Sensorimotor learning in speech is modulated by interaction with another voice

A. Bradshaw¹, E. Wheeler², C. McGettigan³ & D. Lametti²

¹University of Cambridge, ²Acadia University, Canada, ³University College London.

**Introduction**

- Real-time alterations to the sound of a speaker's voice trigger unconscious compensatory changes to speech movements = **speech motor adaptation**.
- When we interact with another speaker, our voices tend to become more similar = **vocal convergence**.

**Key question:** How do adaptation and vocal convergence interact?

**Methods:** Speech motor adaptation during synchronous speech

**Vocal convergence**

- The congruent group showed significant convergence in F1 ($\beta = -7.55$, t(35.58) = -2.69, $p = .011$) and F2 ($\beta = 10.51$, t(46.42) = 3.51, $p = .001$) (LMM analyses).
- The incongruent group showed no significant changes in F1 or F2.

**Adaptation**

- Adaptation was significantly smaller in the incongruent group than the congruent group ($\beta = -12.34$, t(41) = -3.67, $p = .001$) (LMM analysis).

**Results**

![Figure 1: Changes in F1 and F2 of speech productions from block 1 (solo reading) to block 2 (synchronous speech). Coloured arrows show individual participant responses (see Table 1 for key), black arrows show group averages.](image1)

![Figure 2: Changes in F1 and F2 of speech productions from block 2 to block 6. Coloured arrows show individual participant responses (see Table 1 for key), black arrows show group averages. Thin grey arrows indicate direction of real-time alteration to speech.](image2)

| Table 1: Frequency of participants showing adaptation/following. |
|------------------|------------------|------------------|------------------|
|                  | Congruent group  | Incongruent group |
| Significant adaptation response | 13   | 10   |
| No significant adaptation | 3    | 2    |
| Significant following response | 0    | 3    |

**Statistical analyses**

- **Vocal convergence**
  - The congruent group showed significant convergence in F1 ($\beta = -7.55$, t(35.58) = -2.69, $p = .011$) and F2 ($\beta = 10.51$, t(46.42) = 3.51, $p = .001$) (LMM analyses).
  - The incongruent group showed no significant changes in F1 or F2.

- **Adaptation**
  - Adaptation was significantly smaller in the incongruent group than the congruent group ($\beta = -12.34$, t(41) = -3.67, $p = .001$) (LMM analysis).

**Discussion**

- As predicted, adaptation was significantly reduced when simultaneous vocal convergence opposed the direction of adaptation (incongruent group) compared to when it agreed with it (congruent group).
- This suggests the use of shared targets for speech perception and production.
- Models of speech motor control need to be extended in order to account for flexibility in the targets that control speech production.

---

[Image 113x3123 to 1470x3285] [Image 813x1950 to 2430x2723] [Image 1604x825 to 2366x947] [Image 25x1724 to 2359x1846] [Image 26x2599 to 791x2723] [Image 813x826 to 1575x948] [Image 983x2285 to 1176x2479] [Image 940x1962 to 1215x2237] [Image 839x2503 to 911x2576] [Image -90x1086 to 2421x1732] [Image 79x115 to 770x586] [Image 33x824 to 792x946]