Dynamics of Sequence Learning in Rats: The Influence of Rehearsals and Training by Blocks.

B. Jones[1], A. McClung[2], A. Hupbach[2], O. Hardt[3], R. Gomez[2], L. Nadel[2], JM. Fellous[1,2]

207.16

1. Program in Neuroscience, Univ. of Arizona, Tucson, AZ 2. Dept of Psychology and Cognitive Science, Univ. of Arizona, Tucson, AZ 3. Dept of Psychology, McGill Univ. Montreal, Canada

1. Introduction

- Memory reconsolidation involves previously fixed memories returning to a labile state in which they are subject to change (Hupbach et al., 2007). See poster 525.8 on Monday.
- A mild reminder (e.g. contextual information) can cause old memories to be integrated into newly learned ones. However, the explicit recall of those same old memories does not, in general, interfere with newly learned ones.
- As a first step to design an animal model for memory reconsolidation similar to that used in humans, we first examined the effects of rehearsal of a previously learned sequence on the acquisition of a novel sequence.
- We then explored the effect of learning by blocks and training in a mixed fashion on learning performance.

2. Methods

Behavioral apparatus

• Open field area with 8 equally spaced feeders (sugar water).

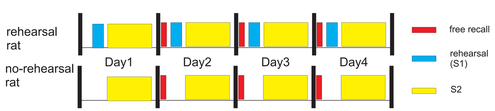
• Each feeder has a blinking LED that can be used as a cue.

S1: 1-2-5-1
S2: 1-6-3-1

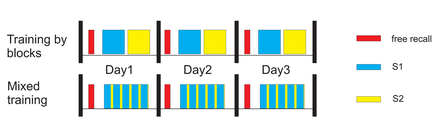
Behavioral training

Rats were pre-trained on one sequence (S1: 1-6-3-1), and were about to learn a second sequence (S2:1-2-5-1). Learning is assessed by the rat's ability to properly complete a sequence with no cue, after the first distinguishing feeder is cued (here 2 or 6). Four rats provided the data for this work.

Rehearsal Vs no Rehearsal
One rat received no rehearsal of the prior sequence before training for the new one, a second rat briefly rehearsed the first sequence.

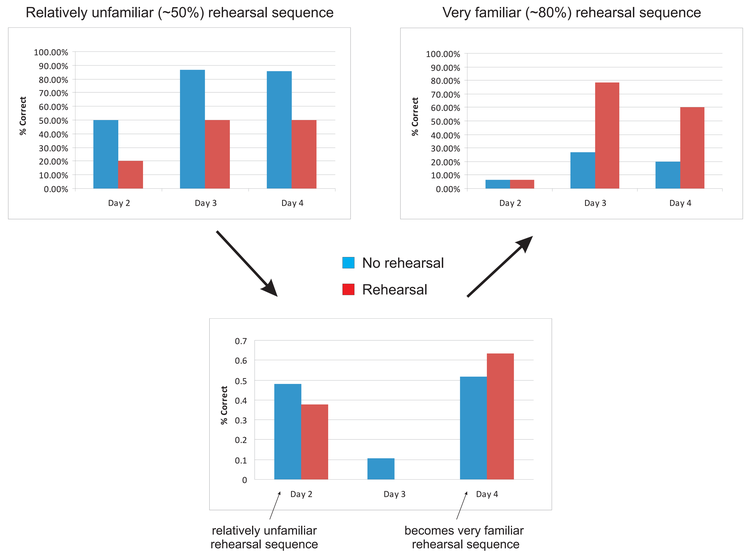


Blocked Vs Mixed training
One rat was trained on two sequences in two separate blocks, while the other rat learned both sequences in a random order (mixed condition).



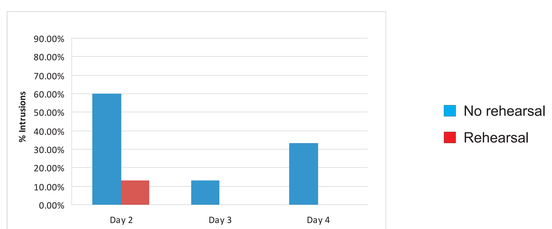
3. Results: Rehearsal Vs No Rehearsal

Effect of rehearsal on the learning of a new sequence



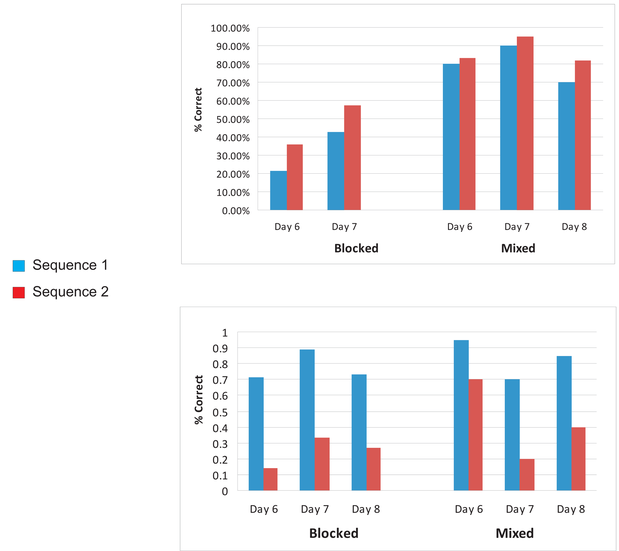
The rehearsal of a relatively unfamiliar sequence impairs the learning of a new sequence. The rehearsal of a very familiar sequence improves the learning of a new sequence.

Intrusion of a rehearsed sequence into a newly learned sequence



In sessions where intrusions do occur (early training), the rehearsal of a very familiar sequence decreases the chances of its intrusion in the learning of a new sequence.

4. Results: Training Schedule



The learning of unfamiliar sequences is better achieved when they are learned in a mixed fashion, rather than consecutively. Mixed or blocked training involving an already well learned sequence does not affect its retention.

5. Conclusions

- These data indicate that the rehearsal of a previously *well learned* sequence improves the acquisition of a new sequence. On the other hand, the rehearsal of a *relatively unfamiliar* sequence interferes with the learning of a new sequence. This suggests that retrieving fully consolidated memories does not interfere with (and may improve) new learning.
- Training on two sequences in a mixed-presentation procedure does not impair (and may improve) the learning of the two sequences.
- These experiments are the first steps towards the design of a sequence learning paradigm that will enable the study of constructive memory effects in rats.

6. References

Hupbach A, Gomez R, Hardt O, Nadel L. Reconsolidation of episodic memories: a subtle reminder triggers integration of new information. Learning and memory 3;14(1-2):47-53 (2007).