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ACT-R Tutorial

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ACT-R (Anderson, Bothell, Byrne, Douglass, Lebiere & Qin, 2004) is a cognitive theory and simulation system for developing cognitive models. It assumes cognition emerges through the interaction of a procedural memory of productions with a declarative memory of chunks and independent modules for external perception and actions. Since its release in 1993, ACT-R has supported the development of over 100 cognitive models, published in the literature by many different researchers. These models cover topics as diverse as driving behavior, implicit memory, learning backgammon, metaphor processing, and emotion. This tutorial will discuss the latest version of ACT-R, ACT-R 6.0, which is more interruptible, achieves greater across-task parameter consistency, has better mechanisms of production learning, and is more in correspondence with our knowledge of brain functioning. The tutorial has no prerequisite knowledge, and is intended to on the one hand give an overview of the theory, and on the other hand offer some direct demonstration of ACT-R models. Although half a day is not sufficient to cover all material, it can whet the appetite for and serve as a kick-start to the full ACT-R tutorial that is available online at http://act-r.psy.cmu.edu/. This website also provides the necessary software, and overview of researchers using ACT-R, and it has a list of ACT-R publications (many of them downloadable).

During the tutorial, following Taatgen, Lebiere and Anderson (2006) four popular research paradigms within ACT-R will be used as a vehicle both to explain the architecture and to explain how ACT-R accounts for these phenomena.

Instance learning

Learning by retrieving old experiences from memory, similar to Logan's instance theory.

Utility learning

Learning which of several available strategies is optimal by keeping track of costs and probability of success.

Perceptual/Motor constrained processing

Models in which the main factor in explaining human performance lies in the limitations of their perceptual and motor systems.

Rule learning

Models in which new production rules are learned on the basis of combination of old rules and substitution of declarative knowledge.

Although these individual research paradigms have produced interesting models by themselves, the full potential of the architecture can only be seen when they work together in models of complex cognition, which is the focus of a large proportion of current ACT-R research.

In addition to the modeling paradigms we will discuss imaging research that shows how components of the ACT-R architecture can be mapped onto brain regions.
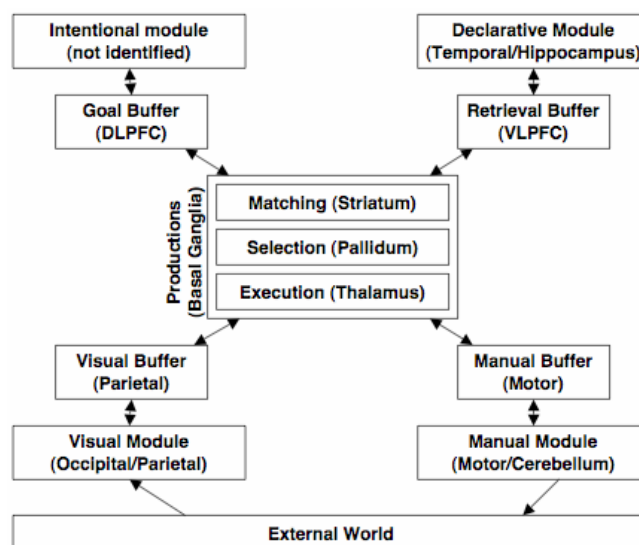

Figure 1: Overview of the ACT-R architecture

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