Breathiness in speech directed to 4-month-old infants

Anna Kohári[1], Uwe D. Reichel[1], Alexandra Markó[2,3] and Katalin Mády[1]

[1]Hungarian Research Institute for Linguistics, Budapest
[2]Eötvös Loránd University, Budapest
[3]MTA-ELTE „Lendület" Lingual Articulation Research Group, Budapest

Infant-directed speech

Speech entrainment

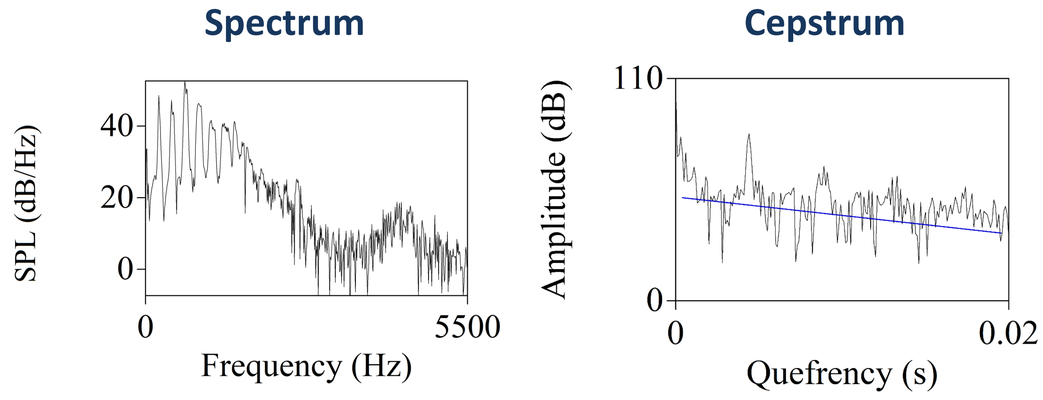
- mothers tend to speak differently to infants than to adults (Saint-Georges et al. 2013, Mady et al. 2018)

The characteristics of motherese or infant-directed speech (IDS)

- prosody (e.g. higher fundamental frequency)
- timing (e.g. slower speech rate)
- sparse data available on the voice quality features
- breathier voice in Japanese speech directed to 20-month-old infants (Miyazawa et al. 2017)

Questions

- Is IDS **breathier** in other languages as well?
- Is this feature of IDS already present in the first year of the infants' lives?

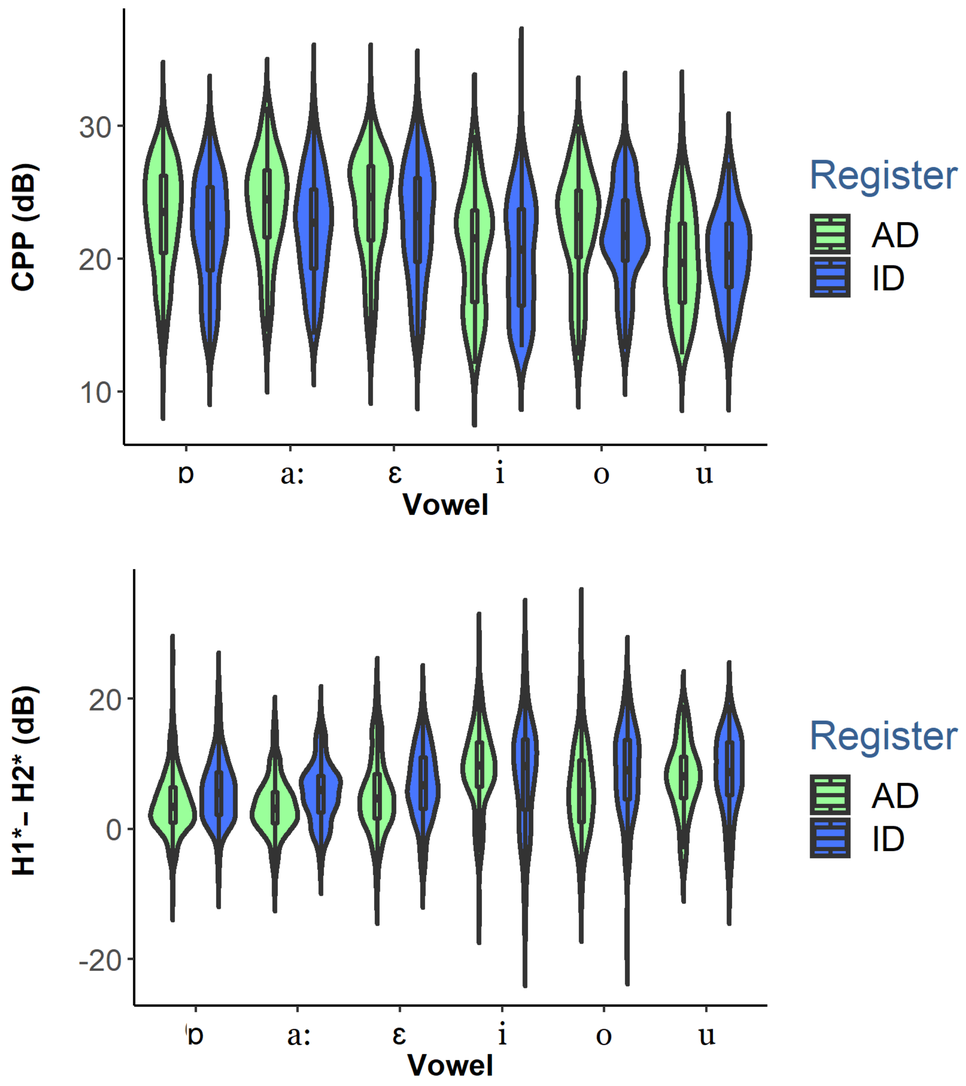


Results

- **CPP** values were **lower in IDS** ($p < 0.05$) indicating that vowels are less modal, except in the cases of /i/ and /u/
- **higher** values of **H1*–H2* in IDS** also indicating breathy voice, except in the cases of /i/ and /u/
- HNR metrics unaffected by the registers

Material and methods

- **20 Hungarian** primiparous (giving birth for the first time) **mothers**
- half-spontaneous speech, story telling based on a book
- 9 read sentences (7-9 syllables) without disfluencies
- two registers:
  - to an adult (ADS)
  - to her own infant (IDS)
- **6 vowels** (/ɒ/, /a:/, /ɛ/, /i/, /o/ and /u/) at least 5 tokens
- vowel segment boundaries corrected manually (Praat 6.0)
- the mid third of each vowel was analyzed
- statistical analysis (R 3.4.3) – (random slope) **mixed-effect models**
- separate mixed effect models for each vowel
- dependent variables the voice quality parameters; independent variables the registers; random factor the speaker (and random intercepts by items)



Investigated parameters

- measured voice quality parameters using VoiceSauce (Shue et al. 2011):
  - cepstral peak prominence (**CPP**)
  - the difference between the first two spectral harmonic magnitudes (H1−H2) and its formant-corrected version (**H1*–H2***)
  - harmonics-to-noise ratios (**HNRs**) in various frequency bands (0–500Hz, 0–1500Hz, 0–2500Hz)

Conclusions

- IDS characterized by **breathier voice** than ADS
- breathy voice was markedly detectable in the early months of the infants' age
- lack of IDS-ADS differences in /i/ and /u/ due to the surrounding consonants or vowel height
- high vowels tend to have higher H1*–H2* (Esposito et al. 2019), which may blur voice quality differences between the two registers
- **expression of positive emotions** – a main function of IDS prosodic features (Saint-Georges et al. 2013)
- expressions of strong positive emotions – breathiness (Bartók 2018, Wang et al. 2018)

Acknowledgments

This work was supported by the Hungarian National Research, Development and Innovation Office (NKFIH) under grant 'The neurocognitive aspects of early language development' (no. NKFI-115385) and 'Longitudinal study of infant-directed speech using multimodal methods' (no. NKFI-134775).

Contact

Anna Kohári
kohari.anna@nytud.hu

References

1. Saint-Georges, C., Chetouani, M., Cassel, R., Apicella, F., Mahdhaoui, A., Muratori, F., Laznik, M-C., & Cohen, D. (2013). Motherese in interaction: at the cross-road of emotion and cognition?(A systematic review). PloS one, 8(10), e78103.
2. Mady, K., D Reichel, U., Szalontai, A., Kohari, A., & Deme, A. (2018). Prosodic characteristics of infant-directed speech as a function of maternal parity. In 9th International Conference on Speech Prosody 2018 (pp. 294–298).
3. Wang, T., Lee, Y. C., & Ma, Q. (2018). Within and Across-Language Comparison of Vocal Emotions in Mandarin and English. Applied Sciences, 8(12), 2629.
4. Miyazawa, K., Shinya, T., Martin, A., Kikuchi, H., & Mazuka, R. (2017). Vowels in infant-directed speech: More breathy and more variable, but not clearer. Cognition, 166, 84-93.
5. Shue, Y.-L., P. Keating , C. Vicenik, K. Yu (2011) VoiceSauce: A program for voice analysis, Proceedings of the ICPhS XVII, 1846-1849.
6. Garellek, M. (2019). The phonetics of voice. The Routledge handbook of phonetics, 75-106.
7. Esposito, C., Sleeper, M., & Schäfer, K. (2019). Examining the relationship between vowel quality and voice quality. Journal of the International Phonetic Association, 1-32.
8. Bartók, M. (2018). A gégeműködés variabilitása az érzelemkifejezés függvényében. Beszédkutatás, 26(1), 30-62.