Chapter 5 Simple Heuristics for Decision Making

How do humans make judgments and decisions under the constraints of limited time, knowledge, and computational capacity? Many models of decision making implicitly view the mind as if these constraints did not exist. Rather, they assume that the mind is afforded with unlimited computational power to process all the available information in an optimal way. The best-known models of such unbounded rationality are Bayesian models. In contrast, Simon (1956, 1983) has repeatedly insisted that the constraints of limited time, knowledge, and computational capacity have to be taken into account when modeling human behavior. Simon's approach of *bounded rationality* has two interlocking components: the cognitive limitations and the structure of the environment.

The first component implies that psychological models should incorporate our knowledge about humans' cognitive limitations. To apply this idea to repeated bargaining games this implies that humans' limitations in memory suggest that individuals will not keep track of all decisions that have been made in the past during a repeated game and do not plan many periods in advance. Furthermore, a psychological model should not assume that individuals will specify a decision for all possible eventualities of a repeated game, especially not when the game lasts for a very long time. The second component of bounded rationality promotes the idea that our cognitive processes are adapted to the structure of the environment. Simon's (1956) classical example is about a foraging organism that has the single goal of finding food. In an environment in which food is randomly distributed the best strategy for the organism is to perform a random search. However, if in another environment food is also distributed randomly but comes in hidden areas then these areas might be inferred by various cues. In such an environment a strategy that will make use of these cues is more appropriate for foraging and the organism should develop mechanism to use these cues. The second component can also easily be applied to social interactions, if the concept of environmental structure is enlarged as the structure of the social environment. In a social environment (e.g. a group, culture, society) containing dishonest individuals, an individual is well advised to be cautious. The disadvantage of precaution is that it produces costs that one can avoid in a social environment in which general trust and trustworthiness exist. In general, the outcome of a particular strategy in a social interaction will always depend on the social environment, that is, on the other individuals.

Models of bounded rationality, however, have had only minimal impact in the field of psychology. One recent attempt to overcome this deficit is the book "Simple heuristics that make us smart" by Gigerenzer et al., (1999). This book promotes the view of bounded rationality as the way humans usually make their judgments and decisions. The program of studying boundedly rational heuristics as outlined by Gigerenzer and Todd (1999) "involves (a) designing computational models of candidate simple heuristics, (b) analyzing the environmental structures in which they perform well, (c) testing their performance in real-world environments, and (d) determining whether and when people really use these heuristics" (p. 16). Strategies in general can be defined as a sequence of goal-oriented operations for solving a particular problem. Heuristics are a subset of strategies. In contrast to algorithms that form another subset of strategies, a heuristic does not guarantee the correct solution to a problem. Additionally, a heuristic is characterized by high efficiency (i.e. heuristics do not require a large amount of information, process information in an easy fashion and nevertheless often perform quite well). Because the difference between heuristics and other strategies is often fluid, the general term 'strategies' is used in the present work. Gigerenzer et al. (1999) showed that the simple heuristics designed for various types of tasks perform astonishingly well and sometimes even outperform complex strategies such as multiple regression. The combination of good performance and little effort makes it psychologically plausible that these simple heuristics are actually used (for other studies demonstrating the high efficiency of heuristics see Thorngate, 1980; Payne et al., 1988). Many authors have also shown that simple heuristics are good behavioral models (Broeder, 2000; Payne et al., 1988; Rieskamp & Hoffrage, 1999; for a review see Abelson & Levi, 1985). Rieskamp and Hoffrage (1999), for instance, demonstrate that a simple lexicographic strategy is most appropriate in describing choices under time pressure in a probabilistic inference task.

As mentioned above, Axelrod's studies (Axelrod, 1984; see also Axelrod & Dion, 1988; Axelrod & Hamilton, 1981) have demonstrated the good performance of simple strategies, in particular of the Tit-for-Tat strategy, for interactive decision making. Due to the differences between the prisoner's dilemma and the investment game it is difficult to transfer the Tit-for-Tat strategy to the investment game. Even if high investments by player A are classified as "cooperation" and low investments as "defection" the sequential game structure leads to a crucial distinction that makes the transfer complicated: If player A makes no investment, and thereby, distrusts player B (defects), then player B cannot make any decisions. In contrast, in the prisoner's dilemma player A could observe that a decision to defect was "unjustified" given a cooperative decision of player B. Therefore, for the investment game it is unspecified when a strategy for player A similar to Tit-for-Tat would return to a trusting (cooperative) decision. Likewise, it is not apparent how to apply Tit-for-Tat to player B. The sequential game allows player B to react directly to player A's decision in a present period. The investment game also differs from the prisoner's dilemma by the exploitation possibilities. First, player A has no exploitation possibilities at all. Second, due to the sequential decisions an exploiting decision of player B always increases her payoff. It should become apparent that although player B depends on player A's investment to increase her payoff, player B's position is strong given that her decision can always take player A's decision into account. In addition, it is player B's decision that determines how any surplus is divided.

In sum, simple strategies can often perform astonishingly well in social interactions. Besides the work of Axelrod there are many other simulation studies that have demonstrated the good performance of simple strategies (see Kraines & Kraines, 1993; Kraines & Kraines, 1995; Messick & Liebrand, 1995). The good performance of simple strategies makes it psychologically plausible that people actually use these strategies for decision making. In the next chapter the results of these simulations will be described in more detail. Most of them used the prisoner's dilemma as a model for social interactions. Because strategies designed for the prisoner's dilemma cannot simply be transferred to the investment game, in chapter 9 new strategies for the investment game will be developed by an evolutionary process. These strategies can then be compared to strategies that are appropriate in describing participants' real behavior in the investment game.