

The effect of reduction and orthographic consistency in an auditory repetition task



Introduction

Research objective: Examines the relationship between effects of reduction and orthographic consistency on Japanese word production

Reduction: Shortening or deletion of speech sounds is a natural process in speech communication: /daigaku/ → [daiyaku] or [daiaku] [1]. While reduced words are easier to produce, they require more perceptual effort [2]

Orthographic consistency: Words with consistently spelled pronunciations are produced and recognized faster and more accurately: /-ak/ vs. /-ip/ [3]

Japanese orthography: Logographic or morphographic characters represent morphemes or an entire word meaning: 大 /da.i/ 'big' + 学 /ga.ku/ 'education' = 大学 /da.i.ga.ku/ 'university'

Japanese orthographic consistency index:

Target word	現在	/ge.n.za.i/	'now'	24	
Phonological neighbours	現代	/ge.n.da.i/	'modern times'	38	OF (PN and ON)
	存在	/so.n.za.i/	'existence,	28	OF (PN and ON)
	犯罪	/ha.n.za.i/	'crime'	35	OE (PN but ON)
	限界	/ge.n.ka.i/	'limit'	31	OE (PN but ON)
Consistency Index	$\frac{24 + 38 + 28}{24 + 38 + 28 + 35 + 31} = 0.58$				

Method

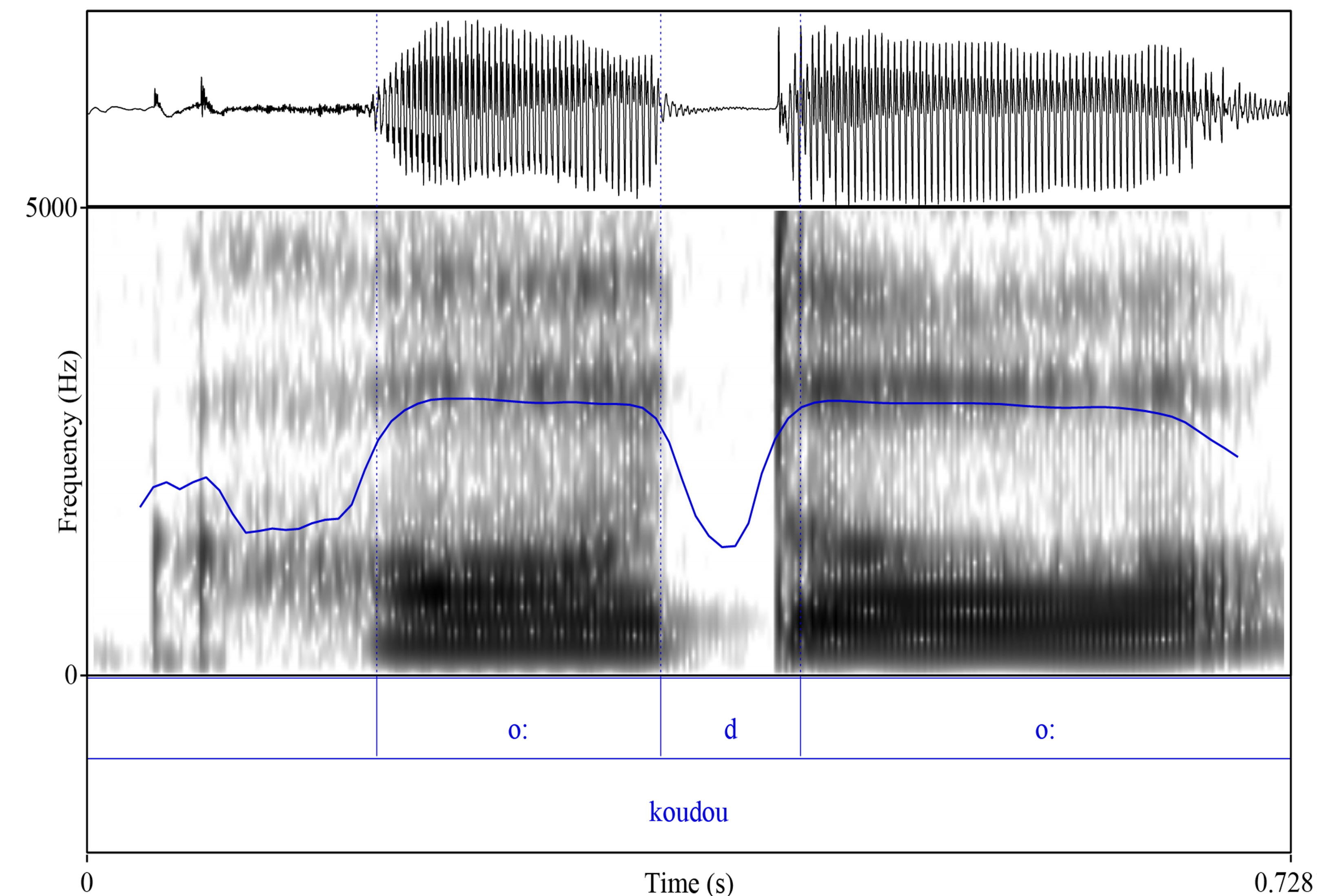


Fig. 1: Spectrogram of the Japanese word 行動 *koudou* 'act on'

Data: Production data from Mukai et al. [1]

Stimuli: 226 four-mora and two-logograph words in reduced and unreduced forms with medial /m/, /n/, /ŋ/, /ɲ/, /b/, /d/, /g/

Participants: 36 Japanese speakers

Listen-and-repeat Task: Stimulus (reduced or unreduced) → 1000 ms pause → 500 ms pure tone → auditory repetition

Dependent variables:

- Segment duration, word duration, intensity difference (Figure 1)

Independent variables:

- Reduction (reduced or unreduced)
- Consistency Index (0 – 1)

Results

Segment Duration:

- Shorter duration for reduced stimuli than their unreduced counterparts (Fig. 2)
- Interaction effect between reduction and orthographic consistency (Fig. 3)
 - Increase in consistency decreases duration
 - Stronger consistency effect for unreduced stimuli
 - Duration differs for reduced and unreduced stimuli, but the difference decreases as consistency increases

Word Duration:

- Same effect as segment duration, but consistency effect was stronger

Intensity Difference:

- Higher consistency leads to lower intensity difference. No effect of reduction (Fig. 4)

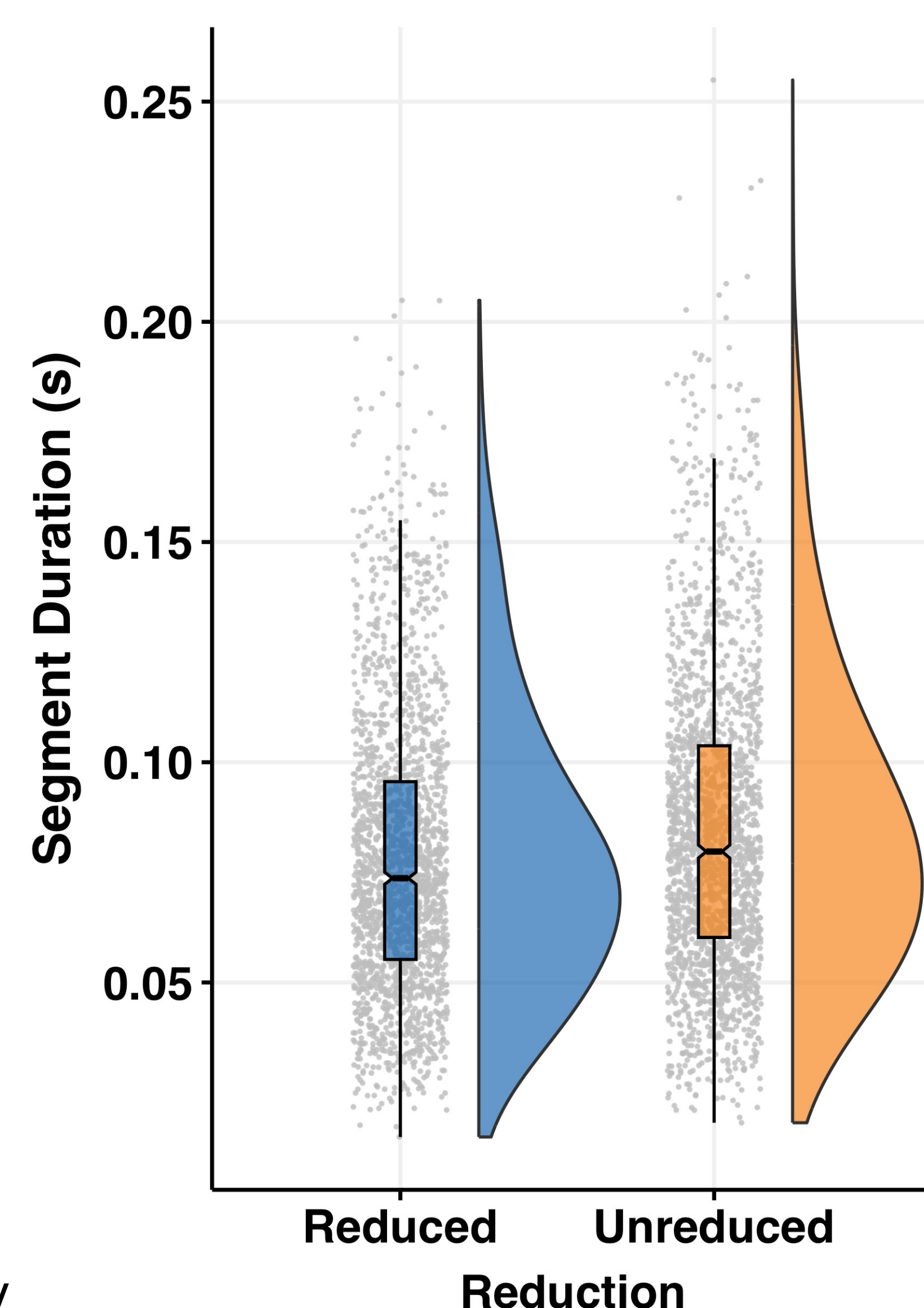


Fig. 2: Distribution of segment duration for reduced and unreduced stimuli

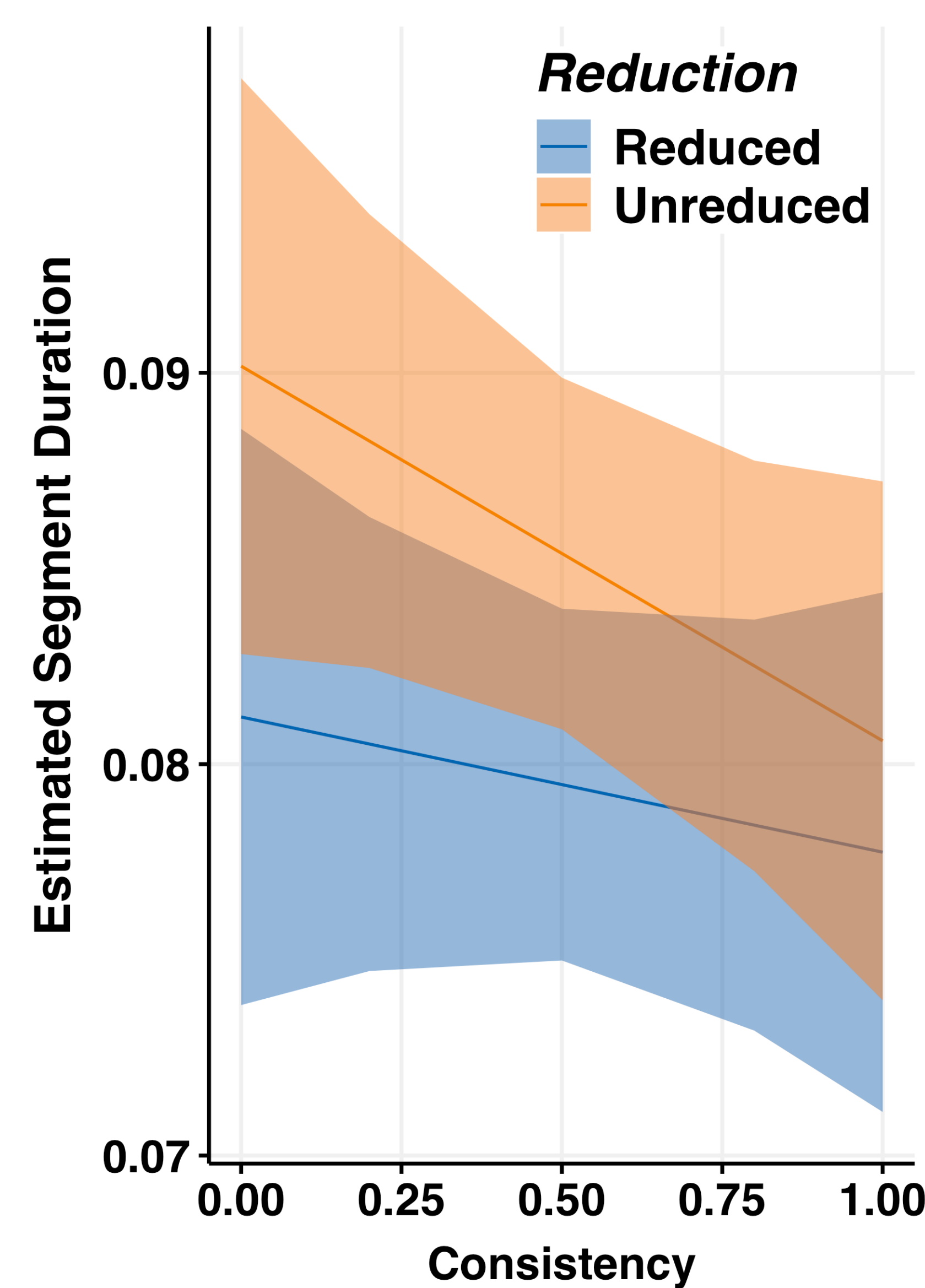


Fig. 3: Interaction effect between reduction and orthographic consistency on segment duration

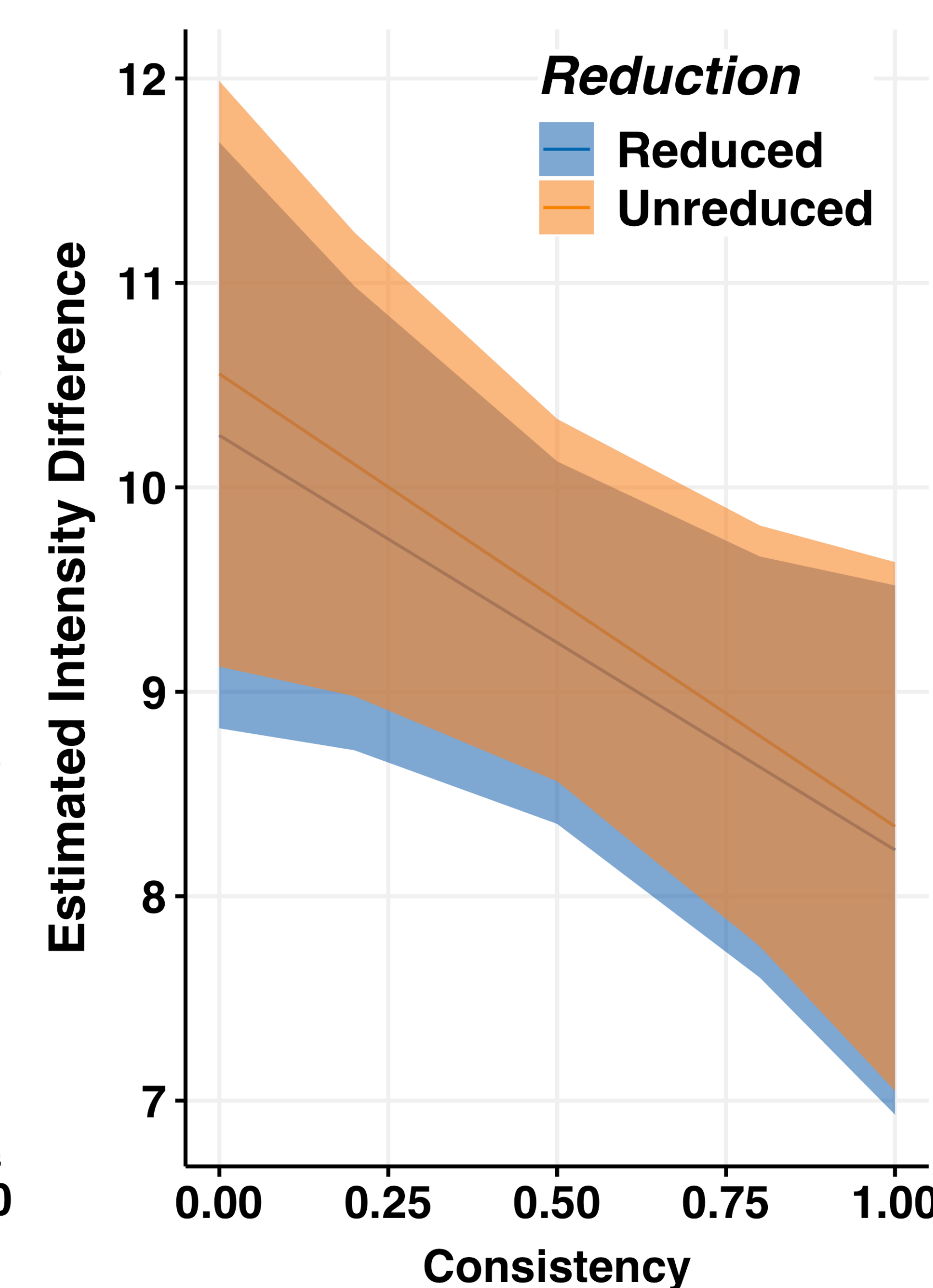


Fig. 4: Effect of orthographic consistency on intensity difference

Discussion

- Higher consistency leads to more reduction: shorter duration and lower intensity difference
 - Consistent words are easier to process [2], leading to production with shorter duration and lower intensity difference
- Duration for reduced stimuli shows smaller consistency effect
 - Reduced acoustic information in reduced stimuli increases the cost of activating the corresponding orthographic representation
- Reduced and unreduced differences disappear with higher consistency in both production and perception [2]
- Participants may imitate the characteristics of the original stimuli, rather than relying on stored representations

References:
[1] Arai, T., Warner, N., & Greenberg, S. (2007). Analysis of spontaneous Japanese in a multi-language telephone-speech corpus. *Acoustical Science and Technology*, 28(1), 46–48
[2] Mukai, Y., Järvikivi, J., & Tucker, B. V. (2023). The role of phonology-to-orthography consistency in predicting the degree of pupil dilation induced in processing reduced and unreduced speech. *Applied Psycholinguistics*, 44(5), 784–815.
[3] Ziegler, J. C., Petrova, A., & Ferrand, L. (2008). Feedback consistency effects in visual and auditory word recognition: Where do we stand after more than a decade? *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 34(3), 643–661.