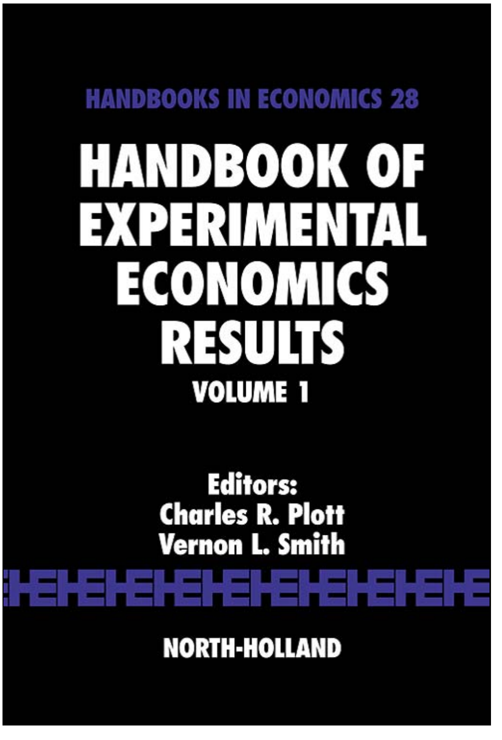

Peter M. Todd, Jörg Rieskamp and Gerd Gigerenzer, Social Heuristics. In: C.R. Plott and V.L. Smitt, editors, Handbook of Experimental Economics Results, Volume 1. Amsterdam: North-Holland, 2008, p. 1035.
ISBN: 978-0-444-82642-8

Chapter 110

SOCIAL HEURISTICS

PETER M. TODD, JÖRG RIESKAMP and GERD GIGERENZER

Center for Adaptive Behavior and Cognition, Max Planck Institute for Human Development, Berlin, Germany

Some of the most challenging decisions faced by humans and other social species are those arising from an environment comprising the decisions of conspecifics. The particular demands of social environments – such as the necessity of responding quickly to decisions made by others, coordinating mutual decisions, and detecting cheaters – call for heuristics that make rapid decisions rather than spend time gathering and processing information over a long period during which a fleeter-minded competitor could leap forward and gain an edge. Moreover, heuristics that handle social situations must address specifically social goals such as making decisions that can be justified and defended to others, that are transparent and understandable by the peer group, and that do not violate the fairness expectations held by people in the group (Tetlock, 1983). Thus, social heuristics must be judged by standards of effectiveness, adaptive advantage, and social intelligence, rather than by the traditional norms of optimality and consistency. Here we describe two types of social heuristics, for social exchange (including cheater detection) and sequential mate choice, and show how they perform from the standpoint of ecological rationality.

1. Social Heuristics for Cooperation

Ever since Darwin, altruism has caused a problem for the view of humans as selfish. In evolutionary biology, Hamilton's (1964) inclusive fitness theory provided an answer to why genetically related conspecifics would cooperate. *Homo sapiens* is one of the very few species that exhibits cooperation between genetically unrelated individuals, an ability that underlies the development of trade, negotiation, and markets. How can cooperation between unrelated individuals be explained? Repeated interactions enable cooperation because it offers the opportunity to reciprocate cooperative behavior and punish uncooperative behavior. Trivers (1971) was one of the first researchers to emphasize the role of such repetition, a perspective that has inspired most of the research since then that tries to explain cooperation between unrelated, self-interested individuals (e.g., Axelrod, 1984; Schelling, 1960).

To study how people decide whether or not to cooperate in repeated interactions, we can look at possible decision mechanisms used in simple economic games. The Iterated Prisoner's Dilemma (Luce and Raiffa, 1957) is often used to explore cooperation in symmetric situations where both players have equivalent roles. Less work has been

Handbook of Experimental Economics Results, Volume 1

DOI: 10.1016/S1574-0722(07)00110-2

done on the interesting case of asymmetric settings, where the two players have different actions available to them – a condition often encountered in the real world (e.g., between doctors and patients or auto mechanics and customers). The investment game is a two-person sequential bargaining game (Berg, Dickhaut, and McCabe, 1995) that has been used to study cooperation and trust in such asymmetric situations. Two players, A and B, both receive an initial endowment, for instance $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 decides how much of the then tripled amount she wishes to return to player A. The game provides the opportunity of a surplus for both players. If player A trusts player B and invests the entire endowment, an efficient outcome that maximizes the mutual payoffs is produced. However, according to the subgame-perfect equilibrium player B will return nothing to player A to maximize his monetary payoff, which is anticipated by player A; hence, no amount is sent to player B. However, again, if the game is repeated indefinitely, substantial investments and returns are reasonable. Player B will hesitate to exploit player A, as A might then not invest in the following periods. With this threat, it becomes reasonable for player A to invest.

Rieskamp and Gigerenzer (2002) studied how well simple social heuristics could predict people's decisions in the indefinitely repeated investment game. In their experiment, participants played several indefinitely repeated investment games against different opponents. After each period of the game a new period followed with a continuation probability of 87.5%. The participants in the role of player A invested 100% of their endowment in 47% of all periods. The most frequent outcome (19% of all periods) led to an equal split of the final payoff for both players, consistent with the equity principle (Walster, Berscheid, and Walster, 1973), defining fair outcomes. However, participants often did not reach an agreement – one participant exploited the other or payoff allocations contrary to the equity principle were obtained. This large variance cannot be explained by a static fairness principle. In contrast, as the different outcomes result from dynamic decision processes, it is necessary to describe this process.

To explore the decision mechanisms used by people playing the investment game, Rieskamp and Gigerenzer (2002) modeled social heuristics with finite state automata. Heuristics for both player roles were developed and fitted to the observed data and then cross-validated for an independent data set. Two heuristics describing participants' decisions in the role of player A outperformed competing models including a simple learning mechanism in predicting participants decisions. The best heuristic for player A, Moderately–Grim, predicted 65% of the decisions for the validation sample by using three states (see Figure 1). The heuristic starts with an investment of 100% and if player B returns an amount greater than or equal to 34% it moves to state 2, in which it repeats the investment of 100% as long as player B makes a substantial return. However, if in the first period player B makes a return lower than 34%, Moderately–Grim advances to the third state, in which it will make no investment in the next and in all following periods. After the first period, if the opponent ever returns less than 34% two times consecutively, the heuristic always ends in the third (terminal) state. Moderately–

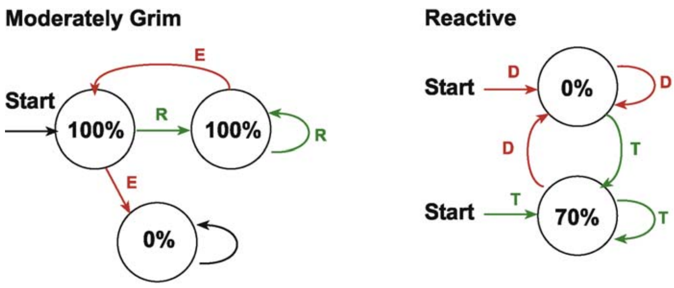

Figure 1. The figure shows the best heuristics developed to predict individual's behavior in the indefinitely repeated investment game. Moderately–Grim, the heuristic for player A, starts with an investment of 100% as long as the other player makes a reciprocal return (R) of at least 34%. If player B exploits (E) player A twice in succession, the heuristic moves to the third state with no investment from that point on. Reactive, the social heuristic for player B, returns 70% when player A trusts (T) player B by making a substantial investment, which leads to an equal final payoff for both players. If player A distrusts (D) player B by making investments lower than 17%, no return is made.

Grim is mostly trusting, even if it is occasionally exploited, but it turns to distrust if it is exploited repeatedly.

Two heuristics developed for player B also outperformed competing models. The better of these heuristics, Reactive, predicted 52% of the decisions for the validation sample using two states (see Figure 1). Depending on player A's decision in the first period, Reactive either returns nothing if the investment is lower than 17% or returns 70% given a higher investment, which leads to final equal payoffs for both players. The combination of the simple social heuristics Reactive and Moderately–Grim demonstrate how people can make good cooperative decisions in asymmetric interactions with a minimum of memory and computation.

2. Detecting Cheaters

Cooperation demands specific cognitive mechanisms in humans, and their study can further our understanding of when cooperation succeeds and when it fails. In contrast to experimental games where behavior can easily be interpreted as trust, cooperation, defection etc., in the real world outside the laboratory, cognitive mechanisms are necessary to interpret the behavior and figure out the intentions of others. One such cognitive adaptation is a cheater detection heuristic, which can be formulated as follows: If an agent is engaged in a social contract with another party, then the agent's attention is directed to information that could reveal that he or she is being cheated. A social contract is an agreement of the type "if you take the benefit, then you pay the costs," and cheating means that one party took the benefit but did not pay the costs. Cosmides (1989) looked for evidence of such a social heuristic in human cognition by employing the "selection

Numbers-and-letters rule:

If there is a "D" on one side of the card, then there is a "3" on the other side.

Each of the following cards has a letter on one side and a number on the other. Indicate only the card(s) you definitely need to turn over to see if the rule has been violated.

D	E	3	4

Overnight rule:

If someone stays overnight in the cabin, then that person must bring a bundle of wood from the valley.

The cards below have information about four hikers. Each card represents one person. One side of the card tells if the person stayed overnight and the other side tells if the person brought firewood.
Indicate only the card(s) you definitely need to turn over to see if the rule has been violated.

STAYED OVERNIGHT	DID NOT STAY	BROUGHT WOOD	DID NOT BRING WOOD

Day-off rule:

If an employee works on the weekend, then that person gets a day off during the week.

The cards below have information about four employees. Each card represents one person. One side of the card tells whether the person worked on the weekend and the other side tells whether the person got a day off during the week.
Indicate only the card(s) you definitely need to turn over to see if the rule has been violated.

WORKED ON THE WEEKEND	DID GET A DAY OFF	DID NOT WORK ON THE WEEKEND	DID NOT GET A DAY OFF

Figure 2. The four-card selection task. Top: The classical version with an abstract numbers-and-letters rule. Middle: A social contract (overnight rule) comprising two possible perspectives, one with and one without the possibility of being cheated. Bottom: A social contract (day-off rule) with two possible perspectives and cheating options for *both* parties.

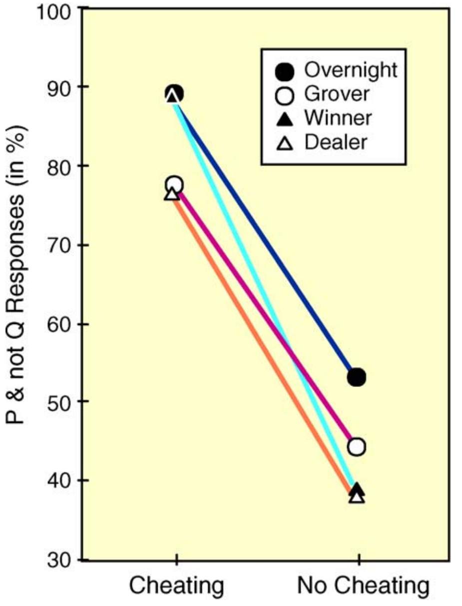

Figure 3. Search for information of the type "benefit taken and costs not paid" depends on whether or not the agent can be cheated in a social contract. The overnight rule is shown in the figure; the Grover rule is "If a student is to be assigned to Grover High School, then that student must live in Grover City"; the winner rule is "If a player wins a game, then he will have to treat the others to a round of drinks at the club's restaurant"; the dealer rule is "If a small-time drug dealer confesses, then he will have to be released" (see Gigerenzer and Hug, 1992).

task" (Wason, 1966), which is widely used in cognitive psychology to study rational reasoning.

The classical version of the selection task involves four two-sided cards and a conditional statement in the form "if P then Q" – for example, "if there is a 'D' on one side of the card, then there is a '3' on the other side." The four cards are placed on a table so that the participant can read only the information on the side facing upward. For instance, the four cards may read "D," "E," "3," and "4" (Figure 3). The participant's task is to indicate which of the four cards need(s) to be turned over to find out whether the conditional statement has been violated.

According to propositional logic, the "P" and "not-Q" cards (here, "D" and "4"), and no others, must be selected to test for rule violations. However, only about 10% of the participants in numerous experiments gave this answer. This result has been taken as evidence that human reasoning is "irrational" due to cognitive fallacies (see Gigerenzer and Hug, 1992). Further experiments showed that, depending on the content of the P's and Q's, the proportion of people giving the logical answer could go up or down. But the sources of this "content effect" remained elusive after it became clear that it is not simply "availability" or "familiarity" with the content or the rule (as proposed by Griggs and Cox, 1982; see Gigerenzer, 1996). Finally, Cosmides (1989) reported that if the conditional statement is coded as a social contract, then people's attention is directed to information that can reveal being cheated. Participants in this case then tend to select those cards that correspond to "benefit taken" and "cost not paid." There are competing views about what these results signify: Do they indicate that people have a specific cognitive adaptation for checking for cheaters, or just that people are better at reasoning about social contracts than about abstract numbers-and-letters problems?

3. Cheater Detection Versus Social Contracts

Gigerenzer and Hug (1992) experimentally disentangled reasoning about social contracts from cheater detection by varying whether the search for violations constitutes looking for cheaters or not. Consider the following social contract: "If someone stays overnight in the cabin, then that person must bring along a bundle of firewood from the valley" (Figure 3). This was presented in one of two context stories, as follows.

The "cheating" version explained that a cabin high in the Swiss Alps serves as an overnight shelter for hikers. Because it is cold and firewood is not otherwise available at this altitude, the Swiss Alpine Club has made the rule that each hiker who stays overnight in the cabin must bring along a bundle of firewood from the valley. The participants were cued to the perspective of a guard who checks whether any of four hikers has violated the rule. The four hikers were represented by four cards that read "stays overnight in the cabin," "does not stay overnight," "carried wood," and "carried no wood." The instruction was to indicate only the card(s) you definitely need to turn over to see if any of these hikers have violated the rule (Figure 3).

In the "no-cheating" version, the participants were cued to the perspective of a member of the German Alpine Association, visiting the same cabin in the Swiss Alps to find out how it is managed by the local Alpine Club. He observes people carrying firewood into the cabin, and a friend accompanying him suggests that the Swiss may have the same overnight rule as the Germans, namely "If someone stays overnight in the cabin, then that person must bring along a bundle of firewood from the valley." That this is also the Swiss Alpine Club's rule is not the only possible explanation; alternatively, only its members (who do not stay overnight in the cabin), and not the hikers, might bring firewood. Participants were now in the position of an observer who checks information to find out whether the social contract suggested by his friend actually holds. This observer does not represent a party in a social contract. The participants' instructions were the same as in the "cheating" version.

Thus, in the "cheating" scenario, the observation "stayed overnight and did not bring wood" means that the party represented by the guard is being cheated; in the "no-cheating" scenario, the same observation suggests only that the Swiss Alpine Club never made the supposed rule in the first place.

Suppose that what matters to human reasoners is only whether a rule is a social contract and therefore somehow easier to process – in this case, a cheater-detection

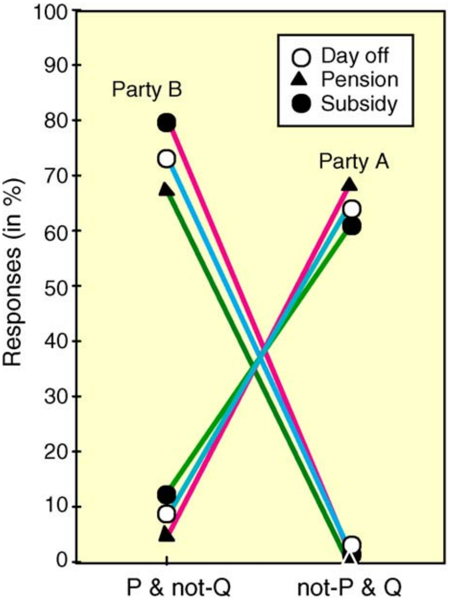

Figure 4. Responses to social contract rules become "illogical" when perspective is switched. When participants' perspective is switched from Party A to Party B in three social contract rules, the cards chosen to be checked when looking for cheaters in the selection task switch from the logical choices P and not-Q to the opposite choices, not-P and Q, indicating that cheater detection is not the same as logical reasoning. The day-off rule is specified in Figure 3; the pension rule is "If a previous employee gets a pension from the firm, then that person must have worked for the firm for at least 10 years"; and the subsidy rule is "If a home owner gets a subsidy, then that person must have installed a modern heating system" (see Gigerenzer and Hug, 1992).

mechanism becomes irrelevant. Because the rule to check is the same social contract in both versions of the alpine cabin story, this conjecture implies that there should be no difference in the selections observed. In the overnight problem, however, 89% of the participants selected "benefit taken" and "cost not paid" when cheating was at stake, compared to 53% in the no-cheating version, as shown in Figure 4. Similarly, the averages across four test problems were 83% and 45%, respectively (Gigerenzer and Hug, 1992). This evidence supports the presence of a specific cheater-detection heuristic used when processing social contracts.

4. Cheater Detection Versus Logical Reasoning

The experiment just reported, however, does not rule out the possibility that social contracts with cheating options somehow merely facilitate logical reasoning rather than invoke an additional psychological adaptation specifically designed for cheater detection. The reason for this is that the cheater-relevant "benefit taken" and "cost not paid" choices coincide with the logically implied "P" and "not-Q" choices. Gigerenzer and Hug (1992) tested this conjecture by using social contracts in which both sides can cheat and inducing participants to switch perspectives. For instance, one of the social contracts was the Day-off rule: "If an employee works on the weekend, then that person gets a day off during the week" (Figure 3). If social contracts merely facilitate logical reasoning, then the perspective of the participant should not matter (nor the content of the contract), because logical reasoning is by definition independent of perspective and content.

Figure 5 shows that perspective does matter in social contracts. When participants were assigned the role of the employee in this scenario, 75% checked "worked on the weekend" and "did not get a day off," that is, the "benefit taken" and "cost not paid" information from the employee's perspective, which coincide with the logically implied answers. Only 2% of participants checked the "did not work on the weekend" and "did get a day off" cases. When participants were assigned the role of the employer, the choices reversed. Now the majority checked "did not work on the weekend" and "did get a day off," which are the "benefit taken" and "cost not paid" cases from the employer's point of view. But these do not correspond with the logical "P" and "not-Q" cases. Two other social contracts gave essentially the same results (Figure 5). Thus, humans do indeed appear to have cognitive adaptations specifically designed to look for cues to being cheated in social exchanges – content does not simply facilitate logical reasoning about social contracts. (See Ortmann and Gigerenzer, 1997, for more on the economic implications of these results.)

5. Searching for Mates

When choosing which offspring to feed (as we have explored in Hertwig, Davis, and Sulloway, 2002 and Davis and Todd, 1999), or which stock to purchase (see Ortmann et al., this handbook), all of the alternatives are currently available to the decision maker, so it is only necessary to search for cues to base a choice upon. But a different strategy is called for when alternatives themselves (as opposed to cue values) take time to find, appearing sequentially over an extended period or spatial region. In this type of choice task, a fast and frugal reasoner need not (only) limit information search, but must (also) have a stopping rule for ending the search for alternatives themselves. One instance of this type of problem is the challenge that faces individuals searching for a mate from a stream of potential candidates met at different points in time. Mate choice is thus a process of sequential search rather than selection from a set of known options. What strategies are appropriate for sequential search such as this?

Models of optimal search behavior have been developed for decades in statistics (e.g., Ferguson, 1989) and economics (particularly in job search and consumer shopping behavior; see, e.g., Stigler, 1961 and Rapoport and Tversky, 1970, for early work). Classical search theory indicates that in the realm of mate choice one should look for a new mate until the costs of further search outweigh the benefits that could be gained by

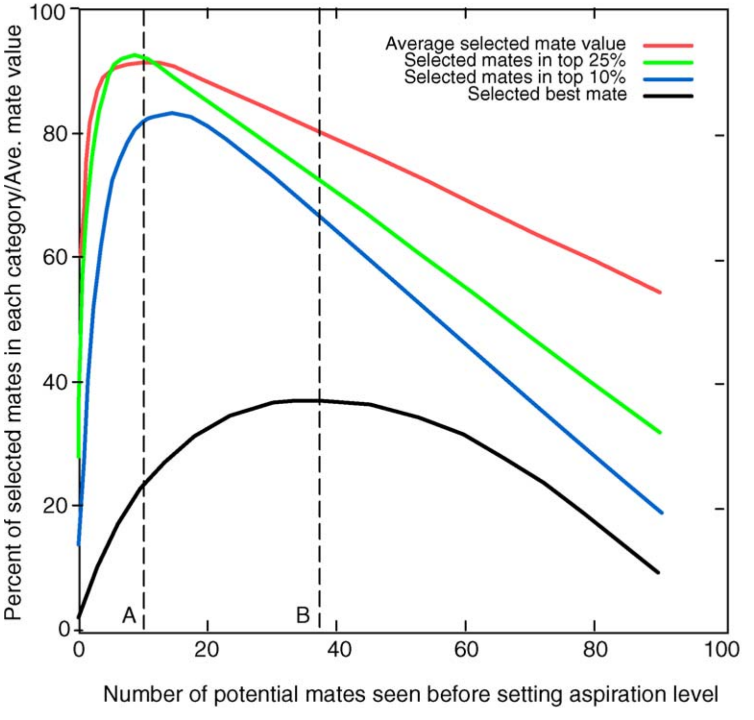

Figure 5. Basing an aspiration level on a small sample (rather than a large one) can be advantageous if the goal is to find a good mate rather than the best mate. Performance on four different criteria is plotted as a function of number of individuals sampled initially (assuming one-sided, non-mutual search), with the highest value individual from that initial sample used as the aspiration level for future search. These smoothed results are based on simulations with a total mating population of 100, each individual having a mate value between 1 and 100. If the initial sample comprises 10 individuals ($x = 10$, marked A), the average mate value obtained given the resulting aspiration level will be 92 (red curve); the chance that the selected mate will be in the top 25% of the population is 92% (green curve); the chance that the selected mate will be in the top 10% is 82% (blue curve); and the chance that the very highest value mate will be selected is 23% (black curve). "Sampling about 10 individuals is also a fast way to form a useful aspiration level for population sizes larger than 100." In contrast, the "37% rule" ($x = 37$, marked B) does better at maximizing the chance of obtaining the very highest valued mate (to 37%) but has a much higher search cost and does worse on the other three criteria – average mate value of 81 (red); only a 72% chance of getting a mate in the top 25% (green); only a 67% chance of getting a mate in the top 10% of the population (blue) (reprinted from Miller and Todd, 1998).

leaving the current candidate (see Roth and Sotomayor, 1990, for a different approach when search and choices are both mutual). But in practice, not only is performing a rational cost-benefit analysis for optimal mate search intractable, it also makes a bad impression on a would-be partner. As a consequence, some economists (e.g., Frey and Eichenberger, 1996) have proposed that human mate choice is not performed in a rational manner, and in particular that individuals search far too little before deciding on a marriage partner. In contrast, the results reported below indicate that relatively fast search heuristics can yield adaptive decisions in this domain.

We have focused on the applicability of Herbert Simon's (1955, 1990) notion of a satisficing heuristic for mate search, in which an aspiration level is set for the selection criterion being used (e.g., mate value, defined somehow on a unidimensional scale), and search proceeds until a prospect is encountered who meets that aspiration. How should that aspiration level be set? One well-known approach is the "37% rule" derived for the "Secretary Problem" from statistics (Ferguson, 1989): Estimate the number of prospects one is likely to meet in life, let the first 37% of them pass by without picking any of them, but use the highest mate value observed in that initial sample as the aspiration level for searching through the rest, until one is found who exceeds that threshold. This is the optimal method for setting an aspiration level, provided the search situation meets the following restrictive characteristics: The searcher receives positive payoff solely for picking the very highest value prospect, from a random sequence of prospects with an unknown distribution of values, without any backtracking to previously encountered prospects, without any search or courtship costs, and without any possibility of being rejected by the prospect. Different heuristic approaches become appropriate when these characteristics are changed, particularly when the payoff criterion is relaxed so that other choices are also rewarded to some degree.

We have investigated satisficing heuristics for mate search by simulating their performance in various settings (Miller and Todd, 1998; Todd and Miller, 1999), focusing on simple methods for setting the aspiration level. The goal was to find satisficing heuristics that would limit both the time needed to determine a good aspiration level and the average number of potential mates that had to be considered before one was found exceeding the aspiration level. By sampling a much smaller number of prospects initially, say a dozen, one can actually attain a higher expected mate value than the 37% rule delivers (although a somewhat lower chance of finding the very highest valued prospect) and a higher chance of picking a mate in the top 10% of the population (see Figure 2) while greatly lowering the search time required and the risk of picking a low-quality mate; moreover, people put in such a situation seem to take this into account in their searching behavior (see Dudey and Todd, in press; see also Seale and Rapoport, 1997, for related experimental results). However, this only works in the one-sided search setting of the Secretary Problem. When two-sided search is introduced, so that both sexes are searching for appropriate mates simultaneously, an aspiration level set near to one's own mate value can quickly lead to assortative mating in a population. A further class of simple heuristics can enable individuals to learn their own value or rank in the mating population on the basis of mating proposals and refusals (Todd and Miller, 1999). Additionally, these search rules can account for demographic data on patterns of mate choice: When an entire population of individuals searches for mates according to these rules, they get paired up over time at rates that mirror the distribution for age at first marriage observed in many cultures (Todd and Billari, in press).

6. Conclusion

The results presented in this section illustrate how a concept of social rationality that differs from traditional definitions of domain-independent rationality can be built. Socially rational agents can solve the adaptive challenges that face them in their interactions with conspecifics without amassing all available information and combining it optimally (as shown by the single-cue parental investment heuristics) and without calculating costs and benefits to guide search (as shown by the satisficing heuristics for mate search). They need not even follow the laws of propositional logic (as shown by the domain-specific cheater-detection reasoning results). Instead, simple rules that apply to specific situations can give social agents an adaptive – and, often, economic – advantage.

References

Axelrod, R. (1984). "The Evolution of Cooperation". Basic Books, New York.

Berg, J., Dickhaut, J.W., McCabe, K.A. (1995). "Trust, reciprocity, and social history". Games and Economic Behavior 10, 122–142.

Cosmides, L. (1989). "The logic of social exchange: Has natural selection shaped how humans reason?" Cognition 31, 187–276.

Davis, J.N., Todd, P.M. (1999). "Simple decision rules for parental investment". In: Gigerenzer, G., Todd, P.M., the ABC Research Group (Eds.), Simple Heuristics that Make Us Smart. Oxford University Press, New York, pp. 309–324.

Ferguson, T.S. (1989). "Who solved the secretary problem?" Statistical Sciences 4, 282–296.

Frey, B.S., Eichenberger, R. (1996). "Marriage paradoxes". Rationality and Society 8, 187–206.

Gigerenzer, G. (1996). "Rationality: Why social context matters". In: Baltes, P.B., Staudinger, U.M. (Eds.), Interactive Minds: Life-span Perspectives on the Social Foundation of Cognition. Cambridge University Press, Cambridge, UK, pp. 319–346.

Gigerenzer, G., Hug, K. (1992). "Domain-specific reasoning: Social contracts, cheating, and perspective change". Cognition 43, 127–171.

Griggs, R.A., Cox, J.R. (1982). "The elusive thematic-materials effect in Wason's selection task". British Journal of Psychology 73, 407–420.

Hamilton, W.D. (1964). "The genetic evolution of social behavior, Parts I, II". Journal of Theoretical Biology 7, 1–52.

Hertwig, R., Davis, J.N., Sulloway, F.J. (2002). "Parental investment: How an equity motive can produce inequality". Psychological Bulletin 128, 728–745.

Luce, R.D., Raiffa, H. (1957). "Games and Decision". Wiley, New York.

Miller, G.F., Todd, P.M. (1998). "Mate choice turns cognitive". Trends in Cognitive Sciences 2, 190–198.

Ortmann, A., Gigerenzer, G. (1997). " Reasoning in economics and psychology: Why social context matters". Journal of Institutional and Theoretical Economics 153, 700–710.

Rapoport, A., Tversky, A. (1970). "Choice behavior in an optional stopping task". Organizational Behavior and Human Performance 5, 105–120.

Rieskamp, J., Gigerenzer, G. (2002). "Heuristics for social interactions: How to generate trust and fairness". Manuscript submitted for publication.

Roth, A.E., Sotomayor, M. (1990). "Two-sided Matching: A Study in Game-theoretic Modeling and Analysis". Cambridge University Press, Cambridge, UK.

Seale, Darryl A., Rapoport, Amnon (1997). "Sequential decision making with relative ranks: An experimental investigation of the 'secretary problem'". Organizational Behavior and Human Decision Processes 69 (3), 221–236.

Schelling, T.C. (1960). "The Strategy of Conflict". Harvard University, Press Cambridge, MA.

Simon, H.A. (1955). "A behavioral model of rational choice". Quarterly Journal of Economics 69, 99–118.

Simon, H.A. (1990). "Invariants of human behavior". Annual Review of Psychology 41, 1–19.

Stigler, G.J. (1961). "The economics of information". Journal of Political Economy 69, 213–225.

Tetlock, P.E. (1983). "Accountability and complexity of thought". Journal of Personality and Social Psychology 45, 74–83.

Todd, P.M., Miller, G.F. (1999). "From pride and prejudice to persuasion: Satisficing in mate search". In: Gigerenzer, G., Todd, P.M., the ABC Research Group (Eds.), Simple Heuristics that Make Us Smart. Oxford University Press, New York, pp. 287–308.

Trivers, R.L. (1971). "The evolution of reciprocal altruism". Quarterly Review of Biology 46, 35–57.

Walster, E., Berscheid, E., Walster, G.W. (1973). "New directions in equity research". Journal of Personality and Social Psychology 25, 151–176.

Wason, P.C. (1966). "Reasoning". In: Foss, B.M. (Ed.), New Horizons in Psychology. Penguin, Harmondsworth, UK, pp. 135–151.