An Introduction to the COGENT Cognitive Modelling Environment

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The COGENT Environment

COGENT (Cooper & Fox, 1998; Cooper 2002) is a graphical environment that is designed to simplify the process of developing and evaluating computational models of high-level cognitive processes. COGENT does not embody any particular theory of the cognitive architecture, nor is it a general purpose programming language. Rather it provides a set of primitives that may be assembled and configured to yield a variety of models in many different domains. COGENT has been used extensively for teaching cognitive modelling at numerous institutions in Europe and the US. It also has applications in modelling research.

The basic system provides the modeller with a sketch pad on which a model may be drawn as a box and arrow diagram (see Figure 1). This level of description provides the psychologist with a familiar notation, thus simplifying the modelling processes, but is inadequate for a computationally complete specification. In order to fully specify a COGENT model the boxes in each diagram must be fleshed out, either by specifying computational properties (such as capacity limitations or decay rates of buffers) or by adding production-like rules. Structured editors are provided to simplify the process of writing rules, and to ensure that the resultant rules are syntactically well-formed.

COGENT also includes tools for model evaluation. Its model execution environment embodies the notion of a subject or "virtual participant", as well as notions from standard experimental psychology of trial and block. These provide hooks that help bridge the gap between empirical psychology and cognitive modelling. Thus, it is possible to define virtual subjects with different memory spans and compare their performance over several trials of a task (for example). Integrated tools allow behavioural measures to be graphed or tabulated, simplifying the interpretation of model output.

For further details of COGENT, including versions of the software for a variety of platforms and detailed tutorial notes, see http://cogent.psyc.bbk.ac.uk/

Tutorial Description

The tutorial will begin with a brief tour of the COGENT system aimed at demonstrating some of the environment's capabilities and giving attendees a clear understanding of its intended purpose. This will be followed by a hands-on session in which participants will work through the implementation of a well-known cognitive theory: the Modal Model of memory (Atkinson & Shiffrin, 1968). COGENT allows users to specify both a model and a task environment within the one system, and participants will be provided with a sophisticated task environment within which their implementation of the Modal Model will be developed. This will allow participants to test their models on the standard free recall memory task.

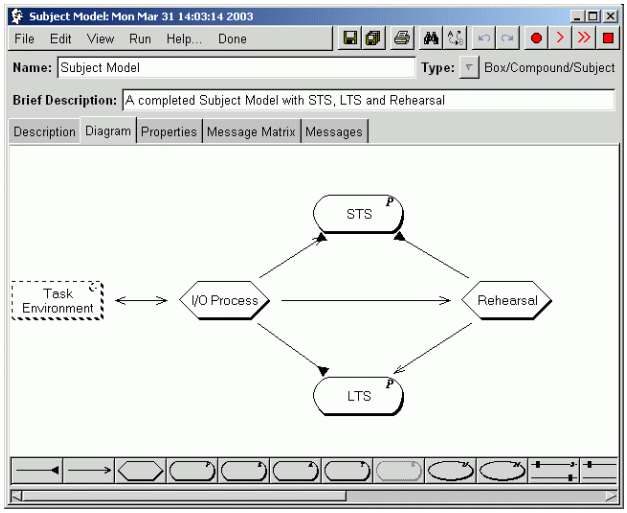

Figure 1: A COGENT box and arrow diagram of Atkinson & Shiffrin's Modal Model of memory

The second half of the tutorial will focus on the role of parameters within COGENT models and participants will examine the effects of parameter variation on their model's behaviour. Thus, we will consider how capacity limitations and decay in the buffers that make up the Modal Model affect behaviour on the standard free recall task. The goal will be to reproduce the U-shaped free-recall curves that originally motivated the development of the Modal Model. The tutorial will conclude with a review of recent extensions to the COGENT environment.

References

Atkinson, R. C. & Shiffrin, R. M. (1968): Human memory: A proposed system and its control processes. In K. W. Spence (ed.), *The Psychology of Learning and Motivation: Advances in research and theory, Volume 2*. pp. 89–195. New York: Academic Press.

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