Using Virtual Reality to Unpack How Context Reinstatement Aids Memory

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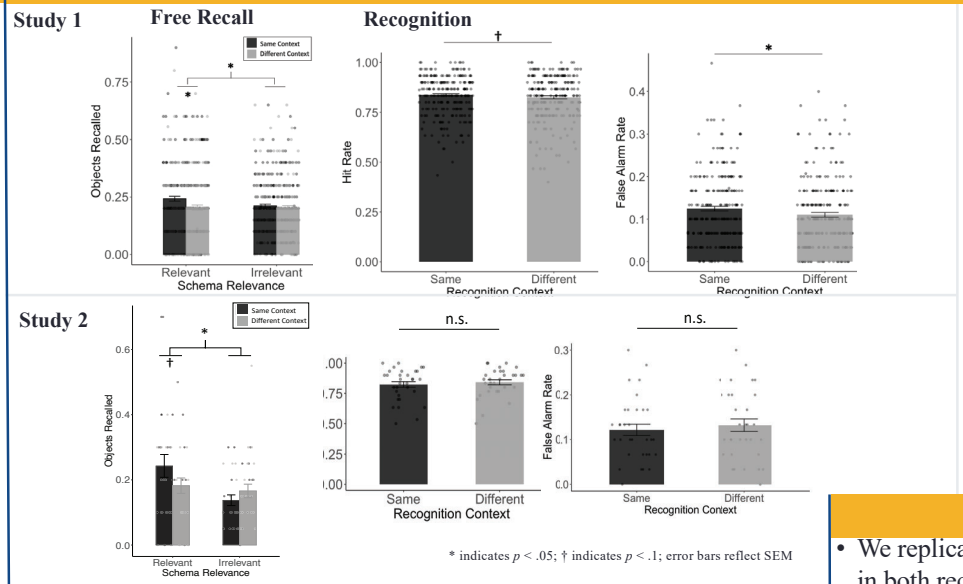
INTRODUCTION

- We are more likely to retrieve memories when the context of encoding matches that of retrieval (context-dependent memory)[1,2]
- Some laboratory-based studies have failed to replicate this finding[3,4]
- The item-environment relationship is relevant[5], but it remains unclear whether explicit attention to it is necessary for observing these effects
- Visually rich and complex environments may be more likely to elucidate context-dependent memory effects[6]
- Virtual reality (VR) can provide more natural and realistic environments in which to better study these effects[7]

What aspects of a context and/or objects are relevant for context-dependent memory effects?

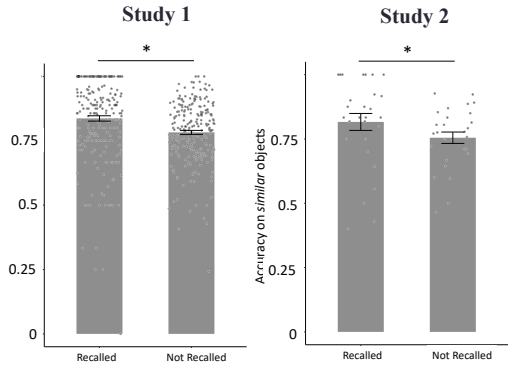
RESULTS



* indicates $p < .05$; † indicates $p < .1$; error bars reflect SEM

Combining Recall & Recognition

Correct identification of objects similar to those recognized – for objects recalled and not recalled



METHODS

Study 1

240 participants recruited evenly across 4 conditions *in-person*

Condition (encoding - recognition)	Average Age (SD)	Gender (F / M / NB)	First Experience in VR
Static – Static	20.1 (4.3)	32 / 27 / 1	43%
Motion – Static	20.5 (5.2)	37 / 23 / 0	38%
Static – Motion	20.0 (2.5)	34 / 25 / 1	42%
Motion - Motion	19.4 (1.7)	37 / 21 / 2	42%

Kitchen environment consisted of background components being either static (S) or containing motion (M) such as curtains blowing in wind, water boiling, and mixer spinning

Object schema	Kitchen rating	Classroom rating
Kitchen	6.6 (0.9)	1.3 (0.7)
Classroom	1.9 (1.3)	6.3 (1.2)
Miscellaneous	1.5 (1.0)	1.8 (1.3)

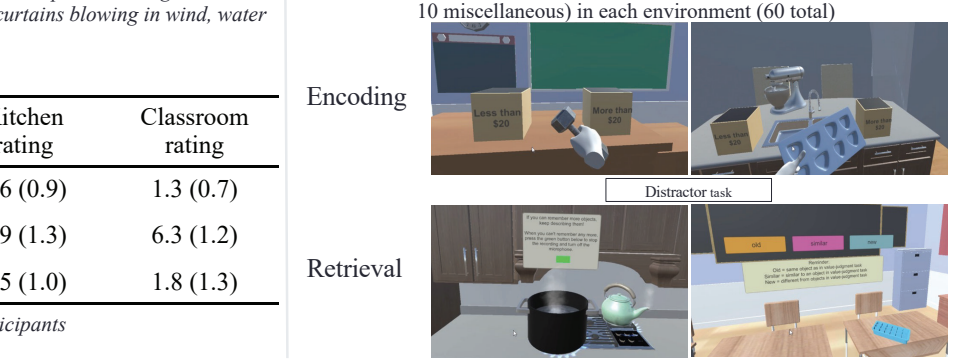
Ratings from Study 1 participants

Study 2

32 participants recruited across 4 conditions *remotely*

Condition (encoding - recognition)	N	Average Age (SD)	Gender (F / M / NB)	Number of Previous VR Studies (1st study / 1-5 studies / 6-10 studies)
Static – Static	12	28.5 (8.0)	2 / 10 / 0	2 / 10 / 0
Motion – Static	4	33.5 (10.3)	0 / 4 / 0	1 / 3 / 0
Static – Motion	9	30.0 (8.3)	0 / 8 / 0	2 / 6 / 1
Motion - Motion	7	28.0 (7.3)	0 / 7 / 0	2 / 5 / 0

During encoding, participants sorted 30 objects (10 kitchen, 10 classroom, 10 miscellaneous) in each environment (60 total)



DISCUSSION

- We replicate the context-dependent memory effect within VR in both recall and (marginally) recognition (hit rate)
- Potential tradeoff – more false alarm rates when encoding/retrieval contexts match
- Context-dependent recall is greatest when learned objects are relevant within the encoding environment
- Memory systems draw on specific features of object when recalling (rather than simply object-type), resulting in successful mnemonic discrimination

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