Spectral properties of breathy and falsetto voices

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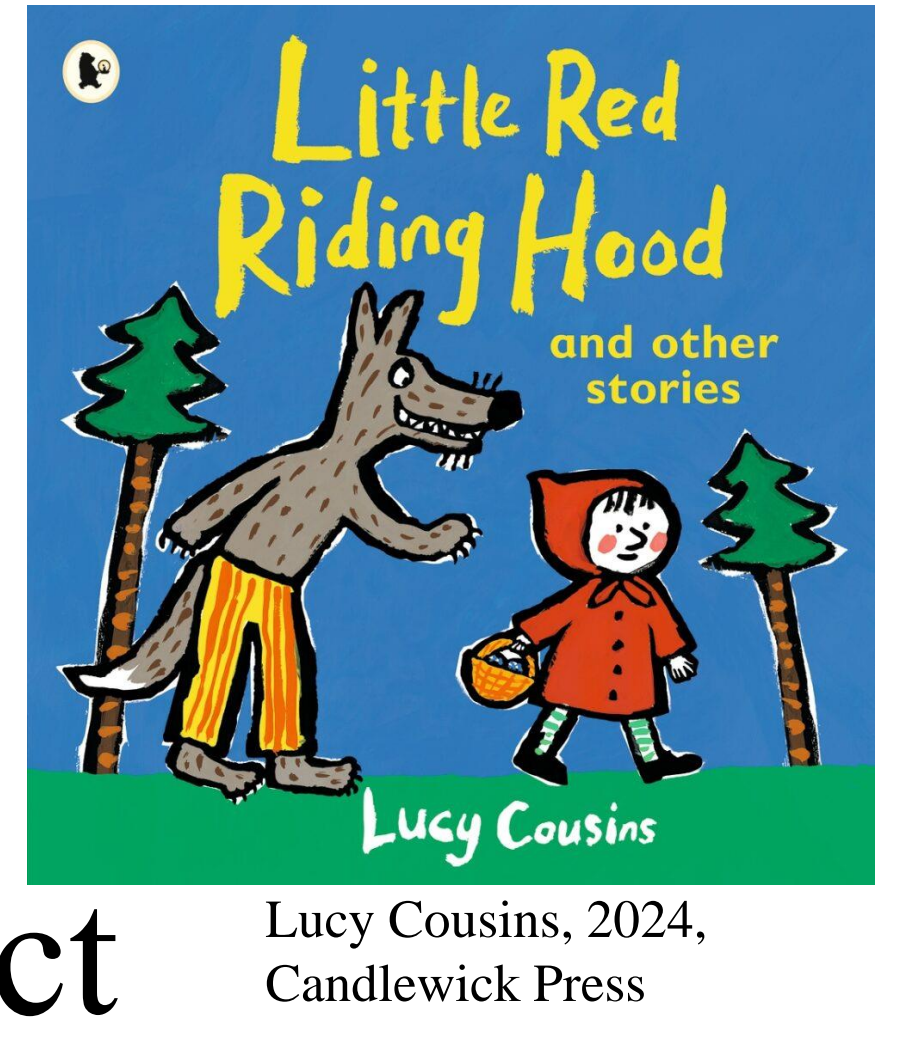[1]yuanchai@uw.edu

Corpus Description (Scan QR code for script and data)

- **Research questions:**
  - What are the spectral profiles for breathy [1,2] vs. falsetto [3,4,5] voices?
- **Corpus:**
  - *Little Red Riding Hood* story narration in Mandarin
  - UCLA "Production and Perception of Linguistic Voice Quality" project
  - 19 speakers (10 women, 9 men)
  - Used different voices for different characters
- **Annotation:**
  - **1033** vowel tokens annotated for phonation (breathy, falsetto, modal), vowel quality, environment
    - **Example:** falsetto-O-O-ai
      Phonation-Oral/Nasal before-Oral/Nasal after-Vowel

Lucy Cousins, 2024, Candlewick Press

vowel or not	V	
target	falsetto-O-O-ai	
phone	l	ai2
word	来	

- **Data processing:** VoiceSauce [6] for harmonic energy, formants, f0
- **Error detection:** plot f0 and formant tracks, manual exclusion
  - **f0**: 4 tokens excluded, **formant**: 135 tokens excluded, 117 tokens shortened
- **Tokens for analysis:** breathy: 119; falsetto: 222; modal: 553

VoiceSauce Modification

- **Modified** VoiceSauce formula for correcting harmonics for formant effects [7]
 - to avoid formant correction **boosting** the harmonic energy
- **Newly added parameters** to provide additional harmonic amplitude measures beyond the Kreiman et al. model of the source spectrum [8, 9]
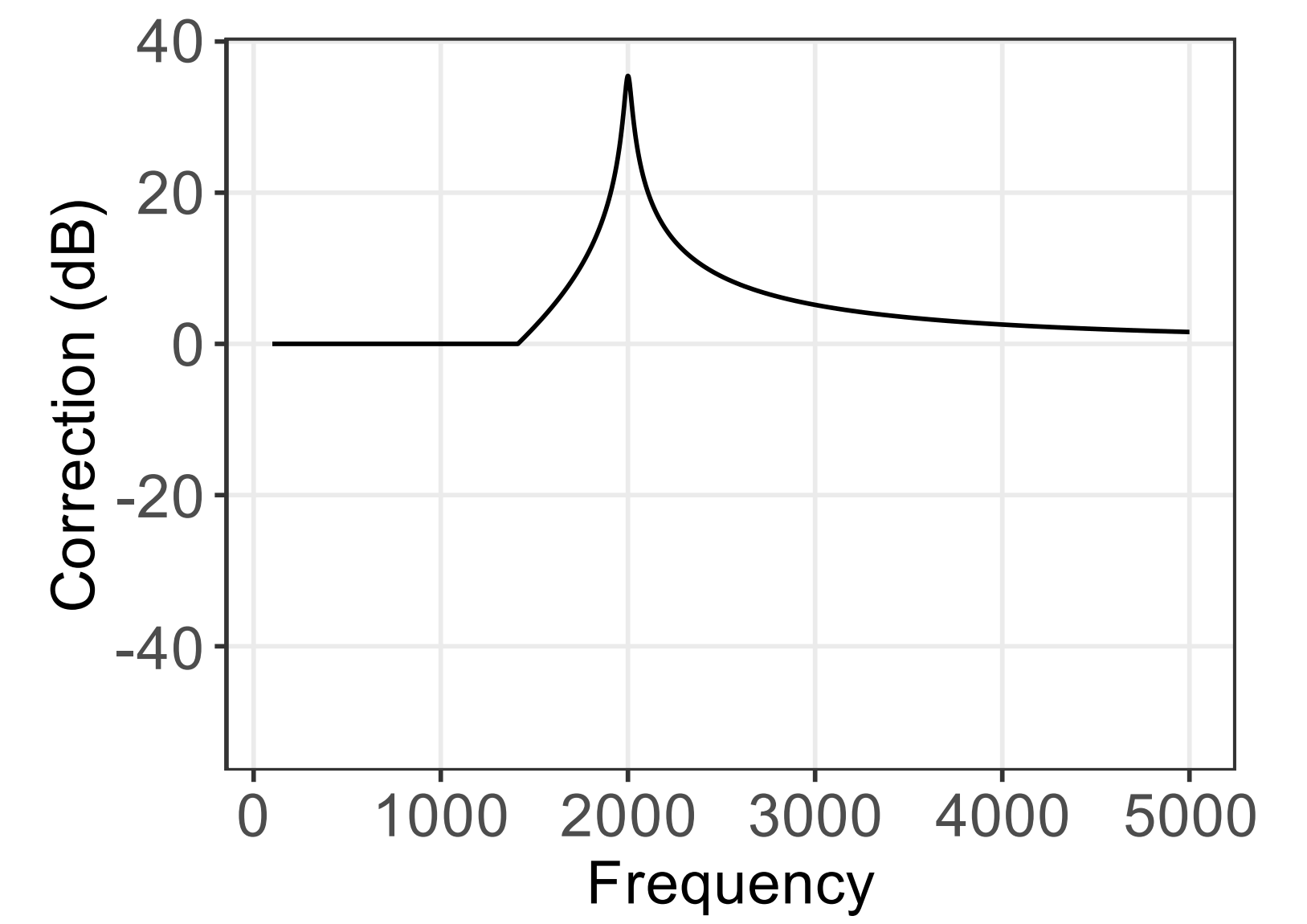- **Modified** and **newly added** parameters:
  - H1*, H2*, H3*, H4*, H1K*, H2K*, H3K*, H4K*, H5K*

Harmonic	Formant corrected
H1*, H2*, H1K*, H2K*	F1, F2, F3
H3*, H4*	F1, F2, F3, F4
H3K*	F2, F3, F4
H4K*, H5K*	F3, F4, F5

VoiceSauce correction on **H2K** for **formants** from **100** to **5000** Hz
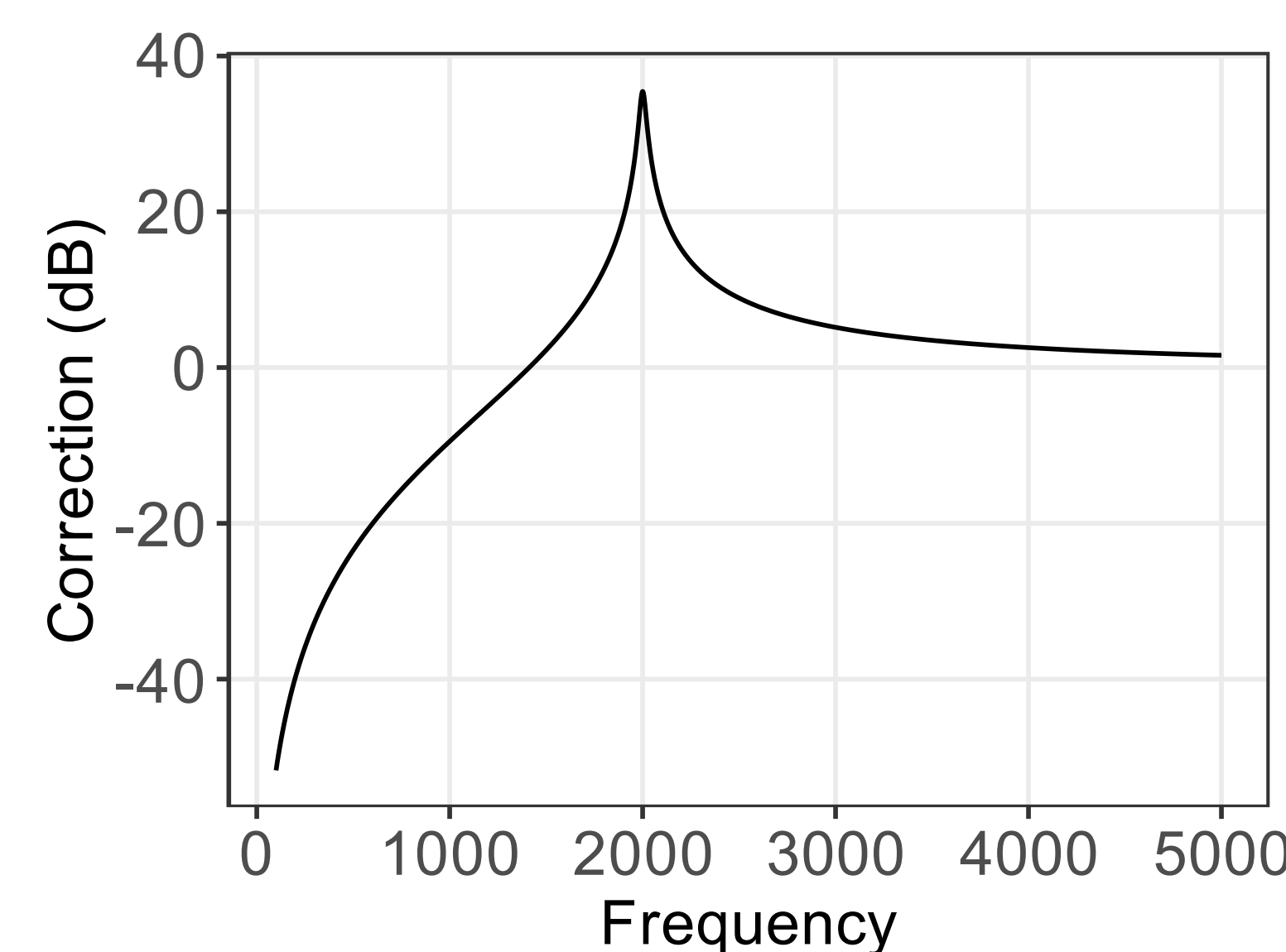
After **modification**, correction on **H2K** for **formants 100** to **5000** Hz

Results and Conclusion (Scan QR code for references)

Harmonic amplitude of H1, 2*, 3*, 4*, 1K*, 2K*, 3K*, 4K*, 5K**

Harmonic amplitude of H1 and 5K**
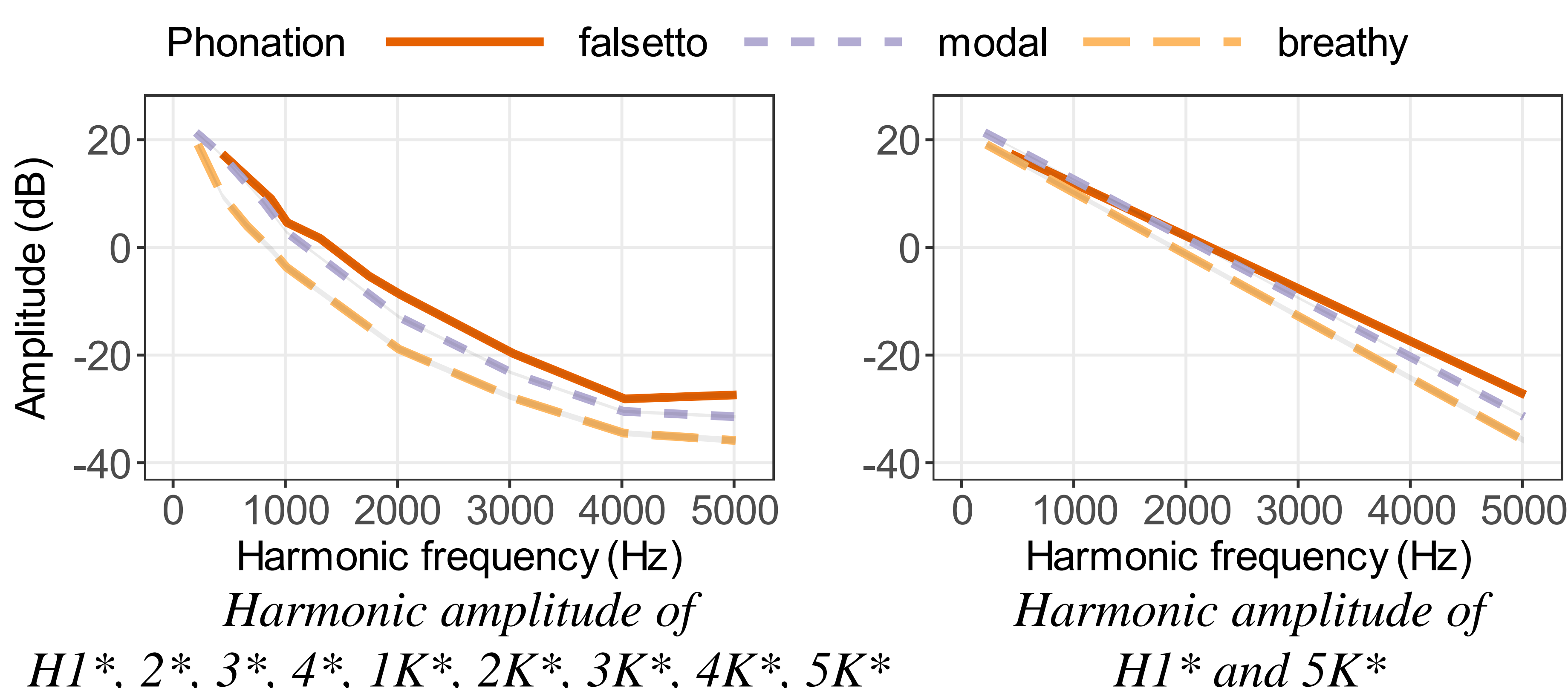
	falsetto	breathy	modal
H1*–H2* (dB)	8.4	9.6	3.7
H1*–H5K* (dB)	44.8	55	52.8

- **Falsetto** voice has **higher energy** in **high frequencies** compared with breathy voice.
  - **Falsetto** voice has the **shallowest H1*–H5K*** slope compared with breathy and modal voices.