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Speech perception training with orofacial somatosensory stimulation affects speech production

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Introduction

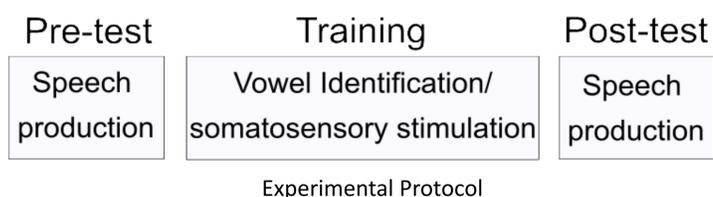
- Sensorimotor adaptation to speech motor training induces changes in speech perception^{1,2}.
- Since speech perception and production are closely linked, speech perceptual training may also affect speech production.
- Repetitive exposure to speech based somatosensory inputs paired with auditory inputs during speech perceptual training modulates speech perception³.
- We hypothesized such exposure to paired auditory-somatosensory stimulation would also induce a change in speech production.

Aim

- To examine whether speech perception training with orofacial somatosensory stimulation modifies speech production.

Methods

- Twenty-eight French native speakers participated. 14 for SOMA group and 14 for CTRL group.
- Speech production performance was compared before and after training (i.e. pre- vs. post-test).



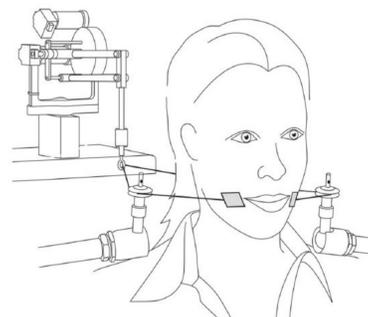
Speech Production Test

- French words, 'dé' for /e/ and 'deux' for /ø/ were recorded 10 times in each test.
- F1, F2 and F3 were compared between pre- and post-tests.



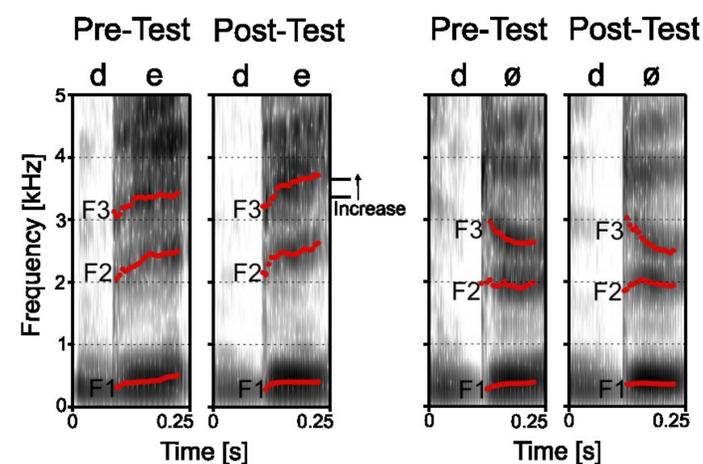
Speech Perception Training with Somatosensory stimulation

- Vowel identification test using /e/-/ø/ continuum.
- In the SOMA group, backward facial skin-stretch was applied by a robotic device when the stimulus sound was presented.
- In the CTRL group, the same training was carried out, but without somatosensory stimulation.



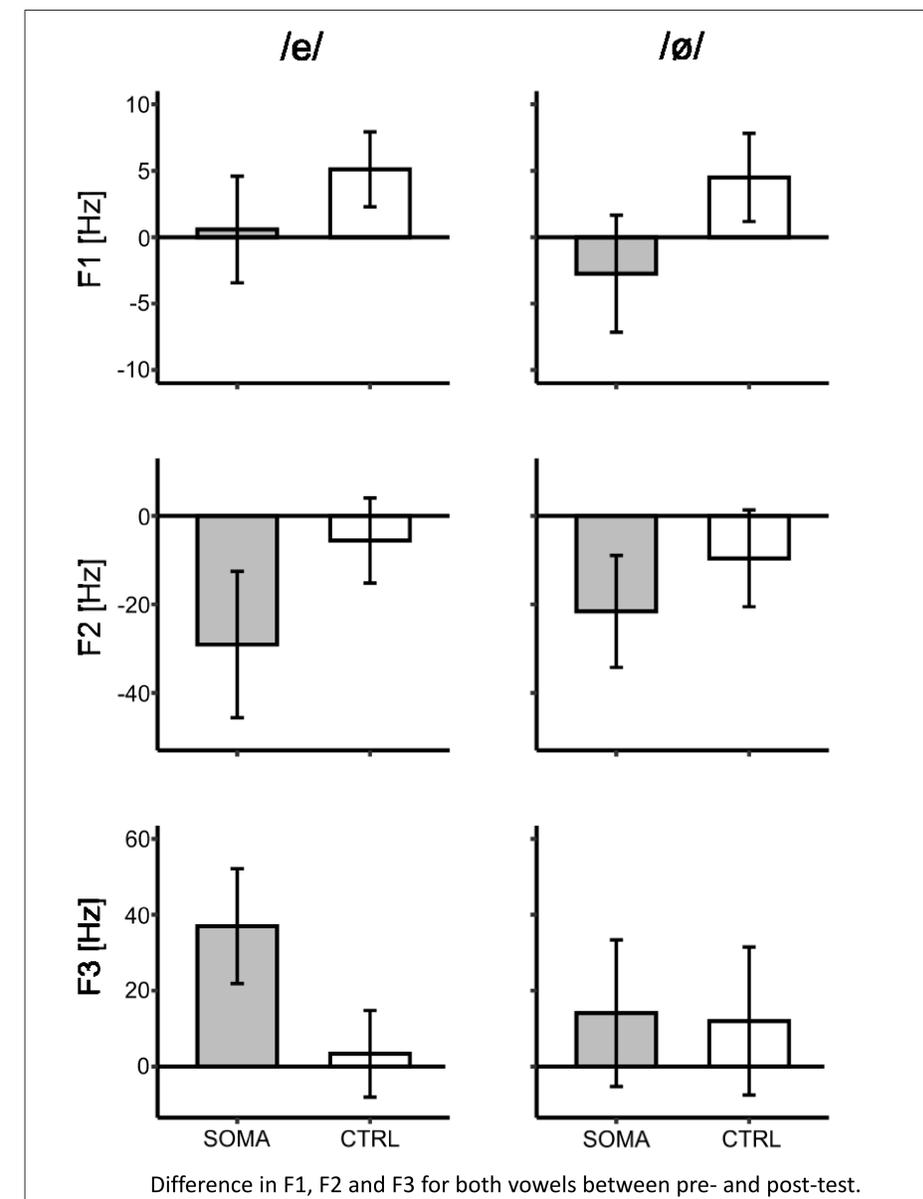
Experimental setup with somatosensory stimulation

Results



Representative Spectrogram of the words "dé" and "deux" in pre- and post-test

- F1 and F2 of vowels /e/ and /ø/ were not changed between pre- and post-test in both groups.
- F3 of the vowel /e/ in the post-training was increased in the SOMA group ($t(13) = 2.44, p < 0.05$), but not in the CTRL group ($t(13) = 0.29, p = 0.77$), while there were no significant difference for F3 in /ø/ in both groups.
- The increase of F3 in /e/ may be due to a change of articulatory movement, possibly with more lip spreading.



Conclusion

- Repetitive exposure to paired auditory-somatosensory stimulation resulted in a change in speech production performance after training.
- The results suggest that somatosensory inputs play an important role in speech learning.

Acknowledgements

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References

1. Nasir, S. M., & Ostry, D. J. (2009). Auditory plasticity and speech motor learning. *Proceedings of the National Academy of Sciences*, 106(48), 20470–20475. <https://doi.org/10.1073/pnas.0907032106>
2. Shiller, D. M., Sato, M., Gracco, V. L., & Baum, S. R. (2009). Perceptual recalibration of speech sounds following speech motor learning. *The Journal of the Acoustical Society of America*, 125(2), 1103–1113. <https://doi.org/10.1121/1.3058638>
3. Ito, T., & Ogane, R. (2022). Repetitive Exposure to Orofacial Somatosensory Inputs in Speech Perceptual Training Modulates Vowel Categorization in Speech Perception. *Frontiers in Psychology*, 13, 839087. <https://doi.org/10.3389/fpsyg.2022.839087>