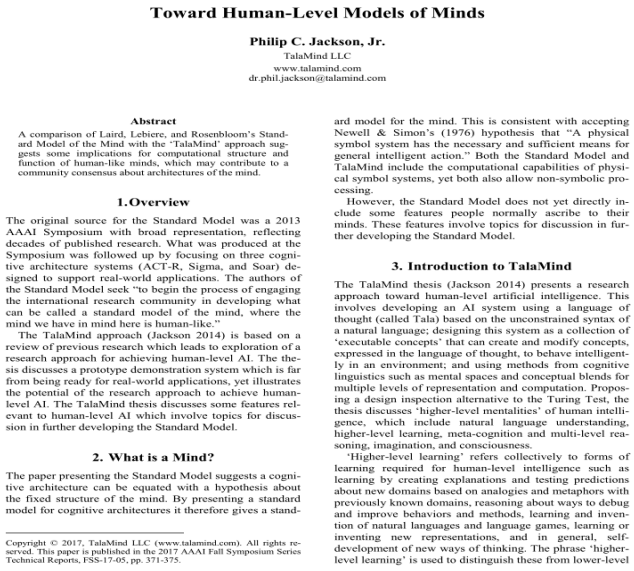
Human Intellect and Cognitive Science: Toward a General Unified Theory of Intelligence



Toward Human-Level Models of Minds

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Abstract

A comparison of Laird, Lebiere, and Rosenbloom's Standard Model of the Mind with the 'TalaMind' approach suggests some implications for computational structure and function of human-like minds, which may contribute to a community consensus about architectures of the mind.

1. Overview

The original source for the Standard Model was a 2013 AAAI Symposium with broad representation, reflecting decades of published research. What was produced at the Symposium was followed up by focusing on three cognitive architecture systems (ACT-R, Sigma, and Soar) designed to support real-world applications. The authors of the Standard Model seek "to begin the process of engaging the international research community in developing what can be called a standard model of the mind, where the mind we have in mind here is human-like."

The TalaMind approach (Jackson 2014) is based on a review of previous research which leads to exploration of a research approach for achieving human-level AI. The thesis discusses a prototype demonstration system which is far from being ready for real-world applications, yet illustrates the potential of the research approach to achieve human-level AI. The TalaMind thesis discusses some features relevant to human-level AI which involve topics for discussion in further developing the Standard Model.

2. What is a Mind?

The paper presenting the Standard Model suggests a cognitive architecture can be equated with a hypothesis about the fixed structure of the mind. By presenting a standard model for cognitive architectures it therefore gives a standard model for the mind. This is consistent with accepting Newell & Simon's (1976) hypothesis that "A physical symbol system has the necessary and sufficient means for general intelligent action." Both the Standard Model and TalaMind include the computational capabilities of physical symbol systems, yet both also allow non-symbolic processing.

However, the Standard Model does not yet directly include some features people normally ascribe to their minds. These features involve topics for discussion in further developing the Standard Model.

3. Introduction to TalaMind

The TalaMind thesis (Jackson 2014) presents a research approach toward human-level artificial intelligence. This involves developing an AI system using a language of thought (called Tala) based on the unconstrained syntax of a natural language; designing this system as a collection of 'executable concepts' that can create and modify concepts, expressed in the language of thought, to behave intelligently in an environment; and using methods from cognitive linguistics such as mental spaces and conceptual blends for multiple levels of representation and computation. Proposing a design inspection alternative to the Turing Test, the thesis discusses 'higher-level mentalities' of human intelligence, which include natural language understanding, higher-level learning, meta-cognition and multi-level reasoning, imagination, and consciousness.

'Higher-level learning' refers collectively to forms of learning required for human-level intelligence such as learning by creating explanations and testing predictions about new domains based on analogies and metaphors with previously known domains, reasoning about ways to debug and improve behaviors and methods, learning and invention of natural languages and language games, learning or inventing new representations, and in general, self-development of new ways of thinking. The phrase 'higher-level learning' is used to distinguish these from lower-level

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