Is the Brain a Bayesian Machine?

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For the last twenty years, the so-called Bayesian Models have been widely circulated in the field of cognitive science and computational neuroscience.

Many of this kind of different models has been applied to a wide range of cognitive phenomena, from perception (Ernst and Banks, 2002) to consciousness (Lau, 2007): their success led some cognitive scientists to claim the existence of a new Bayesian Paradigma within Cognitive Science.

According to people following this new paradigma, the predictive success of Bayesian models would show that human cognition might be based on unconscious execution of inferences describable by the Bayesian Inferencial Stathistics and the Bayesian Decision Theory.

Some bayesianists have gone further, arguing that the human brain itself may ultimately be a sort of Bayesian Machine: a "computer" operating according to Bayesian algorithms. Such a thesis has several consequences: actually, if the brain were a Bayesian machine we would expect the Bayesian models would provide an exhaustive explanation of the phenomenon of human cognition in its complexity.

I think these expectations will be greatly disappointed: in fact, as I try to show in the following work, both the predictive success of Bayesian models does not provide sufficient evidence for the Bayesian Machine Thesis, and the arguments inferring the Bayesian nature of the mind / brain from the predictive success of bayesian models are the result of some conceptual and reasoning mistakes. The aim of the first part of the work will be exposing these mistakes. The second part, instead, will be dedicated to better clarify what epistemological role Bayesian models could have in contemporary Cognitive Science: I will argue that Bayesian models, although useful predictive tools in the psychophysical field, are not informative of the real nature of the human cognition and their applicability is sufficiently independent of this from the methodological point of view.

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