Abstract for Ariel Caticha

Title: Belief and Desire: On Information and its Value

Abstract:

The challenge of reasoning under conditions of uncertainty is the single common thread that unifies all sciences. In this talk I will argue that the challenge can be successfully met by addressing three interrelated problems.

The first problem is to design a scheme that allows one to represent a state of partial knowledge. The result is well known—it is given by Bayesian probability theory. Even though the foundations of Bayesianism remain an active subject of discussion, the practical success of the whole framework is by now undeniable.

The second problem is to design a procedure that allows us to revise our beliefs as we acquire new information. Indeed, if the source of all our troubles is incomplete information what do we do in the fortunate circumstance that some information becomes available? Which raises another question: what, after all, is information? I shall argue that in a Bayesian setting the notion of information must be defined in terms of its effects on the beliefs of rational agents: Information is what induces a rational agent to change its mind. The tool to perform the updating is entropy and the associated method, Entropic Inference, includes the MaxEnt method and Bayes' rule as special cases.

The actual functional form of the entropy follows from purely pragmatic requirements. The method must be of universal applicability and we must recognize that prior information is a valuable asset that should not be squandered. Which brings us to the third problem: Why bother? What do we expect to gain by going through the trouble of collecting and processing information? The answer is that we are driven not just by what we believe but also by what we desire. Better information leads to better beliefs which lead to decisions that stand a better chance of getting us what we want. Thus the value of information is to be measured in terms of differences in the expected utility of the decisions we make.

Caticha’s papers on entropic inference and on its applications to the foundations of statistical and quantum mechanics can be found at http://www.albany.edu/physics/acaticha.shtml.