

Awareness growth and belief revision

How should an agent update their beliefs when they encounter a completely new possibility? Bayesianism has no answer, as it insists that agents have priors for all possibilities. But ordinary people like you and me regularly confront new possibilities. When I moved to Stockholm, I learned that Riddarholmen lies just west of Gamla Stan. Climate scientists in the twentieth century explored new theories and mechanisms, such as the runaway greenhouse effect, to explain observed climate phenomena and predict climate change. These each involved the formation of new beliefs. The configuration of Stockholm's islands involves a set of prosaic propositions that I had simply never encountered or considered before. In the climate case, the scientists involved developed and learned entirely new concepts.

I develop a model of growing awareness which specifies how an agent's probabilistic beliefs ought to be extended to a new space of possibilities, and which provides constraints for the formation of new beliefs about those new possibilities. It is a two-stage model, with each stage justified by norms of conservative belief change. The first stage is a form of Reverse Bayesianism, a proposal for extending one's current credences to a new set of possibilities. My model resolves a challenge by Mahtani, that Reverse Bayesianism yields the wrong result when a proposition "splits" due to the change in awareness.

Here is the first stage, in outline: An agent's initial awareness state is represented by the Boolean algebra on which their probabilities are defined. After their awareness grows, their awareness is again represented by such an algebra. Propositions from the old algebra are identified with propositions in the new by a kind of mapping called a lattice embedding: a one-to-one homomorphism which preserves logical conjunctions and disjunctions, but not negations. In most cases it is obvious which propositions are preserved across awareness changes, and when more care is needed. I propose that the reasons underlying the agent's credal structure fix this identification. The agent's initial probabilities are extended to the new algebra, a process which determines what the old belief state has to say about the wider set of possibilities the agent now confronts.

The second stage involves revising these extended beliefs. Steele and Stefánsson argued recently that Reverse Bayesianism cannot deal with new propositions that are evidentially relevant to old propositions, but I show that these cases are easily handled in my two-stage model. The process of extension takes place without considering any new evidence that the agent learns during the experience that brings about her awareness growth. After her initial probabilities have been extended to the new algebra, they can be updated in a belief revision process to reflect any information she has learned about the new possibilities, or the relations between new and old possibilities. As the agent has no priors for the new propositions, this belief revision cannot be Bayesian. I show that that the same logic of conservative belief change which underlies ordinary Bayesian conditioning and the Reverse Bayesian belief extension procedure can guide belief revision following awareness growth. I conclude with a discussion of the rational grounding of general, non-Bayesian, belief revision in this context.