

Two Refutations of Hegemonic Bayesianism

in Cognitive Science and Artificial Intelligence

version 0309141300NY

Selmer Bringsjord & Naveen Sundar G.

Covey Award (SB) Lecture Abstract
IACAP 2014; July 2–4, Thessaloniki, Greece

We take hegemonic Bayesianism (HB_{CogSci}) in cognitive science to be the claim that human cognition consists of Bayesian processing, and take the in-AI-version of this claim (HB_{AI}) to be that the best route to reach human-level computing machines is to endow these machines with suitably tuned Bayesian processing.¹ The sign of a mind infected with either or both of these views is that it outputs with disturbing frequency such sentences as

- “ N in human cognition is just $P[\text{Bayesian}]$.”

where N is an abstract noun and $P[u]$ is an English phrase in which the word u appears; or, on the AI side, such sentences as

- “The best way to build a machine that can do N , is to use $P[\text{Bayesian}]$.”

It’s easy-peasy to refute both HB_X claims. Path 1: Step 1₁: For simplicity and economy, restrict N to be the kind of reasoning that humans routinely perform when doing formal logic and mathematics, and P to be ‘Bayesian inference.’ Step 2₁: Observe now a rather ironic little problem: viz., Bayesian inference is insufficient to prove even the dirt-simple Bayes’ Theorem. Step 3₁: Observe that proving this theorem is to do (elementary) logic and mathematics. **QED** (If there are any hegemonic Bayesians in the Grecian room, they can be counted upon to be positively obdurate even in the face of the disproof just provided them, and to specifically spout the slogan that “Deduction [= N here] in human cognition is just a special case of Bayesian inference [= $P[\text{Bayesian}]$ here]!” We shall explain in person why this protest is but vapor.)

A second refutation is available via Path 2: Step 1₂: Observe that Bayesian inference is as a matter of mathematical fact based on some axiomatization \mathcal{A} of probability going back to Kolmogorov. Step 2₂: Focus on the formal language \mathcal{L} on which \mathcal{A} is based. Step 3₂: Show that \mathcal{L} is insufficiently expressive in the face of human logico-mathematical reasoning (which Leibniz, \approx three centuries before modern CogSci/AI arrived on the scene, apprehended when but a student). Step 4₂: Accordingly, supplant \mathcal{L} with a more expressive \mathcal{L}' . We save the final two nails in the coffin for presentation in Thessaloniki, but are quite confident that readers will be able by non-Bayesian analogical reasoning to derive them from the final two steps in Path 1.

¹There is also of course the related neuro-claim (HB_{Neuro}): that the mechanisms in the brain corresponding to human cognition are fundamentally Bayesian in nature. A disproof of HB_{Neuro} is saved for five minutes on another day. By the way, Bayesian doctrines other than the HB_X treated herein have been decisively refuted; e.g., Bayesian epistemology by John Pollock, and Bayesian-reasoning-is-the-essence-of-scientific-argument by Clark Glymour.