Social and Evolutionary Rationality

We live in a social world. Most other animals do too. The social world affords many opportunities and challenges for decision making, from the benefits of collective cognition and cooperation to the costs of groupthink and cut-throat competition. Some social situations appear, at least at the moment, to be uniquely human. For instance, morality in humans has been studied for millennia, with dozens of viewpoints on what behavior is morally permissible. But do morally relevant situations always require special sophisticated decision-making processes, or can simple heuristics play a role in moral behavior?

Other social situations are not uniquely human, but are faced by a number of animal species. An evolutionary perspective can be useful here because it provides two advantages. First, it offers the ability to test hypotheses across different species that differ in their natural ecology. Thus, we can investigate ecological rationality with a potentially broad range of environments experienced by different species. Second, an evolutionary view can offer a theoretical framework for thinking about the adaptive nature of decision making. Here, we explore how the study of heuristics and the core capacities underlying them are relevant to social decision making in humans and other animals by assessing the adaptive benefits of group decision making and cooperation.

Moral Satisficing

Every year, an estimated 1,000 Germans die waiting in vain for a suitable organ donor. Only 12% of Germans have consented to donating their organs upon their death. Other countries, such as the United Kingdom and the United States, show only slightly higher levels of consent, 17% and 28%, respectively. In contrast, Austria, France, Hungary, Poland, and Portugal all have consent rates exceeding 99% (see Figure 7). Why do we see such differences in organ donation across these countries? Whether to donate one’s organs is a moral decision that we all face. How do we make decisions in these types of morally relevant situations? There are at least three primary perspectives. In the utilitarian view, the morally permissible action is the one that maximizes the overall utility of all individu-

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Figure 7. Countries differ dramatically in the proportion of potential organ donors. The clear disparity in consent rate is attributable to majority use of the default heuristic, and the countries’ policy regarding whether residents must opt in to give consent or opt out of assumed consent (Johnson & Goldstein, 2003).

Source. Based on the figure of Gigerenzer (2010c) and Johnson & Goldstein (2003).
als involved, accounting for the costs and benefits of the potential outcomes. A virtue perspective, in contrast, highlights the moral character of individuals. Finally, the deontological perspective emphasizes the following of moral rules. Similarly, following commandments and other socially transmitted rules can govern moral behavior. Gigerenzer (2010c) argues that there exists another possible mechanism underlying our behavior in morally relevant situations: heuristics. In some of these situations, we may exhibit consistent character traits, trade off the good and the bad of our actions, or follow the dictate of a moral rule or commandment. But in many cases, we may simply use a heuristic in morally relevant situations. Take the organ donor shortage (Johnson & Goldstein, 2003). Is it possible that a heuristic could account for the extreme differences in consent rates between countries? Rather than making sweeping claims about the moral character of residents of these countries, Gigerenzer (2010c) suggests that most people use the same default heuristic: If there is a default, do nothing about it. What differs across these countries is not moral character or commandments, but the government-imposed default for making an organ donation choice. In Germany, the United Kingdom, and the United States, individuals must actively opt in to consenting to donate their organs. In the other countries, the default is giving consent to donate, and individuals must opt out. Thus, a simple heuristic has potentially life-saving implications in the moral domain of organ donation.

In addition to the default heuristic, other heuristics are used in moral situations. Imitation heuristics are particularly relevant. In particular, imitate-your-peers is a powerful heuristic that ignites jealousy and propagates fads worldwide. It also applies to moral situations, enhancing donations to charity yet amplifying discrimination toward minorities. Imitate-the-successful and follow-the-leader are further examples of imitation-based heuristics that we use frequently in moral situations. The equality heuristic involves dividing a resource equally among all possibilities. Though proposed as a means to allocate investments over a financial portfolio, this heuristic may be relevant to parents dividing their love, time, and attention among their children (Hertwig, Davis, & Sulloway, 2002). An even split tends to foster coherence in a group by generating a sense of fairness and justice. Finally, tit-for-tat is a heuristic of helping someone who helped you last time (and withholding help if he or she withheld it last time). In his 1984 book on The Evolution of Cooperation, Axelrod describes how tit-for-tat is used in the morally charged domain of warfare: a system of “live and let live” for the soldiers in the trenches during World War I. If the soldiers attacked their opponents’ supply lines, the opponents would reciprocate in turn. Therefore, a system of mutual restraint developed, allowing both sides to have access to their food and supplies. Implicit ceasefire agreements would even result in night patrols openly walking in front of the trenches, exposed to their enemy. Nevertheless, a single shot from the enemy would unleash a barrage of retaliatory fire. The military command put a stop to this tit-for-tat-like response. The heuristics we rely on may not be moral heuristics, but more general heuristics that are applied to morally relevant situations as well. The default heuristic applies not only to organ donation consent but also to environmental or “green” defaults (Pichert & Katsikopoulos, 2008), purchasing insurance, and choosing retirement plans. The equality heuristic is termed 1/N when used as a method for distributing investments and may explain distributions in the Dictator Game (Keller, Gummerum, Canz, Gigerenzer, & Takezawa, in press). Thus, these heuristics work well in nonmoral situations and may often be applied in morally relevant situations as well.

The critical role of the environment is vital to understanding the heuristics discussed here. Like ecological rationality, the concept of ecological morality proposes that moral behavior results from the interaction between the mind’s mechanisms and the environment. The organ donation case exemplifies this interaction. The striking difference in organ donation consent rates across countries can be attributed to using the same heuristic in different environments. When the default is

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consent, few people opt out. When the default is no consent, only a small percentage of people actively override that default (Johnson & Goldstein, 2003). This concept of ecological morality highlights the chance to engineer our environments to better reach our moral goals. If higher organ donation consent rates will help save lives, then changing the default may improve actual donation rates better and more cheaply than marketing campaigns. In summary, morally neutral heuristics may account for our behavior in many morally relevant situations. These heuristics depend on the environment, which gives us the opportunity to construct appropriate environments and shape the nature of decision making in the moral domain.

When to “Follow an Expert” and “Aggregate Information”

When confronted with a problem, social interaction can provide a solution that is not available to individuals. Two potential group decision-making mechanisms can yield solutions: (a) individuals can aggregate information across a group, thereby harnessing “collective cognition,” or (b) individuals can follow specific “leaders,” those experts with information particularly relevant to the decision at hand. A classic example of such social interaction involves a group of individuals deciding when to move toward a specific resource, such as foraging site or waterhole (Figure 8), or when to switch behavior (e.g., from resting to foraging). Biologists are now beginning to comprehend more fully the heuristics (which they refer to as rules of thumb) individuals use to make such social decisions. They find that individuals can exploit a higher order collective computational capability. Group members may come to a consensus not only about where to travel but also about what heuristics to use. Thus, groups may adapt to compute “the right thing” in different contexts, matching their collective information strategy with the statistical properties of their environment. This perspective lies at the heart of many research projects undertaken by the ABC Research Group. Importantly for the study of social decision making, ecological rationality emphasizes the importance of the social environment (Stevens & King, in press). Katsikopoulos and King (2010) modeled the process of groups of individuals matching their collective information strategy with the statistical properties of their environment. They began by considering a hypothetical situation in which individuals have to choose between two options. In this situation, there is a correct choice for all individuals, and the level of information (“accuracy”) varies across individuals and is sampled from a normal distribution. This is likely to be representative of a variety of choices faced by social animals (e.g., the presence or absence of a food resource or a predator). The model predicts that, when individuals favor the incorrect
option (are misinformed) or are equally likely to choose between options (have very little information), groups should adopt the choice of a single expert, especially in larger groups (Figure 9). However, if individuals are informed, then the collective is equal in accuracy to the expert in aggregating information. In these situations, follow-the-leader or the policy of aggregating information would work equally well.

Katsikopoulos and King (2010), however, acknowledged that this model, although applicable to one-shot decisions, might not represent what goes on in more stable social groups, in which individuals encounter repeated collective decisions and can store and recall information. They therefore used a Bayesian model to predict the probability of groups using expert and aggregate rules across time, based on the outcome of past decisions. In this form of the model, the rule that aggregates information is always favored, unless the first decision that a group makes is correct with high probability, in which case groups marginally favor the expert rule.

How might a group choose between these two decision rules? King, Johnson, and Van Vugt (2009) discussed this issue in a recent review. On the one hand, the group-level heuristic can emerge passively as a consequence of the properties of the group. Otherwise, individuals can be more likely to follow certain “types” of individuals and thus be more likely to copy their actions. King et al. (2009) argue that, across species, individuals are more likely to emerge as leaders if they have particular morphological, physiological, or behavioral traits increasing their propensity to act first in coordination problems, and if they have superior knowledge.

King et al.’s (2009) review suggests that leadership shares common properties across humans and other animals, pointing to ancient roots and evolutionary origins. They suggest that identifying the origins of human leadership, as well as which aspects are shared with other animals and which are unique, offers ways of understanding, predicting, and improving leadership today. One of the most striking claims that King et al. make in their search for the evolutionary origins of leadership is that the same simple heuristics may underlie coordination of activities in humans and nonhumans alike. There are evolved
rules of thumb that prescribe who to follow and when to follow them that have a deep evolutionary history. Thus, the mechanisms of group decision making are broadly adaptive, shaping social interactions across a broad range of species, including humans.

**Memory Constraints on Cooperative Heuristics**

Imagine that once a month you meet a colleague for lunch at an upscale restaurant. This month, your colleague pays for lunch. What should you do next month? And the following month? Should you pay for lunch, let your colleague pay again, or split the bill? A simple heuristic that one might use in this situation is tit-for-tat, which starts by cooperating and then copies a partner's previous action. This "you scratch my back, I'll scratch yours" heuristic has been successful in evolutionary and economic analyses of cooperative behavior. In fact, it has become the most studied solution to the problem of cooperation. Despite its popularity and apparent simplicity, few studies have explored the cognitive capacities required to implement tit-for-tat and similar heuristics.

Memory represents a primary cognitive capacity needed for heuristics like tit-for-tat that depend on past behavior. Tit-for-tat requires that players accurately remember the single last choice from each partner. Humans and other animals, however, sometimes forget. Given the nature of forgetting, Stevens, Volstorf, Schooler, and Rieskamp (2011) asked whether existing heuristics that promote cooperation (such as tit-for-tat and its variants) are cognitively feasible. They explored whether humans have the memory capacity required to implement these strategies. To address this capacity question, they conducted an experiment with human participants, in which a series of simulated partners chose to cooperate or defect. They measured participants' memory accuracy in recalling each partner's last action. To test the effects of

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**Figure 10.** Can humans recall interactions with their partners well enough to accurately employ the tit-for-tat strategy? Memory error rate for this task (mean +/- SEM) increases with more intervening interactions. The smooth lines represent the least-squares best-fit power function of memory. With no intervening interactions, error rates where lower than 10%. Error rate increases rapidly with just a single intervening interaction.

*Source.* Stevens et al. (2011).
memory interference on cooperation, they varied the number of simulated interaction partners. From these manipulations, they estimated how memory errors respond to increases in memory interference. In this study, participants performed fairly accurately when tracking only 5 partners, but, with 10 or more partners, memory errors increased dramatically. In fact, the error rates in the 10- and 15-partner conditions suggest that participants were guessing in half of the trials. Thus, memory interference from tracking multiple partners sharply increased memory errors in this task. To further explore this memory interference, Stevens et al. (2011) examined error as a function of the number of intervening interactions. Between consecutive presentations of the same partner, there were other intervening partners. When consecutive interactions with the same partner occurred with no intervening interactions, participants performed well, with a mean error rate below 10% (Figure 10). With even one intervening interaction, however, error rates doubled and continued to rise with more intervening interactions.

Estimates of memory accuracy alone, however, do not demonstrate the complete role of memory in cooperation. We must also assess how well specific heuristics cope with error caused by misremembering a partner’s last actions. For instance, tit-for-tat’s performance decreases when errors exist because of mistakenly defecting results in the lower payoffs of mutual defection. A more forgiving form of tit-for-tat called contrite tit-for-tat performs better when individuals make errors. Stevens et al. (2011) used agent-based simulations to systematically analyze the success of several heuristics proposed in the literature across a broader range of error rates. Figure 11 shows, that at low error rates, GRIM—a heuristic that begins by cooperating, then permanently switches to defection

![Figure 11](image-url)
following the partner’s first defection—outperformed all other heuristics. Tit-for-tat (TFT), contrite tit-for-tat (CTFT), and win-stay, lose-shift (WSLS) won a small percentage of the simulations, along with always defecting (ALLD). As error rates increased, ALLD and GRIM outcompeted TFT and the other cooperative heuristics. The poor performance of the cooperative heuristics resulted in the frequency of cooperative acts, employed by all agents in the population, decreasing dramatically as errors became more prevalent. Cooperation could not be sustained, even at low levels of error.

In summary, this study found that people make many mistakes when recalling past behavior. In addition, heuristics that require this kind of memory did not perform well in an evolutionary simulation when faced with the error rates observed in the experiment. Though these models have proven valuable in investigating cooperation for the last 30 years, they do not accurately reflect underlying cognition. Humans certainly use reciprocal strategies when cooperating, but they likely do not use strategies like tit-for-tat and its relatives. They simply cannot use these heuristics because the memory load is too great. To examine the types of reciprocal strategies that humans and other animals use, we must embed what we know about memory into new realistic cooperative strategies.

Building psychology into these models is a crucial next step in better understanding the nature of cooperation.