

Creaky voice perception modulated by f0 and gender cues



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1. BACKGROUND

The production-perception mismatch

- Acoustic studies of creak find that **men are creakier than women** (e.g., Brown & Sonderegger, 2024; Klatt & Klatt, 1990)
- However, **current impressionistic** studies of creak find that **women are creakier than men** (e.g., Podesva, 2013; Yuasa, 2010)

Creaky voice perception does not reliably reflect creaky voice acoustics

Acoustic bias hypothesis

Because creaky voice is produced at a low pitch, it is more salient when a speaker has a higher habitual (modal) pitch and therefore, a **larger creak-to-modal pitch differential**.

Gender bias hypothesis

Listeners are biased to assume that creak is **more common in women's speech** compared to men's.

Systematic studies of creaky voice perception

Davidson (2019)

- 54 AmE listeners (v.1 24F, 29M, 20, 22-60yo; v.2 15F, 34M, 60, 23-61yo)
- Social expectation: Women are creakier
- Natural speech
- Binary creak identification
- Voices: hi-f, mid-f, mid-m, lo-m

No robust evidence for the acoustic bias, nor gender bias

White *et al.* (2024)

- 258 AusE listeners (130F, 128M, 17-55yo)
- Social expectation: Women are creakier
- Manipulated speech
- Binary creak identification
- Voices: hi-f, mid-f, mid-m, lo-m

Pitch given gender bias

Li *et al.* (2023)

- 40 Mandarin listeners (8M, 33F, 19-36yo)
- Social expectation: No gender difference
- Lab speech
- Binary creak identification
- Voices: hi-f, lo-m

No support for the acoustic bias, nor gender bias

Lowest-pitch male modal voices increase creak identification rates!

2. RESEARCH QUESTION

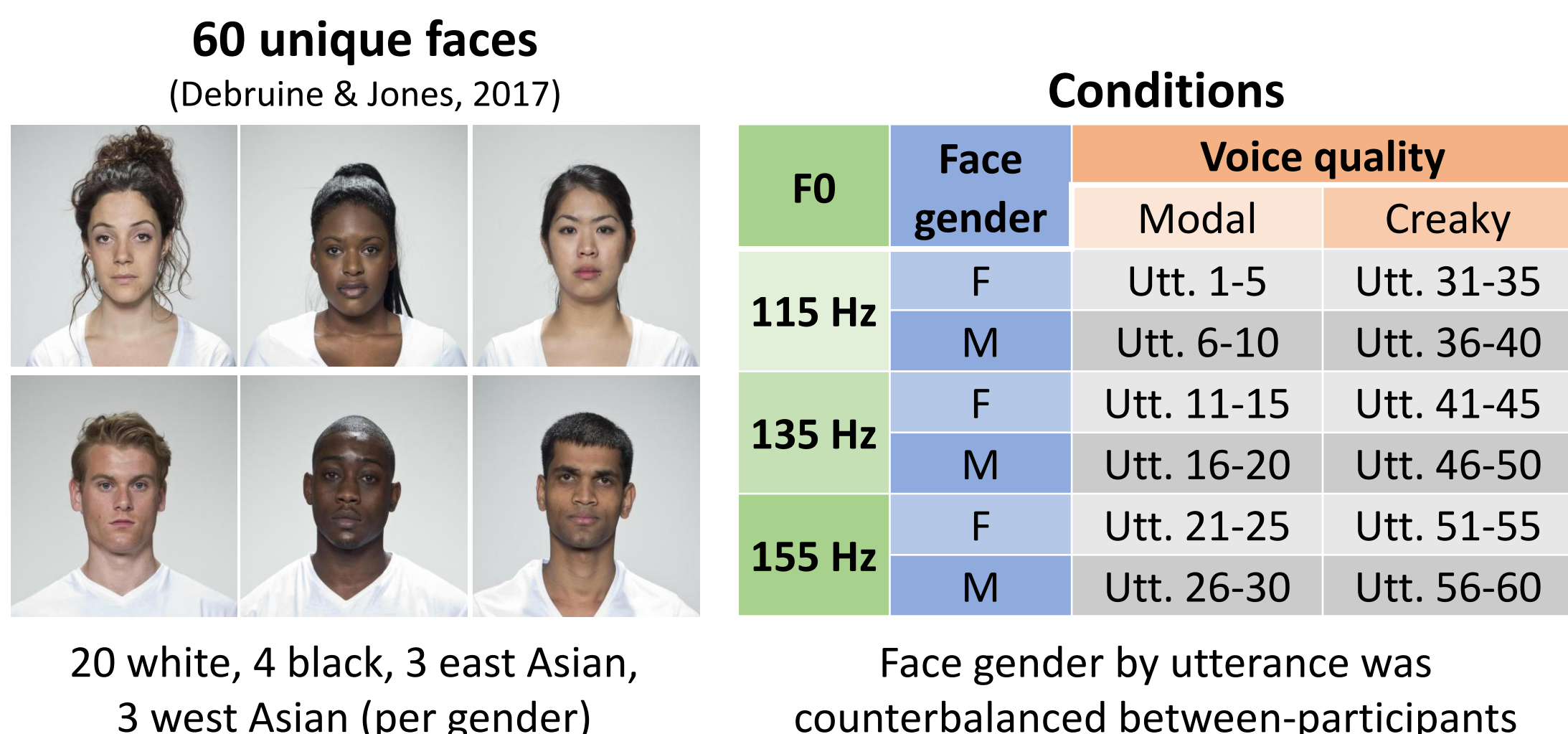
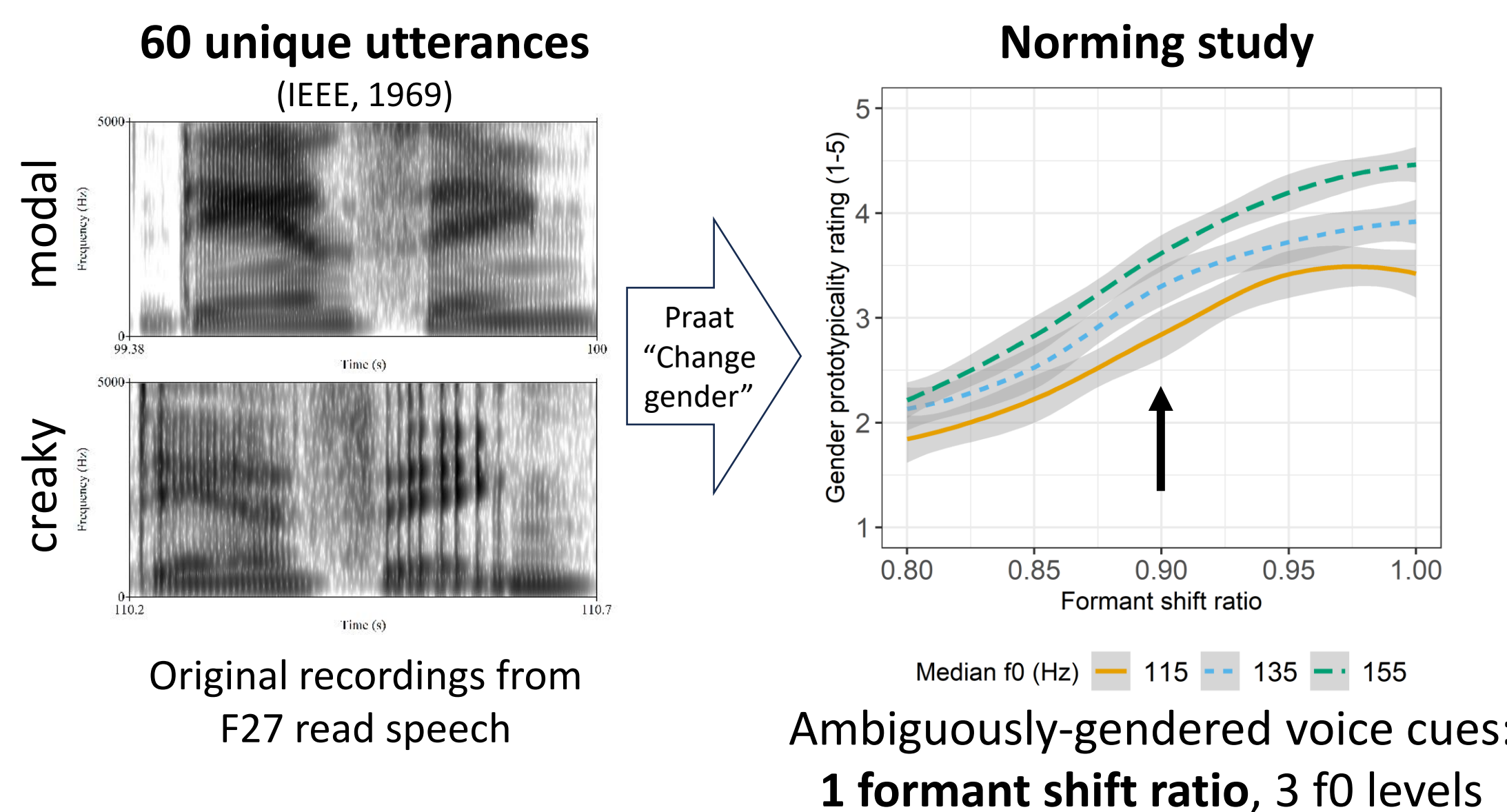
Goal

Isolate the **acoustic effect** from the **social effect** to determine whether either or both contribute to a perceptual asymmetry

Do **voice f0** and **visual face gender** both independently show quantifiable effects on creaky voice perception in Canadian English?

3. METHOD

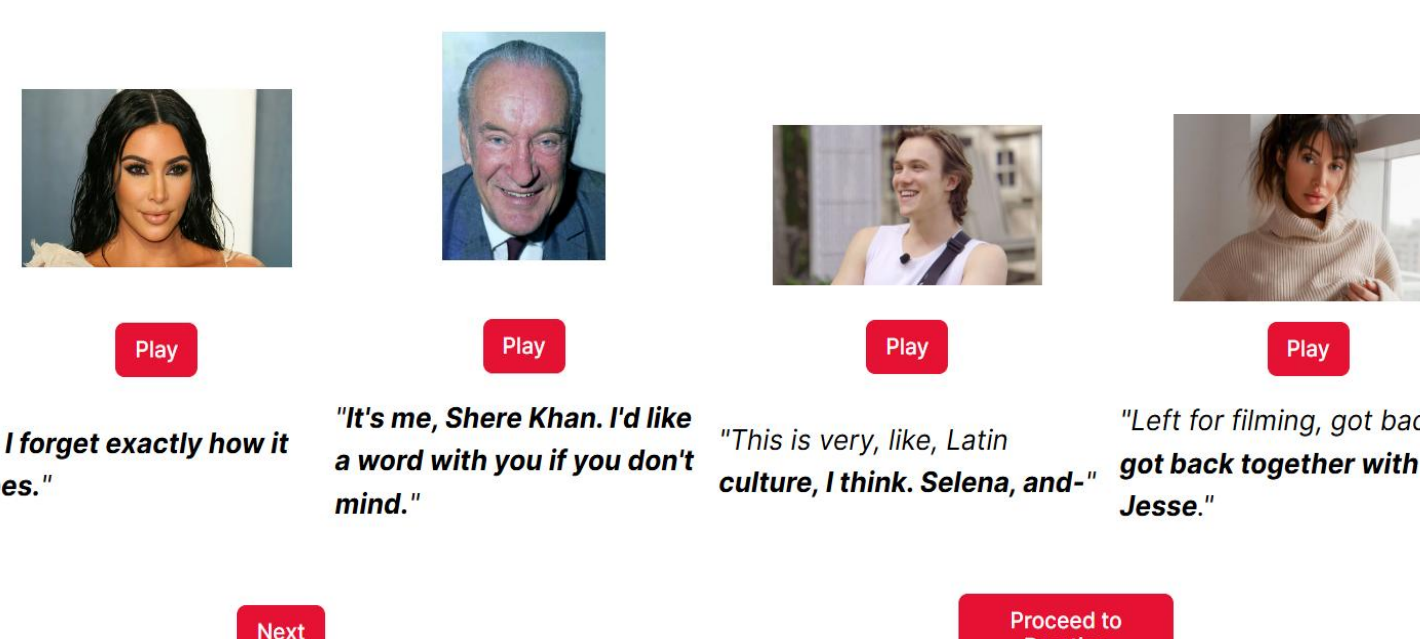
Stimuli



Experimental design

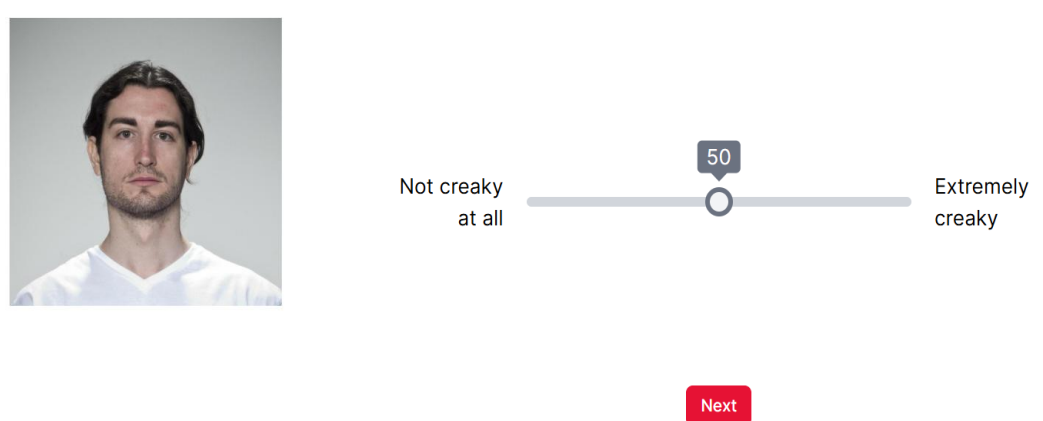
Training

- Broad description of creaky vs. modal voice
- 2 stereotyped examples
- 2 local examples



Creakiness rating task

- 60 trials
- Matched-guise (Strand & Johnson, 1996)
- VAS slider from 0-100



Participants

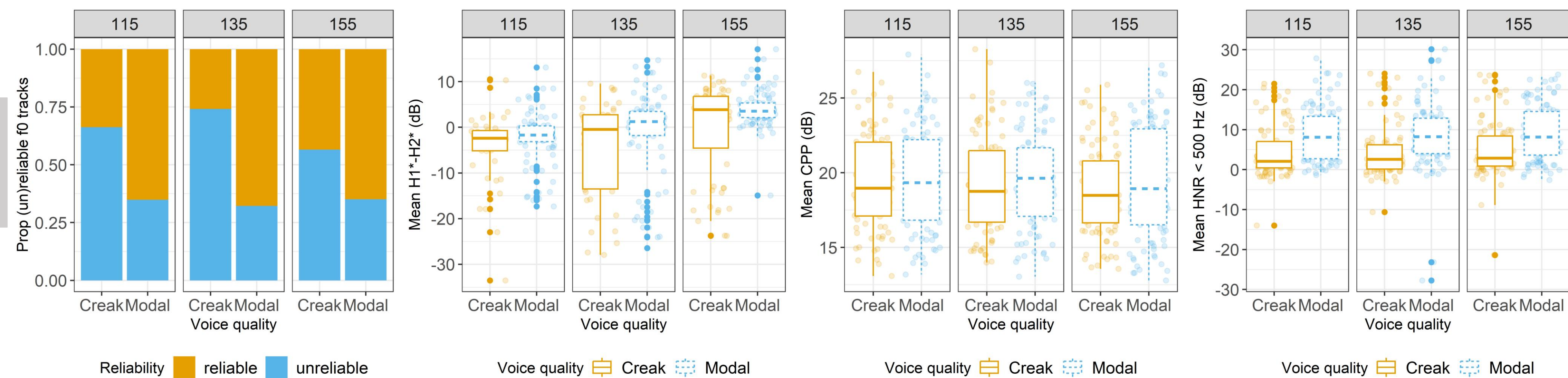
- 40 CanE listeners
- 14 F, 26 M
- 18-71 years old (median age: 32)

Statistical analysis

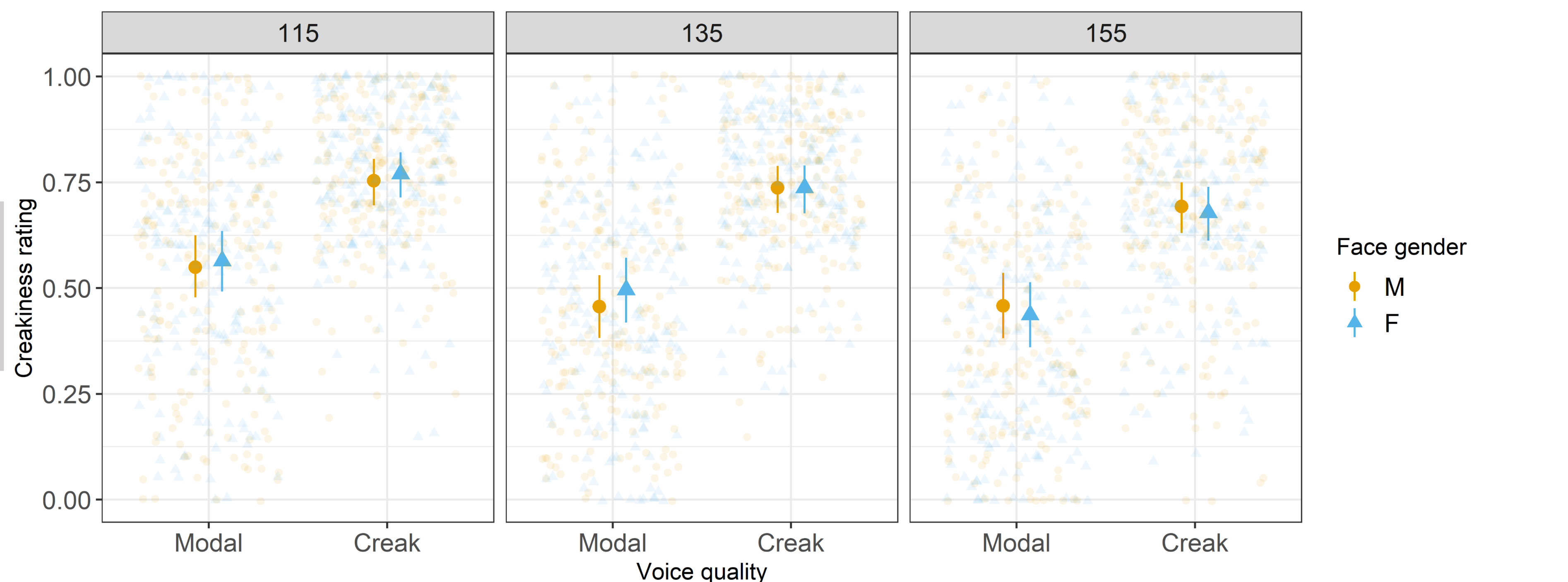
Bayesian zero-one-inflated beta regression
prior(1kj(1.5), class=cor)
Formula: Response_prop ~ VQ * f0 * FG + (1 + VQ*f0*FG | Participant) + (1 + FG | Utterance) + (1 + VQ*f0 | Face),
phi ~ 1 + (1 | Participant),
coi ~ 1 + (1 | Participant),
zoi ~ 1 + (1 | Participant)

4. RESULTS

Acoustic correlates of creak



Predicted creakiness ratings



Summary of results	Creakiness ratings		Hypothesis tested	Hypothesis predictions
	155 Hz < 135 Hz < 115 Hz		Acoustic	low-f0 < high-f0
	M < F	M < F	F < M	M < F

Voice quality

Listeners can consistently **distinguish creaky from modal** voice.

(creak-modal: $\hat{\beta} = 1.04$, $\hat{\sigma} = 0.12$, CI = [0.80, 1.30])

F0

Low pitch is closely related to perceptual creakiness, even within a relatively restricted range.

(135Hz-115Hz: $\hat{\beta} = -0.12$, $\hat{\sigma} = 0.05$, CI = [-0.22, -0.02];
155Hz-(135Hz+115Hz): $\hat{\beta} = -0.10$, $\hat{\sigma} = 0.03$, CI = [-0.16, -0.04])

Face gender

No effect in isolation.

(F-M: $\hat{\beta} = 0.03$, $\hat{\sigma} = 0.03$, CI = [-0.04, 0.10])

Face gender priming only weakly influenced creakiness ratings in interaction with f0 values.

(facegender*155Hz-(135Hz+115Hz): $\hat{\beta} = -0.05$, $\hat{\sigma} = 0.02$, CI = [-0.10, -0.01])

A **female face** might prime increased creakiness perceptions for **lower-pitched voices**, but a **male face** might prime increased creakiness perceptions for **higher-pitched voices**.

5. DISCUSSION

Why do we consistently fail to find increased creak perception in women's voices?

Limitations	Validity of measures	Expectation, awareness, salience
- Participants not convinced by the faces - CanE listeners may not show the same biases as AmE listeners - Stereotypes associated to persona rather than just voice quality	- What if we aren't actually measuring creak perception? - Lack of consensus on the relevant acoustic measures - Confirmation bias in impressionistic studies	- Stereotypes vs. markers vs. indicators (Labov, 1972) - Sociolinguistic "bullet-proofing" (Campbell-Kibler, 2009) - Perceptual normalization (Drager & Kirtley, 2016)

6. ACKNOWLEDGEMENTS & REFERENCES

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