Is voicing encoded in speech motor representations? Evidence from transfer of learning

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plan
PsychoLinguistics Aphasia & Neuromodulation Lab

Introduction

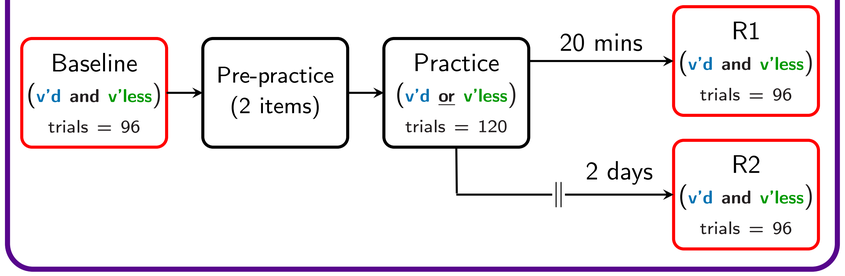
- What is the nature of learned speech motor representations?
- Learning non-native onset clusters (e.g., **GD**EEMOO, **KT**EEMOO):
  - **GD**EEMOO $\xrightarrow{\text{generalizes}}$ **GD**AHBEE (Buchwald et al., 2019)
- At the level of cluster, what exactly is being learned?
  - General coordination pattern? (e.g., stop-stop clusters)
  - Specific coordination pattern? (e.g., GD vs KT)
- **Present study:**
  - Does training on [**voiced**, **voiceless**] clusters transfer to untrained items with different voicing?

Predictions

- If general stop-stop coordination pattern is learned:
  - GD ⇒ KT, KT ⇒ GD } = **Bi-directional transfer**
- If specific coordination pattern is learned:
  - GD ⇏ KT, KT ⇏ GD } = **No transfer**
- Complexity:
  - Voiced clusters are harder to produce aerodynamically (Ohala, 1983) and had lower empirical accuracy rate (Davidson, 2010)
  - GD ⇒ KT, KT ⇏ GD } = **Uni-directional transfer**

Methods

- Speech motor learning paradigm: nonword production with orthography and auditory models
- **Participants:** 34 (23 female, 11 male) native speakers of American English (Mean age = 23.76 yrs, SD = 4.9 yrs)
- **Practice:** random & variable practice (Mass et al., 2008), no feedback
  - **Voiced condition**: /db/, /gb/, /gd/ (4 words each)
  - **Voiceless condition**: /tp/, /kp/, /kt/ (4 words each)

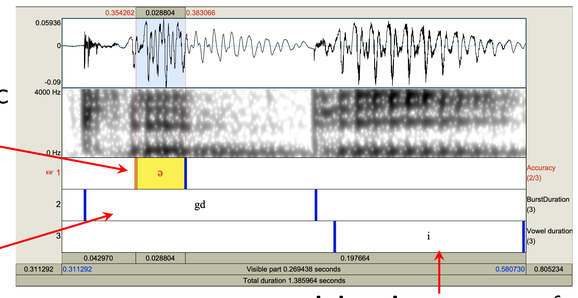


Analyses & coding

- Measurements taken by two blinded coders
- Separate mixed effects models for each condition and for each analysis
  1. accuracy ~ session*type + (1|subject) + (1|item)
  2. duration ~ session*type + vowel duration + (1|subject)+(1|item)
- Session ≡ baseline, R1, R2
- Type ≡ trained, untrained, transfer

Analysis 1. **Cluster accuracy**: incorrect if there is an epenthetic vowel (Wilson et al., 2014)

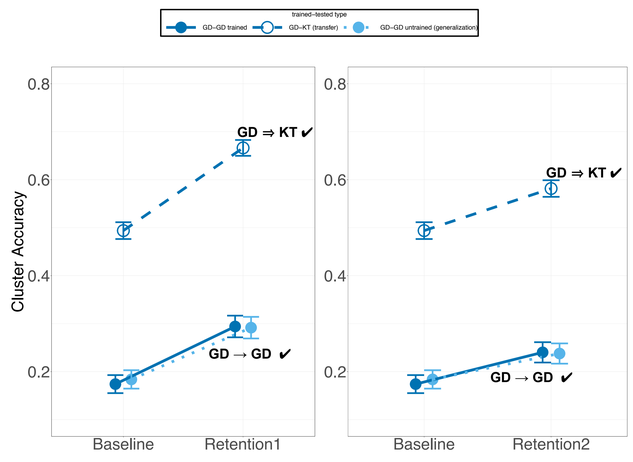
Analysis 2. **Burst-to-burst duration** (improvement ≡ shorter duration)



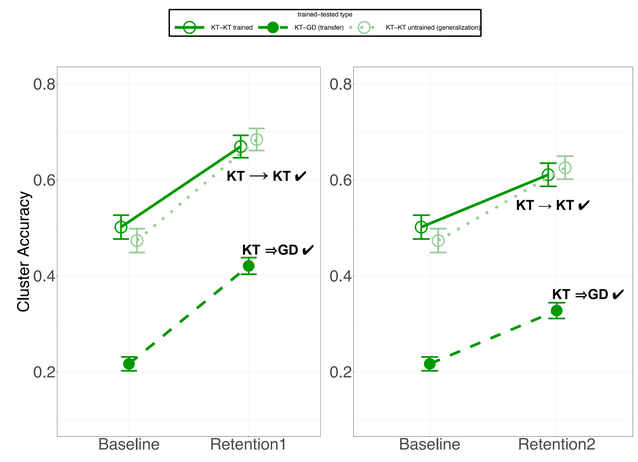
vowel duration as a proxy for speaking rate

Cluster accuracy

Voiced condition



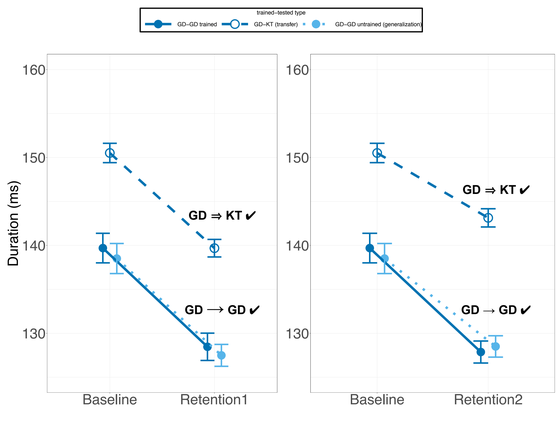
Voiceless condition



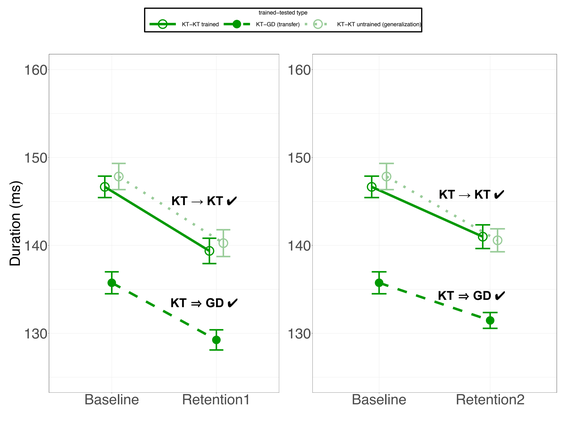
- Session effect not affect by type for both conditions (bi-directional transfer at phonemic accuracy level)

Burst-to-burst duration

Voiced condition



Voiceless condition



Discussion

- Motor representations may encode general coordination pattern of oral-oral articulators
- Effect of complexity was not found

Future directions:

- Transfer within the same manner of articulation, but differing in place of articulation? (e.g., trained on /gd/, tested on /bd/)

- Session effect not affect by type for both conditions (bi-directional transfer at motor acuity level)