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Inference To The Best Explanation

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Having tasted lots of lemons I conclude that all lemons are bitter. I have good reason to think this, but this conclusion does not necessarily follow from the limited evidence that I have; the premisses could be true and the conclusion false. Induction leads to conclusions that are likely to be true, or that are probably true, rather than to ones that are certainly true. Such reasoning aims to extend our knowledge: the content of inductive conclusions goes beyond the content of the relevant premisses. A claim is made about all lemons from my experience of only some lemons. Induction can therefore involve arguments of different strengths: if I taste a million lemons, all bitter, I have more reason to think that all lemons are bitter than if I taste only ten. Such reasoning is contrasted with deduction: this involves the drawing of conclusions that must be true if the premisses are true; deductive conclusions are certain, not probable. Induction used to refer only to induction by enumeration, but the term now covers a wider range of non-deductive inferences. *See also* DEDUCTION; INDUCTION BY ENUMERATION; LOGIC, INDUCTIVE. [DOB]

Induction by Enumeration. Induction by enumeration is the simplest form of inductive reasoning. From the premise that all observed *F*s have been *G*, the conclusion is drawn that all *F*s are *G*. From the fact that all the peas I have seen have been green, I infer that all peas are green. There is also a probabilistic form of this kind of inference: from the premise that 1% of opened oysters have contained pearls, the conclusion is drawn that 1% of all oysters contain pearls. *See also* INDUCTION; LOGIC, INDUCTIVE. [DOB]

Inference. An inference is an action of drawing a conclusion from a set of premisses, data or evidence. A good or valid inference is such that its premisses justify its conclusion. While we have no general theory of what sets of premisses count as a justification for a conclusion, the special case of deductive inference is well understood. Validity in this case reduces to the ordinary notion of logical consequence which has been the primary business of logic since its inception. On the other hand we still lack a satisfying account of the validity of even more widespread inferences, especially inductive inferences. *See also* INDUCTION; INFERENCE, RULES OF; LOGICAL CONSEQUENCE; PREMISS; VALIDITY. [HG]

Inference to the Best Explanation. A method of reasoning, also known as *abduction*, in which the truth of an hypothesis is inferred on the grounds that it provides the best explanation of the relevant evidence. In general, inference

to the best explanation (IBE) is an ampliative (i.e., non-deductive) method. In cases where *a* is not only the best explanation of *b* but *a* also entails *b* then IBE is formally equivalent to the logical fallacy of *affirming the consequent*. However, IBE does not license inferring *a* merely on the basis of the fact that *a* entails *b*. Criticisms of IBE come in both local and global varieties. Locally, such inferences are always defeasible because one can never be sure that all potential explanations have been found and hence that there is not some better, hitherto undiscovered explanation of the given evidence. Globally, some philosophers have questioned the grounds for taking explanatoriness as a guide to truth in the first place. There is also the practical issue of determining criteria for the comparison of different explanations, perhaps borrowing from more general criteria of theory choice such as simplicity, fruitfulness, expressive power and so on. There has been a tendency to see IBE as a distinctive feature of the empirical sciences. However, there are reasons for thinking that IBE may also play a role in the formal sciences, including both logic and mathematics, when it comes to choosing axioms. Thus a rationale for favouring one particular set of axioms may be that it provides the best explanation of the core results in the theory under scrutiny. *See also* ABDUCTION; AXIOM; FALLACY; INDUCTION. [ABa]

Inference, Rules of. Logical proofs are comprised of inference steps, which must conform to prevailing rules of inference. Typically, each rule specifies the logical form of the proposition(s) from which a proposition of a given form may be derived. Inference rules should be sound in the sense that they must not license invalid inferences. Where possible, proof systems are also expected to be 'complete': permitting the derivation of *all* valid inferences.

All proof systems include at least one inference rule. 'Hilbert-style' presentations contain only one rule, typically modus ponens, supplemented by axioms. However, Gerhard Gentzen's natural deduction presentations are comprised solely of inference rules. Natural deduction is so-called because it mimics the informal reasoning of practicing mathematicians, something axiomatic systems fail to do. Most modern textbook accounts of proof are descended from Gentzen's work.

Gentzen's version of natural deduction provides each connective with introduction and elimination rules, respectively, permitting the derivation of a proposition containing the connective from other propositions in which the