On the Principal Principle and Subjective Imprecise Bayesianism

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Whilst Bayesian epistemology is widely regarded nowadays as our best theory of knowledge, there are still a relatively large number of incompatible and competing approaches falling under that umbrella. With respect to precision, classical Bayesians think that beliefs about a state of affairs should be represented by a single probability distribution whereas imprecise Bayesians think that a set of probability distributions can be permissible and often even mandatory.

With respect to objectivity, Bayesians can be divided into objective Bayesians (who believe that in every evidential situation, there is a unique probability distribution every rational agent ought to have) and subjective Bayesians (who believe that at least in some cases, several probability distributions are permissible) [2].

The Principal Principle (PP) stipulates that when physical probabilities are known, one's degrees of belief ought to match them exactly. While radical subjective Bayesians (such as De Finetti) reject it and believe that anything goes, moderate subjective Bayesians accept it while at the same time rejecting the Principle of Indifference (POI) that forces (precise) objective Bayesians to use a uniform prior to represent complete ignorance. One of the main motivations for using Imprecise Probability is that the POI arguably fails to represent true ignorance as can be seen by reformulating the variables of the problem it is applied to. It leads one to mistake utter lack of knowledge for a specific knowledge about symmetries [1].

Very recently, Wallmann and Williamson wrote an interesting article [3] that aims at showing that a subjective Bayesian who accepts the principal principle and uses a known physical chance as her degree of belief for an event A could end up having incoherent or very implausible beliefs if she subjectively chooses the probability of an event F for which she has much poorer evidence. They also argued that their own version of objective Bayesianism is completely immune to that challenge.

In this contribution, after having presented the strongest version of Wallmann's and Williamson's argument, I will show that if successful, it has far-reaching consequences and would not only invalidate moderate subjective Bayesianism and imprecise probabilism but also a form of objective Bayesianism that relies on conditionalisation, the principal principle, reference classes, and the principle of indifference applied to the most basic partitions. It paradoxically would even invalidate radical subjective Bayesianism that does not accept the Principal Principle in the first place.

I then argue that their argument can be defeated by adding the rule that it is always irrational to choose a probability that can be computed from the known probabilities associated to one's other beliefs. I finally argue that the authors' main intuition that probabilities have different degrees of reliability favours imprecise Bayesianism over precise Bayesianism. The counter-intuitive result they obtained (one's purely subjective probability about F has the same weight as the known physical probability of A) disappears in an imprecise probabilistic framework.

References

[1] J. D. Norton. Ignorance and indifference. *Philosophy of Science*, 75(1):45–68, 2008.

[2] W. Talbott. Bayesian Epistemology. In Edward N. Zalta, editor, *The Stanford Encyclopedia of Philosophy*. 2007. URL https://plato.stanford.edu/archives/win2016/entries/epistemology-bayesian/.

[3] Christian Wallmann and Jon Williamson. The principal principle and subjective bayesianism. *European Journal for Philosophy of Science*, 10(1):3, 2020.