The role of cognitive abilities in speech perception under cognitive load: An individual differences approach

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Donghyun Kim & Meghan Clayards
Contact: d.kim2@exeter.ac.uk

University of Exeter
McGill

Research Questions

1. **How and to what extent are speech perception abilities modulated by cognitive load?**
2. **Do individual listeners differ in their use of acoustic cues in speech categorization under cognitive load?**
3. **Are individual cue weighting strategies under cognitive load related to individuals' cognitive abilities and gradiency in phoneme categorization?**

Background

Do listeners show adaptive strategies for speech categories in the face of cognitive load? If so, what makes some listeners better adapters?

Speech perception under cognitive load

- Speech perception is an inherently attention demanding process and limited attentional resources have been shown to disruptive effects on speech perception [1, 2].

Cognitive abilities in speech perception

- Cognitive abilities (e.g. inhibitory control, working memory) play a role in speech perception in adverse conditions [3, 4].

Gradiency in phoneme categorization

- Listeners who have more gradient categorization patterns are more sensitive to acoustic-phonetic details [5, 6].

Methods

Participants

- 54 monolingual speakers of Canadian English

Dual task

- **2AFC + Visual search**
- 2AFC (*head* or *had*): 5 spectral (TANDEM-STRAIGHT [7]) x 5 duration steps (PSOLA in Praat)
- Visual search: A black diamond is present?

Gradiency in phoneme categorization

- **Visual Analog Scaling** (VAS: *heed—hid*): 7 spectral x 7 duration steps

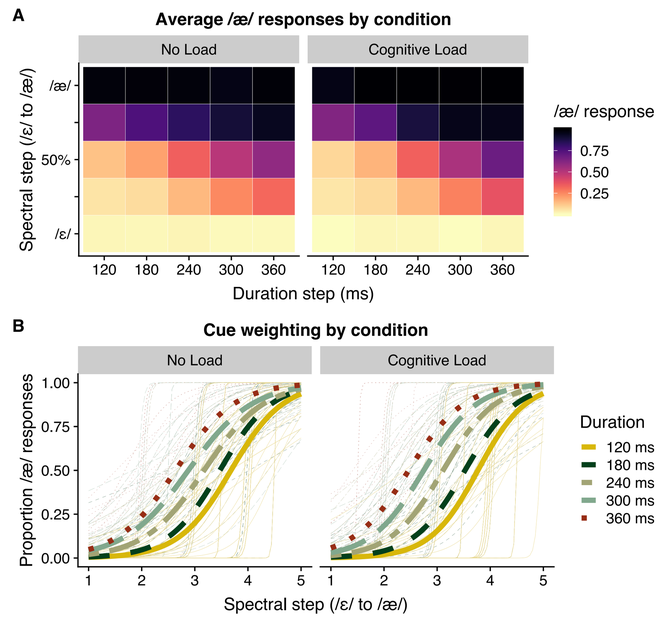
heed ⟷ hid

Cognitive abilities

- **Working memory** (Backward Digit Span, Reading Span), **Inhibitory control** (Stroop, Go/No-go) [8]

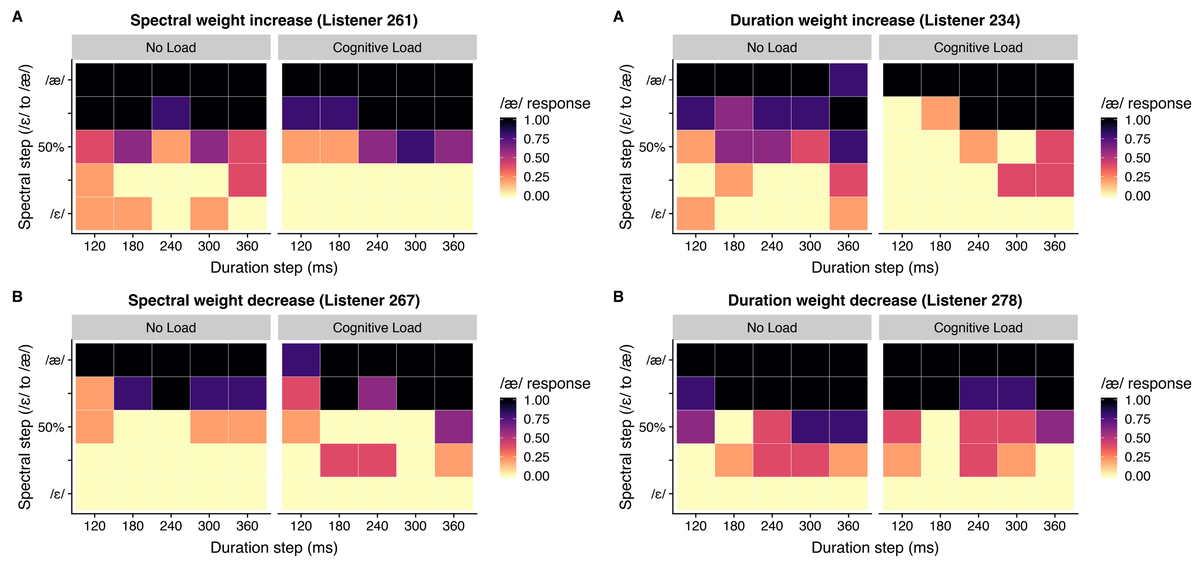
Results

RQ1: Listeners overall showed an increased reliance on the primary (spectral quality) and the secondary cue (duration) under cognitive load.



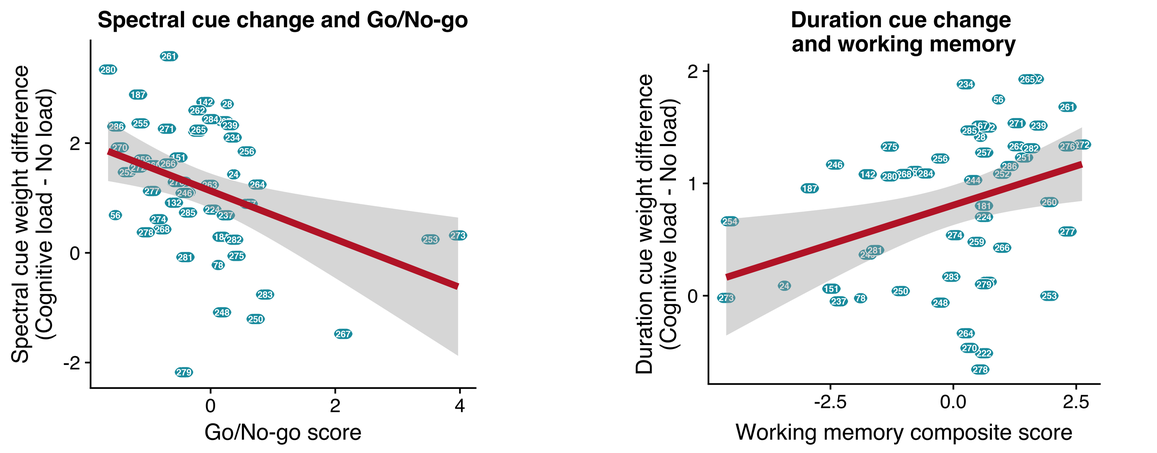
Increased cue weights under cognitive load may be interpreted as an **active cognitive process** [9]

RQ2: There were considerable differences across individuals in the effect of cognitive load on perceptual cue weighting.



Some listeners showed **an increased (decreased) reliance on spectral quality** whereas others showed **an increased (decreased) reliance on vowel duration under cognitive load**.

RQ3: Individual differences in adaptive cue weighting strategies under cognitive load were linked to cognitive abilities (but not to phoneme categorization gradiency).



Individuals with better **inhibitory control** showed more adaptive **spectral change**.

Individuals with better **working memory** showed more adaptive **duration change**.

Individual differences in **adaptive cue weighting strategies** under cognitive load, which may be interpreted as an **active cognitive process**, were linked to listeners' **cognitive abilities**.

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