The modality effect in free recall: A retrieved context account

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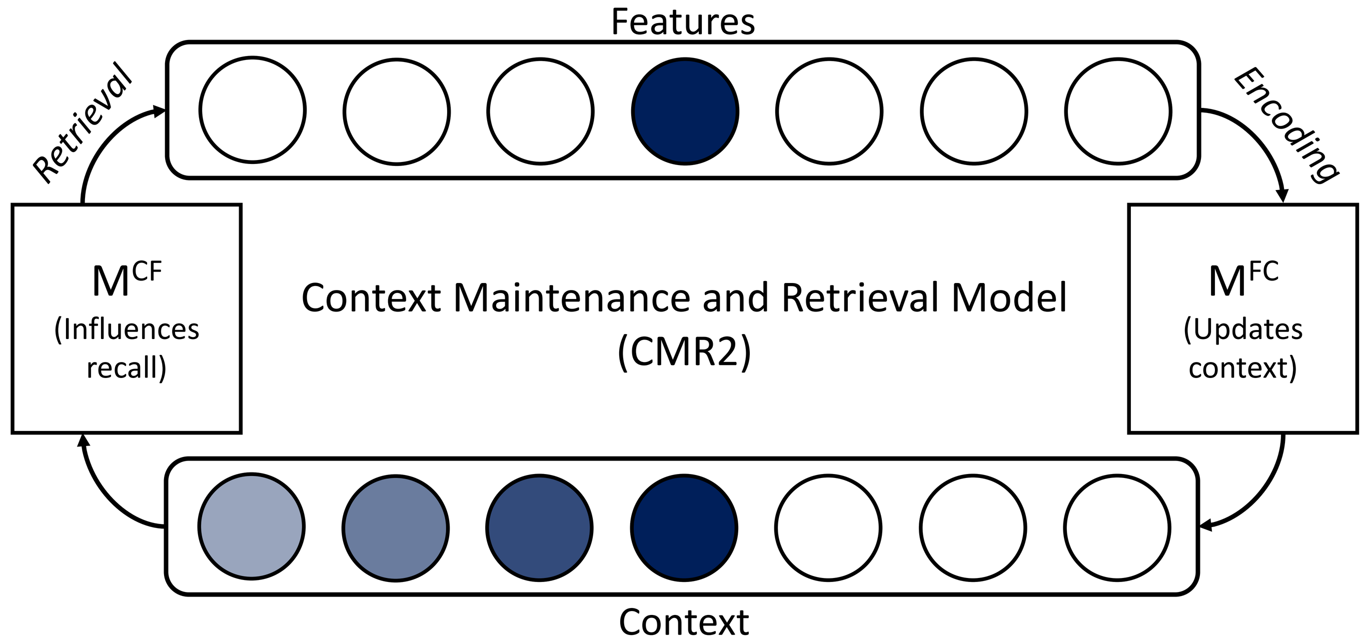
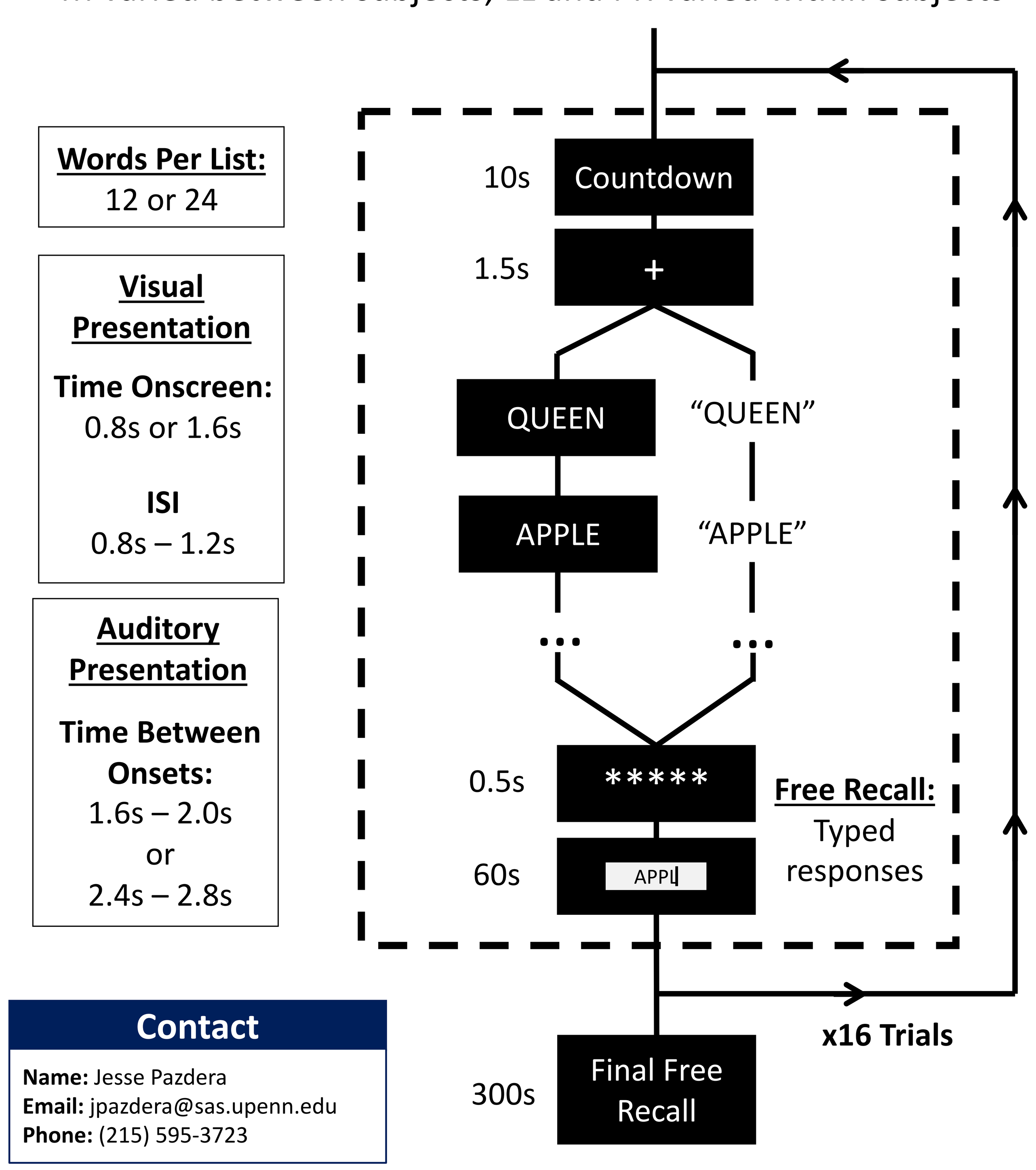
Background

- **Modality effect (ME):** Enhanced recency performance for auditory vs. visual items
- **Inverse modality effect (IME):** Enhanced primacy performance for visual vs. auditory items (Beaman, 2002; Craik, 1969; Grenfell-Essam, Ward, & Tan, 2017)
- Typically viewed as evidence for a dual-process model of retrieval
- Popular explanations of the ME:
  - Greater persistence of auditory store (Crowder & Morton, 1969)
  - Auditory items more temporally distinct (Glenberg & Swanson, 1986)
  - Auditory items contain richer sets of features (Nairne, 1990)
- Retrieved-context theory argues in favor of a single process
- **Goal:** Develop a retrieved-context account of the modality effect in free recall using the CMR2 model (Lohnas, Polyn, & Kahana, 2015)



Methods

- Immediate free recall experiment on Amazon Mechanical Turk
- 2000 participants completed 16 lists + final free recall
- Manipulated modality (M), list length (LL), presentation rate (PR)
- M varied between subjects; LL and PR varied within subjects



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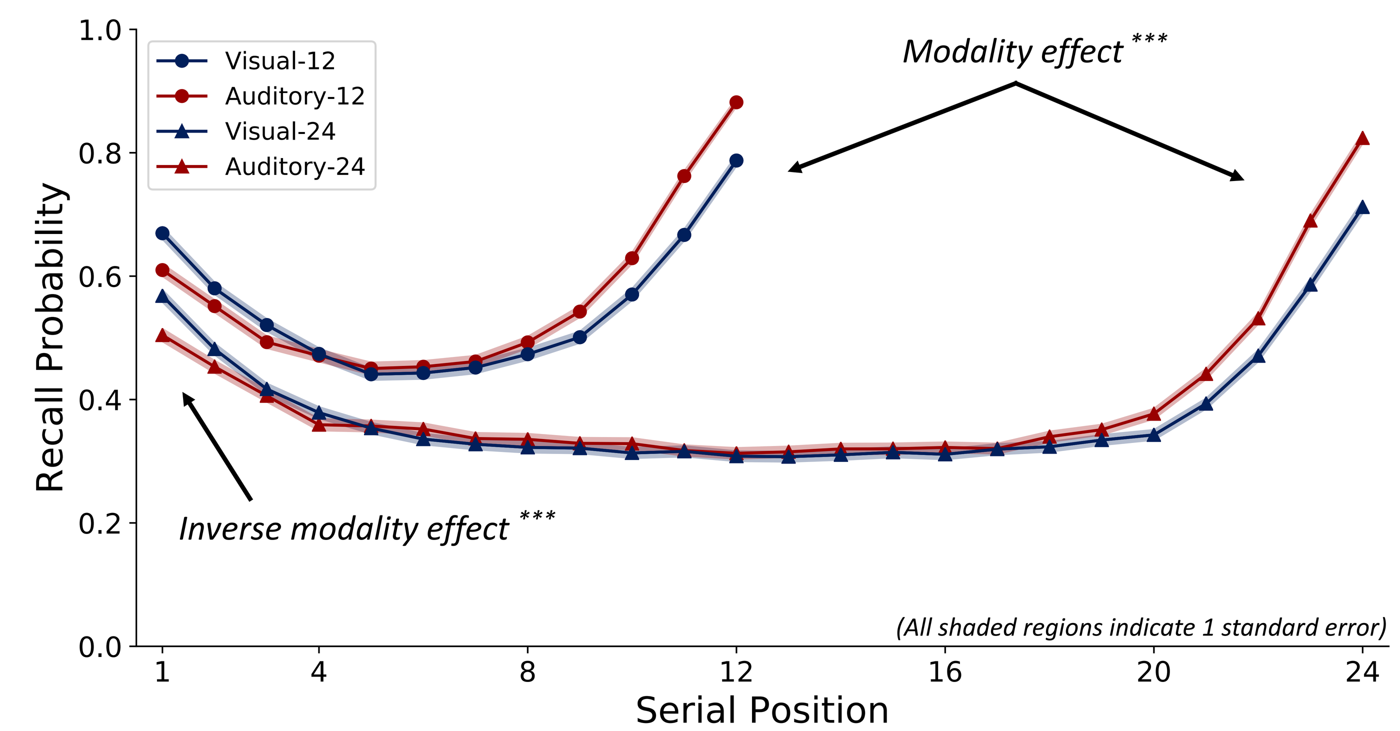
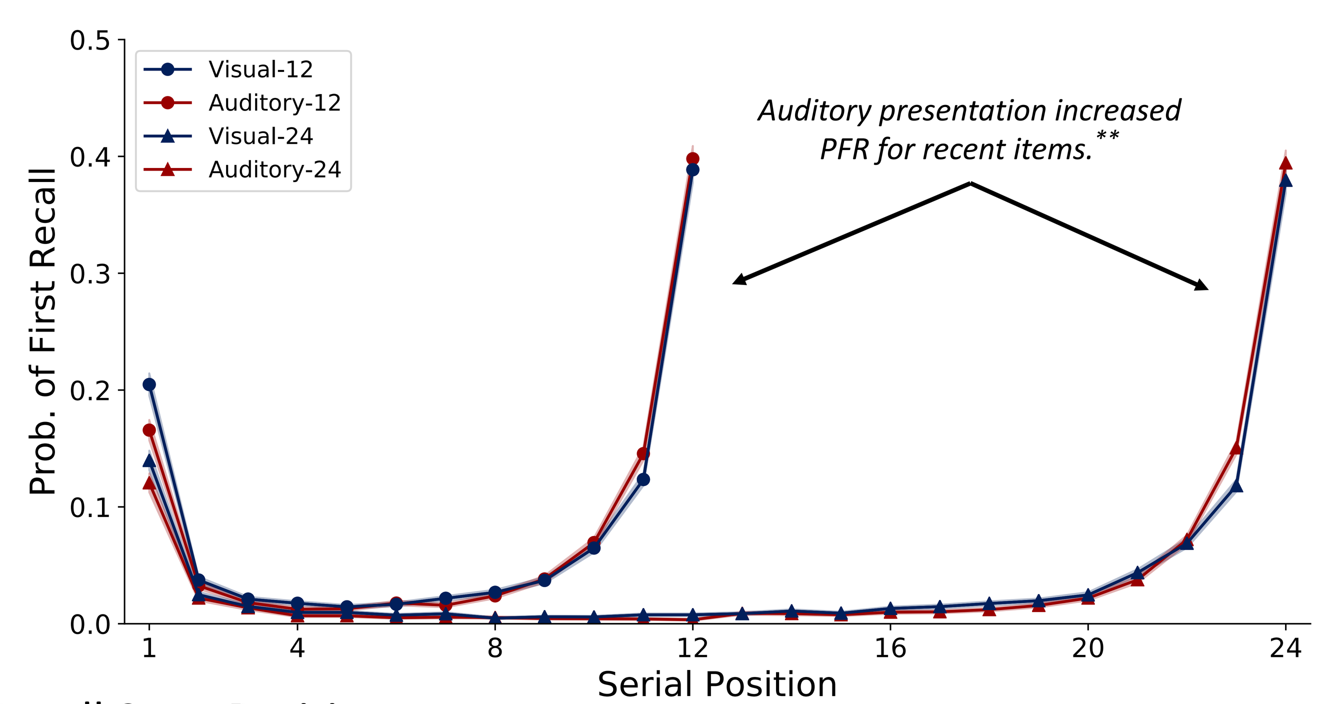
Serial Position Effects

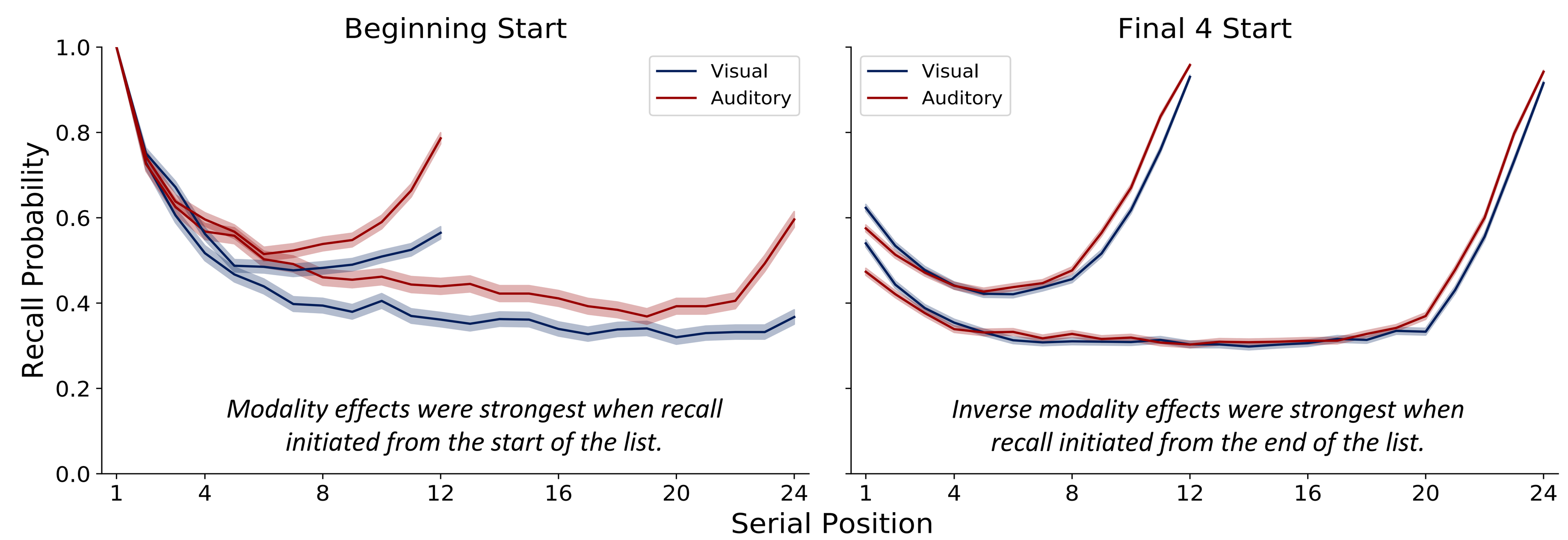


Recall Initiation

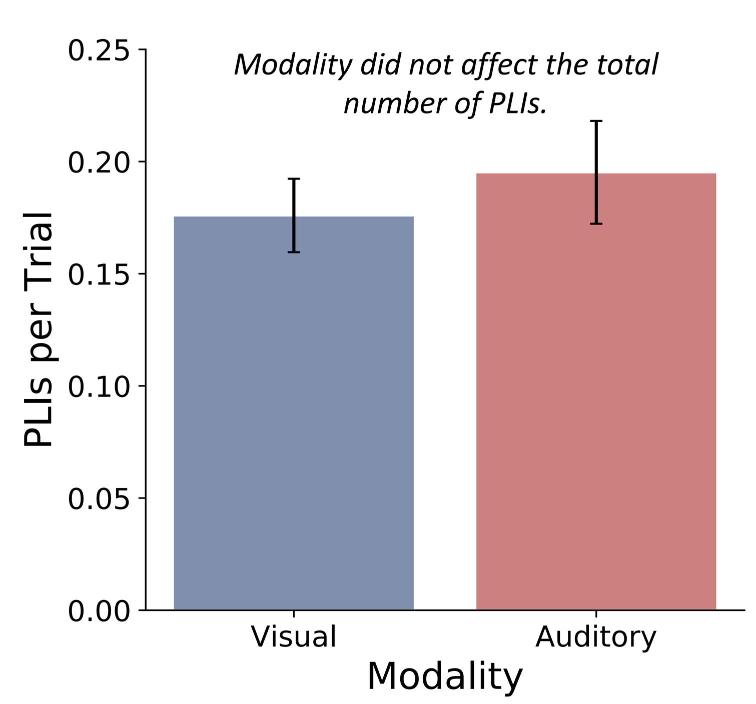
Probability of First Recall:

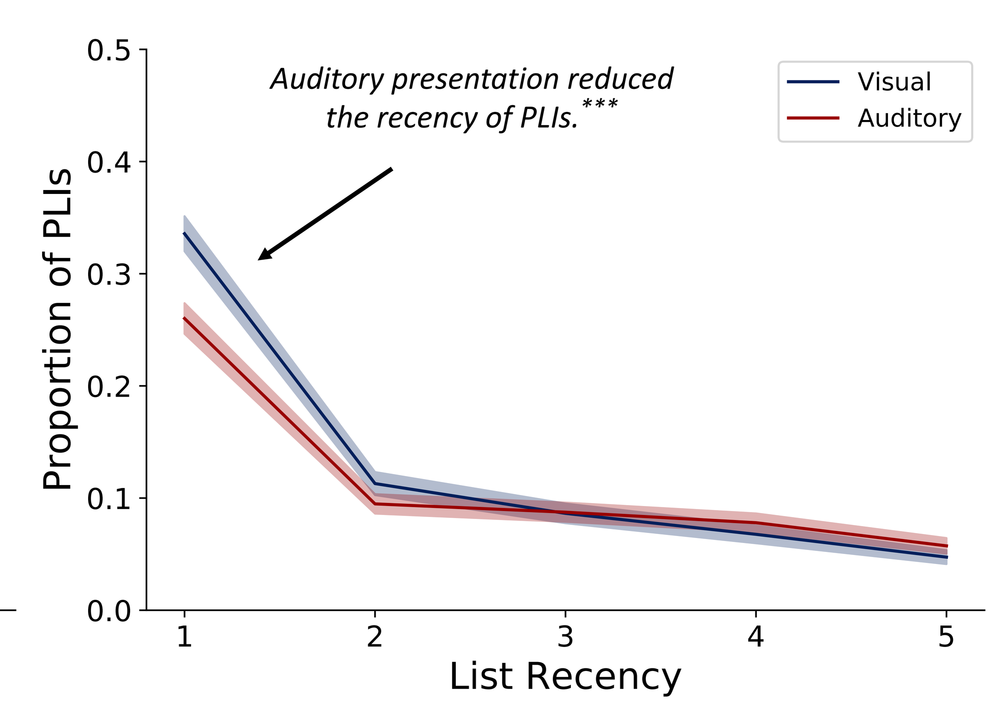


SPC by Recall Start Position:



Prior-List Intrusions





* $p < .05$, ** $p < .01$, *** $p < .001$

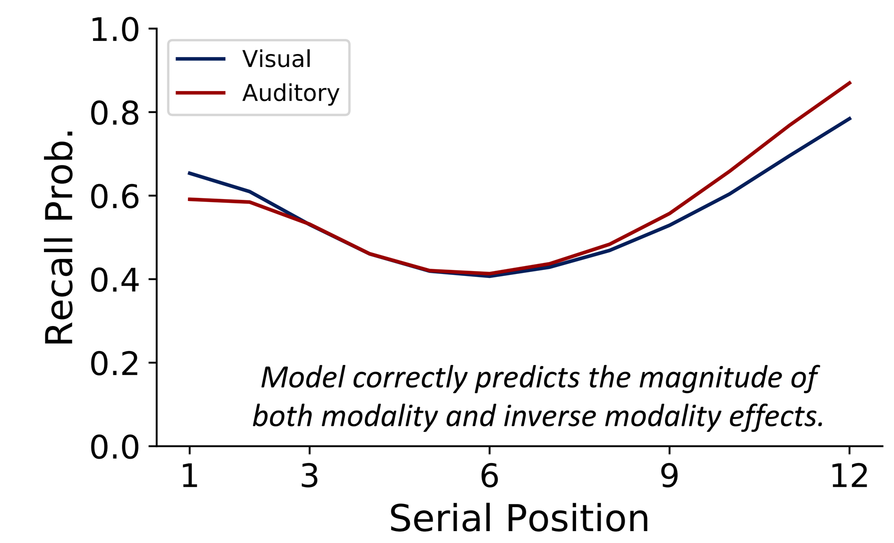
Computational Modeling

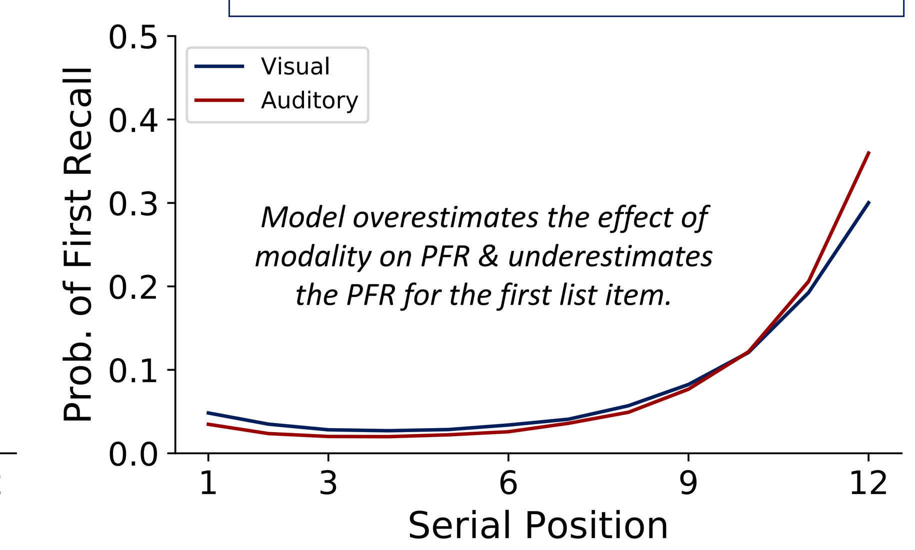
Steps:

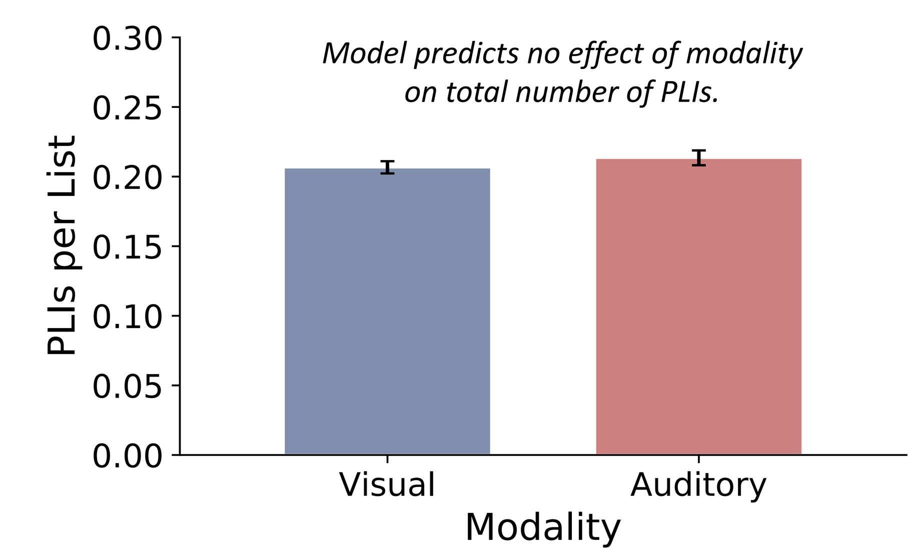
1. Fit CMR2 to our average data (short lists only) using particle swarm optimization
2. Allowed context drift rate (β_{enc}) and strength of contextual cueing (γ_{CF}) to vary by modality – inspired by temporal distinctiveness theory (Glenberg & Swanson, 1986)
3. Grid search to identify which pair of β_{enc} and γ_{CF} best simulates each modality

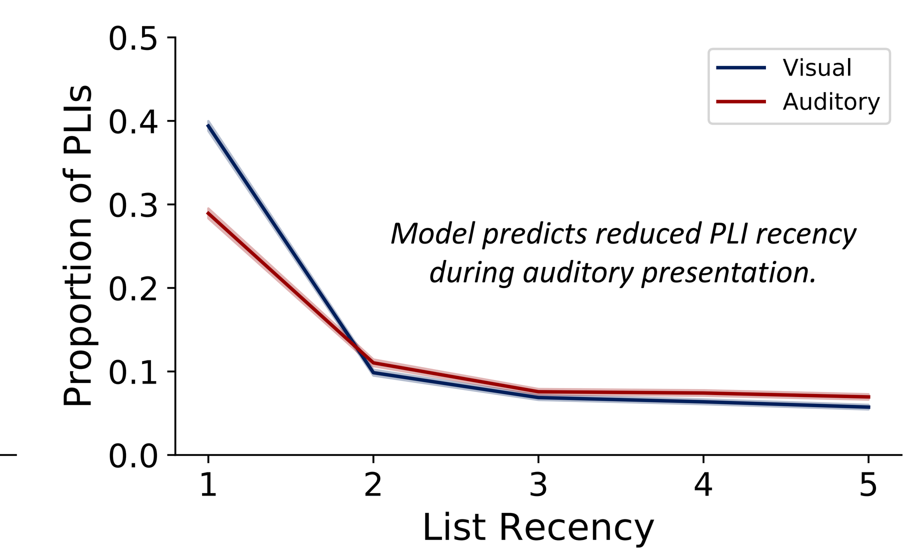
Visual: $\beta_{enc} = 0.4942$, $\gamma_{CF} = 0.5680$
Auditory: $\beta_{enc} = 0.5347$, $\gamma_{CF} = 0.7072$

Best-Fitting Model Predictions:

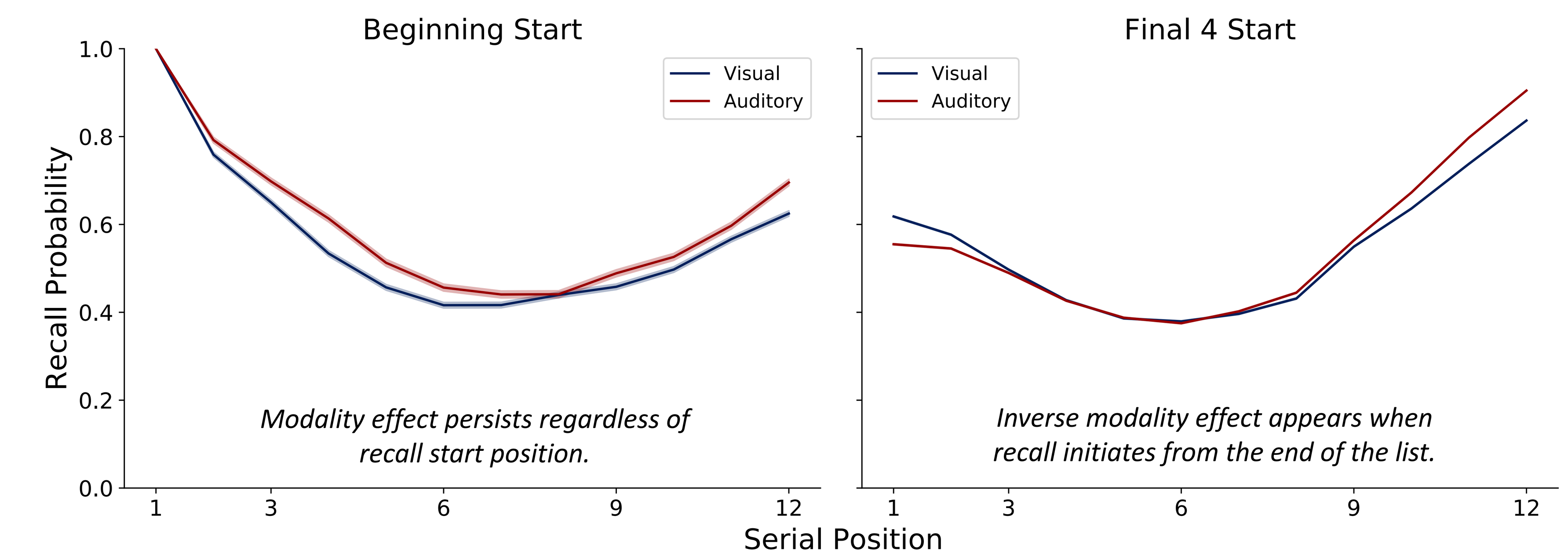








Predictions of SPC by Recall Start Position:



Discussion

- CMR2 can account for modality effects in free recall by associating auditory presentation with a **higher drift rate** during encoding and **stronger contextual cueing** during retrieval
- Increased drift rate may be due to temporal dynamics of auditory presentation (vs. static visual items)
- Stronger contextual cueing may result from auditory/dynamic stimuli having richer sets of features
- Unlike most existing accounts, CMR2 can simultaneously explain both the ME and the IME
- CMR2 also predicts the patterns we observed in intrusion behavior and SPCs by start position
- A retrieved-context account can explain why "modality" effects also appear during dynamic visual presentation (e.g. lip reading, sign language, and finger spelling) (Campbell & Dodd, 1980; Krakow & Hanson, 1985)

References

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