How Minds Work: A Cognitive Theory of Everything

A Tutorial on the IDA Model of Cognition

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Abstract. The IDA model of cognition is a fully integrated artificial cognitive system reaching across the full spectrum of cognition, from low-level perception/action to high-level reasoning. Extensively based on empirical data, it accurately reflects the full range of cognitive processes found in natural cognitive systems. As a source of plausible explanations for very many cognitive processes, the IDA model provides an ideal tool to think with about how minds work. This online tutorial offers a reasonably full account of the IDA conceptual model, including background material. It also provides a high-level account of the underlying computational "mechanisms of mind" that constitute the IDA computational model.

Keywords: cognition, consciousness, mechanisms of mind, action selection, tutorial.

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Supplementary Material

Tutorial Resources for Download

Datasheet

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Topical Context

Like the Roman god Janus, the IDA project has two faces, its science face and its engineering face. Its science side fleshes out the global workspace theory of consciousness and cognition (Baars 1988, 1997), while its engineering side explores architectural designs for software agents (Franklin 2005) that promise more flexible, more human-like intelligence within their domains (Franklin 2001). We can expect the architectures and mechanisms that underlie consciousness and intelligence in humans to yield software agents (Franklin and Graesser 1997) that learn continually, that adapt readily to dynamic environments, and that behave flexibly and intelligently when faced with novel and unexpected situations.

How Minds Work is intended to give a detailed picture of several mechanisms of mind (Franklin 1995) combined to produce a conceptual model of cognition in the context of a human-like software agent, IDA. But why should you want to engage yourself with this tutorial? The burning question that drives my research, and that of many others, is how do minds work? Understanding the conceptual model that underlies the IDA model buys me something. Given a question about some cognitive process, I can most often ask how does it work in the model, and get an answer. The hypothesis thus generated is that it works the same way in humans. This hypothesis may or may not be correct. That's left for the cognitive scientists and the neuroscientists to sort out. But I have an answer that gives me at least the illusion that I understand how minds work, or at a minimum, how they could work. It's heady stuff, and to me, worth the effort of understanding the IDA model deeply enough to get answers.

This tutorial is intended to bring about just such an understanding in the reader. The diligent reader should emerge from this tour with a clear understanding of the workings of the IDA model. That is, he or she should carry away a clear picture of how this model says that human minds work, not only in their function, but also something of their mechanisms.

The tutorial consists of a Full Tutorial and a Brief Tutorial. The Full Tutorial consists of eight chapters, with each chapter containing one to five topics. Each topic consists of a slide show, with or without audio. Slide shows might average some twenty-five slides. The Brief Tutorial is built around the Cognitive Cycle diagram. Clicking on items in the list of Modules and Processes restricts the diagram and brings up explanatory text.

Application Context

The Full Tutorial consists of PowerPoint presentations with accompanying audio taken from a semester long class that met twice a week for an hour and twenty minutes each session. The Full Tutorial has been augmented by several additional presentations without audio. The author has contemplated using the tutorial in another such class in which the students would be assigned to view and listen to a presentation in preparation for each class session. Class time would be devoted to discussion of previously viewed material.

Not everyone who comes to this Tutorial on How Minds Work will want to devote sufficient time and energy to work his or her way through all of the Full Tutorial. Some readers may prefer to customize a less than complete itinerary through the Full Tutorial based on his or her particular interest. The Brief Tutorial is intended to make such a customization easier to do. It consists of a diagram depicting the LIDA (Learning IDA) cognitive cycle, the fundamental atom of cognition out of which the molecules of higher cognitive processes are built. Every autonomous agent (Franklin & Graesser 1997), be it

human, animal or artificial, must operate by means of a continual iteration of some such sense–cognize–act cycle. We hypothesize that humans operate by means of something like the LIDA cognitive cycle iterating at an asynchronous rate of something like five to ten times each second. The Brief Tutorial contains a list of modules and processes. Selecting and clicking on any item in the list will result in an altered diagram showing only those modules and processes that interact directly with the one clicked on. Directly below the altered diagram you will find text briefly describing the module or process selected. To the left of this text, will be suggestions for more detailed information on the selected module or process to be obtained from the Full Tutorial.

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