Current Computational Models in Cognition

Supplementary table for: Lewandowsky, S., & Farrell, S. (2011). *Computational modeling in cognition: Principles and practice*. Thousand Oaks, CA: Sage Publishers Inc.

This document was downloaded from http://www.cogsciwa.com and is part of the supplementary material for the book.

This table will be regularly updated to keep pace with developments in the field. Suggestions for updates are welcome and should be addressed to stephan.lewandowsky@uwa.edu.au.

8.5.1 Memory

Retrieving Effectively from Memory (REM; Shiffrin & Steyvers, 1997): a Bayesian model of recognition memory, in which the likelihood of partial episodic traces is calculated in parallel given a presented probe.

Scale-Invariant Memory, Perception and Learning (SIMPLE; G. D. A. Brown et al., 2007): a contemporary model of memory in which items are confused on the basis of their proximity in multidimensional space, with a particular role accorded to temporal proximity.

Search of Associative Memory (SAM; Raaijmakers & Shiffrin, 1980, 1981): a classic dual-store model of episodic memory that specifies the process by which retrieval cues are instantiated and used to search memory.

Serial-Order in a Box (SOB; Farrell & Lewandowsky, 2002; Lewandowsky & Farrell, 2008b): a connectionist model of serial order memory in which learning is gated by the novelty of sequence elements.

Temporal Context Model (TCM; Howard & Kahana, 2002; Sederberg, Howard, & Kahana, 2008): a distributed connectionist model that explains forgetting in episodic memory as a consequence of the evolution of temporal context driven by incoming information.

8.5.2 Language

Bayesian Reader (Norris, 2006): a Bayesian model of word recognition, lexical decision, and semantic categorization.

Saccade Generation With Inhibition by Foveal Targets (SWIFT; Engbert, Nuthmann, Richter, & Kliegl, 2005): an accumulator model of saccade generation during reading,

accounting for effects of word length and word frequency on fixation positions and latencies.

Dual-Route Cascade Model of Reading (DRC; Coltheart, Rastle, Perry, Langdon, & Ziegler, 2001): a connectionist model of word recognition and naming that assumes different methods of processing words (variously using semantic, lexical, and graphemic knowledge) are carried out in parallel.

Bound Encoding of the Aggregate Language Environment (BEAGLE; M. N. Jones & Mewhort, 2007): a composite holographic model that builds representations of word meaning and word order from unsupervised experience with natural language.

Word-form Encoding by Activation and VERification (WEAVER; Roelofs, 1997): a model explaining how the passing of activation between localist representations of lexical, syntactic, and morphemic information enacts retrieval of word forms in speech production.

8.5.3 Perception and Action

Model of the Influence of Task on Attention (Navalpakkam & Itti, 2005): the model explains task-specific guidance of visual attention in real-world scenes. Information about the task is stored in working memory and, together with relevant long-term information, biases the visual attention system to perceive relevant features.

Recurrent Model of Sequential Action (Botvinick & Plaut, 2004): a recurrent connectionist model of sequential action that explains context as recurrent feedback from previous network states.

Dynamical Systems Model of Coordination (Haken, Kelso, & Bunz, 1985): a dynamical systems model treating bimanual coordination as a system of coupled oscillators, where qualitative changes in coordinating behaviour arise from phase transitions.

The Bayesian Ventriloquist (Alais & Burr, 2004): a Bayesian model of multimodal integration that explains ventriloquism as precise (in terms of spatial location) visual information capturing imprecise auditory information.

Neural Model of Cognitive Control (J.W. Brown, Reynolds, & Braver, 2007): a neurally inspired model that implements two distinct control mechanisms for task switching.

8.5.4.a Perceptual Decision Making

Diffusion Model (Ratcliff & Rouder, 1998): a diffusion model of two-choice decisions, in which evidence drives a random walk between two decision thresholds until one of the thresholds is crossed.

Leaky Integrator Model (Usher &McClelland, 2001): an accumulator model of decision making, in which the activity of accumulators increases stochastically over time but is

limited by leakage from the accumulators and competition (inhibition) between accumulators.

(Linear) Ballistic Accumulator Model (LBA; S. Brown & Heathcote, 2005; S. D. Brown & Heathcote, 2008): a simple, deterministic accumulator model in which latency variability arises from variability in model parameters across trials; different versions do or do not assume inhibition between accumulators.

8.5.4.b Judgment and Choice, models of Economic Behavior

Prospect Theory (Kahneman & Tversky; e.g., 1979): probably the most influential descriptive model in psychology which earned Kahneman a Nobel Prize. It accounts for many basic aspects of decision making, such as people's tendency to underweight probable outcomes over those that are certain.

Regret theory (Loomes & Sugden, 1982): an alternative to Prospect Theory that is arguably simpler and accounts for much of the same data.

Decision Field Theory (DFT; Busemeyer & Townsend, 1993): a model of decision making under uncertainty, in which a random walk is driven by samples from possible events and the valence of the outcomes.

Decision by sampling (BbS; Stewart, Chater, & Brown, 2006): a model of decision making especially in economic contexts that is based on the notion that people sample a few relevant instances from memory and judge an attribute based on its rank within that sample.

8.5.5 Identification and Categorization

Generalized Context Model (GCM; Nosofsky, 1986): an exemplar model of categorization, in which objects in the world are categorized according to their aggregate perceptual match to experienced objects in memory.

Attention Learning and Covering Map (ALCOVE; Kruschke, 1992): a connectionist instantiation of the GCM that implements learning of attention and exemplar-to-category associations.

General Recognition Theory (GRT; Ashby, 1992b): a model of categorization in which the multidimensional space in which items are represented is carved up by decision boundaries, and objects are categorized according to the partition in which they fall.

Supervised and Unsupervised STratified Adaptive Incremental Network (SUSTAIN; Love, Medin, & Gureckis, 2004): an exemplar model in which a new exemplar is stored only if it is sufficiently novel or surprising and explains both supervised and unsupervised learning.

Selective Attention, Mapping, and Ballistic Accumulation (SAMBA; S. D. Brown, Marley, Donkin, & Heathcote, 2008): a model of absolute identification in which perceptual information is accumulated over time, based on comparisons between the stimulus and anchor points set by the participant.

Relative Judgment Model (RJM; Stewart, Brown, & Chater, 2005): a model of absolute identification in which identification is based on comparisons between the current and previous stimuli, as well as feedback from the previous trial.

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