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Individual and Group Differences in Sound Category Learning

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Individual and Group Differences in Sound Category Learning

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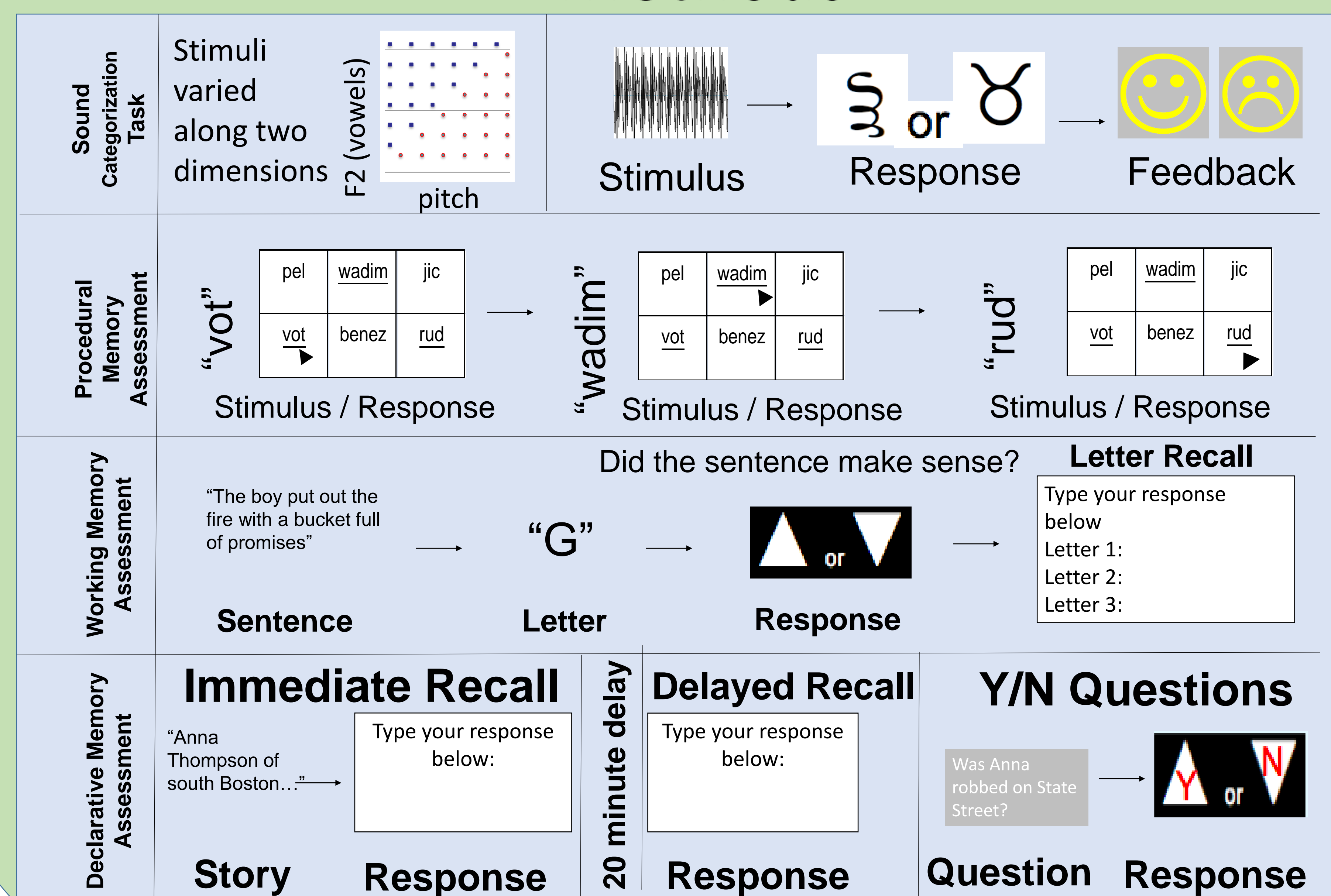
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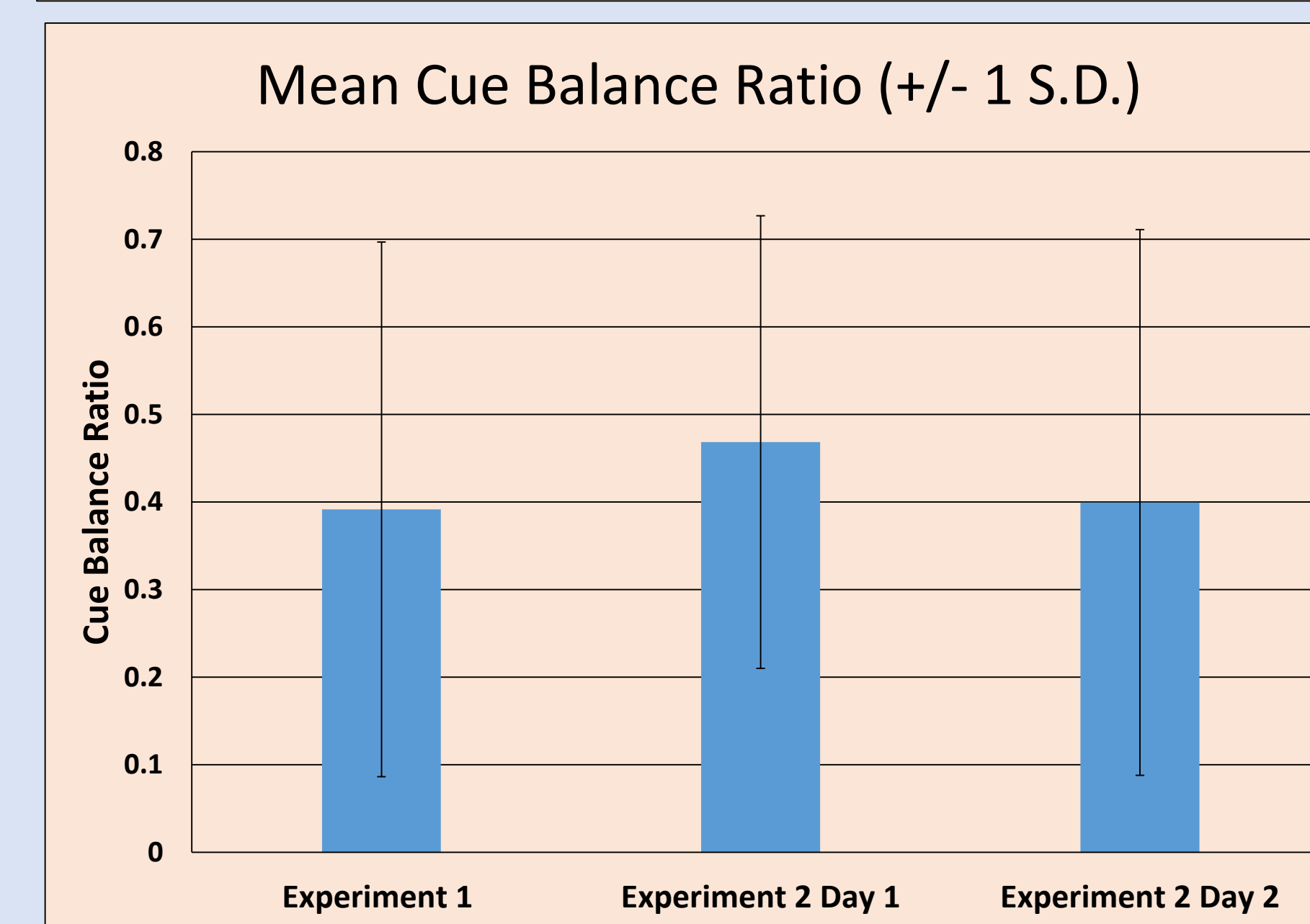
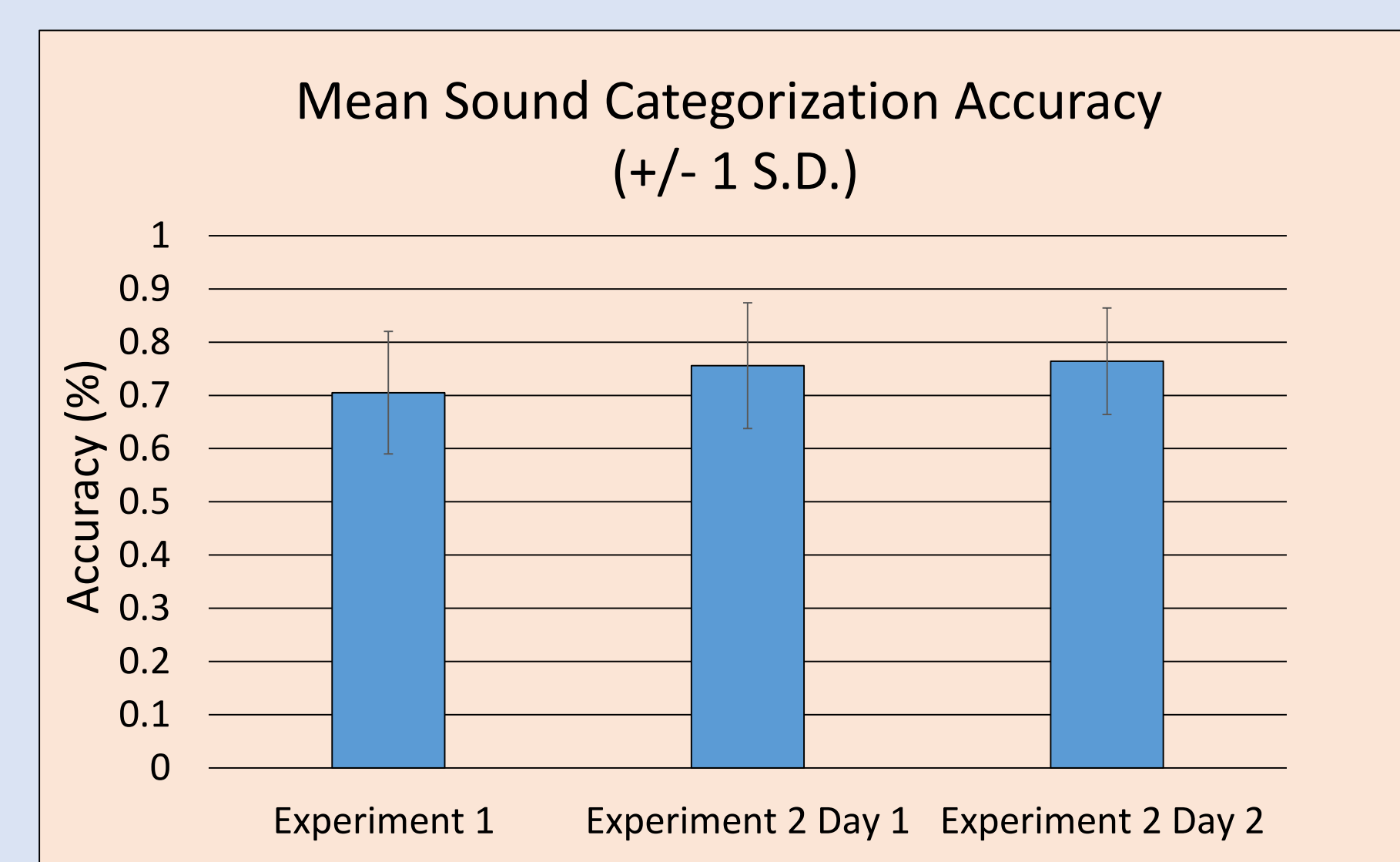
Abstract

- There is growing interest in the idea that certain aspects of language are best learned implicitly/procedurally, and models of impaired language like the Procedural Deficit Hypothesis suggest that procedural deficits are predictive of language learning outcomes (Ref. 1).
- To test the hypothesis that language structure is best learned implicitly/procedurally, we created a sound categorization task in which optimal learning required participants to integrate information from two different cues (pitch and vowel quality). Similar tasks in the visual domain have been shown to be best learned implicitly (Ref. 2).
- In **Experiment 1**, 31 undergraduate participants completed procedural, declarative, working-memory assessments, and a sound categorization task.
- In **Experiment 2**, 43 undergraduate participants completed the same memory assessments, but the sound categorization task consisted of twice as much speech-sound training distributed over 2 days, and highlighted the training at the category boundary.
- Experiment 1 sound categorization accuracy and cue balance was predicted by procedural memory skills.
- Experiment 2 showed significant effects of both procedural-memory skills and working-memory skills.

Methods



Results



Declarative Recall

Experiment 1
mean: 22.16 ± 7.71 story details

Experiment 2
mean: 18.65 ± 6.61 story details

Working Memory Letter-recall Accuracy

Experiment 1:
mean: 95% ± 4%

Experiment 2
mean: 94% ± 6%

Procedural Prediction Accuracy

Experiment 1:
mean: 56% ± 25%

Experiment 2:
mean: 50% ± 23%

Analysis

Independent variables

Procedural Prediction Accuracy
Declarative Recall
Working Memory Letter-recall Accuracy

Dependent Variables

Cue Weight Balance
Sound categorization accuracy

Multiple Linear Regression Analysis

Category-learning Accuracy

Experiment 1
Significant effect of procedural prediction accuracy (p=.022)

Experiment 2
Day 1: Trend for procedural day 1 (p=.072).
Day 2: Significant effect of working-memory (p=.027)

Cue-balance Ratio

Experiment 1
Trend for procedural prediction accuracy (p=.066)

Experiment 2
Day 1: No significant effects.
Day 2: Significant effect of procedural prediction accuracy (p=.041)

Conclusion

- The trend for category-learning accuracy in Experiment 2 day 1 was not present on day 2. Instead, a significant effect of working-memory was observed. This may suggest that procedural memory was predictive of category-learning accuracy, but the sound-category training participants received before day 2 eliminated those individual differences.

- All trends and significant effects were observed in procedural memory tasks, except for the significant effect of working-memory in category-learning accuracy in Experiment 2 day 1.

- Although the results are mixed, they support the Procedural Deficit Hypothesis and our original research question.

Future Directions

- An upcoming collaboration with Dr. Todd Maddox at the University of Texas, Austin may provide greater sensitivity in the dependent measure.

- It is possible that considering the dynamics of learning over the course of the training could help reveal the time-course of contributions of these memory systems (Ref. 3).

Citations

1. Lum, Conti-Ramsden, Page, & Ullman. (2012). Working, declarative and procedural memory in specific language impairment. *Cortex*, 48(9), 1138-1154.
2. Filoteo, J.V., Lauritzen, S., & Maddox, W.T. (2010). Removing the frontal lobes: The effects of engaging executive functions on perceptual category learning. *Psychological Science*, 21: 415-423.
3. Morgan-Short, Kara, Faretta-Stutenberg, Mandy, Brill-Schuetz, Katherine A., Carpenter, Helen, & Wong, Patrick C. M. (2014). Declarative and Procedural Memory as Individual Differences in Second Language Acquisition. *Bilingualism: Language and Cognition*, 17(1), 56-72.

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