

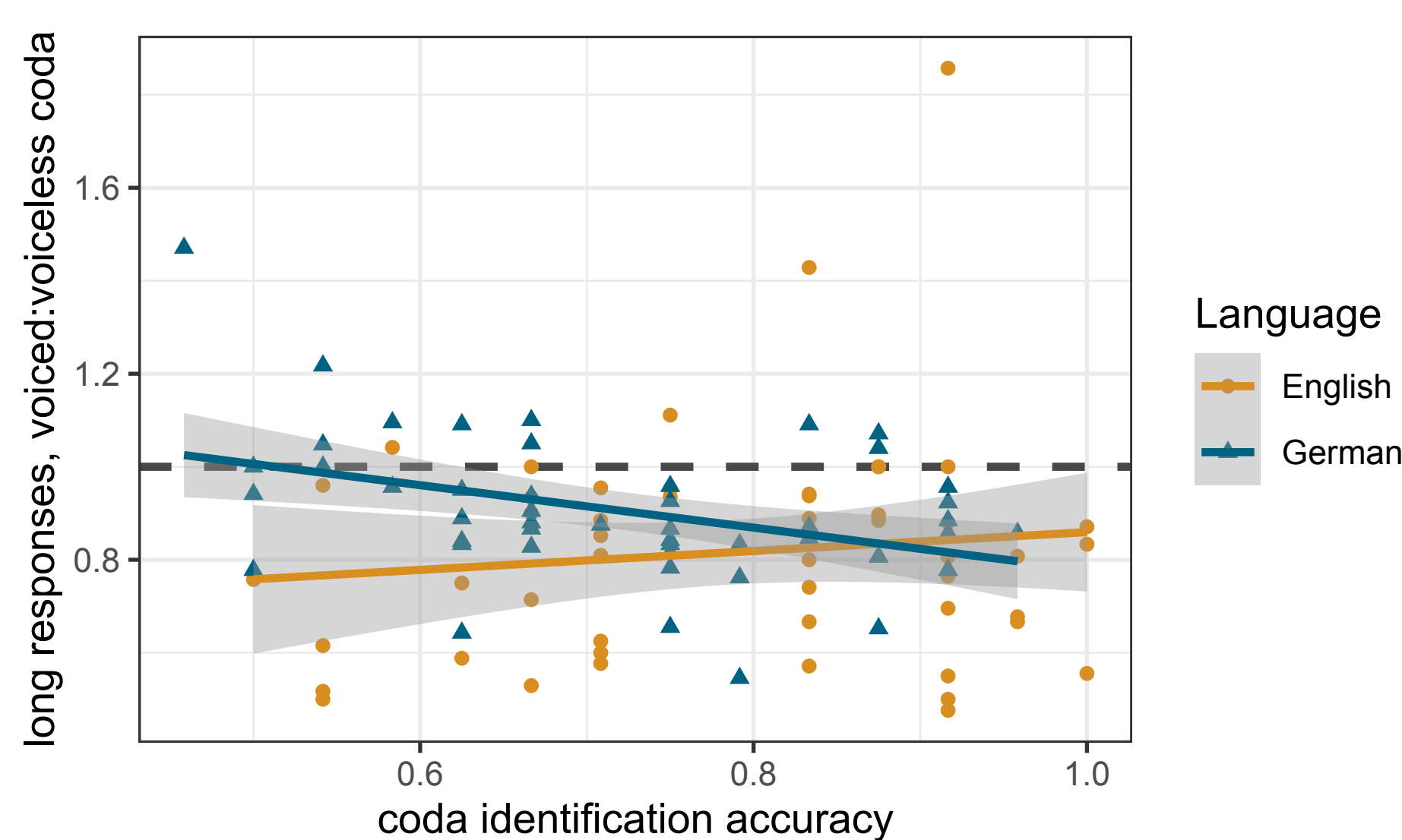
## Introduction

- Vowels are longer before voiced codas than voiceless codas in many languages (Chen 1970)
- The relationship is reflected in perception in two main ways:
  - Longer duration increases perception that the coda is voiced (Port & Dalby 1982), and listeners perceive vowels as shorter before voiced codas (Sanker 2020)
  - But when the coda itself is spliced out, vowels originally produced with voiced codas are perceived as longer than those produced with voiceless codas
- How do speakers of a language with final devoicing perceive the relationship between coda voicing and vowel duration?

**This Study:** How native language (English vs German) interacts with effects of coda voicing on perceived vowel duration, using cross-spliced vowels and codas

- Is the effect of original coda voicing language-specific? *No.*
- Is compensation for the spliced coda language-specific? *Yes.*

## Sensitivity to coda voicing



**Figure 3:** Categorizations based on accuracy of coda identification

For German speakers, the effect of spliced coda on perceived vowel duration is predicted by accuracy in identifying coda voicing

German participants with higher accuracy have a lower ratio of long responses with voiced codas vs voiceless codas ( $r(48) = -0.4, p = 0.00396$ )

English speakers exhibit no clear correlation ( $r(48) = 0.12, p = 0.42$ )

## Methodology

### Main Task: Duration Perception

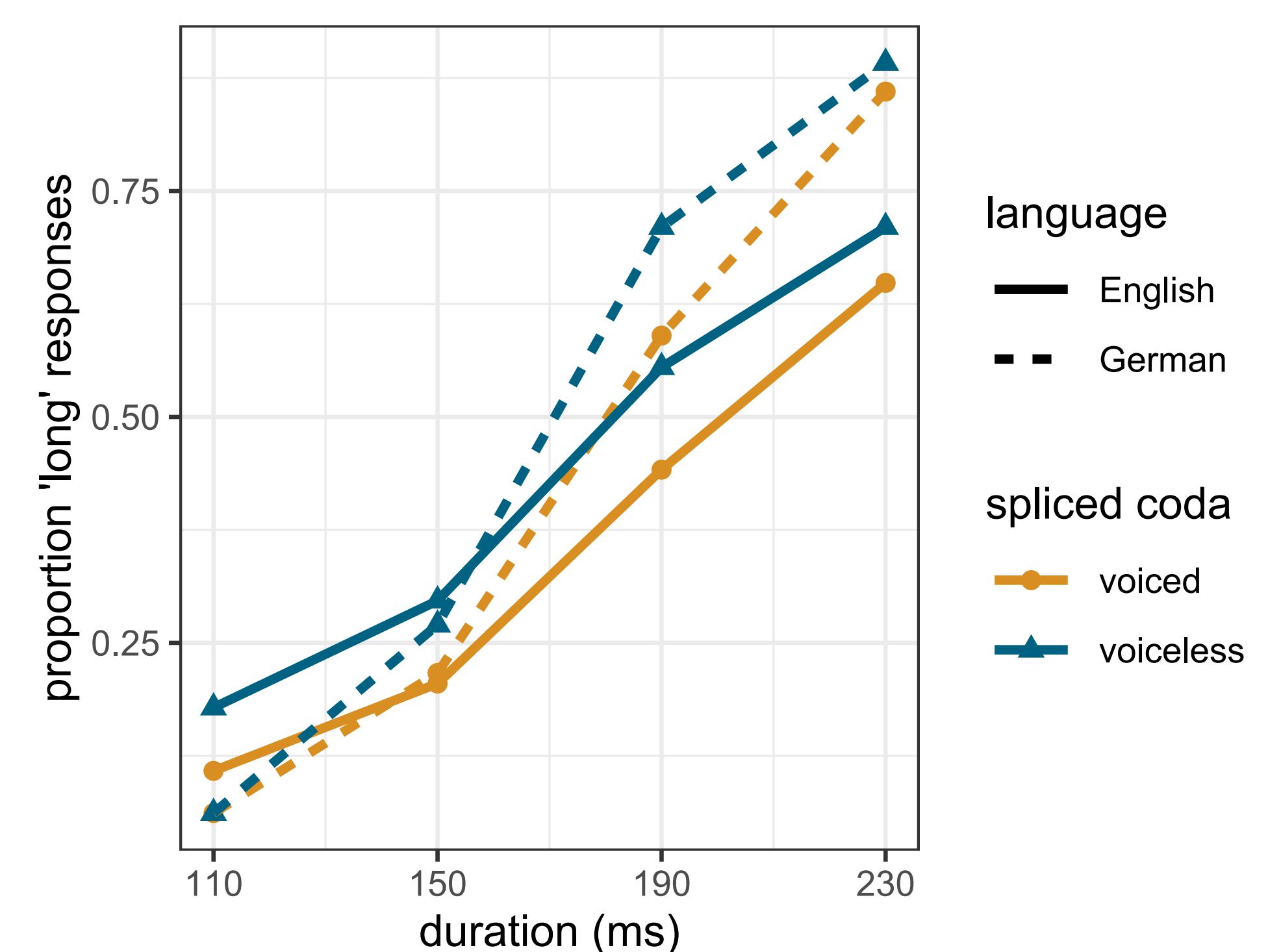
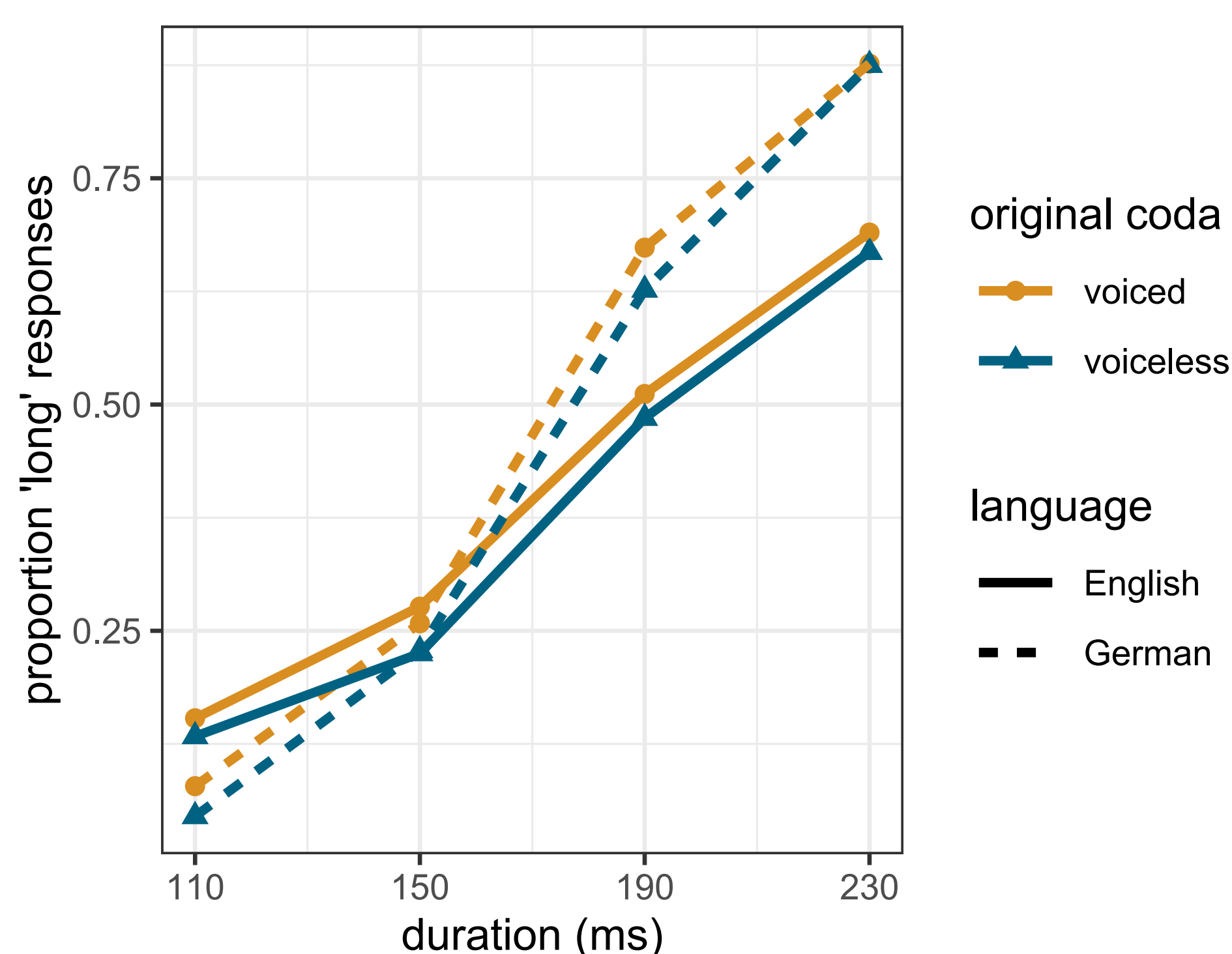
- *Participants:* 50 English speakers and 50 German speakers
- *Task:* Participants categorized the vowel of each item as 'long' or 'short' in duration
- Stimuli made from 6 English monosyllabic minimal pairs differing in voicing of the coda stop, e.g. *mob, mop*; produced by a native English speaker
- Vowel duration manipulated to create a 4-step duration continuum (110 ms to 230 ms)
- The original coda was removed and each vowel was spliced with voiced and voiceless codas
- The same 96 items for everyone (6 pairs \* 2 original codas \* 2 spliced codas \* 4 durations)

### Second Task: Coda Identification

- The same participants as the main task
- Identifying the coda voicing of 24 of the items from the main task, where the original coda voicing and spliced coda voicing matched, with 110 ms and 190 ms vowel durations

## Main Results

**Figure 1:** Categorizations by original coda



**Figure 2:** Categorizations by spliced coda

	Estimate	Std. Error	z value	p value
(Intercept)	-0.945	0.147	-6.42	< 0.0001
Duration	0.339	0.0072	47.2	< 0.0001
Language German	0.604	0.20632	2.93	0.00341
SplicedCoda Voiceless	0.582	0.0764	7.616	< 0.0001
OriginalCoda Voiceless	-0.208	0.076	-2.74	0.00622
SplicedCoda Voiceless * Lang German	-0.259	0.105	-2.46	0.0138
OrigCoda Voiceless * Lang German	0.0319	0.105	0.304	0.761

Listeners could perceive and categorize vowel duration – actual duration predicted responses

Voicing of the coda spliced onto the vowel influenced responses – spliced voiceless codas resulted in more 'long' responses, with a larger effect for English speakers

Voicing of the original coda influenced responses – vowels that had been produced with a voiced coda were more often identified as 'long', with a similar effect in both groups

## Conclusions

### Language-specific compensation:

- English speakers compensate for the duration expected based on the spliced coda – In English, vowels are longer before voiced codas, so the threshold for 'long' vowels is lower before voiceless codas
- German speakers exhibit less compensation, because of the lack of strong relationship in German (though this is influenced by English fluency)

### General acoustic effects:

- Both groups perceive vowels as longer when they were originally produced with a voiced coda, suggesting a basic perceptual influence of vowel characteristics influenced by coda voicing, such as spectral tilt and intensity contour (cf. Sanker 2020)
- Not an effect of language-specific phonological knowledge
- Provides a possible pathway for how voicing-conditioned vowel duration could develop; vowels sound louder when produced with voiced codas

## Selected References

- Chen, M. 1970. Vowel length variation as a function of the voicing of the consonant environment. *Phonetica*, 22), 129-159.
- Nicenboim, B, Roettger, T., & Vasishth, S. 2018. Using meta-analysis for evidence synthesis: The case of incomplete neutralization in German. *Journal of Phonetics*, 70, 39-55.
- Port, R., & Dalby, J. 1982. Consonant/vowel ratio as a cue for voicing in English. *Perception & Psychophysics*, 32(2), 141-152.
- Sanker, C. 2020. A perceptual pathway for voicing-conditioned vowel duration. *Laboratory Phonology*, 11(1), Art. 18.