Individual differences in plasticity in speech perception under cognitive load

CHSCOM2019
Linköping, Sweden
June 9-12, 2019

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 individuals differ in their use of acoustic cues in phonetic 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 phonetic categories in the face of cognitive load? If so, what makes some listeners better adaptors?

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].

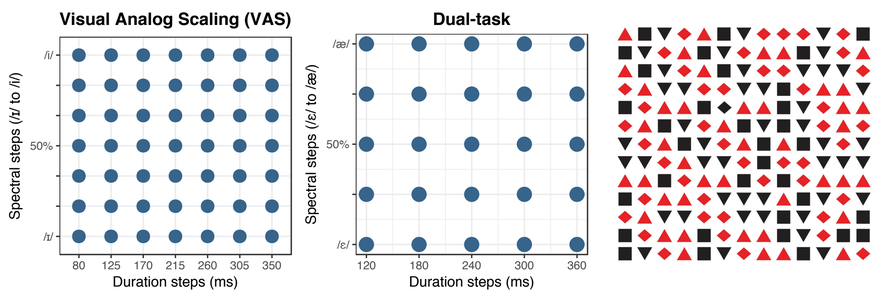
Methods

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 Analogue Scaling** (VAS: *heed—hid*): 7 spectral x 7 duration steps

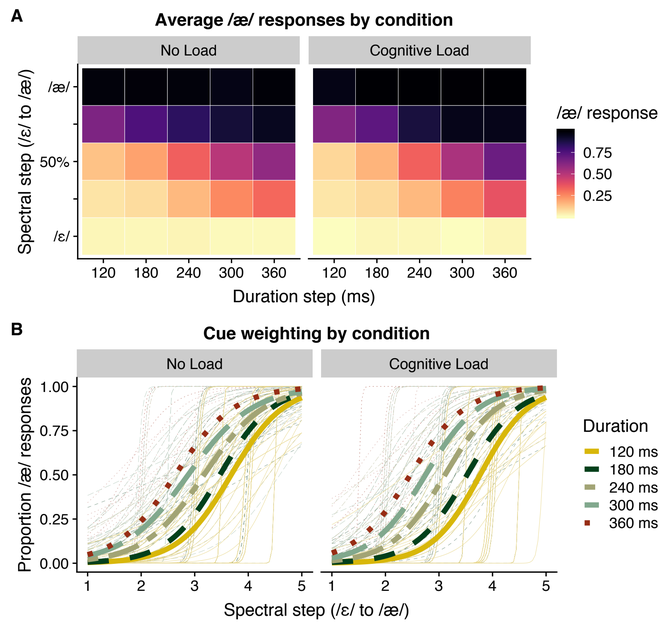
heed ⟷ hid

Cognitive abilities

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

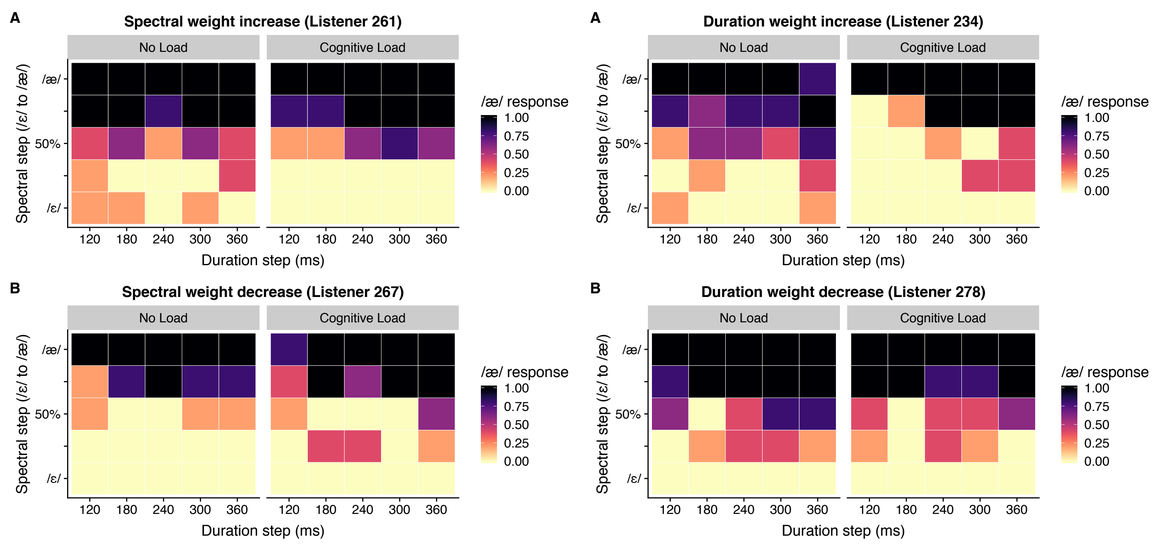
Results

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



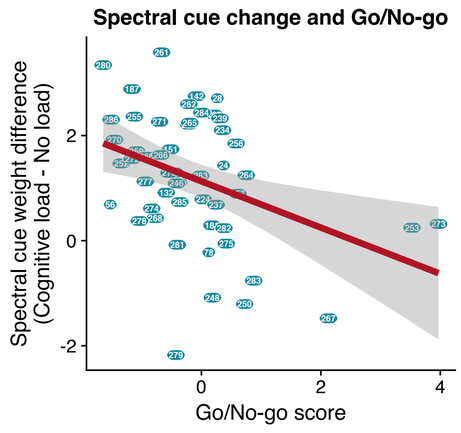
Increased cue weights under cognitive load may be interpreted as an **active cognitive process** [9]

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

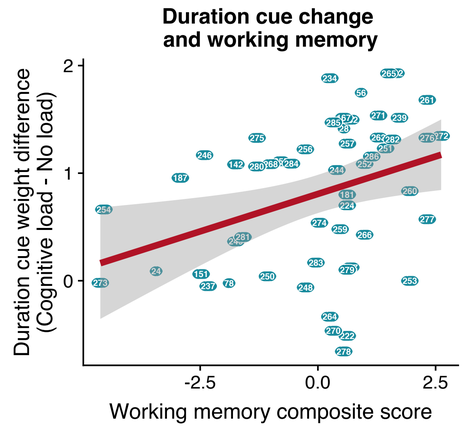


Some listeners showed **an increased (decreased) reliance on spectral quality** whereas others showed **an increased (decreased) reliance on vowel duration under cognitive load**.

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



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.

This work was supported by SSHRC grant 435-2016-0747 to Meghan Clayards.

Social Sciences and Humanities Research Council of Canada
Conseil de recherches en sciences humaines du Canada
Canada

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