DEFICIENCIES IN THE RETRIEVED-CONTEXT ACCOUNT OF SPACING AND REPETITION EFFECTS IN FREE RECALL

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Retrieved-context theory (RCT) accounts for free recall of item lists by asserting that 1) studied items are associated with a gradually changing, recency-weighted representation of temporal context, 2) the contexts retrieved from studying (or recalling) items update the current state of context, and 3) the current state of context is the proximate cue for each item recall. These mechanisms help account for many repetition effects in free recall, including the mnemonic advantage of spaced over massed item repetition and tendencies to successively recall items that follow a shared repeated item (Lohnas & Kahana, 2014). Here, though, we present evidence that this account has significant deficiencies.

To re-evaluate RCT, we re-analyzed two datasets used to study repetition effects in free recall (Kahana & Howard, 2005; Lohnas & Kahana, 2014). We applied likelihood-based fitting (Morton & Polyn, 2016) to a computational model embodying RCT, the context maintenance and retrieval model [CMR; Polyn, Norman, & Kahana (2009)]. Across datasets, the model underpredicted the mnemonic benefit of spaced over massed repetition. It also poorly generalized between task conditions that included or excluded item repetitions in study lists (Busemeyer & Wang, 2000).

We also report a novel analysis identifying a deficient repetition contiguity effect: after recalling an item presented repeatedly in a study list, participants transitioned more often to neighbors of the item's initial rather than successive presentation(s). CMR poorly accounts for this pattern, even after adding mechanisms to either reduce learning for items' successive presentations or enhance memory for neighbors of items' initial presentations. Contrary to previous reports, these results suggest that repetition effects may present a significant challenge for retrieved-context theory.

1 Introduction

First, start with a review of the spacing effect and then of associated effects.

Then bring up the explanations proposed for it across the literature: contextual variability, study-phase retrieval, deficient processing.

Review work relating retrieved context theory to two of these accounts, and outline the main gaps we'll be addressing. The original paper focused on showing how CMR realizes the contextual variability and study-phase retrieval effect mechanisms and illustrating similar patterns in their own dataset. But while the work showed model mechanisms can generate some benchmark repetition and spacing phenomena, model fitting was not performed that would evaluate its ability to account for patterns of retrieval across free recall of lists with item repetitions. This potentially obscures any hidden inconsistencies in the retrieved-context account.

Provide high-level overview of how we address this gap in the literature through model fitting and simulation, novel behavioral analyses, inspection of model representations, and evaluation of accommodative mechanisms. Compared to abstract, we can go into enough detail to clarify what we mean and contextualize our direction with literature.

And a high-level overview of what we found, what we think this means, and what this meaning would implies.

2 Methods

How are we evaluating retrieved context theory here? We'll present datasets, model, and the new-ish evaluation/fitting technique. We may rename this section ("Evaluating RCT at the Level of the Recall Sequence") and/or blend it with the next to emphasize what's new about our approach additionally use it to review benchmark phenomena in context of our technique, similarly to how Lynn does in her 2014 paper. Won't introduce the deficient repetition contiguity effect just yet.

2.1 Datasets

2.1.1 Lohnas2014

2.1.2 HowaKaha2005

2.2 Sequence-Based Model Evaluation and Fitting

To evaluate how effectively each model accounts for the responses in our datasets, we applied a likelihood-based model comparison technique introduced by (**kragel2015neural?**) that assesses model variants based on how accurately they can predict the specific sequence in which items are recalled. According to this method, repeated items and intrusions (responses naming items not presented in the list) are included from participants' recall sequences. Given an arbitrary parameter configuration and sequences of recalls to predict, a model simulates encoding of each item presented in the corresponding study list in its respective order. Then, beginning with the first item the participant recalled in the trial, the probability assigned by the model to the recall event is recorded. Next, the model simulates retrieval of that item, and given its updated state is used to similarly predict the next event in the recall sequence - either retrieval of another item, or termination of recall - and so on until retrieval terminates. The probability that the model assigns to each event in the recall sequence conditional on previous trial events are thus all recorded. These recorded probabilities are then log-transformed and summed to obtain the log-likelihood of the entire sequence. Across an entire dataset containing multiple trials, sequence log-likelihoods can be summed to obtain a log-likelihood of the entire dataset given the model and its parameters. Higher log-likelihoods assigned to datasets by a model correspond to better effectiveness accounting for those datasets.

2.3 CMR

Model specification blended with details of how it realizes repetition effects.

3 References

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