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Order within associations as a test of association-memory models

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In learning associations (e.g., a pairing of items, A-B), the hippocampus appears to implement Associative Symmetry, namely, when learning a forward association (A->B), picking up the backward association (B->A) for free [3], a characteristic of human association-memory that has been replicated numerous times (e.g., [5]). A mathematical operation that does this automatically, and thus might be carried out by the hippocampus, is the convolution operation, the operation used to store associations in a range of influential behavioural memory models [2]. Convolution-based models lead to a specific prediction about within-pair order memory (the participant's ability to retrieve the relative orders of the A and B items), namely, that within-pair order memory should be at chance levels. In contrast, models based on the outer product, known as matrix models [1] the way they have been applied, lead to perfect within-pair order memory (assuming the pairing is retrieved); likewise for numerous other models that assume associations are stored by concatenating the vector representations of paired items [6].

Here we test within-pair order memory with a verbal double-function list paradigm in which participants are presented with pairs of words in which the left-handed item of one pair is the right-handed item of a different pair. Thus, within-pair order information is critical for later effective cued recall. The results suggested that human participants have neither poor nor near-perfect memory for within-pair order, challenging all current models to our knowledge. Our recently proposed positional coding model for paired-associate memory [4], which already incorporates within-pair order in the same manner as between-pair order. Even this positional coding model requires some additional assumptions to fit the fine structure of the behavioural data.

In sum, our findings suggest that within-pair order memory is neither poor nor perfect, pointing to a fallible mechanism for within-pair order learning in verbal association memory tasks and constraining the computational mechanisms the hippocampus could plausibly use to learn pairs with the property of Associative Symmetry.

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References

1. Anderson JA: **Two models for memory organization using interacting traces.** *Mathematical Biosciences* 1970, **8(z)**:137-160.
2. Borsellino A, Poggio T: **Holographic aspects of temporal memory and optomotor responses.** *Kybernetik* 1972, **10**:58-60.
3. Bunsey M, Eichenbaum HB: **Conservation of hippocampal memory function in rats and humans.** *Nature* 1996, **379**:255-257.
4. Caplan JB: **Associative Isolation: unifying associative and order paradigms.** *Journal of Mathematical Psychology* 2005, **49**:383-402.
5. Kahana MJ: **Associative symmetry and memory theory.** *Memory & Cognition* 2002, **30**:823-840.
6. Mensink G, Raaijmakers JGW: **A model for interference and forgetting.** *Psychological Review* 1988, **95**:434-455.

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