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Abstract #2049

Give Me a Break: Pausing to Reflect May Lessen Attention Attenuation in Massed Learning

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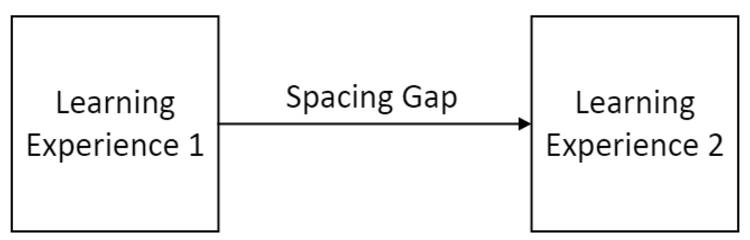
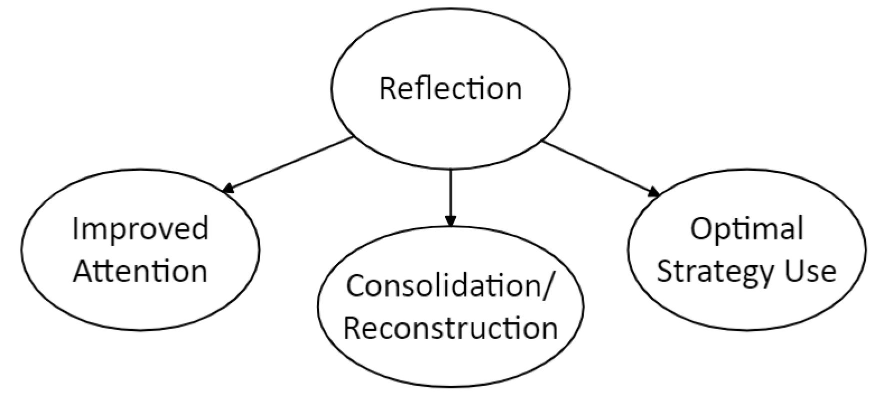
Introduction

- **Spacing Effect**:
  Temporally-distinct learning experiences are superior for long-term retention.

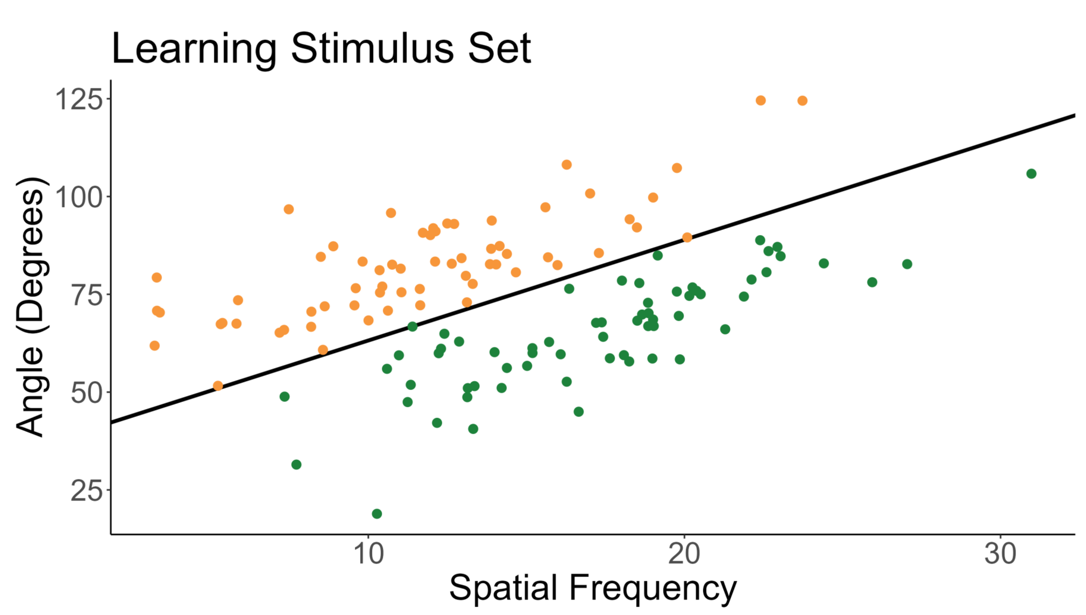


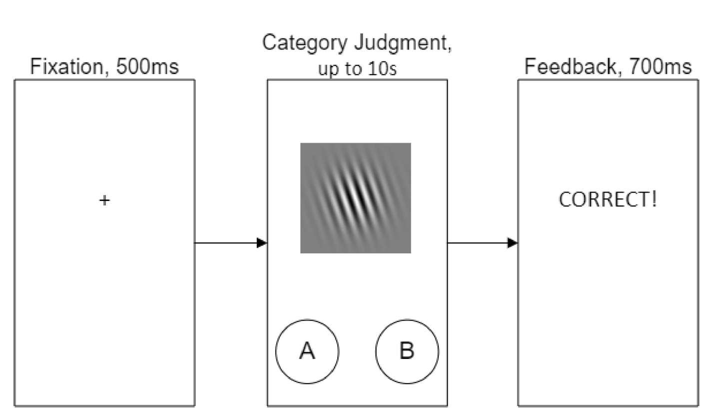
- Information-integration category learning benefits from spacing (Cruz & Minda, 2023).
  - Massed learners may have more difficulty maintaining attention.
  - Distributed learners are better able to classify studied stimuli at test.
  - Distributed learners were more likely to use the optimal categorization strategy.
- Learners have time to reflect on learning during spacing gaps.
  - May make it easier to maintain attention.
  - May facilitate memory consolidation or reconstruction of previously studied items (Jacoby & Cuddy, 1982).
  - Reflection may encourage new strategy exploration later in learning.



Methods

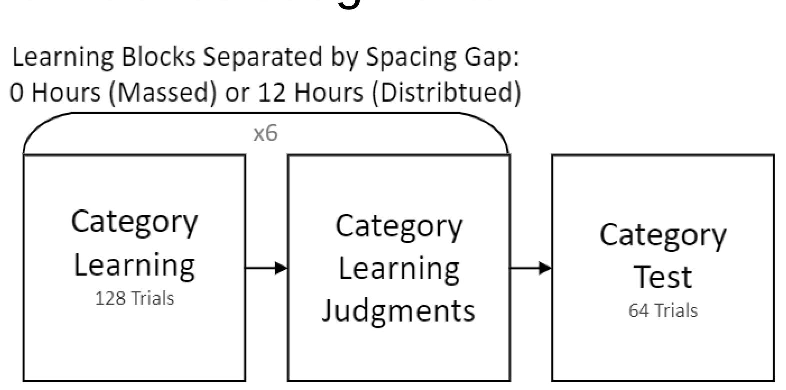
- Smartphone-based data collection.
- Feedback-Based Category Learning:
  6 Blocks x 128 Trials/Block
- Stimuli were Gabor patches varying in angle and spatial frequency.





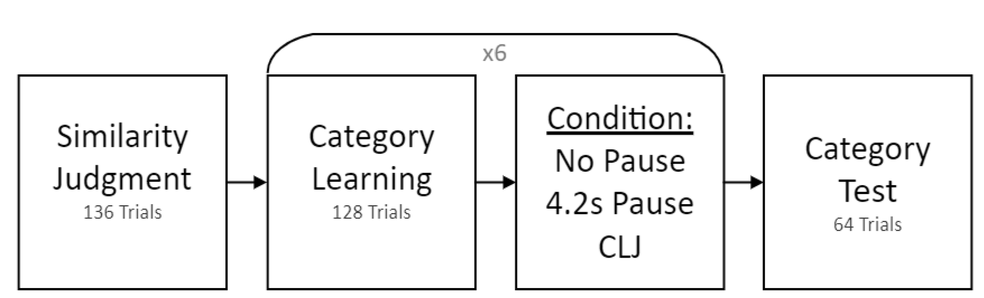
Experiment 1 (Prolific)

- Bootstrapped power analysis of Cruz & Minda data: $N \geq 116$ for $power \geq .8$ when $\alpha = .05$.
- Learning Phase:
  - Massed (N=80) vs. Distributed (N=73)
  - Category Learning Judgments
- Test Phase:
  - Immediate (N=74) vs. Delayed (N =78)
  - No feedback replaced with trial-by-trial Confidence Judgments



Experiment 2 (SONA)

- Pre-Learning Phase: Similarity Judgment
  All pairs of 16 stimuli rated on a 1-8 scale.
- Learning Phase: Massed
  - No Pause (Control; N = 6)
  - Pause (4.2 seconds; N = 14)
  - Category Learning Judgment (N = 15)
- Test Phase: Immediate, without feedback

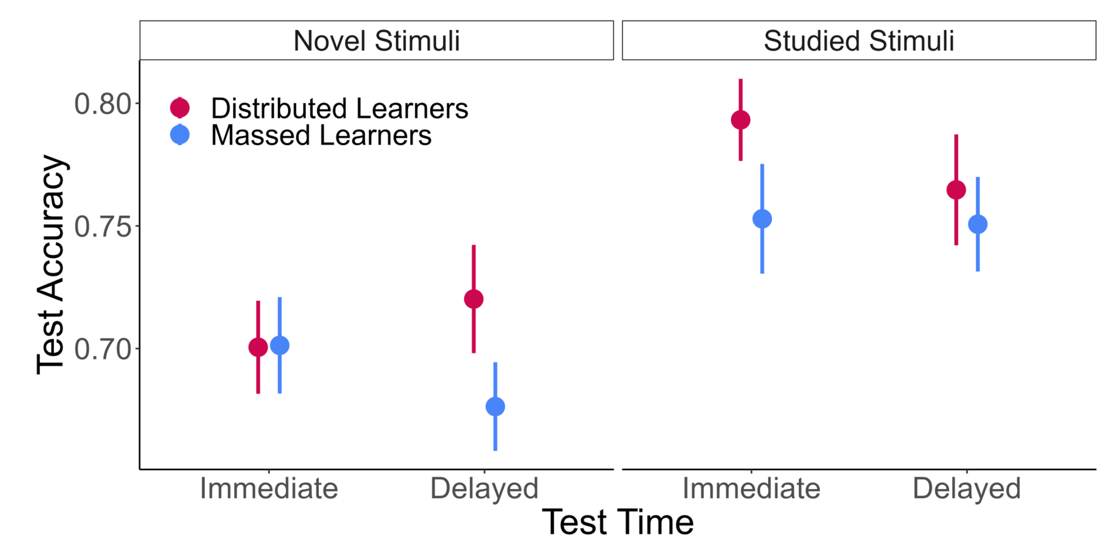


- Tests included both novel and studied stimuli.
- Category learning judgments and confidence judgments are like those used in previous work (Morehead et al., 2017; Wahlheim et al., 2012).

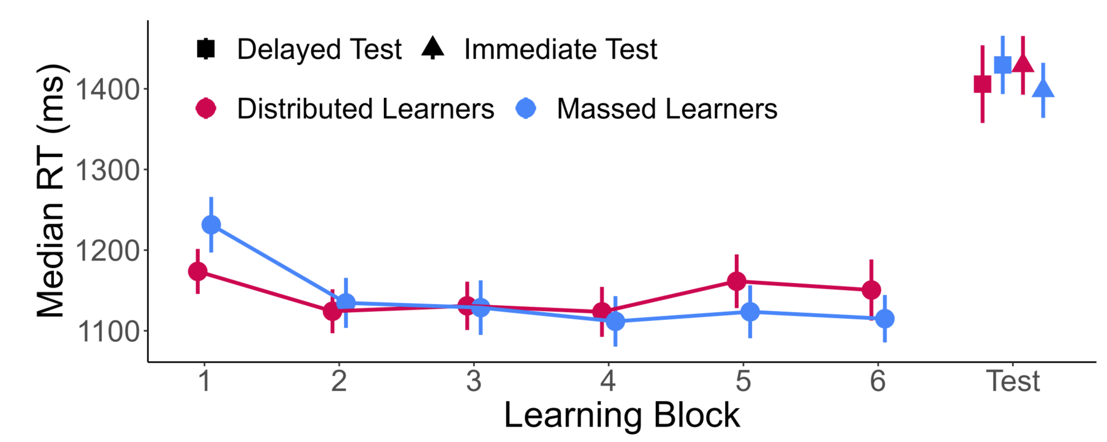
Results

Experiment 1

- Accuracy increased across learning, $F_{5,755} = 63.535, p = 2.39 \times 10^{-55}$. Learning condition main effect and interaction were not significant, each $p > .19$.
- At test, significant interaction among novelty, learning condition, and test condition, $F_{1,148} = 5.134, p = .034$.



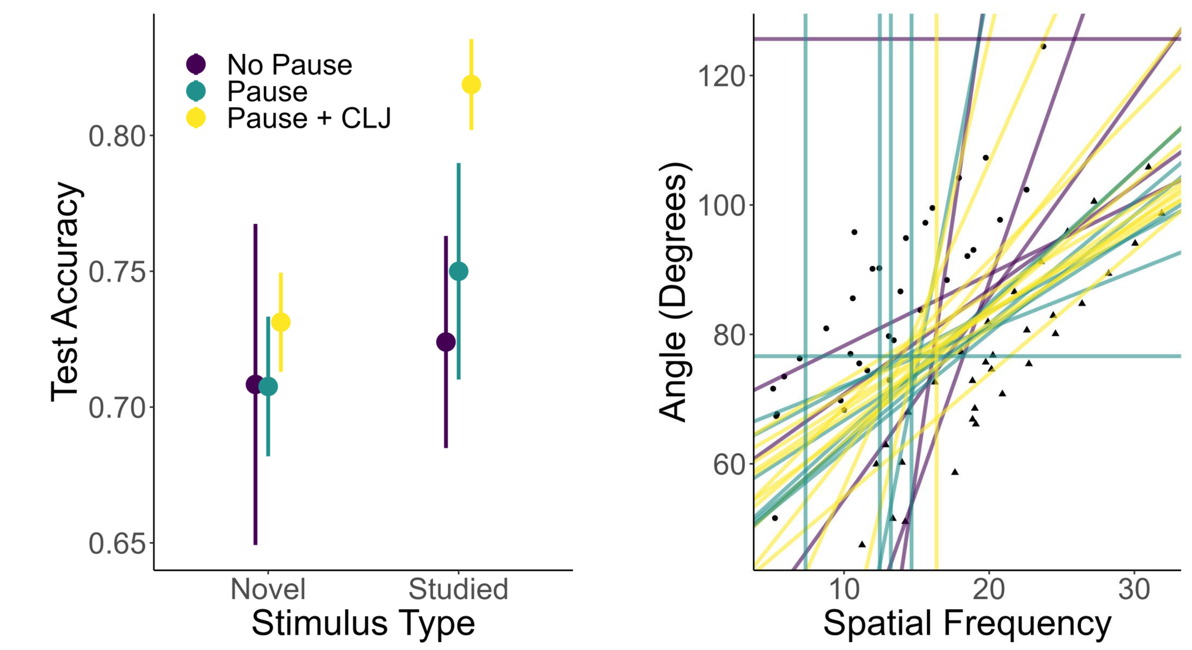
- RTs decreased across learning, $F_{5,755} = 6.621, p = 4.80 \times 10^{-6}$, but did not differ by learning condition $F_{1,151} = .007, p = .936$. Interaction $p = .051$.
- No significant RT differences at test, each $p > .3$.



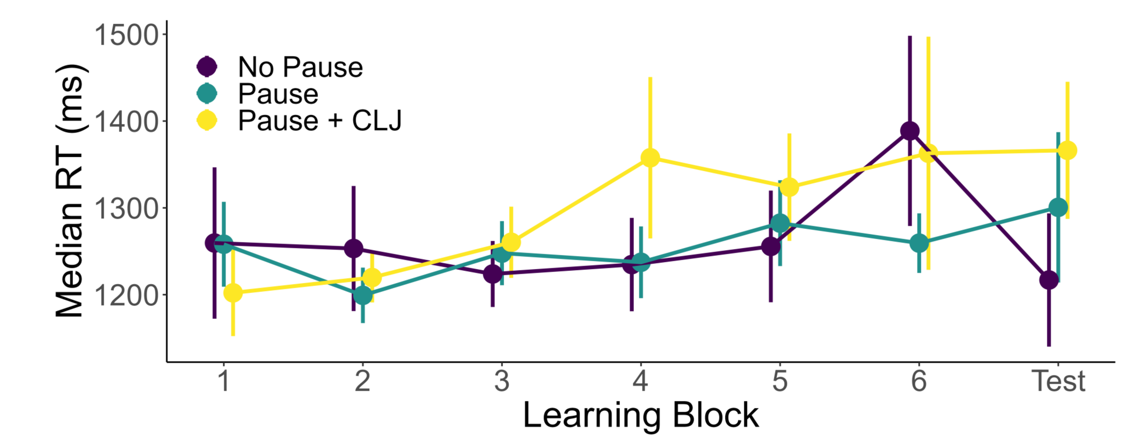
- Learning condition did not significantly affect optimal strategy use at end of learning $\chi^2(1, N = 152) = .131$, $p = .717$ or test, $\chi^2(1, N = 152) = .256, p = .612$.

Experiment 2

- Accuracy increased across learning, $F_{5,160} = 4.859, p = 3.64 \times 10^{-4}$, but did not differ by condition $F_{2,32} = .513, p = .604$. Interaction $p = .917$.
- Higher accuracy for studied ($M = .775, sd = .115$) vs. novel items ($M = .718, sd = .094$), $F_{1,32} = 5.093, p = .031$.



- Condition did not significantly affect optimal strategy use at end of learning $\chi^2(2, N = 35) = 1.287, p = .525$ or test, $\chi^2(2, N = 35) = 4.047, p = .132$.
  See test phase decision bound models above.



- RTs did not differ by block ($F_{5,160} = 1.541, p = .180$) or condition ($F_{2,32} = .224, p = .801$). Interaction $p = .327$.
- No significant RT differences at test, each $p > .25$.

Discussion

- In Exp. 1, the spacing effect did not replicate.
  - At least in part, this is due to poorer performance among distributed learners.
  - At test, distributed learners only ever showed an advantage on novel items, completely counter to our previous findings (Cruz & Minda, 2023).
- In Exp. 2, reflecting appears to be causing improved performance on previously studied test items.
  - This may partially explain unexpected Exp. 1 test results. Perhaps Massed learners closed the gap.
  - **Reflection may make it easier to reconstruct previously seen test items**. Reconstructing items has long been hypothesized as a spacing effect mechanism (Jacoby & Cuddy, 1982).
- Reflection may play a role in the spacing effect.
- Future work might explore different types of reflection, such as meditation and elaboration.
- Future work might also explore this paradigm using real-world stimuli, which participants might have more interest in reflecting upon.

References

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