

Perception of Talker Height in Children's Productions of Sustained /a/



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INTRODUCTION

Children's voices reflect changes in physical size as they grow. At a previous ASA meeting¹, we showed that adult listeners can estimate the height of child talkers, ages 5-18 years, from /hVd/ syllables. The present study focuses on listener judgments of child talker height from sustained /a/ vowels, which lack durational cues and transitions between phonological segments.

QUESTIONS

What **acoustic variables** do listeners use to judge talker height from excerpts of children's productions of sustained /a/?

How do **listener judgments of talker gender**² affect perception of talker height?

DATA

Stimuli: 1-s excerpts from sustained /a/ productions. 1 token per talker. Selected for stable amplitude & FO.

Talkers:

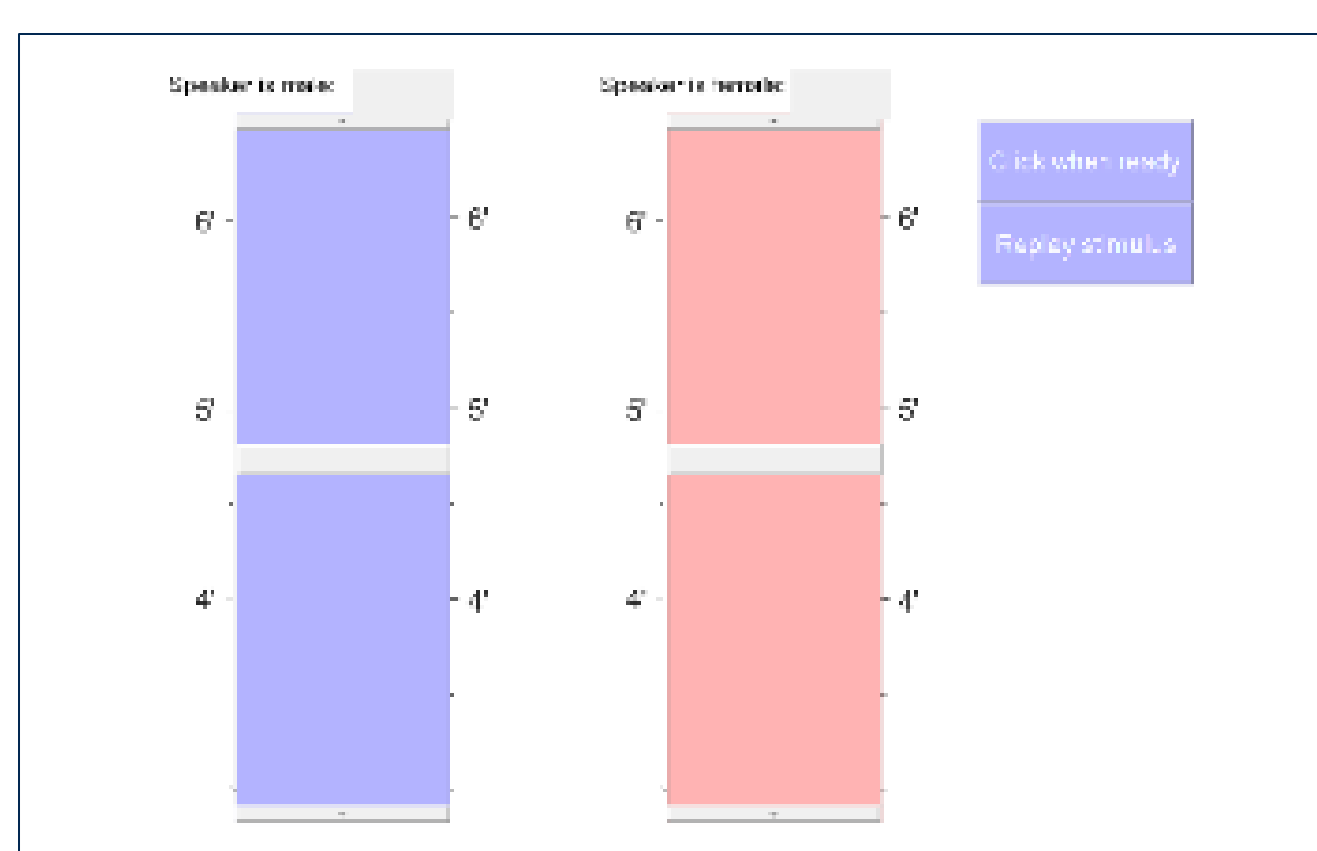
- 174 children. 92 males; 82 females.
- 5-18 years of age. 9-16 children per year of age.
- Distribution of height at each age did not differ from population means provided by the CDC.

Listeners: 18 UG students at UT Dallas.

PROCEDURE

- Stimuli were:
 - randomized for each participant.
 - presented monaurally over headphones using Tucker-Davis System 3 and RP2.1 hardware.

Listeners used a Matlab user interface (left) to play the audio & indicate height and sex of the talker on each trial.

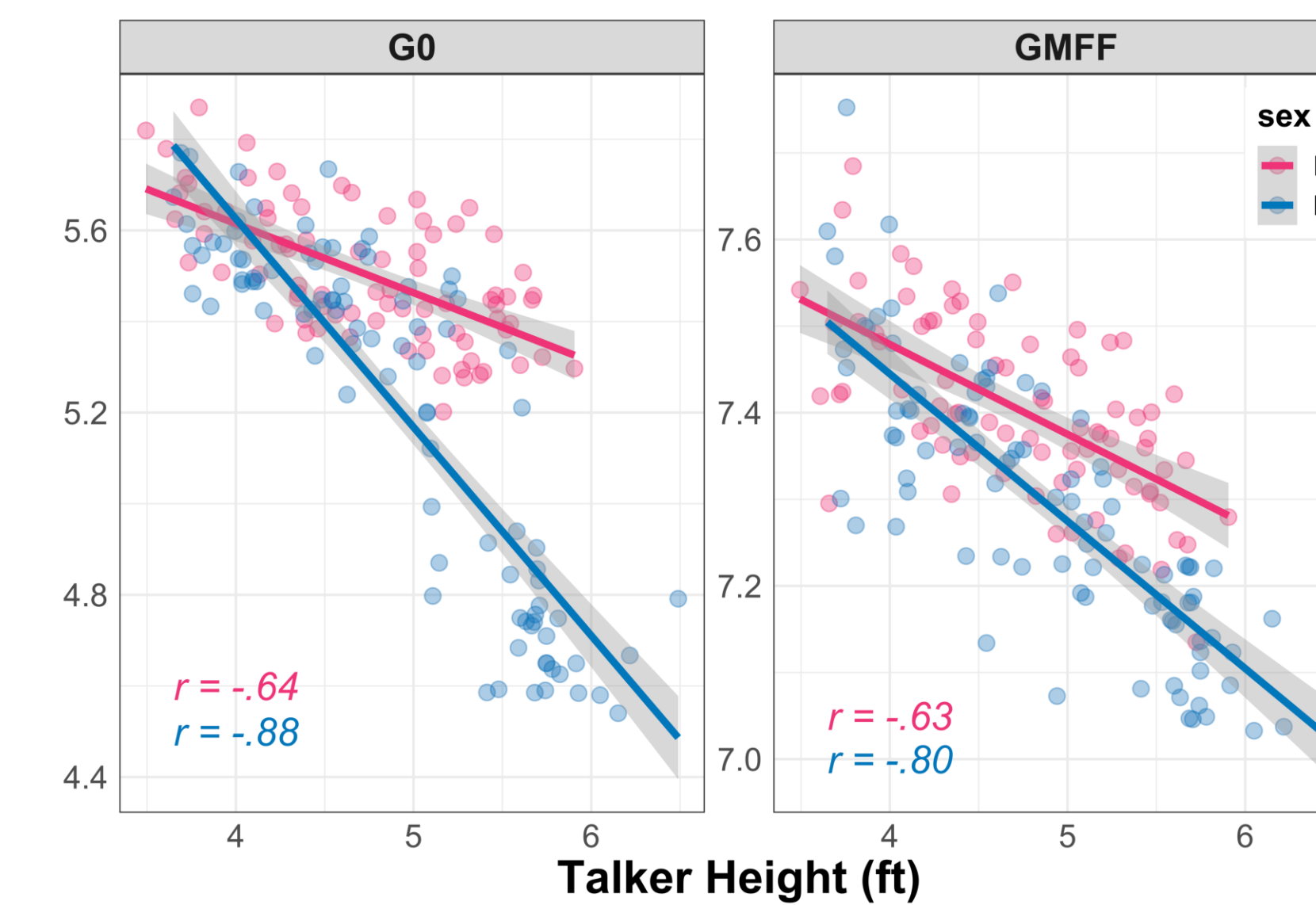


ACOUSTIC ANALYSIS

Acoustic properties previously shown¹ to be related to talker height in children were estimated for each stimulus:

- Log-transformed mean FO (GO) estimated using STRAIGHT.³
- Formants 1-4 estimated with the Nearey formant tracker,⁴ and hand-corrected with TrackDraw.⁵
- Geometric mean of first 3 formants (GMFF) computed in R.⁶
- Both variables summarized by median for each token.

GO & GMFF were negatively correlated with veridical talker height.

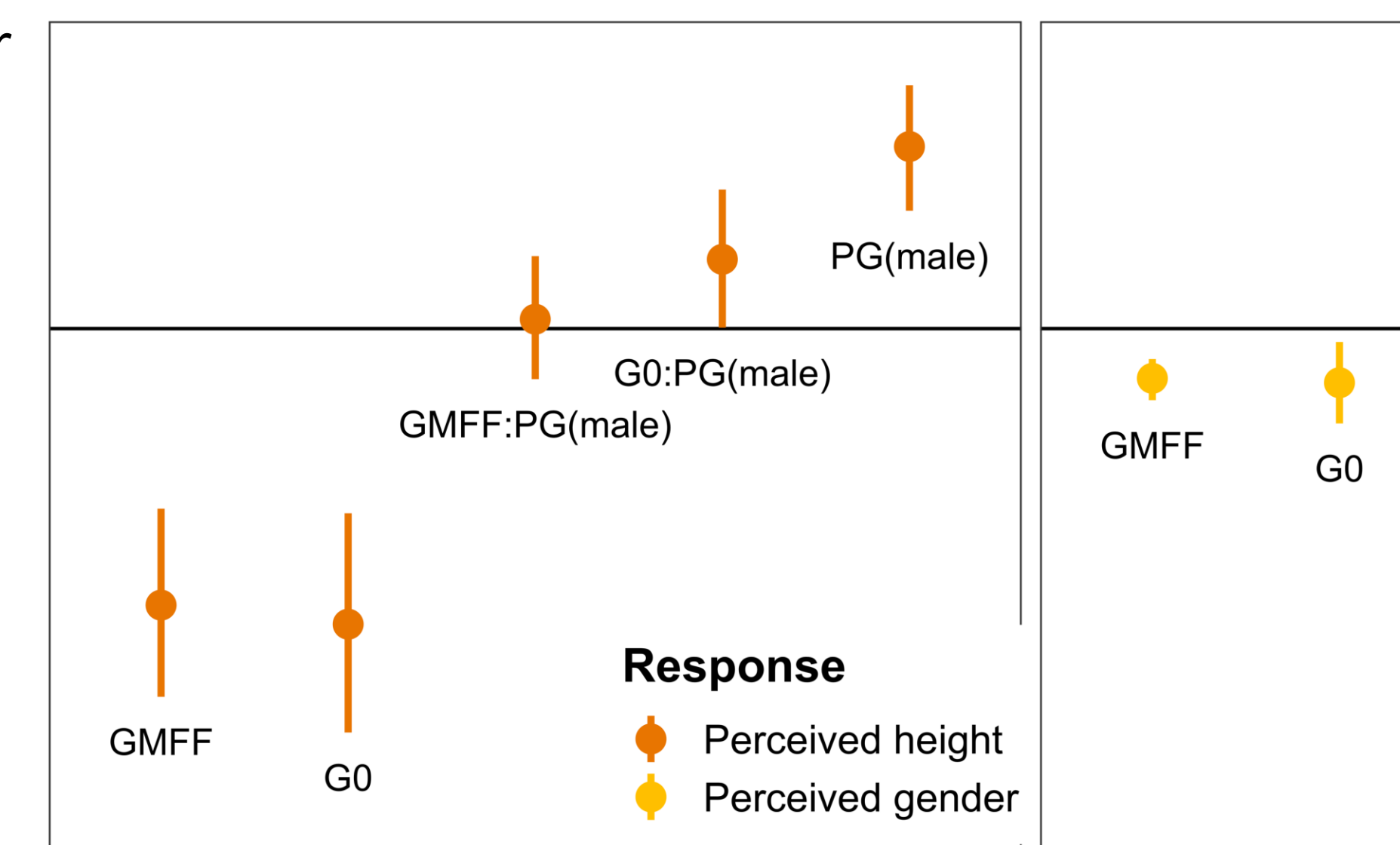


MODEL 1: LISTENER JUDGEMENTS OF TALKER HEIGHT & GENDER

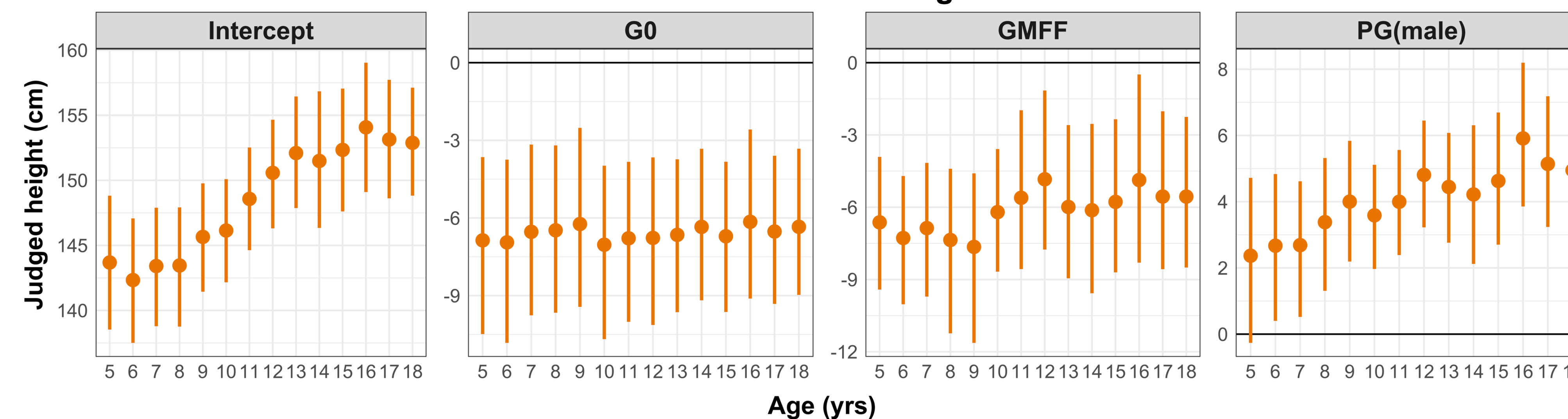
- Modeled with Bayesian multilevel models fit in R with "brms".⁷
- Perceived height predicted by GMFF & GO, perceived gender (PG), & the interaction between PG & each acoustic variable.
- PG predicted by GMFF & GO.
- Random slopes by listener & by talker age for all terms.
- Random intercept for each talker.
- **GO & GMFF negatively correlated with perceived height.**

$$\text{Perceived height} - (\text{GMFF} + \text{GO}) * \text{PG} + (1 | \text{Talker}) + ((\text{GMFF} + \text{GO}) * \text{PG} | \text{Listener}) + ((\text{GMFF} + \text{GO}) * \text{PG} | \text{Age}) + (\text{PG} - (\text{GMFF} + \text{GO}) + ((\text{GMFF} + \text{GO}) | \text{Listener}) + (1 | \text{Talker}) + ((\text{GMFF} + \text{GO}) | \text{Age}))$$

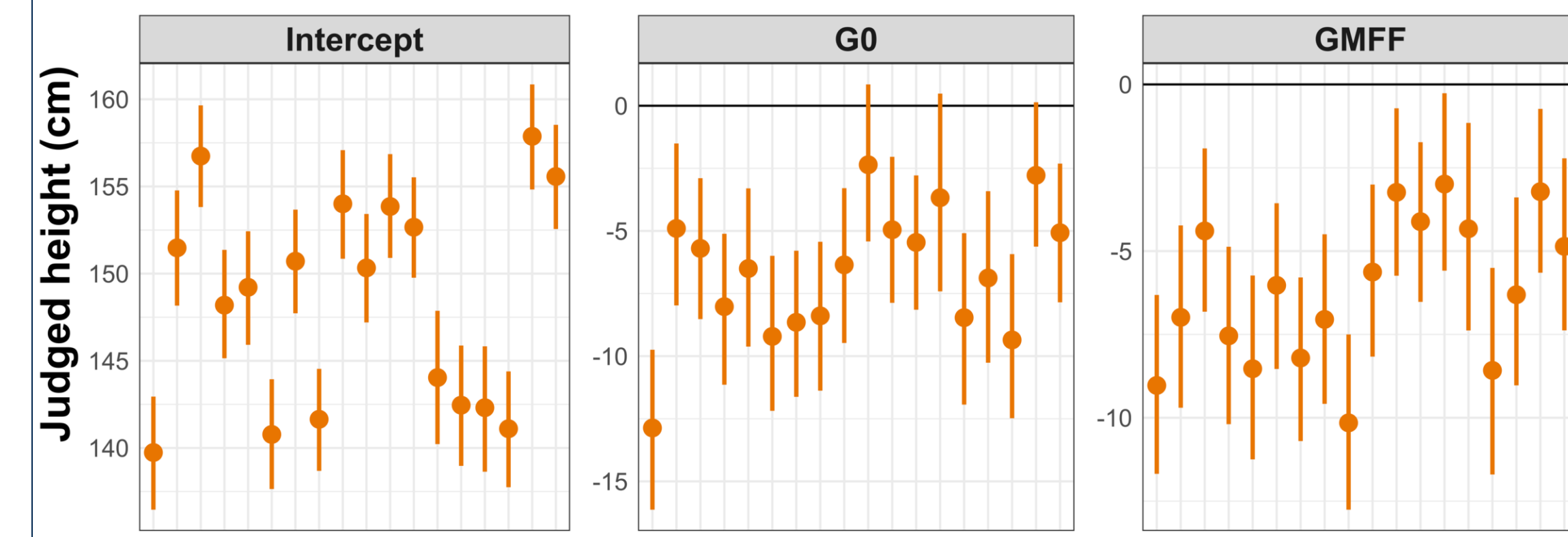
Model 1: Fixed Effects



Random Effect: Age



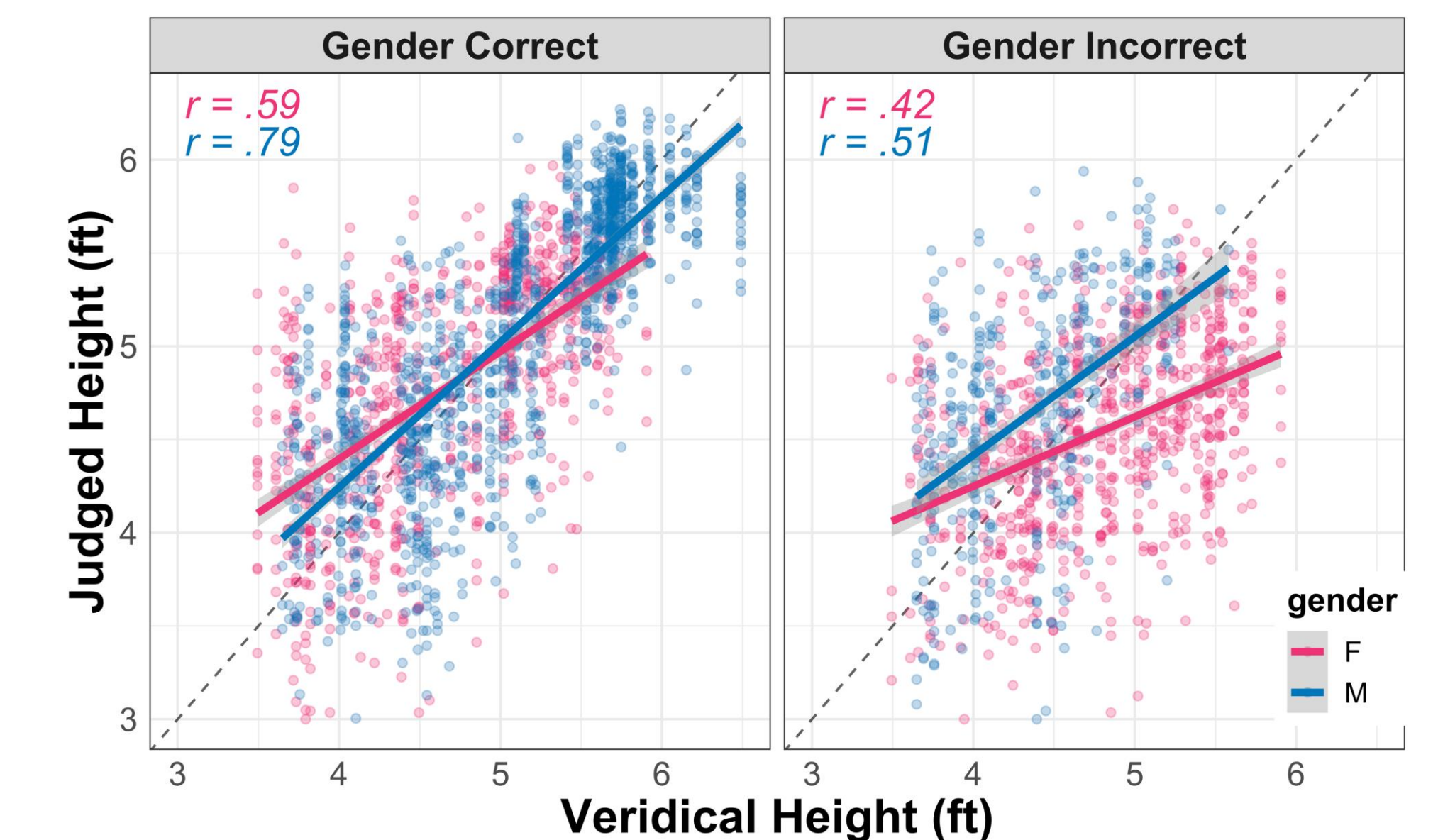
Random Effect: Listener



Results

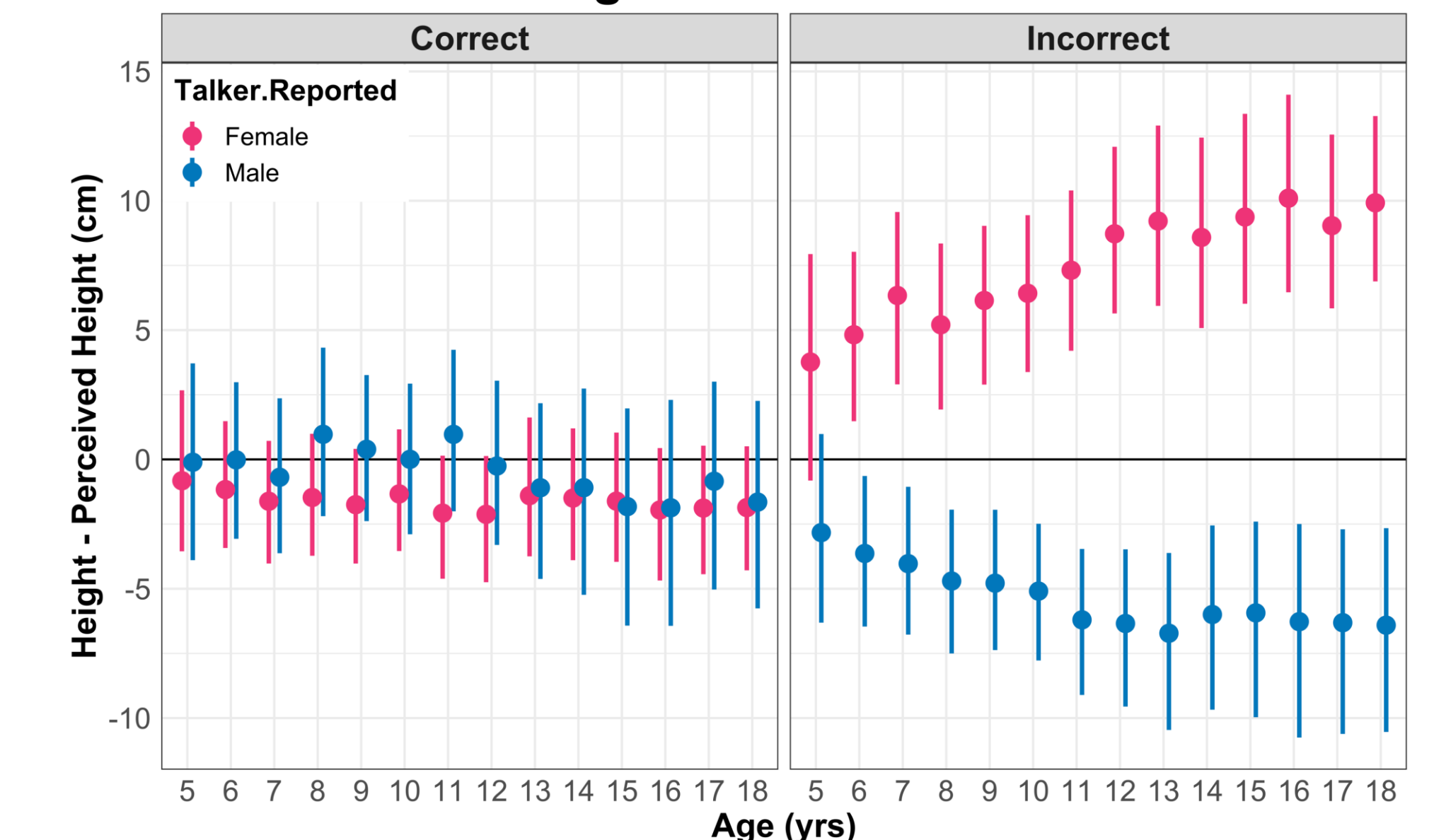
- Effect of age beyond the effects of GO and GMFF: older children judged as being taller when GO & GMFF were held constant.
- Effects of GO & GMFF did not vary systematically with age.
- The negative correlation between GO & GMFF & perceived height was present for all listeners.

Model 2: Errors in Height Judgements Predicted by Errors in Gender Judgements



Errors in listener judgments of talker height were modeled as a function of the interaction between self-reported talker gender and listener-perceived talker gender.

Listener Judgments of Talker Gender



Heights of older males were **overestimated** when they were thought to be females. Heights of older females were **underestimated** when they were thought to be males.

References

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