Being right in the information era

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Introduction

No question occurs without a context or an origin story. Typically, in philosophy, questions like "What is the answer to" are immediately followed by "how do I know that I am right"? This thesis will focus on the epistemological challenge of the later. This issue has been the focus of philosophers (Descartes) and non-philosophers (Trump) for many centuries.

Descartes [1641] considered the question of the nature of his reality by denying the relevance of sense data and only believing in the reality of his cognition. Arguing that he could be asleep and in a dream without the ability to distinguish this state from waking and perceiving, so only his thoughts were undisputably real. This lead to the famous position of "I think therefore I am" as the basis for his philosophical meditations on the nature of his reality [Descartes1641].

In Meditation four, Descartes [2013] uses as his truth determinant the stated existence of God, who inherently does not have properties which would render his *(sic)* judgement open to any doubt. Descartes, on the other hand, states his imperfections as being the basis of his errors [Descartes1641].

Error or falsity occurs when Descartes exercises his free will (actions) to move beyond his cognitive understanding of a given situation. Conversely, if Descartes confines his efforts to situations where he has full knowledge, then he is right as evidenced by his ability to "so see there the image of God [Descartes1641]."

Descrates argues he is right when his beliefs and actions are aligned to an external source of truth, in his case the Judo-Christian God as perceived in the 15th Century

Hume [1751] had the diametrically opposite perspective to that of Descartes. Primary sensory perceptions and the impressions generated from reflections on those perceptions are the basis of ideas [Hume, 1751, Section II - Of the origin of ideas].

The association between ideas for Hume can be one of "Resemblance" or "Continuity" and most importantly "Cause and effect" [Hume, 1751, Section III - Of the association of ideas]. The first two can never have truth validity associated with them. A Tuatara resembles a lizard; only it is not. All swans are not white, but all swans in Europe are white, so when a European is thinking of a swan they will recall only a white swan, but this does not prove all swans are white.

In Section IV - "Sceptical doubts concerning the operations of the understanding" **?** focuses on the *"is-ought"* paradox he first raised in his "A Treatise on Human Understanding" [Hume, 1739, p. 379]. Namely, because one thing **is** associated with another, does not mean they **ought** to be associated with each other. For Hume, such infinite scepticism will be addressed through human reason, which he divides into two categories; "Relations of ideas" and "Matters of fact" [1751].

The concept of "Relations of ideas" is obviously influenced by Newton's laws of Physics, where describing the causal relationship between two ideas is mathematically derived and underpinned by the self-evident core axioms [Hume, 1751, Part 1, Section IV]. Where the force created in one billard ball is transfered to another by the collision and described by the formula for Newton's second law;

$$Force = Mass.Acceleration$$

"Matters of fact" or cause and effect between two ideas have to transcend the temporal or spatial. The example used is free will, or human thought can control finger movement but not liver action, so free will cannot cause the finger to move as it is not necessary or sufficient. For Hume, finger movement derives from the nerves connecting the brain to the finger and arm muscles. Each component in this causal chain is a sensory derived idea [Hume, 1751, Part 1, Section VII - Of the idea of necessary connection].

In this Hume was describing a deterministic universe based on internal consistency and derived from sense based information. Excluded are concepts of cognition or external social sources of validity including theism. These excludions were fundamental to Descartes [2013] formula for being correct.

HISTORY PLAYS CRUEL JESTS on the wise. Hume [1751] rejected probability as a sufficient basis to underpin determination of cause behind an effect. The relentless determinism which followed instead demonstrated that the universe was by nature inherently probabilistic.

In the early 20th century , statistics and probability developed into cornerstones of modern science, so that now little-deemed science occurs without them, and statistical techniques have spilt into non-traditional subjects such literature through techniques like text analysis [Silge and Robinson, 2016].

Fisher [1925] describes how he saw statistics as being the application of applied mathematics to populations. In his work, this original concept had been extended to an understanding of variation and the "reduction of data" (Fisher [1925] p. 1). His worked extended into the study of frequency distributions, which describe the spread of a characteristic within a population and enable the use of specific statistical

Hume argues for the primacy of the senses as the basis of ideas. For Hume being right is establishing a causative relationship is an internally consistent chain that invariably decsribes the connection and is based on other sense derived phenomea or basic matehmatical axioms

Statistical truth merges the concepts of an intrinsic casual relationship defined by mathematics derived from fundamental axioms

models to explain that variation [Fisher, 1925].

Described is also the work by Pearson on correlation or covariance (Fisher [1925], p.6). Covariance describes how the stronger two properties of a population are related can be measured by how much they vary at the same time. Student [1908] describes the differences between two means, where a mean is a measure of the central tendency within a population.

As a result of this work, the truth or validity was about the properties of two related populations; whether the difference was mathematically higher than that expected by chance alone or conversely if these two populations varied were statistically covariant then it could mean they were causally related. This new methodology not only suggested possible avenues for further study, but it also provided a vehicle to demonstrate which explanation is most likely [Field et al., 2012].

THE PHILOSOPHY OF SCIENCE presents its student with a different aspect to the challenge of knowing if you are right. As most scientific theories are wrong and only a stepping stone towards a deeper understanding of the underlying question. For Popper [2005] the answer was that scientific theories were right if no one has proved them wrong. The nuance of this seemingly self-evident statement was for a scientific theory to be a valid theory; it had to generate new hypotheses to test including at least one that if true would disprove the theory [Popper, 2005].

> For Popper being right was having a valid thory that now one had proved wrong

For Kuhn [2012], Popper may have described a scientific theory and its exploration through progressive experimentation, but there was more to science. For Kuhn saw the process of science as being organised around a central paradigm (Kuhn [2012]). Where adoption of this theory was a social process, as was its abandonment. Where doubts about the incumbent rose with evidence that did falsify it, leading to the development of the new theory. Adoption of this new theory would be a social process across the sictentific community as a whole [Kuhn, 2012].

> Kuhn extended this theory of being right to include a social acceptance by the scientific community

The information era

Appendix 1: Prolog programming language

Colmerauer and Roussel [1996] describes both the birth and the intent of the Prolog computing language in the early 1970s. Prolog's focus was to be in natural language processing, but with time Prolog has also developed to become a general purpose computing language (Liu [2018]). Its most common use remains in natural language processing and the development of expert systems including IBM Watson (Liu [2018], p. 15).

Prolog aims to enable the representation of knowledge through the used of formal predicate logic (Baral and Gelfond [1994]). Logic programming is unique among computing paradigms in that it includes the concepts of fact and validity of expressions as fundamental core constructs, inherent to the language itself (Colmerauer and Roussel [1996]).

To a logistician, Prolog is an idiosyncratic representation of the usual and commonplace. Consider modus pons;

$$p \supset q$$

$$p$$

Hence

$$q$$

is represented in Prolog as;

$$p$$
$$q :- p$$

Which is to be read as p is true, hence q must be true given p is true.

So Prolog provides a vehicle for knowledge representation through the use of formal logic. What is less obvious is what it adds to a discussion of the logic itself and its underlying formal proof.

Although logic is core to Prolog, the utility of Prolog in Logic is less certain. Currently this is a tool with potential but without purpose.

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