Northwestern | COMMUNICATION

Auditory feedback control of vocal intensity during speech and sustained-vowel production

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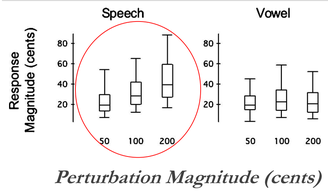
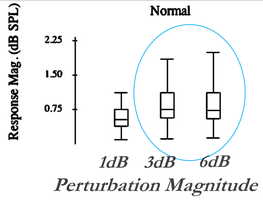
Background

The auditory feedback control system is more **sensitive to pitch errors during phrase than sustained vowel production** (Chen et al., 2007). For **loudness errors**, the auditory feedback control system is **more sensitive to larger than smaller loudness perturbations** in sustained vowel production (Bauer et al., 2006). These results suggest differences in the sensitivity of the speech production mechanism for phrase vs. vowel production and for the magnitude of the perturbation. The goal of this study was to examine the effect of speech task and perturbation magnitude on the reflexive intensity response.

Phrase vs. vowel (Chen et al., 2007)

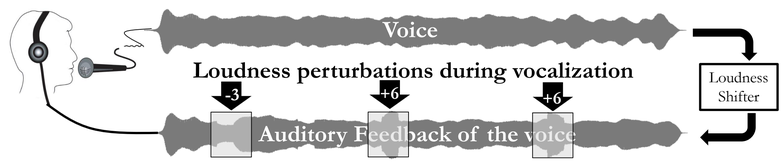


Intensity Responses (Bauer et al., 2006)



Methods

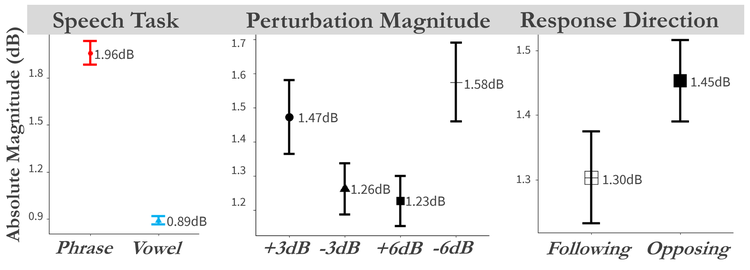
Twenty-six healthy, native-English speaking adults produced a **sustained vowel** ("aaa") or a **phrase** ("You know Nina?") while their voice output was **perturbed in loudness +/- 3 or 6dB SPL for 200 milliseconds** and fed back through headphones. We then measured the magnitude, latency, and direction of the difference wave (experimental wave – averaged control wave) of the reflexive intensity vocal response based on the speech task and perturbation magnitude. The difference wave was used to control for natural vocal variation.



The auditory feedback control system is more sensitive to **loudness errors** in phrase than sustained-vowel production.

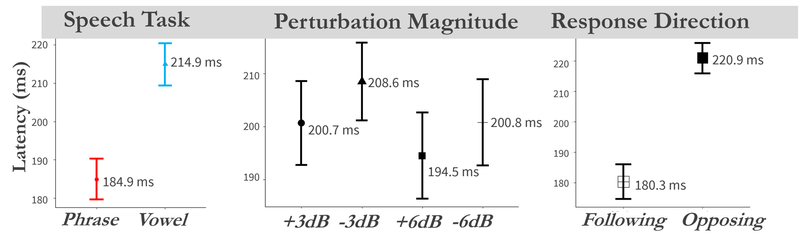
Intensity Response Magnitude

Reflexive intensity responses to the loudness perturbations. Main effects were significant for **absolute response magnitude by task** ($p < .0001$, $\eta^2 = 0.84$), **perturbation magnitude** ($p = .001$, $\eta^2 = 0.05$), and **response direction** ($p = .02$, $\eta^2 = 0.02$). Overall, responses were greater in phrase than in vowel production, for +3dB and -6dB perturbations, and for opposing than following responses.



Peak Intensity Response Latency

Main effects were significant for **peak response latency by task** ($p < .0001$, $\eta^2 = 0.15$) and **response direction** ($p < .0001$, $\eta^2 = 0.25$), but not perturbation magnitude ($p > .05$). Overall, peak responses were faster in phrase than in vowel production and for following than opposing responses.



Results & Conclusion

- **Intensity responses** were **larger and faster in phrase** than **sustained vowel production**
- **Perturbation magnitude** affected response magnitude but not latency
- **Opposing responses** were **larger in magnitude** with **later peak responses** than following responses

Overall conclusion: Auditory feedback control of loudness is more sensitive in phrase than in sustained vowel production