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A systematic exploration of model-mechanisms for interactions between item- and association-memory in paired-associate learning

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Paired-associate learning paradigms are extremely common in memory research; however, memory behaviour in these paradigms relies on both memory for items and for their pairings. We recently developed an experimental paradigm that is able to dissociating effects of item- and association-memory with cued recall [1,2]. Several mathematical modeling frameworks have been applied successfully to PA empirical phenomena. However, our new behavioural results demand that these memory models be developed further, in order to identify loci within the major models where item-level versus association-level effects could materialize. Here we present a systematic approach to modeling item- versus association-memory effects in PA learning, with a specific focus on comparing memory modeling frameworks (including the Matrix model [3,4], TODAM [5], and BSB [6,7]).

Methods

We propose a generative model of PA learning based upon the distributed memory model frameworks proposed by the matrix model [3,4] and convolution-correlation memory models [5] of associative learning. To further define our model we employ the brain-state-in-a-box model [6,7] as our deblurring mechanism to increase ecological validity of our model, as opposed to a heuristic such as the winner-take-all choice rule. Here we model how item- and association-memory manipulations may modulate within memory performance in a cued recall task. In particular, we ask whether manipulations of material-type can passively result in stronger associations (i.e., without requiring the participant to vary their strategy). For example, current modeling results demonstrate how items that are learned stronger during study can result in better association-memory.

This modeling approach represents a framework for a range of PA learning effects that have already been reported (e.g., [1,2]) as well as predicting as-of-yet unobserved patterns. Simulations of how manipulations of material-type can modulate item- and association-memory have not yet been theoretically explored and can have profound implications to current memory models.

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