

From Tools to Theories: A Heuristic of Discovery in Cognitive Psychology¹

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The study of scientific discovery—where do new ideas come from?—has long been denigrated by philosophers as irrelevant to analyzing the growth of scientific knowledge. In particular, little is known about how cognitive theories are discovered, and neither the classical accounts of discovery as either probabilistic induction (e.g., Reichenbach, 1938) or lucky guesses (e.g., Popper, 1959), nor the stock anecdotes about sudden “eureka” moments deepen the insight into discovery. A heuristics approach is taken in this review, where heuristics are understood as strategies of discovery less general than a supposed unique logic of discovery but more general than lucky guesses. This article deals with how scientists’ tools shape theories of mind, in particular with how methods of statistical inference have turned into metaphors of mind. The tools-to-theories heuristic explains the emergence of a broad range of cognitive theories, from the cognitive revolution of the 1960s up to the present, and it can be used to detect both limitations and new lines of development in current cognitive theories that investigate the mind as an “intuitive statistician.”

Scientific inquiry can be viewed as “an ocean, continuous everywhere and without a break or division” (Leibniz, 1690/1951, p. 73). Hans Reichenbach (1938) nonetheless divided this ocean into two great seas, the context of discovery and the context of justification. Philosophers, logicians, and mathematicians claimed justification as a part of their territory and dismissed the context of discovery as none of their business, or even as “irrelevant to the logical analysis of scientific knowledge” (Popper, 1959, p. 31). Their sun shines over one part of the ocean and has been enlightening about matters of justification, but the other part of the ocean still remains in a mystical darkness where imagination and intuition reign, or so it is claimed. Popper, Braithwaite, and others ceded the dark part of the ocean to psychology and, perhaps, sociology, but few psychologists have fished in these waters. Most did not dare or care.

The discovery versus justification distinction has oversimplified the understanding of scientific inquiry. For instance, in the recent debate over whether the context of discovery is relevant to understanding science, both sides in the controversy have construed the question as whether the *earlier* stage of discovery should be added to the *later* justification stage (Nickles, 1980). Con-

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