MENTAL EFFORT AS RETROACTIVE INTERFERENCE:
COMPARING CUED RECALL AND PAIR RECOGNITION PERFORMANCE

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OUR QUESTION

WHAT IS THE EFFECT OF WHEN MENTAL EFFORT OCCURS ON PERFORMANCE IN CUED RECALL AND PAIR RECOGNITION TASKS?

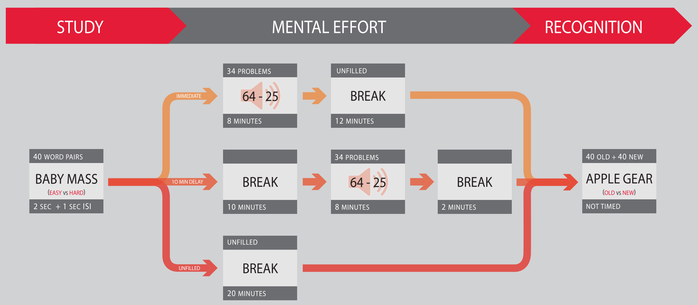
- Retroactive interference occurs when studying new information negatively affects the ability to remember old information
- Mental effort, a form of retroactive interference, may disrupt consolidation of new memories more than more completely consolidated old memories (Dewar et al., 2007; Skaggs, 1933; Wixted, 2004)
- Both cued recall performance and consolidation may rely on the hippocampus, whereas pair recognition performance may be less dependent on the hippocampus (Mandler, 1980; Parks & Yonelinas, 2007; Wixted, 2004; Yonelinas, 2002)
- Therefore, cued recall performance may be more sensitive to mental effort than pair recognition performance, especially with no delay in mental effort

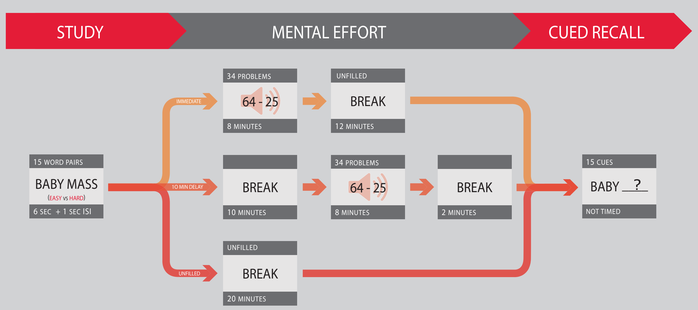
HYPOTHESIS

We predicted that immediate mental effort will affect memory performance more than delayed mental effort (and relative to no mental effort). This effect should be more pronounced in the cued recall task compared to the pair recognition task.

DESIGN

Participants studied a word pair list followed by an immediate or delayed mentally effortful math task or an unfilled 20-minute retention interval, Then they completed either a cued recall or pair recognition task





METHOD

INDEPENDENT VARIABLES

- Test type: cued recall and pair recognition
- Delay of mental effort: Immediate, 10 mins
- No mental effort (control)

DEPENDENT VARIABLE

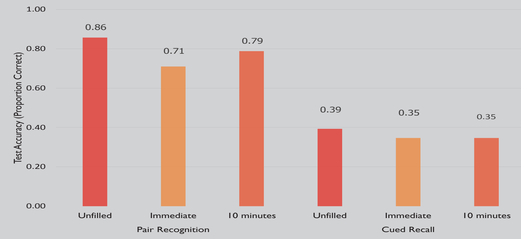
- Memory performance

DESCRIPTION OF SAMPLE

- 45 volunteers from UNLV subject pool
- Mean age was 20.2 years (SD = 1.1), 10 male, 35 female
- Mental effort was created by audibly presenting math problems to reduce modality similarity
- All participants underwent a 20-minute retention interval
- Control condition served as a baseline for the other two conditions
- Post-experimental survey measured sleep intensity, rehearsal of word pairs, and mental effort during break

RESULTS

CUED RECALL AND PAIR RECOGNITION TEST ACCURACY AS A FUNCTION OF THE TEMPORAL POINT OF INTERPOLATION

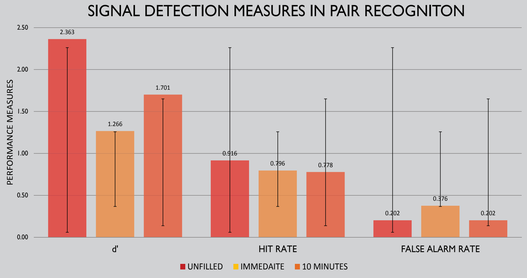


One-way ANOVA assessing the effect of delay on...

-Pair recognition test accuracy
$F(2, 12) = 5.547$, $p = .05$, $\eta p2 = .48$

-Cued recall test accuracy
$F < 1$, $\eta p2 = .012$

SIGNAL DETECTION MEASURES IN PAIR RECOGNITON



Effect of delay on a combination of d', hits, false alarms, and response criterion (c, not shown)

$F(8, 18) = 2.239$, $p = .074$, $\eta p2 = .499$

Follow-up tests ($\alpha/4 = .0125$) showed that the effect of delay on d' was significant

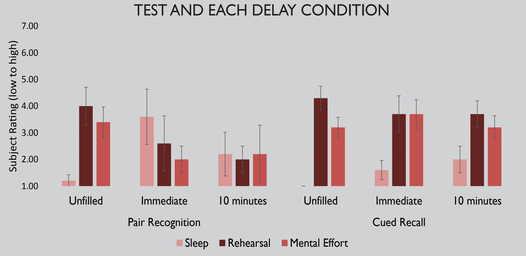
$F(2, 12) = 7.137$, $p < .0125$, $\eta p2 = .543$

Hits and false alarms not statistically significant, but effect sizes were large

Hits: $F(2, 12) = 2.878$, $p = .095$, $\eta p2 = .324$

False alarms: $F(2, 12) = 2.754$), $p = .104$, $\eta p2 = .315$

SLEEP, REHEARSAL, AND MENTAL EFFOR FOR EACH TEST AND EACH DELAY CONDITION



Effect of test type on questionnaire measures was significant

$F(4, 14) = 5.089$, $p = .01$, $\eta p2 = .592$

No follow up tests reached statistical significance

Sleep: $F(1, 17) = 5.903$, $p = .026$, $\eta p2 = .258$

Rehearsal: $F(1, 17) = 4.033$, $p = .297$, $\eta p2 = .064$

Mental effort: $F(1, 17) = 9.633$, $p = .079$, $\eta p2 = .170$

Math Accuracy (Not Shown): $F(1, 17)$ 2.280, $p = .149$, $\eta p2 = .118$

DISCUSSION

WHAT WAS MENTAL EFFORT'S EFFECT ON MEMORY PERFORMANCE ?

- Results tentatively suggest that memory performance in pair recognition tasks is more sensitive to mental effort than in cued recall tasks
- We did not find a statistically significant difference between the delayed mental effort conditions in the cued recall task, which conflicts with temporal gradients observed in prior studies (Dewar et al., 2007; Skaggs, 1933; see Wixted, 2004 for review)
- In the pair recognition task, we did not find a statistically significant difference between the delay conditions for hits, false alarms, and criterion. But the effect sizes for hits and false alarms were large.
- There was a large effect of delay for d', suggesting that consolidation was disrupted by mental effort more for immediate compared to delayed mental effort

LIMITATIONS

- All subjects run during midday
- Could not ensure mental quietude during rest periods (e.g., "Did I just fail that test?")
- Discrepancy in number of word pairs studied between cued recall and pair recognition
- Solving math is also strongly associated with anxiety and stress
- Cued recall performance was not similar to pair recognition performance

IMPROVEMENTS GOING FORWARD

- Increase number of temporal points of interpolation
- Survey participants about what they thought about during break
- Modify the mental effort task (e.g., tone detection task)
- Use associative recognition task because it is more sensitive to recollection than other recognition memory tasks (Yonelinas 2002; Parks & Yonelinas, 2007)

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