

"Information and Dynamics in Minimally Cognitive Agents"

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ABSTRACT

Within cognitive science, there has been considerable debate about the relative merits of information-processing vs. dynamical approaches to understanding cognitive processes. This talk will adopt the position that the mathematical theories underlying these two approaches - information theory and dynamical systems theory, respectively - are best viewed as distinct mathematical lenses through which one can examine the operation of any system of interest. Thus, the concern should not be which approach to cognition is "right", but rather the different sorts of explanations that each lens reveals and the interrelationships between these explanations when both lenses are applied to the same cognitive system.

In order to explore these issues, this talk will describe the analysis of a model agent evolved to solve a relational categorization task. Specifically, we separately analyze the operation of this agent using the mathematical tools of information theory and dynamical systems theory. Information-theoretic analysis reveals how task-relevant information flows through the system during categorization. Dynamical systems analysis reveals the mechanisms underlying the categorization decision. We then demonstrate the possibility of an integrated perspective on information and dynamics by showing that one can translate back and forth between informational and dynamical explanations of the same cognitive agent. This talk describes joint work with Paul Williams.