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

Donghyun Kim & Meghan Clayards

Contact: d.kim2@exeter.ac.uk

**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

**Cognitive abilities**
- Working memory (Backward Digit Span, Reading Span), Inhibitory control (Stroop, Go/NoGo) [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.