

Ecological Rationality

Jörg Rieskamp and Torsten Reimer

Max Planck Institute for Human Development, Berlin, Germany

Definition

Human reasoning and behavior are ecologically rational when they are adapted to the environment in which humans act. This definition is in stark contrast to classical definitions of rationality, according to which reasoning and behavior are rational when they conform to norms of logic, statistics, and probability theory.

History

The notion of ecological rationality, that is, the interaction of cognition and environment, is highlighted in Herbert Simon's analogy of a pair of scissors: human rational behavior is shaped by a pair of scissors, with one blade being the structure of the environment and the other blade the computational capabilities of the actor. This notion highlights two important aspects of the concept of ecological rationality. First, just as one cannot understand the function of scissors by looking at a single blade, one cannot understand human cognition by studying either the environment or cognition alone. Second, the concept of ecological rationality can be employed to evaluate more than just people's behavior; it is additionally presumed that people's reasoning is the result of an adaptation of the individual to his or her environment.

The concept of ecological rationality has been strongly influenced by the psychologist Egon Brunswik's work on human perception. Brunswik argued that human perception cannot be understood when it is studied in a non-representative laboratory setting that eliminates the ecological structure of real-world environments. When following the common experimental practice of using a factorial design, objects are constructed or selected such that the cues describing the objects, which are the focus of interest, are independent of each other. This procedure does not acknowledge that the same cues are often correlated with each other in everyday life, and that human perception could take these correlations into account. Ignoring these environmental aspects in an experimental setting has profound consequences: It severely limits the generalizability of the results and, in particular, obscures the adaptation and ecological rationality of cognitive mechanisms.

According to Brunswik, to understand cognition one needs to explore the characteristics of the environment upon which cognition is based. This point has inspired many

researchers including, John R. Anderson, James J. Gibson, Gerd Gigerenzer, David Marr, and Roger Shepard, to name a few. Anderson, for instance, argues that any study of psychological mechanisms should be preceded by an analysis of the environment. His point is that such an analysis may help to identify the cognitive mechanisms that underlie human behavior. This process can be problematic, however, given that different mechanisms often predict very similar behavior. Therefore the behavior alone does not allow us to infer unambiguously which of the mechanisms produced that behavior. However, when we also analyze what mechanisms are able to produce adaptive behavior in a specific environment, the set of mechanisms can be reduced. If we focus on a limited set of adaptive mechanisms to explain cognition, the identification of the most adequate mechanism is simplified.

The identification of cognitive mechanisms that govern human behavior can further be improved when we take into account that people's reasoning is constrained by limited resources, such as time, memory, or computational power. Faced with these limitations it is reasonable to assume that humans will aim for solutions to a problem that do not require many resources. Thus, when two potential cognitive mechanisms are able to produce adaptive behavior in a specific environment, it is likely that humans will apply the mechanism that requires the least amount of resources. In this vein, researchers have argued that people apply fast and frugal heuristics that are adapted to an environment (Gigerenzer, Todd, & the ABC Research Group, 1999). A heuristic is frugal when it does not require much information, and it is fast when it relies only on simple computations. From the perspective of ecological rationality, a heuristic that does not require many resources and in addition is able to solve a problem well is a very promising candidate to describe the cognitive process that underlies human behavior.

Classical definitions of rationality

The definition of ecological rationality stands in stark contrast to classical definitions of rationality. According to the classical definition human behavior is rational to the extent that it conforms to the norms of logic, statistics, and probability theory. For example, most theorists use principles of consistency and coherence when evaluating the rationality of people's preferences (Rieskamp, Busemeyer, & Mellers, 2006). For instance, if a person prefers option A to option B, and option B to C, the preference of option C to A would be intransitive and violate consistency. Due to the violation of the logical consistency principle the person's preferences are perceived as a violation of rationality. The use of this classical definition of rationality to evaluate cognitive processes

Correspondence may be sent to Jörg Rieskamp, Max Planck Institute for Human Development, Lentzeallee 94, 14195 Berlin, Germany. or by e-mail to rieskamp@mpib-berlin.mpg.de.

has prevailed in one of the most influential psychological research programs on human reasoning, judgment, and decision making of the last three decades—namely, the heuristics-and-biases program. This program has illustrated for a large variety of reasoning problems that human behavior often violates basic norms of logic or probability theory. These violations, following the classical definition of rationality, have consequently been labeled as biases and have been explained by the application of heuristics that also violate the classical norms of rationality.

An example of classical and ecological rationality

Consider a physician's problem of inferring which of two heart attack patients needs more urgent treatment. This inference can be made on the basis of several cues, for example, the patients' systolic blood pressure or age. A physician might consider blood pressure as a more important indicator compared to age when inferring a patient's risk. When considering two patients, A and B, the physician might decide that although patient B has higher blood pressure than A, due to a small negligible difference, she will treat the older patient A first. The same might be the case when the physician compares patient B with C, where again patient C's blood pressure is not substantially higher than B's, so she treats the older patient B first. However, if the physician had com-

pared patients A and C, she might have treated patient C first, because now C's blood pressure is substantially higher than A's. Thus, the physician's decisions would be intransitive and thereby would violate the consistency principle, a cornerstone of classical definitions of rationality.

Consider the decision now from an ecological perspective, and a different conclusion can be drawn. First, the physician has to make her decisions rather quickly and her sequential inference strategy allows for very quick decisions. Second, the above hypothetical example illustrating intransitive decisions might not occur very often in real life: Blood pressure could be positively correlated with age, so that when treating the patient with the higher blood pressure, most likely the older patient will be treated first. Thus, the ecologically rational inference strategy of the physician, in principle, violates classical definitions of rationality, but in fact these violations might not occur frequently in real life.

Further Readings:

Gigerenzer, G., Todd, P. M., & the ABC Research Group. (1999). *Simple heuristics that make us smart*. New York: Oxford University Press.

Rieskamp, J., Busemeyer, J. R., & Mellers, B. A. (2006). Extending the bounds of rationality: A review of research on preferential choice. *Journal of Economic Literature*, 44.