Tutorial on the ICARUS Cognitive Architecture

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Objectives and Scope

This tutorial will introduce attendees to ICARUS, a computational theory of the human cognitive architecture. The framework makes claims about the nature of cognition that distinguish it from more established architectures like ACT-R and Soar, and that we believe many conference participants will find intriguing.

The presentation will cover the motivations behind ICARUS, the theoretical assumptions it shares with other architectures and those on which it differs, and the types of cognitive phenomena it aims to cover. The tutorial will also introduce attendees to a programming formalism that embodies ICARUS' theoretical commitments, present some example cognitive models, and illustrate their use in synthetic environments.

Plans for Tutorial Delivery

The tutorial presentation will involve a combination of PowerPoint slides, recorded videos, and live runs of ICARUS models. We will encourage questions from the audience to clarify ambiguities and uncover assumptions not shared by all participants. The tutorial will begin with a review of symbolic modeling to ensure communication with attendees from different backgrounds.

We will provide attendees with hard copies of slides from the presentation to aid in note taking. We will also provide them with a URL at which they can access papers on ICARUS during the tutorial and download software for running the example models we cover.

Qualifications of Presenters

The presenters will include Pat Langley (Arizona State University) and Dongkyu Choi (University of Illinois, Chicago). As co-developers of the ICARUS architecture, they are very familiar with the design decisions behind it, with details of its implementation, and with using the framework to develop intelligent agents. Both have authored papers and presented talks on the architecture, many slanted toward an unfamiliar audience.

Reasons for the Tutorial

Research on cognitive architectures has played a central role in cognitive science. In recent years, the conference has hosted tutorials on other architectural frameworks like CHREST, Polyscheme, and CLARION. Thus, many attendees will be familiar with the idea of an architecture-oriented tutorial and they will attend if they find its material relevant and interesting.

We believe that a tutorial on ICARUS in particular is especially timely for three reasons:

- The architecture has a strong commitment to embodied cognition, a theoretical position that has been receiving increased attention in recent years.
- ICARUS specifically aims to model aspects of high-level cognition such as problem solving, dialogue, and reasoning about other agents, which have not been emphases of most architectures.
- The associated modeling language provides a syntax that is higher level than those offered by other architectures, which should make it attractive to novice cognitive modelers.

Taken together, these reasons suggest the event should be well attended and well received.

Intended Audience

We expect a mixed audience for this tutorial. Some researchers who have experience with another architecture like Soar or ACT-R will attend to learn about the differences from that framework. Some others will participate because they are novice modelers who believe that ICARUS might provide a relatively easy entry into computational modeling of cognition. We expect a mixture of age groups, but many attendees are likely be graduate students or postdoctoral researchers who are not yet fully committed to a theoretical paradigm.

The tutorial will assume some familiarity with computer programming, but not with any particular language. Exposure to ideas about predicate logic and pattern matching will also be useful, but they should not be required. However, attendees should have a desire to learn about the benefits of cognitive architectures in developing models of conceptual inference, skill execution, problem solving, and learning, along with the structures and processes that ICARUS offers to this end.

References

Langley, P., Choi, D., & Rogers, S. (2009). Acquisition of hierarchical reactive skills in a unified cognitive architecture. *Cognitive Systems Research*, *10*, 316–332.

Langley, P., & Rogers, S. (2005). An extended theory of human problem solving. *Proceedings of the Twenty-seventh Annual Meeting of the Cognitive Science Society*. Stresa, Italy.