Integration of somatosensory and auditory information in vowel production

**Methods**

**BACKGROUND**

Articulatory plans to reach vowel targets are updated throughout life by monitoring auditory and somatosensory feedback. Articulation is adjusted when there is a mismatch between observed and expected feedback from either source (Houde & Jordan, 2002, Tremblay, Ostry, & Shiller, 2003), but the amount of adjustment is smaller than the mismatch (Katseff, Johnson & Houde, 2010). Here, we ask whether the amount of compensation for altered auditory feedback is mediated by salience of somatosensory feedback.

**RESULTS**

Due to significant individual variation, subjects were split into two groups:

- **Good compensators** = talkers whose formants changed at least 2*std. deviation of baseline vowel region
- **Poor compensators** = talkers whose formant production changed by less than this amount.

Wedges encompass 95% of the last 30 vowel productions with maximum formant shift.

Good compensators reacted differently to the three vowel conditions: compensation magnitude was greatest for shifts in /u/ formant feedback, with several subjects appearing to compensate nearly completely. Compensation angle was statistically different from 0 degrees for /u/, but not for /a/ or /u/.

Poor compensators appeared to wander around their baseline vowel regions in all three conditions, as indicated by the wide range of angles in this group; their compensation was not directed.

**DISCUSSION**

Because compensation for shifts in /u/ feedback was neither larger in magnitude nor more direct than compensation for shifts in /u/ feedback, we suggest that salient palatal and lip somatosensory feedback does not lead to increased weighting of somatosensory relative to auditory feedback. This finding suggests that we should not expect vowels with salient somatosensory feedback to be more stable over time either within or across individuals.

It is possible that the large compensation found for /u/ is due to the large size of the /u/ region in California English; perhaps it is more natural to compensate for altered feedback that falls within the same vowel region. This account predicts that speakers of languages with smaller /u/ regions would compensate less for altered /u/ feedback than California English speakers.

**ACKNOWLEDGMENTS**

Many thanks to Matt LaCoste and Svetlin Gahl for their assistance in subject testing and data analysis. Thanks are also due to Suzanne Gehr, Reiko Kataoka, Will Chang, Richard Hahn, and the UC Berkeley phonology lab for helpful discussions.

**REFERENCES**


**PROCEDURE**

Formant Alteration Device

Analysis

Formant shift

Resynthesis

**Measurement**

**Formant Alteration Device**

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**Formant shift**

**Resynthesis**

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