Bounded Rationality

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Bounded rationality is the idea that in decision making, rationality of individuals is limited by the information they have, the cognitive limitations of their minds, and the finite amount of time they have to make decisions. It was proposed by Herbert Simon as an alternative basis for the mathematical modeling of decision making, as used in economics and related disciplines; it complements rationality as optimization, which views decision making as a fully rational process of finding an optimal choice given the information available. Another way to look at bounded rationality is that, because decision-makers lack the ability and resources to arrive at the optimal solution, they instead apply their rationality only after having greatly simplified the choices available. Thus the decision-maker is a satisficer, one seeking a satisfactory solution rather than the optimal one. Simon used the analogy of a pair of scissors, where one blade is the "cognitive limitations" of actual humans and the other the "structures of the environment"; minds with limited cognitive resources can thus be successful by exploiting pre-existing structure and regularity in the environment.

Some models of human behavior in the social sciences assume that humans can be reasonably approximated or described as "rational" entities (see for example rational choice theory). Many economics models assume that people are on average rational, and can in large enough quantities be approximated to act according to their preferences. The concept of bounded rationality revises this assumption to account for the fact that perfectly rational decisions are often not feasible in practice due to the finite computational resources available for making them.

Models of bounded rationality

The term is thought to have been coined by Herbert Simon. In Models of Man, Simon points out that most people are only partly rational, and are emotional/irrational in the remaining part of their actions. In another work, he states "boundedly rational agents experience limits in formulating and solving complex problems and in processing (receiving, storing, retrieving, transmitting) information" (Williamson, p. 553, citing Simon). Simon describes a number of dimensions along which "classical" models of rationality can be made somewhat more realistic, while sticking within the vein of fairly rigorous formalization. These include:

limiting what sorts of utility functions there might be.
recognizing the costs of gathering and processing information.
the possibility of having a "vector" or "multi-valued" utility function.

Simon suggests that economic agents employ the use of heuristics to make decisions rather than a strict rigid rule of optimization. They do this because of the complexity of the situation, and their inability to process and compute the expected utility of every alternative action. Deliberation costs might be high and there are often other concurrent economic activities also requiring decisions.

Daniel Kahneman proposes bounded rationality as a model to overcome some of the limitations of the rational-agent models in economic literature.

As decision makers have to make decisions about how and when to decide, Ariel Rubinstein proposed to model bounded rationality by explicitly specifying decision-making procedures. This puts the study of decision procedures on the research agenda.

Gerd Gigerenzer argues that most decision theorists who have discussed bounded rationality have not really followed Simon's ideas about it. Rather, they have either considered how people's decisions might be made sub-optimal by the limitations of human rationality, or have constructed elaborate optimising models of how people might cope with their inability to optimize. Gigerenzer instead proposes to examine simple alternatives to a full rationality analysis as a mechanism for decision making, and he and his colleagues have shown that such simple heuristics frequently lead to better decisions than the theoretically optimal procedure.

From a computational point of view, decision procedures can be encoded in algorithms and heuristics. Edward Tsang argues that the effective rationality of an agent is determined by its computational intelligence. Everything else being equal, an agent that has better algorithms and heuristics could make "more rational" (more optimal) decisions than one that has poorer heuristics and algorithms.