Psychology of Reasoning

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November 19, 2022

The psychology of reasoning is the study of how people reason, often broadly defined as the process of drawing conclusions to inform how people solve problems and make decisions. It is at the intersection of psychology, philosophy, linguistics, cognitive science, artificial intelligence, logic, and probability theory.

Overview

Psychological experiments on how humans and other animals reason have been carried out for over 100 years. An enduring question is whether or not people have the capacity to be rational. What does it mean to be rational? Current research in this area addresses various questions about reasoning, rationality, intelligence, relationships between emotion and reasoning, and development.

Everyday reasoning

How do people reason about sentences in natural language? Most experimentation on deduction has been carried out on hypothetical thought, in particular, examining how people reason about conditionals, e.g., If A then B. Participants in experiments make the modus ponens inference, given the indicative conditional If A then B, and given the premise A, they conclude B. But given the indicative conditional and the minor premise for the modus tollens inference, not-B, about half of the participants in experiments conclude not-A and the remainder conclude that nothing follows.

The ease with which people make conditional inferences is affected by content, as demonstrated in the well-known selection task developed by Peter Wason. Participants are better able to test a conditional that contains sensible content, e.g., if the envelope is sealed then it must have a 50 cent stamp on it compared to one that contains symbolic content, e.g., if the letter is a vowel then the number is even. Background knowledge can also lead to the suppression of even the simple modus ponens inference. Participants given the conditional if Lisa has an essay to write then she studies late in the library and the premise Lisa has an essay to write make the modus ponens inference 'she studies late in the library', but the inference is suppressed when they are also given a second conditional if it the library stays open then she studies late in the library. Interpretations of the suppression effect are controversial.

Other investigations of propositional inference examine how people think about disjunctive alternatives, e.g., A or else B, and how they reason about negation, e.g., It is not the case that A and B. Many experiments have been carried out to examine how people make relational inferences, including comparisons, e.g., A is better than B. Such investigations also concern spatial inferences, e.g. A is in front of B and temporal inferences, e.g. A occurs before B. Other common tasks include categorical syllogisms, used to examine how people reason about quantifiers such as All or Some, e.g., Some of the A are not B.

Theories of reasoning

There are several alternative theories of the cognitive processes that human reasoning is based on. One view is that people rely on a mental logic consisting of formal (abstract or syntactic) inference rules similar to those developed by logicians in the propositional calculus. Another view is that people rely on domain-specific or content-sensitive rules of inference. A third view is that people rely on mental models, that is, mental representations that correspond to imagined possibilities. A fourth view is that people compute probabilities.

One controversial theoretical issue is the identification of an appropriate competence model, or a standard against which to compare human reasoning. Initially classical logic was chosen as a competence model. Subsequently some researchers opted for non-monotonic logic and Bayesian probability. Research on mental models and reasoning has led to the suggestion that people are rational in principle but err in practice. Connectionist approaches towards reasoning have also been proposed.

Development of reasoning

How does reasoning develop? Jean Piaget's theory of cognitive development describes a sequence of stages in the development of reasoning from infancy to adulthood. According to the neo-Piagetian theories of cognitive development, changes in reasoning with development come from increasing working memory capacity, increasing speed of processing, and enhanced executive functions and control. Increasing self-awareness is also an important factor.