Attention and salience in lexically-guided perceptual learning

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PhD Defense

Outline

1. Background
   - Sources of variation
   - Attentional sets
2. Experiments 1 and 2
   - Set up
   - Results
   - Summary
3. Experiment 3
   - Set up
   - Results
   - Summary
4. Discussion

Sources of variation

Example: /s/

Speaker

- Indexical
  - Accent
  - Gender
- Contextual
  - Style
  - Speaking rate
  - Coarticulation (/stɹ/)
  - Position in word
  - Predictability

Listener

- Indexical
  - Accent
  - Perceived accent
  - Perceived gender
- Contextual
  - Speaking rate
  - Coarticulation (/stɹ/)
- Attention

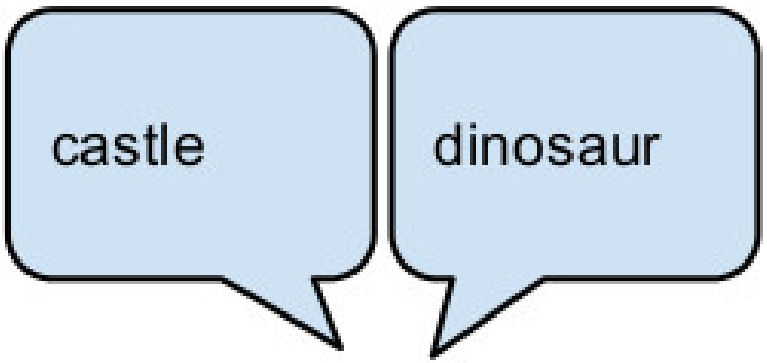
Strand and Johnson (1996); Kraljic and Samuel (2005); Clopper and Pierrehumbert (2008); Pitt and Szostak (2012)

Perceptual constancy

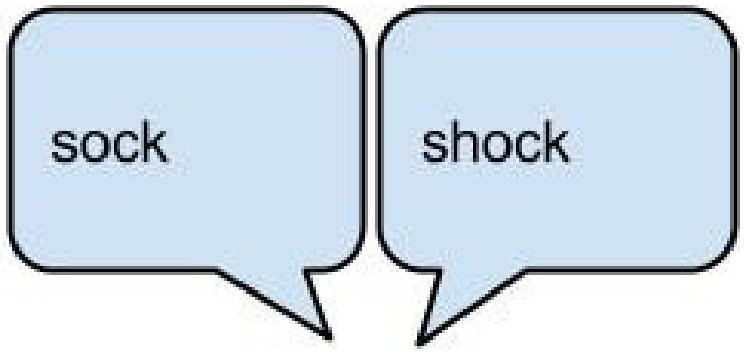
Despite variation, listeners can interpret variable productions as a single word type

Shankweiler et al. (1977); Kuhl (1979); Sumner and Kataoka (2013)

Perceptual learning



Exposure



Categorization

Research question:
How do changes to a listener's attentional set in exposure affect perceptual learning in future categorization?

Sources of variation

Example: /s/

Speaker

- Indexical
  - Accent
  - Gender
- Contextual
  - Style
  - Speaking rate
  - Coarticulation (/stɹ/)
  - **Position in word**
  - **Predictability**

Listener

- Indexical
  - Accent
  - Perceived accent
  - Perceived gender
- Contextual
  - Speaking rate
  - Coarticulation (/stɹ/)
- **Attention**

Strand and Johnson (1996); Kraljic and Samuel (2005); Clopper and Pierrehumbert (2008); Pitt and Szostak (2012)

Attentional sets

Perception-oriented

- Focus on perceiving a specific pronunciation
- Tasks
  - Phoneme-monitoring
  - Discrimination of non-speech stimuli
- Perceptual learning in psychophysics
  - Perceptual learning effects don't generalize to new stimuli
- Visually-guided perceptual learning
  - Mixed results in generalizing to new stimuli
- Promoted by experimental design
  - Repetitive stimuli
  - More nonwords than words

Cutler et al. (1987); Ahissar and Hochstein (1993); Pitt and Szostak (2012); Reinisch et al. (2014)

Attentional sets

Comprehension-oriented

- Focus on comprehending meaning
- Tasks
  - Word recognition
  - Word identification
- Perceptual learning in speech perception
  - Generalization to new items (and sometimes new speakers)
- Hypothesized to be similar to normal language use

Hypothesis:
Comprehension-oriented attentional sets allow for greater generalization than perception-oriented attentional sets.

Norris et al. (2003); Kraljic and Samuel (2005); Pitt and Szostak (2012); Reinisch et al. (2013)

Attentional set manipulation

Explicit instructions

- “This speaker’s ‘s’ sounds are ambiguous”
- Promote perception-oriented attentional set

Pitt and Szostak (2012)

Attentional set manipulation

Perceptual salience of modified /s/

- The less predictable an element, the higher its salience
- Increase the likelihood of listener noticing modification
- Promote perception-oriented attentional set
- Assumption: similar to increasing the number of /s/ trials relative to filler trials

Position in word

- Listeners are more tolerant of variation later in the word
- Word-initial modified /s/ should be more salient

Category typicality

- Productions that are unexpected for a category are more likely to be noticed (salient)

Pitt and Szostak (2012)

Experiments 1 and 2

Experiment 1

- Lexical decision exposure task
- Across subject factors
  - Instructions
  - Position of modified /s/ in words (Word-initial vs word-medial)
- 50% word response rate in a pre-test

Experiment 2

- Same design and materials as Experiment 1
- 30% word reponse rate in the pre-test (more atypical /s/; Word-initial vs word-medial)

Experiment 1 and 2 predictions

- Hypothesis 1:
  - Perceptual learning is affected by attentional sets
  - Perceptual learning should be less where perception-oriented attentional sets are promoted
- Hypothesis 2:
  - Perceptual learning is wholly automatic and consistent
  - Equal perceptual learning effects across all conditions
- Hypothesis 3:
  - Perceptual learning effects are dependent on similarity
  - Word-initial exposure > Word-medial exposure

Experiment 1

Exposed to ambiguous /s/

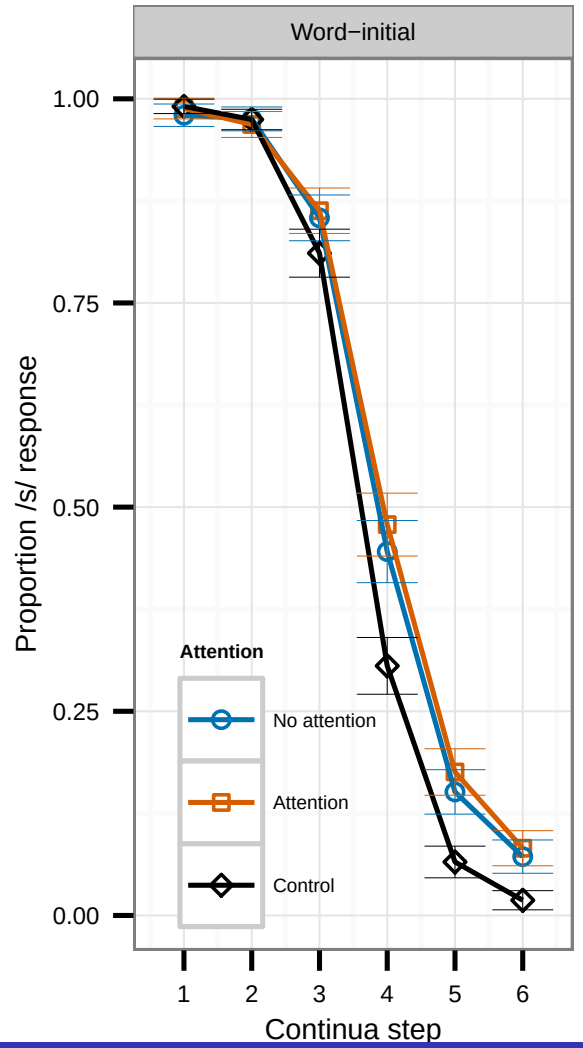
- 50% between /s/ and /ʃ/

Attention

- No /s/-oriented instructions
- Told /s/ would be ambiguous

Position of /s/

- *Word initial*
- Word medial



Experiment 1

Exposed to ambiguous /s/

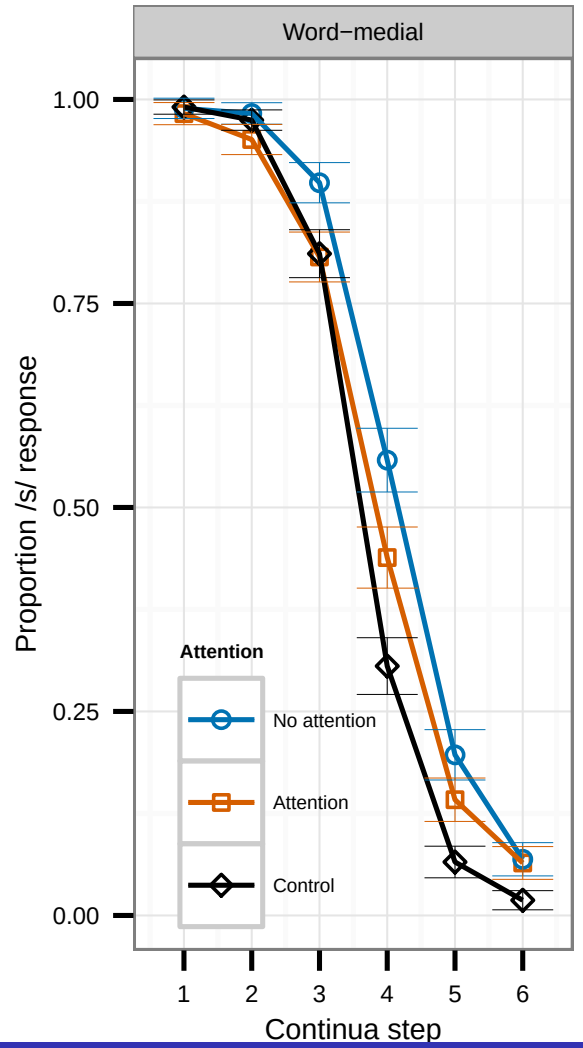
- 50% between /s/ and /ʃ/

Attention

- No /s/-oriented instructions
- Told /s/ would be ambiguous

Position of /s/

- Word initial
- *Word medial*



Experiment 2

Exposed to ambiguous /s/

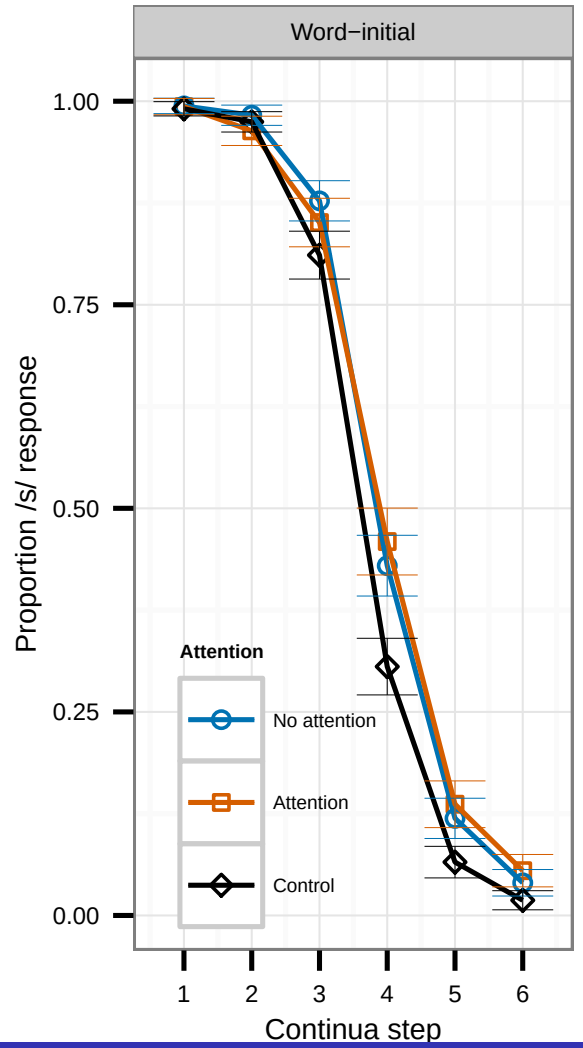
- More like /ʃ/ than /s/

Attention

- No /s/-oriented instructions
- Told /s/ would be ambiguous

Position of /s/

- *Word initial*
- Word medial



Experiment 2

Exposed to ambiguous /s/

- More like /ʃ/ than /s/

Attention

- No /s/-oriented instructions
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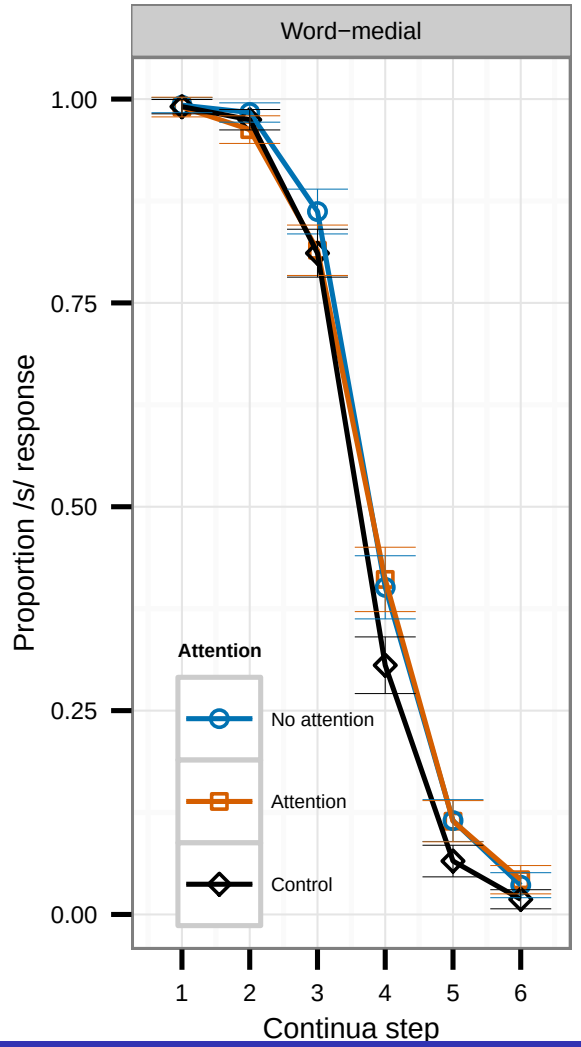
Position of /s/

- Word initial
- *Word medial*



Summary

- Results align with attentional sets
- Fine-grained similarity did not appear to play a role
  - Word-intial exposure <= word-medial exposure
- Conditions promoting a perception-oriented attentional set
  - Still showed perceptual learning
  - Had smaller perceptual learning effects
  - Did not differ from one another
- Task was comprehension-oriented (identifying word)
- Experiment 3 attempts to further promote comprehension-oriented attentional sets

Experiment 3

- Novel cross-modal paradigm
  - Auditory sentences
  - Identification of picture corresponding to final word in sentence
  - Same word-medial modified /s/ stimuli
  - Final targets were predictable or unpredictable
- Across subjects
  - Instructions (identical to Experiments 1 and 2)
  - Modified /s/ only in predictable or unpredictable words
- Predictable words are predicted to have lower salience than unpredictable words

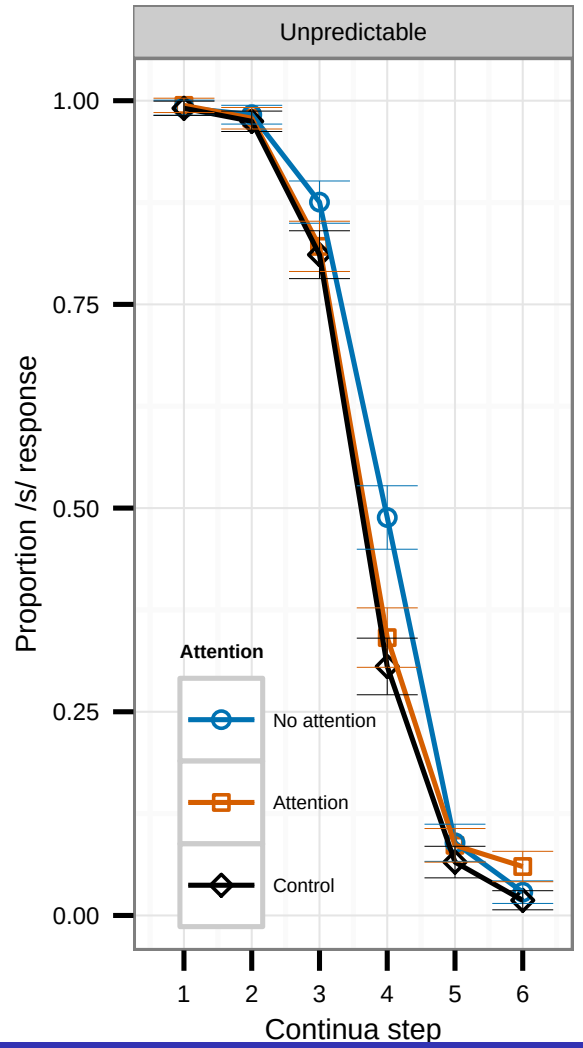
Experiment 3 predictions

- Hypothesis 1:
  - Words in isolation == words at the end of sentences
  - Perceptual learning effects == Experiment 1's Word-medial conditions
- Hypothesis 2:
  - Words in isolation =/= words at the end of sentences
  - Perceptual learning effect < Experiment 1's Word-medial conditions
- Hypothesis 3:
  - High predictability is associated with less distinct acoustics
  - Perceptual learning is not found in coarticulation contexts (/stɹ/)
  - No perceptual learning effect in predictable condition

Clopper and Pierrehumbert (2008); Scarborough (2010); Kraljic et al. (2008)

Experiment 3

- **Exposed to ambiguous /s/**
  - Halfway between /s/ and /ʃ/
  - In sentences
- **Attention**
  - No /s/-oriented instructions
  - Told /s/ would be ambiguous
- **Predictability of final /s/ words**
  - *Unpredictable*
  - Predictable



Experiment 3

- **Exposed to ambiguous /s/**
  - Halfway between /s/ and /ʃ/
  - In sentences
- **Attention**
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- **Predictability of final /s/ words**
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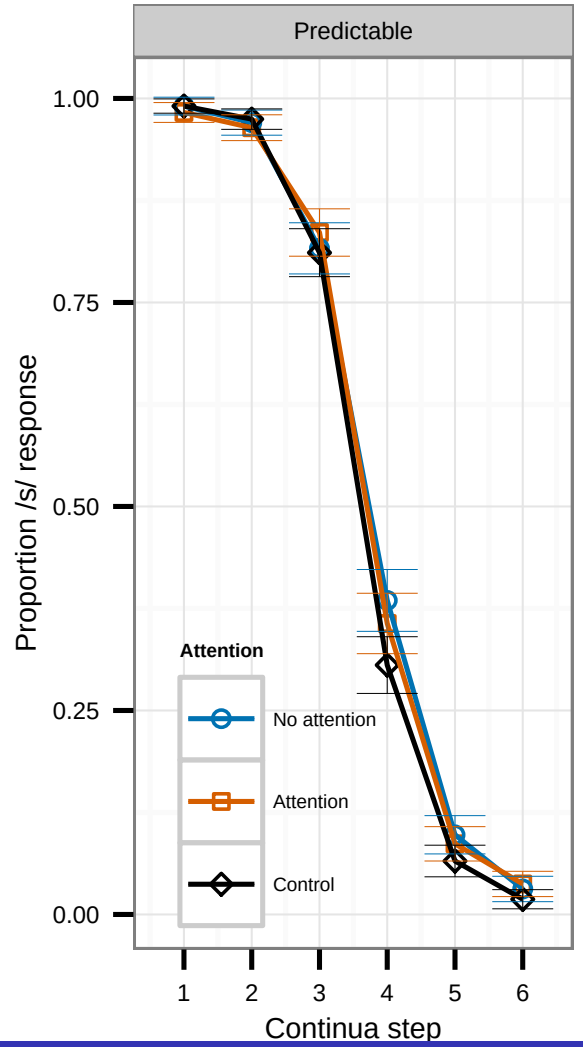
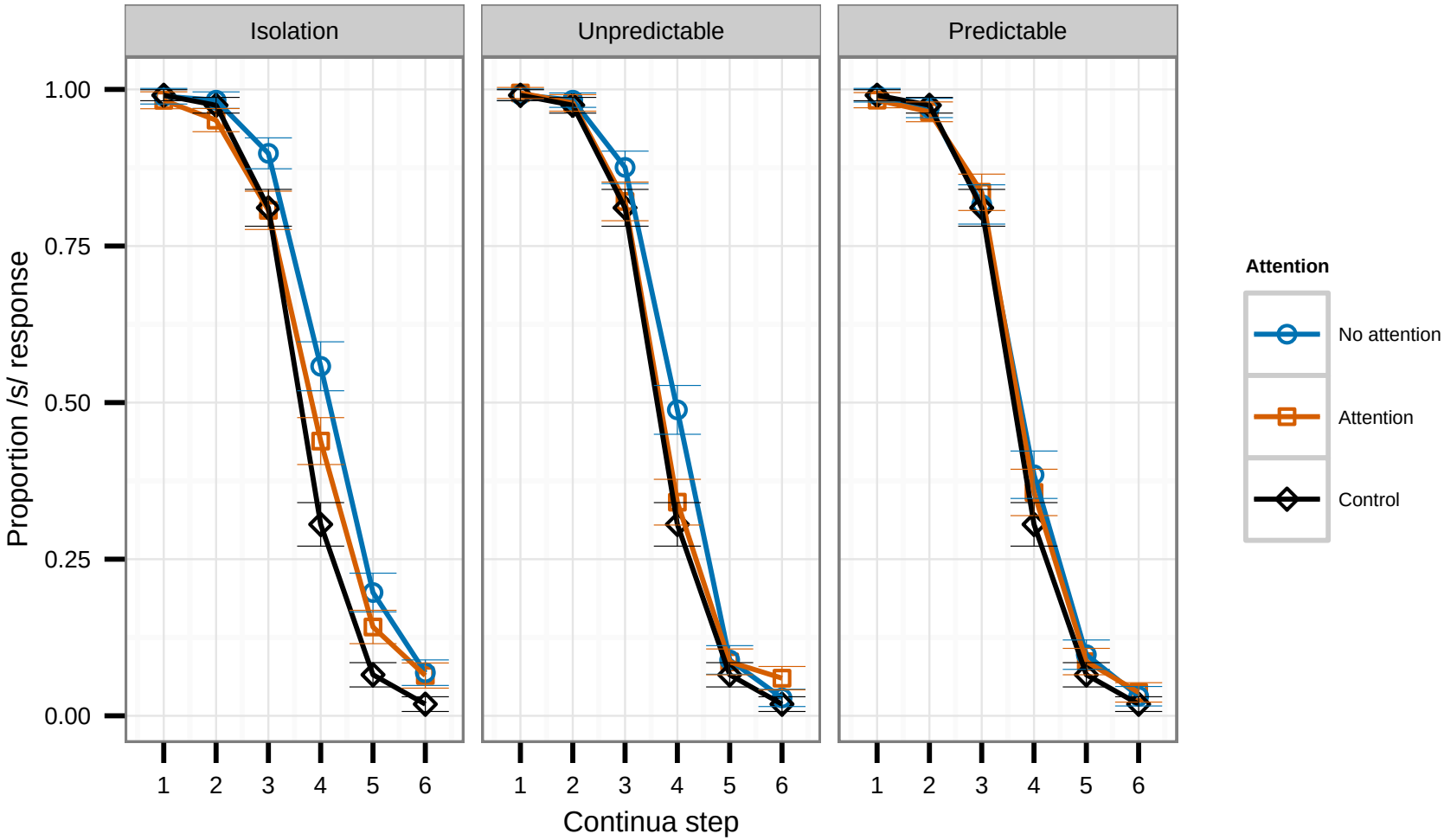
  - *Predictable*



Isolation vs Sentences



Summary

- Unpredictable exposure showed a similar pattern to words in isolation
- Predictable exposure showed no perceptual learning effect
  - Similar to studies using a coarticulation context (/stɹ/)
  - Despite consistent durations for words and sibilants across the two sentence types

Discussion

- Attentional sets affected perceptual learning
  - Conditions that did not promote perception-oriented attentional sets showed larger effects
- Predictability was likely not an attentional set manipulation
  - Instead, allowed for attribution of the modified category to predictability
- Implications for theoretical models
  - Supports hierarchical representations
  - Attention to episodic representations or specific pronunciations inhibits learning in abstract categories

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