

Individual differences in perceptual adaptation to phonetic categories: Categorization gradiency and cognitive abilities

Research Questions

1. Do listeners up-weight a secondary cue (i.e. duration) when a primary cue (i.e. spectral differences) to vowel category is not informative?
2. Are individual differences in phoneme categorization gradiency linked to patterns of perceptual adaptation?
3. Are individual differences in cognitive abilities related to patterns of perceptual adaptation?

Background

Do listeners adapt to unfamiliar speech by using less informative acoustic dimensions? If so, what makes some listeners adapt better?

Perceptual adaptation in acoustic-phonetic perception

- Listeners may adapt to unfamiliar speech by increasing their secondary cue use when exposed to an uninformative primary acoustic dimension (e.g. non-native English vowels) [cf. 1].

Categorization gradiency in speech perception

- Listeners who have more gradient categorization patterns are more sensitive to secondary acoustic cues [2, 3].

Cognitive abilities in speech perception

- Certain cognitive abilities (e.g. inhibitory control, working memory) play an important role in perceptual adaptation to unfamiliar speech [4, 5].

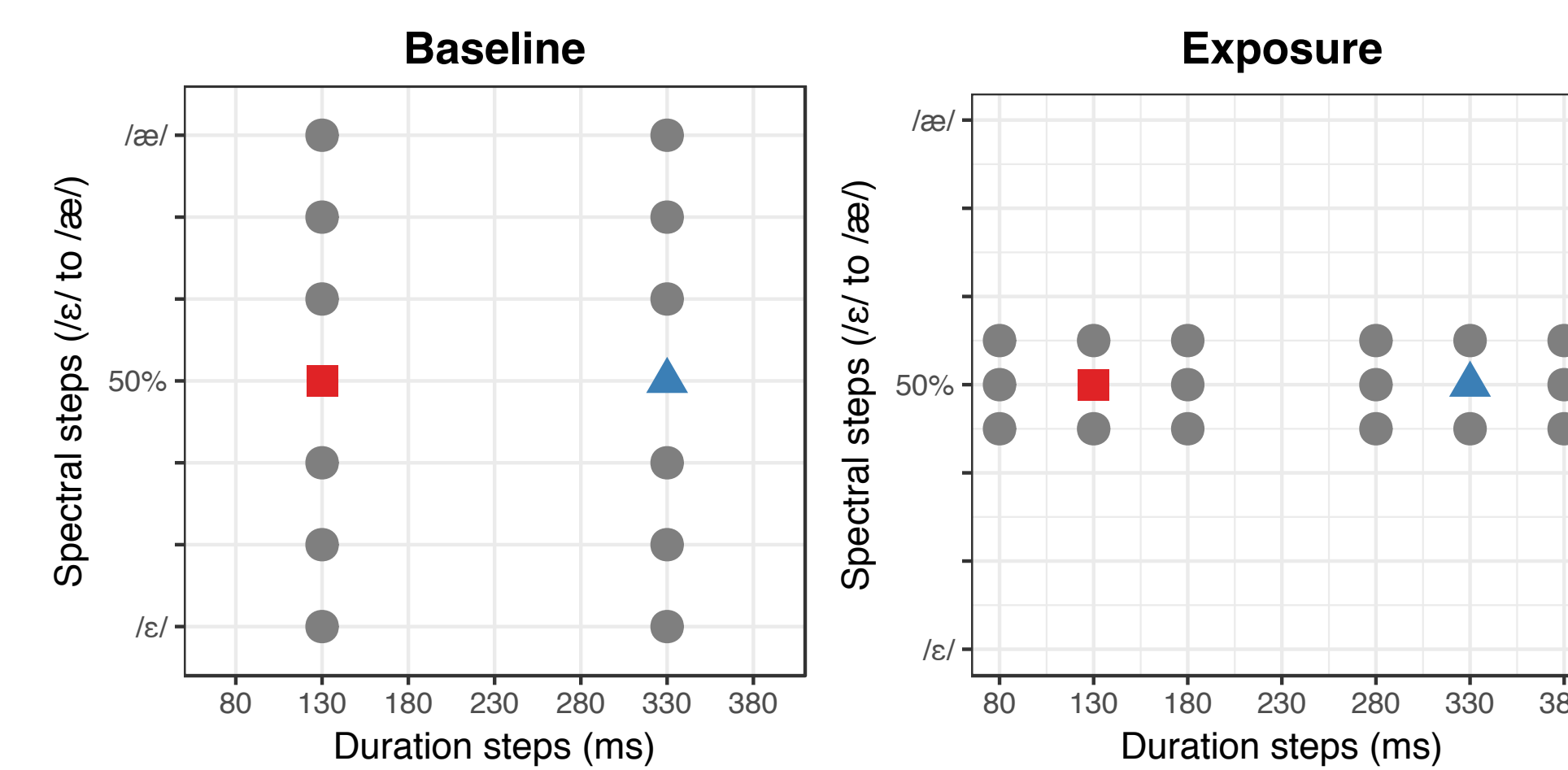
Methods

Participants

- 36 monolingual speakers of Canadian English

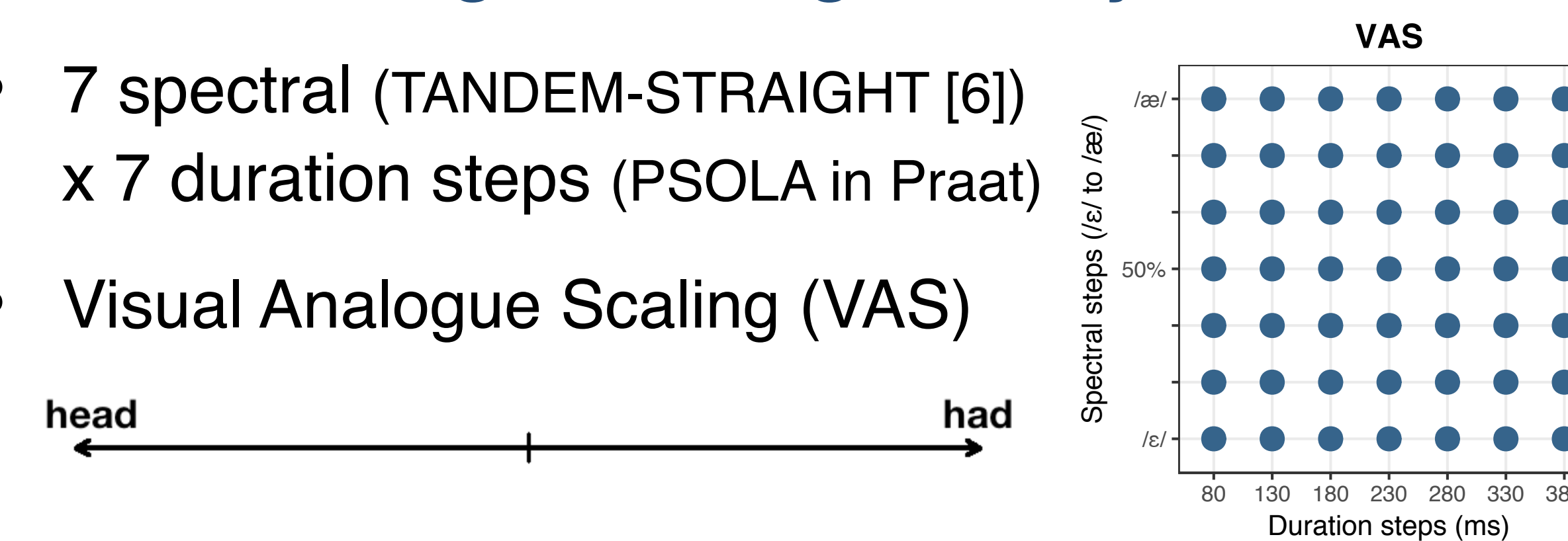
Perceptual adaptation

- **Baseline:** a subset of stimuli from the VAS task
- **Exposure:** 6 tokens at the most ambiguous spectral step and adjacent ambiguous tokens
- Both included Test stimuli (■ & ▲)
- 2AFC: *head* or *had*



Phoneme categorization gradiency

- 7 spectral (TANDEM-STRAIGHT [6]) x 7 duration steps (PSOLA in Praat)
- Visual Analogue Scaling (VAS)



Cognitive abilities

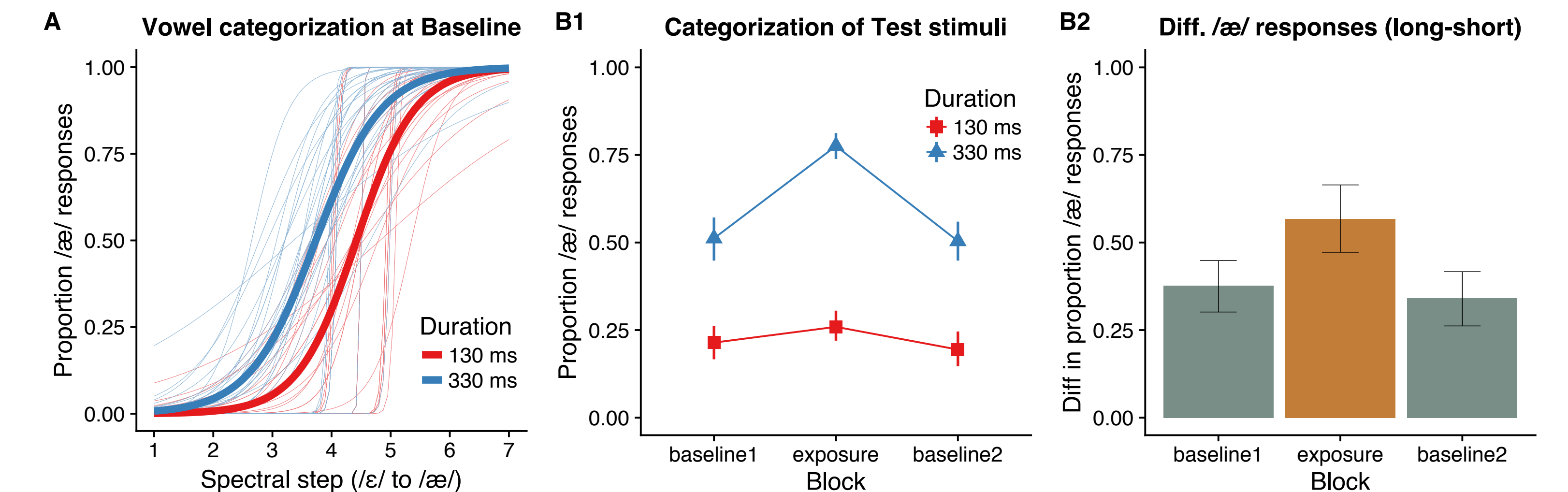
- **Inhibition** (Stroop), **Working memory** (Corsi), **Cognitive flexibility** (Berg Card Sorting), **Sustained attention** (Continuous Performance) [7]

Statistical analysis

- **Response:** Categorization responses in mixed-effects logistic regression
- **Predictors:** Block (Baseline 1 vs. Exposure, Baseline 1 vs. Baseline 2), Duration (130 ms vs. 330 ms), Gradiency (VAS slope), Secondary cue use (crossover differences between two duration regression models at Baseline), Inhibition, Working memory, Cognitive flexibility, Sustained attention

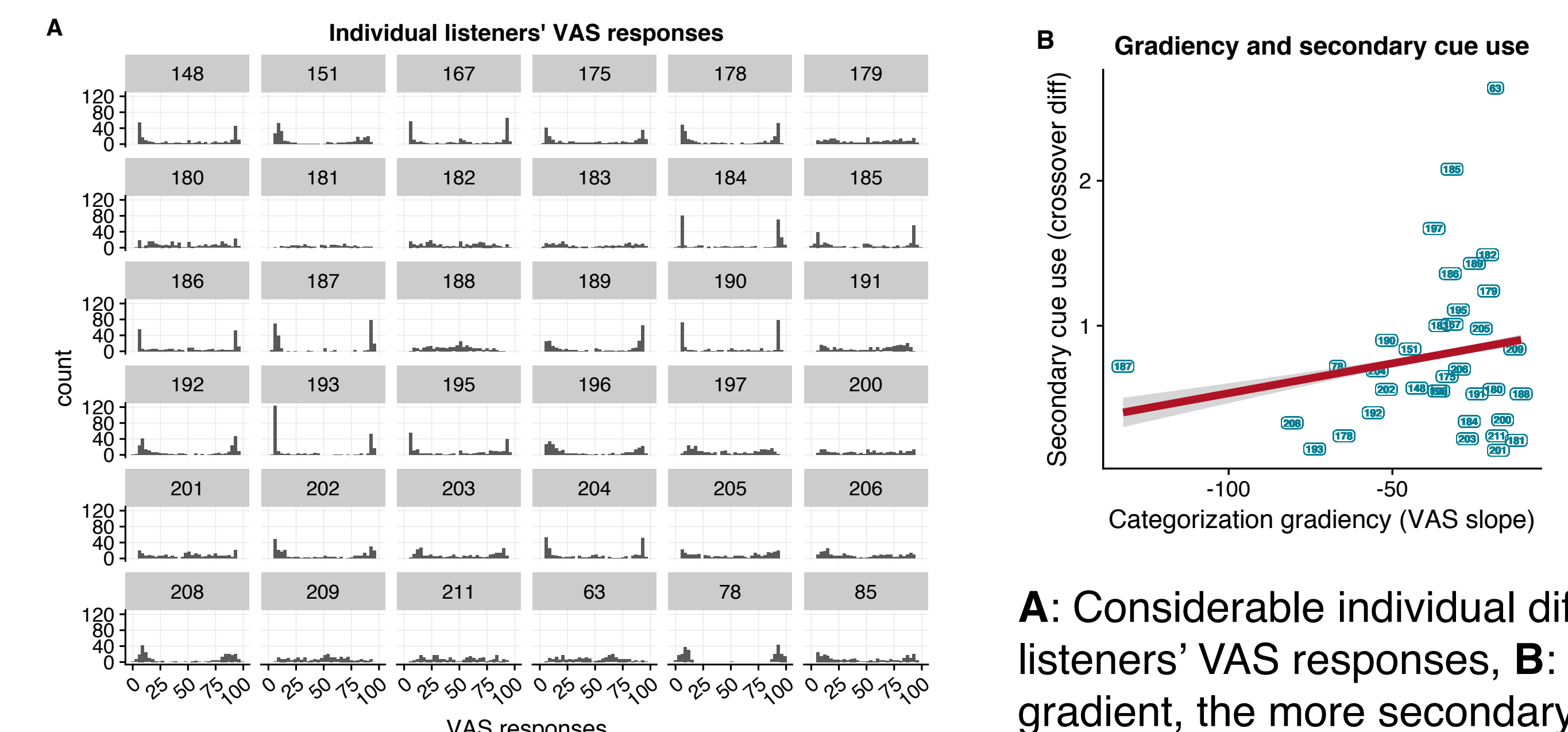
Results

RQ1: Listeners flexibly adapted to unfamiliar vowels by up-weighting a secondary cue when a primary cue is not informative.



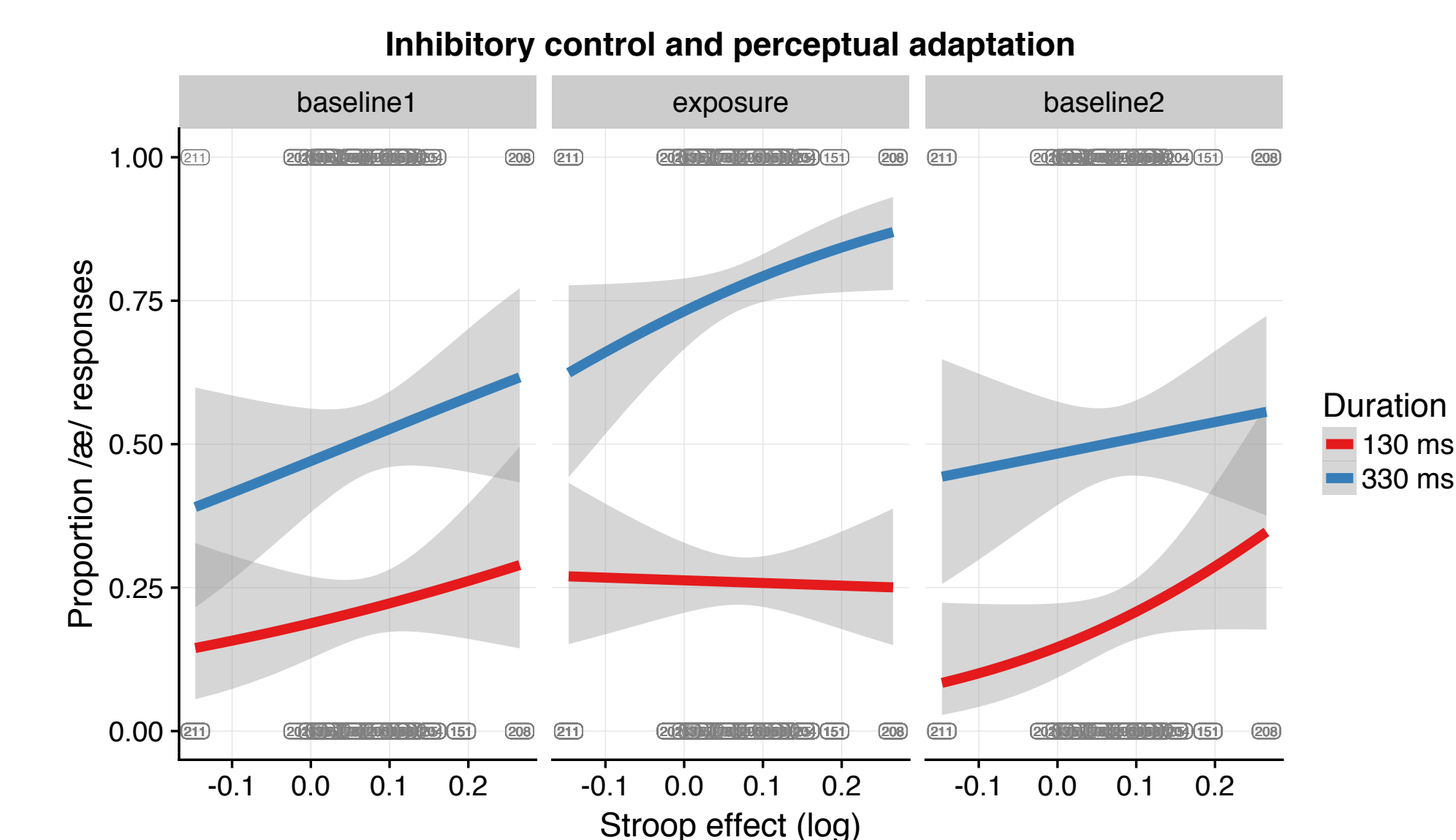
A: Primary use of spectral differences at Baseline, **B1:** Up-weighting of the duration cue when the spectral cue is not informative at Exposure, **B2:** Differences in proportion /æ/ responses (330ms – 130ms)

RQ2: Individuals varied widely in categorization gradiency and this variability was related to their use of a secondary cue, but the link between gradiency and adaptation was not found.



A: Considerable individual differences in listeners' VAS responses, **B:** The more gradient, the more secondary cue use

RQ3: Individual differences in inhibitory control correlated with the amount of adaptation.



Individuals with poor inhibitory control showed more adaptation at Exposure.