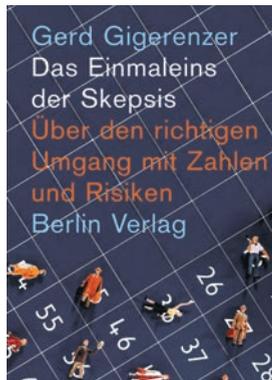
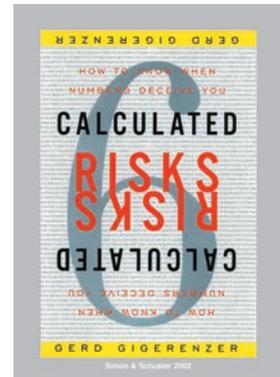
Summer Institutes 2001 and 2002

The Summer Institute intends to put forth a view of decision making that is anchored in the psychological possibilities of humans rather than in the fictional construct of homo oeconomicus. The special focus in 2002 was to explore the idea of social rationality in combination with bounded rationality and to integrate research on emotions into bounded rationality. Our emotional systems enable us to make choices "fast and frugally"—that is, by reacting to our immediate emotional responses as opposed to engaging in costly deliberation. Because of their precise formulation, fast and frugal heuristics provide a fruitful framework for studying when and how emotions come into play. 35 participants from eight European countries, the US, Israel, and China were selected from about 200 applicants. They had backgrounds in psychology, economics, philosophy, anthropology, biology, management, and finance, resulting in an international and interdisciplinary blend of young researchers. They discovered a common interest in bounded rationality and benefitted from learning about perspectives taken in other research fields. We are very encouraged that the Summer Institute worked out as a technique to cross the borders between different disciplines.



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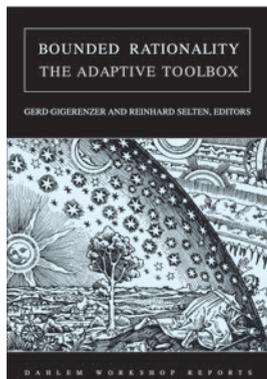
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Center for Educational Research

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Introductory Overview

The Center for Educational Research was restructured in 1996 when Jürgen Baumert was appointed director. The Center's specific concern is research on development and learning from the perspective of institutionalized education. Educational settings such as schools are conceived as providing a specific structure of opportunities and constraints for learning and development. This structure offers a variety of developmental opportunities, but at the same time excludes others. How do aspects of schooling affect learning within and across subject domains, impact on the intra- and interindividual differentiation of personality traits, and guide career-forming processes? Such questions are explored by a multidisciplinary team which includes educational scientists, psychologists, mathematicians, and sociologists. A strong theoretical focus is combined with an applied approach in the fields of system monitoring, professionalization of teaching, and improvement of learning and instruction.

Conceptual Orientation: Schooling as a Cultural Artifact and an Authentic Part of Life

The Center's research program is institutional as well as developmental in orientation. This calls for a multi-level research perspective:

- (1) With regard to the social structure of societies, formal education can be conceived as a career-forming process, even in its initial stages.
 - (2) From an institutional perspective, the focus is on facilitating and fostering cumulative learning within and across subject domains.
 - (3) From an individual point of view, learning development can be conceptualized as a process of inter- and intraindividual differentiation.
- The Center's research agenda is shaped by each of these perspectives.

It is a structural paradox of formal education that the experiences made available within institutions of formalized education are always vicarious—selected and prepared with the aim of facilitating learning

processes which the learner must nevertheless perceive as personal and authentic. The more educational institutions try to integrate authentic everyday experiences into their programs, the more obvious the paradox becomes. The acquisition of knowledge in educational institutions is confined by the structural properties of the institution, regardless of whether or not authentic learning is emphasized. This constitutes the difference between learning inside and outside of school-like institutions.

At the same time, however, school is a central part of the student's life, and impacts strongly on cognitive activities, beliefs, and behavior outside of school. Educational institutions command a large part of the time of children, adolescents, and young adults, and thus constitute social environments in their own right. The social rules and regulations of educational institutions not only create the conditions for systematic instruction and learning, but

provide the setting for immediate everyday experiences. In our research program, this effect of schooling is taken into particular consideration in a longitudinal study exploring individual development in terms of cognitive competencies, motivational and social resources, and value commitment.

The way in which educational institutions have structured content areas into different academic subjects determines the **high domain-specificity of knowledge acquisition.**

This is taken into account in our research on the structure of knowledge—including domain-specific epistemological beliefs—acquired in school. In large-scale assessment studies, classroom studies, and experimental training studies, **we focus on domains of knowledge which represent basic cultural tools** and, as such, are critical for individual development in modern societies. **Mathematics and science education and reading comprehension** constitute main areas of research. Special emphasis is placed on the question of how cognitive activation and self-regulation can be stimulated and supported by instructional environments.

In all our research on the interaction between the individual learner and the institutional educational setting, the learner is perceived as the producer of his or her own development—not only in the constructivist sense of active and idiosyncratic acquisition of knowledge, but also in the sense that he or she proactively selects and shapes the developmental environment.

Summary Outline

The following summary of the Center's research program is not comprehensive. Rather, research projects have been selected to illustrate the major lines of inquiry pursued in the Center and provide a representative overview of the three areas of our current research.

Research Area I focuses on the relationship between the opportunity structure of schools and the optimization of individual development in terms of cognitive competencies, motivational and social resources, value commitment, and successful transition to university education, vocational training, and the labor market. The basis for this research program is provided by a multiple-cohort longitudinal study which was initiated in 1991 with a sample of 13-year-olds. In 2001 these main cohort participants, now aged 23, took part in a sixth wave of measurement (Learning Processes, Educational Careers, and Psychosocial Development in Adolescence and Young Adulthood [BIJU]). BIJU is supplemented by two longitudinal studies focusing on students at the end of schooling and during the subsequent transitions: Transformation of the Upper Secondary School System and Academic Careers (TOSCA) and Developmental Regulation during the Transition from School to Vocational Education (DRAMA).

Research Area II comprises studies which can be seen as representing the first steps in the establishment of a national monitoring system to gauge the performance of the German school system. These foundational studies combine basic re-

search and system monitoring in an international comparative perspective. The most important projects in this research area are the **Third International Mathematics and Science Study (TIMSS)**, and the OECD's **Programme for International Student Assessment (PISA)**. These studies are complemented by the second **CIVIC Education Study** initiated by the International Association for the Evaluation of Educational Achievement (IEA). Together with a project on state schooling in the former GDR funded by the German Research Foundation (DFG), these studies provide a firm basis for the Center's **Report on Education (Bildungsbericht)**, which is published in collaboration with the Center for Sociology and the Study of the Life Course.

Research Area III consists of projects on learning and instruction with an experimental or quasi-experimental approach. Most of these studies address research questions that have emerged directly from the first and second areas of research. They are conducted either in the laboratory (**ENTERPRISE**) or as longitudinal studies in school environments with a strong emphasis on teacher expertise (**COACTIV**). In the field of mathematics education the Center closely collaborates with the **Center for Adaptive Behavior and Cognition**. Building on a strong theoretical background, these studies have practical implications for the optimization of classroom instruction and teacher training.

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**Research Area I
 Opportunity Structures of School and Individual Development in Adolescence and Young Adulthood**

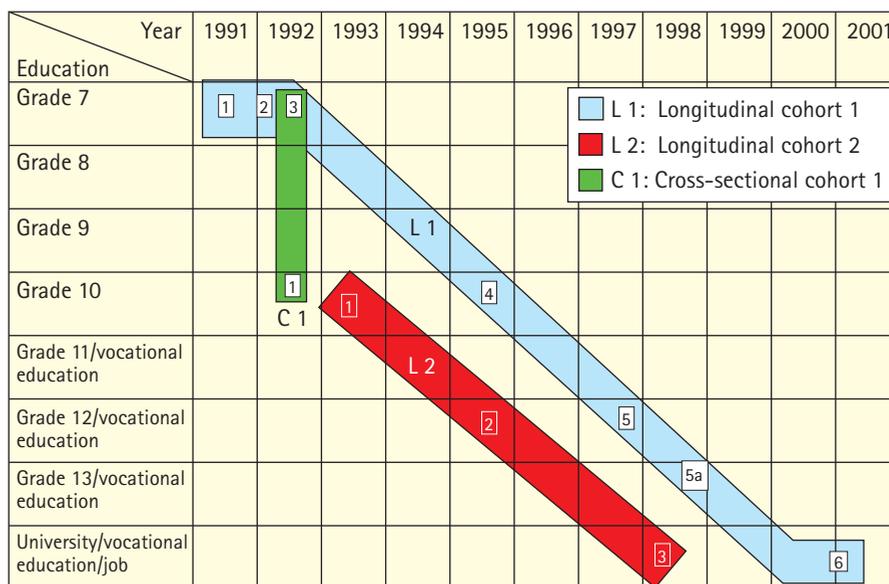
Educational Institutions as Developmental Environments

The successful development of human beings across the entire life span is dependent both on their individual internal characteristics and on external socializers, such as significant others and social institutions. The relative importance of internal and external promoters varies across the life span and between the areas of individual functioning. While parents, for example, play a dominant role for their children's development during infancy, childhood, and early adolescence, their influence decreases during adolescence and often ceases entirely in adulthood. Particularly in the domain of academic learning and, more generally, cognitive development, the social institution of school plays an important role during childhood and adolescence. Furthermore, schools have an impact on the formation or development of motivation, emotions, attitudes, and other personal characteristics.

Inasmuch as the theoretical perspective of the Center for Educational Research highlights the institutional influence on human development, it requires longitudinal multilevel studies that collect data at school, class, and individual levels, cover more than one knowledge domain, and allow the investigation

of intraindividual change across domains and of interindividual differences in the patterns of intraindividual change. The national longitudinal project *Learning Processes, Educational Careers, and Psychosocial Development in Adolescence and Young Adulthood (BIJU)* fulfills the requirements of a multilevel longi-

Figure 1. Research design of the BIJU project.



tudinal design in its investigation of the effects of school and class environments on human development. The BIJU study has four guiding components, each with specific tasks and addressing specific issues: **(1)** provision of institutional and individual baseline data on the integration of the East and West German educational systems; description and analysis of the transformation of the East German educational system and the subsequent impact on system performance; **(2)** analysis of domain-specific learning as dependent on social and cognitive resources, prior knowledge, motivational orientation, learning and processing strategies, quantity and quality of instruction, and general institutional conditions; **(3)** analysis of long-term trajectories of psychosocial development in adolescence as shaped by varying conditions of schooling and instruction;

(4) analysis of ways of coping with the transition from school to vocational training and working life or college, taking into account the interplay of personal resources and the conditions of the vocational training system and the labor market. Thus far, research has focused mainly on the first three guiding components of the BIJU project. Because all the students in the sample have now left school, the theoretical focus is currently shifting to the fourth BIJU component, that is, more emphasis is being placed on students' ways of coping with the transition from school to work or to university. BIJU is the starting point for two supplementary studies, TOSCA and DRAMA, which allow for a more specific investigation of a subset of questions concerning the transition from school to work or to university education. In the following, three of the current research projects will be described in more detail.

The BIJU Study Data Collection

The BIJU longitudinal study began with a survey of the main cohort (longitudinal cohort 1) during the 1991/92 school year (see Fig. 1). Data was gathered from seventh-graders at three measurement points. The first point of measurement coincided with the transformation of the unitary school system of the former GDR 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 next follow-up survey took place in Spring 1997, when the participants were in either the vocational education system or the academic track of upper secondary level. The sixth wave of data collection was conducted in 2001, focusing on how students have mastered the transition from school to university or from vocational education to the labor market.

The sample of school classes comprises of some 8,000 students from 212 schools of all secondary school types in the states of Berlin, Mecklenburg-West Pomerania, North Rhine-Westphalia, and Saxony-Anhalt.

In Spring 1993, the sample was supplemented by a second longitudinal cohort of 1,330 students in the final grade of lower secondary level. In order to provide a baseline for an East-West comparison at the end of lower secondary school, a separate cross-sectional study of the tenth-grade (involving approximately 1,600 students) was also carried out. This study concentrated on issues of political socialization and the transition to vocational training and working life.

Overall, the BIJU design makes it possible to simultaneously analyze aspects of individual development, the particular situation of different birth cohorts, and the impact of social change.

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Opportunity Structures, Academic Achievement, and Cognitive Development in Secondary Schools

One of the basic assumptions of our research program is that schools represent learning environments in which cognitive development during adolescence may be promoted more or less successfully. Due to its long-term character, with five measurement points over a period of six years within the school context, the BIJU project enables us to compare the learning trajectories of students in different types of secondary schools from grade 7 to grade 12. The findings show quite clearly that the transition from elementary school to different types of secondary school has remarkable effects on domain-specific learning processes. The highest achievement gains are reached at the *Gymnasium*, followed by the *Realschule*, the *Gesamtschule* (comprehensive school), and finally the *Hauptschule*. Additional analyses show that learning differences across the school types are not only a consequence of reducing the achievement heterogeneity between students within classes, but are mainly effects of different learning and teaching cultures in the different school types. Interestingly, the different types of secondary school do not only influence learning trajectories in curriculum-based knowledge, as measured with standardized achievement tests, but also impact on nonverbal psychometric intelligence.

The rationale for the early assignment to different school types in Germany is that learning and instruction are supposedly more effective in relatively homogeneous

groups of students, in which teachers can adapt their instructional strategies according to the entry achievement levels of their students. It is, therefore, assumed that school types differ with respect to the demands made by instruction: The higher the track, the more demanding the classes. Being exposed to higher demands in class should lead to higher levels of cognitive stimulation and higher gains in achievement. The different types of secondary school are thus assumed to provide specific learning environments that differ with respect to how much they promote the cognitive functioning of their students. The assumption that different school types will result in different achievement levels was tested in a series of studies and for several subjects. Especially for the core subjects, such as English as a foreign language and mathematics, considerable differences in achievement gains were shown even after controlling for important preconditions, such as basic cognitive abilities and social background. The steeper achievement trajectory of *Gymnasium* students may not be caused by ability-grouping per se. It is likely that the learning environment of the *Gymnasium* contributes to higher learning rates. This assumption is supported by the findings of the TIMS-Video study, in which mathematics lessons in German schools were rated by experts on various instructional variables. Relative to students' prior knowledge, the exercises used at the *Gymnasium* are cognitively more demanding than in other school types, thus helping students to learn in a

more effective manner. These results provide empirical support for the assumption that different school types in Germany represent different learning environments, in which the given opportunity structures have a substantial influence on student progress (Köller, Baumert, & Schnabel, 1999; Köller & Baumert, 2001).

The context effect is not restricted to curriculum-based achievement outcomes only, but also impacts on highly g-loaded measures of mental ability. Because of the transformation of the school system of the former German Democratic Republic (GDR) in 1991, the BIJU dataset is well suited to draw conclusions about unique schooling effects on cognitive development. Prior to 1991, all students in the former GDR had attended the comprehensive Polytechnische Oberschule and thus had experienced a similar institutionalized education. After German reunification, however, these students were tracked in accordance

with the segregated system of the Federal Republic of Germany (FRG). At the beginning of the BIJU data collection (Time 1), these students had just been placed in either Gymnasium or lower track schools. A nonverbal marker test for mental ability was available at two time points, at Time 1, when the students were in grade 7 and at Time 2, in grade 10.

Our analyses replicated the well-known finding that the choice of a particular type of secondary school (academic vs. vocational track) is strongly determined by students' prior school achievement and by parental socio-economic status (SES). Moreover, even after controlling for these variables, students' mental ability turned out to be highly predictive for their choices, meaning that, all other things being equal, brighter children were more likely to enter the Gymnasium. This finding indicates a self-selection process into different types of schooling.

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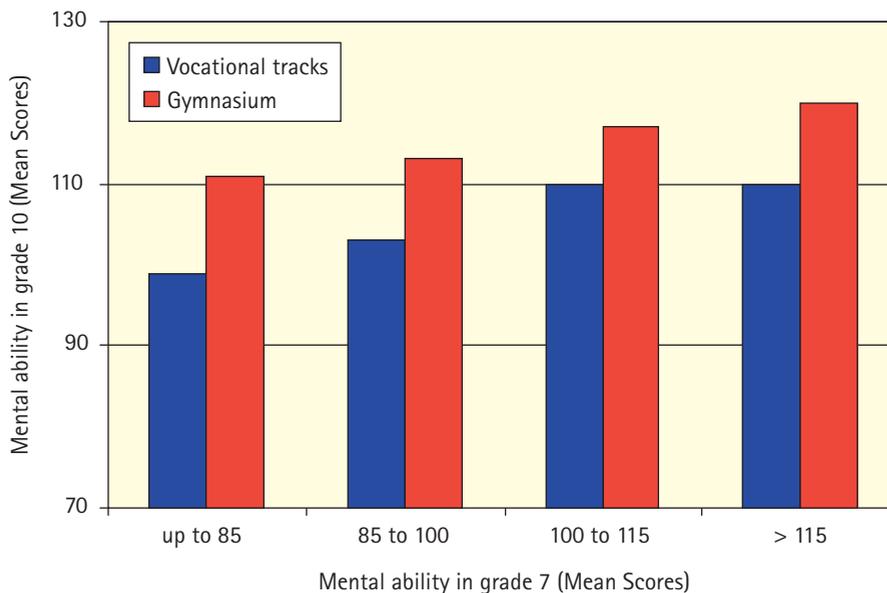
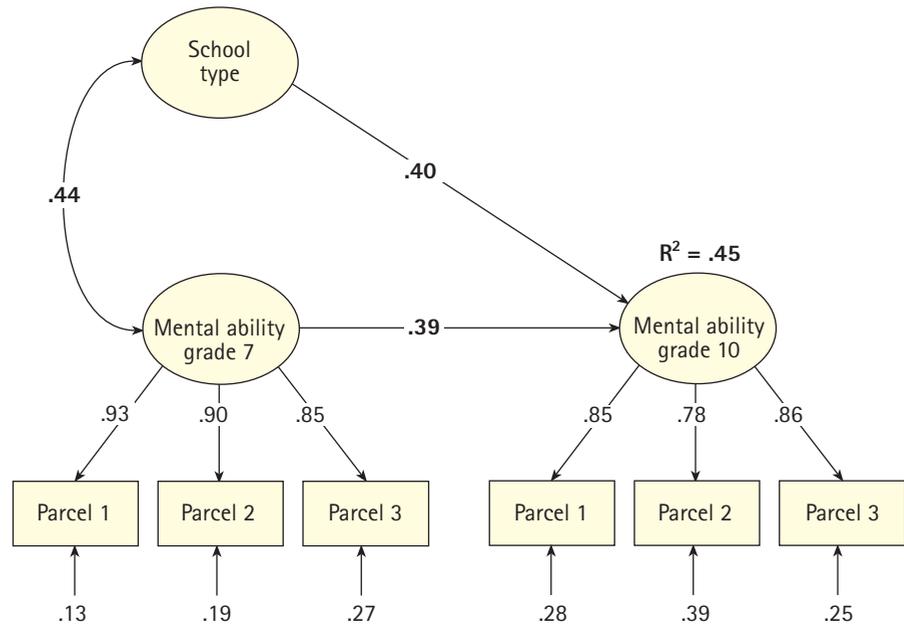


Figure 2. Cognitive development in four student groups with different initial levels of mental ability.

Figure 3. Structural equation model for predicting mental ability in grade 10.



However, differences between school tracks in psychometric intelligence emerge not only because of self-selection effects. Our analyses show that prior differences increase longitudinally as a function of school type. Longitudinal multilevel and structural equation modeling (SEM) analyses revealed a substantial effect of school type on the development of mental ability.

After controlling for mental ability and social background at grade 7, students in the academic track had mental ability scores at the end of grade 10 that were more than half a standard deviation higher than vocational track students. As shown in Figure 2 for four groups of students, gains from grade 7 to grade 10 were larger in the Gymnasium than in the vocational tracks of Realschule and Hauptschule. Further research on the details of this pattern was conducted using a structural equation model (see Fig. 3). After correcting for measurement error, the SEM

analyses revealed a highly significant effect of school type (Gymnasium vs. others; standardized regression coefficient $\beta = .40$).

After controlling for school type there was no effect of school-average ability score. This suggests that institutional features of the different school types are predictive, but not the composition of the student body in terms of basic intellectual capacity. This finding is in line with the results on the quality of mathematics exercises in different types of secondary schools reported above. Moreover, the analyses also revealed that parental SES did not influence cognitive development within the school types. Since prior differences in all relevant variables were controlled for in all reported analyses, the differences in cognitive development are attributable to differences in the quality of schooling between school tracks.

Taken together, this research shows that different school types attract

different student populations. The children differ with respect to their school achievement, parental SES, and mental ability. Moreover, different school opportunity structures maximize the differences in student's intellectual abilities in the long run. The substantial effect of schools or school types on cognitive development reaches beyond the confines of curriculum-based knowledge. Possible pedagogical implications of these results include the provision of more favorable opportunity structures in vocational track schools, in order to improve the cognitive development of the students in these schools.

Opportunity Structures and Nonacademic Outcomes

The impact of contextual factors is not confined to progress in specific subjects and basic cognitive abilities. Many studies have also demonstrated the malleability of self-concepts, academic interests, and societal beliefs in different or changing contexts. The BIJU design extends beyond the effects of school types, outlined in the previous chapter, to include further contexts that are important for individual development. Here this will be illustrated by the dynamics of self-concept of students from West and East Germany after reunification. A second study focuses on the effects of school-to-work-transition on students' societal beliefs.

Context Effects on the Dynamics of Self-Concept

Context effects on self-concepts are pervasive in the educational context. For instance, the results of several

studies indicate that academic self-concepts of adolescents drop after the transition to high school. One possible reason for this decrease in the mean level of self-concept of high school students is the increased emphasis on achievement and competence evaluation in higher grades. Moreover, transitions into more academically selected classes tend to have a deteriorating effect on the self-concept of high-achieving students. These findings were confirmed by the BIJU study, which allowed the development of self-concept of East German students to be examined after introduction of the three-tier school system (Marsh, Köller, & Baumert, 2001). Thus, there is clear evidence that changing social comparison groups impact on the *mean level* of self-concepts in a particular subgroup.

However, contextual effects may not be restricted to the mean level of self-concepts; they may also affect the *structure* of self-concept or even moderate the *dynamics of self-concept*, that is, the directionality of causal effects between more global self-concepts (such as self-esteem; e.g., "At times I think I am no good at all") and more domain-specific self-concepts (such as mathematics self-concept; e.g., "Nobody's perfect, but I am just not good at maths"). Whereas some classic models emphasize *bottom-up effects* (i.e., effects from domain-specific self-concepts to more global self-concepts), other researchers have adopted a *top-down perspective*. Because East and West German students experienced very different school environments prior to and shortly after reunification, the BIJU

Key Reference

Marsh, H. W., Köller, O., & Baumert, J. (2001). Reunification of East and West German school systems: Longitudinal multilevel modeling study of the big-fish-little-pond effect on academic self-concept. *American Educational Research Journal*, 38, 321-350.

Key Reference

Trautwein, U. (in press). *Schule und Selbstwert* [Schools and self-esteem]. Münster: Waxmann.

study design provides a unique opportunity to examine the moderating role of context factors on the dynamics of self-concept. When the Wall came down, the newly established East German states decided to replace their unitary school system with the West German school system. Therefore, East German students experienced a profound change in their school environment. In addition to differing structural elements (comprehensive school system vs. tracking system), there were several other differences in the East and West German school environment. For instance, it was an explicit educational goal in East Germany to foster accurate self-evaluations. "Accurate self-evaluation," which essentially meant that students were expected to conform with the teachers' evaluation, was seen as a prerequisite for "creating harmoniously developed socialistic personalities." Accordingly, teachers in East Germany emphasized social comparisons in their classes. Their feedback stressed the relative performances of individual students and was given publicly in front of the entire class throughout the school day and in public settings outside of school. Hence, in the BIJU study the members of the East German sample differed greatly from their West German counterparts. Given the differences between East and West in the school environment, we expected the school context to moderate the relationship between more specific and more general self-concepts (Trautwein, in press). More precisely, we expected to find more empirical support for bottom-up effects in the dynamics of self-

concept in East Germany than in West Germany for two reasons. First, because the East German school system put more emphasis on social achievement comparisons, academic achievement can be expected to be of greater relevance to the general self-concept of East German students. Although the East German school system was replaced by the West German system, we assumed that these elements of the teaching culture should remain stable for some time. Second, these students had to deal with a major shift in their school environment shortly before our study commenced—namely, the introduction of a tracked system. For most students, this meant placement in a new class, the experience of new teachers, and the establishment of new school policies. Such changes in the school environment (e.g., grading practices and a different social comparison group) might lead to a readjustment of domain-specific self-concepts which, in turn, will affect global self-esteem. Accordingly, relative to their West German counterparts, bottom-up effects should be stronger in students from East Germany.

The hypothesis was tested in a three-wave cross-lagged panel design. The study took place shortly after German reunification, using a sample of 5,648 students from West and East Germany. Mathematics and German school grades and domain-specific self-concepts in German and mathematics were sampled in addition to global self-esteem. Moreover, the effects of school type were controlled. Overall, the results supported our hypotheses. The inter-

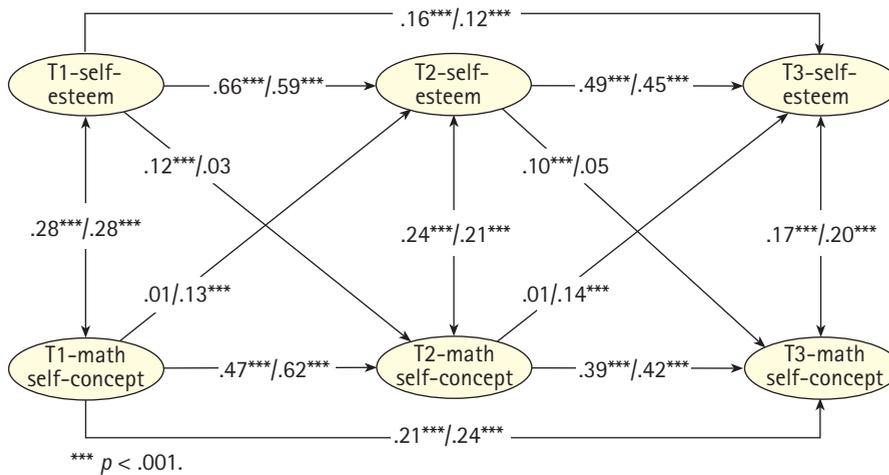


Figure 4. The dynamics of self-concept. T1, T2, T3 = measurement point. Numbers left of slash: scores for West German students; numbers right of slash: scores for East German students.

relationship between self-esteem and mathematics self-concept is illustrated in Figure 4. As can be seen, the stability of self-esteem and self-concept was high in both the West and the East German sample. However, stronger bottom-up effects were found in the self-concept development of East German students (values following the slash), whereas top-down effects predominated in West German students. Thus, the study indicates that context effects do not only influence the mean level of self-concept, but also might moderate the dynamics of self-concept.

Context Effects on the Dynamics of Societal Beliefs

In modern liberal societies, middle and late adolescence is known to be the formative period for developing political identity. It is often argued that adults' political attitudes and values are shaped in part by the way they dealt with social experiences during this developmental phase. One key component of political identity formation concerns the process of acquiring and modifying

a general understanding about the causes of social inequality in a given society. For instance, people make sense of societal issues such as social upward mobility (i.e., being successful in one's life or career) by identifying their causes. Causal explanations for social upward mobility typically fall into two broad categories: either individual factors or societal factors are held responsible. Whereas individual or dispositional factors refer to differences in motivation, effort, or capability (e.g., "in order to get ahead in life you have to be talented and smart"), societal or situational factors refer to conditions of birth or social background (e.g., "in order to get ahead in life you have to come from the right family"). The results of several studies indicate that both individual and societal explanations for social success can be found in an individual's belief system.

In order to gain a more accurate insight into why people develop particular explanations for social upward mobility, contexts have to be taken into account. General ideas about "how society works" are

Key Reference

Watermann, R. (in press). *Gesellschaftsbilder im Jugendalter. Vorstellungen Jugendlicher über die Ursachen sozialer Mobilität* [Adolescents' views of society: Their causal beliefs in upward mobility]. Opladen: Leske + Budrich.

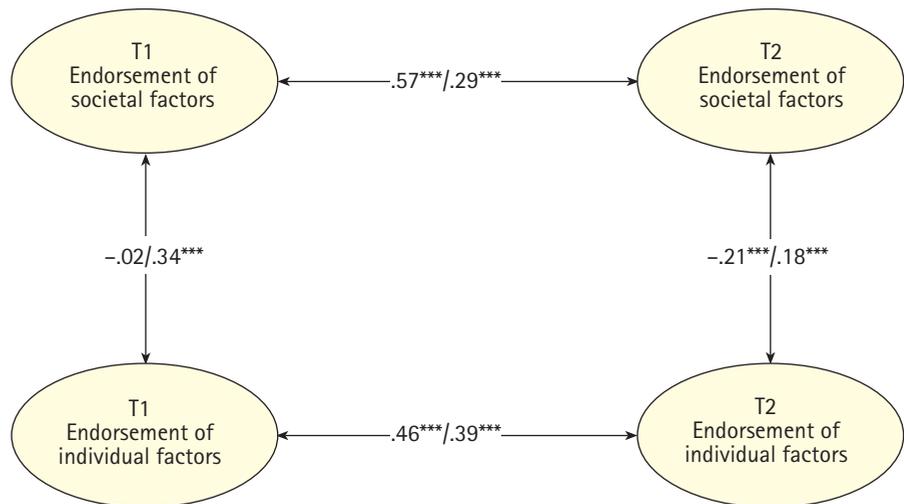
learned during childhood and early adolescence in the family context and in school. Particularly the school system fosters beliefs in the efficacy of individual factors such as effort and ability. In middle and late adolescence, students' growing personal experience as well as their more sophisticated reasoning, critical analysis of society initiated by various subjects at school, and intense exchange among peers may stimulate the awareness that both individual and societal factors may be implicated. At this stage, the belief system is assumed to be relatively unstable and open to diverse influences.

One of the great challenges for adolescents' societal beliefs is, of course, the school-to-work transition. Conflicts between personal beliefs and experiences acquired during this stage are not unlikely to occur. The German school system, in which students are allocated to one of three secondary tracks according to their ability level, is particularly

well suited for investigating the effects of the school-to-work transition in general, and the importance of individual experience in particular. In Germany, vocational-track students (but not their counterparts in the academic track) typically face the transition from school to apprenticeship or other types of vocational training at the end of grade 10. Particularly in a tight labor market, students reflect on the difficulties facing adolescents entering vocational training after school. Their experiences during the transition from school to work are likely to conflict to some degree with beliefs about the efficacy of individual factors developed in school. Thus, the interplay of peer context and the school-to-work transition may make young adults more aware of situational and societal factors that might account for differences in social upward mobility.

In light of these considerations, we expected experiences gained during the school-to-work transition to im-

Figure 5. Results of multiple-group longitudinal factor analysis. Numbers left of slash: scores for academic track students; numbers right of slash: scores for vocational track students.



*** $p < .001$.

pact on the stability and change of school leavers' beliefs about social upward mobility. Specifically, youths with a less successful transition from school to work (i.e., students who did not manage to find an apprenticeship in their desired occupation) are expected to be more likely to endorse societal factors than those who have been successful. Longitudinal data were collected from $N = 1,455$ German students in grade 10 (in the school year 1995) and again in 1997 when they were in grade 12 (academic-track Gymnasium) or in vocational training. Students were asked: "What do you think is necessary in our society to be successful in one's life and career?" Two factors were derived based on participants' responses to 12 Likert-type items (1 = strongly disagree to 4 = strongly agree) that tapped their beliefs about the relevance of individual (e.g., "you have to make an effort and work hard") and societal factors (e.g., "you have to have money and wealth" or "you have to have the right connections").

Results of a multiple-group (academic-track Gymnasium vs. non-academic school types) two-wave factor analysis revealed significant group differences in the stability over time of beliefs about the importance of societal factors for upward mobility ($r = .57$ vs. $r = .29$). Lower stability in the nonacademic group indicates that the transition from school to work impacts on the formation of societal beliefs as an ecological context variable. Group differences in the stability of the importance accorded to individual factors were not significant (see Fig. 5).

Our findings also show that the perceived efficacy of individual factors predominates in the whole sample. In line with developmental studies, our data provide evidence for an increase in the perceived relevance of individual factors (not illustrated). However, as expected, adolescents who did not find an apprenticeship in their desired occupation become more cognizant of societal factors (see Fig. 6). Further analyses showed that this change is at least partly

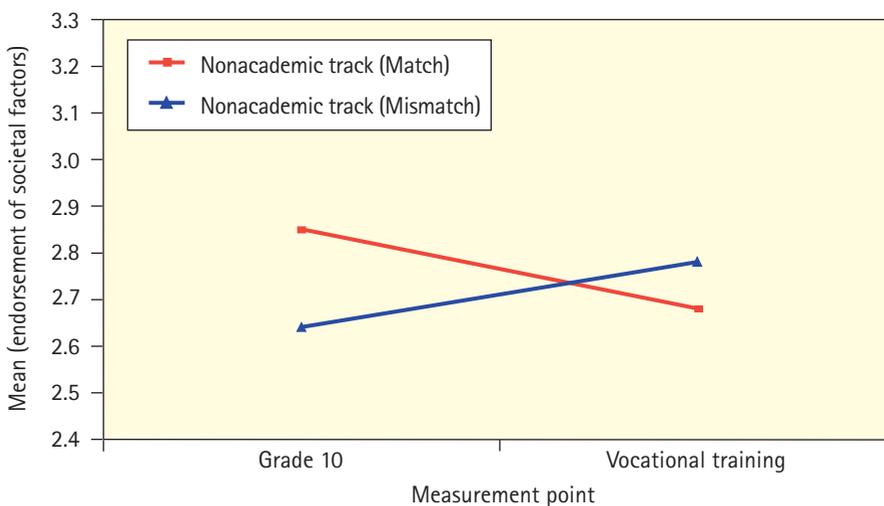


Figure 6. The dynamics of the perceived relevance of societal factors for social upward mobility in two groups: nonacademic track with match (desired apprenticeship obtained), or mismatch (desired apprenticeship not obtained) at two time points.

explained by the tendency to blame the system. Although students become more critical about societal allocation mechanisms, the perceived efficacy of individual factors for getting ahead in life remains unaffected. In contrast, a successful transition was related to a decline in the perceived importance of societal or situational factors.

Our results suggest that adolescents' views about the causes of upward mobility may develop in concert with the experiences they gain in their developmental contexts. With regard to the process of political socialization, it is noteworthy that—despite an increase in the awareness of societal factors—there seems to be a consensus among young people that unequal social outcomes reflect differences in individual effort and ability. Thus, adolescents learn to balance individual and societal explanations for social upward mobility. From a human development perspective, the maintenance of beliefs about the relevance of individual causes can be considered highly adaptive and an important resource for adolescents' future career management.

Opportunity Structures and the Transition from School to Work or University

The BIJU study as well as the supplementary data supplied by the TOSCA and DRAMA studies provide a deeper insight into the transition from school to work or from school-to-university education. In our approach, the focus is on the predictors of successful transition, taking into account individual resources as well as certain aspects of the aca-

demical context. In a first step, the TOSCA project is currently concerned with students from two academic settings, "berufliches Gymnasium" (vocational Gymnasium) and "allgemein bildendes Gymnasium" (traditional Gymnasium): How do they differ? Do they reach the same levels of qualification for university access and successful university education?

Due to the opening up of the educational system, university access in Germany has become more diversified (Köller & Baumert, 2002a). Tracks leading to the General Higher Education Entrance Qualification now include the Integrated Comprehensive School (Integrierte Gesamtschule) and the vocational Gymnasium as well as the traditional Gymnasium. The former two have the important role of providing an access to university education for a population that, traditionally, tended to be averse to the preuniversity tracks of secondary school. There is solid evidence that, on their entrance to upper secondary level, students of the traditional Gymnasium, on the one hand, and students of the vocational Gymnasium and the Integrated Comprehensive School, on the other hand, significantly differ in their social and educational backgrounds. For instance, about 80% of the students at vocational Gymnasiums in Baden-Württemberg, currently under review by TOSCA, had initially attended schools of the non-preuniversity type. Thus, vocational Gymnasiums help to ensure that a sufficient number of students are qualified for university education. This school type is a typical example of the opening up of universi-

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ty access—previous choices prompted by the three-tier school system can be more easily revised. Differences in students' educational and social backgrounds lead to differences in the achievement levels reached in the traditional and in the vocational Gymnasiums. Therefore, it seems more reasonable to focus on the extent to which students of the vocational Gymnasium attain the *minimum standards* needed for successful university education, rather than on the issue of differences in overall achievement. Furthermore, as a matter of distributive justice, efforts should be made to ensure that assessment standards in different school types are comparable. Laying down minimum standards is not always an easy task because of the lack of criteria that teachers and school and university administrators agree upon. However, there are achievement tests for which some

practical criteria exist (e.g., college entrance exams) and tests for which proficiency levels have been defined on a sound theoretical basis. In the TOSCA project (Köller, Watermann, Trautwein, & Lüdtke, in press), we stick to such well-established instruments. For assessing mathematics achievement, the preuniversity mathematics test from the Third International Mathematics and Science Study (TIMSS) was used. This use of TIMSS tasks, on the one hand, provides a basis for comparing results with the national average and, on the other hand, allows for academic achievement to be interpreted in terms of the proficiency levels defined in TIMSS. These proficiency levels can be described as critical thresholds in achievement, above which there is sufficient probability that students will provide the correct response to advanced mathematics questions

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The TOSCA and DRAMA Studies—Research Goals and Database

The **TOSCA** project combines educational and developmental questions. On the educational side, TOSCA examines the opportunity structures for students with different backgrounds, attainment of educational standards in German upper secondary schools, and the comparability of school-leaving certificates in Germany. It also attempts, on the basis of multiple measures and assessments, to predict the academic choices students from different backgrounds are likely to make.

The TOSCA project encompasses data of about 4,700 students in their last year of upper secondary education (about age 17–19). All students were sampled from Baden-Württemberg, and they attended either "allgemein bildendes Gymnasium" (traditional Gymnasium) or one of five forms of "berufliches Gymnasium" (vocational Gymnasium). The first wave of data collection took part in March to May 2002. A second wave of data collection in November to December 2003 is planned, thereby opening a longitudinal perspective. By that time, a large proportion of the students (> 50%) will attend college.

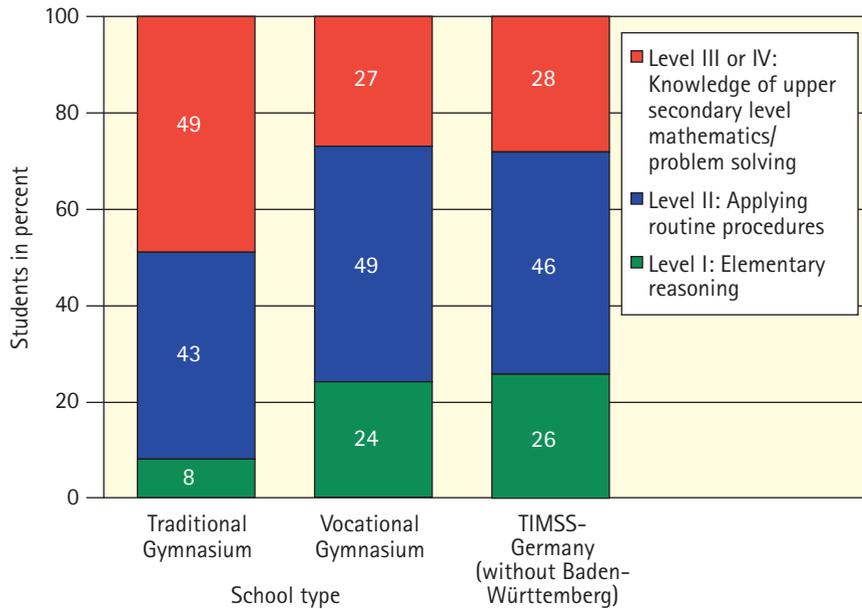
TOSCA measures focus on academic achievement variables (e.g., TIMSS tests, TOEFL scores) and cognitive abilities (indicators of mental ability). Additional instruments include student self-reports on motivation and personal goals, academic and nonacademic self-concept, interests, and family background. Moreover, the students' school and family context was further examined using teacher, school headmaster, and parental reports.

The **DRAMA** longitudinal study examines the microsequential change of adolescents' goal engagement in the transition from school to work in 760 adolescents in grade 9 and 10 of German comprehensive schools ($N = 760$). Students were examined at the beginning and the end of grade 9 and five more times at intervals of two months during grade 10, and there are several follow-ups after the transition to working life. Currently, goal-related strategies for the developmental goal "finding an apprenticeship" and "qualifying for the upper level of the preuniversity school track" are a primary research interest.

Associated scientist (TOSCA, DRAMA):
Olaf Köller
(University of Erlangen-Nuremberg)

DRAMA: In collaboration with
Jutta Heckhausen
(University of California, Irvine, USA)

Figure 7. Distribution of students across levels of mathematical proficiency in the final year of upper secondary school in Baden-Württemberg (by school type) in comparison with TIMSS-Germany results.



which call for particular knowledge or skills. Here, sufficient probability is defined as a 65% probability that the correct answer will be given. In TIMSS four different levels of mathematical proficiency were defined. On the lowest level, tasks involve elementary, everyday reasoning. Level II, characterized by the correct application of routine procedures which should as a rule have been acquired before the end of compulsory schooling, constitutes the lower limit of what can be expected from students at the end of upper secondary school (Abitur). A considerable share of these students, however, should be able to cope with Level III tasks, since these represent typical upper secondary level content. The tasks posed on Level IV not only require knowledge typical of upper secondary level mathematics, but call for independent argumentation and problem solving. The desirable minimum standard for English

can be defined as the achievement level which will enable students with Abitur to pursue a university education in Anglo-American countries. The *Test of English as a Foreign Language* (TOEFL), which was elaborated by the *Educational Testing Service* (ETS) in Princeton, New Jersey, has been generally accepted as a standard instrument for testing English language proficiency in students with English as a foreign language, who are planning to study in English-speaking countries. In the USA, the lower limit is by now fixed at a minimum score of 500, with prestigious universities relying on a cut-off point of 550 or more. In the TOSCA study, a specifically validated short version of an older TOEFL was used.

First analyses for mathematics revealed that achievement levels were positive as compared to the national level while, at the same time, marked differences in achievement

levels were shown between the vocational Gymnasium and the traditional Gymnasium (cf. Fig. 7). English scores of at least 500 (TOEFL test) were achieved by more than half of the students with Abitur in the TOSCA sample—their English proficiency, thus, being no obstacle to studying in the USA. Here again, however, marked differences between school types were revealed. Results from TOSCA so far suggest that differences in the opportunity structures of different school types have a significant effect on academ-

ic achievement. As had been expected, differences in students' social backgrounds and prior knowledge could not be compensated. What, then, are the consequences of these differences in the achievement levels reached in various subjects for a long-term prediction of success in university education? The longitudinal design of the TOSCA study, which in future steps will focus on indicators for success in university education, will provide the basis for a more detailed examination of this issue.

The Center for Educational Research 2002



Left to right: (front row) Gundel Schümer, Mareike Kunter, Nele Julius-McElvany, Ping-Huang Chang, Ulrich Trautwein; (middle row): Oliver Lüdtke, Anke Demmrich, Ilonca Hardy, Anja Felbrich, Jürgen Baumert, Elsbeth Stern, Petra Stanat, Martin Brunner; (back row): Helmut Köhler, Thomas Rochow, Rainer Watermann, Michael Schneider, Cordula Artelt, Regina Wolf, Gabriel Nagy, Stefan Krauss, Kai Maaz.

Research Area II

Establishing a Monitoring System for Educational Performance: Foundational Studies

Despite the complex system of governance and federal cooperation that has been developed in the German educational system, Germany is one of the few industrial states which has no national system of quality control to monitor the outcomes of educational processes and provide a framework for international or national comparisons. With participation in TIMSS and PISA, reliable data on performance of selected cohorts of students in curricular and cross-curricular domains have become available.

Key Reference

Stanat, P., & Baumert, J. (2001). Large-scale assessment studies and their contribution to educational psychology. *European Journal of Psychology of Education, 16*(3), Special Issue.

In the past, the Organization for Economic Cooperation and Development (OECD) used the results of studies such as the Third International Mathematics and Science Study (TIMSS) as performance indicators for the comparison of the education systems in its member states. Data on student performance are a regular feature of the OECD's annual publication "Education at a Glance" (OECD, 2002). In 1997, the OECD launched its own program to monitor the outcomes of education systems in terms of student achievement, and to provide internationally comparable indicators for central domains on a regular basis. All 16 of the German states participate in this Programme for International Student Assessment (PISA), which builds on the experiences of TIMSS, but seeks to achieve qualitative improvement in many respects. As was the case for TIMSS, the Center for Educational Research chairs a consortium responsible for the national management of PISA.

In addition to TIMSS and PISA, we are also involved in the Civic Education Study, a collaborative project of 28 countries conducted under the auspices of the International Associ-

ation for the Evaluation of Educational Achievement (IEA). Funded by the German Research Foundation, the Center for Educational Research implemented the international design and extended it with a number of national supplements. In Spring of 1999, 3,700 8th-grade students participated in the assessment which included knowledge tests and attitude items relating to such aspects as democracy, social and ethnic disparities, and national identity. The national report on the results of the assessment was published in 2002 (Oesterreich, 2002). With its involvement in international large-scale assessment studies such as TIMSS, PISA, and Civic Education, the Center for Educational Research pursues several goals. In addition to helping to establish a monitoring system based on state-of-the-art theoretical and methodological foundations, we utilize the opportunities these studies afford for basic research (Stanat & Baumert, 2001). Based on theoretical approaches from psychology, sociology, and education, we have systematically extended the international design of each of the three projects, allowing us to explore ba-

sic research questions from multiple perspectives with representative samples of students. Examples of such investigations will be presented below.

Using the instruments developed within the large-scale assessment projects, moreover, our Center has carried out several studies designed to evaluate innovative school programs. These studies demonstrate how system monitoring and school effectiveness research—two traditions that, for a long time, were considered to be largely incompatible—can be linked. In one of the projects, five comprehensive schools with unique profiles in the Land of Hesse were examined with tests and questionnaires from TIMSS and BIJU (see Research Area I). This project has three goals. First, it examines whether comprehensive schools with innovative programs differ from other comprehensive schools in terms of the composition of their student bodies and in terms of achievement levels in mathematics. Second, the study analyzes the extent to which cognitive and noncognitive goals of schooling are compatible and shows how instruments from large-scale assessments can be used to explore such questions. Finally, by providing comprehensive feedback on the results, it shows how individual schools can utilize information from assessment studies for school development (Köller & Trautwein, 2003). In a related project, instruments from PISA and the Civic Education Study were used to evaluate the *Laborschule Bielefeld*, a prime example of a school which has implemented substantial structural changes. With its strong emphasis

on developing the skills and orientations necessary to function as an autonomous citizen, the school tries to provide an environment that functions like a small society and gives students the opportunity to experience being part of a democratic system. The evaluation study explores the extent to which such a set-up can succeed in simultaneously fulfilling the goals it aims to achieve in the domains of personality development and civic education as well as in the curricular domains of reading, mathematics, and science (Stanat, Watermann, Trautwein, Brunner, & Krauss, in press). In addition to assessing existing programs, the Center for Educational Research has also evaluated a new curriculum designed to improve mathematics instruction. Again, using tests and questionnaires from TIMSS, this study takes advantage of the opportunities that large-scale assessments offer in terms of instrumentation and benchmarking information, and provides an example of a productive connection between system monitoring and school-level evaluation (Klieme, Baumert, & Schwippert, 2000).

The Programme for International Student Assessment (PISA)

The Programme for International Student Assessment (PISA) is designed to provide information on the outcomes of school systems in the participating countries. The project assesses the knowledge, skills, and competencies of 15-year-old students in reading, mathematics, and science, as well as in cross-curricular domains. Because the assessments take place on a regular basis,

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with three-year cycles, the study presents a tool for monitoring changes in the performance of countries' education systems and for gauging the effects of measures taken to improve learning outcomes. Another important feature of the PISA project is that it allows for national additions to the international design. This gives national committees the opportunity to address research questions that are of particular interest to them. The German PISA consortium has made extensive use of this opportunity and supplemented the program such that central research questions in education and educational psychology can be addressed. Table 1 lists some of

these national additions to the international design. As part of the national options, moreover, the German ministers of education decided to enlarge the PISA sample such that it provides reliable estimates for the individual states and allows results to be compared across the states. Thus, the monitoring approach in Germany includes both an international and a national perspective.

PISA allows for in-depth analyses of the outcomes of educational systems within and across the participating countries. The project is designed to yield three types of indicators:

Table 1
Some national supplements to the international PISA design for analyses of knowledge structures and their determinants

Reading	Mathematics	Science	Cross-curricular competencies	Student background
<ul style="list-style-type: none"> Assessment of learning from texts as a component of reading literacy distinct from working with texts Assessment of proximal antecedents of text comprehension to identify possible points for intervention 	<ul style="list-style-type: none"> Fine-grained differentiation and description of competency classes Addition of a broader range of items assessing aspects of mathematical literacy not covered by the international test Ratings of items based on a theory of cognitive demands Identification of effects of curricular and didactical traditions on knowledge structures 	<ul style="list-style-type: none"> More comprehensive assessment of understanding of scientific concepts to test the distinction between concept and process components of scientific literacy Identification and description of competency levels Differentiation of five cognitive competencies defined in terms of processes in working out science problems 	<ul style="list-style-type: none"> Assessment of general problem-solving skills and validation of the construct Assessment of aspects of social competence Exploration of the role schools play in the development of cross-curricular competencies 	<ul style="list-style-type: none"> Assessment of mental ability as a control variable for estimating effects of individual-level and school-level factors Assessment of additional indicators for students' social background More differentiated assessment of families' migration history Assessment of peer-group characteristics

- Profiles of the knowledge and skills acquired by students approaching the end of compulsory education in curricular and cross-curricular domains. These profiles pinpoint the strengths and weaknesses of educational systems and locate areas requiring action.
- Contextual indicators relating performance to student and school characteristics. Information on these relationships can shed light on the effectiveness of educational systems (e.g., to what extent they succeed in weakening the link between student performance and social background) and draw attention to possible points of intervention.
- Trend indicators showing how results change over time.

Data collection for the first cycle of PISA took place in the year 2000, and the first national report was published in December 2001 (Baumert et al., 2001). Two further reports presenting detailed analyses of performance profiles in the German federal states appeared in June 2002 and March 2003 (Baumert et al., 2002, 2003). In addition to the level of performance, both the international and the national reports explore issues of equity in

depth. The first cycle of PISA includes a carefully designed assessment of students' socio-economic background, cultural capital, and social capital. The data provide a unique opportunity to examine the relative role of these factors for school success in different educational systems. Analyses of the effects of socio-economic background on student performance, and of the ways these effects are mediated, will be presented below, after a description of the test design and some of the main assessment results.

International Test Design and National Extensions

PISA does not seek to examine whether students have acquired a specific knowledge base. Rather, it aims to assess the extent to which young people have developed a deeper understanding of central concepts; master processes such as modeling situations, communicating results, or critically evaluating information; and are able to apply this conceptual and procedural knowledge in various contexts (OECD, 1999/Deutsches PISA-Konsortium, 2000).

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Reading Literacy

Each cycle of the international PISA program will focus on one of the three assessment domains. In the first cycle, this major domain is reading. The international framework for the assessment of reading literacy is largely based on a structural model developed by Kirsch and Mosenthal (1998), which strongly influenced both the U.S. National Assessment of Educational Progress (NAEP) and the OECD's International Adult Literacy Study (IALS). At a general level, this model distinguishes between a primarily text-based and a more knowledge-based aspect of reading comprehension. Whereas the former relies almost exclusively on information provided in the text, the latter also draws on prior knowledge. These two aspects are further broken down into five types of demands that readers encounter when working with texts, namely retrieving information, developing a broad understanding, and developing an interpretation, on the one hand (representing text-based comprehension), as well as reflecting on the content of the text and reflecting on the form of the text, on the other (representing more knowledge-based comprehension). For the purposes of reporting, these demands are collapsed into three scales summarizing students' performance in retrieving information, in interpreting texts, and in reflecting and evaluating. The PISA reading assessment covers a broad range of text types. In addition to continuous texts, which are typically organized in terms of sentences and paragraphs, it also includes noncontinuous texts, such as graphs, tables, and forms, that

present information in a variety of different ways. Thus, PISA adopts a relatively broad notion of what constitutes a text.

The international approach examines reading comprehension in the context of *working with texts*. In the test, students were allowed to refer back to the text while answering questions about it. This approach clearly captures an important aspect of reading literacy. Yet, reading literacy also encompasses the ability to generate mental representations of a text such that the information can be used at a later point in time, without having to consult the document again. This aspect, which can be described as *learning from texts*, was assessed in the national extension of the international PISA design. The national test is based on the psychological theory of text comprehension developed by Kintsch (1998) and van Dijk and Kintsch (1983). This theory differentiates three types of text representations: verbatim representations, which result from the basic processing of a text's surface; prepositional representations, which capture the meaning of texts; and situational representations, which integrate the information from the text with prior knowledge. By separating the reading or learning phase from the test phase, the national test assesses each of these representations. More specifically, students answered questions about a text they had read without being able to refer back to it. Using methodology developed within the framework of probabilistic test theory, analyses exploring the dimensionality of the international and national reading tests

show that they do, in fact, capture distinct competencies (Artelt, Stanat, Schneider, & Schiefele, 2001; Artelt, Schiefele, & Schneider, 2001).

Mathematical Literacy

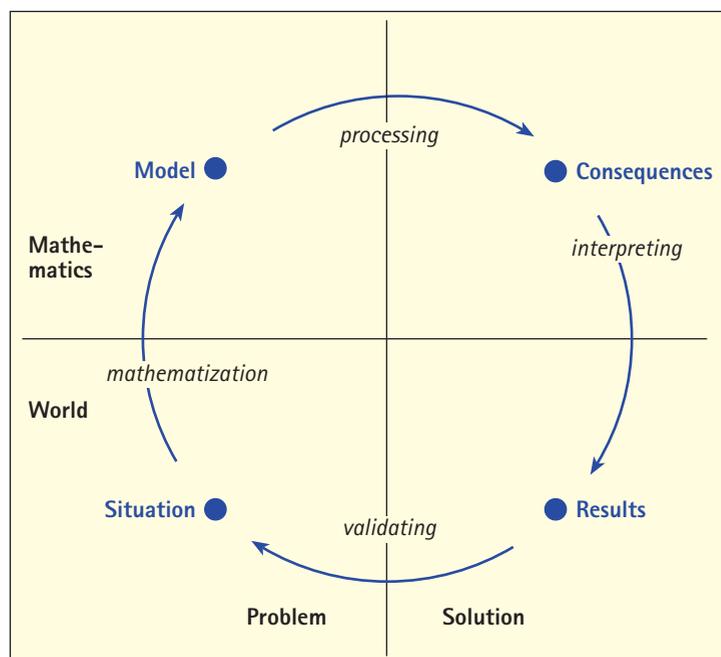
The international PISA framework for the assessment of mathematical literacy is strongly influenced by the "realistic mathematics" approach introduced by Hans Freudenthal. The approach starts with the assumption that mathematical concepts and ideas have primarily been developed as tools for grasping and structuring phenomena of the physical, social, and mental world. In line with this assumption, the international PISA test consists mainly of items that require students to apply their knowledge and skills in authentic situations. Moreover, the composition of the test reflects the idea that problems involving modeling and application present the best indicators for mathematical understanding. The "realistic mathematics" approach reflects current ideas on constructivist teaching and situated learning that are quite popular in research on instruction (see Research Area III).

The national PISA consortium extended the notion of mathematical literacy adopted in the international framework to develop a broader conceptualization of the domain. This conceptualization is based on a process view of working out mathematical problems that draws on models from cognitive psychology (Kintsch & Greeno, 1985; Reusser, 1992, 1996) and mathematics education (Blum, 1996; Schupp, 1988). According to this view, which is depicted in Figure 1, solving mathe-

matical problems requires the person to link an initial situation with a mathematical model ("mathematization"). The model has to be identified, processed, interpreted, and validated. Although the situation in which the problem presents itself may involve an authentic, real-life context, it may also be situated strictly within the world of mathematics. In working on complex problems, the circle of mathematization, processing, interpreting, and validating will have to be completed more than once. Thus, it is assumed that this notion of mathematical modeling describes the general process involved in working on different kinds of problems.

Using the theoretical framework of mathematical modeling as a starting point, the national consortium further differentiated the three competency classes defined for mathemat-

Figure 1. The process of mathematization.



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ical literacy in the international PISA framework, thus providing a more fine-grained conceptualization of mathematical competency. In order to capture the elements of this model, the international test design was extended by a broader range of items that were administered on a second, national test day. Based on theoretical approaches from mathematics, mathematics education, and cognitive psychology, moreover, a model of cognitive demands was developed. Trained experts applied this model to rate the cognitive demands of each item used in PISA. The assessment data and item ratings were used, among other things, to test hypotheses about the structure of mathematical competency, to identify and describe levels of mathematical proficiency, and to gauge the effects of traditions in mathematics education on structures of mathematical knowledge and skills (Klieme, Neubrand, & Lüdtke, 2001; Neubrand, Klieme, Lüdtke, & Neubrand, 2002).

Scientific Literacy

As is the case with mathematics, the first cycle of PISA assesses scientific literacy as a minor component. In line with the Anglo-American notion of scientific literacy, as described in the *Benchmarks for Science Literacy* published by the American Association for the Advancement of Science, for example, the international PISA framework emphasizes process skills. It defines processes as "mental (and sometimes physical) actions used in conceiving, obtaining, interpreting, and using evidence or data to gain knowledge or understanding" (OECD, 1999, p. 61) and distin-

guishes five such processes: (1) recognizing scientifically investigable questions, (2) identifying evidence needed in a scientific investigation, (3) drawing or evaluating conclusions, (4) communicating valid conclusions, and (5) demonstrating the understanding of scientific concepts. Although some scientific knowledge is needed for all five processes, only the fifth primarily focuses on this aspect of scientific literacy. In other words, the understanding of scientific concepts is not intended to be the main challenge in working out items designed to assess the first four of the processes covered in the international PISA test.

The national framework for scientific literacy differentiates the international conceptualization from two perspectives. First, to ensure compatibility with the German curriculum, the subdomains of biology, physics, and chemistry are distinguished such that students' performance can be evaluated separately for each of these school subjects. Second, the framework adopts a psychological perspective and defines five cognitive competencies representing basic building blocks of scientific literacy. These competencies are described in terms of processes involved in working out science problems, such as transforming information from graphs or diagrams, using knowledge of scientific concepts or facts, or applying a mental model. Again, we extended the international test design for the science domain with national items that were administered on the second day of testing. Analyses of the complete item pool confirm that the five cognitive competencies form distinct components

of scientific literacy. Using this distinction, moreover, profiles of strengths and weaknesses could be identified for different student groups, such as male and female students and students from former East and West German states.

Assessment of Cross-Curricular Competencies

PISA is the first international assessment study that goes beyond the measurement of knowledge and skills in curricular domains and attempts to capture so-called cross-curricular competencies that can be applied in a broad range of situations. This approach follows the general idea that the goals of formal education are not restricted to maximizing curriculum-based knowledge. In the first cycle of PISA, cognitive, metacognitive, and motivational prerequisites of self-regulated learning were assessed in most participating countries. The instrument for this part of the assessment was developed by PISA-Germany in collaboration with the OECD and the University of Groningen. It is based on Boekaerts's (1997) model of self-regulated learning, which assigns equal status to the cognitive and motivational components of learning. Boekaerts defines self-regulated learning as a complex interactive process involving motivational as well as cognitive self-regulation. Ideally, at the end of their school career, students should have acquired not only competencies in school subjects, but also the ability to evaluate whether their approaches to learning are effective and to gauge their own levels of interest, motivation, and proficiency. Motiva-

tion is vitally important for young people leaving school. Similarly, the capacity to evaluate one's own effectiveness and learning strategies is relevant for working life as well as for leisure activities. A positive self-concept, finally, helps individuals to overcome barriers in such activities. By analyzing students' approaches to learning, namely their motivation, their use of learning strategies, and their academic self-concepts, PISA focuses on central prerequisites for effective self-regulation and lifelong learning. These characteristics play a central role when it comes to the prediction of students' competencies as measured with the PISA literacy tests. The picture that emerges from the international data is relatively consistent across the participating countries: Students who have acquired the prerequisites for self-regulated learning are at a relative advantage in developing academic competencies (Artelt, Baumert, Julius-McElvany, & Peschar, in press).

Within the framework for self-regulated learning, the role of motivational dispositions in academic domains is explored. In addition, we conducted an experiment to test the effects of different types of test motivation on student performance. In this experiment, we investigated the impact of (1) social incentives associated with participation in an international study, (2) informational feedback on performance, (3) grades, and (4) performance-contingent financial rewards. The findings suggest that all of these conditions make the various components of test motivation equally salient. Consequently, no differences were found

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with respect to either intended and invested effort or test performance (Baumert & Demmrich, 2001).

Performance Profiles in Curricular Domains: Results of International and National Comparisons

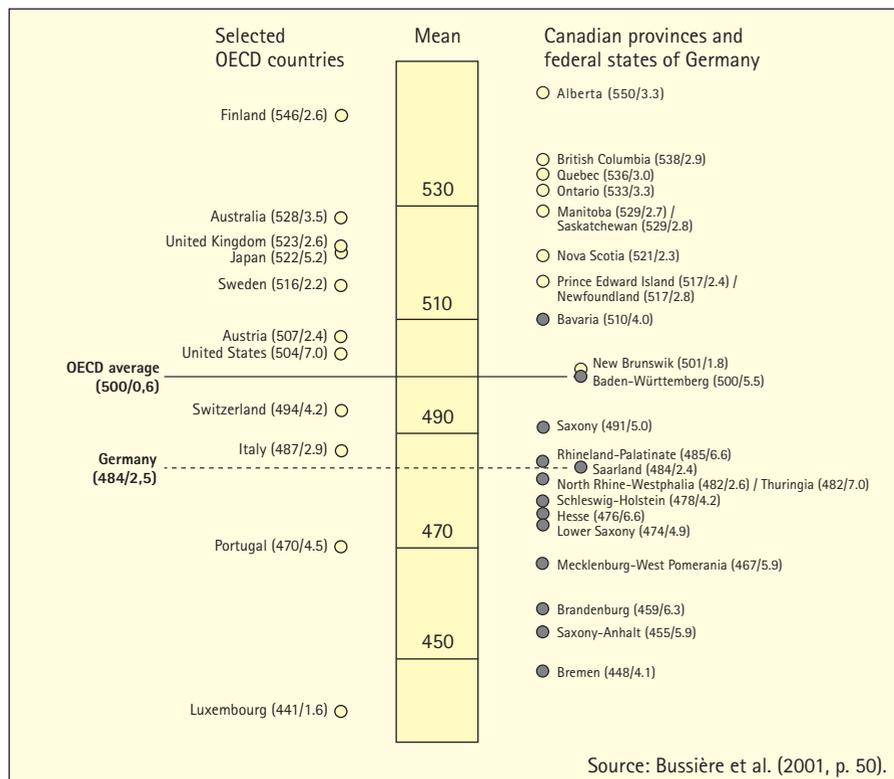
How well did students in Germany and within the German states perform on the PISA tests? In reading (see Fig. 2) as well as in mathematics and science, student performance in Germany falls below the OECD average. The differences between the German mean and the means of the highest performing countries are equivalent to achievement gains of one-and-a-half to two academic years.

Particularly in reading, variation in student performance is comparatively large in Germany. The gap

between the lowest and the highest achieving students is wider than in any of the other participating countries. The large disparities in student performance are attributable primarily to the particularly poor results of the least proficient students (see left half of Fig. 3). In Germany, 13% of students only reach the lowest of five proficiency levels defined in PISA and almost 10% are not even proficient at this level. Thus, almost one-quarter of young people can only read at an elementary level (OECD average: 18%). In terms of independent reading and lifelong learning, these students must be regarded as a potentially at-risk group. In countries such as Korea, Finland, Canada, Australia, and Sweden, this group is much smaller, at less than 15% of students.

Figure 2. Mean reading literacy in 14 federal states of Germany in comparison with 8 Canadian provinces and selected OECD countries (mean/standard error).*

* In Berlin and Hamburg, student participation rates fell below the specified minimum of 80%. Therefore, these states had to be excluded from most analyses



Source: Bussière et al. (2001, p. 50).

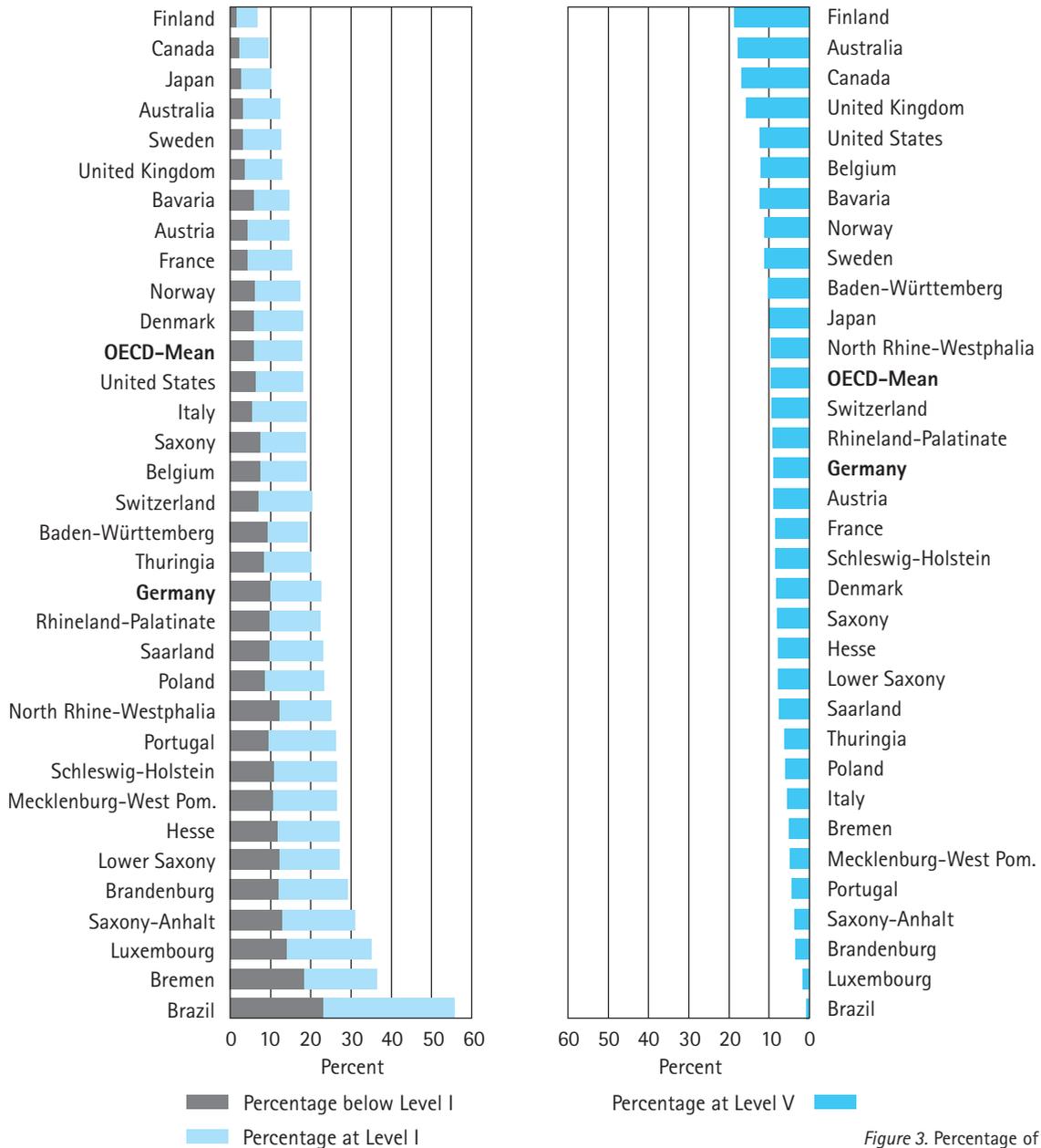


Figure 3. Percentage of students in 14 of the German federal states and selected OECD countries performing below or at proficiency Level I and at proficiency Level V on the reading literacy scale.

By contrast, the proportion of students in Germany performing at the highest proficiency level in reading is close to the international average, with 9% of students reaching Level V (see right half of Fig. 3). This is comparable with the OECD average

as well as with the performance of students in countries such as Denmark, France, Austria, and Switzerland.

For the most part, the pattern of results for Germany in the domains of mathematics and science is quite

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¹ Odds ratios are commonly used in research on social disparities and epidemiology to describe relative chances and risks. Unlike differences between percentage points or proportions of conditional probabilities, they are independent of base rates.

similar to that found for reading. Also, the findings for the German states generally substantiate those of the international comparison. In almost all of the states, a relatively low level of overall performance (see Fig. 2) is coupled with a wide variation in student performance and a relatively high proportion of students classified as belonging to the at-risk group (see Fig. 3). Most of the states perform around the German mean in all three domains and, within this middle range, any cross-state differences are practically insignificant. When the highest and lowest performing states are compared, however, the differences are substantial. In fact, the largest cross-state differences are equivalent to performance gains of one-and-a-half to two academic years. Regional performance differences of this magnitude are also found in other federal countries such as Canada (see Fig. 2). Even when taking account of differences in the composition of the student population across the German states, and considering the performance of students without a migration history separately, marked differences in mean performance can still be observed.

The performance of individual students within a country in the reading literacy assessment is related to a number of different factors. In Germany, there is a significant link between student performance and, among other things, interest in reading and reading activities. At the same time, the proportion of young people who report that they never read for pleasure is—at 42%—particularly high in Germany. This

suggests that measures to promote reading literacy should make reading motivation a primary target. The association between reading performance and knowledge of effective learning strategies, moreover, is even closer. Again, this points to opportunities for targeted intervention measures (Artelt, Schiefele, Schneider, & Stanat, 2002).

Family Background and Student Performance: Results of International and National Comparisons

Although the relationship between social background and school success relaxed somewhat in the two decades following World War II, the connection is still quite strong. Transition points involving decisions about future paths in the educational system, such as the decision for a certain track after the completion of elementary school, have proved to be crucial for the development of social disparities in attainment. At such points, primary and secondary disparities can be identified (cf., Breen & Goldthorpe, 1997). Primary disparities are differences in competencies relevant to a transition that persons have acquired up to that point and that are related to their social background. Secondary disparities, on the other hand, emerge when transitional decisions vary depending on individuals' social backgrounds, even when their competency levels are comparable.

In PISA, primary and secondary social disparities in school type attendance were estimated with odds ratios¹ (Baumert & Schümer, 2001a, 2002). Table 2 shows the relative chances of 15-year-olds from different social backgrounds of attending

Table 2
Relative chances of attending different school types depending on social class (odds ratios)¹

Social class of household head (EGP)	Educational track (Reference category: Intermediate track—Realschule)								
	Lowest track/vocat. school (Haupt-/Berufsschule)			Academic track (Gymnasium)			Comprehensive school (Gesamtschule)		
	Model ²			Model ²			Model ²		
	I	II	III	I	II	III	I	II	III
Higher grade professionals (I)	.49	.55	.48	4.28	3.40	2.89	.56	.61	.59
Lower grade professionals (II)	.46	.54	.69	3.34	2.75	2.24	ns	ns	ns
Routine non-manual employees (III)	ns	ns	ns	1.80	1.83	1.97	ns	ns	ns
Self-employed (IV)	ns	ns	ns	1.87	1.79	1.77	ns	ns	ns
Skilled manual workers (V, VI)	Reference group (odds = 1)								
Semi-skilled and unskilled manual workers (VII)	1.50	1.33	ns	ns	ns	ns	1.51	1.52	1.40

¹ Only statistically significant findings are reported; ns = nonsignificant.

² Model I does not control for covariates; Model II controls for mental ability; Model III controls for mental ability as well as reading, mathematical, and scientific literacy.

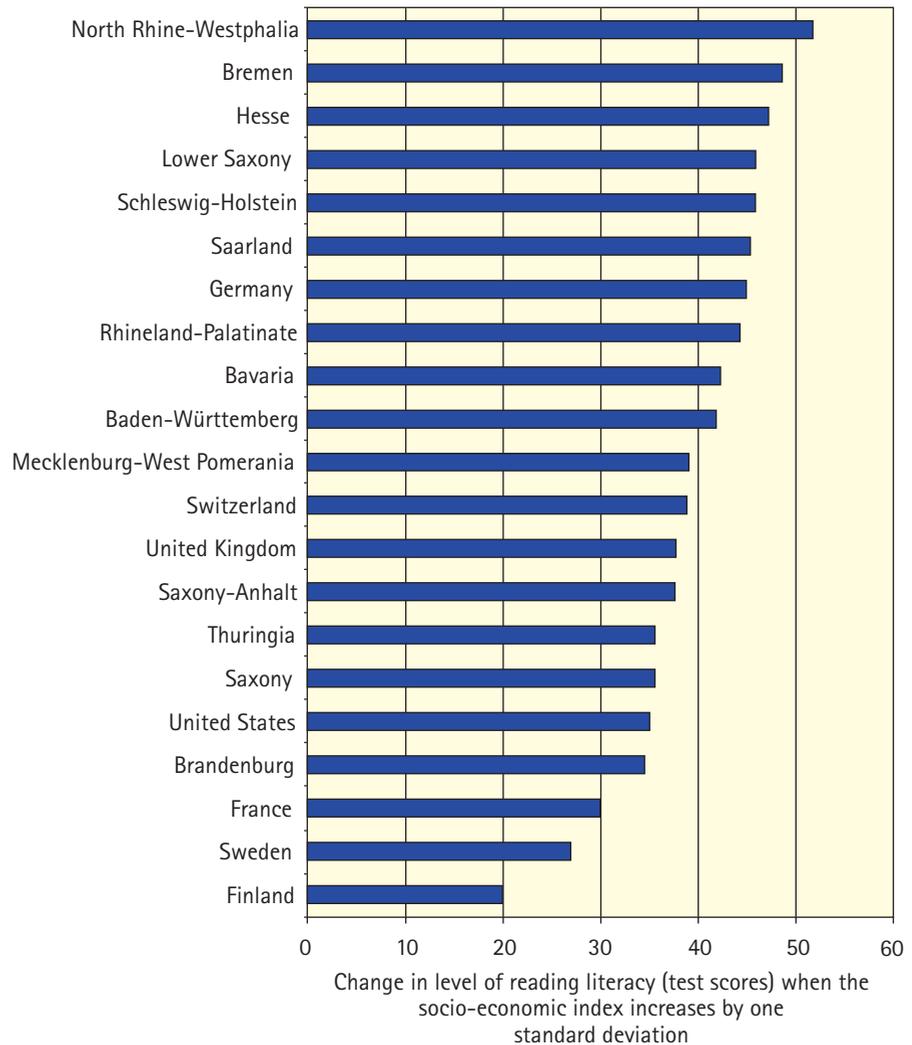
a certain school type. In this analysis, social background is categorized according to the multidimensional classification system by Erikson, Goldthorpe, and Portocarero (1979). To facilitate interpretation, the same reference categories were used in all comparisons, namely, children of skilled manual workers as the social reference group and the intermediate track (*Realschule*) as the reference category for school type. Thus, the figures reported in Table 2 describe the relative chances that 15-year-olds with a given social background will attend a school type other than the *Realschule* as compared to children of skilled manual workers. The odds ratios presented for Model I show the

combined effect of primary and secondary disparities. For example, the figure of 4.28 reported for children of higher grade professionals in the *Gymnasium* column indicates that the relative chances of students from this background to attend the academic-track *Gymnasium* rather than the *Realschule* are 4.28 times higher than those of children of skilled manual workers. By comparison, the odds that a young person from the highest socio-economic class will attend the vocationally-oriented *Hauptschule* rather than the *Realschule* are only about half (odds ratio = .49) those of a student from a working-class background. To estimate secondary disparities, Model II controlled for the level of

basic mental ability as an indicator for the competency level reached at the end of primary education, and Model III also controlled for reading, mathematical, and scientific literacy at age 15. As Table 2 shows, even when their basic mental ability and reading literacy are comparable, students from the highest socio-economic class have an almost three times higher chance of attending the Gymnasium rather than the Realschule than children of skilled manual workers.

Social disparities in school-type attendance were found in all of the 14 German states for which sufficient data are available. However, in the former East German states, the relative probability of attending a Gymnasium is far less dependent on the family's socio-economic status than in the former West. In addition, considerable differences among the former West German states can be observed. The association between social background and type of school attended is most pronounced

Figure 4. Slopes of the social gradients for reading literacy in 14 of the German federal states and selected OECD countries.



in Bavaria, Rhineland-Palatinate, and Schleswig-Holstein. Exploratory analyses suggest that these variations between the states are, among other things, related to regional differences in traditions of educational participation and accessibility of the different school types.

To compare the extent to which student achievement and social background are related within the OECD countries and the German federal states, regression analyses were performed, predicting students' performance on the PISA tests from the socio-economic status of their parents. The slopes of the resulting regression lines, which are commonly referred to as social gradients, indicate the extent to which students' competency levels change when the socio-economic index increases by one standard deviation. These slopes are depicted in Figure 4. In all of the countries participating in PISA 2000, there is a significant link between social background and performance. However, nowhere is this relationship as strong as it is in Germany. Links of a similar magnitude are found in countries such as Belgium, Switzerland, and Luxembourg. This pattern of results suggests that the association between social background and achievement tends to be stronger in systems with early tracking. Particularly Japan, Korea, Iceland, Finland, but also Canada and Sweden manage to combine a high overall level of performance with a weak relationship between social background and student performance. This desirable combination—high performance, low social inequality—is attained largely by ensuring a satisfactory level of

performance in the lower socio-economic groups.

Again, within Germany, the closest links between student background and performance are found in the former West German states (see Fig. 4). Although the social divide tends to be less pronounced in the former East German states, it is still large compared to the other PISA countries.

Mediation of the Relationship Between Students' Family Background and Achievement

As PISA and other studies have shown, various structural aspects of students' family background are related to school performance. These include socio-economic status, level of education, and migration history. However, little is known about the factors that mediate this relationship. Based on the work of Bourdieu (1983) and Coleman (1988), we explored the role of several process factors indicating aspects of families' economic, cultural, and social capital (Baumert, Watermann, & Schümer, in press). Figure 5 shows the resulting structural model describing the interplay between characteristics of students' families and the level of reading literacy achieved.² The structural characteristics of family background entered in the model are the parents' highest socio-economic status and educational level, their migration history, and the students' length of residency in Germany. The process factors are cultural practices (cultural possessions, common cultural activities) and communication within the family (general amount of discussion, discussions of cultural

Key Reference

Baumert, J., Watermann, R., & Schümer, G. (in press). Disparitäten der Bildungsbeteiligung und des Kompetenzerwerbs: Ein institutionelles und psychologisches Mediationsmodell. *Zeitschrift für Erziehungswissenschaft*.

² Due to considerable regional differences in migration patterns, separate models had to be estimated for the former East and West German states. The main difference between the models is that the relationship between social background and achievement is less pronounced in the former East German states.

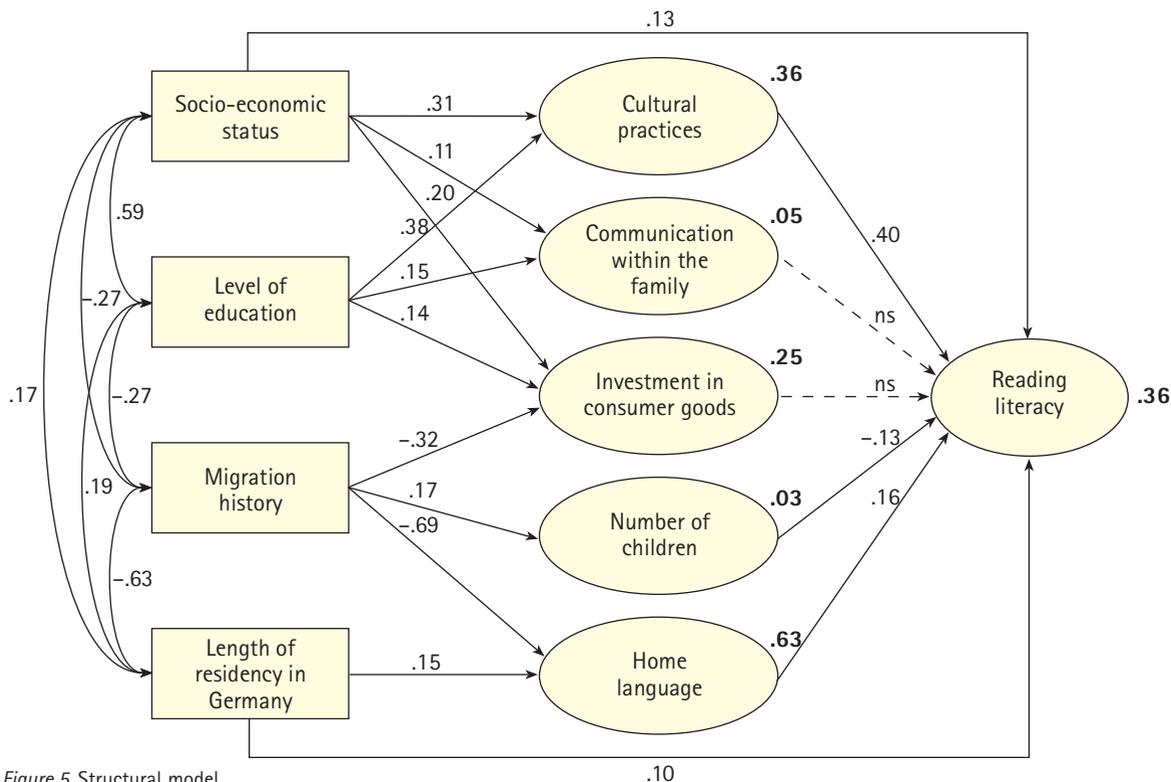


Figure 5. Structural model of the relationships among structural and process aspects of the family background and reading literacy in the former West German states (standardized path coefficients; R² in bold type).

issues), investment in consumer goods (possession of consumer durables), number of children, and home language (German vs. another language). With the exception of number of children and home language, the process factors are modeled as latent variables, each of which is represented by two indicators. The criterion variable is reading literacy, represented in the measurement model by the three components of retrieving information, interpreting texts, and reflecting and evaluating that were differentiated in the PISA assessment.

The variables contained in the model explain 36% of the variance in reading literacy—a much larger proportion than when only structural characteristics of family background are taken into account. Thus, when

process factors are overlooked, the relationship between family background and competency development is systematically and significantly underestimated. Furthermore, the process variables specified in the model prove to be important mediators of the impact associated with structural factors. The effect of the parents' educational level is mediated entirely by the family's cultural practices. Likewise, the family's migration history has no direct effect on the reading literacy of 15-year-old students when controlling for their length of residency in Germany. Thus, consistent with the assumptions of Bourdieu (1983), cultural capital seems to be the best predictor of competency development. On the other hand, contrary to Coleman's (1988) predictions,

communication within the family was not found to have a specific impact above and beyond the effects of the other process factors. It is, however, conceivable that the negative effect of the number of siblings reflects changes in communication patterns that may be associated with this variable.

The model of the relationships between family background and reading literacy presented in Figure 5 is an improvement on simple analyses of bivariate correlations as well as on models that take a multivariate approach but consider structural aspects only. From the psychological and sociological standpoint, however, the model is unsatisfactory as it does not identify the psychological and institutional mechanisms that mediate the association between family background and competency development. Such mediation processes are of particular interest from a pedagogical point of view. A relatively simple psychological and institutional mediation model is outlined in Figure 6.

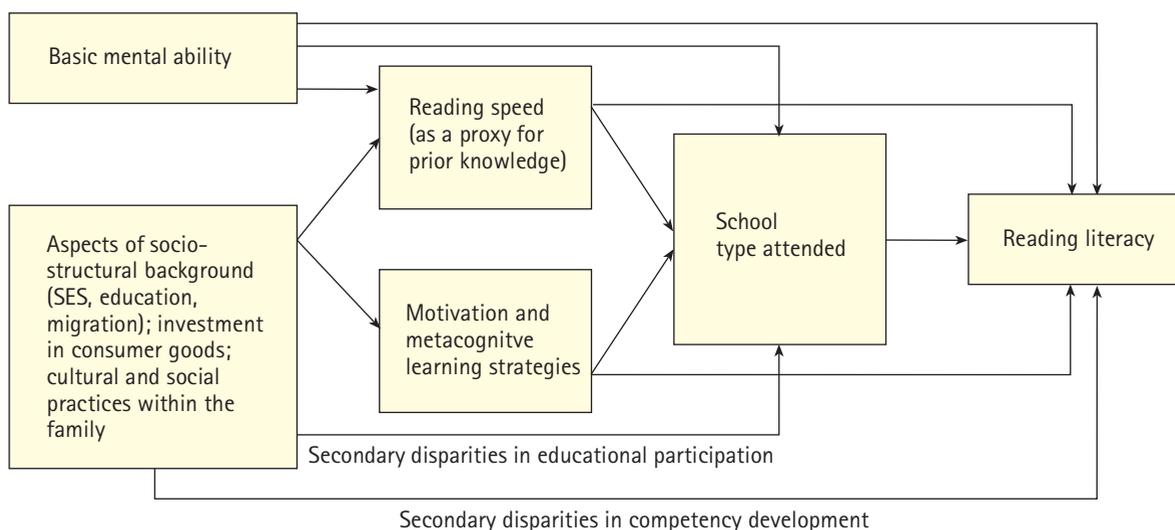
Baumert, Köller, and Schnabel (2000) have shown that the various school types in Germany constitute different developmental environments. More specifically, in some tracks, students gain more in terms of knowledge and skills over the course of secondary school than in others. This means that the choice of a secondary school track has direct implications for students' educational outcomes—even when cognitive, motivational, and social prerequisites for learning are held constant. For this reason, it is vital for mediation models to include an institutional component that reflects this choice. In the current analysis, it is represented by the school track attended.

However, students' progress within educational tracks is also largely dependent on their prior knowledge and motivational characteristics—that is, the skills and dispositions that determine which secondary track is chosen at the end of primary schooling (see, e.g., Lehmann, Peek, & Gänsfuß, 1997; Baumert &

Key Reference

Baumert, J., Köller, O., & Schnabel, K. (2000). Schulformen als differentielle Entwicklungsmilieus—Eine ungehörige Fragestellung? In *Gewerkschaft Erziehung und Wissenschaft GEW (Ed.), Messung sozialer Motivation. Eine Kontroverse* (pp. 28–68). Frankfurt a.M.: Bildungs- und Förderungswerk der GEW (Schriftenreihe des Bildungs- und Förderungswerks der GEW, Vol. 14).

Figure 6. Psychological and institutional mediation model of the relationships between aspects of family background and school outcomes.



Schümer, 2001). These performance-relevant characteristics, in turn, covary with students' social and cultural background. Accordingly, basic mental ability and reading speed (as a proxy for prior knowledge) as well as motivational characteristics and metacognitive learning strategies are included in the model as psychological mediating variables. The model presented in Figure 6 suggests that the effects of structural and process attributes of family background on competency development are mediated by psychological process factors and the school type attended. The model also allows primary and secondary disparities in educational participation and in competency development to be disentangled. Again, secondary disparities result from direct effects of the family background that are not mediated by performance-related or motivational characteristics or by differential decisions for a certain school type. An accurate estimation of these secondary disparities hinges on the specification of the psychological mediation model. It is quite possible that the relevant part of the model is underspecified in Figure 5 such that the secondary disparities may, to some extent, be overestimated.

Stepwise regression analyses were performed to test the psychological and institutional mediation model in Figure 6. Due to its complexity, the table of results is not presented here. The structural and process aspects of students' family background, the psychological variables, and the school type attended were entered blockwise in the regression analyses. The complete mediation

model explains 73% of the variance in reading literacy, indicating a very good model fit. The predictors with the most explanatory power are, as expected, the indicators approximating students' prior knowledge. More importantly, the effects of the process attributes of family background are mediated almost entirely by psychological and institutional mechanisms. At the same time, the institutional effects of school type attended remain substantial, even when controlling for process attributes of family background and psychological characteristics. In line with our expectations, the academic-track Gymnasium represents the most conducive environment with respect to competency development, even when holding individual differences in aptitude constant. Overall, the results of these analyses indicate that the relationship between social background and school success can only be mapped out properly if both structural and process characteristics of the family are taken into account. If—as is often the case in the literature—the analysis is limited to structural aspects, the magnitude of the relationship is systematically underestimated. Furthermore, the findings show that the effects of family structure and process characteristics are largely transported by individual differences in aptitude and motivation (basic mental ability, reading speed, interest in reading, metacognitive learning strategies). The psychological and institutional mediation mechanisms contribute jointly as well as individually, and thus cumulatively, to social differences in achievement.

Research Area III

Learning and Instruction: Cognitive Activation and Cognitive Tools

Three cornerstones of competence acquisition have to be integrated into research on learning and instruction: the tasks to be mastered, the students (who have to be engaged in meaningful learning activities), and the teachers (whose task it is to facilitate students' learning). Each cornerstone highlights different aspects of the learning process. Focusing on the tasks means asking what kinds of knowledge structures and more general cognitive preconditions have to be accessible in order for certain tasks to be mastered. Switching to the students' perspective leads to the question of how the learners' existing knowledge can be modified, extended, cross-linked, hierarchically ordered, or how new knowledge can be generated, in order to master the tasks. The teacher's role is to mediate between the tasks and the students. By selecting learning materials, giving appropriate feedback, and involving students in meaningful learning activities, teachers can support learners in closing the gap between prior knowledge and the knowledge needed to master the tasks in question.

Insightful Learning: A Challenge for Teachers as well as for Scientists

In comparison to the acquisition of facts, skills, and routines, insightful conceptual understanding—a central aim of science and mathematics instruction, in particular—is still a puzzle, for teachers as well as for researchers. Nonetheless, scientific progress in modeling and explaining the emergence of insights and conceptual understanding is evident. It is now widely accepted that new concepts and insights are not acquired through passive transmission of the expert's knowledge to the learner's mind, but rather that they are the result of the learner's active process of constructing increasingly complex and elaborated cognitive structures. Powerful learning environments stimulate students' cognitive activation, that is, students' mental involvement in the tasks to

be mastered. In so doing, learners have to make use of, and are constrained by, the knowledge already available to them. Particularly for science and mathematics, it has been widely shown that students enter classrooms with intuitive concepts and belief systems which are partly based on universal conceptual primitives. These may have innate roots, but are also shaped by schooling. The negative consequences of ignoring this kind of prior knowledge have been demonstrated, particularly for physics and mathematics education. Students often only adopt the knowledge taught at school at a superficial level and, therefore, can only use it when faced with problems that have already been dealt with at school. Overcoming certain misconceptions that are deeply rooted in everyday experience is the most difficult task of science education.

To effectively initiate and assist student learning, teachers need to take into account students' specific prior knowledge and understanding, and they need to design and organize lessons and classroom discourse in a way that closely attends to the curriculum as well as to the social construction of meaning in classrooms. Teachers can only do a good job if they know what makes certain tasks particularly difficult, on the one hand, and are aware of the way their students learn, on the other. For instance, they have to know what kinds of mistakes and obstacles typically occur during the learning process and whether students need special support to overcome these. In order to combine the task perspective and the student perspective, teachers need pedagogical content knowledge. This means that teachers have to know how particular topics, problems, or issues are organized, represented, and adapted to meet the diverse interests and abilities of learners and how they should be presented during instruction. Teachers' classroom behavior thus needs to be based on an understanding of how students learn in the respective academic domains. In order to provide teachers with appropriate pedagogical content knowledge, research on learning and instruction has to focus on students' insightful learning. Important questions to be addressed include the following: What is the structure of the knowledge to be acquired? What prior knowledge does the learner have to build on? What particular tasks, explanations, and interactive discourse will assist students' construction of intelligent knowledge?

Is the understanding of certain concepts subject to conscious or unconscious processes? At what stage of the learning process are feedback and direct instruction helpful? At what age can students make sense of certain forms of visual-spatial representation? What kind of practice do students need for the application of such tools in new content domains? Which tool is most appropriate for reasoning in a given content domain? What kinds of misconceptions can arise from using a tool that has not yet been fully understood?

The Orchestration of Students' Learning Activities

Classroom instruction is not the only factor that determines the knowledge structures and epistemological beliefs acquired by students. It is, however, the factor that is most likely to be affected by the institutions of the education system and the professional activity of teachers. Recent findings emphasize that classroom instruction, rather than the school environment or management structures, has the main impact on school effectiveness in terms of learning outcomes. As such, the question of what actually determines good instructional practice is central to the success of education and the functionality of the education system. For this question to be addressed, pedagogical concepts of instructional quality need to be combined with the analysis of individual and collective processes of knowledge acquisition in specific domains.

From Distal to Proximal Factors in Research on Instructional Quality: Fostering Cognitive Activation in Powerful Learning Environments

There is a high level of consensus in the description of "instructional quality" in the international research community. High quality instruction is typically described by a set of basic properties that combine aspects of direct instruction with adaptivity and affective quality:

- good classroom management,
- appropriate pacing and moderate speed of interactional exchange, allowing for a high level of student attentiveness and participation,
- clear and well-structured presentation of material and setting of tasks,
- adaptivity of task selection and feedback given by the teacher, based on their diagnostic understanding of the ability and learning progress of individual students,
- affective quality of the teacher-student relations.

This concept describes the basic requirements of "instructional quality," the conditions that have to be met to allow for successful knowledge acquisition in the classroom.

However, this concept of instructional quality is limited by that fact that (a) it does not show how teachers implement each of its elements in the structure and delivery of their lessons, (b) it has a distal relationship to the students' actual learning processes, and (c) it overlooks subject content and, thus, cannot adequately reflect the structure and quality of the knowledge acquired.

In the approach taken by the Center for Educational Research, the concept of instructional quality is extended by adding specific pedagogical aspects that (a) describe how basic elements of instructional quality are implemented in the setting of tasks and in interaction processes, (b) have a more proximal relationship to the psychological processes of insightful learning, and (c) take domain-specific criteria of knowledge acquisition into consideration. Linking up with the investigations of domain-specific knowledge structures, we ask the following question: How should instruction be shaped to allow students to gain a deep understanding of domain-specific concepts and develop adequate, nonschematic epistemological beliefs?

In learning laboratories as well as in classrooms we mainly focus on competence acquisition in the fields of mathematics (COACTIV) and science (ENTERPRISE). This research will be described in detail in the following section. Moreover, as a consequence of the PISA study, which revealed knowledge and effective use of reading strategies to be important predictors of literacy, Anke Demmrich is currently evaluating the Reciprocal Teaching Program by Palincsar and Brown (1984) in her doctoral thesis. This program was designed to teach students in specific reading comprehension strategies. In an experimental training study, central mechanisms that might cause the large gains in reading comprehension are evaluated, and key features of the program that contribute to its success will be identified.

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www.ipn.uni-kiel.de/projekte/biqua/biqua_eng.htm

Baumert, J., Blum, W., & Neubrand, M. (in press). *Drawing the lessons from PISA 2000—Long-term research implications: Gaining a better understanding of the relationship between system inputs and learning outcomes by assessing instructional and learning processes as mediating factors.*

COACTIV: Cognitive Activation in the Classroom: The Orchestration of Learning Opportunities for the Enhancement of Insightful Learning in Mathematics

Teaching for Understanding: Linking PISA 2003 to Research on Learning and Instruction

With mathematics literacy forming the main component of PISA 2003, a more differentiated investigation of the structure of the mathematical competencies acquired by the end of lower secondary level will be attainable. Moreover, the PISA 2003 study will be extended to a longitudinal study spanning the period of one academic year, with a sampling design allowing for class and school effects to be separated systematically. The investigation of domain-specific instructional processes as related to the pedagogical expertise of mathematics teachers will be a main focus of the panel study. By conducting a computer-based survey focused on the pedagogical content knowledge of mathematics teachers, the study will break new grounds in the field of research on teaching.

The COACTIV study, which is funded by the German Research Foundation (DFG), is based on preliminary work carried out in the context of BIJU, TIMSS, and TIMSS Video (see Research Area I). In this study, the three cornerstones of mathematical competence acquisition—the students, the teachers, and the tasks to be mastered—will be investigated in a combined approach. The main focus of interest will be the mathematics teachers, whose role it is to mediate between the tasks and the students by selecting learning materials, giving appropriate feedback, and involving students in meaningful learning activities. The theoretical framework of the research project is based on the process-mediation-product model, the (social-)constructivist approach, and the notion of teacher expertise, and integrates these in the context of a multilevel and multivariate model. On the one hand, the theoretical framework incorporates robust findings from research on teaching; on the other hand, it broadens the scope in the analysis of instructional processes and practices by paying particular attention to the enhancement of cognitive activation, and by systematically relating instructional

processes to teachers' expertise and professional beliefs. The study focuses on the question of how insightful learning can be facilitated in classrooms. An outline of the theoretical framework is given in Figure 1. Despite differences on various details in research on learning and instruction, there is a broad consensus about some central principles of insightful learning:

- Insightful learning is an active process of construction of meaning, in the course of which mental representations are modified, extended, cross-linked, hierarchically ordered or generated. Even meaningful receptive learning is a constructive activity in this sense. The decisive factor in insightful learning is mental involvement, which occurs in the active engagement with the social or natural environment or with symbolic representations. The opportunity structure of a learning environment should thus be evaluated in terms of the extent to which it supports, fosters, or impedes this kind of mental activity.
- Insightful learning depends on an individual's cognitive prerequisites, and particularly on domain-specific prior knowledge. The scope and

organization of the available knowledge base determines the quality and ease of further learning. The more demanding a task or problem, the more important a student's prior knowledge becomes.

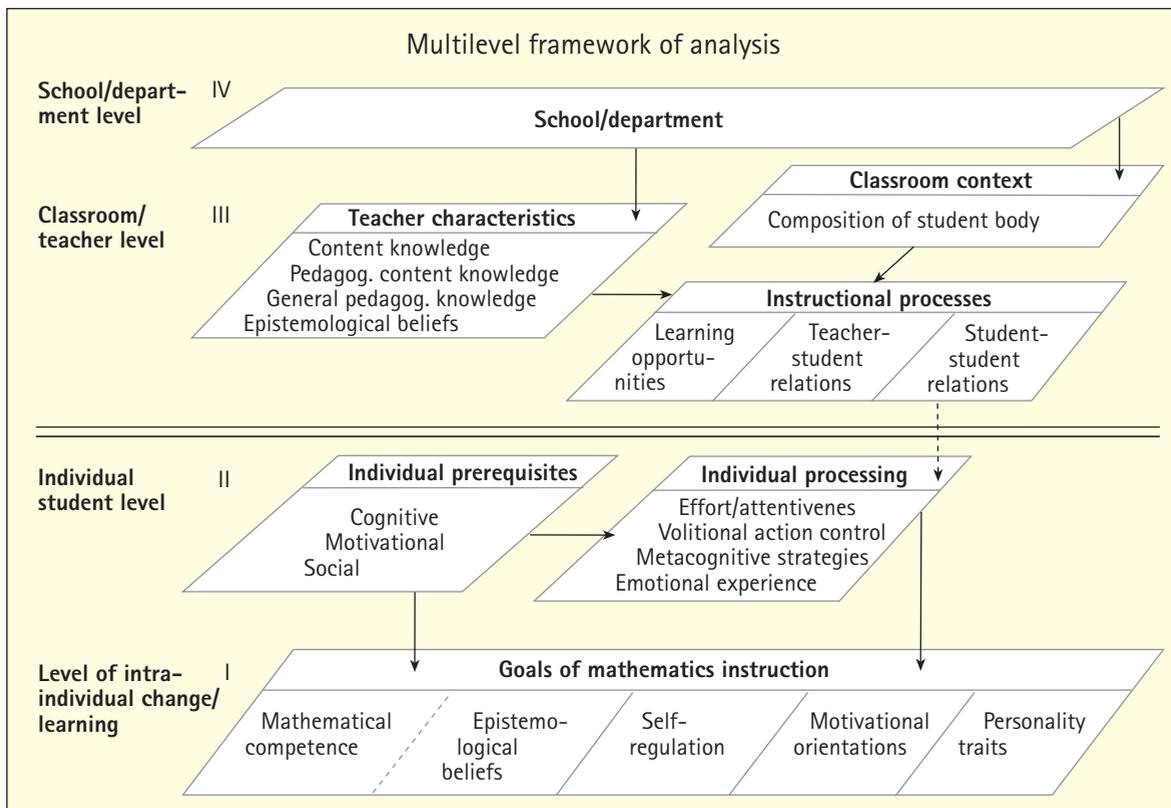
- Despite its cumulative nature, insightful learning is always situated—it inevitably occurs in a given, mostly social context. Knowledge thus entails a connection with the situational context of acquisition. To a certain extent, learning is always anchored in the life world—be it as artificial as the life world of the school. Because knowledge is situated in the context of acquisition, there is an inherent limitation on its transferability. To broaden the area of transfer,

instruction needs to vary the contexts of acquisition and application.

- Insightful learning is also regulated by motivation and the meta-cognitive processes of planning, monitoring, and evaluation.
- Insightful learning is supported by mechanisms that reduce cognitive load. These include chunking and the automatization of processes of thought and action.

Insightful learning thus evolves through the active and intelligent use of rich and diverse learning opportunities. The horizontal lines in Figure 1 represent the fundamental division between the supply and usage of such opportunities (Fend, 2002). The most important aspect of the learning supply side that can be

Figure 1. Multilevel framework of analysis.



optimized is the structure and quality of learning opportunities. Recent research on learning in mathematics draws attention to the significance that demanding and open-ended tasks, the structural and contextual variation of those tasks, the teacher's response to student errors, and the acquisition and automatization of teaching strategies have for high-quality instruction. These findings highlight the importance of teachers' domain-specific expert knowledge. Video analyses conducted in the framework of TIMSS and TIMSS-Repeat have revealed considerable cross-country differences in the intelligent choreography of domain-specific opportunities for insightful learning in the classroom. Based on these findings, a parsimonious model of teacher expertise distinguishing different facets and types of teachers' professional knowledge was developed, focusing

on what Lee Shulman (1987) termed pedagogical content knowledge and the related beliefs and attitudes. In other words, the model focuses on the expert knowledge instructors need to transform subject matter into insightful learning opportunities. The most important features are presented in Figure 2. This conceptual framework raises problems of data collection, however, particularly in the context of a large-scale assessment program. To date, the results of teacher surveys on instructional processes and practices have been disappointing, and there is no reason to believe that such questionnaires could provide valid assessments of professional expertise. In the context of the TIMSS Video Study, which was embedded in a one-year longitudinal study in Germany, we asked students, teachers, and independent observers to rate instruction with

Figure 2. Structure of teachers' professional knowledge: Pedagogical content knowledge in mathematics.

Structure of teachers' professional knowledge: pedagogical content knowledge in mathematics			
<i>Facets of professional knowledge</i>	<i>Declarative expert knowledge</i>	<i>Procedural expert knowledge</i>	<i>Beliefs and attitudes</i>
<i>Subject matter knowledge</i>	Structure of the mathematics curriculum	Selecting mathematical tasks and problems	Goals of instruction
Pedagogical content knowledge	Cognitive demands and pedagogical potentials of mathematical problems	Handling tasks in classroom instruction	Preference for specific models of teaching mathematics
	Student preconceptions	Sequencing tasks in classroom instruction	Enthusiasm about teaching mathematics
<i>General pedagogical classroom knowledge</i>	Typical student difficulties in understanding mathematical problems	Responding to unexpected student ideas	Epistemological beliefs about learning of mathematics
		Responding to student mistakes	
		Organizing cognitively demanding practice in classroom	
		Selecting and sequencing tasks for homework and tests	
		Diagnostic competence in the field of mathematics	

respect to the same theoretical constructs. We ensured that the wording of the items was as uniform as possible. Nevertheless, the concurrent validity of the three rating methods was remarkably low (Clausen 2002). The findings suggest that teachers, students, and independent observers perceive instruction from different perspectives and focus on different facets. Nevertheless, all three approaches were shown to have differential validity where the prediction of learning progress is concerned:

- Students seem to be experts on the general affective quality of instruction, the efficacy of classroom management, and the occurrence of infrequent classroom events.
- Independent observers are distinguished by their relatively reliable evaluation of the overall quality of instruction assessed with high inference ratings. Additionally, their judgments of frequent events measured with low inference ratings are also reliable.
- Teacher reports on their own instruction are characterized primarily by a self-serving bias. At the same time, their assessments do seem to become informative when focusing on dimensions that can only be evaluated by raters with the necessary professional expertise and, in particular, the necessary pedagogical content knowledge. Precisely these aspects are very rarely addressed in traditional questionnaires, however.

To elicit professional expertise, a teacher survey must involve teachers in a kind of conversation about their work and give them the opportunity

to document their professional expertise. Therefore, we have decided to develop a computer-based assessment instrument that engages mathematics teachers in a virtual dialogue about their professional activities. This instrument allows us: (1) to present and manipulate mathematics tasks on the computer screen, and (2) to show videos presenting critical situations from mathematics lessons or different choreographies of mathematics instruction. In other words, the instrument allows us to generate situations that require the activation of pedagogical content knowledge and professional responses.

With this method, we will be able to explore the following aspects of mathematics teachers' pedagogical content knowledge:

Selecting Tasks for Lessons on a Standard Grade 9 or Grade 10 Mathematics Topic

A series of tasks with differing cognitive potential are presented on the computer screen (see Fig. 3). Some of these tasks can be solved in multiple ways, thus allowing teachers to take different levels of students' prior knowledge into account. Teachers are asked to select tasks appropriate for introducing a new mathematics

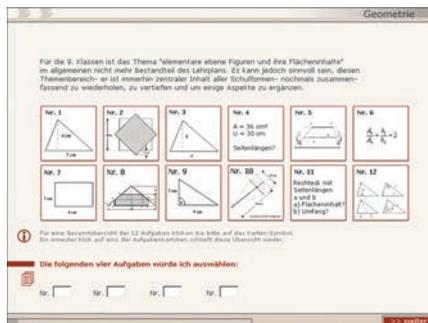


Figure 3. Screenshot taken from the computer-based questionnaire, where teachers were asked which 4 of the 12 tasks presented they would use in their 9th grade classrooms to consolidate the topic "areas of plane figures." Teachers could click on each of the 12 symbolic representations of geometry tasks to view them completely.

topic as well as for organizing practice periods, and to give reasons for their choice.

Handling Selected Tasks in Classroom Instruction

The aim here is to determine whether the teachers utilize the cognitively activating potential of tasks effectively.

Sequencing of Tasks

Teachers are asked to select tasks suitable for introducing a new mathematical topic, to arrange these tasks in the order they would use them on the computer screen, and to give reasons for the chosen sequence. In a second step, they are presented with other sequences, each of which represents a different instructional approach. They are asked to select one of these sequences for their lessons and to give reasons for their choice.

Structuring the Content of Instructional Processes at Critical Points in the Lesson

Teachers are shown short videos of mathematics lessons. The videos break off at a point which is critical for the further development of the lesson. The decisions teachers make at this point determine whether the

level of cognitive activation will be maintained or the lesson is trivialized. The teachers are asked to describe how they would continue the lesson (see Fig. 4).

Responding to Unexpected Student Ideas

Teachers are shown short videos or descriptions of situations in which students present unexpected mathematical ideas. The teachers are asked to respond to these ideas (see Fig. 5).

Responding to Student Errors

The teachers are confronted with student mistakes. These errors represent temporary misunderstandings, typical misconceptions in the topic area, as well as more unusual errors that can be put to good use in cognitively activating instruction. The teachers are asked to account for the errors in students' thinking and to give their reactions to the errors (see Fig. 6).

Diagnostic Competence in Mathematics

Four dimensions of the mathematics teachers' diagnostic competence are examined. The teachers are presented with tasks in order to explore whether they are able to:

- (1) identify misconceptions typically held by lower secondary school students,
- (2) distinguish different approaches to open-ended tasks and predict the probability that students will use these approaches,
- (3) accurately gauge the difficulty of the tasks for the students in their class, and

Figure 4. A scene from a geometry lesson shown to the teachers.



(4) diagnose the prior knowledge of individual students.

The computer-based instrument for the assessment of teachers' expert knowledge is complemented by a random selection of homework assignments and informal tests. This material is analyzed from the perspective of its implicit pedagogical conception. Finally, a traditional questionnaire is used to assess socio-demographic teacher variables and aspects of the teachers' occupational career, professional commitment, and belief systems.

Parallel to the teacher study, we also tap into students' perceptions of classroom management and instruction. A student questionnaire collects data on characteristics of the instructional process for which students reports are reliable and

have predictive validity. For the purposes of construct validation, these aspects of instruction are also assessed from the teachers' perspective within traditional teacher questionnaire.

Following initial testing in face-to-face situations in which teachers commented on the computer presentations, a first field trial with 80 mathematics teachers was completed successfully. A revised version of the computer-based instrument is now available in CD-ROM format, and will be implemented in the PISA 2003 assessment. The study will be repeated one academic year later. Hierarchical linear modeling will be used to link its results to student performance gains and motivational development.

Figure 5. One of the situations presented is the following: Imagine that one of your students comes to class very excited. She explains that she has discovered that, as the perimeter of a closed figure increases, the area also increases. She shows you this picture to prove what she is doing.

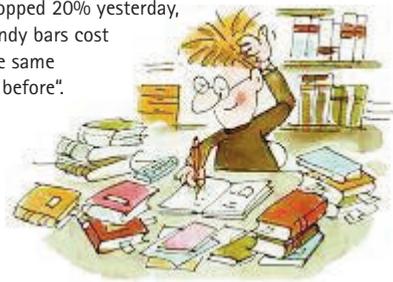


The question to the teacher was:
"How would you react to this claim?"

(According to Liping Ma [1999]. *Knowing and teaching elementary mathematics*).

Figure 6. One student error presented was the conceptual error as depicted in this cartoon.

"If the price of candy bars rose 20% last week and dropped 20% yesterday, candy bars cost the same as before".



The question to the teacher was:
"How do you think this student formed this idea—what was the thought process behind it?"

The Research Team

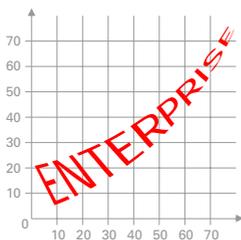
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Key Reference

Haag, L., & Stern, E. (2003b). In search of the benefits of learning Latin. *Journal of Educational Psychology, 95*, 174–178.

Understanding comes from having a good representation
Novick & Hmleo



ENTERPRISE: Cognitive Activation in Elementary School Children: The Potential of Diagrammatic Tools

The ENTERPRISE project (Enhancing Knowledge Transfer and Efficient Reasoning by Practicing Representation In Science Education) aims to explore the conditions under which graphs and diagrams can serve as tools for structuring learning environments and, thus, foster conceptual understanding in science as well as other content areas.

Symbol Systems as Reasoning Tools

It is now widely recognized that higher order cognitive activities of humans, such as learning, reasoning, and transfer are based on an elaborated knowledge rather than on formal rigor (Haag & Stern, 2003b). Knowledge dealt with in academic contexts is based on symbolic systems, such as script, formal mathematical language, pictures, and diagrammatic representations. Symbols can be understood as mental tools that allow the construction of meaning in concepts, ideas, or plans. Within the mental tool framework, understanding can be conceptualized as the ability to use representations in a flexible manner. While pictures, number systems, and written language have a long tradition of use in human culture, visual-spatial tools, such as graphs and diagrams were only devised as tools for knowledge representation about two centuries ago. Since then, space has been used to represent nonspatial information, particularly in formal domains, such as science and economics. Because computers have made the construction and modification of graphs and diagrams so easy, the frequency with which individuals encounter such representa-

tions has increased markedly over the past decades. In view of this trend, cognitive science has put a great deal of effort into researching diagrammatic literacy. Beyond the function of depicting information, however, diagrams and graphs can also serve as active reasoning tools. The old adage that one picture can be worth ten thousand words has been confirmed by cognitive science research. Diagrams support a large number of perceptual inferences which are easy for humans to process. By grouping together all related information, extensive searches for elements needed in a problem-solving inference become superfluous. Indeed, visualization may lead to new insights into the formal structures of a problem. Moreover because the constraints to be considered when drawing graphs and diagrams are the same in different domains and content areas, learners using external representations may be able to identify previously imperceptible commonalities between domains (Stern, 2001b). Exploring best ways to implement diagrammatic tools in science and mathematics instruction, the ENTERPRISE project focuses on elementary school children. Investigations of this age group provide valuable insights into human development, particularly because elementary school children's cognitive potential has long been underestimated (see also pp. 116–117). (Stern, 2002). The ENTERPRISE project has put the main emphasis on two topics: First, the use of line graphs as powerful reasoning tools and second, ways of improving children's understanding of floating and sinking of objects.

Line Graphs as Powerful Reasoning Tools

Line graphs are broadly disseminated in learning materials dealing with topics of formal domains, such as science or economics. They are most appropriate to represent causal as well as incidental relationships between two variables. In Germany, students encounter line graphs as a means for data representation already in early secondary school, while core elements of graphs, such as the slope or the intersection on the y-axis, are part of the mathematics curriculum in eighth grade, when students learn to map linear functions on graphs. However, despite the value of graphs and diagrams as tools for knowledge structuring, reasoning, and problem solving, the competent use of such tools is not as widespread as would be desirable. Stern, Aprea and Ebner (2003) found that active graphical representation—that is, transferring information given in a table into a graph—helped young adults of different educational backgrounds to use graphs as reasoning tools in new contexts. Without practice in active graph construction, even university students of mathematics and economics were not able to exploit the potential of graphs, which suggests that practicing the competent use of graphs as reasoning tools is neglected in the German curriculum. The item following was presented to the preuniversity sample of TIMSS III:

The acceleration of an object moving in a straight line can be determined from
(a) the slope of the distance-time graph
(b) the area below the distance-time graph
(c) the slope of the velocity-time graph
(d) the area below the velocity-time graph

While 67% of the international sample solved the problem, the achievement in the German sample was much worse. 55% of the students of the Gymnasium who had chosen mathematics as their major subject found the correct answer "c," whereas only 44% of the students from the Gymnasium who had not specialized in mathematics gave the correct answer. The incorrect answer "a" was chosen most frequently. Most of the students had encountered distance-time graphs, while they probably had never before seen a velocity-time diagram. For those students who are aware of the fact that the slope of a graph represents the rate of change of the y-value in relationship to the x-value, it should be easy to map the described situation on the graph. In contrast, students who lack this deep understanding of graphs have to rely on information retrieved from memory. Differential item functioning analyses revealed special weakness in German students for this item (DIF parameter = $-.30$).

One of the goals of the ENTERPRISE project is to research how the use of graphs as reasoning and transfer tools can be fostered already in elementary school.

In her doctoral dissertation, Susanne Koerber showed that the interpretation of the slope of a graph is within the realm of third-graders (for a detailed description of the results, see Research Report 1998–2000).

When trained to compare mixtures of lemon and orange juice with respect to their intensity of taste, with the help of a balance beam or graphs, it turned out that third-

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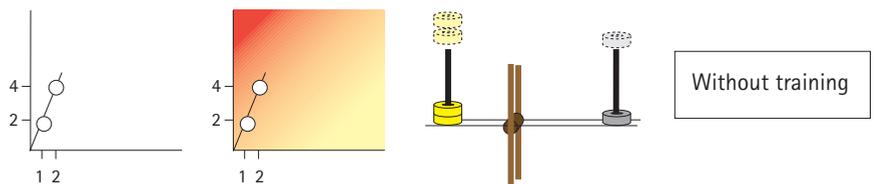
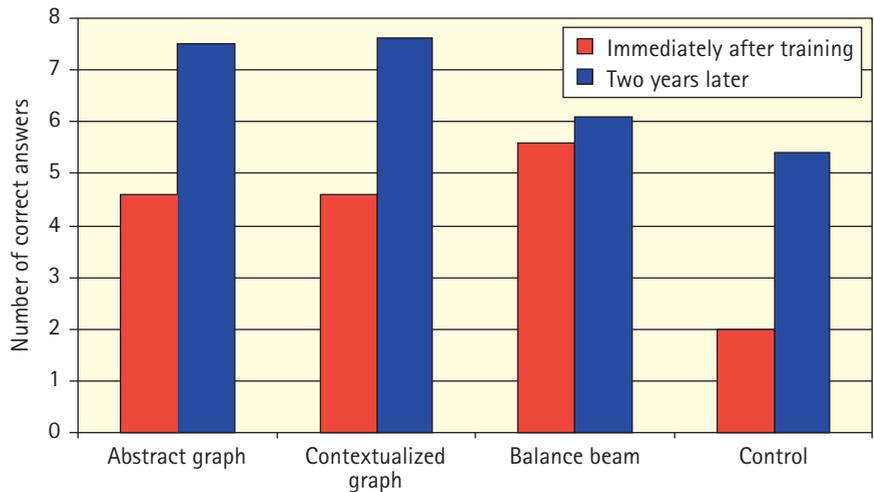
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graders quite easily abandoned the so-called additive misconception, that is, taking "6" instead of "8" to be the result when solving the problem $2 : 4 = 4 : ?$." At the end of the two-day training, particularly those students who had learned to represent the juice mixture by moving the pivot of the balance beam showed considerable improvement in proportional reasoning. However, also the students trained with either the contextualized or the abstract graph gave up the additive misconception. The contextualized graph was artificially enriched by two elements of the juice mixture context: Glasses of orange and lemon juice were drawn on the axes, and the background of the coordinate system continuously changed color from light yellow to dark orange.

In a follow-up study it was investigated whether two years later there was a long-term effect of the short training on proportional reasoning. In order to control for learning experience at school, students who had been trained two years ago were compared to untrained classmates with similar mathematical achievement levels. Figure 1 shows achievement in proportional reasoning immediately after the training (red bars) and two years later (blue bars).

During those two years, proportional reasoning had improved not only for trained, but also for untrained participants. In fact, untrained students reached the scores of trained students two years ago. However, during these two years, students who had been trained with graphs achieved a head start due to the short training. Learning to separate-

Figure 1. Mean performance of the three different training groups (abstract graph, contextualized graph, balance beam) and of a group, that did not receive any training on the proportional reasoning test (maximum score: 8 points) immediately after the training and two years later.



ly represent two dimensions and to integrate them into a single new variable seems to give rise to a deeper insight into proportional structures in general. The follow-up study also tested the extent to which participants could make use of graphs as reasoning tools in a more general way. The results presented in Figure 2 suggest that particularly the students who had been trained with contextualized graphs two years ago had achieved a deeper understanding of how to represent information with the help of graphs. From these results we conclude that starting to use graphs already in elementary school might help students to gain deeper insight into the structure and the potential of these reasoning tools when, in accordance with the grade 8 mathematics curriculum, they start to use them for representing linear functions. Before students learn to map formulas on graphs, they should have been familiarized with their core elements as there are the slope or the intercept. In an experimental training study Anja Felbrich is currently investigating

methods of focusing young children's attention on the meaning of the slope of the graph. The results of the follow-up study were surprising in two respects. First, contrary to conclusions drawn in the Research Report 1998–2000, adding elements of the context to the graph seems to particularly support a deeper understanding of this form of representation. Second, long-term effects for the balance beam were lower than what was expected from the promising effects of the training. There may be two reasons for this. First, the sample of former participants for the longitudinal approach showed a slight (though not significant) negative bias for the balance beam group. Second, and probably more important, the balance beam was a rather complicated construction at that time which may have impeded a deeper understanding of its functioning. In the meantime, a new version of the balance beam has been developed which will be described in the following section.

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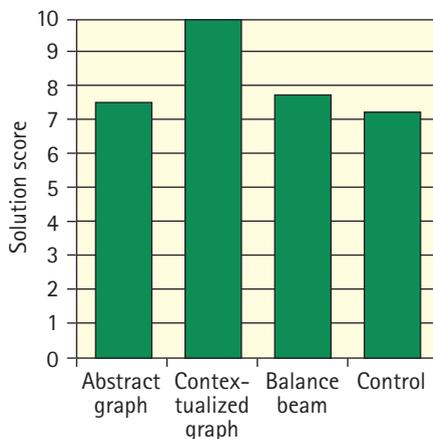


Figure 2. Understanding graphs in a new context.

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How to Improve Children's Understanding of Floating and Sinking of Objects

When elementary school children are faced with the item in Figure 3, most of them will answer that the tree trunk will sink, and a common explanation is that this will happen because the tree trunk is very heavy. In this case the children only focus on one dimension—the mass—while failing to consider also the volume. An alternative explanation often heard from children is that the tree trunk will sink because water sucks it to the bottom, which means that an active force is attributed to the water. Those children who correctly state that the tree trunk will float mostly give an inappropriate explanation by saying that the air pulls it to the top. This explanation expresses an understanding of air as some

kind of force rather than matter—a misconception which is hard to rule out.

Learning environments for third-graders are worked out which support a basic understanding of the scientific concepts underlying the floating and sinking of objects in water, as there are buoyancy force and density (Möller, Jonen, Hardy, & Stern, 2002).

Learning environments that intend to foster conceptual development have to acknowledge a constructivist view of learning, which means that all learning is understood to be dependent on the individual's own constructive cognitive processes (Staub & Stern, 2002).

In essence, the constructivist view focuses on the role of the subject's prior knowledge, which provides the means to relate stimuli in ways that

Figure 3. An item of the test on floating and sinking.

5. Schwimmt ein großer Baumstamm im Wasser?
(Does a large tree trunk float in water?)



Fünf starke Männer können ihn nicht hochheben.
(Five strong men are not able to lift it.)

Der Baumstamm schwimmt (floats) Der Baumstamm geht unter (sinks)

Warum? (Why?)

go well beyond registering their temporal contiguity. The basic principles of a cognitive constructivist view of learning do not lend themselves to direct practical application. Instead, they should be thought of as general orienting frameworks within which to address pedagogical issues and develop instructional approaches. Cognitive constructivist beliefs need to be interpreted in terms of specific content domains, particular learners, and a socially interactive context. What does it mean for teachers to initiate and assist the content-specific constructive processes of particular learners? How can teachers proactively initiate, prompt, and assist students' constructions of rigorous knowledge?

A crucial aspect in this respect is the degree to which students' activities should be structured in a learning environment. From a rather extreme constructivist point of view, one might argue that teachers have to provide the learning material, but that the students themselves have to decide when and how they will make use of it. From a more moderate constructivist view, one would argue that learners can best make use of a learning environment that

is already sequenced and that allows teachers to intervene when students get stuck or show inappropriate activities. Two studies with third-graders dealt with questions of appropriately structuring learning environments.

The Experimental School Study

In a classroom-based curriculum divided into eight 90-minute sessions, children had the opportunity to engage in several experiments designed to help them understand principles, which can be seen as the precondition for understanding buoyancy force. For instance, children learned that objects dunked into water will displace water, or they felt that water will press against objects when putting their plastic-gloved hands into a box of water.

Three instructional groups were compared: (1) some structuring ($N = 71$), (2) open inquiry ($N = 70$), and (3) without intervention ($N = 41$). Achievement measures were applied one week after instruction and one year later. Conceptual understanding was assessed with a test of objects floating and sinking considering both the correct rejection of misconceptions and the adoption of

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If you put a piece of metal wire into water, it

will sink will rise to the surface

because it holds on.

because the displaced water weighs less than the metal wire.

because it is so long and so thin.

because the displaced water weighs more than the metal wire.

because it is not pushed up hard enough by the water.

because it is so light.



Figure 4. An item of the test on floating and sinking.

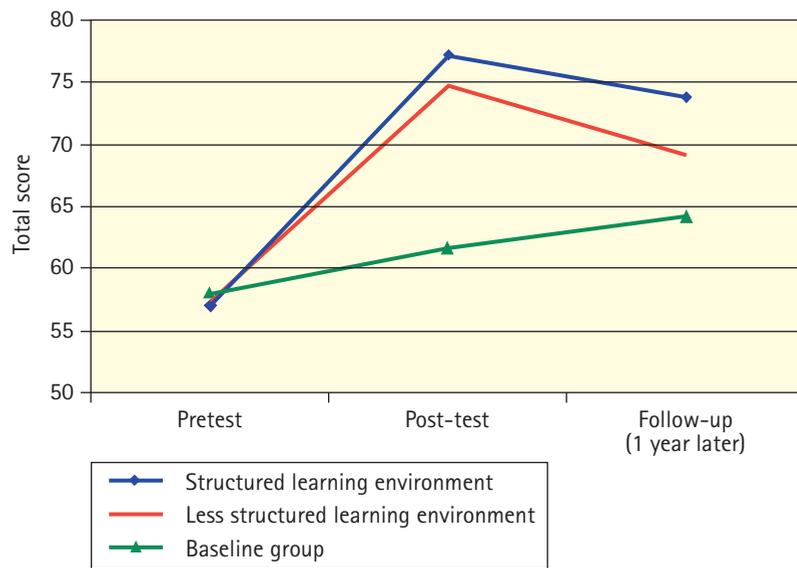
scientific explanations, which contained items such as shown in Figure 4. We hypothesized that elements of structured learning environments, such as focused discussions and sequencing of instructional content, would support students' integrated conceptual understanding because of a direct confrontation with existing preconceptions and their resolution during discussions and experimenting.

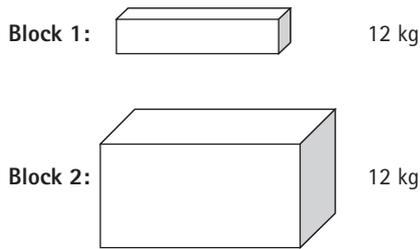
Results as represented in Figure 5 showed a significantly greater gain in conceptual understanding of the group with structured instruction compared to the other groups one week after the instruction had been finished. Detailed analyses of students' answers showed that compared to the baseline group, both instructional groups gave up more misconceptions and adopted more scientific explanations, while the baseline group developed a basic understanding with regard to the different qualities of specific materials equally well. Effects one year

after instruction showed a persisting gain for both instructional groups concerning misconceptions, scientific explanations, and specific materials, whereas the baseline group merely intensified their understanding of specific materials.

The study shows that complex physics topics are already accessible to elementary school children on a lasting conceptual basis, especially if structured instruction allows for an integration of students' pre-existing and new concepts. At the same time, the study revealed some deficits in the understanding of the concept of density. Many students still focused on weight and neglected the volume, which became particularly apparent when answering items such as shown in Figure 6. We hypothesize that integrating tools for representing two-dimensional concepts into the curriculum may help to foster the understanding of density. In a laboratory study this question was addressed.

Figure 5: Achievement in the test on floating and sinking.





Which block is heavier?
 Block 1 Block 2 Both are the same

Which block is bigger?
 Block 1 Block 2 Both are the same

Which block is of the heavier material?
 Block 1 Block 2 Both are the same

Figure 6. An item of the test on floating and sinking.

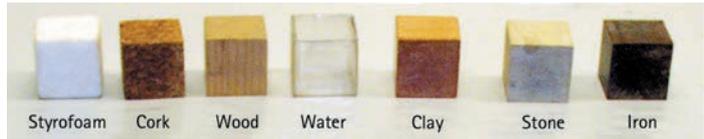
An Experimental Laboratory Study on Structuring the Learning Environment With the Help of Cognitive Tools

Using tools for representation fits into a moderate constructivist learning environment because, on the one hand, they constrain students' activities and, on the other hand, they provide opportunities for self-regulated learning (Stern, Möller, Hardy, & Jonen, 2002).

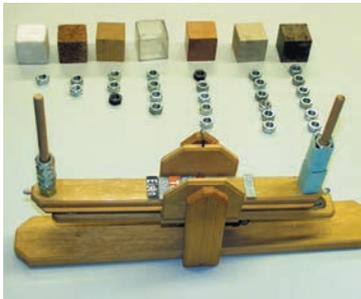
If learners meaningfully connect the structures of a representation to the situational variables represented and the phenomenon to be explained, the use of a representation may enhance conceptual change by building on, refocusing, and extending initial conceptions. Representations focusing on the proportional relationship between two quantities will thus lead learners to attend to both quantities simultaneously. In an instructional unit on floating and sinking, representations may thus show the inadequacy of students'

initial conceptions, for example, their consideration of only one quantity when describing objects. Representations may also support students' construction of new explanations by allowing the prediction of objects' floating and sinking based on a comparison of densities. Representations differ in the way they afford the integration of two quantities. In this study, two forms of representation for the concept of density were compared. On the *balance beam*, weights representing mass and volume can be put on both ends of a beam. An adjustable pivot allows the comparison of two ratios by observing the behavior of the beam when putting on weights for the second ratio. Since balancing a beam is dependent on students' multiplicative additions on either end of the beam, both numerical and visual comparisons are supported. With the *cardboard matrix*, volume is represented by large squares of cardboard while mass is represented by small squares placed on them. Students' comparison of the densities of two objects is thus assumed to be supported especially on a qualitative level, judging the relative crowdedness of volume cardboard squares. The effects of training with the cardboard matrix and the balance beam on an understanding of the floating and sinking of objects as well as on a proportional understanding of density were compared to the effects of a training with numbers rather than with visual representations. The material used in this study is depicted in Figure 7. Three dimensions of cognitive progress were investigated: First, do

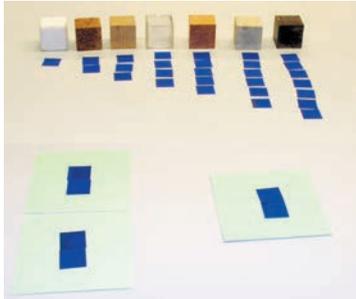
Material used by all participants



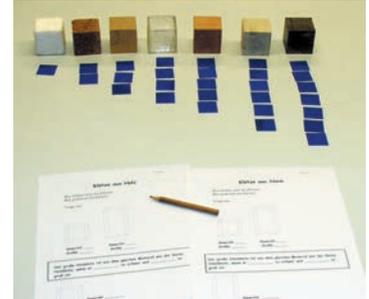
Material used in the three training groups



Balance beam



Cardboard matrix



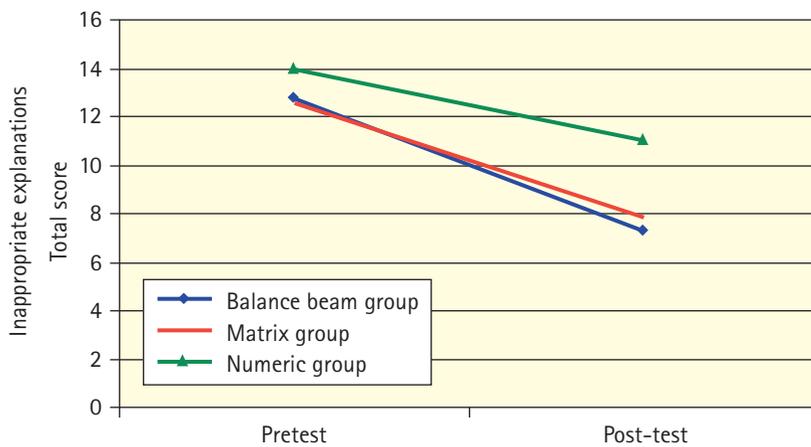
Numbers

Figure 7. Material used in the experimental laboratory study.

participants adopt appropriate explanations for the floating and sinking of objects, such as "an object floats if the water displaced by the immersed object is heavier than the object itself." Second, do participants reject inappropriate explana-

tions, such as "objects sink because they are not pushed up hard enough by the water." The third aspect concerned proportional reasoning, such as tested in the item in Figure 6. Results revealed that only the group trained with the balance

Figure 8. Decrease of inappropriate explanations for the floating and sinking of objects.



beam improved on all three dimensions.

The group trained with numbers improved with respect to adequate explanations, but they also kept inappropriate explanations; although trained with numbers, they did not improve in proportional reasoning.

The group trained with the cardboard matrix, on the other hand, exactly showed the inverse pattern of learning gains. Figure 8 depicts the decrease of inappropriate explanations after the trainings.

Working with the balance beam helped children to realize the inadequacy of their preconceptions as well as to integrate mass and volume to form the proportional concept of density.

Current Directions

Together with our colleagues in Münster we are currently working out projects of how to integrate the balance beam into the curricula on floating and sinking in third-grade classrooms. For this purpose we developed a balance beam (see Fig. 9) which is easier to handle than the old one. Moreover, students can operate this balance beam with their hands and they can use the familiar Lego bricks as weights. As can be seen from Figure 10, this new balance beam is already used at school.

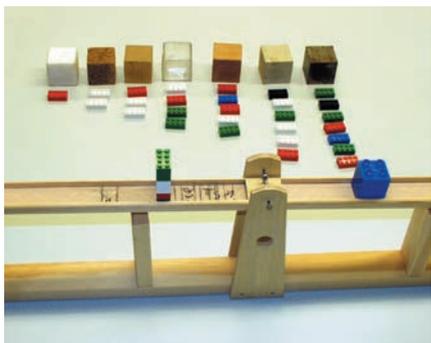


Figure 9. The new balance beam.



Figure 10. The new balance beam at school.

„Unabhängig von den unterschiedlichen Fähigkeiten und Talenten der Schüler muss alles gelernt werden, was später gewusst und gekannt wird. Lernen ist der mächtigste Mechanismus der kognitiven Entwicklung. Das gilt uneingeschränkt sowohl für hochbegabte Kinder als auch für schwächer begabte Schüler. In vielen Fällen ist dabei didaktische Unterstützung notwendig und wirksam. Noch so gut gemeinte motivationspsychologische oder sozialpädagogische Maßnahmen können für den eigentlichen Lernakt kein Ersatz, sondern nur eine oft sehr wirksame Voraussetzung sein.“

F. E. Weinert, Leistungsmessungen in Schulen, 2001, p. 85.

Translation:

Regardless of differences in students' skills and talents, everything they later know or are able to do has to be learned. Learning is the most powerful mechanism of cognitive development. This is true, without exception, for high achievers as well as for children with poorer preconditions. In many cases, didactic support is necessary and effective in this process. Steps taken in terms of motivational psychology or social pedagogy, however well meant, can never take the place of the actual learning act, but only constitute the—often highly effective—prerequisites for it.

Elementary School in Focus: Why Mathematics and Science Education Has to Become More Challenging

In the domain-specific perspective of research on cognitive development, children's competencies as well as deficits in mastering mathematics and science problems are explained by their lack of prior knowledge in the respective areas. Results from longitudinal studies suggest that within-age-level differences in mathematics achievement are, to a remarkable extent, determined by prior domain-specific knowledge acquired in earlier grades. Stern (2002, in press-a, in press-b), for instance, found that achievement variance in grade 11 mathematics could be much better accounted for by mathematics achievement in grade 2 than by mental abilities measured in grade 11. Detailed analyses revealed that only students who, as second-graders, had been able to solve problems which required an advanced understanding of numbers and mathematical operations showed high mathematical achievement in secondary and high school. Advanced mathematical understanding in elementary school, for instance, goes along with an understanding of the function of numbers beyond mere counting, and with being aware of the inverse relationship addition and subtraction as well as between multiplication and division. Achievement in arithmetic word problem solving has proven to be a good indicator of advanced mathematical understanding. In current mathematics classes in German elementary school, most of the time is dedicated to practicing algorithms and number facts rather than to solving challenging word problems. Therefore, elementary school children often do not acquire the kind of mathematical knowledge they need to build on when the curriculum requires them to deal with fractions, algebra, or trigonometry.

In science education, German elementary school teachers mainly deal with geographical or biological topics rather than with physics or chemistry. Children, nonetheless, are interested in how the physical world works. They construct their own explanations of why some objects will float in water while others will not or why balloons will pop when inflated beyond their capacity. Often, children's own explanations are not compatible with the adequate scientific theories. If young children would be confronted with alternative explanations that can be integrated into scientific theories, they might in later years have less difficulties in understanding physics.

From a domain-specific constructivist perspective of cognitive development, it can be concluded that chances for students to leave school as competent mathematics and science learners would be better if they started to acquire and restructure elaborate knowledge in these domains at an early age.

Four Widespread Objections to a More Challenging Elementary School Education and How They Can be Ruled Out

The call for more challenging science and mathematics classes in elementary school is not undisputed. Four objections are frequently raised:

Objection 1: Children are not little adults, therefore, they have the right to grow up in environments which are suitable for them.

Response: It is definitely true that children differ from adults in the way they process information about the world and in the way they are emotionally affected by certain events and situations. However, it is also true that from a very early age children want to know how the world works and ask adults for explanations. Environments which help children to find an answer to their overwhelming number of "Why" questions are, therefore, child-appropriate.

Objection 2: Early training means unnecessary efforts—children will anyhow achieve the same level much easier when they are older.

Response: This is true for the emergence of competencies supported by genetically determined universal programs of neuronal development, for instance, language acquisition or cleanliness. In these cases, the environmental and instructional input which, at a certain period of maturation, is necessary and sufficient to prompt developmental progress is comparatively small in terms of time and effort. Evolution has prepared human beings for the acquisition of many competencies even if they grow up in adverse environments. However, the use of writing systems, mathematical tools, or scientific explanations is not among them, since these are the result of cultural development. Only systematic support given in professionally organized learning environments allows human beings to acquire, within a few years, competencies which took mankind centuries or millenniums to develop. Acquiring such competencies is time-consuming for all human beings—even the most competent ones—because the underlying knowledge has to be restructured repeatedly by applying it to different contexts. There is good reason to assume that the earlier knowledge acquisition in science and mathematics sets in, the higher will be the level students will have reached at the end of school.

Objection 3: In more demanding learning environments children with poor cognitive preconditions will be overtaxed and frustrated from the very beginning of schooling.

Response: Many people involved in education think that students with poor cognitive preconditions will benefit more from learning environments which primarily focus on associational and rote learning rather than on deeper understanding. The assumption is that only the more intelligent students can profit from stimulating learning environments. There is, however, no empirical evidence for this assumption. Rather, for elementary school children's learning of mathematics, Staub and Stern (2002) showed that regardless of students' intelligence level, larger achievement gains were obtained in classrooms with teachers who held a cognitive constructivist rather than a direct transmission view of learning. Classroom observations revealed that although teachers with a direct transmission view spent more time practicing factual knowledge and arithmetic procedures, they were not more successful in fostering computational proficiency in students with poor preconditions. Hasemann and Stern (2002) compared effects of two trainings on arithmetic word problem solving in second-graders. One training focused on the use of visual-spatial representations, while the other training referred to the everyday experience of the children. It turned out that particularly students with poor prior knowledge gained from the more challenging training dealing with representations. Möller, Jonen, Hardy, and Stern (2002) showed that particularly students with poor preconditions gained from structured learning environments, which support children in acquiring scientifically appropriate explanations for why certain objects will float in water while others will sink. There is good reason to believe that stimulating learning environments, which take into account the learner's prior knowledge as something to be extended and restructured, will help all students to achieve their personal optimum.

Objection 4: If young students are confronted with content they cannot fully understand, this will necessarily result in misconceptions which will make further learning more difficult.

Response: It is true that if teachers would talk to younger children about scientific concepts in the same way as they talk to older students, this would necessarily result in severe misunderstandings. According to a constructivist view of learning, incoming information is always connected to knowledge already existing in the mind. Misunderstandings occur if students do not access the knowledge necessary for storing the incoming information in the way expected by the teacher. There are, however, other ways of talking to children about scientific concepts, which consist in adapting these concepts to children's prior knowledge. For instance, one can focus on the meaning of the slope of a graph in a context of speed, density, or juice concentration without referring to the mathematical formula. There is nothing wrong about saying that objects, which are put into water, will push against the water while at the same time the water will push against them. This explanation is compatible with the scientific concept of buoyancy. What might cause misconceptions is the use of definitions based on technical terms unfamiliar to children. Presenting elementary school students with the definition of density as the quotient of mass and volume will clearly overtax them. Young Children will hardly understand the theoretical context which makes it necessary to distinguish between weight and mass, and they are unfamiliar with the term "volume." Defining density as the quotient of weight and size, however, is definitely incorrect. Therefore, an elementary school curriculum on the floating and sinking of objects in water will have to operate without the definition of density. In fact, no such definition is necessary for directing young children's attention to the relevant aspects of floating and sinking. The major challenge of appropriate elementary school education is to find ways to connect new information to existing knowledge that can be extended in the desired direction.

"It seems to be widely believed that children must not be told the truth about the system to begin with because they could not cope with such complexities. I believe this to be quite mistaken. What underlies the mistake is, I think, a failure to make a crucial distinction—a failure to see the difference between understanding the nature of the system and mastering all the individual patterns of relationship. It will inevitably take a child some time to learn all the sets of correspondences. The question is simply whether he will do this better if he is correctly informed about the kind of thing to expect."

Margaret Donaldson, Children's minds, 1978, p. 105.

"We begin with the hypothesis that any subject can be taught effectively in some intellectually honest form to any child at any stage of development."

Jerome Bruner, The process of education, 1979, p. 33.

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Research Projects of W. Edelstein, Director Emeritus

Experiential Learning and the Lifeworld of the School

Until the 1990s, the basic fit between the educational system and the manpower needs of the economic system was never called into question. However problematic their relationship, in a fairweather society with an expanding economy schools continued to "prepare for life" and to guarantee the social inclusion of their graduates.

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In the last decade of the 20th century the balanced relationship between school and life was being upset. An imbalance in the relation between the school and the globalizing economy would lead to the potential exclusion of a sizeable segment of young people of school-leaving age. Simultaneously, the unification of Germany produced a set of problems more specifically felt in the Eastern provinces of the country. The unitary school system of the GDR had been abolished and a system akin to the three-track Western system introduced; the job security of the graduates, which had been part of an institutional patronage system linking schools to industries and workplaces, was dissolved.

The Rise of a Right-Wing Culture in German Youth

A review of right-wing activities among German youth conducted for the Federal Ministry of Education and Science (Bromba & Edelstein, 2001) disclosed that groups of young people who are dissatisfied with school and complain about the meaninglessness of their learning experience, in particular in the non-academic tracks of secondary schools in the Eastern provinces, turn out to be the major breeding ground for antidemocratic attitudes, right-wing postures, racism, and vi-

olence. The experience of alienation in secondary schools thus appears to be a major reason for adolescent anomie (Bromba & Edelstein, 2001; Edelstein, 2002a; Edelstein, in press-b). The transformation of the economy in the globalization process, the imbalances created by unification, and the extent of unemployment resulting from these processes have produced a fiscal crisis that threatens the welfare system, tends to deprive the school system both in the old and the new German states of essential funds, and restricts the number of available teaching positions and thus the access of younger teachers to schools. This fact has led to diminishing expectations and decreasing professional aspirations of teachers as well as to increasing burnout, as the average age of the teaching force continues to rise. On the local level this may result in growing numbers of cancelled lessons and underserved extra-curricular projects, with the consequence of diminishing discipline and increasing pressure for achievement. These stresses, of course, vary across states, hitting the poorest like Berlin or Mecklenburg-Pomerania harder than some wealthier ones. On the background of this picture of widespread dysfunction, the results of the PISA study caused a major stir. Contrary to expectation, Ger-

man schools, on average, performed in the lower third internationally, far below the top Scandinavian systems, Canada, Japan and New Zealand, all in fact either unitary or comprehensive school systems. These findings started a new educational debate in the country. Although the debate tended to shy away from central structural questions raised by the PISA results, such as the restriction of the elementary school to a mere four years or the selective tracking of secondary school students from the fifth-grade onwards, the debate raised questions as to the quality of instruction, teacher performance, school change as well as various questions concerning the quality and development of the schools. In the context of renewed educational debate it seemed both reasonable and necessary to give increased attention to social psychological processes in the schools, such as the quality of teacher-student interactions, the meaningfulness of learning experiences for students, and the quality of the school as a setting for life experience and moral growth in childhood and adolescence. The state of youth in Germany and the dissatisfaction with schools have become the targets of various programs and projects in which the Institute has a share.

Self-Efficacious Schools

Already in the mid-nineties we had been instrumental in launching a federal pilot program of "self-efficacious schools" supported by private funds from the Jacobs and the Freudenberg foundations. The program targeted the self-organization of teachers and the enhanced

achievement and self-worth of students in the age range of 12 to 18 years as a consequence of increased self-efficacy among them. A major objective of the program was to change instructional modes and evaluation strategies of teachers. These teacher characteristics remained rather resistant to change in spite of the intervention, whereas major effects were seen in readiness to change in most participating schools regarding organizational development and collegial cooperation among teachers. A training program for teachers was developed in the course of the project and refined on the basis of the project's evaluation in the past years by educational psychologist Matthias Jerusalem of the Humboldt University in Berlin. The training program has proven successful in recent pilot runs and will be used intensively to train teachers in the new federal program for democratic schools (cf. below). Preliminary evidence has shown that the change potential of the program is considerable. It is a sign of organizational self-efficacy that has emerged from the program that a new "coalition of self-efficacious schools" remains active (Edelstein, 2002).

Youth Take Responsibility

The foundation-funded program "Youth Take Responsibility" ("Jugend übernimmt Verantwortung") of the Brandenburger Tor Foundation of the Berlin Bank Company is another attempt to respond to the social and psychological situation of youth, especially in the lower tracks of secondary schools. Whereas the "self-efficacious schools" program was specifically

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designed to enhance student optimism and effort and to decrease teacher burnout through student-oriented instruction, collegial communication and organizational processes, the focus of the youth responsibility program is both more limited and more precise. The aim is to fuse the abstract characteristics of self-efficacy beliefs with the concrete experience of responsibility for cooperative action in projects based in a school or in a community. Again, the basic idea is to counteract the sense of helplessness, heteronomy, and alienation affecting many, especially low-achieving students, in the secondary schools and to activate them through a sense of achievement with a self-chosen task undertaken in cooperation with others. Projects in the program represent an experience of cooperation and democratic exercise of control in the context of cooperative goalsetting and decision making about a common task. It implies responsibility taken for action and responsibility shared with others. A first expert workshop on responsibility learning was held in May 2000. A conference on the learning of responsibility in various domains (schools, ecological projects, international youth programs, reeducation of adolescent delinquents) took place in May 2001 and a summer school for teachers on responsibility learning in projects took place in July of that year.

Learning and Living Democracy

The new federal program "Learning and Living Democracy" ("Demokratie lernen und leben"), which started in Fall 2002 and will remain operative

for five years, is yet another attack on the same set of problems. Originally developed as a measure of prevention of right-wing radicalism among adolescents, the program deploys a broad strategy designed to enhance competence, meaningful learning in projects, students' democratic participation at all levels of the school, service learning and, more generally, the school as a productive community (Edelstein & Fauser, 2001). Elements of this program have been adopted by 12 of the 16 federal states establishing networks that encompass between 6 and 24 schools each. The networks engage in program-related organizational development, providing counsel for schools and teachers and in-service training specific to the program, for example, teaching for understanding, sociomoral competence, civic learning, project instruction, and self-efficacy training. Transfer of competence beyond the program schools and the five years of the program's operation is warranted by training modules and summer academies for expert school developers and training officers who earn credits for the courses they attend.

The program, thus, is both more ambitious and more encompassing than most previous programs targeted on civic commitment and relying on an extensive public-private partnership initiative involving federal and state authorities together with various private foundations. It is designed to offer assistance to schools prepared to invest effort in change and the development of teaching for competence and commitment as well as democratic governance.

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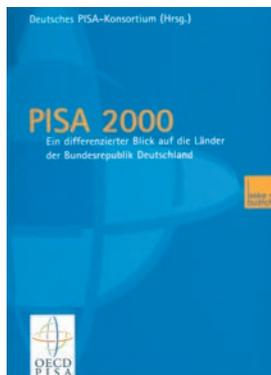
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Introductory Overview

The Center for Lifespan Psychology was created in 1981 when Paul B. Baltes was appointed Director. Research and theory in the Center is conducted primarily from the perspectives of the field of developmental psychology. Its special focus is on the study of psychological change during adulthood and old age. The choice of these age periods is guided by the fact that the second half of life, though one of the major themes and issues of modernity and the aging of the population, is underresearched and offers unique opportunities for innovation, both in theory and practice. In fact, it seems fair to argue that the Center has been a major player in advancing the fields of lifespan psychology and the study of aging.

Conceptual Orientation

What is developmental psychology, the field that is the disciplinary home of most researchers in the Center for Lifespan Psychology? The psychology of the ages of life, from childhood to old age and their interconnections, is the substantive scope of this field. To this end, developmental psychologists aspire to understand the behavioral, mental, social, motivational, and interpersonal characteristics and processes that constitute, accompany, and modify lifetime development. The major sources for the nature of lifespan development include (a) the long-term (distal) consequences of biocultural evolution as expressed, for instance, in genome-driven brain plasticity and (b) the ongoing opportunity and inequality structures of society at large, and especially the more proximal microenvironments, such as families, friendships, schools, universities, firms, senior homes, and residential locations within which individuals live. In addition, the role of individual factors and processes, such as individual differences in learning histories, mental capacities, motivation, self-regulation, and strategies of life

management take center stage when psychologists attempt to understand the course of life, including its many variations and faces. As illustrated by the foregoing observations on the general sources of human development, developmental psychologists concern themselves primarily with the more proximal sources of individual behavior during the lifespan. However, to achieve a fuller understanding of individual development it is necessary for developmental psychologists to engage themselves in collaborative efforts with the biological and the social sciences. This is the special opportunity of the transdisciplinary concept of human development that guides work in the four centers of the Max Planck Institute for Human Development. In this vein, there has been considerable interaction of scientists in the Center for Lifespan Psychology with researchers in the other centers or from other institutions. A good example is the Berlin Aging Study in which medical researchers and behavioral and social scientists collaborate in the pursuit of knowledge about human aging in a changing society. During the recent decade, lifespan and life-course re-

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search have become a major focus of the Institute's research profile. This emerging focus has led to an increased cooperation between all centers. The shared overall framework is the coordination of several lines of inquiry (psychological, sociological, educational) to understand the evolution and ontogeny of human behavior.

A sample of questions that developmental psychologists typically study are the following:

- How do nature and nurture interact in determining development, such as the emergence of the mind?
- How and why do such functions as intelligence and memory change with age?
- How and to what end do individuals acquire and maintain a sense of personal control?
- How do persons plan and manage their lives?
- What are the special bodies of knowledge and dispositions, such as life skills and wisdom that make for successful aging?
- How do aging individuals cope with illness or rapid technological change?
- How do parent-child relationships change with time as children become adults and parents turn into seniors?
- How do individuals maintain a sense of life satisfaction as they navigate the many transitions of life with their unique gains and losses?

These and similar questions are not only pursued in the search for universal laws. On the contrary, developmental psychologists treat the human condition as coconstructed

by biology and culture and, therefore, they are deeply committed to understanding individuality and the role of personal and non-normative (idiosyncratic) choices in development. In this spirit, additional topics of great concern to developmental psychologists are questions of commonalities and differences in development and the ways by which individuals and their close partners can improve their own development as well as that of others.

What is special about the general research orientation that scientists in the Center for Lifespan Psychology display and use as mental scripts? The theoretical and methodological perspectives and research agenda of the Center are summarized below in seven propositions. These propositions reflect what may be considered the theoretical framework of lifespan psychology (Baltes, 1987, 1990, 1997; Baltes, Lindenberger, & Staudinger, 1998; Baltes & Singer, 2001).

(1) Human development is viewed as occurring throughout the lifespan, implying cumulative-continuous as well as innovative-discontinuous developmental processes and outcomes.

(2) The process of human development from childhood into old age is considered to be an age-related change in adaptive capacity, in which there is a continuous interplay between growth (gains) and decline (losses).

(3) Understanding psychological development requires theoretical models that are often identified as contextual, interactive, or dialectical. For example, ontogenetic development occurs in the context of

biosocial systems that exert biocultural influences. Three macrostructural components are particularly relevant: (a) social change, (b) the system context provided by familial and/or generational transmission, and (c) the lifespan ecologies associated with social settings, such as the family, school, work, leisure, health care, and retirement.

(4) The plasticity or basic potential of development (i.e., its range and constraints) is a central focus of investigation. Of major concern are studies exploring the functional range within which individual developmental processes can be influenced. Objective and subjective knowledge about developmental plasticity (in either a positive or a negative direction) is essential for the formulation of strategies optimizing human development.

(5) Human activity and goal orientation during lifespan development are other conceptual emphases that guide the Center's studies. Such an emphasis makes explicit the role that individuals play as producers of development—both their own as well as that of others.

(6) Another conceptual orientation is the notion of interactive minds. This orientation, an orientation that has much in common with the field of cultural psychology, reflects the notion that the psychological nature of the social context of human development is essentially collective and involves internal as well as external mechanisms of social transactions and collaborations.

(7) Understanding the nature of human development is facilitated by a perspective that attempts to link components of functioning into an

integrated whole, that is, the individual. To this end, the search for general models of successful development and aging is a leitmotif of research in the Center. One such model currently under investigation postulates that selection, optimization, and compensation constitute the functional elements of the developmental process. It is argued that their dynamic coordination and orchestration results in successful development, that is, the maximization of gains and minimization of losses across the lifespan.

The following summary of the research programs of the Center is selective rather than comprehensive. Its purpose is to highlight samples and illustrate the lines of inquiry that Center scientists pursue in making a contribution to research and theory in lifespan psychology as well as its implications for social policy and the future of humankind.

Lifespan Psychology: Implications for Conceptions of Intelligence and Cognition

Background

Lifespan conceptions of intelligence provide a first general theoretical orientation of the research conducted at the Center. One domain of psychological research that has undergone major changes in theoretical orientation during the last decades is the psychology of intelligence. Research on lifespan intelligence was one of the contributory sources for this change. To illustrate, the psychometric tradition of intelligence testing pioneered, for instance, by Stern and especially Binet close to 100 years ago is very much ingrained in people's everyday thinking of intelligence. In the minds of the general public, being smart and having a high IQ (Intelligence Quotient) is synonymous. In contrast, over the last couple of decades the climates of the scientific inquiry about intelligence have shifted from the IQ-based tradition—usually measured with respect to limited sets of abilities associated primarily with academic performance and work productivity—to broader inquiries about the contextual and functional aspects of intelligence and its underlying cognitive resources. A new and productive integration of the psychometric, cognitive-psychological, and ecological traditions is in the making.

Implicit in the psychometric approach is a focus of measuring intellectual abilities, as opposed to understanding the causes, contexts, and functions of intelligence. Specifically, this approach views intelligence as reflecting a collection of static abilities that characterizes a person, as opposed to a dynamic system of contextualized and adaptive cognitive functions that the individuals continue to acquire throughout their life course. One aspect of the Center's research program focuses on the theoretical and empirical investigations of lifespan intellectual development. This program has contributed to the conceptual shift in intelligence research by reconceptualizing intelligence with new insights into its nature as a system of contextualized and ontogenetically driven adaptive cognitive functions.

We pursued several lines of inquiry in our search for a dynamic view of intelligence that is both contextually and lifespan sensitive. Originally, our approach was guided by cognitive training research demonstrating more plasticity of the aging mind than is commonly assumed and subsequently by age comparative research on limits of functioning that showed the existence of a lifespan function of cognitive plasticity (Baltes, Lindenberger, & Staudinger, 1998). Meanwhile, we have broadened this approach by adding new theoretical orientations, if not new conceptions, that stem from efforts to further integrate cognitive experimental and contextual thinking with the psychometric traditions of intelligence testing. A key characteristic defining intelligence and intelligent behavior is its adaptive value in novel situations.

Lifespan contexts include continuity and change in contexts of adaptation. In old age, for instance, an increasingly larger share of cognitive resources is invested into maintaining bodily functions, rather than "academic" pursuits. Seen from this perspective, intelligence is intrinsically related to a lifespan perspective of human development that considers development as a process within which individuals continue to adapt their bodies of factual and procedural knowledge to changes and transformations in biological, environmental, and cultural constraints that inevitably take place throughout their life course. In this spirit, and by extending the Cattell-Horn theory of fluid-crystallized intelligence (Cattell, 1973), we have presented a new dual-process model of intelligence (Baltes, Staudinger, & Lindenberger, 1999; Krampe & Baltes, in press) that highlights two distinct, but interacting dimensions of intellectual functioning (see Fig. 1): the biologically (or neurophysiologically) driven cognitive mechanics and the culture-based cognitive pragmatics of the mind. On the one hand, the cognitive mechanics are basic information-processing primitives for the memorizing and learning that people are capable of. They are predominantly preprogrammed by the neurophysiological architecture of the mind as it has evolved during biological evolution and unfold under a minimum level of environmental support during individual ontogenesis. The speed, accuracy, robustness, and coordination of elementary information-processing mechanisms index cognitive mechanics. The pri-

mary substrate of cognitive pragmatics, on the other hand, is culture-based knowledge that is acquired through cultural learning and life experiences. Prototypical examples of cognitive pragmatics are being able to speak and understand the social implications of language and to solve practical daily problems involving formal-logical reasoning, to acquire the knowledge and skills related to professional expertise or the kind of life skills that are necessary to navigate the modern world. In the following, we describe three general lines of our ongoing research aimed at extending conventional models of intelligence from the perspective of lifespan psychology. The first line of research focuses on the relations between cognitive mechanics and pragmatics with biological and cultural factors and their differential lifespan trajectories. A second line of research that has been motivated by our concept of the cognitive mechanics is the investigation of resource management in sensorimotor functioning. The third line, the study of wisdom, is rooted in our work on the cognitive pragmatics.

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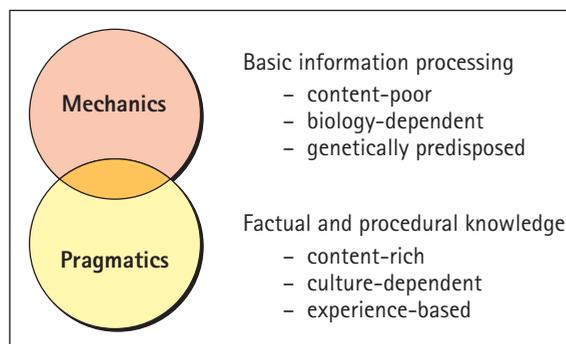


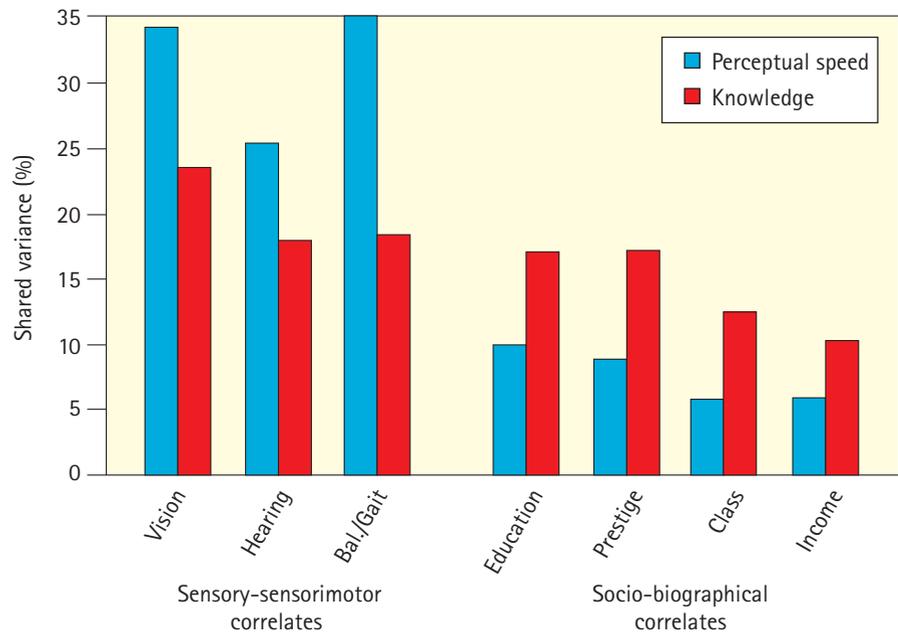
Figure 1. The dual-process model of lifespan intellectual development distinguishes between the cognitive mechanics and pragmatics of intellectual functioning (adapted from Baltes, Staudinger, & Lindenberger, 1999).

Sources of Age Differences in Cognitive Mechanics versus Pragmatics

To test the dual-process model of lifespan intellectual development, our research, thus far, directly examined the relations between these two aspects of intellectual functioning and biological and cultural factors, and their differential lifespan trajectories. In our view, sensory and intellectual functions are closely related when cognitive primitives (mechanics) are operative in the task at hand. Congruent with this expectation, our empirical findings show that among old adults basic sensory processing is much more highly correlated with the cognitive mechanics than with cognitive pragmatics (see Fig. 2). In contrast, socio-biographical predictors correlate more with cognitive pragmatics than with cognitive mechanics (Lindenberger & Baltes, 1997). The association between the more biolo-

gy-based sensory-sensorimotor processes and cognitive mechanics is a robust phenomenon that generalizes to measures other than the average level of performance. For instance, within-person week-to-week fluctuations in old people's sensorimotor performance also correlate highly with the cognitive mechanics. Accordingly, old people who varied more in their walking performance from week to week showed worse episodic and spatial memory (S.-C. Li, Aggen, Nesselrode, & Baltes, 2001). Given that biology and culture co-contribute differentially to the mechanics and pragmatics of intelligence, investigations of how these two aspects of intellectual functioning develop, maintain, and decline throughout life could offer insights into the complex and coconstructive interplay between the individual's biological and cultural "inheritances" in development (Baltes &

Figure 2. Differential correlational links of perceptual speed (a marker of the mechanics) and verbal knowledge (a marker of the pragmatics) to biological and socio-biographical indicators in old age (adapted from Lindenberger & Baltes, 1997).



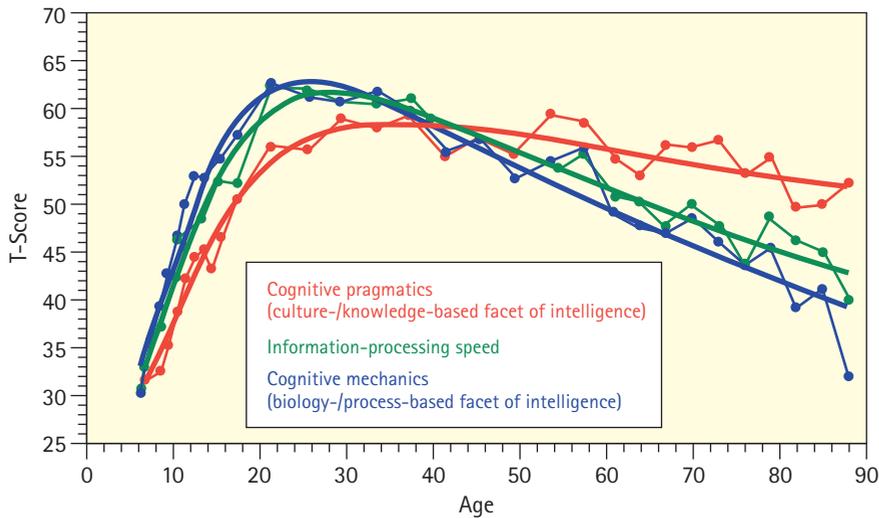


Figure 3. Lifespan age gradients of cognitive pragmatics, cognitive mechanics, and processing speed (adapted from S.-C. Li, Lindenberger, Hommel, Aschersleben, Prinz, & Baltes, in press).

Singer, 2001; S.-C. Li, 2003). Combining our research on cognitive aging and concurrent work drawing data from a lifespan sample covering the first to the eighth decades of life, we found differential lifespan trajectories for cognitive mechanics and pragmatics in line with our theoretical expectations. As is true for research on the fluid-crystallized distinction, cognitive mechanics display an earlier growth pattern up to early adulthood. The growth of cognitive mechanics primarily driven by brain maturation can then be invested into the acquisition and refinement of culture-based cognitive pragmatics. However, because of their close ties to biology and genome-based determinants, continuous loss of cognitive mechanics starts early in adulthood. In contrast, the culture-based pragmatics, represented by the abilities of knowledge and language, have a later onset of decline which is less pronounced. In old age, how-

ever, the role of biology-based cognitive mechanics in regulating the cognitive pragmatics increases. Details in our evidence have provided further empirical support for the neurobiology versus acculturation distinction between these two domains of intelligence (S.-C. Li, Lindenberger, Hommel, Aschersleben, Prinz, & Baltes, in press). The lifespan age gradients of information-processing speed correspond very well with the age gradient of cognitive mechanics, but much less so with cognitive pragmatics (Fig. 3). Furthermore, overall information-processing speed correlated more highly with cognitive mechanics than with cognitive pragmatics and especially at both ends of the lifespan (Fig. 4).

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Correlation with processing speed

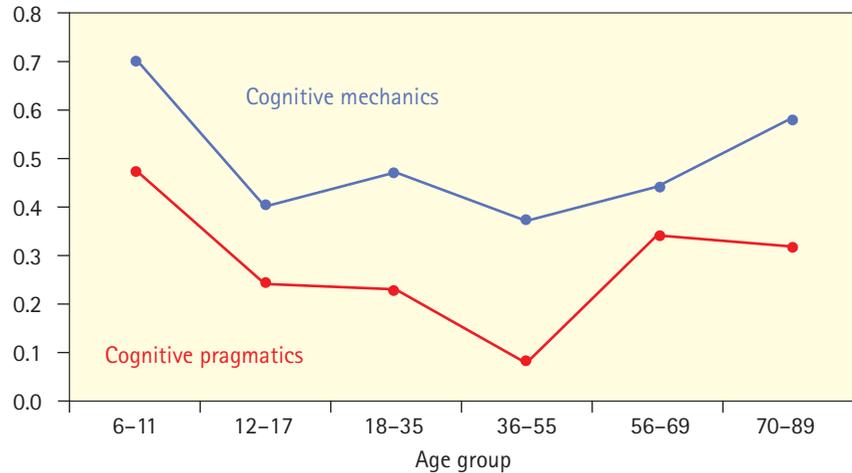


Figure 4. Correlations between processing speed, cognitive mechanics, and cognitive pragmatics across six continuous age groups (adapted from S.-C. Li et al., in press).

Lifespan Differences in the Allocation of Cognitive Resources

In addition to the efficiency of basic information processes, the category of cognitive mechanics also encompasses the optimal allocation of cognitive resources. Flexible resource allocation is especially important whenever the individual is faced with multiple tasks or situational constraints. An example of these tasks or situational demands comprises of basic sensorimotor functions such as maintaining balance or walking while talking to a friend. Everyday life, for the most part, consists of such multi-task situations. In the context of lifespan development, age brings with it different adaptive demands for individuals at different parts of their life course. Basic sensorimotor functions such as postural stability and walking accuracy lose efficiency in later adulthood because of decreased muscular strength and reduced peripheral vision, as examples. As a

corollary, we argue that such emerging deficits in the coordination of bodily functions require more and more cognitive resources. To illustrate: In our studies we systematically combined sensorimotor tasks of varying difficulties (i.e., walking with or without obstacles, balancing on a stable or moving platform) with cognitively demanding tasks (memorization) (K. Z. H. Li, Lindenberger, Freund, & Baltes, 2001; Lindenberger, Marsiske, & Baltes, 2000). Using dual-task and training research paradigms, the results suggest that older adults invest considerable cognitive resources to compensate for the decreased efficacy of their sensorimotor functions. On a larger scale, we assume that in later adulthood a considerable amount of the available cognitive resources is permanently captured by sensorimotor functions that are virtually automatized in younger adults. These cognitive resources, in turn, are no longer available for

other cognitively demanding tasks (such as reading, writing, and conversing) or the acquisition of new skills. Because the conventional assessment of intelligence does not even touch on interindividual differences in resource allocation capabilities, standard IQ assessment most likely misses important dimensions of adaptive intelligent behavior (Krampe & Baltes, in press). We aim at developing tasks and paradigms that reflect the contexts of the second half of life and permit the assessment of these characteristics.

The Psychology of Wisdom

Our research on wisdom is the counterpart of the two other lines of research on cognitive mechanics and focuses primarily on the cognitive pragmatics. The original *raison d'être* for this work was the conclusion that wisdom might be a positive marker of aging; a marker that cannot be found empirically because it has not been included in the traditional tests of intelligence and personality. We have defined wisdom as an "expert knowledge system about the meaning and conduct of life" (e.g., Baltes & Smith, 1990; Baltes & Staudinger, 1993; Staudinger & Baltes, 1996). In our definition, wisdom is thought to include knowledge about difficult and uncertain questions concerning life planning, review, and management. This definition of wisdom expands conventional models of intelligence in that it involves general and specific knowledge about ill-defined life dilemmas that have no clear-cut solutions. Moreover, two core features set wisdom apart from other cognitive abilities: Wisdom is holistic and

integrative knowledge about the world of human affairs; and it involves an orientation toward the common good defined as individual and collective well-being (Baltes, Glück, & Kunzmann, 2002; Baltes & Staudinger, 2000; Kunzmann & Baltes, in press). Both features signal that wisdom may have different functions for successful lifespan development than more limited abilities typically considered in conventional models of intelligence. Although knowledge and insight are important characteristics of wisdom, in our more recent work, we have emphasized that the semantic meaning of this concept encompasses more (e.g., Baltes & Staudinger, 2000; Kunzmann & Baltes, 2003). Wisdom extends beyond "intellectual" subject matters to include notions of virtues versus vices. In this sense, wisdom can be seen as a body of knowledge, skills, and motives that function as a metaheuristic to orchestrate human development toward higher levels of functioning (Baltes & Staudinger, 2000). To be sure, memory, analytical, creative, social, and emotional skills are all important for living a good life as an individual, but they are not enough if the goal is a balance between individual well-being and social well-being. In our view, the special strength of wisdom is that it selects and orchestrates more specific abilities and bodies of knowledge toward maximizing the individual and common good. For instance, when guided by wisdom, individuals would consider only those goals and means as ways of self-development that do not violate the rights of others and, in addition,

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coproduce resources for others to develop. It is in this sense that we have considered wisdom as the integration of mind and virtue. Since 2001, we have invested effort into the search of an additional substantive construct that we consider salient for understanding the pragmatics of life. It is the concept of life-longing (Sehnsucht). This topic

is pursued in Susanne Scheibe's dissertation project which is supervised by Paul Baltes, Alexandra Freund, and Ute Kunzmann. So far, a theoretical conception of life-longing has been articulated, and a first method using a self-report questionnaire to assess lifespan changes in life-longing is being tested.

The Mastery of Life: Selection, Optimization, and Compensation (SOC)

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A second general theoretical orientation of research in the Center for Lifespan Psychology is motivated by the question of how people develop successfully and avoid negative outcomes. To gain a better understanding of the factors contributing to successful development, that is, the simultaneous maximization of gains and minimization of losses, we attempt to specify the behavioral and cognitive strategies by which people, individually and collectively, master their lives. The focus of our theory is on the orchestration of selection, optimization, and compensation.

According to the model of selection, optimization, and compensation (SOC), originally articulated by Paul and Margret Baltes (1990; Baltes, 1997) and now developed further primarily with Alexandra Freund (Freund & Baltes, 2000) and Ralf Krampe (Krampe & Baltes, in press), successful development encompasses the selection of functional domains on which to focus one's resources, optimizing developmental potential (maximization of gains) and compensating for losses, thereby, ensuring the maintenance of functioning (minimization of losses). The SOC-model constitutes a general model of development defining universal processes of developmental regulation. These processes vary phenotypically depending on socio-historical and cultural context, do-

main of functioning, as well as on characteristics of the system or unit of interest (e.g., person, group, society). The meta-theory of SOC needs to be embedded in a specific theoretical framework for applying it to various domains of functioning (e.g., identity formation and maintenance, social relations, athletic performance) and to different levels of analysis (e.g., societal, group, or individual level).

On a macro-analytical level, it is possible to apply SOC-related perspectives to questions of societal functioning. How do the American, German, and Japanese cultures differ in goals, ways to optimize, and strategies of compensation? This would be one example for a macro-analytic comparative study. An example of a micro-analytic level

approach to the study of SOC would be the investigation of cognitive and motor performance in dual-task conditions and the way people of varying ages allocate resources differentially to memory and walking (K. Z. H. Li, Lindenberger, Freund, & Baltes, 2001).

(1) Selection

Throughout the lifespan, biological, social, and individual opportunities and constraints specify a range of alternative domains of functioning. From this large number of options, individuals, in collaboration with other forces, such as norms and parental expectations, select a subset on which to focus their resources. Selection of personal goals gives direction to development by focusing resources on specific life domains and by guiding behavior across situations and time. The function of selection is nicely illustrated by the saying "Those who follow every path, never reach any destination." Selectivity can also be an adaptive response to losses threatening one's goals. We call this loss-based selection, in contrast to elective selection. An example of loss-based selection is concentrating on one's most important goals (e.g., enjoying being with one's family) and giving up less important personal goals (e.g., cultural activities) when an illness constrains the level of energy one can devote to various activities.

(2) Optimization

To achieve higher levels of functioning, goal-relevant means, that is, means that are conducive to goal attainment, need to be acquired,

refined, coordinated, and applied in the selected goal domains. We call the acquisition and orchestration of such means of goal attainment optimization. An example of optimization is practicing scales when starting to learn to play the piano. By practicing scales, one can acquire flexibility in finger movements and stroke techniques, both important skills for playing the piano. Of course, which means are best suited for achieving one's goals depends on the goal domain (e.g., sports, friendships), the social and cultural context providing opportunity structures that make certain means more accessible than others, and personal characteristics such as age or gender. We also need to recognize that in most cases there are different pathways of optimization; consistent with the saying "There are many ways to Rome."

(3) Compensation

When transient or permanent losses or decline in goal-relevant means threaten one's level of functioning, it is necessary to invest resources into counteracting the losses in order to maintain a given level of functioning. We call the process of activating or finding such alternative means compensation. For instance, when knee problems do not allow going for walks any longer, using a wheelchair as a compensatory means of transportation can help to maintain one's routine of spending an hour in the park every day. As is true in the case of optimization, which means are best suited for compensating transient or permanent losses depends on the domain of functioning, the social

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Integrating research on wisdom and selective optimization with compensation

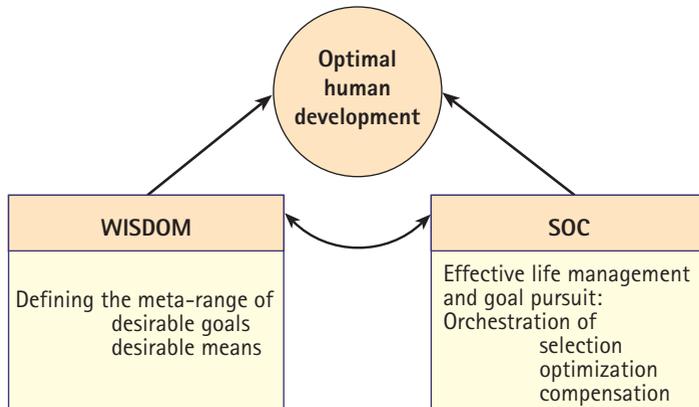


Figure 5. A model integrating SOC-strategies and wisdom to achieve successful human development (Baltes & Freund, 2003b).

and cultural context, and personal characteristics. More recently, we have explored the nature of the interrelationship between wisdom and the theory of selective optimization with compensation (Baltes & Freund, 2003a, 2003b). The argument advanced is that wisdom defines the general space of desirable goals and means. SOC, on the other hand, is value-neutral. It specifies the conditions under which outcomes are achieved, irrespective of their moral or ethical valence. We suggest that their joint application represents a powerful strategy to create a good life (Fig. 5).

The Center for Lifespan Psychology 2002



Left to right: (front row) Oliver Huxhold, Albina Bondar, Denis Gerstorff, Florian Schmiedek, Daniel Grünh; (middle row) Lixia Yang, Shu-Chen Li, Susanne Ehrhorn, Natalie C. Ebner, Alexandra M. Freund, Jacqui Smith; (back row) Sabine Schäfer, Antje Stange, Ralf T. Krampe, Julia Delius, Christina Röcke, Kurt Kreppner, Ute Kunzmann, Susanne Scheibe, Michaela Riediger, Paul B. Baltes.

Research Project 1

Parent–Adolescent Relationships: Family and Differential Perspectives

Scientific
Investigator

Kurt Kreppner

Adolescence in the Family, an Unavoidable Clash?

When the oldest child brings home strange new friends for the first time, tries to dye his or her hair green, drives telephone costs up to unprecedented amounts, and wants to quit school, parents sometimes really feel helpless. How does one negotiate with a 12- or 13-year-old child? How should parents react to an outburst of rebellion in their home? How should they handle this sudden threat to their common lifestyle? Doors are banged and tears flow, parents get angry and, at the same time, have the feeling that they have become strangers to their own child. Will this situation worsen or can they gain control after some time? If there are younger children in the family, what do the younger siblings make of it?

Not in all, but in many families the beginning of a child's puberty represents a "difficult time" for each of the family members involved. This is a time of rapid change. Transition from childhood to adolescence is a unique period in an individual's life where major shifts in both body and ego development occur. At the same time, parents must be students of effective parenthood as well, they have to learn to be effective and adaptive with their child. Parents who experience this transition with their first child for the first time have to cope with developmental shifts in body growth, cognitive capabilities, demands for more autonomy, and an increase in peer orientation.

The situation becomes even more complex when there is a second, younger child in the family. The question can be raised whether parental adaptation to the first child has a kind of "spill-over effect" for the parents' behavior and communication modes with the younger child. Do parents cope with the first child's demands and new capacities and keep their communication mode unchanged with regard to the second child? Similarities or dissimilarities in parental treatment of the first and second child during marked transition periods such as adolescence was a central topic in this study. A detailed analysis of continuities and changes in family communication during the first child's

On Systems Theory in Family Research

Systems theory contributed to a new understanding of family functioning. The study of families focuses on the dynamics among family members, such as those between parents and children, mother and father, or siblings. Communication among family members and its quality is believed to be a central characteristic of family dynamics. Therefore, the analysis of communication patterns has become a central aspect in family research. When researchers interested in developmental changes operate exclusively from an individual perspective (e.g., focusing on the parent's personality type or on the child's temperament), they miss normative changes in parent-child communication modes associated with the family developmental process by overlooking a crucial part of individual development related to the family's competence in mastering transitions.

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Multimethod Approach: Use of Questionnaires for Obtaining Self-Reports and Videotechniques for Recording Communication Inside the Family

In this study, 67 families with at least two children were followed in eight waves of data collection for three-and-a-half years. The age of the first child was eleven-and-a-half years at the beginning of the study and 15 years at the end. The second child was about two years younger. In order to explore divergent types of families and their ways of dealing with children's developmental changes, various sources of information were included in the longitudinal investigation. One source consisted of adolescents' self-reports about the quality of self-esteem or judgments about the relationship quality within the family; another source encompassed concrete communication behavior between family members, including not only parent-child dyads, but also parent-parent and sibling-sibling dyads or triadic constellations.

Naturalistic and semi-structured observations of family discussions (a total of 715 hours on videotape) provided a rich record of the families' patterns of interaction and communication during the oldest child's passage from childhood to adolescence. Applying a family-developmental and systems-oriented perspective, the study was designed to analyze continuities and changes in communication patterns within families and to explore differences in families' modes of fostering or impeding children's development.

transition from childhood to adolescence was used as a means to gain insight into family dynamics. A unique strength of the study is that extensive observations of communication were conducted in the families' own homes and served as our main data base.

Of special significance is how parents and children communicate with each other. Analyzing the process of communication over time was made possible by the use of video tapes. General trends of changes in communication patterns were found in parent-adolescent discussions over time. Communication formats indicating parental modes of talking to the child as a child, such as "teaching" or "giving attention," decreased during the three-and-a-half year period, whereas frequencies of behaviors such as "negotiation" or "exchange of statements" (signifying affirmation of one's own position) increased in both mothers' and fathers' communication modes (Kreppner, 2002a; see Fig. 1). Did all families behave identically? This was not the case. Adolescents' assessments of the quality of the

relationship with their parents and self-reports were used as a criterion to differentiate among dissimilar types of family contexts. Three groups were distinguished on the basis of adolescents' consistent responses over time on three relationship scales. Adolescents in these three groups characterized the relationship quality with their parents as being (a) secure, (b) habitual, or (c) ambivalent.

The most striking changes in family communication were found for groups in which adolescents had rated the quality of the relationship with the parents as being consistently "secure" or "ambivalent." For example, in the families of "secure" adolescents, fathers' integrative modes of communication, on the one hand, and the use of "statements" in discussions (exchange of different opinions without a common solution) changed considerably over time. The adolescents from the secure group, for their part, experienced these changes in a climate of emotional closeness. In contrast, in families of "ambivalent" adolescents, fathers did not show such time-

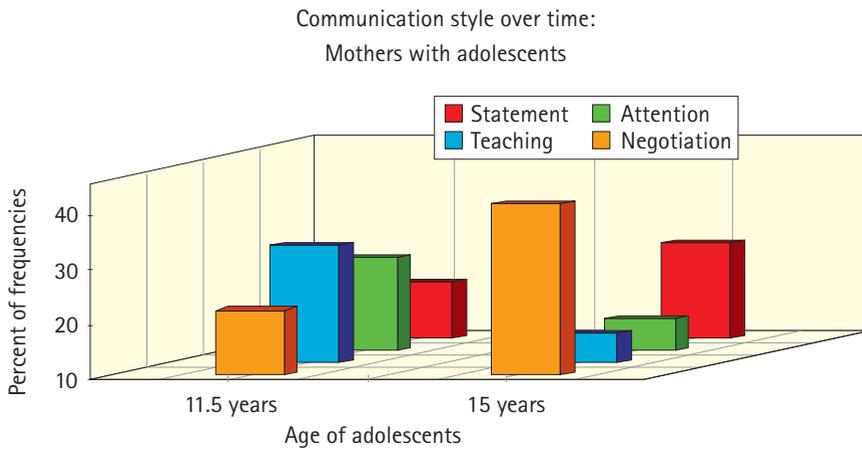
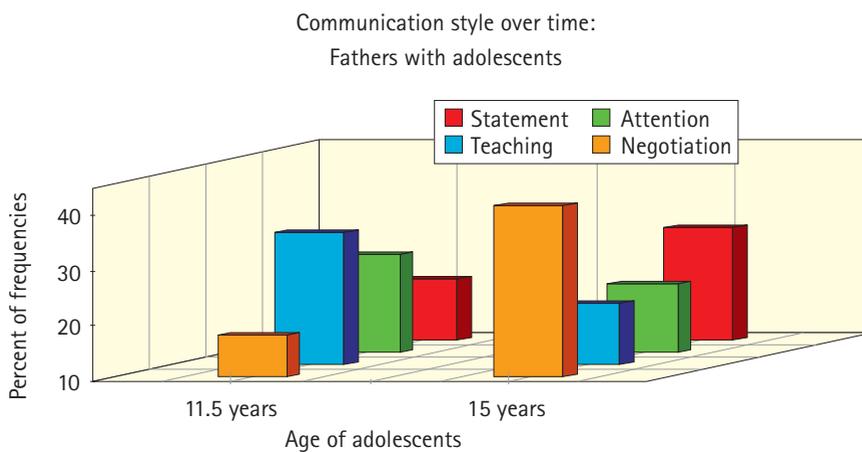


Figure 1. Variations in parental communication with adolescent children.



specific variations in discussing different opinions and adolescents did not experience a comparable degree of closeness during discussions with their fathers (Kreppner, 2001d, 2002b; Kreppner & Ullrich, 1998). When adolescents from the secure and the ambivalent group were compared, major differences were found in various aspects of self-esteem, pointing to a continuously higher level of self-esteem in adolescents from the secure group as compared to adolescents from the ambivalent group (Kreppner, 1996). Another series of data analyses dealt with differences in communication

patterns between mothers and adolescents in divorced and non-divorced families. Results indicate that negotiations between mothers and their children concerning the reorganization of an extant relationship result, more frequently, in a more egalitarian and partner-oriented communication than is the case in non-divorced families, where rule- and principle-oriented controversial communication between mother and adolescent prevail (Kreppner & Ullrich, 1999). What about the differences in communication patterns when parents interact with their younger, second

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children? Contrary to many expectations, there was much similarity. Results show a high degree of family consistency in the quality of closeness across all family relationships (Kreppner & Ullrich, 2003). Parent-child communication patterns are changed over time and adapted to the first child's needs, but parents also seem to apply the newly adopted communication format they use with their first child when they talk to their second child. Thus, the second child is confronted with a more adult-like exchange pattern in the family earlier than the first child.

The degree of closeness, for example, decreases over time not only for the first, but also for the second child; and the frequency of discussions in the parent-child triad which end with a consensual solution also sharply decreases for the second child (see Fig. 2).

In sum, our multi-method approach to data collection in families which included observation of communication behavior was successful. We were able to show how families adapt to the changing needs of their children during major developmental transitions. Families differ in their flexibility in producing new communication patterns appropriate to meet their children's changing demands for more autonomy and adult formats of communication. Furthermore, we found in our longitudinal study that families do not only adapt their present repertoires of communication skills while dealing with transition problems with their first child, but also change communication modes with the younger sibling. Future research centering on the detailed description of differential communication modes inside the family may slowly reveal not only the diversity of families' communication patterns and their impact on individual developmental pathways, but also the variety of modes by which families master developmental transitions during the lifespan.

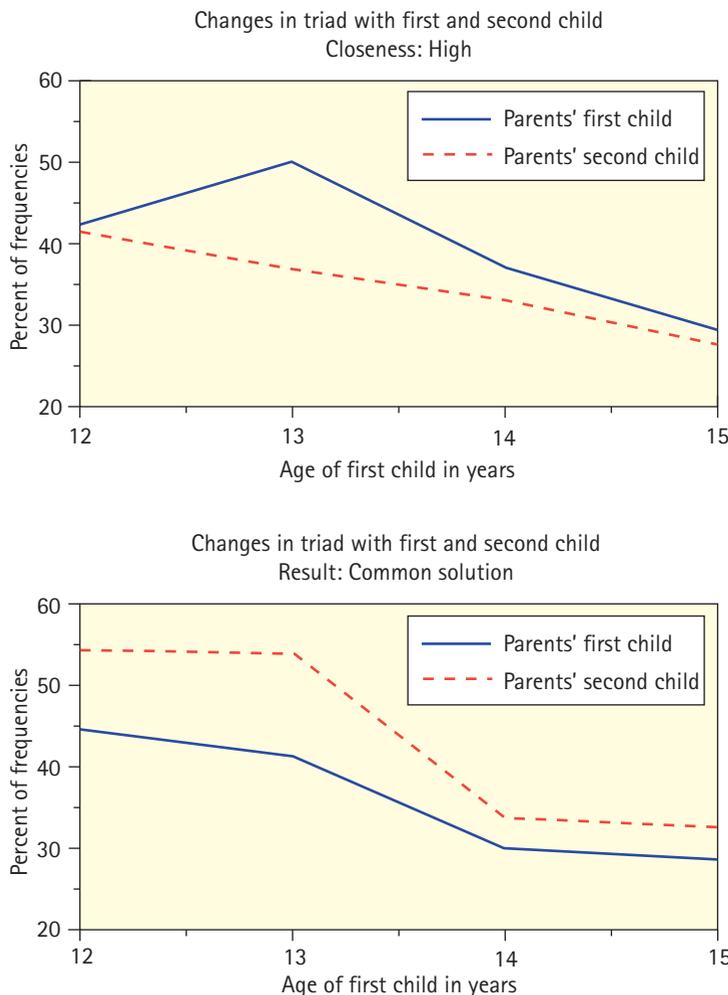


Figure 2. Changes in triadic family communication over time.

Research Project 2 Trends and Profiles of Psychological Aging

For lifespan researchers, the period of old and very old age is a new and exciting area of study. During the 20th century, average life expectancy nearly doubled. More and more individuals in current cohorts 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 functioning and life quality for most people? Are there constraints on aging successfully in the last years of life? Compared to early phases of the lifespan, relatively little is known about advanced old age. Our research in the Center of Lifespan Psychology on the oldest old is acknowledged by many in the field as being at the leading edge.

Since 1989, members of the Center of Lifespan Psychology have investigated age- and death-related changes in psychological functioning from age 70 to 100+ in the context of the Berlin Aging Study (BASE); Baltes & Mayer, 1999, 2001; Mayer & Baltes, 1996, 1999; Smith & Delius, 2003; Smith, Maas, Mayer, Helmschen, Steinhagen-Thiessen, & Baltes, 2002). This multidisciplinary study is one of the few projects worldwide that includes extensive data for a heterogeneous sample. This means that we can begin to distinguish normative trajectories of psychological functioning from pathological change. Over the last years, we have focused increasingly on the portrayal of the two-sides of old age: the Third (young old) Age associated with relative functional stability and maintenance of well-being and the Fourth (oldest old) Age during which individuals appear to be more at risk for impairment and functional decline (Baltes & Smith, 2003; Smith, 2002b). It is in essence an open question whether the advances that have contributed to life quality in the Third Age extend to the oldest old, especially beyond age 85.

As outlined below, our research in the period 2000 to 2002 has focused on mapping individual differences and age-related changes in intellectual functioning (e.g., Singer, Verhaeghen, Ghisletta, Lindenberger, & Baltes, in press), self and personality (e.g., Kunzmann, Little, & Smith, 2002; Smith & Freund, 2002), and well-being (Kunzman, Little, & Smith, 2000; Smith, 2001c; Smith, Borchelt, Maier, & Jopp, 2002) in the young old and oldest old. In addition, we examine the role of different aspects of health (illness, physical and sensory impairments, frailty) and life-history factors (e.g., social advantage, education) in predicting change and the systemic nature of cross-domain associations in intraindividual change patterns. Longitudinal data in BASE are available over five measurement occasions. The last follow-up of the psychology battery was collected in 2000. At this time, 70% of the baseline sample of 516 were deceased. Of the 159 survivors, 52% completed all of our tests and interviews. Lindenberger, Singer, and Baltes (2002) have undertaken analyses to determine the extent to which dif-

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Overview of the Berlin Aging Study (BASE)

The multidisciplinary Berlin Aging Study (BASE), directed by Paul B. Baltes and Karl Ulrich Mayer, was initiated in 1989 under the sponsorship of the former West Berlin Academy of Sciences and Technology and its Committee on Age and Societal Development. Subsequently, and in connection with the reestablishment of the Prussian Academy, the study came under the auspices of the Berlin-Brandenburg Academy of Sciences. As of 2002, the study involves five measurement occasions spaced over 10 years. In addition, subsamples have been recruited for intensive study.

The distinguishing features of BASE include: (1) a focus on the very old (70–100+ years), (2) a locally representative sample, stratified by age and sex, and (3) a broad-based interdisciplinarity (involving two research groups from the Free University of 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 an age by sex stratified heterogeneous sample of 70- to 100+-year-olds who completed a 14-session Intensive Protocol (involving detailed measures from the four disciplines). 516 men and women from the western districts of Berlin participated. Four longitudinal follow-ups involving different amounts of assessment of the survivors from this initial sample have been completed at approximately two-year intervals. A single-session multidisciplinary assessment was collected in 1993–1994 ($N = 361$), 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 in 2000 (e.g., screening for dementia, assessment of well-being: $N = 82$). In addition, we also follow the mortality of the entire BASE sample.

The initial sample of 516 individuals formed the basis of the cross-sectional analyses reported in a German monograph first published in 1996 (Mayer & Baltes, 1996, 1999), in a featured section of *Psychology and Aging* (1997), and an English monograph published with Cambridge University Press (Baltes & Mayer, 1999, 2001). Six papers reporting six-year longitudinal findings were published in November 2002, in a Special Section of the *Journals of Gerontology: Psychological Sciences* (57B, P471–P517). Specific interests of the Psychology Unit of BASE include: issues of sample selectivity and representativeness, cognitive aging, subgroup profiles of psychological functioning, the Fourth Age, gender differences, mortality prediction, self-definition, well-being, and models of successful aging, such as selective optimization with compensation.

Doctoral Training Program (Graduiertenkolleg) in Neuropsychiatry and Psychology of Aging jointly with the Free University of Berlin

Since 1998, the research findings and data of BASE have provided a primary foundation for a DFG-funded graduate research training program (Graduiertenkolleg). The focus of this Kolleg is on the "Neuropsychiatry and Psychology of Old Age." Initiated by the late Margret M. Baltes, the doctoral training program is currently codirected by psychiatrist Isabella Heuser and psychologist Paul B. Baltes. Other key psychologists involved are Ralf Schwarzer (Free University of Berlin) and Jacqui Smith. In the period 2001–2002, the program included 20 fellows.

ferent selection mechanisms (selective mortality, selective dropout among survivors, and the initial BASE sample selectivity) may bias or confound our longitudinal findings about change.

In general, participants in the various BASE longitudinal samples (followed over four, six, and eight years) have been a positive selection of the initial cross-sectional sample in terms of physical and functional

health, social status, cognitive functioning, openness to new experiences, outgoingness (extraversion), age, and distance from death. For example, at baseline, participants in the six-year longitudinal sample ($N = 132$) were on average younger, had better functional health (e.g., vision and hearing), higher socioeconomic status and, in terms of psychological functioning, they were cognitively fitter, more extraverted,

less anxious, and more open for new experiences than the core initial BASE sample.

Changes in Intellectual Functioning from Age 70 to 100+

Intellectual functioning in BASE was assessed using a computerized battery of 14 subtests covering five abilities (perceptual speed, memory, reasoning, fluency, and knowledge). Up to age 80, previous research has shown that performance on two broad categories of intellectual abilities, the fluid-like mechanics and crystallized pragmatics of intelligence, exhibit different patterns of maintenance and decline. The fluid mechanics, thought to reflect the neurophysiological architecture of the human brain, display instances

of decline already in middle adulthood (30–50 years) and exhibit robust and more general decline in old age. In contrast, the crystallized pragmatics, understood as the culture- and knowledge-based software of the mind, is generally maintained at least into the 60s and 70s.

Cross-sectional analyses of BASE data revealed substantial negative age differences in indicators of both the fluid mechanics and crystallized pragmatics of intelligence between 70 and 100+ years (representing a 1.8 SD difference in performance level and 35% of the interindividual variance: e.g., Lindenberger & Baltes, 1997). These findings have now been extended by several longitudinal analyses. Singer, Verhaeghen,

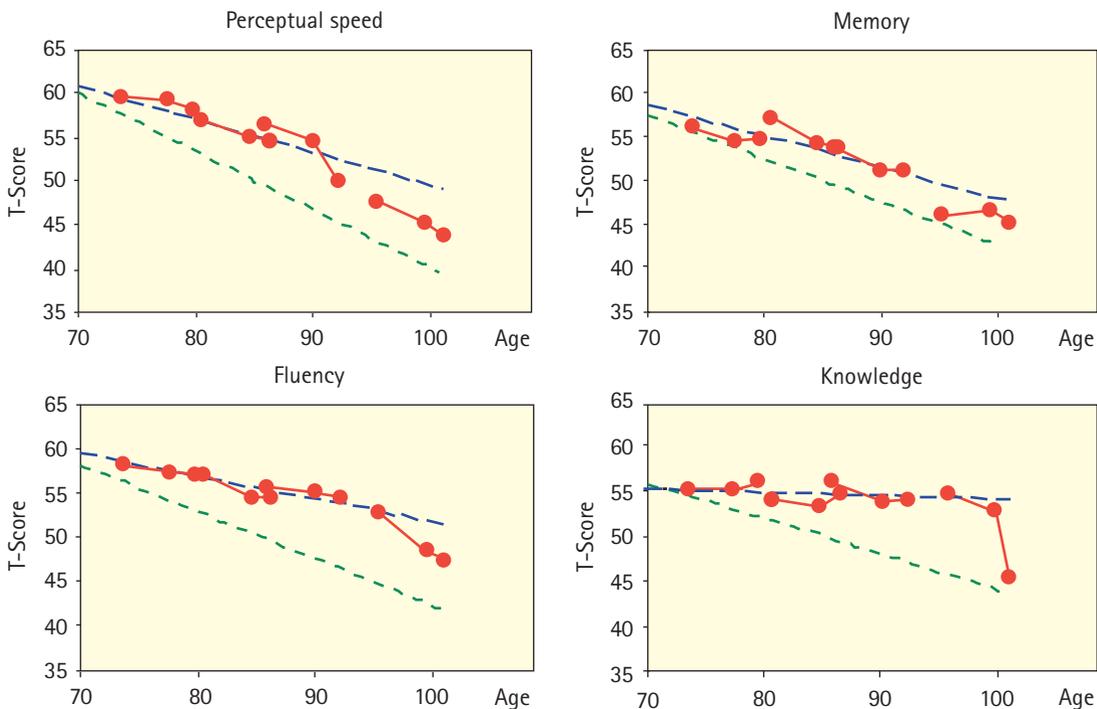


Figure 1. Cognitive change over six years in old age (BASE): Cohort groups older than 80 years demonstrated cognitive fitness (stability) in tests of knowledge despite decline in measures of perceptual speed, memory, and fluency (adapted from Singer, Verhaeghen, Ghisletta, Lindenberger, & Baltes, in press). Dashed lines indicate change estimated from two cross-sectional samples.

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Ghisletta, Lindenberger, and Baltes (in press), for example, reported change trajectories for a longitudinal sample ($N = 132$) examined over six years. This longitudinal sample represented a positive selection of the original cross-sectional BASE sample. Their performance level was generally higher (see Fig. 1). Over time, considerable decline was observed in markers of the fluid mechanics (perceptual speed, memory, fluency) whereas the strongest marker of pragmatic intelligence (knowledge) remained relatively stable for all participants, except those over age 95. The rate of change in intellectual efficacy over time was similar for persons above or below the mean on life-history variables, such as education, prestige, social class, or income. Lindenberger and Baltes (1997) reported that individual differences in intellectual performance in very old age were explained in part by biological indicators, such as vision, hearing, and gait/balance. The extent to which these findings reflect shared influences of aging in different systems is a question that was addressed in the doctoral research of Florian Schmierek. He proposed a statistical modeling technique to examine both shared and specific predictors of aging in different intellectual abilities. Using these models, he found similar amounts of age-related variance in the general ability factor and the specific ability factors (i.e., memory, reasoning, perceptual speed, fluency, and knowledge). Furthermore, aging in these specific ability factors showed meaningful relations to external criterion variables, such as education,

openness to experience, and everyday competency.

Using the six-year longitudinal data ($N = 132$), Ghisletta and Lindenberger (in press-a) examined links between cognitive and sensorimotor functioning in old age. Lindenberger and Baltes were responsible in earlier publications for introducing the strong cross-sectional connection between sensorimotor functioning and cognition in old age as an area of research in the field. Ghisletta and Lindenberger have now related individual differences in change in perceptual speed and knowledge to close and distant visual acuity over time. Whereas distant visual acuity remained relatively stable, close visual acuity declined, indicating the importance of keeping these indicators separate in analyses. The initial level of perceptual speed was found to be the strongest predictor of change in all other dimensions. Knowledge displayed the highest degree of dynamic independence. Although change *within* domains was not coupled (i.e., each cognitive variable was not fundamental in determining change in the other cognitive variable, and each vision variable was not fundamental in determining change in the other vision variable), change *across* domains was found to be coupled. Changes in the cognitive variables affected changes in vision and vice versa. These longitudinal findings are consistent with the BASE cross-sectional correlations between sensorimotor functioning and cognition reported earlier by Baltes and Lindenberger (1997).

Health, in general, plays a role in the maintenance of cognitive func-

tioning in old age. New analyses of BASE data have related performance to cardiovascular and metabolic disease and various risk factors (e.g., smoking). Verhaeghen, Borchelt, and Smith (in press) found that five diagnoses were negatively correlated with cognition: congestive heart failure, stroke, coronary heart disease, myocardial infarction, and diabetes mellitus. The presence of one or more of these diagnoses was linked to lower performance in general, but there was no differential cognitive decline over four years. This suggests that the impact of these diseases on cognitive decline in very old age may be smaller than in younger adults, not because of decreased vulnerability, but because the disease process adds little to the cumulative changes in brain physiology that have occurred over the course of a very long life. Selected cardiovascular risk factors (smoking, alcohol consumption, HDL-cholesterol levels) were associated with both starting level and decline in cognition.

A central question in research on the aging mind concerns the potential range of plasticity of functioning, especially in the capacity to learn and apply new memory strategies. Dissertation research by Tania Singer (2000; Singer, Lindenberger, & Baltes, in press) on a subsample of the oldest-old participating in BASE demonstrated that the quantity and quality of cognitive plasticity show a sizeable loss in very old age as compared to younger age groups. Using a cognitive training paradigm and instruction in a memory technique (the Method of Loci), participants aged 70 to 100+ years evinced

little potential for the new learning of a complex cognitive skill.

Change and Stability in Self and Well-Being in Very Old Age

Whereas we find robust declines in cognitive functioning during old age, our findings in other areas of psychological functioning, such as the motivational aspects of the self (e.g., control beliefs, future-oriented goals) and overall subjective well-being (e.g., life satisfaction, a sense of happiness and contentment), indicate less decline in functionality at least in the young old and a positive selection of the oldest old (see Textbox). Self-related functioning may be more resilient against decline, especially during the Third Age, than is true for the cognitive system. It is generally expected that regulatory processes operate to protect or "immunize" the self against a loss of efficacy and well-being, even under conditions of poor health and chronic impairment. For example, individuals adjust their aspiration levels and comparison targets in order to achieve and maintain a sense

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Characteristics of the Third and the Fourth Age (adapted from Baltes & Smith, 2003)

The Third Age (young old)

- Increase in life expectancy: More older people live longer
- Substantial latent potential for better fitness (physical, mental) in old age
- Successive cohorts (generations) show gains in physical and mental fitness
- Evidence of cognitive-emotional reserves of the aging mind
- More and more people who age successfully
- High levels of emotional and personal well-being (self-plasticity)
- Effective strategies to master the gains and losses of late life

The Fourth Age (oldest old)

- Sizeable losses in cognitive potential and ability to learn
- Increase in chronic stress syndrome
- Sizeable prevalence of dementia (about 50% in 90-year-olds)
- High levels of frailty, dysfunctionality, and multimorbidity
- Dying at older ages: With human dignity?

The 21st Century: The Era of Chronic Incompleteness of Mind and Body?

of control over their life. These psychological processes contribute to a positive aura of well-being and to seemingly paradoxical observations that, after a period of adjustment, individuals report satisfaction even in contexts of chronic stress.

One way in which we have examined the motivational system of the self in old age is by asking individuals about their hopes and fears about the future self (possible selves; Smith & Freund, 2002). *Possible selves* are images of the self that function as incentives for action. We found that the possible selves of adults aged 70 to 103 years were highly personalized and varied. Contrary to suggestions that late adulthood is a period of disengagement from future planning in favor of life review and a focus on the present, participants in BASE reported desires to achieve new aspects of hoped-for selves, especially in relation to identity (personal characteristics), health, and relationships with others (friends and family). Furthermore, the profile of possible selves was dynamic over time: For example, 72% of the participants added new hopes about personal projects over a four-year

period and 27% added highly elaborated possible self-images (i.e., ideas about the future self that were both positive and negative).

Much research on self-regulation focuses on issues of personal (internal) control. *Control beliefs* influence how people think, feel, and act. In particular, believing that one's own efforts can influence an outcome (i.e., a belief in internal or personal control) increases the likelihood of selecting goals to act upon, investing time and energy in the goals selected, and experiencing subjective well-being in association with the positive outcome of one's efforts.

A scale assessing general beliefs about control over the good and bad things in life was included in BASE. Kunzmann, Little, and Smith (2002) examined longitudinal changes in personal and external other control beliefs and their relation to emotional well-being. Whereas beliefs about personal (internal) control over positive and negative aspects of life were stable over time, the belief that others play a significant role in determining the events in one's life (external control) increased. Stability in perceived personal control over desirable outcomes was associated with high emotional well-being. Perceiving that other people have control over one's personal affairs, in contrast, was shown to be associated with high negative affect and low positive affect.

Although the aspects of possible selves and control beliefs appear to be maintained during old age, we have also found some evidence to suggest that the functioning of the

Foto: K. Groß.



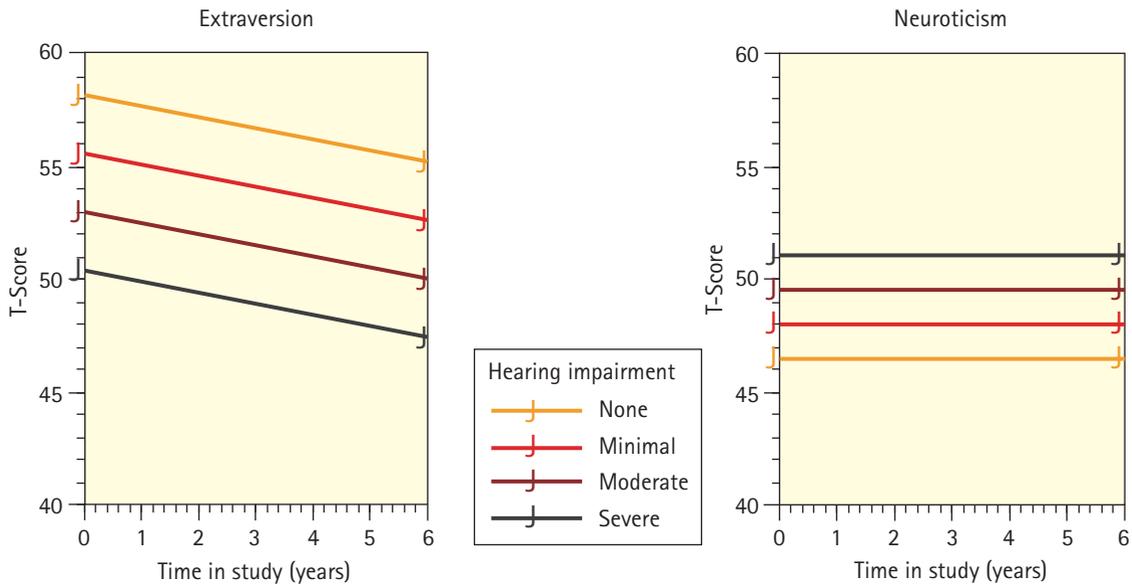


Figure 2. On average, extraversion decreased over time whereas neuroticism remained stable (estimates from latent growth curve modeling; Lißmann, 2002). Severity of hearing impairment predicted average levels over time for both dimensions. In addition, hearing impairment predicted individual differences in the change in neuroticism (not depicted here): Some individuals with moderate to severe impairment increased in neuroticism ($p < .001$).

self system is vulnerable over time, especially in the Fourth Age. To the extent that an older individual becomes physically dependent on others and experiences accumulated chronic health and life strains, their sense of *well-being* is compromised. In particular, we observe a reduction in the potential to experience the positive side of life (Isaacowitz & Smith, in press; Kunzmann, Little, & Smith, 2000; Smith, 2001c; Smith, Borchelt, Maier, & Jopp, 2002). Although the majority of BASE participants were typically satisfied with their present life conditions, those in the Third Age (70 to 84 years) reported significantly higher positive well-being, and higher satisfaction with life in general compared with those in the Fourth Age (85 to 100+). Considerable individual-difference variance in well-being was

accounted for by physical illness and functional impairment (e.g., vision, hearing, mobility, strength). On average, reported satisfaction with aging, life satisfaction and experience of positive emotions decreased after age 80.

We have also found that reported personal well-being is associated with an increased mortality risk after statistical controls for age, socio-demographic characteristics, and health measures (e.g., Maier & Smith, 1999). Every one standard deviation decrease in personal well-being was associated with a 1.36 times higher relative risk of death. The multimorbid life contexts of the oldest old highlight the salience of issues of physical dependency and the psychological "cost" of aging. Three doctoral research projects have also pointed to the gradual

Dissertations

Jopp, D. (2003). *Erfolgreiches Altern: Zum funktionalen Zusammenspiel von personalen Ressourcen und adaptiven Strategien des Lebensmanagements*. Doctoral thesis, Free University of Berlin (Supervisors: J. Smith & P. B. Baltes). Available online: www.diss.fu-berlin.de/2003/50.

Lißmann, I. (2002, submitted). *Intraindividuelle Veränderungen von Extraversion und Neurotizismus im hohen Alter: Die Bedeutung sensorischer Beeinträchtigung*. Doctoral thesis, Free University of Berlin (Supervisors: J. Smith & P. B. Baltes).

Schmiedek, F. (2003). *The structure of cognitive abilities in old and very old age: On the importance of specific group factors in a dedifferentiated factor space*. Doctoral thesis, Free University of Berlin (Supervisors: S.-C. Li & P. B. Baltes).

Habilitation

Smith, J. (1999, December). *Differential psychological aging: Towards clarifying a longstanding concept*. Habilitation thesis (Psychology), Free University of Berlin.

loss of well-being in late life. Ilka Lißmann examined individual differences in change over six years in two personality dimensions, *extraversion* and *neuroticism*. Extraversion indicates personal outgoingness and preferences for social contact and activity, whereas neuroticism indicates general anxiety, apprehension, and inability to deal with stress. Over time, the more positively valued dimension of extraversion declined on average whereas neuroticism remained stable (see Fig. 2). Lower average levels of extraversion over time and higher levels of neuroticism were associated significantly with severity of vision and hearing impairment. Individuals with severe hearing loss which constrains communication with others showed increases in neuroticism over time.

Resources, such as cognitive fitness, good vision, hearing, physical mobility, and support from a well-functioning social network, contribute greatly to a sense of well-being in old age. These resources, however, are likely to be reduced and in some instances lost in later life. Losses of close partners are inevitable during

old age. Susanne Ehrhorn is investigating the role that these losses play in a sense of *loneliness*. She has found that both social and emotional loneliness increases on average over eight years in the BASE longitudinal sample. Daniela Jopp's dissertation examined the interactive role of resources and life-management strategies in the maintenance of well-being over time in the ALLEE sample (a heterogeneous sample aged 70 to 90 years). High levels of resources and greater use of SOC-life-management strategies (e.g., selection, optimization, compensation) predicted higher well-being. However, of great interest was her finding that individuals with reduced resources who used SOC-life-management strategies (especially elective selection and optimization) were able to maintain a stable level of well-being over one year.

Profiles of Psychological Functioning in the Young Old and Oldest Old

Psychologically speaking, the chronic life stressors associated with advanced old age represent a context that appear to "test the limits" of

Living and Dying in the Fourth Age: Findings from BASE (adapted from Baltes & Smith, 2003)

Behavioral Observations

- Chronic life strains accumulate in the Fourth Age:
 - 80% experience losses in 3-6 areas (multimorbidity): e.g., vision, hearing, strength, functional capacity (IADL-ADL), illness, cognition
- Increased systemic breakdown in psychological adaptivity
- Increased losses in the positive side of life (happiness, social contacts)
- Profile of functioning 2 years prior to death is increasingly negative from age 85 to 100+:
- Losses in cognitive functions
- Losses in identity (greater loneliness and psychological dependence)

Social Context

- The oldest old are mostly female
- Majority of women are widowed and live alone (if not institutionalized)
- Majority are hospitalized at some time in the last years of life
- Majority die alone in a hospital or institution

psychological resilience and adaptation and may contribute to systemic breakdown and death (Baltes & Smith, 2003; see Textbox). This proposition is being examined in BASE in several ways. On the one hand, we analyze age-related changes in functional level in different domains and examine whether different rates and correlates of change characterize the young old and the oldest old (Smith & Baltes, 1997; see Fig. 3). In addition, we use cluster analysis to identify subgroups with functional psychological profiles indicative of distress and systemic breakdown. These subgroups have subsequently been followed over time to observe changes in functioning, adaptation, and survival. The longitudinal follow-up of the cluster subgroups is the focus of

the dissertation project of Denis Gerstorf. He asks whether some overall psychological profiles are less vulnerable to change over time than others, and whether cluster membership identified at baseline is stable over time. This perspective attempts to capture the systemic interdependencies across psychological domains. Gerontological and lifespan theories have long recognized that there are many pathways to old age and that the processes of aging are multifaceted. Our research in BASE on the different trajectories of change in psychological domains and subgroup profile differences addresses questions about potential sources of different pathways of aging as well as the limits to achieving personal variations in aging (Habilitation, Smith, 1999).

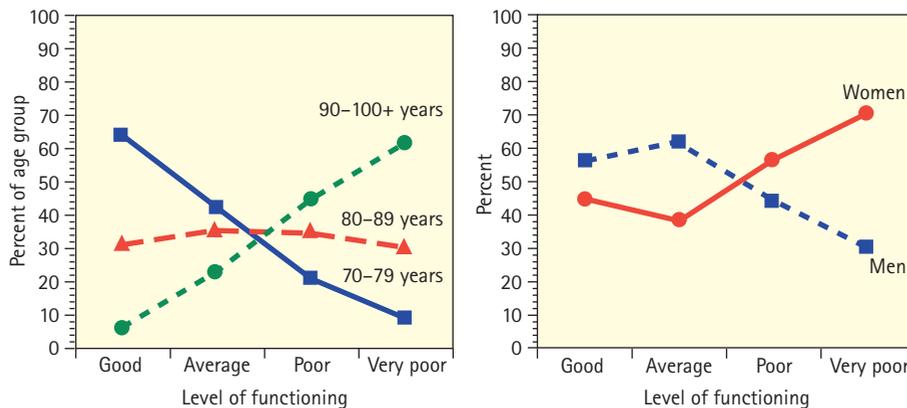


Figure 3. Age and gender are risk factors for belonging to groups with poor and very poor functional status. Groups' profiles were classified by a joint consideration of 23 physical, mental health, psychosocial, and social indicators (Baltes, 1997; Mayer & Baltes, 1996, 1999; Smith & Baltes, 1998).

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Research Project 3 Wisdom: The Integration of Mind and Virtue

Wisdom has been thought to be an ideal endpoint of human development. The view of wisdom as something that is prized has been with us since antiquity: "Happy is the man who finds wisdom," we read in the Proverbs of the Old Testament. Plato called wisdom "the highest of human things." Historically, wisdom is the peak of human excellence, the perfect integration of knowledge and character.

During the last decade, members of our project have developed a psychological conceptualization of wisdom (for a review of this work see Baltes & Staudinger, 2000). Consistent with historical and philosophical conceptions and based on theories and methods developed in lifespan developmental and cognitive psychology, we have defined wisdom as an "expert knowledge system in the fundamental pragmatics of life" (Baltes & Smith, 1990; Baltes & Staudinger, 2000; Staudinger & Baltes, 1996). The term "fundamental pragmatics of life" refers to knowledge about significant aspects concerning the meaning and conduct of life, and includes knowledge about life planning (e.g., What life goals should we pursue and how?),

life management (e.g., How can we deal with severe problems such as suicide, violence, or family conflict?), and life interpretation (e.g., How can we make sense of our past, present, and anticipated experiences?). Wisdom is not necessarily only a property of individuals. It can also be found in written material, such as religious or legal texts. Our past research, however, has focused on wisdom-related knowledge as expressed in a person's thoughts and judgments. To assess wisdom on the individual level, we present participants with short vignettes describing difficult life problems of fictitious people and ask them to think aloud about these problems (see Fig. 1). For example, a problem concerning life management reads:



Figure 1. Wisdom interview in the MPI-Wisdom & Emotion Laboratory.

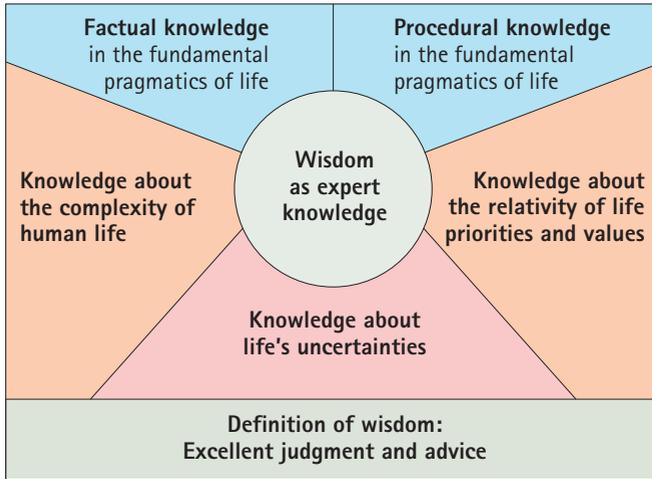


Figure 2. Wisdom: Expert knowledge about fundamental problems of life meaning and life conduct.

"A 15-year-old girl wants to get married right away. What could one/she consider and do?" A panel of trained raters evaluates our participants' responses for wisdom-related knowledge as determined by the following five criteria: rich factual and procedural knowledge about the fundamental pragmatics of life, lifespan contextualism, value relativism and tolerance, and awareness and management of uncertainty. These criteria and two extreme

responses to a wisdom task are depicted in Figures 2 and 3. Past research in the wisdom project (for review see Baltes & Staudinger, 2000) was concerned primarily with testing the validity and reliability of our psychological approach to the concept of wisdom, studying age-related changes, and exploring the antecedents and plasticity of wisdom-related knowledge. In this context, we were able to show that the activation of wisdom-related knowledge is facilitated by social discourse and the use of "inner voices" (Staudinger & Baltes, 1996). Much of our work on age-related changes in wisdom was motivated by the idea that wisdom might be one of the few gains associated with aging and, thus, may

Task: A 15-year-old girl wants to get married right away. What could one/she consider and do?

Low Wisdom Score

A 15-year-old girl wants to get married? No, no way, marrying at age 15 would be utterly wrong. One has to tell the girl that marriage is not possible. (After further probing) It would be irresponsible to support such an idea. No, this is just a crazy idea.

High Wisdom Score

Well, on the surface, this seems like an easy problem. On average, marriage for 15-year-old girls is not a good thing. I guess many girls might think about it, however, when they fall in love for the first time. And, then, there are situations where the average case does not fit. Perhaps in this instance, special life circumstances are involved, such that the girl has a terminal illness. Or the girl has just lost her parents. And also, this girl may not be from this country. Perhaps she lives in another culture and historical period.

responses to a wisdom task are depicted in Figures 2 and 3. Past research in the wisdom project (for review see Baltes & Staudinger, 2000) was concerned primarily with testing the validity and reliability of our psychological approach to the concept of wis-

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Figure 3. Illustration of two extreme responses to wisdom tasks.

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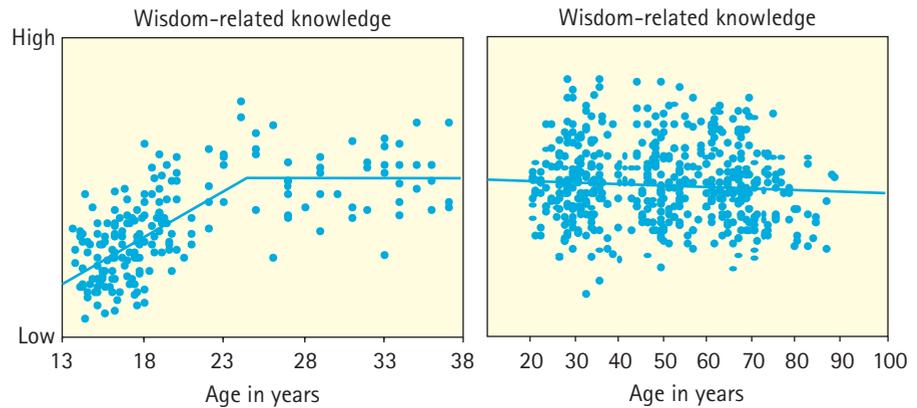


Figure 4. Cross-sectional age gradients and scatter plots for wisdom-related performance. The left panel show data from Pasupathi, Staudinger, and Baltes (2001) including outcomes of a spline analysis. The right panel summarizes results from several studies with adult samples (see also Baltes & Staudinger, 2000).

show improvement over the entire lifespan. What have we found? As seen in Figure 4, wisdom-related knowledge seems to increase during adolescence and young adulthood (Pasupathi, Staudinger, & Baltes, 2001) and then remains stable, at least up to age 75. At first sight, the stability of wisdom across most of adulthood is at odds with the idea that wisdom is a positive aspect of aging. However, given that basic cognitive functions lose efficiency relatively early in the lifespan, for most people the maintenance of wisdom-related knowledge might be the best possible outcome that adulthood and old age can bring about. That many adults do not experience an increase in wisdom-related knowledge during the second half of life is also consistent with our theoretical model of the ontogenesis of wisdom. In this model, wisdom-related knowledge is not strictly tied to the aging process; rather, we have argued that the acquisition and optimization of wisdom-related knowledge requires a wide range of

supportive conditions and processes related to an individual's personality, cognitive capacities, environment, and life history (e.g., Baltes & Staudinger, 2000).

In our present work, we are interested in broadening our definition of wisdom as expert knowledge about life meaning and conduct to also include interpersonal, motivational, and emotional competencies. Related to this research focus is our work on the consequences of wisdom-related knowledge for a person's behavior in a given situation, such as advising others or being involved in a social conflict. Does wisdom-related knowledge make a difference in people's social behavior, emotional life, or the values that they pursue? To begin to address this question, we investigated the relations between wisdom-related knowledge and multiple indicators of affective, motivational, and interpersonal functioning in a correlational field study (Kunzmann & Baltes, in press). In this study, people with relatively high levels of wisdom-related

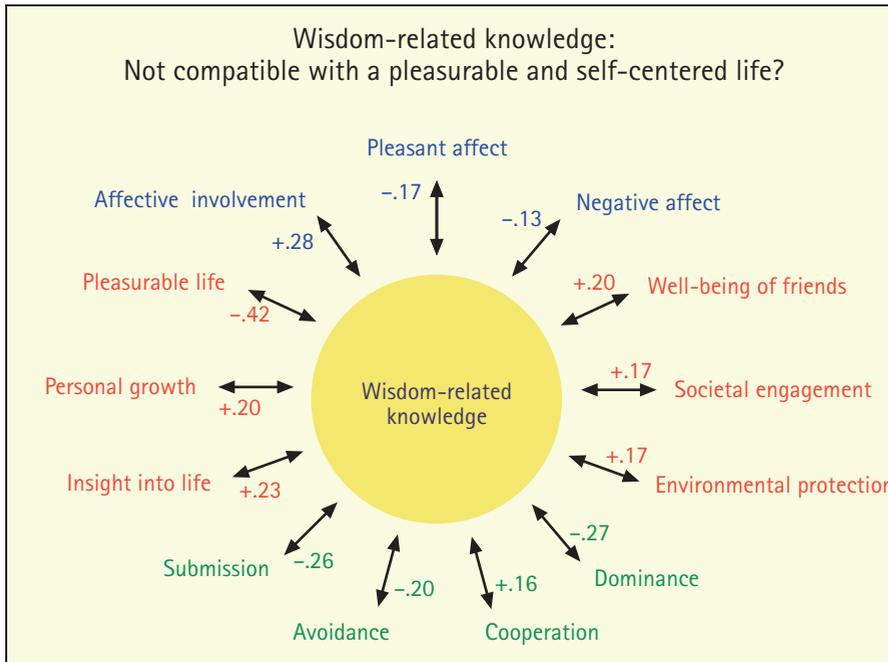


Figure 5. This figure depicts findings from a study with adults on wisdom-related knowledge and its relations to dimensions of affect, motivation, and interpersonal behavior. Central to our theoretical conceptualization is the finding that wisdom-related knowledge was negatively related to values revolving around a pleasurable life and pleasurable feelings. Wisdom may involve a complex and modulated affective life or what has been called constructive melancholy. Our findings are consistent with the idea that wisdom involves a commitment to develop one's own and others' potential simultaneously (Kunzmann & Baltes, in press).

knowledge reported (a) a value orientation that focused conjointly on other-enhancing values and personal growth combined with a lesser tendency toward values revolving around a pleasurable life, (b) higher affective involvement, but lower levels of pleasant affect, and (c) a preference for cooperative conflict management strategies combined with a lower tendency to adopt submissive, avoidant, or dominant strategies (see Fig. 5). Together, these findings are consistent with the theoretical idea that wisdom involves affective complexity and modulation rather than a predominance of self-centered pleasure and happiness. Our findings suggest that, from a motivational perspective, wisdom involves a commitment to develop one's own and others' potential simultaneously. In related work, we are currently investigating the relative salience of

cognitive and social competencies in laypersons' theories of wise people. In past studies, wise persons have been described as possessing cognitive (knowledgeable, reflective, thoughtful, farseeing) and social (e.g., empathic, kind, friendly, compassionate) abilities. Stimulated by this work, in her dissertation project Antje Stange is investigating the degree to which certain social behaviors (i.e., listening behavior) and wisdom-related knowledge about life meaning and conduct make a concrete person appear to be wise and to be sought out as an adviser. Specifically, she presents participants with silent film clips involving two parts. In the first part, an adviser listens to a young woman who talks about a serious personal problem. During the second part, the adviser's written response to the young woman is presented. The film clips vary in the advisers' nonverbal lis-

tening behavior (attentive/positive vs. distracted/negative), age (young vs. old), and quality of verbal advice (reflecting high vs. low levels of wisdom-related knowledge). After they have watched a clip, participants are asked to make several judgments concerning the adviser, including whether they thought the adviser was a wise person. This study will allow us to explore the relative importance of social behaviors (i.e., listening behavior), wisdom-related knowledge (as reflected in the advice given), and age in people's judgments of others as being more or less wise.

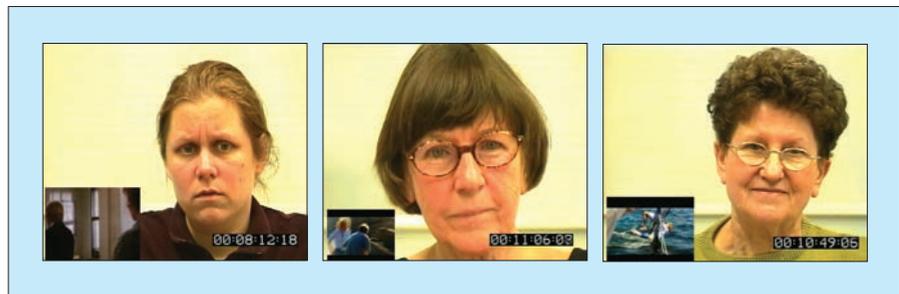
In another line of research, we investigate the interplay of wisdom as knowledge about life meaning and conduct and emotion. Wisdom and emotion have been linked throughout history, but it remains unclear just how they are connected to one another. For example, do people with higher levels of wisdom-related knowledge experience fewer negative emotions and more positive emotions than people with lower levels of such knowledge? Do wiser persons experience fewer and milder forms of any feeling, be they positive or negative? Or could it be that people higher on wisdom-related knowledge experience negative feel-

ings more often and with greater intensity, given their awareness of the complexities of life?

To investigate these and similar questions, we have begun to study the links between wisdom-related knowledge and a wide range of positive and negative emotions (e.g., interest, happiness, sadness, anxiety) as they are experienced in concrete situations or over longer periods of time and manifested in self-reported feelings, facial expressions, and activity of the autonomous nervous system.

In an ongoing laboratory study, for instance, adults with high versus low levels of wisdom-related knowledge, as determined by our standard procedure, watch short films that were developed in our laboratory to elicit strong positive (happiness) and negative (sadness) emotions. Participants' emotional reactions, that is, their subjective feelings, behavioral expressions, and activity of the autonomous nervous system are assessed online during each film clip (see Fig. 6). In addition, we evaluate our participants' cognitive reactions by having them say out loud everything that crosses their minds after they have watched a clip. This study will allow us to test whether wisdom-related knowledge makes a dif-

Figure 6. Young and older adults watching film clips about positive or negative life events in the MPI-Wisdom Et Emotion Laboratory.



ference in adults' emotional and cognitive reactions to emotionally highly negative or positive events. We will also be in a position to explore whether people with high levels of wisdom-related knowledge will have cognitive strategies available that render serious and uncertain life problems less disturbing, for instance, by placing a particular problem into a larger context. In the long run, our goal is to move toward a more comprehensive conceptualization of wisdom that highlights its special strength, namely,

the integration of mind and virtue as the optimum of human functioning (Baltes, Glück, & Kunzmann, 2002; Kunzmann & Baltes, 2003). This work also permits us to spell out the relationship between the theories of wisdom and the theory of selective optimization with compensation (SOC). In this context, we argue that, whereas wisdom defines the general range of acceptable means and goals, SOC offers the pragmatic techniques necessary to reach whatever goals are delineated (Baltes & Freund, 2003a, 2003b).

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Research Project 4 Personal Goals in Lifespan Development: One Research Application of the SOC-Model

How do people manage their lives successfully? Is it better to wait and see what life has to offer, not wanting too much, appreciating what is there without aiming to accomplish something? Or is it better to set clear goals and pursue them persistently even in the face of setbacks and losses? Although the first suggestion might appear to some people as the more attractive kind of life-style, the research conducted in this project suggests that setting and pursuing goals contributes to positive well-being across adulthood.

More specifically, the purpose of this project is the investigation of cognitive-motivational processes regulating human development across the lifespan. We adopted the meta-model of selection, optimization, and compensation (SOC) as a theoretical framework. In the SOC-meta-model, successful development, defined as simultaneous maximization of gains and minimization of losses over time, results from an interplay of three processes: selection, optimization, and compensation (Baltes & Baltes, 1990; Freund & Baltes, 2000).

The project focuses on the action-theoretical study of SOC-related processes in the structure and function of personal goals. In this line of inquiry, we assume that people actively shape their development through (1) the selection of personal goals, (2) the optimization of functioning in selected goal domains, and (3) the compensation of losses in goal relevant means.

We have investigated the role of personal goals for life management in several studies. For purposes of illustration and the use of varying methodology, we highlight three different kinds of approaches:

(1) a self-report method, (2) a proverb method, and (3) process-oriented approaches.

(1) Self-Report Measure of SOC

One methodological line of inquiry focuses on what people report about their SOC-related behaviors. For this purpose, and together with the FU Berlin research group of the late Margret Baltes, we constructed a questionnaire (Baltes, Baltes, Freund, & Lang, 1999). In this questionnaire, study participants are asked to indicate whether they engage in behaviors that we categorize as selection, optimization, and compensation or in alternative, that is, non-SOC-related behaviors. Such alternatives are, for instance, keeping one's options open rather than committing oneself to a set of goals (selection), being content with results of first trials rather than trying to maximize one's performance (optimization) or waiting for solutions and betterment of a loss situation rather than engaging in compensatory behaviors. Table 1 lists sample items for each of the processes.

The psychometric properties of this questionnaire are highly satisfactory. One finding consistent with our

Table 1

Sample items for elective selection, loss-based selection, optimization, and compensation (Baltes, Baltes, Freund, & Lang, 1999). Items in right column indicate alternative (non-SOC) behaviors that serve as distractors

<i>1a. Elective Selection</i>	
I always focus on the most important goal at a given time.	I am always working on several goals at once.
I have set my goals clearly and stick to them.	I often adapt my goals to small changes.
<i>1b. Loss-Based Selection</i>	
When I can't carry on as I used to, I direct my attention to my most important goal.	When I can't carry on as I used to, I direct my attention, like usual, to all my goals.
When something becomes increasingly difficult for me, I consider which goals I could achieve under the circumstances.	When something becomes increasingly difficult for me, I accept it.
<i>2. Optimization</i>	
I make every effort to achieve a given goal.	I prefer to wait for a while and see if things will work out by themselves.
When I want to get ahead, I take a successful person as a model.	When I want to get ahead, only I myself know the best way to do it.
<i>3. Compensation</i>	
When things don't go as well as they used to, I keep trying other ways until I can achieve the same result I used to.	When things don't go as well as they used to, I accept it.
When something in my life isn't working as well as it used to, I ask others for help or advice.	When something in my life isn't working as well as it used to, I decide what to do about it myself, without involving other people.

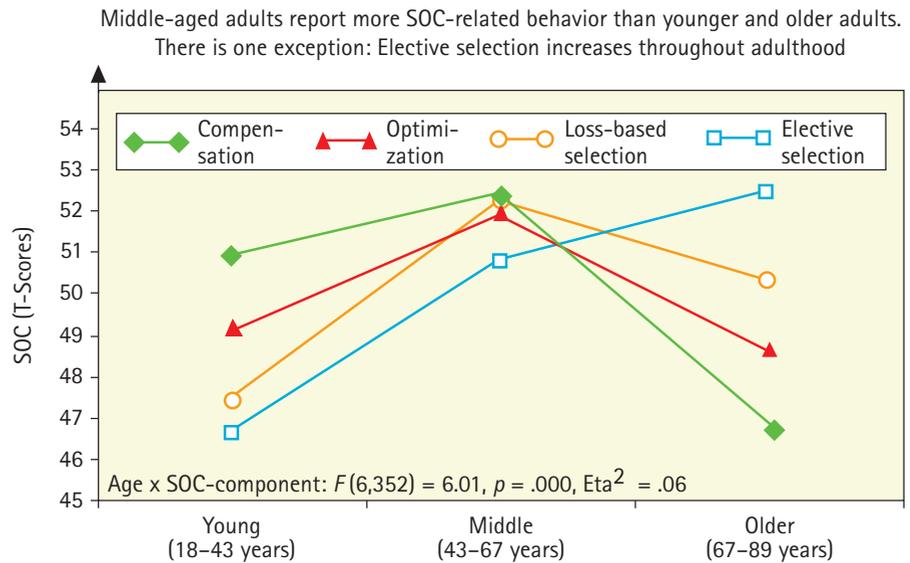
lifespan framework is that it is during midlife that individuals express the strongest preference for SOC-related behaviors (see Fig. 1). Older adults report less engagement in goal pursuit (i.e., optimizing and compensatory behaviors). We interpret this lower level of self-reported optimization and compensation as being due to an age-associated limitation of resources that constrains the implementation of goal-pursuit strategies. Engaging in strategies of goal pursuit is itself effortful and requires more resources than might be available in old age. Future studies

need to investigate more directly the role of resources for the acquisition and implementation of goal-related life-management strategies. A second pattern of findings demonstrates the substantial predictive validity of SOC involving a variety of subjective indicators of successful development. Examples for such subjective indicators of successful development are positive emotions, life-satisfaction, and feelings of having a purpose in life. Table 2 summarizes some of the findings. Note that these results are based on samples varying in age and on dif-

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Figure 1. Life-management strategies of SOC: Cross-sectional age differences in adulthood ($N = 181$) (adapted from Freund & Baltes, 2000).



ferent outcome criteria (Freund & Baltes, 1998, 2002b; Wiese, Freund, & Baltes, 2000). People who report higher levels of selection, optimization, and compensation also report higher levels of subjective well-being (e.g., frequency of experiencing positive emotions, having a purpose in life, life-satisfaction). Being committed to personal goals, pursuing these goals, and investing into their maintenance in the face of losses appears to contribute to positive subjective well-being across adulthood. The importance of selection in young adulthood was also highlighted by the finding that young adults who set clear priorities instead of pursuing work- and family/partnership-related goals at the same time report more goal progress at the present and three years later.

(2) Proverb Method

To check on method artifacts and provide multi-method evidence, we explored evidence about goals and SOC-related behaviors gathered with

a rather different methodology, namely, the use of proverbs. We argued that if personal goals are important for development, there should also be some implicit folk knowledge about this fact. Proverbs can be considered as condensed forms of folk knowledge reflecting cultural knowledge about fundamental aspects of life. Often, proverbs are expected to give advice about how to manage one's life. Are there proverbs reflecting the importance of selecting, pursuing, and maintaining personal goals for life-management?

Using comprehensive collections of German proverbs as sources, we were able to identify a substantial number of proverbs reflecting the importance of personal goals in terms of selection, optimization, and compensation. This can be seen as evidence of cultural knowledge about the role of personal goals for managing one's life (see Tab. 3 for examples of S-, O-, and C-related proverbs). In a series of studies we

Table 2
Overview: SOC (self-report) predicts successful development (outcomes)

Outcome	SOC-prediction (correlation)
Berlin Aging Study (72–102 years; <i>N</i> = 200) (Freund & Baltes, 1998)	
Satisfaction with age	.33**
Positive emotions	.47**
Emotional loneliness	–.31**
Adulthood and Well-Being (14–89 years; <i>N</i> = 395) (Freund & Baltes, 2000a)	
Positive emotions	.32**
Environmental mastery	.35**
Personal growth	.37**
Purpose in life	.44**
Work and Family in Young Adulthood (25–36 years; <i>N</i> = 206) (Wiese, Freund, & Baltes, 2000)	
Overall well-being	.49**
Emotional balance	.37**
Self-esteem	.21**

** *p* < .01.

showed that individuals also make use of these proverbs (Freund & Baltes, 2002a). We presented individuals with life problems and asked them to identify proverbs that would match these situations. The proverbs they could select were either SOC-related or not. The contrasted proverbs did not differ in

other characteristics, such as familiarity. Young and old adults judged proverbs reflecting selection, optimization, and compensation to be more adaptive in the life-problem situations presented than alternative proverbs (see Fig. 2). In a different life-context, however, in which the focus is on relaxation, such as dur-

Table 3
English examples of proverbs reflecting selection, optimization, compensation, or alternative strategies of life-management

Strategy	Proverb
Selection	Jack of all trades, master of none. Those who follow every path never reach any destination.
Optimization	Practice makes perfect. Make hay while the sun is shining.
Compensation	Those without a horse walk. When there's no wind, grab the oars.
Alternatives	Everything comes to he who waits. Time heals all wounds.

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ing a vacation, study participants preferred the alternative proverbs over those that reflected SOC-related strategies (see Fig. 3). Thus, folk knowledge about the role of personal goals is not only reflected in proverbs, but also used by individuals when judging how to manage one's life in terms of proverbs in a context-specific way.

(3) Process-Oriented Studies

A third line of inquiry aims at a closer measurement of behavioral indicators of selection of goals. In this set of studies, we investigate the mechanisms and functions of setting, pursuing, and maintaining

personal goals. For instance, we have studied how important setting priorities in managing the multiple demands of work and family life in young adulthood is for general- and domain-specific well-being (Wiese & Freund, 2001).

Even if people are selective, however, most do hold multiple goals at the same time. Whether or not such multiple goals can be pursued successfully is, among other characteristics, dependent on their interrelations. Results of a diary study suggest that goals that facilitate each other are more likely to be pursued in everyday life. Goal conflict, on the other hand, is primarily associated

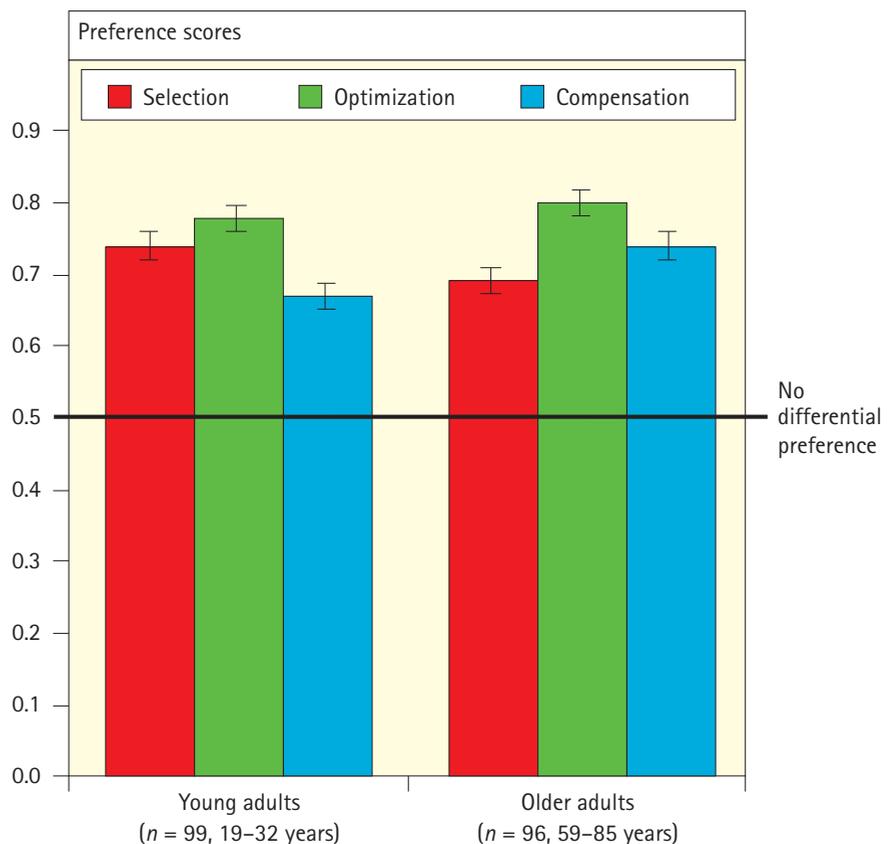


Figure 2. Young and older adults choose SOC-related proverbs more often as adaptive in dealing with life problems than alternative (non-SOC), but equally familiar and meaningful proverbs.

with the experience of positive and negative emotions. Interestingly, older adults reported less conflicting and more facilitative goal interrelations than younger adults (Riediger, 2001). This result could be interpreted as reflecting that older adults have more freedom to select their personal goals compared to younger adults who face more social constraints. In addition, due to their life experience older adults may have developed more adaptive life-management skills, including the selection of goals that facilitate and do not conflict with each other (Riediger, Freund, & Baltes, 2002). In a set of studies on persistence, we investigated age-differential effects of framing goals either in terms of optimization (i.e., achieving maximum gains) or compensation (i.e., counteracting a loss in goal-relevant means). In these studies, we found that younger adults are more motivated and persistent when trying to achieve higher levels of performance than when trying to counteract a loss. Conversely, older adults show higher persistence when engaged in compensation for a loss than when aiming at maximum performance. A second set of studies using self-report and behavioral measures explores whether an age-associated preference for goals geared at growth or at maintenance also holds for the selection of personally relevant goals in younger and older adults (Natalie Ebner's dissertation project). The results of these studies suggest that younger adults orient their goals more toward growth and gains, whereas the goal focus of older adults reflects a preference for a maintenance orien-

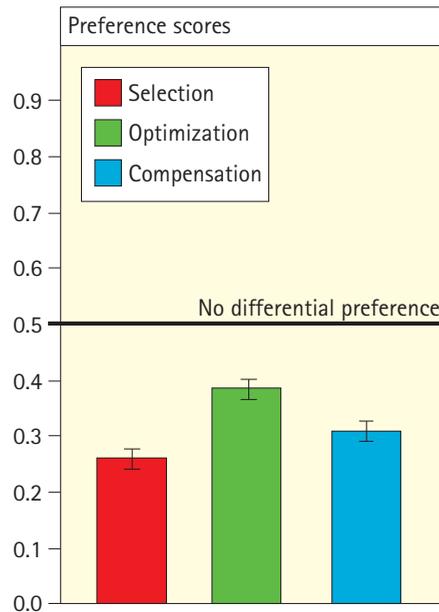


Figure 3. Adults flexibly adjust to the specific life-context when asked about the best life-management strategies. When the life-context is related to relaxation and "going with the flow," adults more frequently choose proverbs that do not reflect SOC-related behaviors such as goal orientation (e.g., "Everything comes to he who waits").

tation. This age-related difference seems to be at least partly driven by the awareness of resource limitations. Taken together, the studies of this project highlight the importance of personal goals for individual development across the lifespan. Using different approaches to study how personal goals impact on developmental outcomes (well-being, goal-related performance), we consistently find that selection of goals, optimization of goal attainment, and compensation of losses in goal domains help to understand how individuals actively shape the direction and level of their development.

Dissertation

Riediger, M. (2001). *On the dynamic relations among multiple goals: In-tergoal conflict and intergoal facilitation in younger and older adulthood*. Doctoral thesis, Free University of Berlin. Available online: <http://www.diss.fu-berlin.de/2001/266>.

Habilitation

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Research Project 5 Toward a Psychological and Developmental Theory of Sehnsucht (Life-Longing)

Sehnsucht (life-longing) is a very powerful and complex experience. Who has not longed for a loved one who is not here? Or for professional success? Or for a special friendship, a wonderful experience of nature? Or for feelings of the ease of childhood that are lost for the adult? Most adults are quite familiar with the bittersweet feeling, the aching of the heart, the vague feeling that something is missing in one's life. At the same time, positive emotions and thoughts can result if one is able to transform the experience of Sehnsucht into a positive view of one's past, present, and future. Astonishingly, Sehnsucht has been largely neglected in psychology (but see Boesch, 1998). In this new project, we attempt to advance an empirically and experimentally grounded developmental-psychological theory of Sehnsucht (life-longing).

Definition: Sehnsucht is an enduring mental representation and expression of desirable, idealized, and alternative life situations and life trajectories.

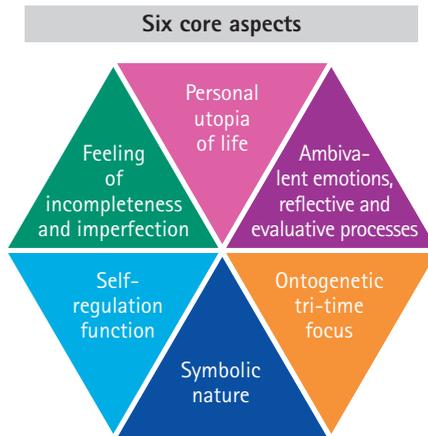


Figure 1. A developmental conceptualization of Sehnsucht.

Sehnsucht (there is no fully equivalent English translation; the closest term is life-longing) is a complex phenomenon, comprising of emotional, cognitive, and motivational aspects. We view Sehnsucht as a developmental construct that evolves and changes over time. For instance, we propose that the Sehnsucht of an older person might be more help-

ful for coping with losses. In contrast, the Sehnsucht of a younger person might be adaptive primarily in outlining possible developmental pathways. One central emphasis of this new project is the investigation of age differences in the content, structure, and function of Sehnsucht across adulthood.

In general, we define Sehnsucht as enduring cognitive representations and expressions of desirable, idealized, and alternative life situations and trajectories. In our preliminary definition of Sehnsucht, we distinguish six key aspects (see Fig. 1).

(1) Sehnsucht evolves out of a sense of imperfection and incompleteness. It deals, however, with personal utopias of life.

(2) Sehnsucht is accompanied initially by strong and bittersweet emotions, and reflective and evaluative processes. These can be transformed, however, into a positive development-enhancing view.

(3) Sehnsucht refers to the personal past, present, and future (ontogenetic tri-time-phenomenon).

(4) Sehnsucht carries diverse meanings and symbolically rich ideas of one's personal life trajectory.

(5) Sehnsucht arises from the necessity of restricting one's life options (of having to select more specific developmental goals) and from the irreversibility of the lifetime.

(6) Sehnsucht can have an adaptive function for development and self-regulation. In its mature form, Sehnsucht helps to cope with the inevitable losses and unrealized utopias people encounter in life. In this sense, Sehnsucht can also motivate the formulation of goals and life-planning and help to generate meaning at two levels: behavioral and imaginary.

To empirically address this complex phenomenon, we will use a multi-method approach, comprising of experimental, experiential, and self-report measures. In the context of Susanne Scheibe's dissertation, we are currently developing a self-report instrument for assessing the content, structure, and function of Sehnsucht. A pilot study has revealed interesting age-related differences in some aspects of Sehnsucht. For instance, older people

report a stronger focus on the past than do younger adults, whose Sehnsüchte are related to the past, the present, and the future equally strongly. As to the emotions associated with Sehnsucht, older adults' positive and negative emotions were largely unrelated, whereas there was a strong negative correlation of positive and negative emotions in younger adults. We interpret this finding as indicating a more complex emotional structure in older as compared to younger adults.

Younger adults experience either positive *or* negative emotions associated with their Sehnsucht. For older adults, however, Sehnsucht appears to have a more bittersweet emotional quality. This indicates that the function of Sehnsucht might not lie primarily in evoking positive emotions. Rather, as our psychological conception of Sehnsucht suggests, Sehnsucht might help to integrate positive and negative aspects of life and the conduct and interpretation of life in different forms of realization (e.g., behavioral vs. imaginary). Such questions will be addressed in future studies of this new project.

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Research Project 6 The Interplay of Sensorimotor and Cognitive Functioning

Let us begin with two backgrounds, one from everyday observations, the other from past research. Everyday observations suggest that older individuals invest much attention into the control of their motor behavior. For instance, when hiking in the mountains and facing an obstacle, such as a rock in the path, they stop talking and resume their conversations after the obstacle has been navigated. Younger people seem to show a lesser effect of this kind. This is an example of the role of declining cognitive resources and of the greater need of cognitive resources for motor behavior with advancing age.

There is a long tradition of research with dual-task paradigms—research models investigating simultaneous performance of two (or more) tasks. These dual-performance conditions are compared with the separate execution of each of the two task performances, that is, a single-task performance. Numerous experimental studies have demonstrated that people find it hard to attend to more than one task at a time or to integrate sensory input from more than one source. It has also been shown that dual-task costs, that is, the reduction in performance levels when two rather than one task is executed, are often greater in old persons than in younger ones. Older adults lose more in performance when required to do two things at once.

At the same time, everyday life, for the most part, consists of settings in which multiple sensory inputs are relevant to behavior or in which concurrent tasks must be coordinated: Examples are walking while trying to memorize a shopping list or maintaining one's balance on a bus while trying to read an advertisement on the other side of the road. How is it possible for individuals to

adapt to these multiple demands and their changes across situational contexts? Do individuals from different age groups differ in their efficiency in coping with related performance constraints? Is understanding development in children or aging changes in adults enhanced by considering the question of simultaneous versus sequential multi-tasking? Children learn how to do such multi-tasks, whereas older adults face the challenge of continuing to be effective multi-task problem solvers despite decline in various functional domains. In this project we investigate the efficiency of basic information processes and the allocation of cognitive resources in a lifespan developmental context. Related phenomena are referred to as aspects of cognitive mechanics in the literature. Examples of basic information processes are the perception of visual and auditory stimuli, their memorization, and their later retrieval from memory. In addition, this category includes sensory information-processing serving motor functions like walking, maintaining an upright posture (balance), or the temporal coordination of movements. Our ba-

sic assumption is that all of these processes tax an individual's pool of limited cognitive resources. In a way, they require "intelligence."

This project existed in an earlier form with Ulman Lindenberger, Michael Marsiske, and Karen Li as investigators (e.g., K. Z. H. Li, Lindenberger, Freund, & Baltes, 2001; Lindenberger, Marsiske, & Baltes, 2000) and is based on several conceptual foundations within the research framework of the Center for Lifespan Psychology. First, it addresses the question of changing resource allocations across the lifespan and the use of selection, optimization, and compensation to master the changing demands and contexts of lifespan development. Second, it illustrates how intelligence—or cognitive resources in the broader sense—is constituted and applied to varying domains as life unfolds. Intelligence is not only a subject matter of logical reasoning or academic-cultural knowledge, it is also involved in such matters as the coordination of bodily movements. Third, the project is an outgrowth of the Berlin Aging Study (BASE) finding that intelligence and sensorimotor functioning are increasingly highly correlated as people reach old age. We attempt to understand this systemic connection and see it "in action."

When more than one task or sensory input channel is relevant to the concurrent behavior, the cognitive system must allocate the resources available at any given time. In line with the theory of Selection, Optimization, and Compensation (SOC) (but also other theoretical accounts such as executive control), one possi-

ble strategy is to prioritize (select) one task over another or to carefully schedule the processing of concurrent tasks. The focus of our investigations is on the age-related developmental changes in resource allocation in multiple-task settings (such as walking and thinking) that have a high degree of everyday validity. Vast literature exists on the simultaneous performance of multiple movements or the perceptual integration from different input channels. Thus, we are mainly interested in the interplay of sensorimotor functions and cognition in settings that matter in everyday life. Individuals from different age groups differ in the amount of cognitive resources that they have available for a given task. The relation between age and available processing resources takes a U-shape function. In young children the processing resources are still developing and growing. Older adulthood is characterized by decrements in available cognitive resources. Many cognitive tasks have been demonstrated to exert higher resource demands on older than on young adults. In the light of reduced capacity and increased task demands, the necessity to optimize the allocation of available processing resources must be even higher in older than in young adults. Optimal resource allocation as a means to adapt overall performance is a critical marker of successful aging as described by the SOC-theory (Baltes & Baltes, 1990; Freund, Li, & Baltes, 1999). One central question in our project is whether individuals from different age groups differ only in terms of their available resources or whether

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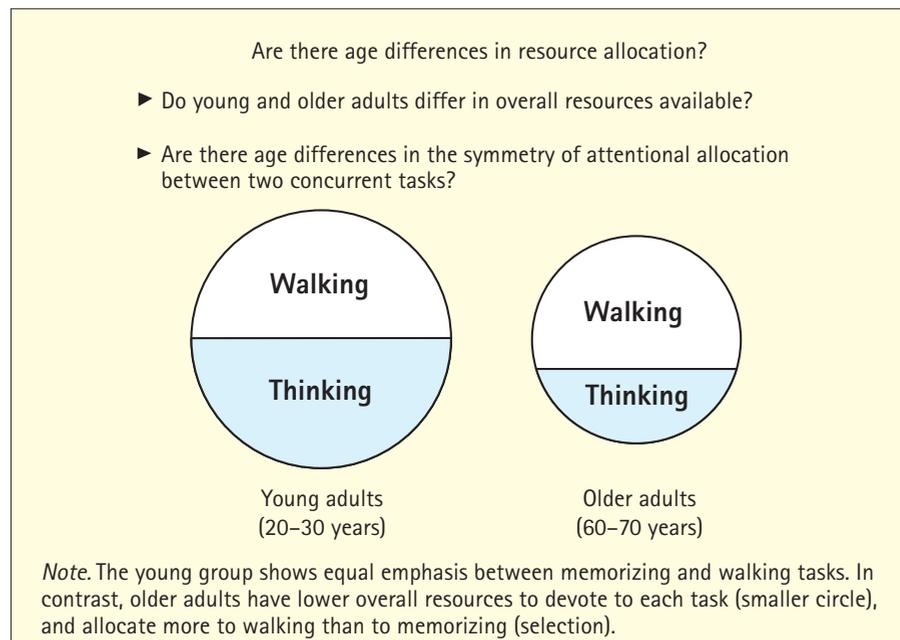
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the efficiency of resource allocation, as such, is subject to developmental changes (Fig. 1).

Completed and ongoing work on this topic includes the study of walking and the investigation of postural stability. To this end, we developed a new laboratory in 2000 with two balance machines that permit dynamic posturography and a parcours that allows the assessment of walking accuracy. In both experimental settings, participants perform the sensorimotor task (walking or balancing) either solely or in combination with cognitive tasks. Two earlier studies from our lab demonstrated that older adults invest considerable cognitive resources to compensate for the decreased efficiencies of their sensorimotor functions. Specifically, Lindenberger, Marsiske, and Baltes (2000) had participants from three age groups walk different tracks while memorizing word lists. They

found that speed and accuracy of walking were reduced when participants had to simultaneously walk and memorize, particularly in older adults. K. Z. H. Li, Lindenberger, Freund, and Baltes (2001) then systematically combined sensorimotor tasks of varying difficulties with a cognitively demanding memorization task and offered compensatory external aids (a handrail to optimize walking and a button-box that delayed the presentation of auditory stimuli). Whereas young adults optimized their memorization performances, older adults focused on the optimization of their walking by more frequently using the handrail. In our interpretation, older adults selected walking efficiency over memory efficiency when their cognitive resources were challenged. Two recently completed studies in this project added a third sensorimotor component, namely balance, by using dynamic posturography.

Figure 1. SOC: Overview of the central questions examined in the Dual-Task Thinking Et Walking Project.



Participants stand on a platform that can tilt at different angular velocities (Fig. 2). The platform contains sensors that measure participants' stability (i.e., the distribution of their weights) at any given point in time. Bondar, Krampe, and Baltes (in prep.) had young and older adults perform choice reaction time tasks while maintaining upright stance despite unpredictable perturbations during trials. Older adults were found to have larger dual-task costs than younger adults. At the same time, they showed increased neglect of the cognitive task when the experimentally induced perturbations were increased. In specific experimental conditions, participants were asked to emphasize performance in either the cognitive task, the balance task, or to place equal emphasis on both conditions. Older and young adults revealed similar flexibilities in resource allocation in the cognitive task. During trials with stronger perturbations, however, only young, but not older adults were capable of a flexible allocation of resources to stance maintenance.

Again, these results can be interpreted in the context of the SOC-model, both as differences in overall resources and as older adults' specific selection of attentional emphasis on walking or maintaining a stable posture over simultaneous cognitive tasks. In older age, sensorimotor functions require more and more cognitive resources. Because of their allocation to the sensorimotor domain, these cognitive resources are then no longer available for competing mental activities. Our results highlight the

differential ecological relevance of tasks for young and older adults and its effects on resource allocation:

Walking or maintaining balance is more critical for older than for young adults. Consequentially, older adults prioritize sensorimotor over cognitive functioning, especially when tested at their limits.

The findings by Bondar, Krampe, and Baltes imply that the observed prioritization in older adults reflects overlearned response tendencies resulting from long-term everyday experiences. This assumption was further supported in another study using the balance-cognition dual-task paradigm. Rapp, Krampe, and Baltes (in prep.) studied young and older adults along with a group that is assumed to have deficits in attentional control or resource allo-

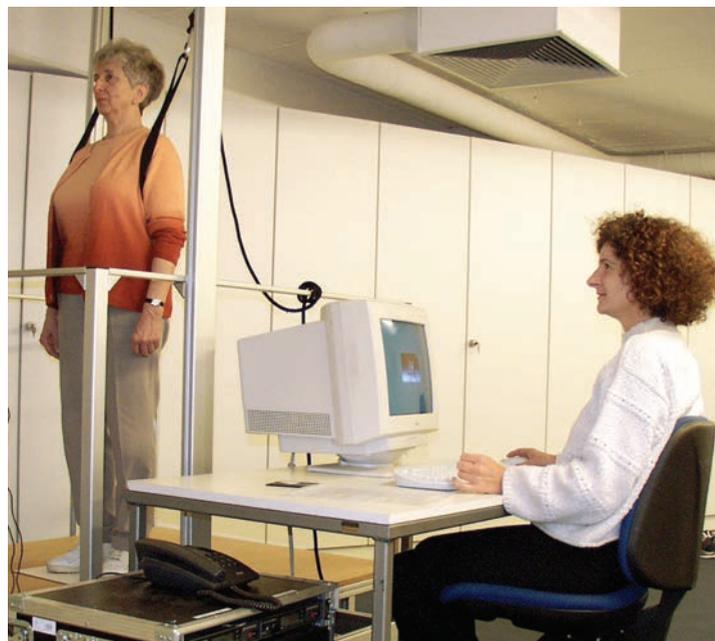


Figure 2. The new laboratory, which has been developed to examine dual-task performance includes apparatus to test dynamic posturography. In one of our studies we assess balance performance while the participant simultaneously memorizes digits presented on a computer monitor.

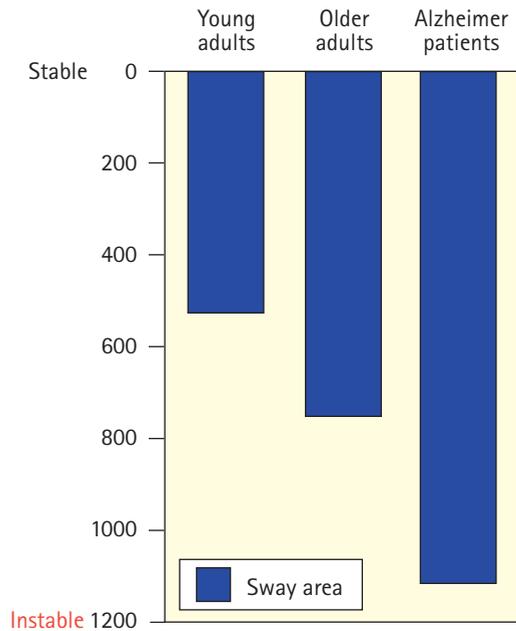


Figure 3a. Stability on a moving platform during a single-task performance. Sway (measured as the area of Center of Pressure Movement) increases with age and dementia. This implies that older adults and most notably Alzheimer patients must already invest more of their cognitive resources into bodily stability under single-task conditions.

Alzheimer patients. Older adults showed a reliable *reduction* in sensorimotor dual-task costs when conditions of stable and moving platforms were compared, again suggesting that they protected their balance at the cost of cognitive performance. Alzheimer patients' dual-task costs were significantly increased relative to healthy age-matched individuals. However, the Alzheimer group showed the same prioritization when limits were challenged: When the platform was moving, Alzheimer patients invested most of their cognitive resources into the sensorimotor task, thereby maintaining almost the same stability as under single-task conditions (Fig. 3a, 3b). A subsequent inclusion of another group of non-demented older adults that was more similar to the Alzheimer patients with respect to their cognitive status (fluid intelligence) revealed that the exaggerated Alzheimer pattern was spe-

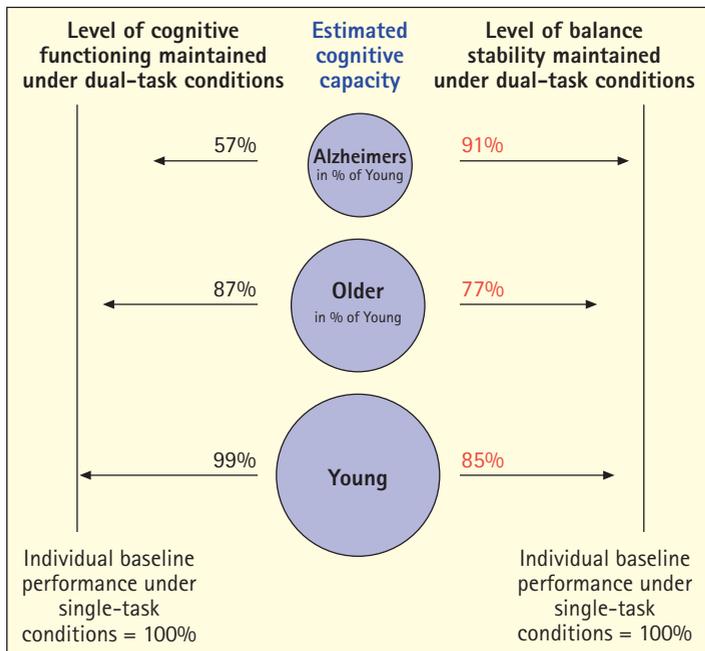


Figure 3b. Resource investment into cognitive and bodily functions under dual-task conditions. Compared to young adults, older adults and most notably Alzheimer patients exhibit smaller levels of cognitive functioning when their balance is challenged through the moving platform. Under these circumstances Alzheimer patients invest most of their cognitive resources into balance, thereby maintaining their stability. Groups differ in baseline balance performance (Fig. 3a) and also in the estimated cognitive resources. The sizes of center circles reflect the assumed group differences in cognitive capacity (shown for Alzheimer patients and older adults in percent of cognitive resources available to young participants).

cific to dementia. These findings demonstrate how Alzheimer patients "know how to survive" in situations where memory and motor behavior are required at the same time. How about the other end of the lifespan, childhood? In an ongoing project we (Krampe, Schäfer, & Baltes, in prep.) investigate resource allocation in children (9 or 11 years old). To this end we use the walking parcours in combination with a semantic fluency task (Fig. 4). In line with our earlier results, we found that young adults maintain their level of performance in the cognitive task and "accept" reductions in walking speed. Children, however, showed

higher costs in walking than young adults did and they also demonstrated considerable costs in the cognitive task. These findings illustrate that the age-differential "protection" of gait and balance is not a result of the amount of available cognitive resources alone. Rather, ecological considerations are important: The consequences of withdrawing attention from gait or balance are far more serious for older adults than for young adults or children. Future projects will study older adults who have presumably optimized their sensorimotor functioning through long-term practice in balance-related forms of expertise.

Dissertations

Bondar, A. (2003). *Balance and cognition: Resource allocation and its control in young and older adults*. Doctoral thesis, Free University of Berlin. Available online: www.diss.fu-berlin.de/2003/48.

Rapp, M. (2003). *Dual-task performance in memory and balance: The role of aging and Alzheimer's disease*. Doctoral thesis, Free University of Berlin.



Figure 4. Dual-task experiment with walking parcours. Participants (9- or 11-year-old children, young and older adults) walk along a narrow parcours at their maximum speed while simultaneously performing a cognitive task, for instance, memorization of a list of words presented over headphones or generating exemplars for semantic categories like animals (recorded from wireless microphone transmissions).

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fellows)

Research Project 7 Dynamics of Intraindividual Variability and Interindividual Differences in Development

"Nothing is permanent except change." For developmental researchers, the statement of the Greek philosopher, Heraclitus, is not a rhetoric, but a veridical expression of the nature of human behavior and its development. Variations within and between individuals are fundamental to all living organisms. When asked to describe a person (e.g., a friend, a family member, or even oneself), in general we can characterize the person in terms of how this person *usually* thinks, behaves, and feels, as well as how this person differs from others. However, besides these "usual," "characteristic" patterns in thoughts, acts, or emotions, we also know that the person does not always think, behave, or feel exactly the same way; rather, the person "varies from the usual" under some circumstances. Put differently, whereas, on the one hand, people show stable characteristics, on the other hand, people also change as they develop throughout life and deviate from their own characteristics from time-to-time as internal and external life conditions vary.

This new research project commenced in 2002 in close collaboration with two external scientists: Ulman Lindenberger and John Nesselroade. Taking the joint concern of developmental psychology with describing, explaining, and modifying intraindividual change and interindividual differences in such change (Baltes, Lindenberger, & Staudinger, 1998) as a starting point, we focus on investigating within-person variations. Within-person variations (i.e., *intraindividual variability*) are intrinsic to all aspects of human functioning, ranging from neurobiological, sensory, perceptual, cognitive, and emotional to social processes. Specifically, we examine intraindividual variability in intellectual abilities, postural control, and emotional and physical well-being as a means to describe individual and age-related differences in the psychological and physical systems as well as their interactions. Within-

person variations in these functions and systems could serve as indicators of their developmental status and of resource allocation across different domains of functioning. Let us consider a few concrete examples. When children acquire arithmetic skills, they tend to go through periods when they try out different problem-solving strategies as they get closer to acquiring the new concepts (Siegler, 1994). In old people, within-person variations in walking speed tend to increase with age and indicate a lack of processing robustness that is not only related to poor sensorimotor performance, but also to poor memory performance (S.-C. Li, Aggen, Nesselroade, & Baltes, 2001). Week-to-week fluctuations in the perception of control over one's life conditions indicate the resilience of psychological and physical systems and predict mortality in old age (Eizenman, Nesselroade, Featherman, & Rowe, 1997).

Although issues of average levels of functioning and how individuals differ from each other have been the focus of different research orientations, very little is known about intraindividual variability in different domains of psychological functioning because traditionally most researchers have viewed within-person variations as "noise" or "errors" in the measurement. Motivated by lifespan conceptions (Baltes, Lindenberger, & Staudinger, 1998), biocultural coconstructivism (Baltes & Singer, 2001; S.-C. Li, 2003), and research on psychological profiles of aging (Baltes & Smith, 2002; Smith & Baltes, 2000), four related notions are central to the research on lifespan dynamics of intraindividual variability:

- Humans are self-constructing living systems, biologically endowed to develop by both adapting to as well as influencing external conditions of life.
- Human behaviors are results of dynamic exchanges between processes that are internal (e.g., neurobiological, cognitive, emotional) and external (e.g., social, cultural, environmental) to an individual.
- As individuals develop, situated in and confronted with different life conditions, the patterns and complexities of dynamic resource allocations between different psychological processes and systems transform throughout life.
- Changes and variations in both internal and external processes unfold on different time scales, from moment-to-moment experiences, day-to-day activities, to lifespan ontogeny.

Specifically, we define intraindividual variability as *variations and transformations in an individual's processes or performances over different time scales that are produced by endogenous factors (e.g., neurobiological and cognitive processes) and their interactions with environmental and experiential influences.*

Types of Intraindividual Variability

Fiske (1955) once distinguished between different types of intraindividual variability, some adaptive and some nonadaptive, that unfold with different degrees of reversibility on different time scales and involve single or multiple functions (e.g., S.-C. Li, Huxhold, & Schmiedek, in press). It is important to differentiate between short-term relatively reversible variations in functioning and progressive long-term relatively permanent developmental changes (Nesselroade, 1991). Apart from intraindividual changes occurring across months, years, or decades (e.g., physical growth and cognitive development), there are other types of progressive, but relatively more reversible intraindividual variability that unfold on the time scales of short testing trials, training sessions, or weeks. Ford (1987) termed these the "being" type of intraindividual variability in functioning, and primarily emphasized cyclic variations within limits that were characterized as the steady metabolic rhythms of the individual. Besides such cyclic variations, there could also be random *processing fluctuation—or lack of processing robustness* (e.g., S.-C. Li, Aggen, Nesselroade, & Baltes, 2001)—around maximum functioning, as well as

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functional plasticity, diversity, and adaptability. *Functional plasticity* refers to the training benefit individuals gain from relatively short-term, but intensive training on a given task. Most cognitive training research has found that, even in old age, individuals are still able to benefit from intensive training (e.g., Baltes & Kliegl, 1992; Kliegl, Smith, & Baltes, 1989). *Functional diversity* signifies digressions of functioning during the initial acquisition of complex new tasks that could be associated with exploratory behavior and strategies (e.g., Siegler, 1994). *Functional adaptability* indicates an individual's ability to alter functioning when faced with perturbations in the human-task environment—either due to sudden fluctuations in processing (e.g., attention slips) or more demanding tasks—in order to regain maximum functioning. Moreover, the concept of intraindividual variability is not limited to variations in a given specific function;

rather, it also applies to transformations in the functional organization of related functions.

First-Stage Research Foci

Among the various types of intraindividual variability, the first-stage focus of this new project is on different aspects of short-term, relatively reversible variations in functioning and their roles as pointers for examining transformations in the interactions between different psychological systems and processes across the lifespan. Currently, our research questions address lifespan dynamics in intraindividual variability at two levels: the interaction between cognitive and sensorimotor system and the interaction between objective performance and subjective well-being.

Intraindividual Variability in Cognitive and Sensorimotor Functioning

One aspect of short-term relatively reversible intraindividual variations that we have examined is *processing fluctuation* or *lack of processing robustness*. Besides the speed and accuracy of performance, the extent of intraindividual processing robustness reflects another important aspect of information processing and shows how robust or resilient the processes and systems are. Recently we investigated intraindividual fluctuations of processing speed in a lifespan sample covering the age range from 6 to 89 years (S.-C. Li, Lindenberger, Hommel, Aschersleben, Prinz, & Baltes, in press). Our results show that during child development and aging, individuals exhibit less robust processing (see Fig. 1). Moreover, in

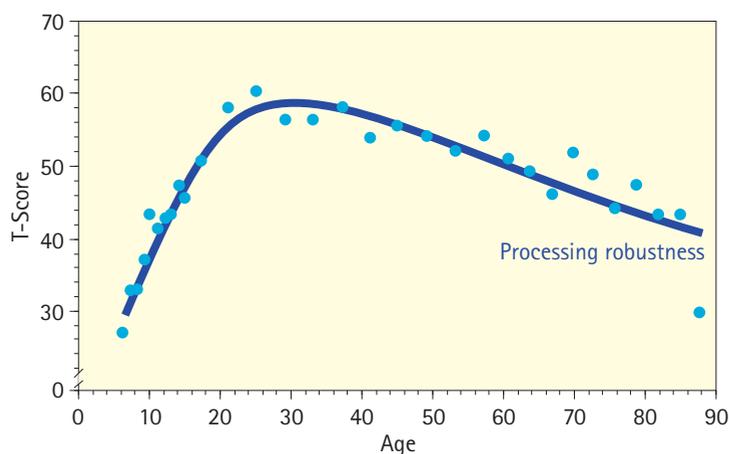


Figure 1. Lifespan age gradients of processing robustness. The extent of within-person fluctuations indicates the robustness of elementary information-processing mechanisms supporting intellectual function. The evidence shows that processing robustness increases during childhood, but decreases during aging (adapted from S.-C. Li, Lindenberger, Hommel, Aschersleben, Prinz, & Baltes, in press).

old age the extent of an individual's processing robustness predicts how well basic mental operations can be performed. Besides attenuated processing robustness in cognitive functioning, we also investigated short-term fluctuations in elderly people's sensorimotor performance by taking biweekly measures of their walking and turning performance for seven months. Across the age range from 64 to 86 years, we found that increased biweekly intraindividual fluctuation in sensorimotor performance, indicating less robust sensorimotor functioning, was related to increasing age and a lower level of sensorimotor functioning. Moreover, there was a cross-domain association: Independent of their mean performances, the individuals who lacked processing robustness in sensorimotor functioning also showed poorer text and spatial memory (S.-C. Li, Aggen, Nesselrode, & Baltes, 2001).

Taken together, our initial results are consistent with other recent findings suggesting that decreased processing robustness in old age may reflect attenuated brain integrity due to aging (e.g., Hultsch et al., 2000; S.-C. Li et al., 2001; Rabbitt et al., 2001). Together, these findings lend support to the processing noise hypothesis of cognitive aging, be it conceptualized at either the information-processing or the neurobiological level, or both (see S.-C. Li, Lindenberger, & Sikström, 2001, for review). Building on these findings, we currently plan to more closely investigate, in the context of Oliver Huxhold's dissertation research and other parallel projects, the influence of aging on intraindividual variability

in the cognitive and postural control systems and their interactions.

Intraindividual Variability in Performance and Subjective Well-Being

Although there are stable individual differences in average levels of subjective well-being, various components of well-being, such as mood, vitality, physical energy, and subjective health vary day-to-day. Our interest focuses on the dialectical relationships between these factors and performance on cognitive and sensorimotor tasks. Doctoral research by Christina Röcke will examine the extent to which day-to-day fluctuations in emotional and physical well-being are associated with performance variability in young, middle-aged, and older adults. Previous studies of intraindividual variability of mood, especially in college students, suggest that emotional regulation is dynamic and complex, and that individuals can be characterized by their patterns of fluctuation. Whereas issues of physical and emotional well-being have been central to aging research (Smith, 2001c; Kunzmann, Little, & Smith, 2000), few studies have linked variability in well-being to performance and few have compared the patterns across age groups. Is a sense of well-being closely associated with performance in all age groups? In addition to a focus on well-being, we will also examine the relationships between performance variability and daily fluctuations in such factors as sleep and task motivation.



International Encyclopedia of the Social and Behavioral Sciences

Together with Neil Smelser, Director emeritus of the Center for Advanced Study in the Behavioral Sciences, Stanford, USA, Paul B. Baltes is the co-editor-in-chief of the new *International Encyclopedia of the Behavioral and Social Sciences*. It was published by Elsevier Science in November 2001 and comprises 3,842 alphabetically organized entries in 26 volumes. Julia Delius served as Scientific Editorial Assistant. The online version of the Encyclopedia (made available in Fall 2002) enables electronic browsing, searching, and linking.

Scientific Investigators

Paul B. Baltes
Julia Delius

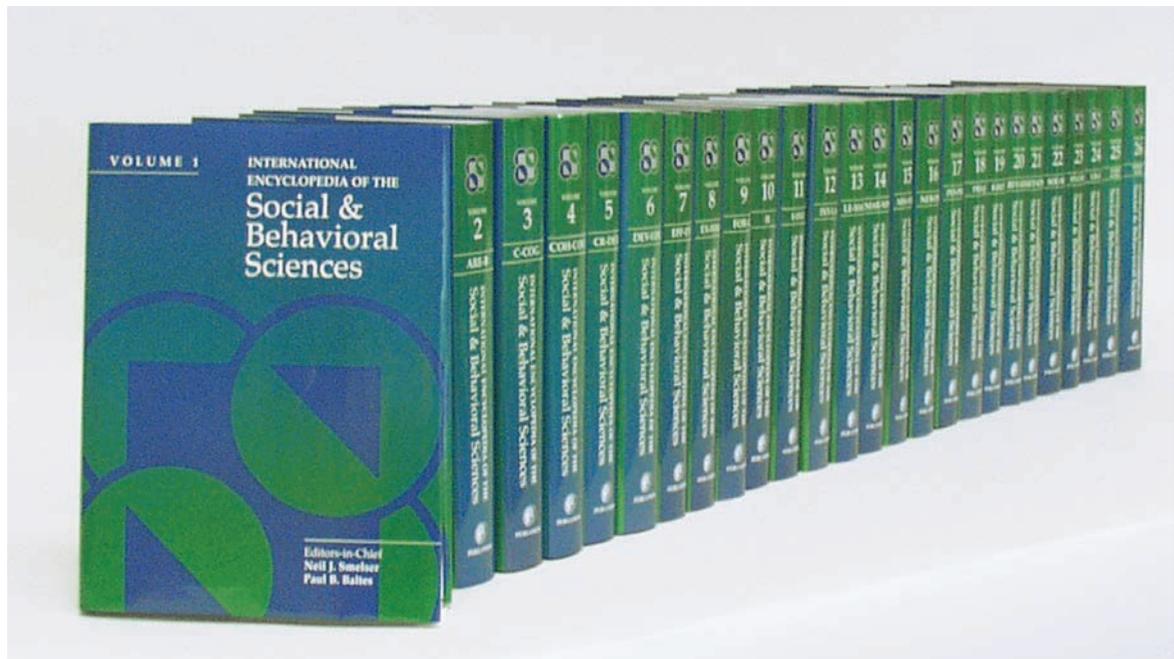
Key Reference

Smelser, N. J., & Baltes, P. B. (Eds.-in-Chief). (2001). *International encyclopedia of the social and behavioral sciences*. Oxford: Elsevier Science.

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Work on this project began in 1997 and was completed in Fall 2001. Working closely with the two editors-in-chief, 52 section editors were responsible for a wide range of areas (from evolutionary sciences to the behavioral and social sciences to philosophy, see Table). All entries underwent an extensive review process involving two stages: a first review by the responsible section editor and then a review by the editors-in-chief who were assisted by a team of expert readers.

The authors came from more than 50 countries. About 79% were men, 21% women. Regarding continents, about 57% were affiliated with institutions in North America (more than 2,000 were located in the USA), 35% were located in Europe (more than 400 in Germany and the UK respectively, and over 100 in France and the Netherlands), and 8% in other regions of the world (e.g., more than 50 in Japan, 40 in Israel, and 25 in India).



Sections, Section Editors, and Number of Articles

Overarching Topics		Disciplines		Intersecting Fields		Applications		
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Note. Encyclopedia is arranged alphabetically by titles of articles.

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**Center for
Sociology and the Study
of the Life Course**

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Research Program and Research Projects

Sociological Research at the Max Planck Institute for Human Development

Sociology as a scientific discipline is interested in the formation of institutions and in the social behavior and actions of individuals embedded in institutions. Within the specific context of an interdisciplinary institute for human development, sociology can make two kinds of contributions. First, it examines the roles that the family, the educational and training system, the occupational structure, and the welfare state play in the development and life courses of individuals. Second, it examines the way in which specific life-course patterns express and affect the distribution of life chances.

We share substantive topics, theoretical perspectives, and methodological approaches with other centers of the Institute, for example, the interest in the conditions of attainment in education and training with the Center for Educational Research. We are also interested in both the individual and social consequences of differential educational attainment. The longitudinal surveys of the two centers overlap in the life phase which occurs at the completion of schooling and commencement of early labor market experience. We are currently cooperating with the Center for Educational Research with the new version of the German Education Report. Together with the Center for Lifespan Psychology we share an interest in the full life course from birth to death, particularly the interplay between social environments and individual development. These common interests resulted in the joint Berlin Aging Study and joint research on psychological covariates of employment trajectories in East Germany during the unification process. Also, with the Center for Adaptive Behavior and Cognition we share an interest in assumptions about rational

behavior. Although our primary goal is to find and use appropriate individual-level assumptions in models of institutions, we also maintain an interest in the ways social structures shape and bound rationality.

Goals of the Research Program

The research program is oriented toward answering three sets of questions:

(1) The first set of questions focuses on the relationships between the macrolevel structure of societies and patterns of the life course. In what manner and with which outcomes do institutions shape the patterns and distributions of individual life courses? We look at life courses generated by social norms, by institutional configurations, and by opportunity structures, all of which vary across social groups as well as specific national and historical contexts. Life courses are a summary concept for the intertwined processes of residential migration, family history, education and training trajectories, employment, and occupational careers, as well as the temporal patterns of relationships to the social insurance systems. Therefore, with respect to institutions, we are

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primarily interested in schools and training institutions, the occupational structure and labor market, the family, and the welfare state. The relevant time dimension, here, is the historical time of socioeconomic change.

(2) The second set of questions focuses on the levels of individual and group action. How do individuals and families actively construct their lives? How do they experience their individual and collective life histories under the given conditions of their own prior biography, their immediate family and work environments, and the generational contexts of their peer birth cohorts? Here, we are primarily interested in the proximate influences of the mesolevel of informal groups, formal organizations, and local opportunity structures, as well as microlevel endogenous processes of the individual life course. The relevant time dimensions, here, are chronological age and the individual aging process, the duration of membership in families, households, and firms, as well as the time dimension of cohort and generational succession.

(3) The third set of questions focuses on feedback processes from the microlevel of individual action to the macrolevel of structural and institutional constraints. How do changes in life-course patterns shape distributional and aggregative features of social structure and institutional arrangements? What are the implications of such processes for social policies? Irrespective of how they arise, life-course patterns are powerful contexts for individual and group action. Life courses form the qualitative and quantitative ba-

sis for macrosocial change and for collective political decision-making. Accordingly, the empirical and descriptive social accounting of life-course patterns is an important research task.

We use **four perspectives** in investigating life courses.

First, we see individual life courses as a part and a product of social and historical processes operating on different levels. Individual life courses are linked to the life courses of other persons (parents, partners, children, colleagues, friends) and are embedded in the dynamics of small groups, especially the family. But, life courses are also subject to the influences of social organization and the macroinstitutions of society, including their development over time.

Second, the life course is a multidimensional process. On the one hand, it unfolds in the different, but mutually related life domains (e.g., family cycle and working life), on the other hand, it is dependent on intraindividual processes of organic and psychological development.

Third, the life course is a self-referential process. The individual behaves and acts self-reflectively on the basis of past experiences and resources, making the life course, to some extent, an endogenous causal process. This is also partially true for the collective life history of birth cohorts. The past and initial conditions and characteristics of a cohort impact both on their later collective life history (e.g., in the relationship between working lives and life in old age) and on the adjacent cohorts. The different age groups live together in the same

time period, but they bring to the present their distinctive past histories.

Fourth, through the manner in which persons shape their own life

courses, they reproduce and transform the social structure. This can happen via "simple" processes of aggregation or in the form of institutional feedback.

Research Areas

The Center's research program is currently organized into the following areas:

Education, Training, and Employment

The transition between education, training, and employment is a major topic of investigation in the Center for Sociology and the Study of the Life Course. This life phase is crucial for both intergenerational status allocation and the later life history. In reconstructing the collective transition experiences of successive cohorts, we gain empirical insights in the changing institutional linkages between the school and training systems, on the one hand, and between the labor market and the occupational structure, on the other. Moreover, we can examine controversial hypotheses about the lengthening and fragmentation of this

transition period, and about the increasing polarization of the opportunities for skill acquisition and early occupational careers. Other topics of research interest include the following: What are the consequences of educational expansion for working lives? Is there a crisis in the dual system of vocational training and how can this be accounted for? How widespread and serious are the problems of mismatch between acquired and required skills in the labor market? Our guiding hypothesis in this research area is that despite massive distributional shifts and intense pressure for labor market flexibilization, the close linkage between education, training, and occupation persists.

Research Area 1

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Research Area 2

Life Courses in the Transformation of Former Socialist Societies

The fall of the Berlin Wall and the unification of Germany not only provided a major challenge for the social sciences to understand and guide this transition, it also provided unique opportunities for theory-guided research. On the one hand, the transformation allowed the functioning and nonviability of the former socialist society to be examined. On the other hand, it provided ample opportunities for the investigation of life courses under the impact of such a sudden dramatic institutional change. We have collected selected cohort and life-course data on both the German Democratic Republic and the trans-

formation process. In addition, we have intensified research cooperation with Polish social scientists for the purposes of comparative study. Our current investigations concentrate on the micromechanisms of individual adjustment, adaptation in the domains of family and work, the life-course consequences of institutional transfer from West to East Germany, and individual-level processes in the transformation of the system of social stratification and class. Our studies have revealed some rather surprising findings: Despite a rapid increase in labor market mobility and considerable breaks in individual careers, the pattern of social stratification has remained very stable.

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Welfare State, Life Courses, and Social Inequalities

In this research area we focus on conceptual and empirical studies on the impact of various national institutional configurations on life-course outcomes. The macroinstitutions of the modern welfare state and the specific provisions and rules of the social insurance systems are among the major determining factors in the life course and in the distribution of life opportunities. The role of the welfare state may prove

to be especially important in current societal adaptations to global competition and decreasing public finances. Microanalytic and cross-national studies are required to unravel the mechanisms and consequences of different welfare state regimes and policies. Our guiding hypothesis for Germany holds that life courses are still relatively protected from pressures of flexibility, and that stability and continuity prevail.

Research Area 3

Hillmert, S. (2001a). *Ausbildungssysteme und Arbeitsmarkt. Lebensverläufe in Großbritannien und Deutschland im Kohortenvergleich*. Wiesbaden: Westdeutscher Verlag (290 p.).

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Research Area 4

Life-Course Research and Analysis: Theory, Methods, and Synthesis

This research area focuses on overarching topics and tasks: the provision of the empirical database for our studies, methodological problems of measurement, analysis, modeling, issues of general theory and empirical work on the full set of cohort studies.

The Center's research program is empirically based on a series of six retrospective surveys. These surveys rely on population probability samples and were conducted from the early 1980s up to the present day. They now comprise quantified of the life histories of 5,591 West German women and men (the cohorts born 1919–21, 1929–31, 1939–41, 1949–51, 1954–56, and 1959–61) and 2,923 East German women and men (the cohorts born 1929–31, 1939–41, 1951–53, 1959–61, and in 1971). Moreover, fieldwork has been concluded and data editing is in progress for an additional 2,911 women and men born in West Germany in 1964 and 1971. Detailed life histories were also obtained for the 516 participants of the Berlin Aging Study, who were born between 1887 and 1922. These surveys are retro-

spective studies. We also carried out a panel study in 1996/97, reinterviewing our East German respondents from 1991/92. Data editing, the development and maintenance of the database, and data documentation form an important part of our ongoing research work. In the coming years our efforts will concentrate on establishing a more user-friendly database containing these cohort studies and putting the data documentation into an electronic format. The Research Center's own data-sets are complemented with other German and non-German longitudinal studies, including the German Socio-Economic Panel (GSOEP), the Microcensus, the 1% sample of the Employment Register, the BIBB/ IAB (Federal Institute for Vocational Training and the Institute for Labor Market and Employment Research) Employment Survey, and the British Household Panel Study (BHPS). Our major methodological tools consist of dynamic models of discrete change in continuous time. Ongoing tasks include maintaining expertise and updating statistical software in this area, as well as improving practices of exploratory data analysis and representation.

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Current Research Projects and Research Associates of the Center for Sociology and the Study of the Life Course

Research Area 1 Education, Training, and Employment

<p>Education, Training, and Occupation: Life Courses of the 1964 and 1971 Birth Cohorts in West Germany (MPIB/IAB)—Cooperative Project with the German Institute for Labor Market Research</p> <ul style="list-style-type: none"> • Dissertation Project Patchwork or Career? Causes and Consequences of Multiple Educational Episodes • Dissertation Project The Career Start of Young Foreigners Who have Finished a Vocational Training in the "Dual System" in Germany between 1975 and 1995 	<p><i>Steffen Hillmert, Karl Ulrich Mayer, Antje Mertens, Heike Trappe; Stefan Bender (IAB), Hans Dietrich (IAB)</i></p> <p>Marita Jacob</p> <p>Holger Seibert</p>
<p>Education and Mismatch in the Labor Market</p> <ul style="list-style-type: none"> • Dissertation Project School Performance, Occupational Choice, and Labor Market Outcomes 	<p>Felix Büchel</p> <p>Matthias Pollmann-Schult</p>

Research Area 2 Life Courses in the Transformation of Former Socialist Countries

<p>Transformation of the East German Labor Market</p> <ul style="list-style-type: none"> • Dissertation Project Working Lives in Family Contexts 	<p><i>Anne Goedicke, Britta Matthes, Heike Trappe</i></p> <p>Anke Höhne</p>
<p>Transformation Processes in Poland and East Germany</p>	<p><i>Anne Goedicke, Britta Matthes, Bogdan Mach, Karl Ulrich Mayer</i></p>
<p>Bourgeois and Non-Bourgeois Intelligentsia in the German Democratic Republic: A Study of Biographical Upheaval</p>	<p>Erika M. Hoerning</p>

Research Area 3 Welfare State, Life Courses, and Social Inequalities

<p>Political Economy and the Life Course in Advanced Societies (POLIS)</p>	<p><i>Frances McGinnity, Steffen Hillmert, Karl Ulrich Mayer</i></p>
<p>Higher Education: Expansion, Institutional Forms and Equality of Opportunity (International Comparative Project)</p>	<p>Karl Ulrich Mayer</p>
<p>Higher Education in Germany and the U.S.</p>	<p>Gero Lenhardt</p>

Research Area 4 Life-Course Research and Analysis: Theory, Methods, and Synthesis

<p>Post-War Social Development as a History of Cohorts</p> <ul style="list-style-type: none"> • Dissertation Project Psychology of Autobiographical Memory and the Reliability of Retrospective Measurements 	<p>Karl Ulrich Mayer</p> <p>Maika Reimer</p>
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Projects Concluded in 2001–2002

Children in the Family: Division of Labor	Helga Zeiher
Education Report: Higher Education	Karl Ulrich Mayer

International Encyclopedia of the Social and Behavioral Sciences (Section on Biographies)—Editorial Project	Karl Ulrich Mayer
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Education, Training, and Occupational Careers

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The 1964 and 1971 Birth Cohorts

The 1980s and 1990s were a period of considerable social and economic change. Among the crucial factors that have shaped life courses during these two decades were educational expansion, occupational changes induced by shifts in labor demand, and demographic changes, such as increasing female labor force participation, and the entry of baby boom cohorts into the labor market. The research project *Education, Training and Occupation: Life Courses of the 1964 and 1971 Birth Cohorts in West Germany* looks at the consequences of these developments for individual life courses.

The project focuses on the links between education and the employment system during this period.

The 1964 and 1971 birth cohorts constitute the most recent part of the German Life History Study and adds up-to-date information to our life-course database, which now includes information on eight birth cohorts in West Germany and three birth cohorts in East Germany. Our life-course data give a detailed picture of the patterns of transition from general education to vocational or academic training, and from there into employment. In reconstructing the collective transition experiences of successive cohorts, we gain empirical access to the historical development of educational and occupational patterns for Germany from the 1930s onwards. The latest survey on the West German 1964 and 1971 birth cohorts includes nearly 3,000 interviews, the majority of which were conducted as computer-assisted telephone interviews. The main focus of this most recent study is on education, training, and occupation and is conducted collaboratively with the Institute of Employment Research (IAB) in Nuremberg.

We have made several analyses using preliminary versions of the dataset, but over the last three years, this data has also gone through a process of careful checking and editing (Hillmert, 2002b). Where necessary, respondents were even reinterviewed (approximately 35%). In the meantime, we have also been involved with supplementary work: This has included, in particular, a closer look at the historical context of the life courses we are observing, and the determinants of the collective opportunities of training and employment of whole cohorts. Obviously, the size of the birth cohort can be regarded as one crucial determinant. Therefore, it is interesting to compare the experiences of the 1964 birth cohort (the largest birth

cohort in the history of the Federal Republic of Germany) with the much smaller 1971 birth cohort (Hillmert, 2001c).

At first glance, it might be surprising that analyses with secondary data show that the relatively large 1964 birth cohort was not disadvantaged in quantitative terms with regard to access to firm-based training. The situation when having completed vocational training, however, was different. The 1964 birth cohort experienced a significantly more problematic entry into the labor market after completing vocational training: Those who left training, from this birth cohort, were unemployed almost twice as often as those of the 1971 birth cohort. When we take labor demand considerations into

account this picture can be better understood: The labor market entry of the 1964 birth cohort was negatively affected in three respects: by a relatively large cohort size, by relatively bad conditions in the labor market at this point of time, but probably also by relatively good conditions when beginning vocational training. Contrasting the two birth cohorts, one can see that all three factors have arisen concurrently, but in opposite configurations: The 1964 birth cohort was a large cohort, but as unemployment rates were low when people left school a large proportion of the birth cohort could enter training. When they completed their training, however, the general labor market situation had worsened considerably. Therefore, all three factors led to major problems of the vocational trainees when entering employment. The 1971 birth cohort was a small cohort, but as unemployment was high when they left school a rather smaller proportion of the birth cohort entered training. When these people completed their training, labor market conditions were relatively good. Therefore, in this case, all three factors led to minor problems for those completing vocational training successfully. Future analyses with the new life-course data will investigate how different pathways into the labor market have performed and how persistent advantages or disadvantages for these birth cohorts have occurred. They will look at the long-term consequences of these different experiences, that is, longer sequences in individual life courses. Another related topic for our future

research will be the question of whether the links between institutions and individual life courses had become weaker during the 1980s and 1990s. This so-called "de-standardization," although sometimes taken for granted in public debates, has barely been empirically evaluated.

The Early Decisions: Vocational Training or University Degree?

This and the following sections will show the variety of life-course stages that can be analyzed with our data. Starting with the beginning of a career, a major issue is to investigate, theoretically and empirically, the educational decisions at various ages.

Hillmert and Jacob (2002, in press) theoretically model the decision of school-leavers to enrol in university in different educational systems. In particular, the impact of an institutional alternative of vocational training (as in Germany) and the possibility to combine vocational and academic training have been examined. The comparative approach shows how different educational systems may increase social class differences with the participation in higher education.

We use a model of utility maximization, where the decision to enrol in one of the several offered educational tracks is determined by the expected returns of different enrolment alternatives. In a first step, we model the investment in higher education in an educational system that offers only the choice between academic training and employment. Then, we extend the model for a more differentiated educational sys-

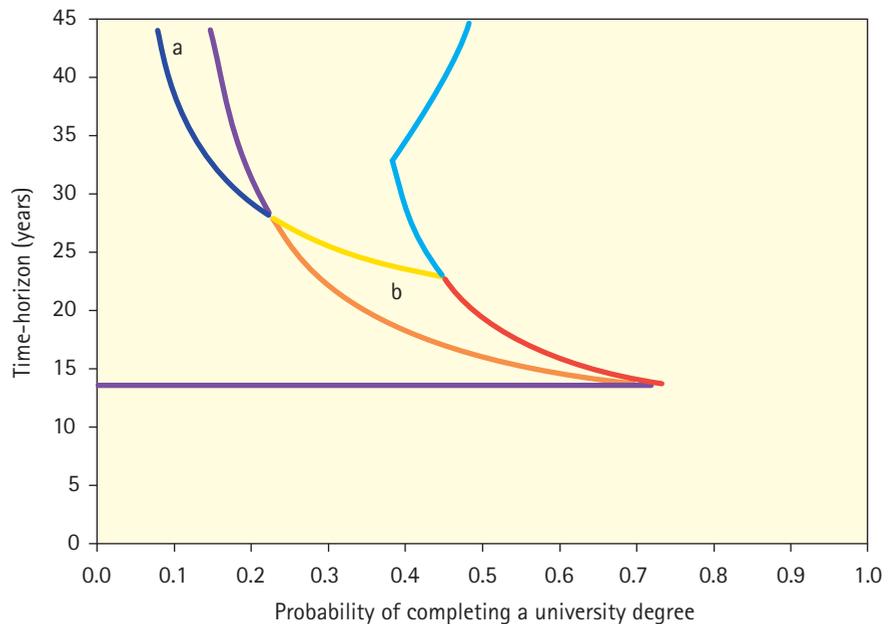
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tem that *ceteris paribus* offers an alternative to the academic track in the form of (shorter) vocational training. In the model, crucial parameters are the time-horizon of expected returns to education and the expected probability of successfully passing vocational training, thereby, attaining an academic degree. The major empirical information that is entered into the simulation is about wage differences between different qualification groups. We further assume that successful completion of vocational training also increases the expectation of academic success.

graphical representations (not shown here) for any educational track, areas indicate what kind of school-leaver, characterized by all possible combinations of the parameters, will opt for this particular alternative. Finally, these two “decision maps” of a system with and a system without a vocational track can be compared. This indicates who (again, characterized by time-horizon and expectation of success) may decide to study in one system, but not in the other (see Fig. 1). By introducing social differences as parameter differences, we question why the youth of lower social class

Figure 1. Given the subjective expectation of success p and time-horizon t —who is attending university? A theoretical comparison of a system offering vocational training to an educational system without vocational training (a = additional entrants; b = detoured entrants).



For any of the two systems, which educational track a person will choose, can be calculated depending on their subjective time-horizon and subjective academic success if they act rationally: no training at all, vocational training, academic training, or a combination of vocational and academic training. Therefore, in

origin might opt for vocational training instead of entering university after leaving school and why some of these apprentices may enter university at a later date. In this respect, the model offers an explanation why school-leavers of different social origin(s) have incentives to choose different educational paths,

even if they have the same level of school qualification. There is also evidence that the populations in the different tracks may be different with respect to average achievement. Such insights are also important for public policy, for example, for targeted financial support to increase enrolment rates of students with lower social class background. Theoretical considerations, such as these, will help us to focus our empirical research on specific analytical problems.

The Influence of Training on Labor Mobility

The mobility of labor plays a major role both for individual work careers and for the functioning of labor markets (Mertens, 1998; Mertens, 2002). From the individual point of view, mobility may be an important means for the workers to improve their own economic position. This has frequently been proven especially in the U.S., where job-changing decisions account for at least one-third of the early career wage growth. Moreover, mobility is also a prerequisite for a functioning economy under structural change. On the other hand, excessive mobility is often said to be undesirable for the economy as a whole and the individual in particular during the early stages of their career. We know that too many job switches and interrupting unemployment periods may lead to losses in human capital, decreasing earning potentials and limited capability to obtain employment due to disadvantage signals. Furthermore, economy wide, long-term labor relationships might be one prerequisite for a highly educat-

ed workforce, which is, to a great extent, responsible for the economic success of a country.

In a recent project we combined our data with Swedish data to question which vocational training systems are best to facilitate the mobility of workers. Does it matter how vocational training is acquired? In particular, should vocational training also be offered within the general educational system or just within the (still) standard apprenticeship system? To answer this question, we looked whether the mobility of those with firm-based vocational training differed from those who received their vocational training in school. This would appear to be an important prerequisite for educational reform that attempts to facilitate structural change.

One of the arguments in favor of an apprenticeship system is that this facilitates labor market entry. Due to the higher proportion of firm and occupational specific training, it is believed that apprenticeship systems reduce job shopping at the beginning of the working life. However, while it is usually assumed that a greater proportion of school-based training is transferable between different jobs, firms, and employers, recent research on mobility among apprenticeship-trained workers in Germany suggests that the links between vocational training and mobility are more complicated. After completion of an apprenticeship, mobility is relatively high, both between firms and occupations. Hence, it has been suggested that a nonnegligible percentage of the training is general. If this is the case, it becomes more uncertain

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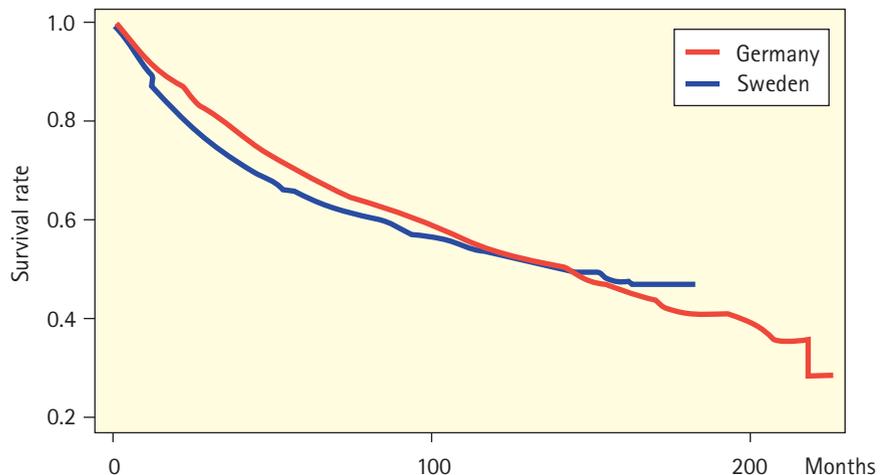
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that the mobility outcomes of an apprenticeship system differ from those of a system in which vocational training is provided in schools, rather than in firms.

In Korpi and Mertens (in press), we therefore, examine the link between the different types of human capital and labor market mobility. Specifically, we focus on whether the impact of apprenticeship training on firm, occupation, and industry mobility differs from that of vocational training in schools. We compare mobility patterns of apprenticeship-trained workers in Germany with that of vocationally trained workers in Sweden, who received their training in full-time schools. Since the apprenticeship system in Germany and the system of school-based vocational training in Sweden are the standard routes to vocational qualifications in the two countries, the two groups could be expected to be relatively similar.

These comparisons show first of all that overall mobility rates, not attributable to any measurable covariate, are higher in Sweden than in Germany. Looking deeper into the mobility patterns, we find that no stable differences in inter-firm mobility can be discerned with regard to the type of vocational training. Figure 2 shows that the German survivor function for a typical vocationally trained worker lies slightly above the Swedish curve, however, the difference is not significant. This suggests that the proportion of truly firm-specific skills acquired during a German apprenticeship is rather low in relation to the transferable skills obtained. It also implies that there is little evidence for one of the purported advantages of an apprenticeship system in relation to a system with school-based vocational training: It does not eliminate unnecessary and detrimental job shopping during the early stages of the career

Figure 2. Employer changes: Baseline survivor functions for representative individuals.



Note. Based on Cox proportional hazard rate models with stratified baseline hazards. The reference person has one-year working experience, vocational training, works in the metal industry in a large firm, and has parents with lower secondary education. Unemployment and industry employment growth are evaluated at the mean.

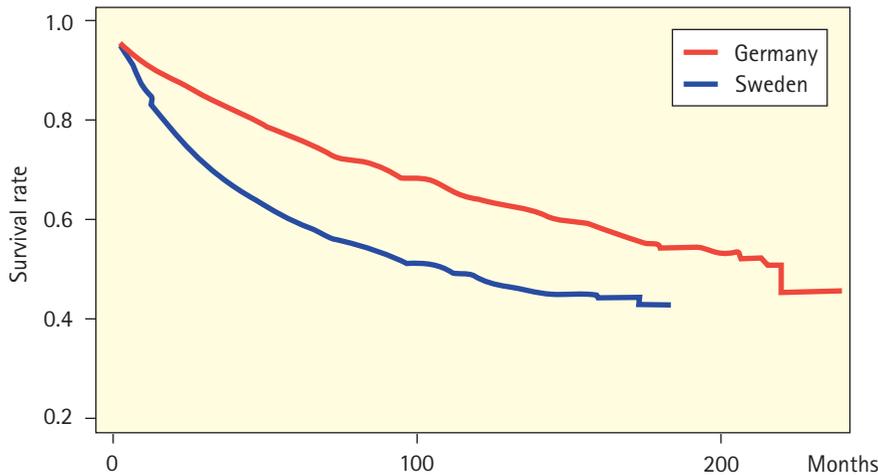


Figure 3. Occupational changes: Baseline survivor functions for representative individuals.

Note. Based on Cox proportional hazard rate models with stratified baseline hazards. The reference person has one-year working experience, vocational training, works in the metal industry in a large firm, and has parents with lower secondary education. Unemployment and industry employment growth are evaluated at the mean.

and does not simplify labor market entrance.

On the other hand, the results on inter-occupational mobility suggest that the German labor market, indeed, is more structured around training occupations than in Sweden where vocational training is school-based. Former apprentices have lower inter-occupational mobility indicating that the skills obtained are less general than those gained through vocational schools (see Fig. 3). This would seem to contradict claims that the completion of an apprenticeship is a signaling device of worker quality rather than of occupational skill acquisition.

It is undoubtedly disadvantageous if individual careers require occupational mobility. Negative side effects can also be expected if occupational flexibility is a necessary component for structural change. However, both educational systems seem equally conducive to industrial relocation, as no country differences in inter-

industrial mobility are found (Korpi & Mertens, 2002). We therefore conclude that although apprenticeship training would appear to reduce occupational flexibility over the work career, with regard to economic adjustment, the choice between vocational training systems would seem rather inconsequential. In future work by Mayer and Mertens, the relationship between training type and labor mobility will be looked at in more detail using six West German birth cohorts from 1940 to 1971. Bergemann and Mertens (2002) have already shown that there seems to be a tendency for a decline in job stability during the 1980s and 1990s. Our new project will enable us to observe whether this is indeed a long-term trend. We will ask whether it has really become more difficult to find a lifelong job since the late 1950s and, moreover, whether any differences between distinct educational groups can be found.

Fixed-Term Contracts, Wages, and Transitions Between Different Labor Market States

Another research area is also related to the question of how to facilitate economic adjustment and mobility. In McGinnity and Mertens (2002), we investigate whether the use of fixed-term contracts, intended to facilitate mobility, has significant (negative) effects on individual career paths. These contracts are often also called temporary contracts, although temporary work can additionally include agency or casual and seasonal work. This research, however, focuses on those contracts that are, by definition, not open-ended, but fixed to a maximum duration from the start.

Labor market theories differ in their perspectives on temporary employment. For some approaches, temporary employment is perceived to be disadvantageous for the labor market situation, resulting in low wages, bad employment conditions, and poor future prospects, in other words, a "trap." In favor of this hypothesis is evidence from a number of European countries showing that workers on a fixed-term contract tend to earn less than comparable coworkers. For others, temporary employment is seen as a stepping-stone to permanent employment, often facilitating the transition into working life from outside the labor market, in other words, a "bridge." In our work, we give some intriguing new insights into wage differentials and wage dynamics, and the transition behavior of fixed-term contract workers using the German Socio-Economic Panel (GSOEP) for East and West Germans. Later studies

will use the new life-course data to supplement these results. Overall, we find that temporary employment in Germany is not as disadvantageous as many people believe, but that temporary employees are a heterogeneous group. In fact, it seems to make sense to speak of a "two-tier" market for temporary employment. Building on previous research on the wages of temporary employees that had found negative wage differentials for employees on fixed-term contracts compared to permanent employees (Germany, Spain, France, UK), we show that ignoring unobserved differences between individuals somewhat overestimated the wage differentials between permanent and temporary workers. However, the wages of temporary workers are still lower on average, which seems to indicate some discrimination or segmentation of the labor market. Controlling for endogeneity of the contract type variable, on the other hand, makes the wage differential become insignificant. This indicates that workers on fixed-term contracts tend to be those who earn lower wages. Looking at wage growth for two-year, five-year and ten-year intervals, we further show that, on average, West German male workers with fixed-term contracts in the base year have higher wage growth. West German women experience higher wage growth at least in the short-run and East German men in the long-run. However, splitting up the sample by quintiles we found that fixed-term contract workers are only overrepresented in the top quintile and higher wage growth is not at all an overall phenomenon of fixed-term con-

tracts. This indicates that the screening hypothesis may only be relevant for some (better educated) temporary workers. Results for East and West Germany are rather similar, though if anything overall differences between temporary workers and permanent workers are not as marked in East Germany, at least in terms of wages.

The screening hypothesis is further supported by the transitions analysis: We find that approximately 40% of all temporary workers are in a permanent job in the following year. Most of these permanent jobs are with the same employer. However, since 12% to 18% of the temporary employees are unemployed the following year, temporary employment could also be seen as a risky labor market situation. Multivariate modeling reveals to whom these rather different scenarios apply: At least in the medium term, workers with more education tend to find permanent employment.

These findings indicate considerable heterogeneity of outcomes for temporary employees, which supports the idea of a two-tier market for temporary employment in Germany. For highly skilled jobs temporary employment functions more as a screening contract, a probation period, after which the employee is offered a permanent job and experiences rapid wage growth. For other jobs, that is, low-skilled jobs with low qualification requirements, employers use temporary workers to regulate fluctuations in demand. For the individual employee in this kind of temporary job, a permanent job is not guaranteed afterwards and, therefore, temporary employment is

an insecure labor market position. Workers falling into what is arguably the "middle-tier" in Germany—those with apprenticeship training—are less likely to obtain a fixed-term contract. We argue that the period of apprenticeship training already allows employers to screen workers, reducing the requirement for fixed-term contracts. Indeed, in further research it would be interesting to investigate, in more depth, how the consequences of fixed-term employment are influenced by the existence of a widespread and highly developed system of apprenticeship training, such as the system existing in Germany.

The question of what proportion of temporary employees falls into each of the categories is more difficult to quantify. The wage growth estimates indicate rapid growth for a smaller group of temporary employees. However, the transition analysis suggests that, at least in terms of the move to permanent employment, a significant proportion of temporary employees achieve permanence, even in the very short term (if we exclude ABM contracts, i.e., East German workers in employment programs). On balance, we conclude that the findings lend more credence to the probation perspective, with temporary employment providing a "bridge" for many into permanent employment. Certainly, outcomes for temporary employees seem much more favorable in Germany than in Spain, where conclusions on temporary employment are much more pessimistic.

East and West German Life Courses in the 1990s

Since the beginning of the political, economic, and social changes that took place in the former German Democratic Republic (GDR) after 1989, we have developed a unique database that includes quantitative life-course studies on five East German birth cohorts as well as qualitative accounts of institution (re)building and individual biographies. These data allow us to study the societal transformation in East Germany in a dynamic, longitudinal, and cross-national perspective. During the last decade, our research concentrated on a reconstruction of the GDR-society as well as on the consequences of the societal changes after 1989 for the occupational careers and family histories of East German women and men. The last two years were characterized by an increasing attention on the labor market entry of young persons. We studied, from an East German as well as from a comparative East-West German perspective, both how young women and men who received their schooling and, in most cases, an occupational training in the GDR managed the first steps into their occupational careers in unified Germany. Their life histories are obviously marked by occupational reorientation and a considerable postponement of childbirth. While many features of the early employment histories in East and West Germany are shaped by common traditions of education and occupational training, for example, the strong emphasis on "dual" firm- and school-based forms of training, the different economic circumstances of labor market entry and diverging employment traditions are responsible for a number of continuing differences.

Our main data come from two surveys carried out in 1991/92 and 1996/97 that collected life history information for the birth cohorts 1929–31, 1939–41, 1951–53, and 1959–62. While the first interviews captured the lives of these women and men in the GDR and the immediate unification period, the second survey allowed following the same people through the time of societal transformation. Approximately 60% of the more than 2,300 women and men, who participated in 1991/92, could be reinterviewed in 1996/97. A fifth cohort, with more than 700 persons born in 1971, was added in the second survey. The design of the questionnaire allows comparisons of this cohort with (a) the older East German cohorts, (b) the West German 1971 birth cohort, and (c) a Polish 1971 birth cohort which was surveyed by Bogdan Mach from the Polish Academy of Sciences in Warsaw. Our data are complemented by a cross-sectional postal questionnaire from 1993 which provides information on social networks, control beliefs, and self-effectiveness estimates, thus, allowing us to study these issues over time, and by a nonresponse survey carried out in 1996/97 with persons who were in the original sample, but did not participate in 1991/92.

Consequences of the East German Transformation on Labor Market Entry

During the system transformation in East Germany, the close linkages between the educational and the employment system were weakened. Regulated labor market entry, con-

tinuous employment, predictable occupational career, and family formation were superseded by uncertain educational and occupational options. What consequences did the transfer of the educational and training system from West to East Germany, the loss of guaranteed

future employment in the training firm, the huge economic restructuring, extensive occupational change, and the rising mass unemployment have for the labor market entry? Research on changing labor market entry during East German transformation documented a continuous structural deficiency of the system of transition from school to employment (Konietzka, 2001). But, even up to now, it is unclear what mechanisms determined labor market entry during transformation. The investigation of labor market entry during East German transformation is confronted with a particular theoretical challenge. The transition from school to work and the changing linkage between the educational and employment system need to be conceptualized as interdependent processes. An analysis of present approaches shows that conventional methods and instruments obviously cannot manage this problem. In her doctoral thesis, Matthes (2002) argued that the adequate investigation of labor market entrance procedure during processes of institutional change might be safeguarded by a combination of different analytical perspectives. On the one hand, if we find labor market entry to be highly standardized and unchanged, we will only look at the investigation of the average labor market entrance patterns. On the other hand, if a large or increasing number of destandardized labor market entrance patterns exists, this procedure tends to result in misleading interpretations. Therefore, it is necessary to take the tendencies of destandardization into account: What conditions ac-

complish a definitive (labor market entrance) event earlier, later, or not at all?

In Matthes (2002) we look at these questions based on our retrospective longitudinal data collected in the project "East German life courses after the Unification." Starting from the analysis of the institutional linkage between the educational and employment system before and after transformation, the transition from school to employment of people born in 1971 in East Germany is compared with those of the 1959–61 cohort. It is apparent that the time of labor market entry of young people starting vocational training or extended secondary schooling before 1989 was delayed compared to the time of labor market entry in the GDR. The completion of the first vocational training was already delayed as a result of the increase in numbers of young people who had to leave vocational training without certificate (due to closures of establishments, terminations of branches of study, and closures of educational institutes). Further, it was delayed by the clearly extended duration of gaining a university degree. Moreover, many labor market entrants who were unable to find a job after their apprenticeship moved on to a second vocational training. However, the difficulties of the transition from vocational training into the first employment, during East German transformation, were less dramatic than expected. Apparently, these were prevented during the early 1990s because apprentices were still employed by their apprenticeship firms and due to generous retraining measures.

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Connectivity of Occupational Certificates

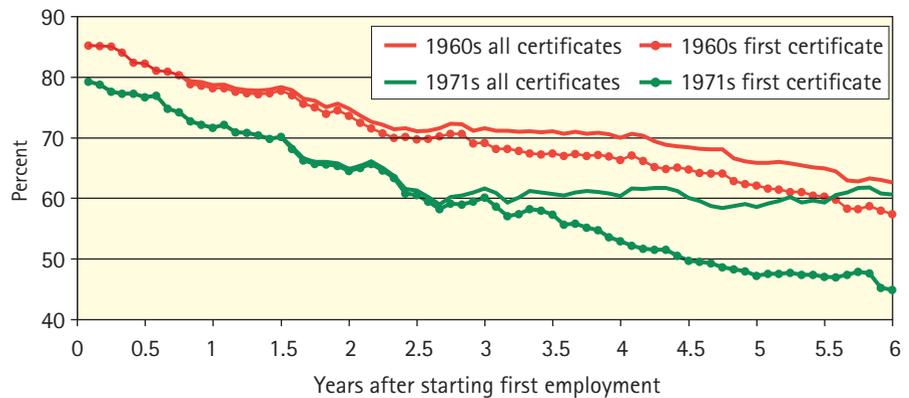
The training occupation certainly is a major determinant for an uninterrupted and unproblematic labor market entry. For those who started vocational training before 1989, many certificates proved to be appropriate for the rapidly changing labor market and there were strong links between vocational training, the first job taken, and the early occupational career even during East German transformation. In the 1971 cohort, a large percentage of the occupational certificates have, how-

tainty about the further economic structure—provided a possibility to avoid unemployment temporarily. However, this additionally did not necessarily have the expected effects on later employment careers.

Gender Differences

In comparison to young men, women's labor market entry lengthened to a greater extent. Conversely, if they were able to find employment after finishing vocational training, women and men were equally likely to find a job matching their vocational training (see Fig. 5).

Figure 4. Congruence of occupational activity and certificate.



ever, been devaluated during the East German transformation as can be seen from Figure 4.

Young people trained in occupations that proved to be nonappropriate to the changing labor market were faced with the question of whether they should attend another vocational training. In general, vocational retraining may be interpreted as an arrangement to readjust the employee's qualifications to the requirements of the labor market. But, in the case of the East German transformation, vocational retraining—due to the substantial uncer-

Particularly women, who attended a vocational training in social services or education, were employed more frequently and also remained longer in the occupation and position for which they were trained. The gender-specific segregation of the apprenticeships in the GDR simultaneously aggravated and weakened the inequality between women and men. Obviously, during East German transformation, employment possibilities were more strongly differentiated between women with different educational levels and occupational certificates than between

men. Additionally, the incorporated West German institutions of family policy differentiated stronger between women in different family positions than in the GDR. Childbirth and child-care in the GDR did not prevent women from being employed. During East German transformation, young mothers were almost completely excluded from

the labor market. Cohabitation—an almost irrelevant criteria in the GDR—became more important for the labor market entry. A young cohabiting person was employed more often in the same occupation continuously, but experienced discontinuity more in their further educational and employment career.

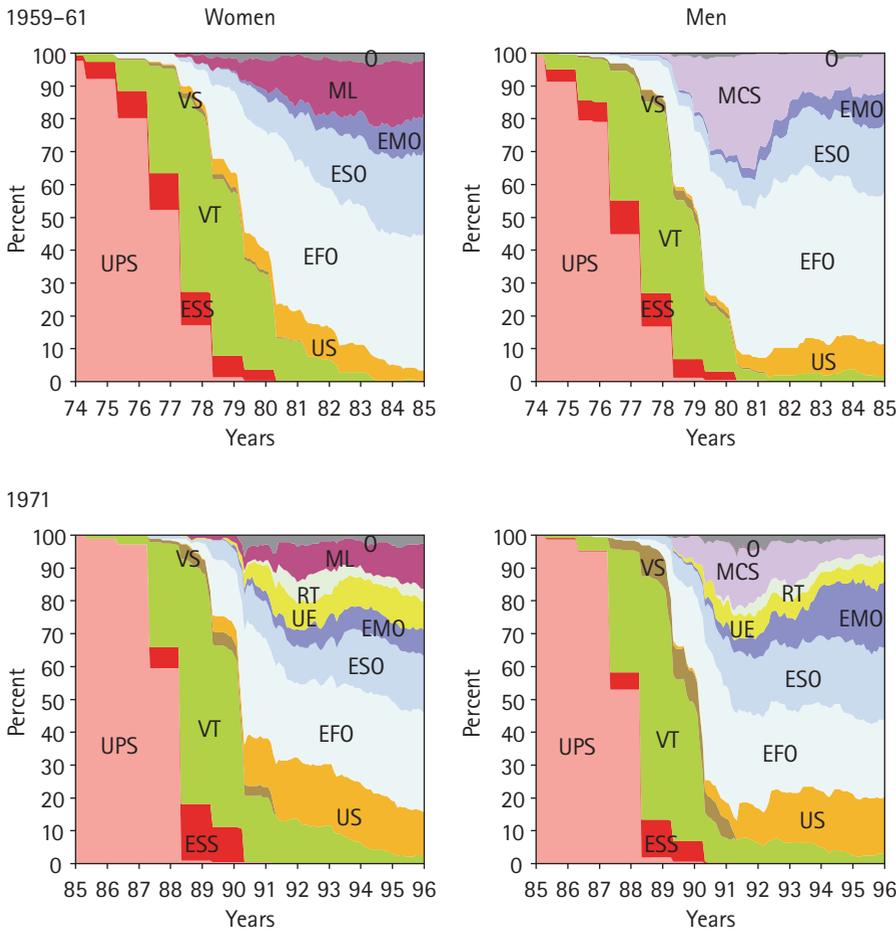


Figure 5. Distribution of education and employment by historical time.

UPS = Unitary Politechnical School (POS); ESS = Extended Secondary School; VT = Vocational Training; VS = Vocational Stream of extended secondary school; US = University Study; EFO = Employment in First Occupation; ESO = Employment in Second Occupation; EMO = Employment in third and further Occupation; UE = Unemployed; RT = Retraining; ML = Maternity Leave; MCS = Military or Civilian Service; O = Others.

Occupational Sex Segregation

The division of labor markets into jobs for women and jobs for men is analyzed in another project. This is especially interesting because two highly sex-segregated, but distinct employment systems have begun to merge since unification in 1990. An extraordinary opportunity is provided, therefore, to study how sudden changes in institutions and economic conditions in a society shape mechanisms of gender inequality. In a series of papers, Trappe and Goedicke analyze whether East and West Germany showed convergence or continuing differences of female and male work domains in the course of the 1990s. Levels, patterns, and trends of occupational segregation by sex at the macro-level of society have been studied (Goedicke & Trappe, in press) as well as the consequences of gender-typed occupations for individual employment opportunities (Trappe & Goedicke, in press). The analyses combine two types of data: Longitudinal data from the German Life History Study for the East and West German 1971 birth cohort informs about individual employment careers. Microcensus data from a 1% household population survey provide information about the distribution of women and men across 249 occupational categories and have been available for East and West Germany since 1991.

Levels and Major Differences in Patterns of Occupational Sex Segregation

At the beginning of the 1990s, both the East and West German labor markets were characterized by a

high degree of occupational segregation. For the year 1991, the Duncan Index of dissimilarity shows that more than 61% of all employed women (or men) in the East and almost 57% in the West would have to change their occupations to reach an even distribution.

However, the patterns of occupational segregation behind these relatively similar levels of segregation were rather different. In both parts of Germany, male occupations (with more than 70% men) outnumbered female occupations (at least 70% women). Conversely 23% of all occupations in East Germany, compared to only 14% in West Germany, were female.

An examination of the distribution of the workforce across gender-typed occupational fields corroborates that the East German employment system was "more female" than the West German system in the beginning of the 1990s. This difference between the distributions was mainly produced by women in East Germany, who concentrated much more in gender-typed jobs than in West Germany. While two-thirds of all East German women worked in female occupations, nearly half of all West German women were occupied in a mixed occupational field with 30% to 70% men. Some occupations differed in their gender type between the two regions, for example, a clerk was a mixed occupation in the West, but a predominately female occupation in the East. These patterns were caused by the different employment traditions of women in East and West Germany and result from dissimilarities in the industrial structure in the form of

job queues, gender ideology, labor requirements, and family policies between the GDR and the FRG before unification. Throughout the 1990s, female labor force participation in the East remained more than 10 percentage points higher than in the West, despite the fact that it declined rapidly during the first years after unification. East German women, even with small children, regard their employment as a matter of course and economic necessity, because the men's jobs are often insecure and wages remain lower than in the Western part of the country.

Diverging Trends in Occupational Sex Segregation

During the 1990s, there was basically no decline in the extent of separation of women and men at work in West Germany. In East Germany, occupational segregation even increased slightly due to the changing occupational structure as well as due to changes in the sex composition within occupations (Rosenfeld & Trappe, 2002).

A closer look at the percentage of women and men in certain occupations (see Fig. 6) reveals that East Germany was in an exceptional situation in the 1990s. While women made inroads into formerly male work domains throughout the Western world since the 1970s, in East Germany relatively more occupations had a tendency toward "masculinization," compared to "feminization." In West Germany the picture was rather balanced. The work domains, with increasing percentages of men in the East, include occupations from the full range of skill hierarchy, from university professors to warehouse laborers. They contain many qualified white-collar jobs (e.g., bank employee, social worker, tax consultant, librarian) that had been woman-dominated at unification. Resegregation takes place especially within the industrial sector and in agriculture with occupations that were mixed or male becoming more male. This increasing closure of male-dominated occupations toward women is largely responsible for the persisting high

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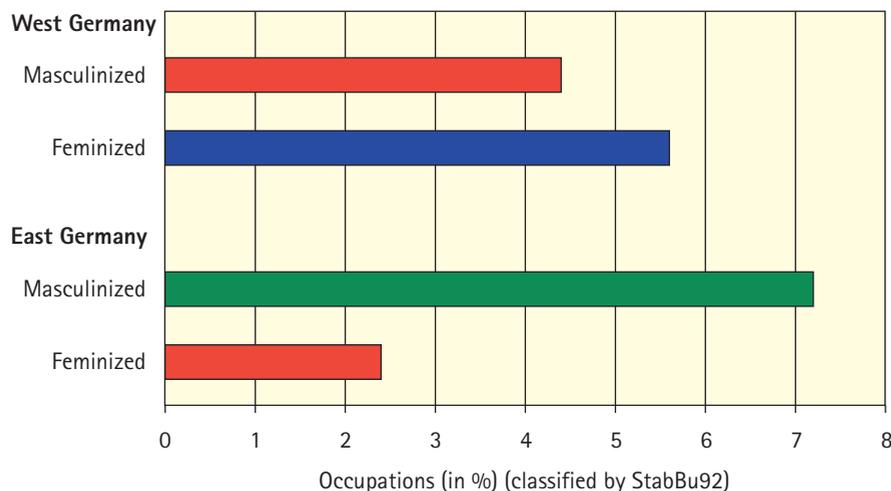


Figure 6. Changes in the gender composition of occupations between 1991 and 1997 (at least 5 percentage point difference).

level of segregation in East Germany while the intrusion of men into qualified jobs, once dominated by women, increases competition among women and men within those occupations that might have been previously less competitive. In the West, occupations gaining a relatively higher percentage of men are mainly middle-level blue-collar jobs in crafts and industries that had been previously mixed or male-dominated. Many of the service economy jobs, in which West German women increased their representation, are located at the middle or upper part of the qualification spectrum (e.g., judge, physician, financial official, legal representative).

To investigate the relationship between macro-level patterns of segregation and individual employment prospects we will look now at some correlates and outcomes of occupational sex segregation in East and West Germany. By using life-history data, we explore how occupational segregation occurs and is maintained.

High Levels of Gender-Typed Occupational Training and Early Careers

For young women and men who were born in 1971 in East and West Germany, occupational training and labor force entry took place in highly gender-segregated work domains. With one exception, women and men were crowded within occupations that were dominated by their own gender. Due to their high share among office clerks, West German women were more likely to be trained and employed in a gender-integrated occupation than East

German women. This was true for every second West German, but only every fourth East German woman. In contrast, two out of three young women in East Germany were trained and employed in a female-typed occupation (e.g., secretary, nurse, preschool teacher). While it is well known that women are confined to a limited range of occupations, generally not much attention is paid to the fact that men are even more likely to work in occupations dominated by their own gender.

More than two out of three West German and even four out of five East German men of that birth cohort received their training in a male-typed occupation (e.g., electrician, mechanic). Due to the tight linkage between the training and the occupational system, gender segregation in the former was largely transmitted to the latter. We find high levels of occupational segregation across the early work life, as well as evidence of the "holding-power" of occupations with a concentration of incumbents of the worker's gender. Mobility between occupations of different gender types is a rare phenomenon and the power of occupational certificates to shape young persons' employment trajectories persists over the early career.

Different Consequences of Gender-Typed Training for Women's Labor Market Entry in East and West Germany

Investigating consequences of gender-typed occupational training on women's and men's employment, we concentrate on two important dimensions: status-adequate and con-

tent-adequate employment. Following their occupational training, at least 87% of young women and men in both parts of Germany obtained their first job in accordance with the level of their training and at least 79% worked in an occupation for which they were trained. However, remarkable differences exist according to the gender type of training received, especially for women. Obviously, women's employment opportunities are more affected by a gender-typed occupational preparation than men's. East German women with female-typed training had higher chances to enter the labor market in a status-adequate occupational position as well as in the occupation for which they received training than women who completed their training in an integrated or male-typed occupation. These effects were largely due to the lower unemployment risks and more favorable employment prospects in occupational fields dominated by women in East Germany or, more generally, to the relative growth of the service sector. In contrast, West

German women, who were trained for female-typed occupations, subsequently carried higher risks of working below their acquired qualifications than women who received other types of training. These different results for women in both parts of Germany indicate that consequences of gender-typed training are modified by economic development and occupational change that varied considerably in East and West Germany in the 1990s.

Persisting Inequalities of Opportunities for Adequate Occupational Placement Over the Early Employment History

Further empirical analyses show that the consequences of gender-typed occupational training are not limited to labor force entry, but persist over the early employment history. As Figure 7 illustrates, the initial contrast between young women in East and West Germany was still evident later. While East German women, who received their first vocational training or higher education for a female-typed occupation, spent

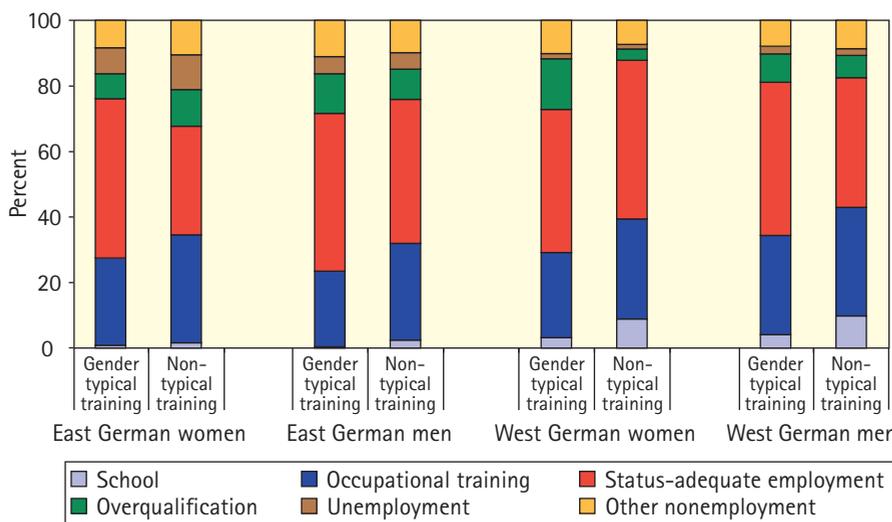


Figure 7. Time spent between age 18 and interview according to gender type of first occupational training (1971 birth cohort).

relatively more time working at the level for which they were trained and less time working below their qualification than women who received different training or education, the opposite was true for West German women. Here women with gender-typed training were relatively more affected by overqualification than women who received training for occupations with a higher share of men. This difference points to risks that are often associated with female-typed occupations, for example, fewer opportunities for upward mobility and further education. At the same time, the East-West

difference that is prevalent for women only, makes clear that the relationship between occupational sex segregation and employment rewards depends on the larger economic development.

At the macro-level, our findings refuse ideas about fast convergence of employment divisions between women and men in East and West Germany. At the level of individual employment histories, we have shown that consequences of occupational segregation vary between the gender groups as well as between different characteristics of careers.

The Center for Sociology and the Study of the Life Course 2002



Left to right: (front row) Frances McGinnity, Maike Reimer, Marita Jacob, Matthias Pollmann-Schult; (middle row) Erika M. Hoernig, Holger Seibert, Karl Ulrich Mayer, Anke Höhne, Juan Rafael Morillas Martínéz; (back row) Anne Goedicke, Felix Büchel, Antje Mertens, Heike Trappe, Britta Matthes, Steffen Hillmert; not pictured: Helga Zeiher, Alessandra Rusconi, Gero Lenhardt.

Political Economy and the Life Course in Advanced Societies (POLIS)

In various studies, we put the empirical results about education and training in Germany into an international context. Especially Britain with its very different system of education and training and its deregulated labor market, has been a particular point of reference for the analyses of educational and employment careers.

Different Welfare State Regimes and First Labor Market Experiences

Hillmert (2001a, 2002d) compares processes of labor market entry and early career stages in Britain and West Germany, starting from the characteristics of the respective institutional structures in which human capital is formed and allocated. The two national systems of formal institutions can be regarded as generating particular modes of coordination between education and the labor market, that is, that the labor market integration of young people follows different rules in the two countries. A general model that distinguishes between a horizontal, a vertical, and a temporal dimension of the process of integration into the labor market provided a frame of reference. These dimensions are also pursued in empirical terms: Effects of formal qualifications on the quality of the first employment are assessed and the multidimensional stability of entry positions in early careers is analyzed. In Britain coordination is, to a larger extent, achieved by the criteria of timing, in addition to the hierarchical grading of qualifications; in Germany the latter, as well as substantive occupational skills, play a major role. There have also been important historical changes

in these dimensions, especially in Britain.

Welfare State Regimes and Unemployment

Comparing Britain and Germany in the 1990s, McGinnity (in press) looks at how welfare policies affect outcomes for individual unemployed persons. In Germany, unemployment is seen to be more of a risk which individuals insure themselves against, the insurance being administered by the state. In Britain, compensation for the unemployed is primarily through means-tested benefits, paid from tax revenue only to those in need. McGinnity studies the implications of these major differences in welfare provision for the lives of the unemployed people. She addresses these issues by combining an in-depth analysis of unemployment policies with a detailed statistical analysis of individual outcomes using large similar nationally representative data sources (BHPS and GSOEP). The principal outcomes considered are (a) income poverty rates and income change, (b) durations of unemployment, and (c) the effects of unemployment on the labor market transitions of partners. In general, relative income poverty rates and income falls are greater for the unemployed in Britain than in Germany, but differences between

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types of benefit are greater in Germany. The unemployed receiving Social Assistance (Sozialhilfe) in Germany are a marginalized group, and face a very high risk of poverty as well as unemployed single mothers in Germany. Indeed, household situation is very important for understanding the risk of income poverty among the unemployed—a cushioning effect of second earners is found in both countries.

McGinnity (in press) then compares durations of unemployment in Britain and Germany among stronger and weaker labor market groups—the weaker groups being women, youth, and low skilled. Unlike in other highly regulated labor markets, only women are significantly disadvantaged in Germany, relative to Britain. Comparing the effect of unemployment benefit on exit from unemployment, it is crucial to consider the effect of benefits not in isolation, but in conjunction with the education systems, labor market regulations, and family structures. In addition, one needs to consider the effect of those who leave the labor market for unemployment durations.

In a closely related paper, McGinnity (2002) compares the effect of unemployment and welfare benefits on the labor market behavior of other family members—in this case the wives of unemployed men. When one partner in a couple becomes unemployed, one might suppose that the other partner will find a job to supplement the household income. While some evidence of the predicted added worker effect is found in Germany, results indicate a disincentive effect of means-tested

benefit on partners' employment in Britain. These findings suggest that the effects of the benefit system on a partner's employment should be considered in both the debates on comparative welfare regimes and the policy discussion of "workless" households.

Some of the policy implications of this research are that while an unemployment insurance system, such as in Germany, may be costly, it has the advantage of lower rates of income poverty among the unemployed and fewer disincentives for partners of the unemployed to work. A means-tested benefit system with low rates of benefit, like the current British system, does not guarantee quicker reemployment and may discourage partners of the unemployed to look for work.

Social Class and Unemployment

McGinnity and Hillmert (2002) have investigated the salience of class structures in a comparative perspective. How is the risk of unemployment distributed among social classes, and has there been a trend in recent decades? Some commentators argue that societies are becoming increasingly individualized, with unemployment affecting a large proportion of the population, while social stratification researchers claim that significant class inequality in life prospects persists. Are such processes similar in all countries? Differences in education systems, welfare, and labor market institutions probably have implications for class-related risks. There is a significant difference between the British and German institutions. Therefore, the key research questions have

been: How does the risk of unemployment vary by social class in different cohorts and across the two countries? Using life-course data spanning nearly 30 years, McGinnity and Hillmert found (see Fig. 8) that in both countries class has been a good predictor of unemployment

risks, although for most cohorts there has been less difference in class-related risks in Germany. There is no evidence of an equalization of unemployment risks across cohorts. Rather, the story is mainly one of rising inequality in Britain and persisting inequality in Germany.

Britain

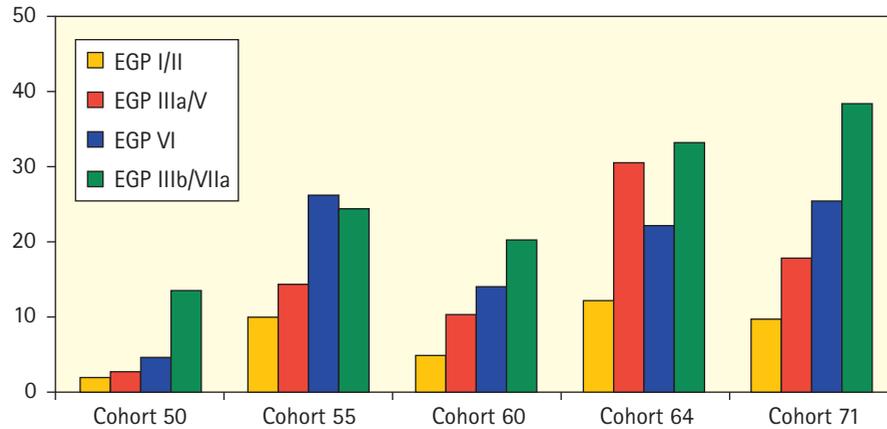
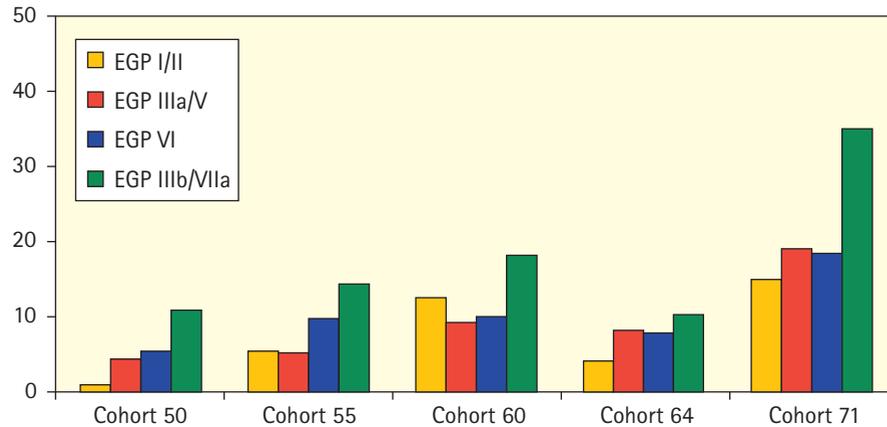


Figure 8. Class-specific risk of unemployment, by birth cohort, age 25.

Germany



Note. Class-specific risk measured at age 23 for the birth cohorts 1971, due to limited observation periods. Social class was coded according to the Erikson-Goldthorpe-Portocarero (EGP) schema (Erikson & Goldthorpe, 1993). The class position of unemployed people is defined by the social class of the last job. To focus on a more specific part of the employment system, we do not consider self-employed and agricultural workers. For reasons of sample size, we aggregate the other classes into four groups, which are theoretically relevant for our investigation, namely (1) Upper service class, EGP I and II, (2) Routine service class and supervisors, EGP IIIa and V, (3) Skilled manual workers, EGP VI, and (4) Unskilled manual and non-manual workers, EGP VIIa and IIIb.

Education and Mismatch in the Labor Market

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Productivity Losses Caused by Overeducation and Suboptimal Female Labor Supply

It is well recognized that unemployment causes great welfare losses and social problems in all industrialized societies. However, it is less obvious which losses are generated by the fact that even employees might have unused and, therefore, unproductive skills when working in jobs for which they are overqualified. Skills are also unused when people's labor supply, here especially the mothers', is restricted by family constraints. One of the main aims of this project is to draw attention to these facts and to show that the actual loss produced by mismatch in employment considerably exceeds the loss indicated by unemployment statistics, even if analyses of hidden labor reserves are taken into account. An important question within this project is how these hidden labor reserves can be reactivated.



German research focusing explicitly on overeducation is still rare, but rapidly developing. In terms of publication activities, this project is, by far, the most productive in Germany. After the Max Planck Institute for Human Development (MPIB) Mismatch Project was initiated in 1998, it released more than 20 publications. These include an edited volume that gathers selected papers from our November 2002 conference—the first conference that explicitly focused on overeducation, jointly organized by the Research Centre for Education and the Labor Market (ROA) at Maastricht University and the Mismatch Project. The program reflected the state of the art in ongoing overeducational research.

Labor Market Entrants and Overeducation

An important part of the project in past years focused on the labor market entrants in Germany by using data from our Life History Studies. Although the German school system is characterized by a strong and persistent trend toward higher education, most German school-leavers still enter into vocational training in the form of an apprenticeship. We tested whether the vocational training system is capable of adapting to the changed circumstances, that is, to continue to offer young people a form of training that will protect them from later unemployment or overeducation (Büchel 2002c). In this paper, the quality of labor market entry achieved by newly qualified apprentices in West Germany is analyzed from 1948 to 1992. A bivariate probit model, using data from the BIBB/IAB Employment Survey, is applied to simultaneously estimate the quality of the school-to-apprenticeship transition and that of the later apprenticeship-to-work transition. This shows that school-leavers with lower levels of general education have been selected into apprenticeships with less favorable employment prospects in all analyzed time periods. However, when controlling for this selection effect, it is only in the most recent period that people with lower academic achievement are further penalized for the shortcomings in their general education in the apprenticeship-to-work transition. Furthermore, the crowding-out of trainees with lower levels of general education could have been observed in both the less demanding

and the more challenging occupational fields. Concerning the type of education, we also dealt with the question why overeducation in Germany is much more widespread among nongraduates with vocational qualifications than among graduates (for a thematically broad mismatch analysis for the latter group cf., Büchel et al., 2002). Based on the theoretical considerations of branch-specific training and hiring strategies that are related to net costs of training, Neubäumer develops a plausible theoretical framework to explain this type of mismatch (Neubäumer, 1999). Branches that offer employment with poor working conditions are expected to train more apprentices than required later as skilled workers. This strategy compensates for the above-average rates of anticipated dropout, resulting in a systematic overproduction of skills in specific occupations (ironically, mainly in those occupations with a low market applicability, such as hairdressing). Hence, those trained in these branches tend to have above-average rates of overeducation (and unemployment). Analyzing data from the BIBB/IAB Employment Survey, we can empirically support Neubäumer's theoretical model (Büchel & Neubäumer, 2001, 2002). A related research interest motivated the article by Büchel and Pollmann-Schult (2002), who focus on apprenticeship-trained people employed in low-skilled jobs. The question was whether these overeducated workers can achieve an "occupational comeback": Can they return to a qualified job that offers a better use of their acquired skills?

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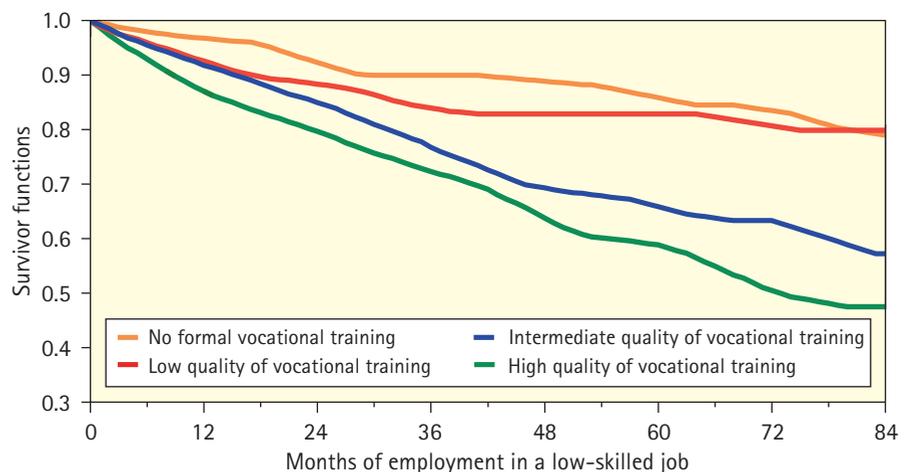
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The earlier detected typological similarity between unemployment and overeducation (Büchel, 2001b) helped us to adopt standard techniques from unemployment research in longitudinal analyses in the context of overeducation. For that purpose, we used data collected by the German Life History Study (GLHS) and employed parametric hazard rate models. Since in this data information about the job demand level is not available, we first had to develop a tool to generate a proxy variable for the job requirement level from information on the occupation and occupational position (Pollmann-Schult & Büchel, 2002b). The phase of work in a low-skilled job often proves to be only temporary for overeducated workers who have successfully completed an apprenticeship of intermediate or high quality. In contrast, it often means long-term professional downgrading for overeducated workers with only a low-quality apprenticeship degree (Pollmann-Schult & Büchel, 2002a). In that case, future career prospects are not significantly better than those of

their colleagues without any formal vocational training (see Fig. 9). Furthermore, we find that the quality of the school-leaving certificate does have a highly significant influence on the upward mobility from a low-skilled to a qualified job. The transition rate for qualified workers with a lower school certificate and school-dropouts without any school certificate is significantly lower than for workers with a higher intermediate school-leaving certificate (see Fig. 10).

Further, we analyze transitions from unemployment to overeducated and correctly allocated work. We can confirm that accepting an overeducated position after a relatively short time is a valuable second best strategy for many unemployed, especially for those who are not eligible for unemployment benefits (Pollmann-Schult & Büchel, in press). Using Büchel (2001c, 2002a) as a starting point, we wanted to further investigate the question of how overeducated workers differ in personal characteristics from their correctly allocated peers. For that purpose we made use of the fact

Figure 9. Survivor functions of an upward move from a low-skilled job to a qualified job (by quality of vocational training).



that the latest data collection of the German Life History Study (GLHS) contained information on school grades, which most German labor market data do not provide. Applying a trivariate probit model, we could confirm that both the type and grade of school-leaving certificate has a strong effect on the overeducation risk later. The quality of the vocational training chosen, only impacts on that risk when the strong selectivity effects in certain types of schools and vocational training remain unconsidered. Consistent with existing literature, they find that the risk of overeducation decreases with increasing traditional skill measures, such as experience, tenure, on-the-job training, and further education. Finally, we replicated Sicherman (1991), who tested the effectiveness

of the career mobility theory by Sicherman and Galor (1990), in the context of overeducation. Büchel and Mertens (in press) estimate random effects models to analyze relative wage growth using data from the German Socio-Economic Panel (GSOEP). We find that overeducated workers in Germany have markedly lower relative wage growth rates than adequately educated workers. These results cast serious doubt on whether the career mobility model is capable of explaining overeducation in Germany. The finding supports the plausibility of the results that overeducated workers have less access to formal and informal on-the-job training, which is usually found to be positively correlated with wage growth even when controlling for selectivity effects.

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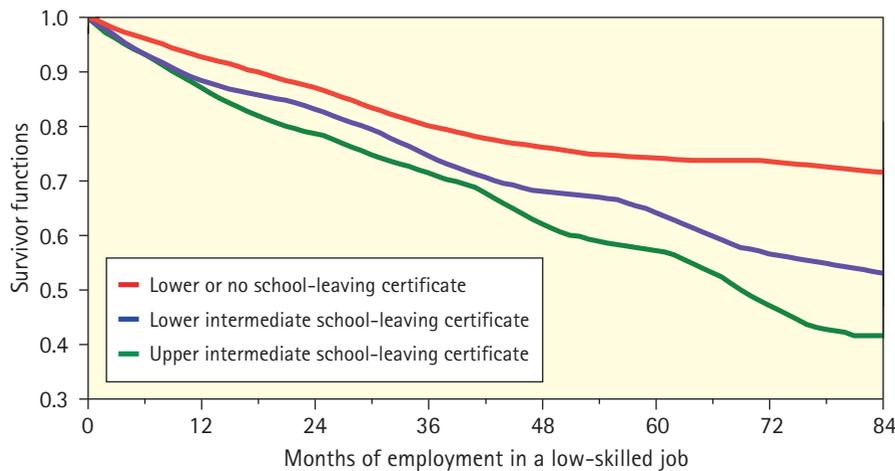


Figure 10. Survivor functions of an upward move from a low-skilled job to a qualified job (by school-leaving certificate).

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Female Labor Supply

A growing proportion of the Mismatch Project is devoted to analyzing female labor supply. According to the theory of differential overqualification developed by Frank (1978), married women living in rural areas run a higher risk of being employed in jobs for which they are overqualified. This is due to the problem of a dual job search being much more difficult to optimize than a single job search. In such a situation, husbands tend to follow a “Male Chauvinist Family Location Decision Rule” and optimize their personal job search—possibly by interregional migration. Wives are “tied movers” or “tied stayers” (Mincer, 1978) and look for employment only under the condition that their husbands already have found their optimal job—which determines their specific local labor market. Particularly in rural areas with small local labor markets, this leads to a higher risk of mismatch between formal qualifications and job requirements. Only McGoldrick and Robst (1996) and Battu, Seaman, and Sloane (2000) have previously empirically tested this theory, and their results lead them to reject it. In contrast, our own findings are consistent with Frank’s theory (Büchel, 2000). Instead of speculating about the factors that produce this unsatisfactory discrepancy in result patterns, we look for cooperation between the Battu et al. group and ours. In this fruitful cooperation we (Büchel & Battu, 2003) use data from the German Socio-Economic Panel (GSOEP). Unlike previous studies, these data control for commuting distances. The results provide

some mixed support for the differential overqualification hypothesis. An extended approach was chosen by Büchel and van Ham (Büchel & van Ham, in press). They argue that the analysis of differential overqualification in a spatial context should not only focus on married women in small labor markets, but also on other risk groups: For most workers, access to suitable employment is severely restricted by the fact that they look for jobs in the regional labor market rather than in the global one. In their paper, Büchel and van Ham analyzed how macro-level opportunities (regional market characteristics) and micro-level restrictions (the extent to which job searchers are restricted to the regional market) can help to explain the phenomenon of overeducation. A variant of the Heckman two-step procedure is applied to control for selective access to employment. The results show that the size of the labor market is an important factor in avoiding overeducation. Related to this line of research is the question of whether day-care provision influences female labor supply decisions. In a report on behalf of the Federal Ministry for Family Affairs, Senior Citizens, and Women and Youth, we analyze the relationship between the day-care situation of children and labor market activities of their mothers. Based on the German Socio-Economic Panel (GSOEP) data from the year 2000, we find that especially for West Germany and for children aged three to six a more intense care (e.g., full-time instead of part-time care) is strongly correlated with a better labor supply of mothers and

better jobs (Büchel & Spieß, 2002a; Spieß, Büchel, & Frick, 2002). Based on the GSOEP data on the provision of day-care vacancies on the district level, we also estimate multinomial logit models to analyze the probability of working part-time or full-time, respectively. Our results show that a better provision with day-care slots for preschool children of three years and older increases the probability of working part-time, while the provision of day-care vacancies for younger children up to two-years-old does not show any significant effect. A higher proportion of full-time day-care among all day-care vacancies increases the probability of part-time employment as well as the one of full-time employment. From a policy perspective, our results are important since there is hardly any German micro-econometric study that shows a significant relationship between the provision of day-care and the mothers' employment decision. If the political goal is to increase the possibilities to combine work and family life, our results indicate that an extension of the provision of full-time day-care is needed (Büchel & Spieß, 2002b; Spieß & Büchel, 2003).

The positive effects of day-care provision have also been proved in another context than in that of female labor support. The study by Spieß, Büchel and Wagner (in press) examines the relationship between *Kindergarten* attendance and the 7th-grade school placement of children in West Germany, differentiating associations for the children of German citizens as compared to those of immigrants. Using informa-

tion from a representative population sample, the GSOEP, different models were estimated. The results indicate that there is no significant correlation between *Kindergarten* attendance of children of German citizens and children's later school placement. However, for children in immigrant households the reverse is true: Later school placement is significantly associated with *Kindergarten* attendance prior to school enrollment. This shows the importance of offering sufficient day-care facilities especially for working mothers with an immigration background.

Family Type and Poverty

Those people living in "atypical" familial constellations, such as large families or single mothers, face a higher income risk than others. The main reason for this is the restricted access of mothers to the labor market caused by the higher requirement of mothers taking child-care responsibilities. In a first study, we analyze trends in the relative income position of large families consisting of two parents and three or more children in Germany using the GSOEP data on equivalent household incomes (Büchel & Trappe, 2001). As expected, our results confirm that the income situation of large families is relatively poor compared to that of other household types. However, a slight improvement over time can be observed for German families in West Germany. For large immigrant families in West Germany, at least no deterioration in relative income position was observed. In contrast, the relative income position of large East German families worsened markedly over the years

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following unification. The results of error component models controlling for the age, education, and employment status of both parents show that in both West and East German households, the mother's employment status has a particularly strong impact on the household income position.

In a second study within the research field of atypical household structures, we focus on the income situation and labor market participation of single mothers (Büchel & Engelhardt, in press). In this study, we try to isolate the income effect caused by the nonexistence of a partner in a single parent household, combined with the number of children of each household type. Within this approach, we take into account the different labor market participation behavior of mothers in different living arrangements. Furthermore, we compare the effects of the determinants of the relative net equivalent household income position in East and West Germany as well as their development in the 1990s due to the exceedingly dynamic labor market. The results from the models indicate that a missing male breadwinner causes severe reductions in the family's relative income position in both East and West Germany, even when controlling for the mothers' social status and earnings. The results remain surprisingly stable between West and East Germany and over time. Furthermore, the family status of single mothers, together with transfer payments, determines the relative income position. Among single mothers, those that never married are substantially worse off than those who are living

separated or divorced. To take account of the very different labor supply behavior of single and married mothers, we reestimated the multivariate model under consideration of this selectivity using the Heckman approach. Not controlling for this selectivity problem mainly causes an overestimation of the mothers' earnings effect and an underestimation of the mothers' educational background on their relative household income position. Consequently, misinterpreting the real dimension of the effects of these crucial socioeconomic status measures could negatively affect the effectiveness of social, labor market, and educational policies to secure the economic well-being of families with dependent children.

The fight against family poverty is a central issue for policy makers in all industrialized countries. Apart from easing the problem by targeted public transfers to families, another strategy is to support mothers' employment. In this respect, policy strategies differ substantially across countries. In cooperation with Kristian Orsini from Département d'Economie Appliquée de l'Université Libre de Bruxelles (DULBEA) at the University of Brussels, we started to analyze the impact of the type of welfare state on the effectiveness of mothers' employment as a family poverty protection strategy. Inspired by Solera (2001) and based on preliminary work by Orsini (2001) we will analyze income and employment structures focusing on families with dependent children in an international comparison. We use data from the Luxembourg Income Study (LIS) for the United Kingdom, France,

Germany, Italy, the Netherlands, Belgium, Finland, and Sweden. First results showed that in all countries the mothers' labor supply plays a crucial role in poverty reduction strategies.

For the future, we plan to look in more detail at the female labor supply decisions and, therefore, extend the Mismatch Project to other types of mismatch apart from overeducation. A mismatch situation can be stated in all situations where people are hindered to make full use of their acquired skills in the labor market. We will, here, focus on analyzing labor supply constraints caused by specific family circumstances, mainly by living together with children in a suboptimal, institutional, economical, and social environment.

Given the dramatic changes in family structure and female labor force

participation, children's nonmaternal day-care has moved to the forefront of German politics, as in several other industrialized countries. Although there is substantial, mostly in the U.S., research on the correlation between the mothers' employment decision and day-care use, there are only a few studies that focus on the effects of day-care availability on the mothers' employment decision or for day-care use. The question of availability is of special interest if day-care vacancies are restricted. From a social inequality and stratification point of view, it is of specific relevance whether the employment decision of socioeconomically disadvantaged mothers is affected by the restricted availability of day-care vacancies to a higher degree than the decision of the socioeconomically better situated mothers.

Further Projects

Gero Lenhardt

A Comparative Study of Higher Education in Germany and the United States

Higher education finds increasing public attention, with reform proposals often alluding to the USA. This is the background of a comparative study, which focuses on higher education in Germany and the USA. The secular process of the universalization of higher learning is the yardstick for this comparison. Universalization is manifest in the expansion of enrolments and in the transformation of academic freedom from a particularistic feudal privilege into a universal human right. The idea of universalization stands at the center of Humboldt's concept of a free university for a democratic society. It is presented in the introduction together with contemporary European concepts of higher education (Bologna Process), German and American perspectives of higher education. The first half of the book, which is concluded. It reconstructs the development of German higher education as a conflict ridden unity of feudal, absolutist, and democratic value orientations, in which democratic norms finally prevail. Democratic culture allowed for the expansion of higher education as well as for the transformation of academic freedom into a universal human right, which finds institutional expression in the organizational transformation of the Chair, the integration of the university and the polytechnic, and in the state's withdrawal from the management of the university.

The chapters on American higher education exist in a raw form. The American university, it is shown, developed in close contact with the civil society, in contrast to its German counterpart, which formed a symbiosis with the feudal absolutist state and the *"Obrigkeitsstaat."* The different origins gave rise to institutional differences: The expansion of enrolments is unanimously supported in the USA, but a matter of serious political conflict in Germany and hence has less proceeded. The American graduates found employment in the private sector of the economy, their German comrades in the public sector. Academic freedom in Germany was based on the Chair, which equipped its incumbent with considerable power and prestige. In the USA, freedom of thought was part of democracy and, hence, subject to public control. In consequence, the social status of the professoriate was quite low. It was enhanced dramatically only during the Cold War. University management, to point at a last distinction, was oriented to the expectations of the civil society in the USA. In Germany, by contrast, this was state oriented and state run. This difference seems to be withering away since the end of World War II. A final chapter deals with higher education and the technocratic culture of the expert in Germany (Max Weber) and American professionalism (Parsons).

The socialist intelligentsia, or the educated class, appeared with the foundation of the GDR in 1949 and was dissolved together with the state in 1990. The original intention was for the ranks of the intelligentsia to be open to social groups hitherto unconcerned with education (workers and peasantry). But since the children of the first generation of graduates demanded the same level of education as their parents, the GDR society shifted increasingly toward stratum-specific differentiation and a reproduction of societal structures. Hoerning looks at case studies of the "socialist intelligentsia" that examined the role of the profession in biographical (re)orientation. The professional and life histories (narratives) of 31 women and men born between 1929 and 1938 (the generation that rebuilt Germany after the Second World War) and between 1950 and 1960 (the children of the "heroes") were recorded on repeated occasions, allowing the description of the social character of the educated class (the new socialist intelligentsia) and the professional cultures of the former GDR, as well as the life courses of both bourgeois

and non-bourgeois members of the intelligentsia. It was then possible to observe the reorientation process, retrospectively, by examining the transition to "new" social, cultural, and political structures, and obtain information about how retrospective assessments change over the course of time and life. Hoerning's study shows that success (or failure) in coping with the transformation process is not only a function of the individual biographical capital, but is also highly dependent on the historical development of the institutions (professions) to which the individuals belong. The institutional and biographical integration into the "new" Federal Republic is being explored in case studies on a number of professional groups: medical, law, media and science professionals, university professors, managers in industry and science, and the clergy. A special chapter will be devoted to the professional careers of women in the nomenklatura-cadre/administrative class. These case studies will be discussed within the framework of current theoretical debates on professions in a publication in progress: "Intelligenz, Experten, Professionen."

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Independent Research Group

Lack of Training:
Employment and Life Chances
of the Less Educated

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Duration: January 2000–December 2004

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Research Topic Relevance

The origin of the group of less-educated persons is to be found in the massive educational expansion in most modern societies after the Second World War. Both educational opportunities and attainment have increased for most children. As a consequence, today young persons entering the labor market without the minimum expected certificate—one that is necessary, but not sufficient for labor market success—represent a residual category of shrinking proportion, but one in a serious crisis due to ever higher expectations for completion of upper secondary education (see Fig. 1).

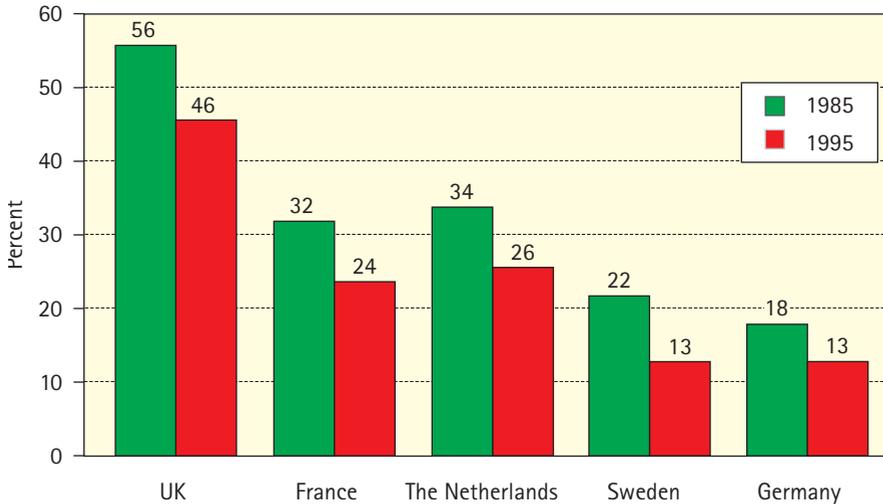


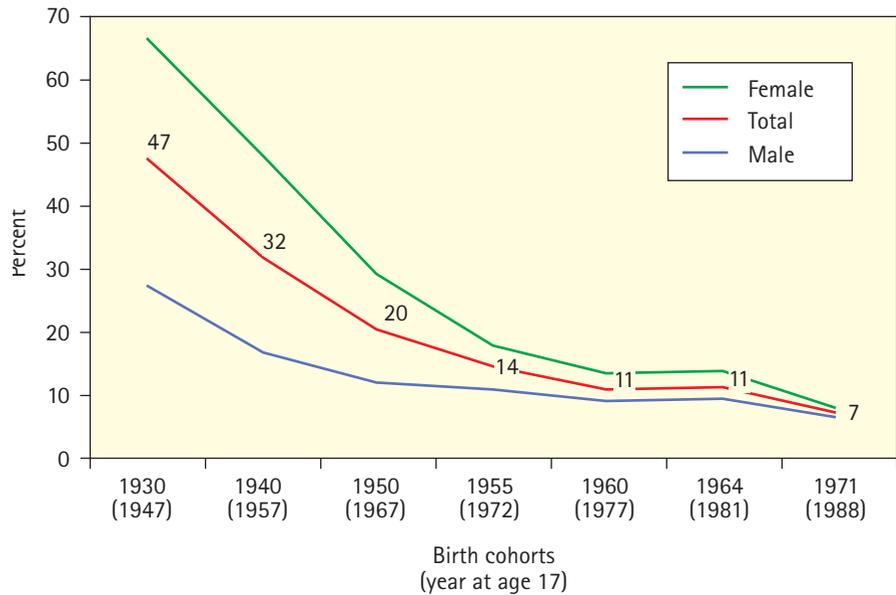
Figure 1. Proportion of persons 25- to 27/28-years-old with less than upper secondary education.

Source: Murray & Steedman (1998). *Growing skills in Europe*.

Figure 2 presents the proportions of different cohorts of youth in Western Germany who have not completed any vocational training by age 25. The proportion has declined from nearly half (47%) in the 1930 cohort to only 7% for the 1971 cohort. Simultaneously with this decreasing proportion, strengthened selection processes in schools and in the labor market are taking place. Our analyses show that in comparison with past cohorts, the proportion among today's youth who lack training coming from socially disadvantaged families has increased (Solga, 2002a, 2002b; Solga & Wagner, 2001).

Furthermore, half of those 20–29 year-olds without training are not of German origin. Among the 26–30 year-olds of non-German ethnic background, 40% have no completed vocational training certificate (Solga, in press-b). Even among those who have lived in Germany prior to the age of 10 or were born here and attended German schools, the proportion is one-quarter. In sum, while during the 1950s this group was largely female, today it has a high proportion of ethnic minority youth (who are furthermore over-proportionally often classified in school as having special educa-

Figure 2. Proportion of persons without completed vocational training up to age 25* (only persons with West German origin).



* Persons in training/at university at age 25 are not counted as "untrained."

Data: German Life History Study of the Max Planck Institute for Human Development (MPIB) and MPIB/IAB Cohort Study 1964/71.

tional needs). Our analyses show that the educational and vocational training systems as gatekeeping institutions play a key role in defining this group, determining its social composition and affecting its public perception and reception. Historical changes over time and variations in the proportion of less-educated youth by country indicate that the "production" of less-educated persons varies considerably by institutional setting. Moreover, the almost entire disappearance of gender differences in the (native-German) group of less-educated people, alongside persistent ethnic differences, indicate that educational structures translate "ascriptive" characteristics of individuals, distribute the risk of educational failure differentially, and determine who receives educational certificates.

Research Agenda

We investigate the *causes and consequences of less education* from a life-course perspective and analyze changes over time as well as regionally and cross-nationally. Our joint research questions are: How do less-educated persons' disadvantages at multiple status passages cumulate over their life courses? What changes, especially in institutional rules and processes, have occurred over the past several decades and what consequences have these had?

(1) *The Causes of Less-Educated Youth*

We investigate how initial inequalities are transformed into exclusion from training and tertiary education, focusing on the educational and training systems and their social mechanisms: sorting and selection

functions, the learning environments that they provide for children with different characteristics—given initial inequalities—and the recruitment practices of firms for apprenticeships or on-the-job training opportunities. The two dissertations primarily address this research question, investigating the societal and institutional factors responsible for the over-representation of certain groups among less-educated youth.

Sandra Wagner's dissertation *Youth Without Vocational Training: Educational Expansion and Institutional Structures in Western Germany Since 1949* investigates the German educational and vocational training system at different stages of its institutional development, asking how it has transformed social origin and ethnicity into disadvantageous resources for socialization and competence development, manifested in low educational attainment. Her contribution is to show why the label "less-educated" is attributed differentially in these changing institutional contexts and, thus, how the social composition of the group of less-educated persons has changed over time (see below "c"). Justin Powell's dissertation *Barriers to Inclusion: The Institutionalization of Special Education in Germany and the United States, 1970–2000* shows how schooling structures categorize students, asking how special educational institutional arrangements themselves contribute to reduced levels of educational attainment for youth classified as "disabled." In Germany today, school leavers from special schools are significantly over-represented among less-edu-

cated youth and those without vocational training, constituting around 40% of all school leavers without the lower secondary certificate (*Hauptschulabschluss*). Besides its proportional importance in studying this educational group, "disability" is of particular significance for our research because it highlights the power of institutional regulations and structures as they "discover" and reify "student disabilities," critically altering individuals' life trajectories. Because the processes that affect life-course phases and transitions as well as individual orientations and aspirations are cumulative, we analyze *early* opportunities and differentiation. Comparing dramatically variable levels of segregation, integration, and inclusion by region and by special-needs category in Germany and the U.S., we show how (special) education institutions generate both student disability and social inequality in credential societies.

(2) Social Consequences of Less Education

The group's second research focus is the social and especially the long-term consequences of attaining less education. Heike Solga addresses this research question in her analyses of labor market participation of less-educated West Germans since the 1950s. We know that in many Western countries, less-educated persons constitute an increasing share of the long-term unemployed. They are less able to enter into even unskilled jobs. The dominant (mainly economic) explanation is the so-called "displacement" argument, which theorizes that given an over-

supply of qualified persons, trained persons out-qualify less-educated persons in job competition. Here, decreasing employment opportunities are seen as being essentially a labor market (mis)matching problem. Yet that explanation does not include the "production process" of less education in its analysis. Our project offers a sociological explanation for the increasing labor market vulnerability of less-educated youth, emphasizing the consequences of historically declining proportions of less-educated youth. This sociological explanation takes into account changes in group size, group composition, and employers' perceptions over the course of educational expansion. This theoretically-derived hypothesis, which has been empirically strengthened by our work, states that less education itself has become a social stigma in highly credentialized societies (such as Germany) and is closely related to the social and psychological processes of self and external selection. We conceptualize analyses of *less-educated persons' life chances in other life domains* as the logical step following labor market analyses. We will explore the extent to which discernible differences in these opportunities can be attributed to either the status "less educated" itself or to labor market exclusion.

Methods/Datasets

Much of our research compares different West German birth cohorts, allowing us to investigate the two research questions given changing educational norms and institutional

settings in educational and training systems, as well as under varying economic circumstances. In our comparison of Western Germany with the U.S., we examine whether and how the degree of locational "segregation" in educational systems—a highly differentiated and hierarchical school system in contrast to tracking or ability grouping within comprehensive schools—influences the production of differential educational attainment levels for ascriptive groups, such as, gender, ethnicity, ability. In addition, we have completed comparative analyses of East and West Germany before unification to discern the extent to which "marketization" in modern capitalist countries may be mainly responsible for less-educated persons' labor market disadvantages, besides unemployment.

The *Life Course Studies* of both West and East German birth cohorts of the Institute's Center for Sociology and the Study of the Life Course are the empirical foundation for our analyses of social change in Germany over time. However, two groups are nearly completely missing from this database, namely those who are of non-German origin and those who attended special schools. For the former, we use the German Institute for Economic Research's German Socio-Economic Panel Study (GSOEP). For the latter, we complement collections of aggregate statistics with our own life history database (from 105 school-leavers from schools for "learning disabled" children) derived from a pilot project on "job coaching" in North Rhine-Westphalia that we studied with the organizers at the

University of Cologne, 2000–2002. This study highlights the interrelationships of ethnicity, social class and disadvantage found in special schools for pupils with learning difficulties. This dataset is particularly valuable because most large-scale educational studies in Germany, including the recent OECD-PISA study, do not specifically address special school pupils or graduates.

Research Results

(a) Differences in the Institutionalization of Special Education in the German and United States School Systems and their Consequences for Educational Participation and Educational Attainment

For almost two hundred years, but especially since the 1960s, both Germany and the U.S. have increasingly provided schooling for children classified as disabled—in structures ranging along a broad continuum from special schools to full inclusion in regular classrooms. The Federal Republic of Germany (FRG) developed one of the most differentiated special school systems in the world with more than ten separate school types. In both countries, education reforms and debates have shifted from whether and how these children can be integrated, to the institutional structures in which they should be taught. Despite growing consensus that school integration and inclusion are desirable, institutional inertia, embodied in highly differentiated classification systems and (special) education bureaucracies and represented in professional interests, block diverse

attempts to school all children together in regular classrooms. Countries such as Norway and Italy have completely eliminated special schools. In contrast, Germany's educational system still segregates the overwhelming majority of its disabled pupils: Over 90% of children classified as disabled do not attend regular schools. While schools in the U.S. still separate the majority of pupils classified as having special needs for part of the schooldays, over 95% of all pupils who have an individualized, special education plan do attend regular, neighborhood schools.

In Germany, nearly 80% of all pupils who attend special schools do not even receive the lower secondary certificate (*Hauptschulabschluss*). In many German *Länder*, special schools are not even allowed to offer the higher degrees that are required for most vocational training programs or tertiary education. In the U.S., a quarter of each year's exiters from special education programs are dropouts or ageouts, a fifth return to regular education, and nearly half graduate with a high school diploma or certificate.

Historical-institutional case studies of special education policy together with aggregate education statistics over time manifest that institutionalization of special education and classificatory praxis and the resulting distributions of educational certificates vary considerably by region and disability category. Variations in all indicators, but especially in educational attainment rates within Germany and the U.S. show clearly that existing institutional structures in (special) education have dramatic

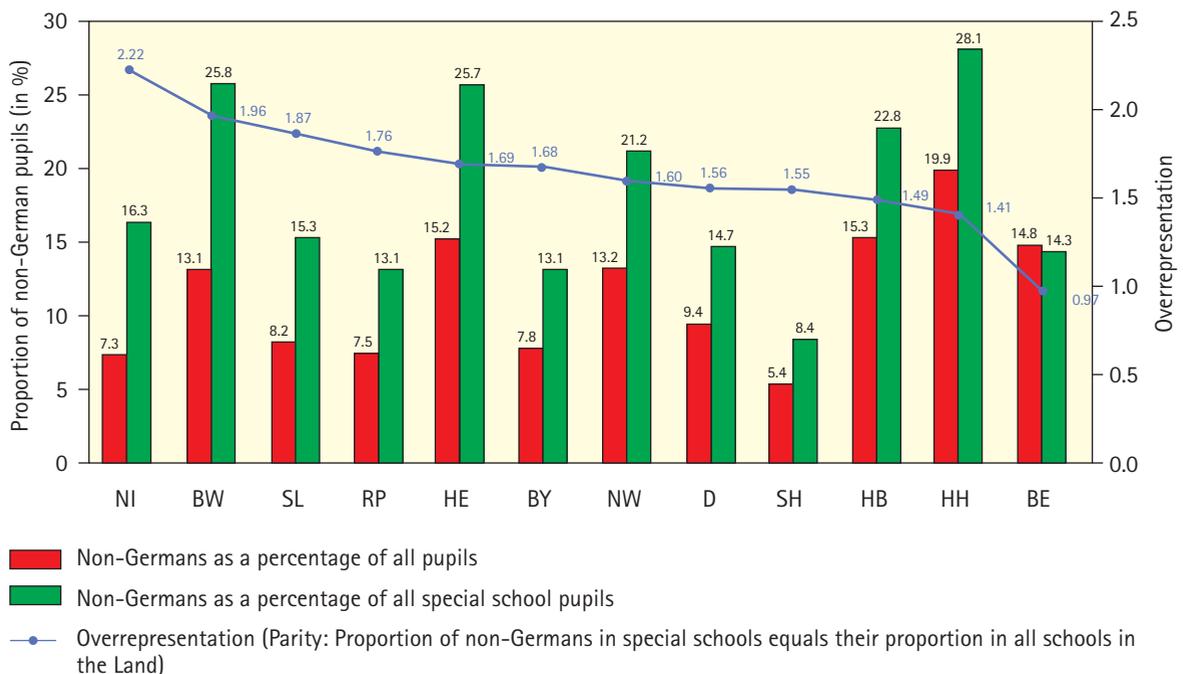
effects on the risk distribution of educational failure.

(b) The Nexus of Ethnicity and "Disability" in the German School System

Between 1965 and 1994, the number of non-German students in Germany increased twenty-fold. In each year since 1991, over a million students without a German passport attended schools in Germany: one in ten students were non-German. At the same time, the proportion of non-German students in segregated special schools rose continuously, such that by 1999 almost 15% of all students in special schools were not German, although their percentage of all students in the Federal Republic was only 9.4%, resulting in an overrepresentation factor of 1.56. Our analyses show that children without German citizenship are

clearly overrepresented in special schools and the trend is going up, not down (Powell & Wagner, 2002; Wagner & Powell, in press). In 1999, a full 70% of non-German pupils attending special schools were classified with a "learning disability"; the remaining 30% attended other types of special schools (for German special school pupils the ratio was 50:50). Furthermore, dramatic variance between federal states (*Länder*) in special school placement rates of non-German students (see Fig. 3) and between children of different European nationalities continues (in the 1998/99 school year, the placement rate varied between 0.5% and 13.6%). This regional variance in the distribution of non-German youth among the nine categories of special educational needs (as of 1994) demonstrate state-specific educa-

Figure 3. Overrepresentation of non-German pupils in special schools, 1999.



Source: Powell, J. J., & Wagner, S. J. (2002).
 Data: Kultusministerkonferenz (2001).

tion policies and institutionalized educational pathways. Significant differences in the acceptance of inclusion and integrative pedagogical concepts, in teacher training and certification, in the development of school systems, and financial constraints resist change. The overrepresentation of children and youth who belong to ethnic or racial minority groups who are schooled in segregating or separating special educational programs is not only an important indicator of their individual educational and employment opportunities. Continuously over the past three decades, it has also been an indicator of social and institutional discrimination in Germany (and the U.S.).

(c) Changing Learning Environments in Germany's "Hauptschulen"

Nearly all sociological research on the results of educational expansion focuses on the reduction in social inequality in terms of access to higher education institutions. Yet the following question has been largely ignored: What consequences has the outflow to higher secondary school types had for pupils in the lowest general German school type (*Hauptschule*)? Explanations for individuals' school failure are not only found in the individuals' own families, but also in their learning environments. Analyses of peer groups' social composition by Heike Solga and Sandra Wagner (2001) for native West German children have shown that today children from less-privileged families—children with parents employed in low-skill, low-wage jobs, and children growing up in stressful family situa-

tions—are overrepresented in the *Hauptschule*. In terms of its educational environment, much less now than in the past this lower German school type today represents a field of "anticipatory socialization" (H. Fend) providing less advantageous role models. These changes in composition of pupil groups point out that educational expansion has impacted lower educational groups in the educational hierarchy just as it has the higher: We find long-term increases in participation rates in higher education, especially for younger cohorts. Then as now we find that the majority of youth without vocational training (in Western Germany) are school leavers from the *Hauptschule*. Yet these school careers can be seen less as a process of status attainment and increasingly as a process of status ascription. As our recent analyses show (Solga, Independent Research Group Working Paper 2/2002), this ascriptive process is visible in the considerably lengthened school careers even of lower educational groups. In addition, today the median age of entry into first employment of these youth has dramatically increased to about 21 (compared to 16 in the 1930 birth cohort). Especially important for these less-educated youth, their educational pathways, and their schooling experiences is that—in international comparison—the German educational system's selection process is largely irreversible.

(d) Less Education in State-Socialist and Capitalist Societies

In his diploma thesis (2001), Kai Maaz compared less-educated per-

Online publications and
Independent Research
Group Working Papers:
<http://www.mpib-berlin.mpg.de/en/forschung/nwg/arbeitsberichte.htm>

sons' employment chances in East and West Germany in the 1980s (Maaz, Independent Research Group Working Paper 3/2002). Two results in particular are worthy of specific mention because for many scholars they were empirically and theoretically unexpected. *Firstly*, the group of persons without vocational training in the FRG—with its much more highly stratified and multi-tiered school system—was less (!) socially homogeneous than the same group in the German Democratic Republic's (GDR) comprehensive school system. In the GDR, the odds of persons without vocational training having parents who also had none was six times higher in comparison with their peers who received vocational training. In the FRG, this risk was only three times as high. Thus, a comprehensive school system that treats unequal children equally and continues to label and categorize children as "educational failures" (such that they drop out of school before receiving a certificate), will not necessarily eliminate social inequality in lower educational strata. *Secondly*, Maaz' analyses show that the currently highly favored modular vocational training programs, which were routinely used in training lower performing youth in the GDR, do not necessarily increase this group's employment opportunities. In fact, these types of certification in a highly certificate-oriented mobility system—as existed in both Germanys and continues to exist today—actually lead to their getting stuck in low-skilled jobs for the rest of their lives.

(e) Stigmatization by Negative Selection

In her research on changes over time in less-skilled individuals' employment chances, Heike Solga (2002a, 2002b) shows that the general scarcity of available jobs and the oversupply of higher-qualified people are not *solely* responsible for less-skilled people's dwindling employment opportunities. Logistic regression analyses instead highlight the increasing risk borne by less-qualified people of finding only a low-skilled, dead-end job—independent of changes in employment supply and demand. Cohort comparisons show, for example, that the difference between those with and without vocational training has increased remarkably over time and is largest in the 1960 cohort (the youngest cohort she has analyzed thus far, see Fig. 4).

The fact that despite holding constant the relationship of employment supply and demand, there continue to be significant, even increasing, effects of less education, suggests that there are additional reasons besides displacement for the lessened opportunities and mobility of less-educated people into qualified work. We have developed four further explanations for this lapse in the displacement hypothesis. Less-educated persons' job opportunities have worsened due to:

- (1) the increased discrediting of less-qualified persons as "unemployable" by employers and society;
- (2) social stigmatization that eventually also leads to self-stigmatization;

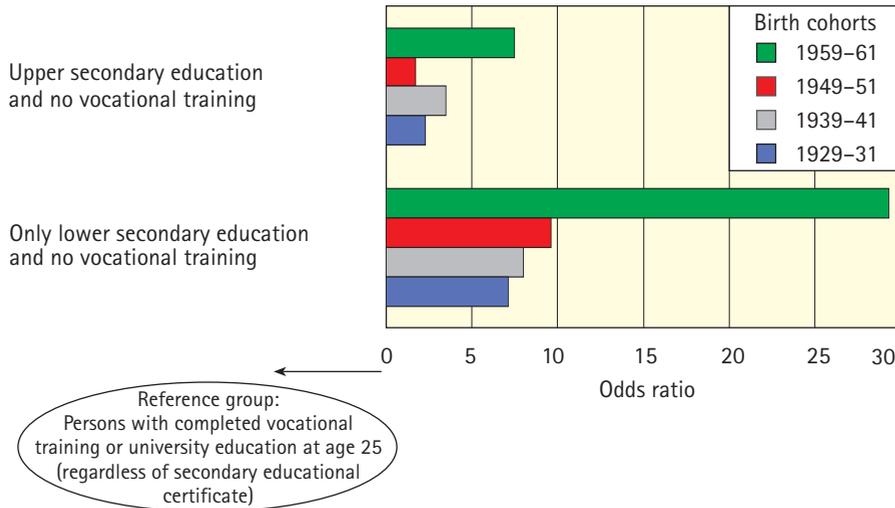


Figure 4. Inner-cohort differences (between persons with and without completed vocational training) in the risk of being in a low-skilled first job (only people of West German origin, cohorts 1929–1961).

Note. Persons who were still in training at age 25 are not counted as having no completed vocational training.
 Controlled for gender: Inner-cohort differences presented can not be attributed to differences in gender distributions.

Source: Solga (2002a).

Data: German Life History Study, Max Planck Institute for Human Development.

(3) structural risks of exclusion caused by institutional practices (e.g., in educational and training systems) that limit the scope of their action in future; and

(4) structural risks of exclusion caused by increasing social homogeneity of less-educated youth's social background and peer networks that reduce their network resources for finding employment.

Publications 2001–2002

Krappmann, L., & Powell, J. J. (in press). Kinder, die besondere pädagogischer Förderung bedürfen. In J. Baumert, K. Cortina, A. Leschinsky, K. U. Mayer, & L. Trommer (Eds.), *Das Bildungswesen in der Bundesrepublik Deutschland*. Reinbek: Rowohlt.

Powell, J. J. (in press-a). Eugenics. In T. Fitzpatrick et al. (Eds.), *International encyclopedia of social policy*. London: Routledge.

– (in press-b). Euthanasia. In T. Fitzpatrick et al. (Eds.), *International encyclopedia of social policy*. London: Routledge.

– (in press-c). Grenzen der Inklusion. Die Institutionalisierung von sonderpädagogischem Förderbedarf in Deutschland und den USA, 1970–2000. In J. Allmendinger (Ed.), *Entstaatlichung und soziale Sicherheit. Tagungsband, 31. Kongress der DGS in Leipzig*. Opladen: Leske + Budrich.

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– (in press-f). Stigma. In T. Fitzpatrick et al. (Eds.), *International encyclopedia of social policy*. London: Routledge.

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Solga, H., Powell, J. J., & Wagner, S. (in press). Ausbildungslosigkeit: Bedingungen und Folgen mangelnder Berufsausbildung. Aktuelle Forschungsprojekte zur Sozialstruktur und sozialer Ungleichheit. In J. Allmendinger (Ed.), *Entstaatlichung und soziale Sicherheit. Tagungsband, 31. Kongress der DGS in Leipzig*. Opladen: Leske + Budrich.

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Left to right: Heike Solga, Justin Powell, Sandra Wagner.



Service Units

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Scientific and Professional Staff (2001–2002)

Library and Research Information: Ursula Flitner, Lydia Lange, Diann Rusch-Feja
(until June 2002)

Information Processing Center: Wolfgang Assmann, Peter Grund, Jürgen Hess
(until September 2001)

Library and Research Information

Rapid access to printed and digital information is a decisive prerequisite for successful studies and internationally renowned research.

The Library and Research Information Unit of the Max Planck Institute for Human Development aims to anticipate, determine, and respond to the Institute's needs for information in the areas of sociology, psychology, education, and neighboring disciplines.

To support the research, teaching, and publishing activities of the Institute's researchers, the Library seeks to provide an environment and facilities conducive to efficient and independent use and dissemination of information.

The Library's collection currently comprises around 190,000 volumes, 550 printed periodicals, and electronic resources. It offers easy and fast access to own materials and information worldwide.

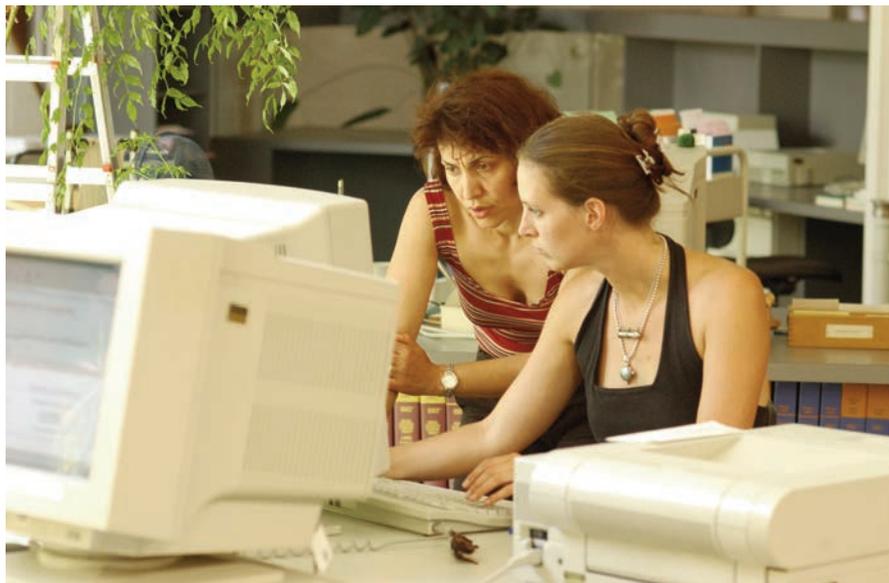
Comprehensive intranet services include online access to the major bibliographic and abstract databases in the fields of social and behavioral sciences and economics as well as to several hundred electronic journals in full text.

The Library's web catalog, most databases, and all electronic journals can now be accessed from all personal computers on Institute premises via the newly introduced "institutional login," without enter-

ing user ID or password. Familiar individual login-features can still be used to rerun saved queries and to access databases while traveling. Personalized table of contents services and a monthly electronic list of new acquisitions support researchers in keeping abreast of the latest publications in their fields of interest and of immediately available information.

Offering facilities for online ordering of books and journal articles and making extensive use of fast document delivery services, the library staff aims at further saving researchers' time. The staff of the Library continue to offer regular introductions to Library services,





including training in using databases.

During 2001, the reference collection of the Library was brought up to date and reorganized in order to improve user orientation. It is now classified and shelved according to the Dewey Decimal Classification. In this context the last ten years' volumes of the journals most frequently used were integrated into the open access area of the Library.

New head of the Library, as of July 2002, is Ursula Flitner, former head of the Library at the University of Applied Sciences Stralsund. Diann Rusch-Feja, head of the Library for the past 13 years, left to take up new challenges.

Opportunities for a cut-down in staff were taken. Efforts to further optimize workflow efficiency will be intensified. To reduce the labor required for cataloging and to speed up information provision, the Library is preparing to make use of cataloging distribution services.

Subject-oriented information retrieval across both German and English language publications at the same time will be facilitated by introducing the Dewey Decimal Classification for all future acquisitions of the Library.

The range of electronic full texts available within the context of the Max Planck Society-wide library cooperation was expanded to include, among other databases, the Annual Reviews and PsycArticles, two long-time desiderata of the Institute.

October 2002 the Max Planck Virtual Library (VLib) was released by the Heinz Nixdorf Center for Information Management in the Max Planck Society (ZIM), marking a major qualitative step toward up-to-date information management and provision for Max Planck Institutes. Heterogeneous catalogs of Max Planck libraries, licensed databases, and journals can be selected according to individual needs and searched simultaneously under a single user interface. Search results will be

linked to full texts available or document delivery services. Additional information pertaining to identified sources is provided via SFX, a context sensitive linking tool.

The Institute's Library catalog has been integrated via Z 39.50 and can thus be cross-searched with other catalogs and databases.

Also released by ZIM during Fall 2002 was a first version of the centrally maintained Max Planck eDoc Server, future portal for all electronic publications of the Max Planck Society. The eDoc Server's workflow management and search features make it a valuable addition to current means of management and

dissemination of the intellectual output of our Institute.

Although questions of long-term archiving, authenticity, and copyright still need to be dealt with, the Library has started to build up test collections on the eDoc Server for internal evaluation before going live. Last, but not least, to be mentioned is the completely reorganized and redesigned intranet homepage the Library offers since December 2002. A less hierarchic structure with access to all major services on the top level, short service descriptions and help texts, unambiguous terminology, and a clear design make it easy and efficient to use.

Information Processing Center

The Information Processing Center supports the projects and other service units at the Institute through its central facilities. Central servers are installed with Windows NT or Windows 2000 for dedicated purposes: internet/intranet servers, software server, etc. Three NT- and two Windows 2000-cluster systems with big RAID storage installations provide the capacity (more than one Tbyte) for the central data management. Several powerful NT-terminal servers establish a CITRIX server farm. They allow the user to run programs (SPSS, SAS, MAT-Lab, EQS, etc.) on the server CPUs from their own workstations (Windows or Apple PC). "Server-based computing" helps to overcome the constraints of the different workstations concerning CPU power and local storage. The decentralized personal computing capacity comprises about 240

Intel PCs and 150 Apple computers. Apple computers are running MacOS, Intel PCs are operating on Microsoft's Windows NT 4.0, Windows 2000, or Windows XP. A central backup service is provided for all data on cluster disks. A wide array of software is available for the desktop systems.

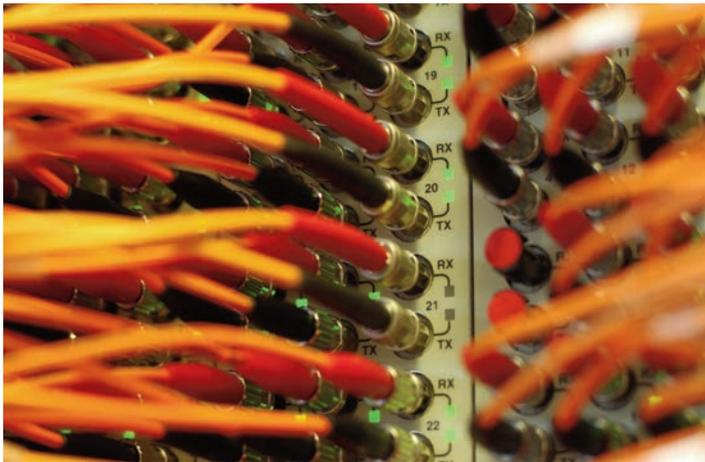
To provide the necessary security, a Cisco-PIX firewall system was installed which allows the failure of certain modules without a complete breakdown. Central virus scanner software—continuously updated via the internet—monitor all Intel and Apple workstations to avoid data loss caused by viruses.

The Local Area Network (LAN) integration of all desktop computers provides access to central resources and cluster capacity. In 1998 the traditional standard- and thin-wire Ethernet was substituted by a new

network based on fiber optic cable. Now the desktop systems are directly connected with a maximum speed of 10 or 100 Mbit/s. Since the Institute has installed a Funk-LAN, notebook users can connect to the internet wireless. The Institute's connectivity to Wide Area Networks (internet, etc.) is provided via the Research Network (WIN) of German Telekom and the German Research Network Association (Deutsches Forschungsnetz [DFN]). Late in the year 2000 the GIGA-WIN (1 Gbit/s) was installed allowing the Institute to increase the use of high-speed connectivity.

The Center's services include

- operating, optimizing, and developing the devices of the central cluster and network equipment;
- mending and updating Windows NT, 2000, and XP operating systems;



- centralized printing capacity, including high-speed and color printers;
- LAN integration of desktop computers and the continuous enhancement of LAN facilities;
- national and international connectivity (Wide Area Network);
- internet services: Email, WWW, NEWS, FTP, and Telnet;
- maintenance and webmaster tasks of the Institute's internet and intranet servers;
- security measures;
- management of the central telephone system, including the voice-mail server;
- user support and trouble-shooting for Intel PCs and Apple computers;
- coordination and technical support for desktop computers and software;
- software acquisition.

The Center provides

- general design and coordination of the Institute's information technology equipment;
- the documentation of data concerning the existing computer and network equipment;
- an overview of market developments;
- advice for the Institute's boards and departments;
- the promotion of new concepts for state-of-the-art computer equipment.



Appendix





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1. Research Colloquia 2001–2002

2002

January 8	Steven Ceci , Cornell University, Ithaca: Reasoning and remembering in context: Selected studies in the bioecology of human development	April 30	Joachim Krueger , Brown University: Why I don't buy self-categorization theory—Yet
January 16	Werner Greve , Kriminologisches Forschungsinstitut Niedersachsen: Adaptivity and norms: Developmental perspectives on legal and illegal action	April 30	Gabriele Kaiser and Rita Borromeo Ferri , Universität Hamburg: Mathematische Denkstile: Erste Ergebnisse einer empirischen Untersuchung
January 22	George Loewenstein , Carnegie Mellon University: Hot-cold empathy gaps	May 3	Asghar Zaidi , London School of Economics: Income dynamics within retirement in Germany and Great Britain
January 23	Ulman Lindenberger , Universität des Saarlandes, Saarbrücken: Lifespan psychology: Co-construction of neural mechanisms and intelligent environments	May 6	Dave F. Bjorklund , Florida Atlantic University: The adaptive nature of cognitive immaturity
January 30	Gerd Antes , Deutsches Cochrane Zentrum, Freiburg i.Br.: Evidenz-basierte Medizin: Von Studiendaten zur Entscheidung am Krankenbett	May 7	Leonard Hayflick , University of California, San Francisco: (1) Human aging, disease, and longevity determination (2) Cellular aging, immortality, and the telomere replicometer
February 1	Andreas Diekmann , Institut für Soziologie der Universität Bern: Irrtümer, Fahrlässigkeiten, Fälschungen. Diagnose von Datenfälschung und Möglichkeiten zu ihrer Verhinderung	May 13	Volker Müller-Benedict , Methodenzentrum Sozialwissenschaft, Göttingen: Ist Akademikermangel unvermeidbar? Eine Analyse einer Tiefenstruktur des Bildungssystems
February 12	John L. Horn , University of Southern California: Intelligence peaks in adulthood: Not g but expertise	May 14	Shinobu Kitayama , Kyoto University: Interdependent agency: Cultural construction of the self
March 11	Jerome R. Busemeyer , Indiana University: Individual differences in the decision making processes used by drug abusers: A cognitive modeling analysis	May 16	Ivan Szelenyi , Yale University: Social determinants of poverty in transitional societies
March 13	Beno Csapo , University of Szeged: Beyond the teaching material: Contrasting aims and outcomes of education	May 21	Ian H. Gotlib , Stanford University: Cognitive, interpersonal, and biological aspects of depression: Toward an integration
March 22	Jens Förster , Internationale Universität Bremen: Accessibility from goals: Mechanisms and consequences for person perception	May 24	Michael Windzio , Universität Bremen: Sind die Befunde der organisationsökologischen Forschung auf alle Organisationstypen verallgemeinerbar? Eine Mehrebenenanalyse von Organisationsauflösungen
April 9	Fritz Strack , Universität Würzburg: Reflective and impulsive determinants of social behavior	May 30	Larry Cuban , Stanford University: Technology in the classroom: Recent trends and developments

May 30	Sheena Iyengar , Columbia Business School: Choice and its discontents: Rethinking the value of choice on intrinsic motivation	November 15	David A. Jaeger , College of William and Mary: Local labor markets, admission criteria, and immigrant location choice
May 31	Javier Garcia de Polavieja , Nuffield College, Oxford: Labour market deregulation and the employment relationship: Why standard class theories fail to explain the mechanisms of inequality amongst Spanish employees	November 28	Janne O. Jonsson , Swedish Institute for Social Research, Stockholm University: Merit rules o.k.? Educational qualifications and the allocation to social positions in Sweden 1968–2000
June 4	Sabine Koch , Evaluative Affektdisplays: Nonverbale Reaktionen auf Männer und Frauen in Führungspositionen	December 3	Thomas Albert , Universität Konstanz: Neuronale Plastizität und Entwicklung
June 10	Markus Gangl , Wissenschaftszentrum Berlin: Two cheers for flexible labour markets: Three U.S.–German analyses of the impact of labour market regulation on unemployment dynamics	December 5	Thomas Mussweiler , Universität Würzburg: Everything is relative: Comparison processes in human judgment
July 17	Ed Elbers , Universiteit Utrecht: Collaborative learning in a multicultural classroom	December 5	Denny Vägerö , CHESS, Stockholm University: A life-course perspective on health inequalities
July 26	Patrick Kyllonen , Educational Testing Service, Princeton: Critical thinking and situational judgment	December 6	Sonja Drobnic , Universität Erfurt: The dynamics of retirement: Gender, marital status, household, and life-course contingencies
July 26	Richard D. Roberts , University of Sydney: Emotional intelligence: What it is and what it isn't	December 10	Dan P. McAdams , Northwestern University: The redemptive self: Life stories and generativity, American style
September 27	Christiane Spiel and Dagmar Strohmeier , University of Vienna: Facetten sozialer Beziehungen in Schulklassen: Migrantenkinder als Zielgruppe & Methodenfragen	December 13	Juan Rafael Morillas Martínez , Nuffield College, Oxford: Wealth and economic opportunities in imperfect economies
October 29	Anthony G. Greenwald , University of Washington, Seattle: Validity of the implicit association test		
November 5	Brian R. Little , Harvard University (USA) and Carleton University (Canada): Personal projects and developmental science: Action in context		
November 8	Francesco Billari , Università Bocconi, Milan: Young adults fuzzily living with their parents: A multilevel analysis of the Italian case		
November 11	Theo Herrmann , Universität Mannheim: Zur Evolution der Sprache		

2001

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|-------------|--|--------------|---|
| January 9 | Regina C. Casper , Stanford University:
Mood, its relationship to physical activity and nutrition | June 18 | Gad Saad , Concordia University, Montreal:
Applications of evolutionary psychology in marketing, economic games, and sequential mate choice |
| January 16 | Friedrich Wilkening , Universität Zürich:
Entwicklung der Informationsintegration: Konzepte von Zeit, Bewegung und Wahrscheinlichkeit | June 25 | Michael H. Birnbaum , California State University, Fullerton:
A web-based program of research on decision making |
| January 24 | Christiane Lange-Küttner , University of North London:
Entwicklung und Folgen des Übergangs vom impliziten Objektraum zu expliziten Raumachsensystemen | June 29 | John Tooby , University of California, Santa Barbara:
What is evolutionary psychology? |
| February 13 | Helmut Leder , Freie Universität Berlin:
When I know you! Features in face recognition | July 2 | Craig R. M. McKenzie , University of California, San Diego:
A Bayesian view of covariation assessment |
| March 12 | Malcolm R. Forster , University of Wisconsin, Madison:
Was the problem of simplicity and unification in science solved in 1858? | September 10 | Tatsuya Kameda , Hokkaido University:
Adaptive social decision making: Handling uncertainty through a collective device |
| March 19 | Rudolf Wieneke , Zentrum zur Therapie der Rechenschwäche Berlin:
Rechenschwäche: Phänomenologie, Diagnose und lerntherapeutische Ansätze | October 11 | Andrea Peter-Koop , Institut für Didaktik der Mathematik, Justus-Liebig-Universität Gießen:
UNI für Kinder: Begabungsforschung und Begabungsförderung als Teil einer diagnostisch angereicherten Lehrerausbildung |
| March 20 | Michael F. Scheier , Carnegie Mellon University, Pittsburgh:
Optimism, coping, and health | October 15 | Avraham N. Kluger , Hebrew University, Jerusalem:
The role of regulatory focus in reaction to feedback sign, risk taking, and personnel selection |
| April 24 | Phyllis B. Mack , Rutgers University, New Jersey:
Wisdom and religion: Mind and motion | October 23 | Klaus R. Scherer , Universität Genf:
Affective science in the making: From cold to hot cognition |
| May 8 | Elke van der Meer , Humboldt-Universität zu Berlin:
Gedächtnis für Zeit | October 25 | Uwe Jensen , Universität Kiel:
Robuste Frontierfunktionen zur Messung von Ausbildungsadäquanz |
| May 22 | Marjorie H. Woollacott , University of Oregon:
Attentional demands of balance control: Contribute to falls in older age? | November 15 | Sir Michael Rutter , King's College, London:
Now that we "know" that genes are all-important, does education still matter? |
| May 28 | Damian Läge , Universität Zürich:
Ähnlichkeitsbasierte Diagnostik von Sachwissen | November 23 | Christian Schluter , University of Bristol:
Does low income in early childhood affect adolescent school attainment? Evidence from the German Socio-Economic Panel |
| May 29 | Paul Verhaeghen , Syracuse University:
Use it and lose it? Aging and the myth of executive control | December 12 | Jens Möller , Universität Bielefeld:
Zur Wahrnehmung von Stärken und Schwächen: Das Modell dimensionaler Vergleichsprozesse |
| June 6 | Herbert W. Marsh , University of Western Sydney:
Self-concept: Theory, measurement, research and practice | | |

2. Visiting Scientists 2001–2002

2002

- Richard K. Belew**, University of California, San Diego
May 2002
- Eduard Brandstätter**, University of Linz
May–August 2002
- Eva van den Broek**, University of Utrecht
May–July 2002
- Hannah Brückner**, Yale University
May–August 2002
- Beno Csapo**, University of Szeged
February–March 2002
- Henryk Domanski**, Polish Academy of Sciences
June 2002
- Rocío García-Retamero Imedio**, Universidad de Granada
September–December 2002
- Maurice Gesthuizen**, University of Nijmegen
February–April 2002
- Konrad Halupka**, University of Wrocław
September 2002–January 2003
- Karen Hooker**, University of Virginia
September–December 2002
- Gisela Labouvie-Vief**, Wayne State University
November–December 2002
- Bogdan Mach**, Polish Academy of Sciences
March 2002 and June–July 2002
- Juan Rafael Morillas Martínéz**, Nuffield College, Oxford
October–December 2002
- Miguel Oliveira**, University of Coimbra
January–June 2002
- Kristian Orsini**, Free International University for Social Studies, Rome
January–February 2002
- Andreas Ortmann**, Charles University Prague
Januar, April, June, September 2002
- Ivan Szelenyi**, Yale University
January–June 2002

2001

- Sherrylin Billger**, Union College, Schenectady, NY
July–August 2001
- Denny Borsboom**, University of Amsterdam
May–July 2001
- Regina Caspar**, Stanford University
January–March 2001
- Ping-Huang Chang**, National Taiwan Normal University
June 2001–December 2002
- Michael Corsten**, Universität Jena
September–December 2001
- Maarten van Ham**, Utrecht University
February–March 2001
- Joop Hox**, University of Amsterdam
April 2001
- Tatsuya Kameda**, Hokkaido University
September 2001
- Edith de Leeuw**, University College Utrecht
April 2001
- Christine Leuenberger**, Cornell University
January–August 2001
- Yong Fang Liu**, East China Normal University
February 2001–February 2002
- Phyllis Mack**, Rutgers University, New Jersey
January–March 2001
- Herbert W. Marsh**, University of Western Sidney
June 2001
- Jens Möller**, Universität Bielefeld
November–December 2001
- Ingo Richter**, Deutsches Jugendinstitut, München
September–December 2001
- Lawrence Roche**, Queensland University of Technology
July 2001
- Rachel Rosenfeld**, University of North Carolina, Chapel Hill
June 2001
- Jorge Simao**, Universidade Nova de Lisboa
September 2000–November 2001
- Josef Thonhauser**, Universität Salzburg
May 2001
- Paul Verhaeghen**, Syracuse University
January–June 2001
- Annika Wallin**, Lund University
September 2001–January 2002
- Hans N. Weiler**, Rector emeritus, Viadrina University, Frankfurt/Oder
June 2001
- Szymon Wichary**, Jagiellonian University, Cracow
September 2000–April 2001

3. Other Professional Activities 2001–2002

Paul B. Baltes

- Academia Europaea (Founding Member; Election Committee, Section on Psychology and Behavioral Sciences; Member of Trust).
- Berlin-Brandenburgische Akademie der Wissenschaften (Founding Member; Vice-Chair, Working Group on Science History and Psychology History).
- Freiberger Stiftung, Berlin (Member of Kuratorium).
- US National Academy of Science, Future Research in Cognitive Aging (Member of Committee).
- International Encyclopedia of the Social and Behavioral Sciences (Coeditor-in-Chief with Neil Smelser).
- International University of Bremen (Member of Board of Governor).
- Jacobs Foundation (Member of Board of Trustees and Jacobs Family Council).
- Deutsche Akademie der Naturforscher Leopoldina (Vice-President).
- IPSEN Foundation, IPSEN Longevity Award (Member of Board).

Jürgen Baumert

- Deutsche Forschungsgemeinschaft (Member of Senate and Main Committee; Member of Committee on Research Perspectives).
- Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz (Senator).
- Programm "Steigerung der Effizienz des mathematisch-naturwissenschaftlichen Unterrichts" (Chair of Board of Scientific Advisers).
- Deutsches Institut für Internationale Pädagogische Forschung (Member of Board of Scientific Advisers).
- Zentrum für Schulforschung und Fragen der Lehrerbildung der Martin-Luther-Universität Halle-Wittenberg (Member of Board of Scientific Advisers).
- Zeitschrift für Erziehungswissenschaft (Coeditor).
- Zeitschrift für Unterrichtswissenschaft (Coeditor).
- International Journal of Educational Research (Editorial Board).
- Zeitschrift für Pädagogische Psychologie (Member of Board of Scientific Advisers).
- Zeitschrift Psychologie in Erziehung und Unterricht (Member of Board of Scientific Advisers).
- Schweizerische Zeitschrift für Bildungswissenschaften (Member of Board of Scientific Advisers).
- Journal für Mathematik-Didaktik (JDM) (Member of Scientific Advisory Committee).
- Waxmann Verlag, Reihe Pädagogische Psychologie und Entwicklungspsychologie, Münster (Member of Board of Scientific Advisers).
- School Effectiveness and School Improvement (Member of Board of Scientific Advisers).

Felix Büchel

- Economics of Education Review (Member of Editorial Board).
- Verein für Socialpolitik, Sozialpolitischer Ausschuss (Member).
- Verein für Socialpolitik, Bildungsökonomischer Ausschuss (Member).
- Swiss National Science Foundation, National Research Programme No. 52: "Childhood, Youth and Intergenerational Relationships in a Changing Society" (Member of Steering Committee).
- The Berlin-Brandenburg Economics Forum BBEF (Active Member).
- Institute for the Study of Labor IZA, Bonn (Research Fellow).
- International Conference "Overeducation in Europe," organized by MPIB Berlin and ROA Maastricht, Berlin 2002 (Coorganizer).
- Swiss Household Panel SHP (Member of Scientific Advisory Board).

- Wolfgang Edelstein**
- Institut für angewandte Familien-, Kindheits- und Jugendforschung e.V., Potsdam (Member of Board of Scientific Advisers).
 - Stiftung "Brandenburger Tor der Bankgesellschaft Berlin" (Member of Board of Scientific Advisers, responsible for Program "Youth Takes Responsibility").
 - Heinrich-Böll-Stiftung (Member of Commission for the Future of Education).
 - BLK-Programm "Demokratie lernen & leben" (Member of Steering Committee).
 - Healthy Children Foundation, Luxembourg (Member of International Advisory Council).
 - Irmgard-Coninx-Stiftung, Internationales Kolloquium Berlin zur Transnationalität (Member of Advisory Council).
 - Beiträge zur Soziogenese der Handlungsfähigkeit, Series with Suhrkamp Verlag, Frankfurt a.M. (Editor).
 - Social Justice Research, New York (Member of Editorial Board).
 - New Directions for Youth Development, New York (Member of Editorial Board).
- Alexandra M. Freund**
- "Die Junge Akademie" an der Berlin-Brandenburgischen Akademie der Wissenschaften und der Deutschen Akademie der Naturforscher Leopoldina (Member).
- Gerd Gigerenzer**
- Berlin-Brandenburgische Akademie der Wissenschaften (Member).
 - Deutsche Akademie der Naturforscher Leopoldina (Fellow).
 - Theory and Psychology (Coeditor).
 - Journal of Behavioral Decision Making (Editorial Board).
 - Humboldt Research Awards Committee (Member of Selection Committee).
 - Latsis Awards on Communications Sciences (Member of Selection Committee).
 - Evolution and Human Behavior (Editorial Board).
 - Summer Institute on Bounded Rationality in Psychology and Economics (Codirector).
 - 24th Annual Conference of the Cognitive Science Society (Program Committee).
- Christa Händle**
- Deutsche Gesellschaft für Politische Bildung, Sektion Politische Bildung (Member of Board).
 - Förderprogramm "Demokratisches Handeln" (Member of Advisory Board).
 - Landesverband der Gemeinnützigen Gesellschaft Gesamtschulen (Member of Board).
- Erika M. Hoerning**
- International Yearbook of Oral History and Life Stories (Coeditor).
 - Oral History Association, USA (Corresponding Member).
 - BIOS, Zeitschrift für Biographieforschung und Oral History (Coeditor).
- Ulrich Hoffrage**
- Memory, Special Issue "Hindsight Bias" (Coeditor).
 - Zeitschrift für ärztliche Fortbildung und Qualitätssicherung (Advisory Board).
- John M. C. Hutchinson**
- Animal Behavior (Consulting Editor).
 - Folia Malacologica (Advisory Board).
- Konstantinos Katsikopoulos**
- IEEE Transactions on Systems, Man, and Cybernetics (Associate Editor).
- Monika Keller**
- Jean Piaget Society for the Development of Knowledge (Member of Board of Directors).
 - Zeitschrift für Ethik und Sozialwissenschaften (Editorial Board).

- Eckhard Klieme**
- OECD, Center for Educational Research and Information, Network for Student Outcome Indicators (Expert Group).
 - Programme for International Student Assessment (PISA) (Member of the German National Scientific Consortium).
 - National Center of Education Statistics, Washington, DC (Scientific Adviser for the International Adult Literacy and Life Skills Study).
- Olaf Köller**
- Zeitschrift für Pädagogische Psychologie (Member of Board of Scientific Advisers).
 - Programme for International Reading Literacy (PIRLS) (Member of the National Board of Scientific Advisers).
 - Bavarian Program for Math and German Achievement in Primary Schools (Bayerische Orientierungsarbeiten) (Member of the Board of Scientific Advisers).
- Kurt Kreppner**
- From Past to Future. Clark Papers on the History of Psychology (Editorial Board).
 - Psicologia: Teoria e Pesquisa (Psychology: Theory and Research, Brazil) (Editorial Board).
- Stephanie Kurzenhäuser**
- Max-Planck-Projektgruppe "Recht der Gemeinschaftsgüter" (Project Cooperation).
- Gero Lenhardt**
- Educação Et Sociedade (Editorial Board).
- Shu-Chen Li**
- Psychology and Aging (Consulting Editor).
- Laura Martignon**
- Swedish Council for the Development of Science (Member).
 - Deutsche Gesellschaft für Didaktik der Mathematik, Arbeitskreis Stochastik (Adviser).
 - International School for Advanced Studies, Neuroscience Section, Trieste (Member of Board of Advisers).
 - Stochastik in der Schule (Editorial Board).
 - Matemática Universitária (Associate Editor).
- Karl Ulrich Mayer**
- American Academy of Arts and Sciences (Foreign Honorary Member).
 - Berlin-Brandenburgische Akademie der Wissenschaften (Committee on "Young Academy").
 - Berliner Journal für Sozialforschung (Editorial Board).
 - British Academy of Sciences (Corresponding Fellow).
 - Cornell University, Center for the Study of Inequality (Member of External Board).
 - Das Sozio-ökonomische Panel des Deutschen Instituts für Wirtschaftsforschung (Member of Advisory Board).
 - Deutsche Akademie der Naturforscher Leopoldina (Senator, Speaker of Section on Economics and Empirical Social Science).
 - Deutsche Gesellschaft für Soziologie (Vice-Chair and Member of the Board).
 - Deutsches Institut für Wirtschaftsforschung (Member of Advisory Board).
 - European Academy of Sociology (Founding Member).
 - Evangelisches Geriatriezentrum Berlin (Member of Advisory Board).
 - Freie Universität Berlin (External Evaluator, Expert Committee for the Faculty of Sociology).
 - Gründungsausschuss des Rates für Sozial- und Wirtschaftsdaten (Chair).
 - Kölner Zeitschrift für Soziologie und Sozialpsychologie (Coeditor).
 - Kommission der Bundesregierung zur Verbesserung der informationellen Infrastruktur zwischen Wissenschaft und Statistik (Member).
 - Max-Planck-Institut für demografische Forschung (Chair of Search Committee, Member of Board of Scientific Advisers).

- Max-Planck-Institut für Gesellschaftsforschung (Chair of Search Committee).
 - Max-Planck-Projektgruppe "Recht der Gemeinschaftsgüter" (Committee Member).
 - Max Planck Society (Member of Presidential Working Group on Financing).
 - Sächsische Hochschulentwicklungskommission (Vice-Chair).
 - Stiftung Hanse-Wissenschaftskolleg in Delmenhorst (Member of Advisory Board).
 - Yale University, Center of Comparative Research (Member of Advisory Board of Electors).
- Antje Mertens**
- Research Fellow of the German Science Foundation DFG Sonderforschungsbereich 373.
 - ETLA and LOWER Conference, Helsinki 2002 (Coorganizer).
 - International Conference "Overeducation in Europe," organized by MPIB Berlin and ROA Maastricht, Berlin 2002 (Coorganizer).
- Justin Powell**
- National Science Foundation, Review Committee for the Science Resources Studies Division "Women, Minorities, and Persons with Disabilities in Science and Engineering" (Member).
- Jacqui Smith**
- Berlin Aging Study (BASE) (Steering Committee).
 - Graduate Program Free University of Berlin "Neuropsychiatry and Psychology of Aging" (Steering Committee).
 - English Longitudinal Study (ELSA) (Member of Advisory Board).
 - Survey of Older Adults in Germany (Member of Advisory Board).
 - China Healthy Longevity Study (Research Consultant).
 - Norwegian Longitudinal and Cohort Study of Aging (Research Consultant).
 - Expertise commissioned for the 4th Report on Old Age in Germany (Vierter Altenbericht der Bundesregierung) (Research Consultant).
- Heike Solga**
- "Die Junge Akademie" an der Berlin-Brandenburgischen Akademie der Wissenschaften und der Deutschen Akademie der Naturforscher Leopoldina (Member).
 - ALLBUS (Member of Scientific Advisory Board).
 - Max Planck Society (Member of Senate)
- Elsbeth Stern**
- Online Journal "Research Dialogue" (EARLI) (Editor-in-Chief).
 - TIMS Elementary School Study (Member of Scientific Board).
 - Max Planck Society, Working Committee for the Advancement of Women in Science (Member).
- Peter M. Todd**
- Adaptive Behavior, MIT Press (Editor-in-Chief).
 - Animal Cognition, Springer Verlag (Associate Editor).
 - Workshop on Artificial Life Models for Musical Applications (ALMMA), Prague 2001 (Coorganizer).
 - Symposium on When Learning Shapes Its Own Environment, Edinburgh 2001 (Coorganizer).
 - Summer Institute on Bounded Rationality in Psychology and Economics, Berlin 2001 (Coorganizer).
- Heike Trappe**
- Conference "Changing Work and Life Patterns in Western Industrial Societies," Berlin 2001 (Coorganizer).
 - Award Committee for the 2002 "Rosabeth Moss Kanter Award for Excellence in Work-Family Research" (Member).

4. Academic Degrees 2001–2002

Habilitations

Freund, A. (2002). Die Rolle persönlicher Ziele für die Entwicklung. Freie Universität Berlin.

Glück, J. (2001). "Jenseits des Rohscores": Empirische und konzeptuelle Beiträge zu qualitativen Aspekten kognitiver Leistungen. Universität Wien.

Hoffrage, U. (2001). Urteilen und Entscheiden. Freie Universität Berlin.

Köller, O. (2001). Leistungsgruppierungen, soziale Vergleiche und selbstbezogene Fähigkeitskognitionen in der Schule. Universität Potsdam.

Vitouch, O. (2001). Kognitive Musikpsychologie: Von den neuronalen Basisprozessen zum Musik-erleben im Kontext. Universität Wien.

Doctoral Dissertations

Bondar, A. (2002). Balance and cognition: Resource allocation and its control in young and older adults. Freie Universität Berlin.

Jopp, D. (2002). Erfolgreiches Altern: Zum funktionalen Zusammenspiel von personalen Ressourcen und adaptiven Strategien des Lebensmanagements. Freie Universität Berlin.

Krauss, S. (2001). Teaching statistical thinking. Freie Universität Berlin.

Lißmann, I. (2002). Intraindividuelle Veränderungen von Extraversion und Neurotizismus im hohen Alter: Die Bedeutung sensorischer Beeinträchtigung. Freie Universität Berlin.

Matthes, B. (2002). Brücken und Stolpersteine auf dem Weg ins Erwerbsleben. Die Folgen der Transformation für den Erwerbseinstieg ostdeutscher Jugendlicher. Freie Universität Berlin.

McGinnity, F. (2001). Who benefits? A comparison of welfare and outcomes for the unemployed in Britain and Germany. University of Oxford.

Rapp, M. (2002). Dual-task performance in memory and balance: The role of aging and Alzheimer's disease. Freie Universität Berlin.

Riediger, M. (2001). On the dynamic relations among multiple goals: Intergoal conflict and intergoal facilitation in younger and older adulthood. Freie Universität Berlin.

Rieskamp, J. (2001). Simple strategies for social interactions: How to generate trust and fairness. Freie Universität Berlin.

Schmiedek, F. (2002). The structure of cognitive abilities in old and very old age: On the importance of specific group factors in a dedifferentiated factor space. Freie Universität Berlin.

Trautwein, U. (2002). Die Entwicklung und Bedeutung des Selbstwertgefühls Jugendlicher im schulischen Kontext. Freie Universität Berlin.

Wanner, B. (2002). Children's perceived control about friendship and action regulation in friendship relationships in the context of peer status. Freie Universität Berlin.

Watermann, R. (2002). Die Entwicklung von Gesellschaftsbildern im Jugend- und frühen Erwachsenenalter. Freie Universität Berlin.

Master's and Diploma Theses

Atmaca, S. (2002). Has the human mind adapted to perception and processing of natural frequencies? Freie Universität Berlin.

Begehr, A. (2001). Verbale Interaktion im Mathematikunterricht. Analysen von Video-Aufzeichnungen in 8. Klassen von Hauptschulen und Gymnasien. Freie Universität Berlin.

Behrens, K. (2002). Explorations into the concept of wisdom: Structural and content dimensions of knowledge in the fundamental pragmatics of life. Freie Universität Berlin.

Bolinth, I. (2001). Analyse von Veränderungen der Kommunikationsformen in Eltern-Kind-Triaden beim Übergang zur Jugend. Technische Universität Berlin.

Brakemeier, E.-L. (2002). Social support management in old age: Associations with depression and well-being. Freie Universität Berlin.

Büchner, C. (2002). Zeitverwendungsmuster und innerfamiliäre Arbeitsteilung in Paarhaushalten. Eine empirische Analyse auf Basis des Sozio-ökonomischen Panels (SOEP). Freie Universität Berlin.

Chojnowska, M. (2001). Nach Sinn oder nach Taten streben? Wie beeinflussen die Zielformulierungen die Zielverfolgung? Humboldt-Universität zu Berlin.

Grühn, D. (2002). Age and emotional reactivity: Subjective responses to negative film clips. Freie Universität Berlin.

Gummerum, M. (2001). The development of the friendship concept in different cultures. A comparison between China, Iceland, the GDR, and Russia. Freie Universität Berlin.

Hahn, S. (2001). Die politische Partizipationsbereitschaft Jugendlicher. Universität Hamburg.

Hollube, B. (2001). Funktionalität negativer Emotionen für die Handlungsregulation am Beispiel des Übergangs von der Schule in den Beruf. Freie Universität Berlin.

Holzhausen, M. (2002). Kognitive Beeinträchtigung, Demenz und Ängstlichkeit im Alter. Freie Universität Berlin.

- Huxhold, O.** (2002). Scanning and feature integration complexity in a visual search task across the lifespan. Freie Universität Berlin.
- Karrer, K.** (2001). Der Einfluss von sozialer Kompetenz auf die Personenwahrnehmung in Situationen mit und ohne Interdependenz. Technische Universität Berlin.
- Karstein, U.** (2001). Kulturschaffen als Handlungs- und Bewältigungsstrategie?! Voraussetzungen und Spezifika der Entstehung soziokultureller Praxis in der DDR.
- Kleinspehn, A.** (2002). Subjektives Alterserleben im hohen Erwachsenenalter: Korrelate und Veränderungen über die Zeit. Freie Universität Berlin.
- Knecht, A.** (2002). Bildung und Partnerwahl: Ein Vergleich der Geburtsjahrgänge 1939–41 und 1959–61 in Ost- und Westdeutschland. Universität Leipzig.
- Knigge, M.** (2001). Psychologische Determinanten der Entscheidung für oder gegen ein Studium in der Bundesrepublik Deutschland. Technische Universität Berlin.
- Kröhnert, S.** (2002). Karrieren von Hochschulabsolventen unter den Bedingungen fachlich strukturierter Ausbildungs- und Arbeitsmärkte. Humboldt-Universität zu Berlin.
- Kuhl, P.** (2002). Was mich betrifft, das merk' ich mir. Gedächtnis für altersbezogene Informationen. Freie Universität Berlin.
- Lichtwardt, B.** (2001). Berufliche Mehrfachausbildung im ostdeutschen Transformationsprozess. Eine Untersuchung anhand der Lebensverlaufsdaten der Geburtskohorte 1971/Ost. Humboldt-Universität zu Berlin.
- Lüdicke, J.** (2002). Soziale Netzwerke und sozialer Wandel. Eine Studie über Veränderungen sozialer Beziehungen in Ostdeutschland und deren Funktion als soziales Kapital auf dem Arbeitsmarkt der ostdeutschen Transformationsgesellschaft. Freie Universität Berlin.
- Maaz, K.** (2001). Konsequenzen von Ausbildungslosigkeit in unterschiedlichen Gesellschaftssystemen. Berufszugangschancen von Jugendlichen ohne Berufsausbildung in der DDR und der BRD in den 80er Jahren. Humboldt-Universität zu Berlin.
- Mannion, S.** (2002). Validating a new measure of implicit motivation. Freie Universität Berlin.
- Meilwes, A.** (2001). Familienkommunikation in Dyaden und Triaden beim Übergang von der Kindheit zur Jugend. Technische Universität Berlin.
- Nagy, G.** (2001). Strukturanalyse eines Fragebogens zur Erfassung primärer und sekundärer Kontrollstrategien. Freie Universität Berlin.
- Ostmann, K.** (2001). Die Bedeutung kultureller und sozialer Ressourcen beim Übergang von der Schule in die Berufsausbildung. Freie Universität Berlin.
- Pachur, T.** (2002). Judgements of health risk frequencies: On people's sensitivity to information validities, the effect of personal experience, and the plausibility of ecological judgement models. Freie Universität Berlin.
- Piperides, C.** (2002). Expert witness use of consistency cues when judging the veracity of adult testimonies. Freie Universität Berlin.
- Radzei, N.** (2002). Der Zusammenhang von Kontrollstrategien und der Wahrnehmung eigener Wirksamkeit im Kontext des Übergangs von schulischer in berufliche Ausbildung. Freie Universität Berlin.
- Röcke, C.** (2002). Behaving and feeling close: A multidimensional perspective on the nature of relationship closeness in old age. Freie Universität Berlin.
- Saalbach, H.** (2001). Prozesse der Worterkennung im Chinesischen, Japanischen und Deutschen. Technische Universität Berlin.
- Schlesinger, I.** (2001). Schulkultur und politische Bildung. Eine Untersuchung der Einstellungen zur Vermittlung von politischer Bildung bei Lehrern und Schulleitern in den neuen und alten Bundesländern. Freie Universität Berlin.
- Schwanzler, A.** (2002). Entwicklung und Validierung eines deutschsprachigen Instruments zur Erfassung des Selbstkonzepts junger Erwachsener. Humboldt-Universität zu Berlin.
- Schwarz, J.** (2001). Emotionen im Alter: Der Einfluss spezieller Ereignisse auf die Zufriedenheit mit den sozialen Beziehungen. Freie Universität Berlin.
- Sokolova, H.** (2002). Die Auswirkungen der Lernkultur auf die Mathematikleistungen der Grundschüler. Technische Universität Berlin.
- Steinberg, S.** (2001). Die Bedeutung graphischer Repräsentationen für den Umgang mit einem komplexen dynamischen Problem. Eine Trainingsstudie. Technische Universität Berlin.
- Traue, B.** (2002). Enttäuschungen und Aufbrüche—Erwerbsverläufe, biographische Konstruktionen und Vertrauen junger Erwachsener in Ostdeutschland. Freie Universität Berlin.
- Trautmann, G.** (2002). Vergleich triadischer Kommunikation in der Familie. Freie Universität Berlin.
- Warneken, F.** (2002). Peerinteraktion und Denkentwicklung. Freie Universität Berlin.
- Wehner, S.** (2002). Exploring trends and patterns of nonresponse: Evidence from the German Life History Study. University of Essex, Colchester.
- Wilke, A.** (2001). The rationality of emotions: Emotions as adaptations. Freie Universität Berlin.

5. Scientific and Professional Staff 2001–2002

Artelt, Cordula (Dr. phil. in Psychology, 1999, Universität Potsdam): Research in learning (learning strategies and metacognition); reading; cognitive development.

Assmann, Wolfgang (Head of Information Processing Center): Service management in research institutions; information technology in the social and behavioral sciences.

Baltes, Paul B. (Dr. phil. in Psychology, 1967, Universität des Saarlandes; Fellow of the Max Planck Society; Co-director of the Institute; Professor of Psychology, Freie Universität Berlin): Lifespan human development: evolution and ontogenesis; aging of the mind (intelligence, memory, personality, wisdom); theory of successful development; science policy: interdisciplinarity, history, and internationality.

Baumert, Jürgen (State Examination for Teachers, 1968, Hamburg; Dr. phil., 1968, Universität Tübingen; Habilitation in Educational Sciences, 1982, Freie Universität Berlin; Fellow of the Max Planck Society; Co-director of the Institute; Professor of Educational Sciences, Freie Universität Berlin and Humboldt-Universität zu Berlin): Research in teaching and learning; cultural comparisons, large-scale assessment, cognitive and motivational development in adolescence.

Baumgarten, Jürgen (Dr. phil. in German Language and Literature, 1973, Freie Universität Berlin; Head of the Editorial and Publications Unit): Pre-history of the Middle East; neolithization; nomadic cultures.

Büchel, Felix (Dr. rer.pol. in Political Science, 1991, Freie Universität Berlin; Habilitation in Economics, 1998, Technische Universität Berlin; Honorary Professor of Sociology, Freie Universität Berlin; Senior Lecturer of Economics, Technische Universität Berlin; Research Professor, DIW Berlin; Senior Research Scientist): Economics of education; labor market research; social policy research.

Czienskowski, Uwe (Dr. phil. in Psychology, 1995, Freie Universität Berlin): Scientific software development (resource distribution in social networks; feature-pattern-analysis; computer-based scientific research); modeling and simulation; self-reference effect; meta-analysis; experimental design and analysis; philosophy of psychology (mind & consciousness).

Corsten, Michael (Dr. phil. in Sociology, 1991, Universität Marburg; habil. in Sociology, 1997,

Freie Universität Berlin): Interpretive sociology; cultural research on institutions, organizations, and professions; studies on biographies, generational discourse, and youth cultures (as of 2001: University of Jena).

Delius, Julia (Dr. med. in Medicine, 1993, Universität Frankfurt a.M.): Editorial organization of the International Encyclopedia of the Social and Behavioral Sciences; interdisciplinary gerontology in the context of the Berlin Aging Study (BASE); BASE Website design and management; coordination of the International Max Planck Research School (LIFE).

Flitner, Ursula (MA in American Studies and German Literature, 1991, Freie Universität Berlin; State Examination in Library and Information Science, 1995, Senatsverwaltung für Kulturelle Angelegenheiten Berlin/Köln; Head of the Library and Information Research Unit): Information management; electronic resources and networked information systems; human resources development.

Freund, Alexandra M. (Dr. phil. in Psychology, 1994, Freie Universität Berlin; Habilitation in Psychology, 2002, Freie Universität Berlin): Processes of developmental regulation; motivation across the life span; development of the self-definition over the life span (as of 2003: Northwestern University, Evanston).

Gigerenzer, Gerd (Dr. phil. in Psychology, 1977, Universität München; Habilitation in Psychology, 1982, Universität München; Fellow of the Max Planck Society; Co-director of the Institute; Professor of Psychology, Freie Universität Berlin): Models of bounded rationality; social intelligence; ecological rationality; heuristics of scientific discovery; philosophy, history, and methodology of social sciences.

Goedicke, Anne (Dipl.-Soz., 1996, Humboldt-Universität zu Berlin; Dr. phil. in Sociology, 2001, Freie Universität Berlin): Social stratification and formal organizations; transformation of former socialist countries; life course; social mobility; labor markets, firms, and occupations.

Grund, Peter (Dipl.-Inform., 1981, Technische Universität Berlin): Statistical software and data base management systems; data protection.

Händle, Christa (First and Second State Examination for Teachers, 1961, 1965; Dr. phil. in Sociology, 1977, Universität Bremen; Habilitation in Educational Sciences, 2000, Universität Olden-

burg): The culture of educational institutions; the double socialization of teachers; transformation of the education system in the new federal states; civic education.

Hardy, Ilonca (PhD in Educational Psychology, 1998, University of Iowa): Learning environments incorporating the social character of cognition (emphasis: collaborative learning); the role of language in problem solving; effects and uses of external representations.

Hartung, Dirk (Dr. rer.pol. in Sociology, 1973, Universität Bremen): Educational training and employment; Chairperson of the Works Council of the Max Planck Society (on leave from the Center for Sociology and the Study of the Life Course).

Hertwig, Ralph (Dr. rer.soc. in Psychology, 1995, Universität Konstanz): Decision making under risk (which heuristics do people use and how do different representations of probabilities and outcomes affect choices under risk); simple heuristics for resource allocation (parental investment), estimation, and judgments of risk (e.g., health risks); methodology of social science (i.e., comparison of the methodological approaches in psychology and experimental economics).

Hillmert, Steffen (Dipl.-Soz., 1996, Universität Bamberg; Dr. phil. in Sociology, 2000, Freie Universität Berlin): Life courses and institutional change; comparative studies; education and training; occupational careers; research methods.

Hoernig, Erika M. (Dr. rer.pol. in Sociology, 1977, Freie Universität Berlin; Habilitation in Sociology of Education, 1994, Universität Bremen; Venia legendi in Sociology of Education, 1995, Freie Universität Berlin): Biographical and life-course research; qualitative methods; historical generations and social change; professions, intelligentsia, and intellectuals.

Hoffrage, Ulrich (Dr. phil. in Psychology, 1995, Universität Salzburg; Habilitation in Psychology, 2001, Freie Universität Berlin): Risk communication, in particular, Bayesian inference and the impact of external representations of information; models of cognitive processes underlying choices and probability judgments; analytical study of simple heuristics; models of cognitive processes in hindsight bias and the reiteration effect, and the co-occurrence of both effects.

Hutchinson, John M. C. (PhD in Biology, 1990, University of York): Behavioral ecology and optimality modelling; rules of thumb in animals and plants (e.g., weather prediction); spatial decisions

in biology and the social sciences; daily routines: the dawn chorus of birds; skylark behavior and morphology; sexual selection of slug genitalia; theoretical morphology.

Keller, Monika (Dr. phil. in Psychology, 1974, Universität Heidelberg; Habilitation in Psychology, 1994, Freie Universität Berlin): Development in cultural context; social and moral development and emotions in cultural context; social perspective taking, theory of mind, and domains of social and moral reasoning; social rationality: Contracts and emotions in cheating detection; social and moral education in nursery school and in school.

Klieme, Eckhard (Dipl.-Math., 1978, Universität Bonn; Dipl.-Psych., 1981, Universität Bonn; Dr. phil. in Psychology, 1988, Universität Bonn; Habilitation in Educational Sciences, 2000, Freie Universität Berlin): Research on teaching and learning; knowledge structures in mathematics and science; cross-curricular competencies; educational assessment and evaluation (as of 2001: University of Frankfurt a.M. and DIPF).

Köhler, Helmut (Dr. phil. in Educational Economics, 1975, Technische Universität Berlin): Statistical analysis of educational development; social background and educational careers; national and international education indicators; research on school statistics of the GDR.

Köller, Olaf (Dipl.-Psych., 1991, Universität Kiel; Dr. phil. in Psychology, 1997, Universität Kiel; Habilitation in Psychology, 2001, Universität Potsdam): Empirical methods of social research; research in teaching and learning; motivational psychology (as of 2002: University of Erlangen-Nuremberg).

Körner, Nina (Second State Examination in Law, 1973, Universität Hamburg; Head Administrator of the Institute).

Krampe, Ralf T. (Dr. phil. in Psychology, 1992, Freie Universität Berlin): Sensory-motor functions and aging; acquisition and maintenance of expertise; movement, timing and coordination; cognitive aging; interindividual differences in learning and motivation.

Krappmann, Lothar (Dr. phil. in Sociology, 1969, Freie Universität Berlin; Honorary Professor of Educational Sciences, Freie Universität Berlin; Senior Research Scientist): 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.

Krauss, Stefan (First State Examination in Mathematics and Physics, 1995, Universität Erlangen-Nürnberg; Dr. phil. in Psychology, 2001, Freie Universität Berlin): Research on teaching and learning; didactics of mathematics, especially didactics of statistics; probabilistic reasoning (Bayesian inferences).

Kreppler, Kurt (Dr. phil. in Psychology, 1969, Technische Universität Darmstadt; Habilitation in Psychology, 1996, Freie Universität Berlin): Families as developing systems; family communication during infancy and adolescence; methodological issues in the study of human interaction; history of developmental psychology.

Kunzmann, Ute (Dr. phil. in Psychology, 1998, Freie Universität Berlin): Wisdom and other pragmatic forms of cognition; emotional competencies (emotional reactivity, regulation, and understanding); lifespan developmental psychology.

Lange, Lydia (Dr. phil. in Social Psychology, 1966, Universität Jena; Dr. sc. phil. [habilit.] in Methods of Empirical Social Research, 1986, Humboldt-Universität zu Berlin): Bibliometrics; history of psychology.

Lenhardt, Gero (Dr. rer.soc. in Sociology, 1974, Universität Konstanz; Habilitation in Sociology, 1983, Universität Frankfurt a.M.): Sociology of education, work, and development; sociology of higher education; sociology of minority groups.

Li, Shu-Chen (PhD in Psychology, 1994, University of Oklahoma): Cognitive development through the lifespan with special interest in cognitive aging; intraindividual variability in behavior and cognition as indicators of aging (and developmental) processes; neurocomputational and cognitive models of cognitive aging (and child cognitive development); mechanisms and processes for reciprocal interactive biocultural influences on cognitive development throughout the lifespan; theoretical studies of computational complexity.

Maas, Ineke (Dr. in Sociology, 1990, University of Utrecht): Social mobility; social participation in old age; cultural participation (on leave; as of 2002: University of Utrecht).

Martignon, Laura (Dr. rer.nat. in Mathematics, 1978, Universität Tübingen; Habilitation in Neuroinformatics, 1998, Universität Ulm): Simple heuristics vs. complex decision machines; analysis of lexicographic algorithms for comparison, estimation, and categorization tasks; detection and measurement of higher-order correlations in nonlinear environments; Bayesian strategies for sta-

tistical inference and machine learning, compared to fast and frugal algorithms for human adaptive behavior; model search in the Bayesian framework; the didactics of Bayesian reasoning based on adequate information formats; stochastics and probability in general (as of 2003: Teachers College of Ludwigsburg).

Matthes, Britta (Dipl.-Soz., 1995, Universität Leipzig; Dr. phil. in Soziologie, 2002, Freie Universität Berlin): Life courses in transformation processes; labor market entry in international comparisons; methods of life course research.

Mayer, Karl Ulrich (Dr. rer.soc., 1973, Universität Konstanz; Habilitation in Sociology, 1977, Universität Mannheim; Fellow of the Max Planck Society; Co-director of the Institute; Professor of Sociology, Freie Universität Berlin): Social stratification and mobility; comparative analysis of social structure; sociology of the life course; occupational structures and labor market processes.

Mertens, Antje (Dr. rer.pol. in Economics, 1998, Humboldt-Universität zu Berlin): Empirical labor economics, especially labor mobility, training, and wages.

Müller-Brettel, Marianne (Dipl.-Psych., 1971, Freie Universität Berlin; Dr. phil. in Psychology, 1995, Freie Universität Berlin): Scientometrics; history of psychology; peace psychology.

Oesterreich, Detlef (Dipl.-Psych., 1968, Freie Universität Berlin; Dr. phil. in Psychology, 1975, Freie Universität Berlin): Theory of authoritarianism, authoritarianism and political consciousness; civic education of adolescents.

Riediger, Michaela (Dipl.-Psych., 1997, Humboldt-Universität zu Berlin; Dr. phil. 2001, Freie Universität Berlin): Development of future-oriented motivation across the life span; strategies of adaptive life management; lifespan developmental psychology.

Rieskamp, Jörg (Dipl.-Psych., 1998, Technische Universität Berlin; Dr. phil. in Psychology, 2001, Freie Universität Berlin): Decision strategies for social interactions (the role of trust, reciprocity, and fairness); evolution of behavior (computer simulations of evolving strategies for bargaining situations); experimental investigation of people's use of simple heuristics for various judgment tasks.

Rötger, Antonia (Dipl.-Phys., 1989, Universität Karlsruhe; Docteur ès Sciences de l'Université Joseph Fourier de Grenoble, 1993; science com-

munication): Behavioral sciences; neuroscience and mathematical modeling of complex systems.

Rusch-Feja, Diann (PhD in German Literature, 1986; MLS in Library and Information Science, 1981, State University of New York at Buffalo): Scientific information systems and information management; electronic information systems and networked information resources; digital libraries, indexing, classification, and metadata; education in library and information-oriented professions.

Schooler, Lael (PhD in Cognitive Psychology, 1993, Carnegie Mellon University): Adaptation of human memory to the statistical structure of past and present environments; computational models of human memory; memory's role in judgment and prediction tasks.

Schümer, Gundel (First and Second State Examination for Teachers, 1962, Stuttgart; 1970, Tübingen; Dr. phil. in Educational Sciences, 1977, Universität Hamburg): School systems and instruction; theories of instruction and methods of instructional research; comparative research on schools and instruction; the language of the classroom.

Singer, Tania (Dr. phil. in Psychology, 2000, Freie Universität Berlin): Lifespan psychology; cognition and aging; longitudinal research.

Smith, Jacqui (PhD in Psychology, 1984, Macquarie University, Sydney; Habilitation in Psychology, 1999, Freie Universität Berlin; Senior Research Scientist): Profiles of psychological functioning in the old and oldest-old; psychological predictors of longevity; potentials and risks for development and successful aging; application of intelligence and life knowledge during adulthood.

Stanat, Petra (Dipl.-Psych., 1992, Freie Universität Berlin; PhD in Psychology, University of Massachusetts at Amherst): Conditions of immigrant students' school success; large-scale assessment and evaluation; internationally comparative research on schooling; gender differences in school performance; social competence.

Stern, Elsbeth (Dipl.-Psych., 1982, Universität Hamburg; Dr. phil. in Psychology, 1986, Universität Hamburg; Habilitation in Psychology, 1994, Universität München; Univ.-Prof. 1994, Universität Leipzig; Senior Research Scientist): Cognitive development; intelligence and knowledge; research in teaching and learning.

Solga, Heike (Dr. phil. in Sociology, 1994, Freie Universität Berlin; Head of the Independent Re-

search Group Lack of Training: Employment and Life Chances of the Less Educated): Social stratification; social mobility; life course; labor market research.

Todd, Peter M. (PhD in Psychology, 1992, Stanford University; Senior Research Scientist): Evolution of behavior (computer simulations of populations of simple organisms adapting to different environmental structures, both physical and social); simple heuristics for sequential search (including mate choice), categorization (including intention-from-motion), and multi-step processes (including parental investment); psychological selection; rhythmic and time-based behavior (including music, sequence learning/production, and evolution of song); connectionist models of cognition.

Trappe, Heike (Dr. phil. in Sociology, 1994, Freie Universität Berlin): Gender and social inequality; life course and labor market research; life courses and institutional change; work-family research.

Trautwein, Ulrich (Dipl.-Psych., 1999, Universität Göttingen; Dr. phil. in Psychology, 2002, Freie Universität Berlin): Development of self-related cognitions in educational settings; school development and management; effects of homework assignment on academic achievement.

Trommer, Luitgard (Dipl.-Kfm. Applied Economics, 1966, Universität München): Civic education; youth integration into the labor market; statistical evaluation and analysis, including that of foreign workers in Germany and women's employment.

Vitouch, Oliver (Dr. rer.nat. in Psychology, 1999, Universität Wien; Habilitation in Psychology, 2001, Universität Wien): Robustness (and related properties) of fast and frugal heuristics (vs. optimization/maximization models); methodological and epistemological issues in psychology (e.g., replicability and cross-validation of findings, problems of NHST, research and publication norms); methods and issues in cognitive neuroscience (functional brain imaging); problems of consciousness; cognitive psychology of music (as of 2002: University of Vienna).

Watermann, Rainer (Dipl.-Päd., 1996, Universität Münster; Dr. phil. in Educational Science, 2002, Freie Universität Berlin): International and comparative educational research; quantitative methods of social research; political socialization.

Zeiger, Helga (Dr. phil. in Sociology, 1973, Freie Universität Berlin): Sociology of childhood; shaping daily life; intergenerational relationships.

Emeritus Members of the Max Planck Society

Edding, Friedrich (Dr. phil. in History, 1934, Universität Kiel; Dr. rer.pol. h.c. in Economics, 1981, Freie Universität Berlin; Until 1977 Director of the Institute; Emeritus Professor of Educational Economics, Technische Universität Berlin): Economics of the educational system; vocational training; adult education; relations between institutionalized and informal learning. (deceased 11 September 2002)

Edelstein, Wolfgang (Dr. phil. in Medieval Studies, 1962, Universität Heidelberg; Fellow of the Max Planck Society; Until 1997 Co-director of the Institute; Honorary Doctorate in Social Science, University of Iceland; Honorary Professor of Edu-

cational Science, Freie Universität Berlin and Universität Potsdam): Development and socialization; social-cognitive and moral development; developmental and structural aspects of curriculum and instruction; developmental and school related conditions of successful learning; conditions of successful school transformation.

Roeder, Peter M. (Dr. phil., 1960, Universität Marburg; Habilitation in Educational Sciences, 1966, 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.

Postdoctoral Research Fellows

Barrett, H. Clark (PhD in Anthropology, 1999, University of California, Santa Barbara): Human cognitive evolution; domain-specific cognition; predator-prey coevolution; South American hunter-horticulturalist societies (Shuar, Achuar, Shiwiar); folk psychology and folk biology; human cognitive development; cognitive neuroscience; biological anthropology; evolutionary psychology (as of 2001: University of California at Los Angeles).

Dorenlot, Pascale (Doctorate in Social Psychology, Ecole des Hautes Etudes en Sciences Sociales, Paris): Identity construction in multicultural contexts; bilingualism; national identities, European identity; multifactorial analysis (physical, psychological, and social factors) of language learning, illness, aging processes (as of 2001: INSERM).

Fasolo, Barbara (PhD, 2002, in Social Psychology, University of Colorado, Boulder): Judgment and decision making.

Ghisletta, Paolo (PhD in Psychology, 1999, University of Virginia): Psychometric measurement; structural equation modeling in longitudinal research; cognitive and sensory aging (as of 2001: University of Geneva).

Glück, Judith (PhD in Psychology, 1999, Universität Wien; Habilitation in Psychology, 2001, Universität Wien): Statistical methods in psychology (classification methods for longitudinal data; item-response models); wisdom (wisdom as a metaheuristic; assessment of wisdom); individual differences in cognitive strategies (as of 2002: University of Vienna).

Katsikopoulos, Konstantinos (PhD in Human Factors, 1999, University of Massachusetts): Mathematical analyses of the ecological rationality of simple heuristics; simple descriptive models of human choice and their relation to normative models.

McElreath, Richard (PhD in Anthropology, 2001, University of California, Los Angeles): Cultural evolution and the evolution of cultural capacities in humans; maintenance of cultural differences; herding economies; human behavioral ecology; game theory and population modeling (as of 2002: University of California at Davis).

McGinnity, Frances (Dr. phil. in Sociology, 2001, Oxford University; MSc in Sociology, 1995, London School of Economics): Unemployment: Financial and psychological consequences; active labor market policy; comparative social research; labor market transitions; temporary employment.

Marsh, Barnaby (Dr. phil. in Behavioral Ecology, 2000, University of Oxford; Juliana Cuyler Matthews Research Fellow, New College, Oxford): Decision making under risk and uncertainty; evolutionary psychology; comparative decision making in humans and animals; behavioral ecology; domain-specific reasoning; experimental economics; applied decision theory; research methodologies and the philosophy of science.

Morillas Martínéz, Juan Rafael (Dr. phil. in Sociology, 2002, Nuffield College, Oxford; PhD in Social Sciences, 2002, Center for the Advanced Study in the Social Sciences, Juan March Institute, Madrid): Social and economic stratification and mobility.

Raab, Markus (Dr. phil. in Sport Psychology, 2000, Universität Heidelberg): Decision making in sports; decision making under time pressure; motor control and motor learning; cognitive neuroscience; simple heuristics in sports; search, stop, and decision rules in individual decision making; hot-hand phenomenon in sports; predicting sport results; judgment of players and team performance (as of 2003: University of Flensburg).

Reimer, Torsten (Dr. phil. in Psychology, 1996, Freie Universität Berlin): Cognitive aspects of group decision making and problem solving.

Takezawa, Masanori (MA in Social Psychology, 1997, Hokkaido University, Japan; PhD in Social Psychology, 2001, Hokkaido University, Japan): Adaptive heuristic approach in distributive bargaining under incomplete information (evolu-

tionary computer simulations and human experiments); development and emergence of social preferences—altruism, reciprocity, egalitarianism and moral punishment (behavioural game experiments with children and adults); social intelligence in cooperative/competitive situations; human experiments and computer simulations.

Yang, Lixia (PhD in Psychology, 1999, Institute of Psychology, Chinese Academy of Sciences, Peking): Cognitive and sensorimotor functions and aging; working memory; wisdom (as of 2003: University of Toronto).

Wallin, Annika (PhD candidate, Lund University): How people structure their decision environment; the use of social information in decision making and problem solving).

Predocctoral Research Fellows

Bondar, Albina (Dipl.-Psych., 1999, Freie Universität Berlin): Balance and cognition: Resource allocation and dual-task costs in young and old adults.

Brunner, Martin (Dipl.-Psych., 2002, Universität Mannheim): Research in instruction and learning; multivariate methods and measurement theory; structural equation modeling and item-response theory.

Chandrasekharan, Sanjay (MA in Linguistics, 1997, Jawaharlal Nehru University, New Delhi; PhD candidate in Cognitive Science, Carleton University, Ottawa, Canada): Role of environment structure in agent design; trust; social situatedness; human-computer interaction (as of 2002: Carleton University, Ottawa).

Chang, Ping-Huang (Master of Education, 1998, National Taiwan Normal University): Comparative research of school system; educational policy.

Daniels, Zoe (Dipl.-Psych., 1998, Universität Hamburg): Research in teaching and learning; motivational development during adolescence.

Demmrich, Anke (Dipl.-Psych., 1999, Universität Potsdam): Research in instruction and learning; cooperative learning; working memory.

Dieckmann, Anja (Dipl.-Psych., 1999, Universität Würzburg): Experimental investigation of people's use of simple heuristics; animal cognition: Concept learning and social intelligence.

Dudey, Thomas (Dipl. in Economics, 1998, Universität Bonn): Game theory; experimental economics; bounded rationality; sequential search.

Ebner, Natalie C. (Dipl.-Psych., 2001, Freie Universität Berlin): Differential and successful aging; processes of developmental regulation; future-oriented motivation across the life span; lifestyle across the life span (LIFE).

Ehrhorn, Susanne (Dipl.-Psych., 1999, Technische Universität Braunschweig): Social relationships and loneliness in old age.

Fanselow, Carola (Dipl.-Psych., 2000, Universität Potsdam): Decision strategies; process-tracing methods in decision making; hindsight bias (as of 2002: University of Applied Sciences Eberswalde).

Felbrich, Anja (Dipl.-Psych., 2000, Universität Potsdam): Research in teaching and learning; development of graphing competencies.

Gerstorf, Denis (Dipl.-Psych., 2001, Freie Universität Berlin): Psychological predictors of longevity; profiles of psychological functioning in the old and oldest-old; cohort differences in levels of functioning.

Grühn, Daniel (Dipl.-Psych., 2002, Freie Universität Berlin): Emotion and emotion regulation across the life span; cognitive functioning in the old and the oldest-old; cognitive and emotional mechanisms of successful aging.

Gummerum, Michaela (Dipl.-Psych., 2002, Freie Universität Berlin): Development of perspective-taking, theory of mind, and fairness (economic game experiments with children and adolescents); development of relationship concepts in different cultural contexts; moral development; cultural psychology.

Gürtler, Christine (Dipl.-Psych., 1999, Universität Würzburg): Social inequality among children; social relationships and friendships; forensic psychology: measurement of the child's attachment to its parents as a basis for custodial decisions (as of 2002: University of Potsdam).

Hanoch, Yaniv (PhD candidate, University of Haifa, Israel): Emotion theory; bounded rationality; rational decision making (MINERVA Fellowship).

Höhne, Anke (Dipl.-Soz., 2000, Humboldt-Universität zu Berlin): Gender-segregated labor market; coupled careers; political and social transformation in East Germany.

Huxhold, Oliver (Dipl.-Psych., 2002, Freie Universität Berlin): Lifespan cognitive development and cognitive aging; intra-individual and inter-individual variability in cognitive performance; cognitive processes contributing to balance control (LIFE).

Jacob, Marita (Dipl.-Soz., 2000, Universität Gießen): Education and training in Germany in the 1990s; rational choice theory and educational inequality; research methods.

Johnson, Joseph (BA in Psychology and Economics, 1998, University of Toledo, Ohio; Doctoral candidate for joint Ph.D in Cognitive Psychology and Cognitive Science, 1999 to present, Indiana University, Bloomington): Dynamic mathematical models of decision making; agent-based models to explore individual differences; experimental economics and consumer behavior; domain-specific decision making and expertise; social influences (e.g., accountability, mere presence) (as of 2002: Indiana University).

Julius-McElvany, Nele (Dipl.-Psych., 2001, Freie Universität Berlin): Research in instruction and learning; reading literacy; self-regulated learning; socialization in the family.

Kunter, Mareike (Dipl.-Psych., 1999, Julius-Maximilians-Universität Würzburg): Research in instruction and learning; social skills; teamwork and cooperative learning; instructional quality.

Kurzenhäuser, Stephanie (Dipl.-Psych., 1999, Universität Heidelberg): The impact of external repre-

sentations on statistical thinking, especially Bayesian reasoning; legal and political implications of bounded rationality; communication of uncertainty and risk in medicine.

Lüdtke, Oliver (Dipl.-Psych., 2000, Freie Universität Berlin): Five-factor model of personality.

Maaz, Kai (Dipl.-Soz.-Päd. (FH), 1998, Catholic University of Applied Sciences Berlin; Dipl.-Soz., 2002, Humboldt-Universität zu Berlin): Transition from school to university and work; social background and educational and vocational chances.

Mata, Rui (Dipl.-Psych., 2002, FPCE University of Lisbon): Adaptation of human memory to the statistical structure of the environment; social cognition (the discipline, not ToM) (LIFE).

Nagy, Gabriel (Dipl.-Psych., 2002, FU Berlin): Research in teaching and learning; developmental regulation across the life span; transition from school to vocational training; quantitative methods of empirical social research (LIFE).

Pachur, Thorsten (Dipl.-Psych., 2002, Freie Universität Berlin; MSc (Health Psychology), 2002, Sussex): Risk perception; simple heuristics based on information sampled in the social network for risk judgements; ecological judgement models, especially adaptive decision making and cue validity learning; social-cognitive health behavior models; decision making and attitude formation in doctor-patient interactions (LIFE).

Pollmann-Schult, Matthias (Dipl.-Soz., 2000, Freie Universität Berlin): Labor market research; social inequality; social stratification.

Powell, Justin (MA, 1999, Humboldt-Universität zu Berlin; BA, 1992, Swarthmore College): Sociology of education; social stratification; social policy; disability studies; life course.

Rapp, Michael (Medical Examination, 1997, Humboldt-Universität zu Berlin, Campus Virchow): Cognition and sensorimotor behavior in older adults and Alzheimer's disease patients; selective optimization with compensation across the life span; behavioral manifestations of normal and pathological aging (as of 2002: Mount Sinai School of Medicine, New York).

Reimer, Maike (Dipl.-Psych., 2000, Freie Universität Berlin): Autobiographical memory; cognitive aspects of survey methodology; individual biographies in institutional contexts.

Röcke, Christina (Dipl.-Psych., 2002, Freie Universität Berlin): Intraindividual variability in psychological functioning as a tool to understand lifespan development; differential perspective on the Third versus the Fourth Age; social relationships and closeness in old age (LIFE).

Rusconi, Alessandra (Dipl.-Pol., 1997, Università degli studi di Firenze): Demographic transformation in East Germany; German-Italian comparison in the life courses of young adults.

Schäfer, Sabine (Dipl.-Psych., 2001, Freie Universität Berlin): Cognitive-sensorimotor coordination across the life span; age differences in the regulation of sequential action (LIFE).

Scheibe, Susanne (Dipl.-Psych., 2001, Humboldt-Universität zu Berlin): The psychology of longing; longing and successful development over the life course; lifespan development of interindividual differences; the role of interindividual differences for psychopathology.

Schmiedek, Florian (Dipl.-Psych., 2000, Universität Mannheim): Cognitive development in old age: Models of psychometric intelligence and intraindividual variability in cognitive functioning; multivariate methods and measurement theory: Structural equation modeling and item-response theory.

Schneider, Michael (Dipl.-Psych., 2002, Technische Universität Berlin): Research in teaching and learning; visual reasoning.

Schrenk, Judith (Dipl.-Psych., 2000, Westfälische Wilhelms Universität Münster): Social inequality among children in classrooms; socio-cognitive development; stimulus intensity in cue reactivity research on alcohol addiction (as of 2002: University of Potsdam).

Seibert, Holger (MA in Sociology, 2000, Universität Rostock): Education, training, and labor market entry; unemployment in early adulthood; ethnic minorities and migration.

Stange, Antje (Dipl.-Psych., 2000, Freie Universität Berlin): Wisdom; social perception; nonverbal expressiveness; lifespan development.

Wagner, Sandra (Dipl.-Soz., 1997, Humboldt-Universität zu Berlin): Social stratification; sociology of education; life course research; migration and ethnic minorities.

Wassner, Christoph (State Examination 1997 in Mathematics and Economics, Universität Erlangen-Nürnberg; State Examination 1999 in Informatics, Universität Erlangen-Nürnberg): Probabilistic reasoning; didactics of mathematics, especially didactics of stochastics; tutorial and simulation software in mathematics; research in teaching and learning in general (as of 2002: University of Kassel).

Wilke, Andreas (Dipl.-Psych., 2002, Freie Universität Berlin): Emotions; evolutionary psychology; judgment and decision making (LIFE).

Wirth, Joachim (Dipl.-Psych., 1998, Technische Universität Berlin): Research in teaching and learning; analogical problem solving; cognitive modeling (as of 2002: University of Essen).

Wolf, Regina (Dipl.-Psych., 2000, Technische Universität Berlin): Control strategies in the life span; coping with finiteness; managing the transition from school to work.

