Douglas Walton. Abductive Reasoning. The University of Alabama Press. xvi, 304. $40 (US)

Abductive reasoning is reasoning from observed data to a hypothesis that would explain them. A famous example is Kepler's inference from a mass of data about the positions of the planets at various times to the hypothesis that they travel in elliptical orbits about the sun. As philosophers of science have only recently begun to appreciate, such reasoning to a possible explanatory hypothesis is common in scientific research. It is also common in legal contexts, for example in determining what caused a particular accident, as well as in medical diagnosis. Researchers in artificial intelligence have incorporated models of it in various expert systems for use in law and medicine. In this study, Walton summarizes and synthesizes for the non-specialist the scholarly literature on abductive reasoning, and presents his own theory of how one should evaluate abductive reasoning as strong or weak.

Abductive reasoning generates a possible explanation. According to Walton, explanation is the transmission of understanding: an explanation communicates information that enables its recipient to infer the thing explained. Thus Walton implicitly equates understanding something with being able to infer it from information at one's disposal. For an explanation to be successful, the recipient must understand its language and must have the background information needed to make the inferences to the thing explained. These requirements, he holds, can be met by a procedural model of rationality according to which the person requesting an explanation asks a series of questions until completely satisfied. The inferences involved in the understanding that is acquired through this process are often defeasible, meaning that they can be defeated (shown to be illegitimate) by further information; for example, from the fact that a moving car goes into a skid one can infer that it will leave tire marks on the pavement, but this inference can be defeated by further information that the pavement was wet or icy or snow-covered.

On the basis of these considerations, Walton proposes what he calls a "query-driven" model of abductive reasoning. He recognizes two forms of abductive reasoning, whose strength is proportional to the extent to which its associated "critical questions" receive satisfactory answers in an ongoing dialogue. One form reasons from the fact that some account E explains given data D better than its identified competitors to its being the most plausible account. Its critical questions are: How successful is E as an explanation of D? How much more successful is E than its identified competitors? How thorough has the search for alternative explanations been? Would it be better to investigate further before making a commitment for or against E? The other form reasons in a corresponding way from the comparative superiority of an argument from D to E, and has analogous critical questions. The components of either form emerge in a dialogue with four phases: the dialogue setting, explanation attempts, evaluation of explanations, closure.

Walton's dialogue model captures the open-endedness of the search for explanations. It highlights the defeasibility of abductive reasoning, the practical impossibility of absolute proof that our favoured explanation is correct. But it needs to be amplified and qualified. More criteria are needed for what makes an explanation successful. We need to distinguish the sort of explanation that transmits already acquired understanding, e.g. of how to get a photocopier to make double-sided copies, from the sort that expresses newly acquired understanding, e.g. of what caused a particular accident or why a cloudless sky is blue. And the model needs to take account of the fact that ability to infer the occurrence of a phenomenon is neither necessary nor sufficient for understanding it; for example, one can understand why an atom of a radioactive isotope decays without being able to infer it from the data, and one can infer from hearing thunder that lightning just struck without understanding why the lightning struck. But the model, as Walton himself points out, provides a framework for investigating outstanding problems about

abductive reasoning. And his book is a useful discussion of a wide range of scholarship about what constitutes good inference to an explanation. (DAVID HITCHCOCK)