Does the extent of acoustic variability prior to an auditory perturbation affect motor learning in speech production?

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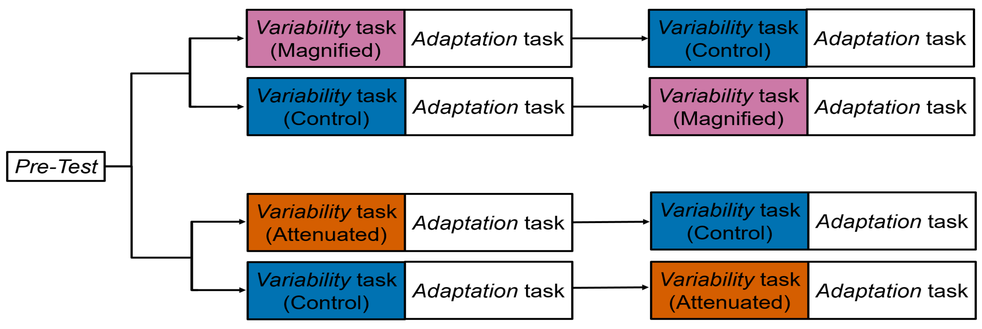
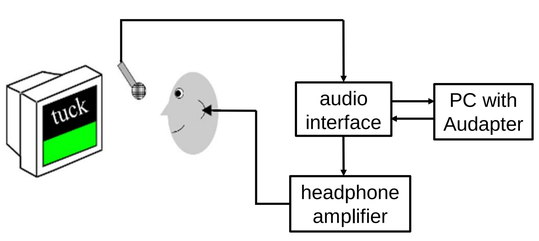
Introduction and Methods

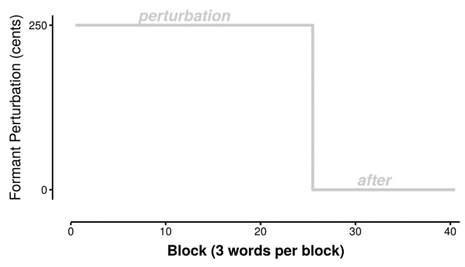
- It remains controversial how variability affects motor learning:
  - ✓ It has been argued that variability reflects workspace exploration that facilitates motor learning [1].
  - ✓ Others have disputed that argument and showed detrimental effects of variability on motor learning [2].
- Here, we tested how variability affects speech auditory-motor learning by artificially attenuating or magnifying the variability of auditory feedback prior to introduction of a formant-shift perturbation.

Experimental procedure



Perturbation implementation





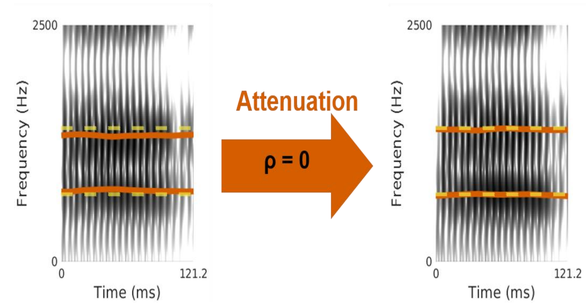
Variability manipulation

Difference between currently produced formant (F_c) and Pre-test formant median (F_m) scaled by a factor (ρ) in the feedback (F_{fb}):

$$F_{fb} = F_m + \rho \times (F_c - F_m)$$

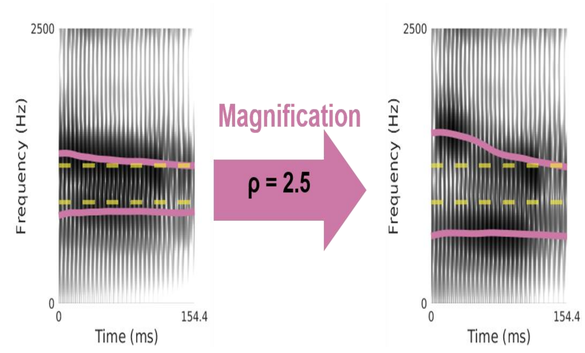
Attenuation

- $\rho = 0 \implies F_{fb} = F_m$
- Feedback formant fixed to Pre-test medians



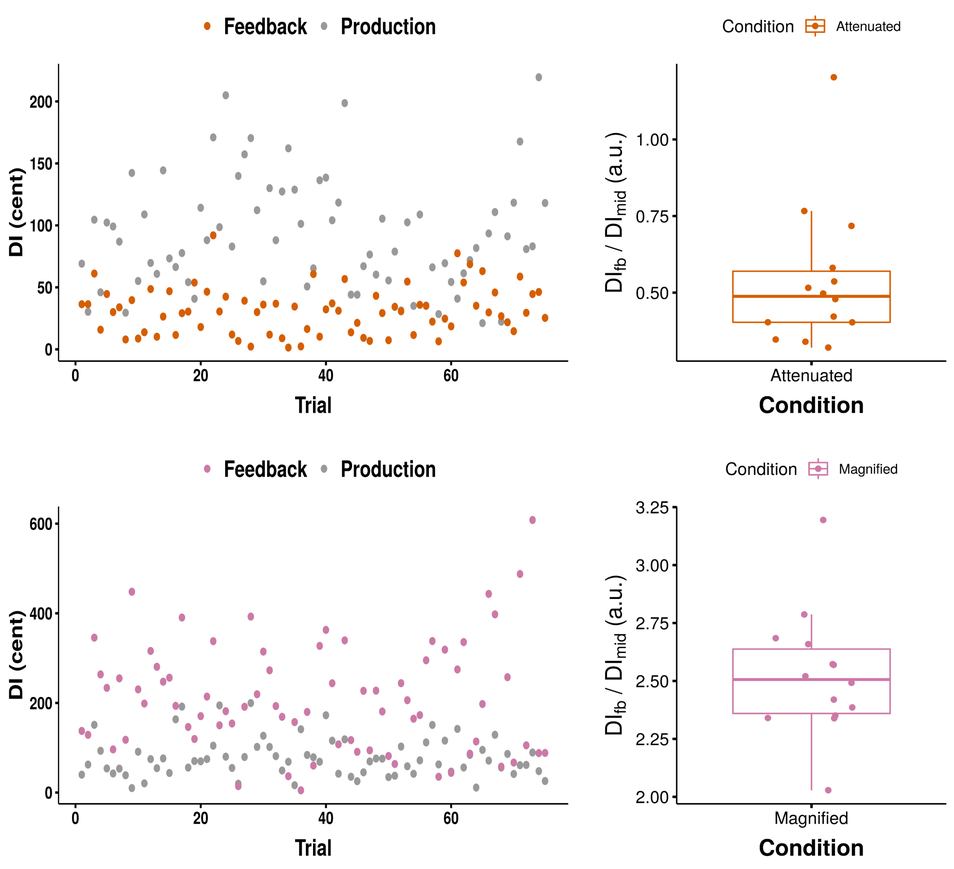
Magnification

- $\rho = 2.5$
- Difference between produced formant and Pre-test median increased by 250%

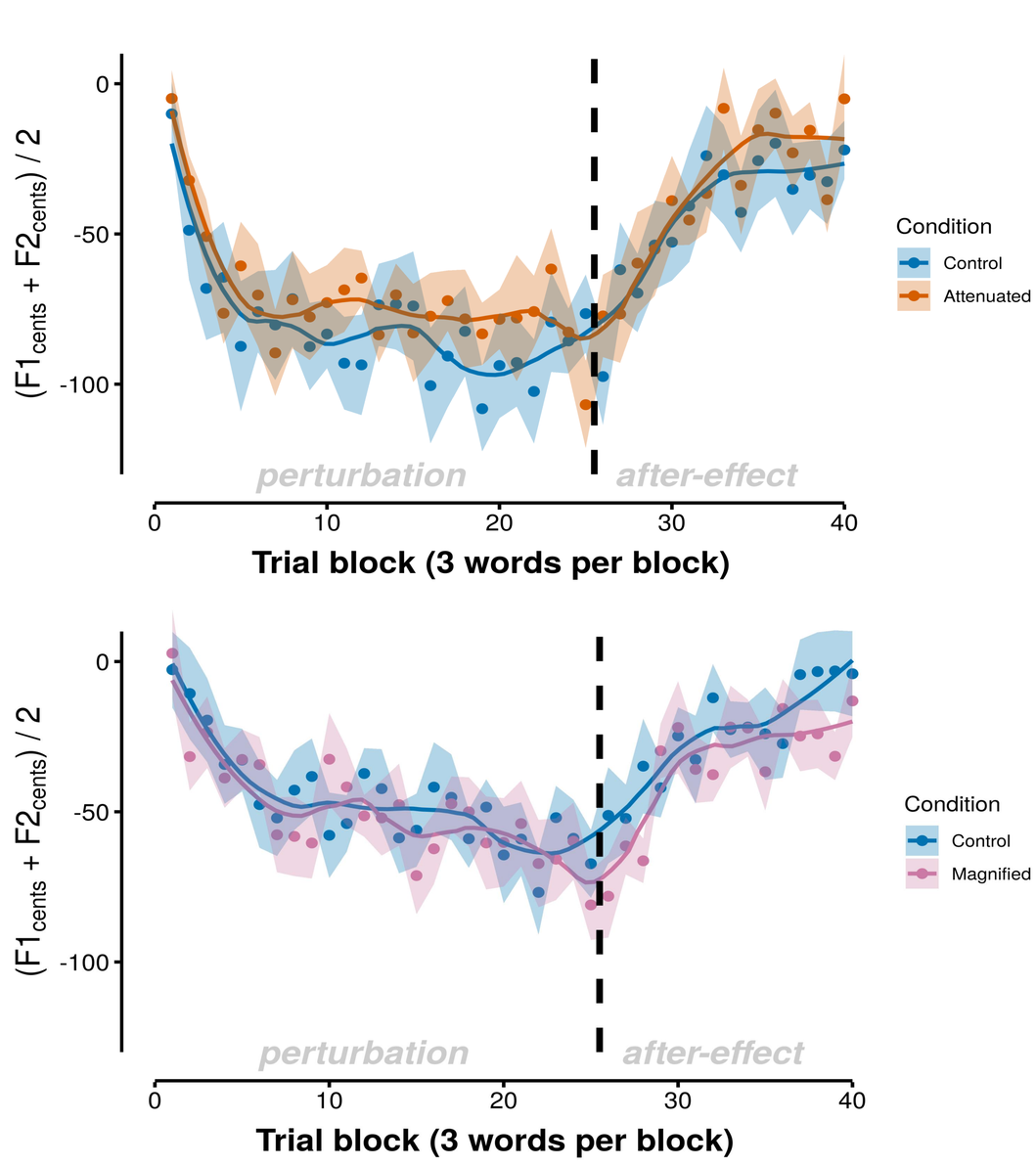


Results

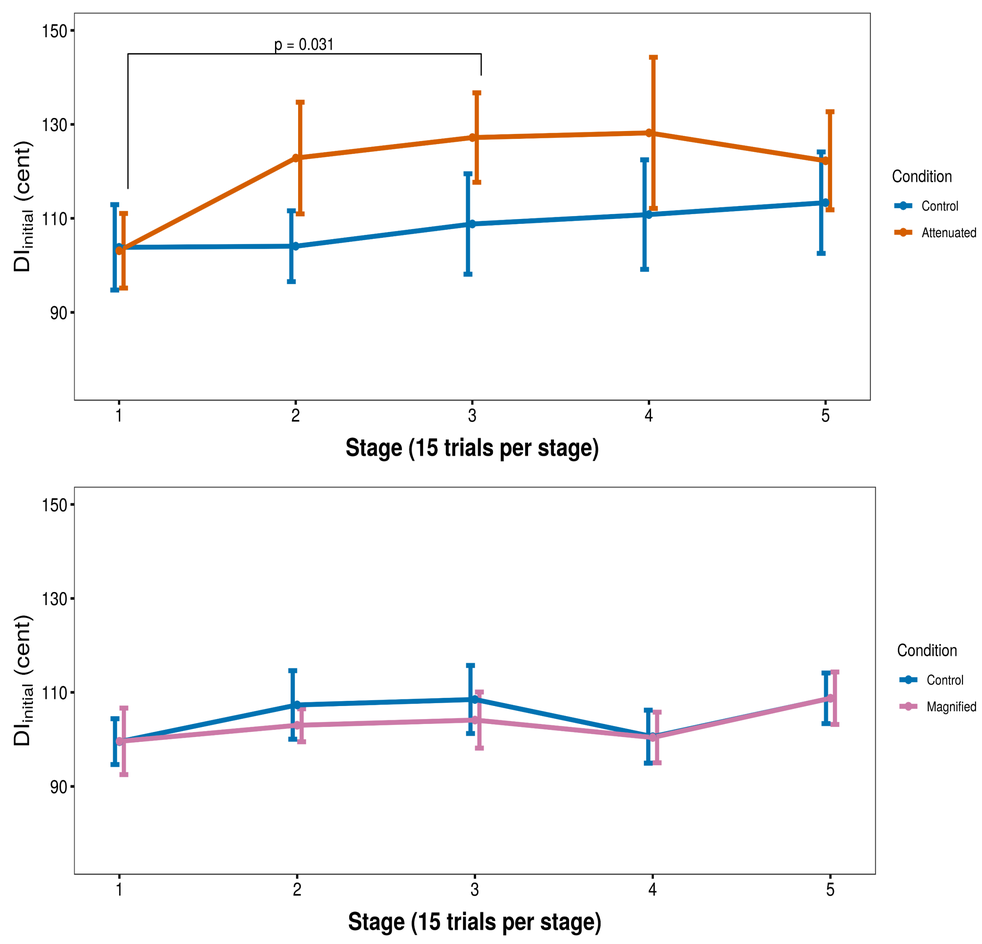
Feedback manipulation results



Manipulation of variability did not affect subsequent adaptation



Effect of feedback manipulation on production variability: do speakers regulate variability?



Conclusions

- The experimental manipulations (variability attenuation and magnification) achieved the desired effect on auditory feedback in the Variability task.
- Increase of production variability in the Attenuated condition may be consistent with the hypothesis that speakers actively regulate production variability based on feedback [3] [4].
- However, manipulating feedback variability had no effect at all on rate or amount of adaptation to a subsequent formant-shift perturbation.

References and Acknowledgment

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