

Effects of distal prosody on novel word segmentation: A comparison of native and non-native English speakers

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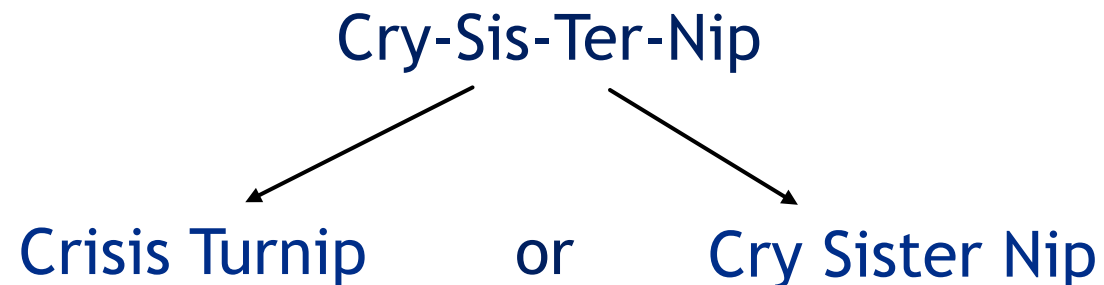
Michigan State University

Introduction

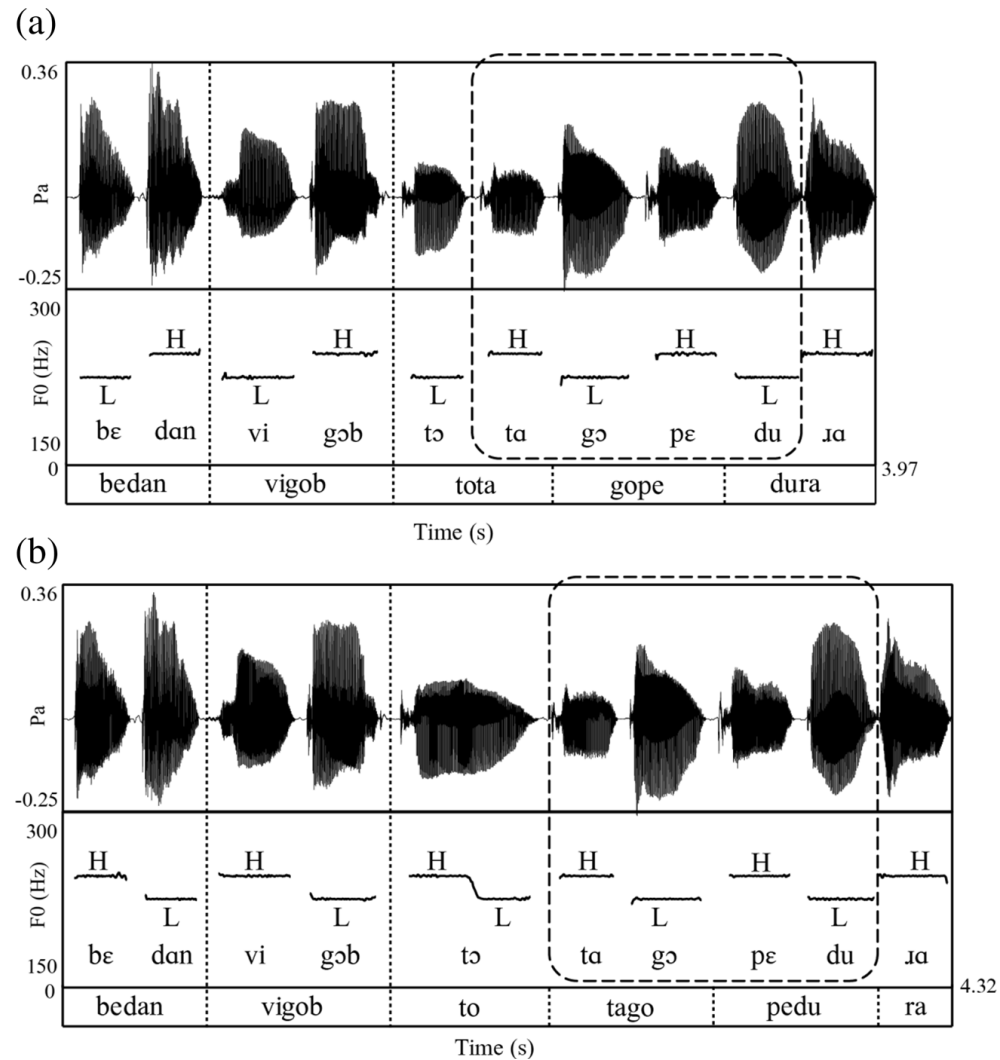
- ▶ To extract words from continuous speech, infants acquiring their native language and adults learning a second language rely on:
 - ▶ Statistical cues (e.g., transitional probabilities)
 - ▶ Local prosodic cues (e.g., intonational phrasing, stress)
- ▶ Recent studies show evidence from English that distal prosodic cues also influence word segmentation and lexical access (Dilley & McAuley, 2008; Dilley, et al., 2010; Heffner et al., 2012).

Perceptual Grouping Hypothesis

- ▶ The perceptual grouping hypothesis (Dilley & McAuley, 2008) proposes that distal prosodic cues at the beginning of an utterance create expectations about how later syllables should be grouped into words
 - ▶ Results from Dilley and McAuley (2008) showed that, in syllable sequences containing ambiguous word boundaries, syllables were grouped into words differently depending on the distal prosodic context



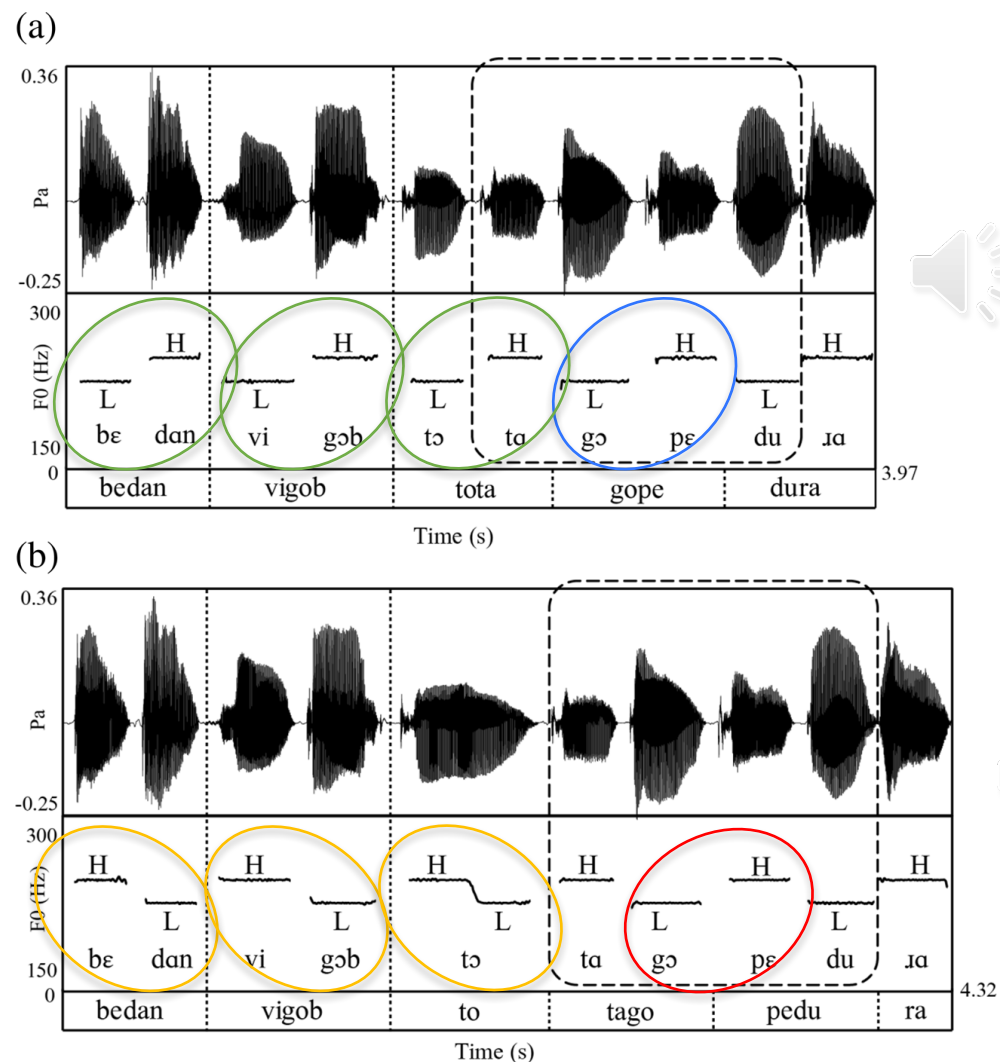
Morrill et al. 2015



- ▶ Support for this hypothesis comes from Morrill et al. (2015)
 - ▶ Subjects listened to utterances from an artificial language
 - ▶ Judged whether disyllabic items were “words” or “non-words” from the artificial language

Figure: Example stimuli illustrating distal prosody manipulations (Morrill et al., 2015)

Morrill et al. 2015



- ▶ Target words were either (a) congruent or (b) incongruent with the distal prosodic context
- ▶ Local prosody of a target word was identical for congruent and incongruent distal prosody conditions

Figure: Example stimuli illustrating distal prosody manipulations (Morrill et al., 2015)

Morrill et al. 2015

- ▶ Word ratings were higher for items that were congruent compared to incongruent with their distal prosody
- ▶ Findings indicate that distal prosody provides cues for downstream perceptual grouping of syllables in a novel language

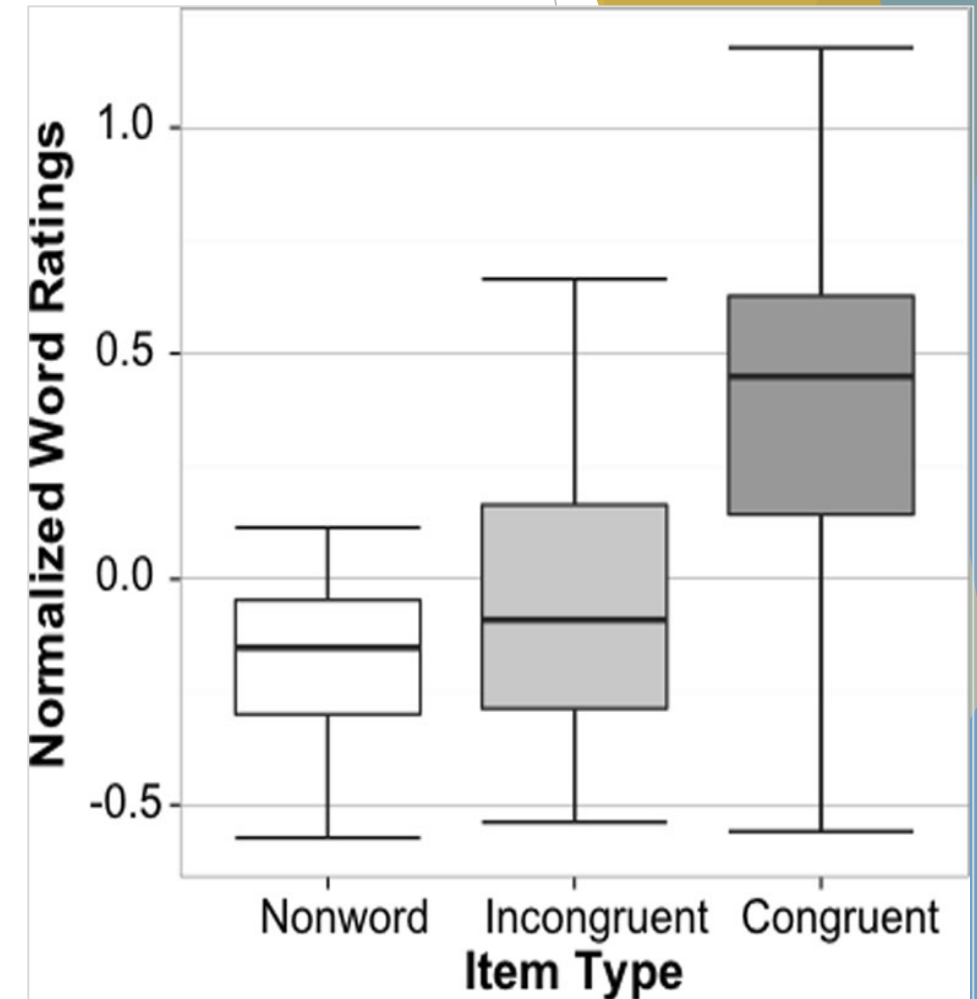


Figure: Morrill et al., 2015

Research Questions

1. Will the results of the Morrill et al. (2015) language-learning study replicate with an online task?
2. Is the perceptual grouping hypothesis universal across individuals with different language backgrounds?
 - ▶ Studies on how listeners' linguistic background and experience affect perception of speech and rhythmic grouping show mixed results
 - ▶ Universal: Hay & Diehl (2007); Jarvikivi, Vainio, & Aalto (2010)
 - ▶ Shaped by linguistic experience/background: Gandour et al. (2002); Iversen & Patel (2008); Tyler & Cutler (2009); Schmidt-Kassow, et al. (2011); Yeung, Chen, & Werker (2012); Tsao (2017)

Present Study

1. Adapted the artificial language task from Morrill et al. (2015) to be an online task rather than language-learning task
 - ▶ Participants listened for a disyllabic target item in a short utterance from the artificial language
 - ▶ Rated how well they heard the target item on a scale from 1 - 6 (No, I did not hear it - Yes, I heard it very well)
2. Tested non-native English speakers (NNS) in addition to native English speakers (NES)

Present Study

- ▶ Compare tonal and non-tonal language speakers
 - ▶ Evidence suggests that native speakers of non-tonal and tonal languages develop different strategies for segmenting speech into meaningful units (Gandour et al., 2002; Tsao, 2017)
 - ▶ In non-tonal languages, words are the fundamental units of meaning
 - ▶ Non-tonal language speakers use distal prosodic cues to group syllables for speech segmentation
 - ▶ In tonal languages, lexical tones are assigned to each syllable, making syllables the fundamental units of meaning/segmentation
 - ▶ This may increase the perceptual weight of each syllable
 - ▶ This may also increase the emphasis on local rather than distal prosodic cues for speech segmentation

Predictions

1. Perceptual grouping hypothesis predicts a congruency effect such that:
 - ▶ Congruent items will be better perceived than incongruent items
2. If the perceptual grouping hypothesis is universal, we predict that:
 - ▶ There will be a congruency effect for speakers of tonal and non-tonal languages
3. If the perceptual grouping hypothesis is language-specific, then we predict a difference between language groups such that:
 - ▶ Speakers of non-tonal languages will show a congruency effect
 - ▶ Non-tonal language speakers will perceive congruent better than incongruent words
 - ▶ Speakers of tonal languages will not show a congruency effect
 - ▶ Tonal language speakers will not show a difference between congruent and incongruent words

Methods

▶ Participants

- ▶ 40 native English speakers (NES)
- ▶ 35 non-native English speakers (NNS)
 - ▶ N = 17 Non-tonal Language Speakers (NTS)
 - ▶ N = 18 Tonal Language Speakers (TLS)

Non-tonal Languages	Tonal Languages
Arabic	Cantonese
Bengali	Mandarin
Hindi	Thai
Korean	Vietnamese
Kurdish	
Malaysian	
Nepali	
Polish	
Portuguese	
Spanish	

Language Group	N	Age	Age Started English	Years Outside English-Speaking Country
NES	40	19.40	4.58	1.15
NNS				
NTS	17	28.88	8.93	16.97
TLS	18	26.67	10.17	20.68

Methods

▶ Design

▶ 3 X 2 mixed factorial

- ▶ (Language group: NES vs NTS vs TLS) X (Item type: Congruent vs Incongruent)

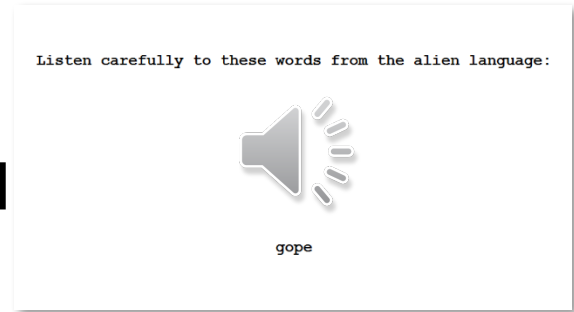
▶ General Procedure

- ▶ Participants completed the artificial language task followed by a survey about demographics, language background, and music experience

Artificial Language Task

1. Exposure phase:

- ▶ Participants heard a list of 12 artificial disyllabic word

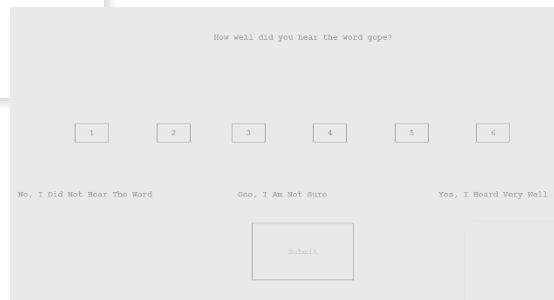
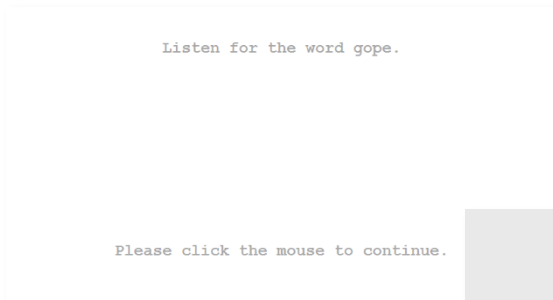


2. Test phase:

- ▶ Participants read one of the 12 target items then listened for it in a short artificial utterance

- ▶ Rated how well they heard the target item on a scale from 1 - 6

- ▶ (1 = No, I did not hear it; 6 = Yes, I heard very well)



Artificial Language Task

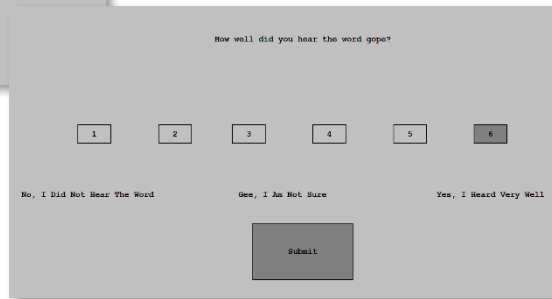
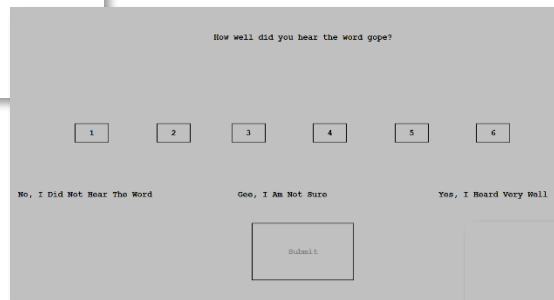
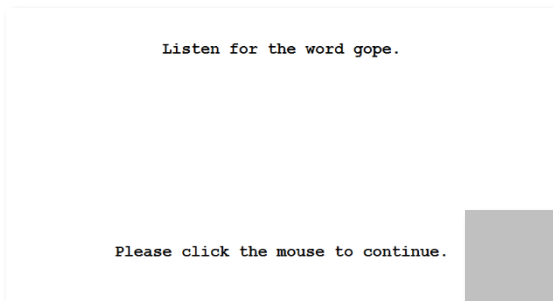
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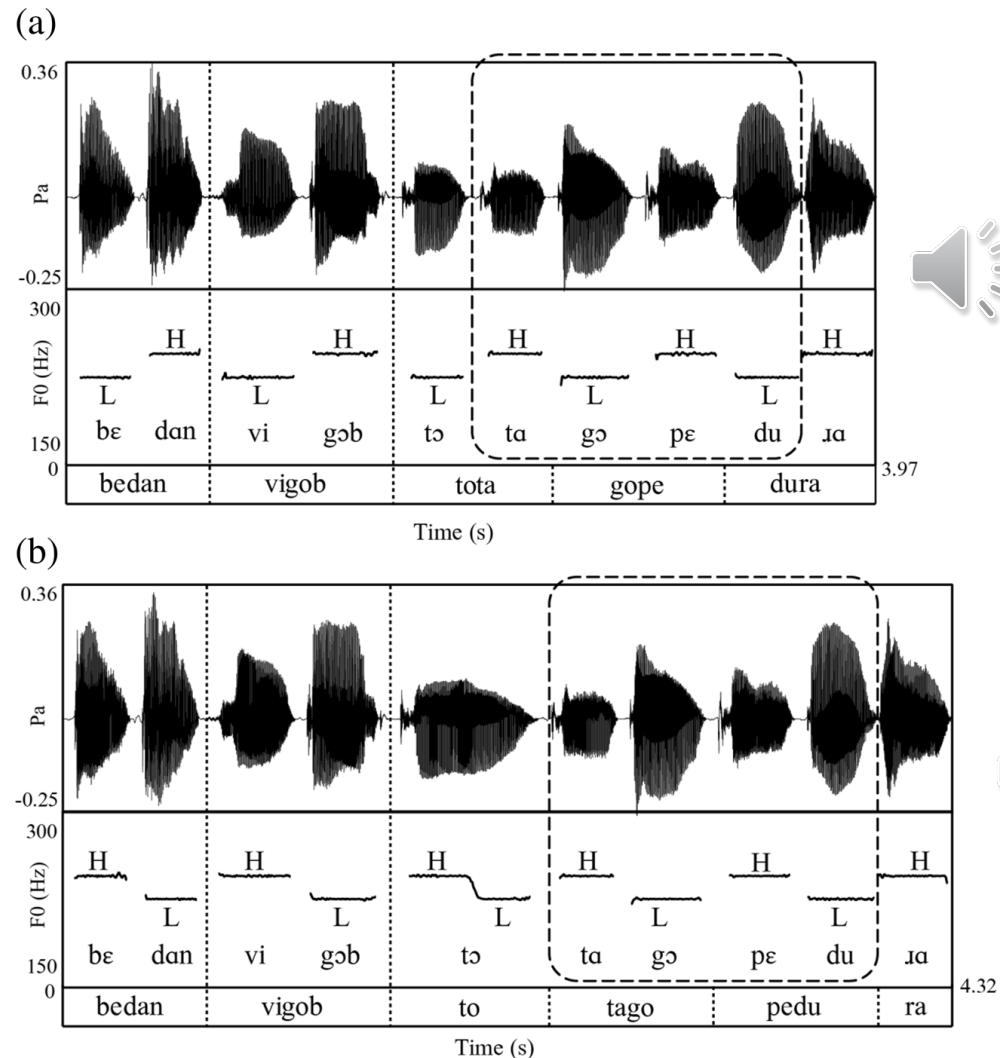


2. Test phase:

- ▶ Participants read one of the 12 target items then listened for it in a short artificial utterance
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Artificial Language Task



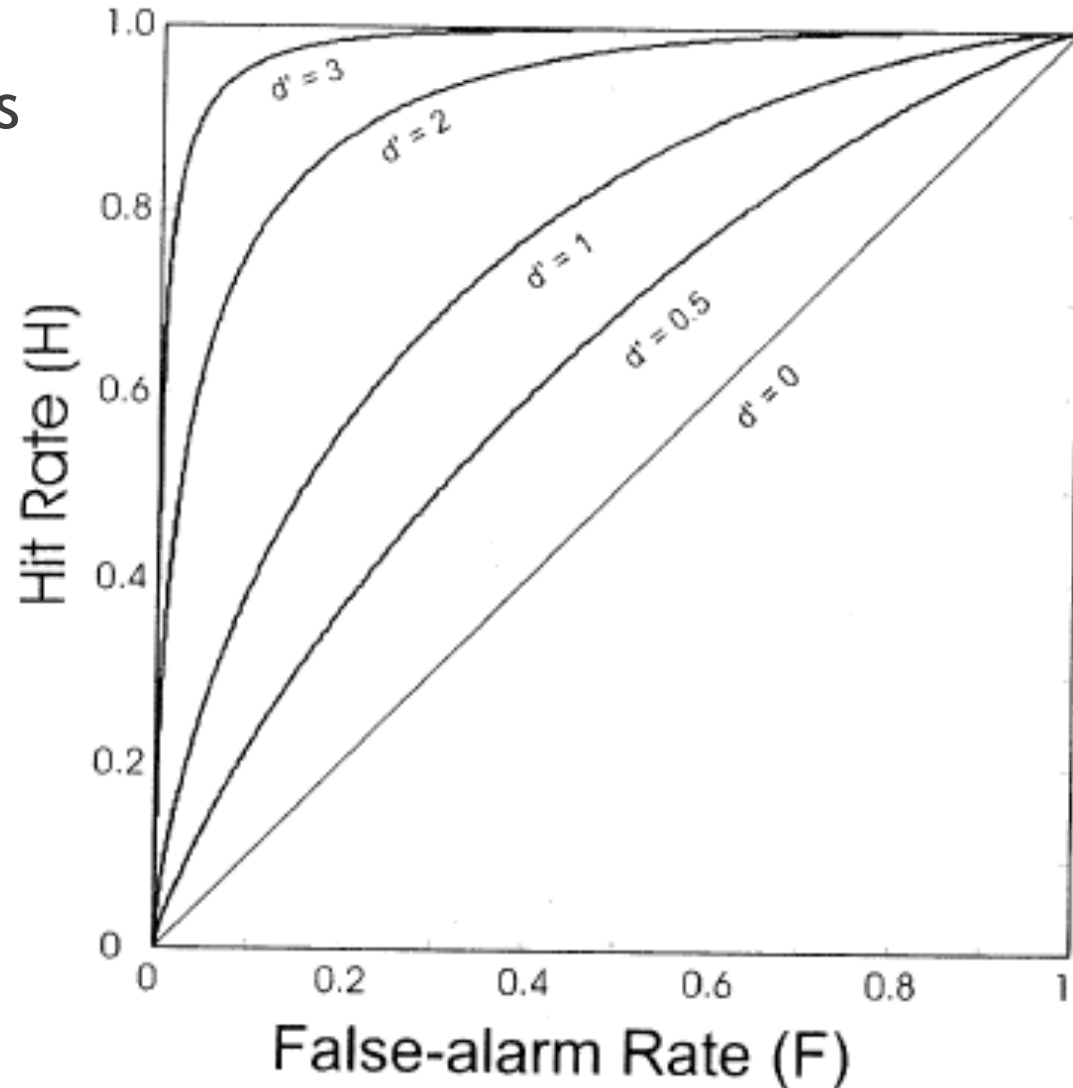
▶ Test phase:

- ▶ 144 Trials
- ▶ Target items were either present or absent on each trial
- ▶ Target-present trials contained target items that were either (a) congruent or (b) incongruent with the distal prosodic context
- ▶ Local prosody of a target item was identical for congruent and incongruent distal prosody conditions

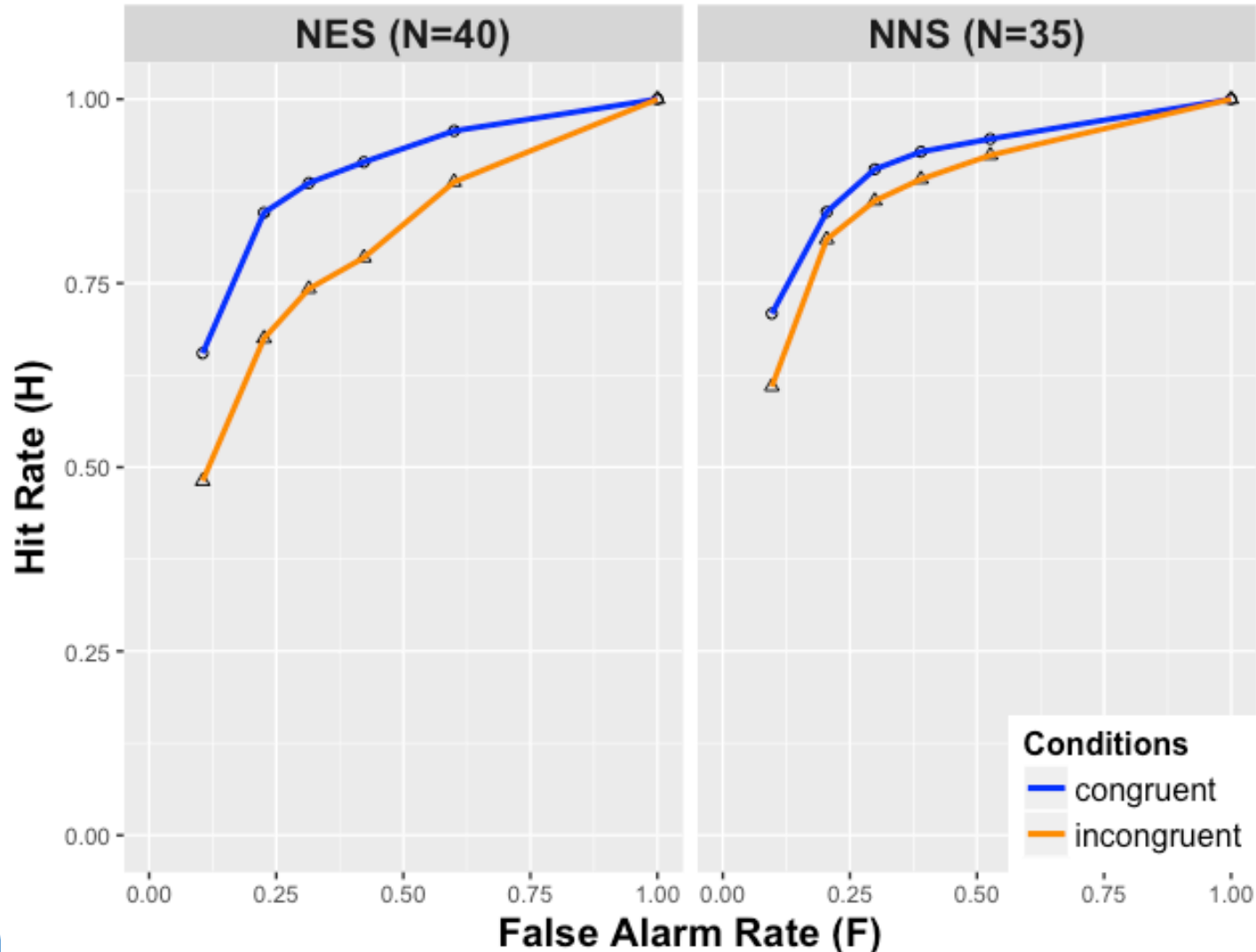
Figure: Example stimuli illustrating distal prosody manipulations (Morrill et al., 2015)

Data Analysis

- ▶ A signal detection analysis was conducted:
 - ▶ Hit (H) & false alarm (F) rates.
 - ▶ Relative/receiver operating characteristic (ROC) curves.
 - ▶ Area under the curves (Az)



Results: NES vs. NNS



Both groups:

- ▶ Target absent trials had significantly lower ratings than target present trials.

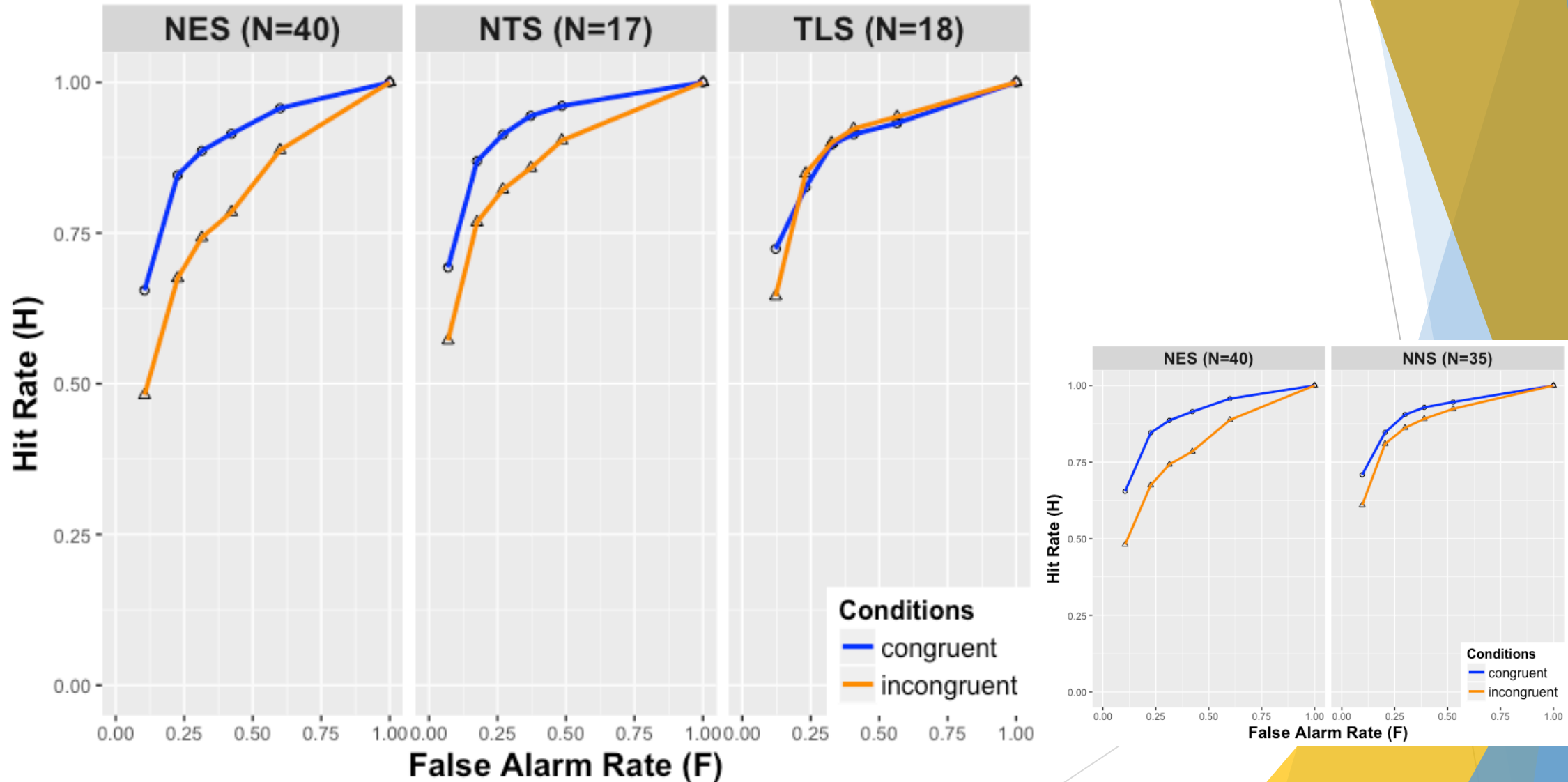
NES group:

- ▶ Congruent words were perceived significantly better than incongruent words.

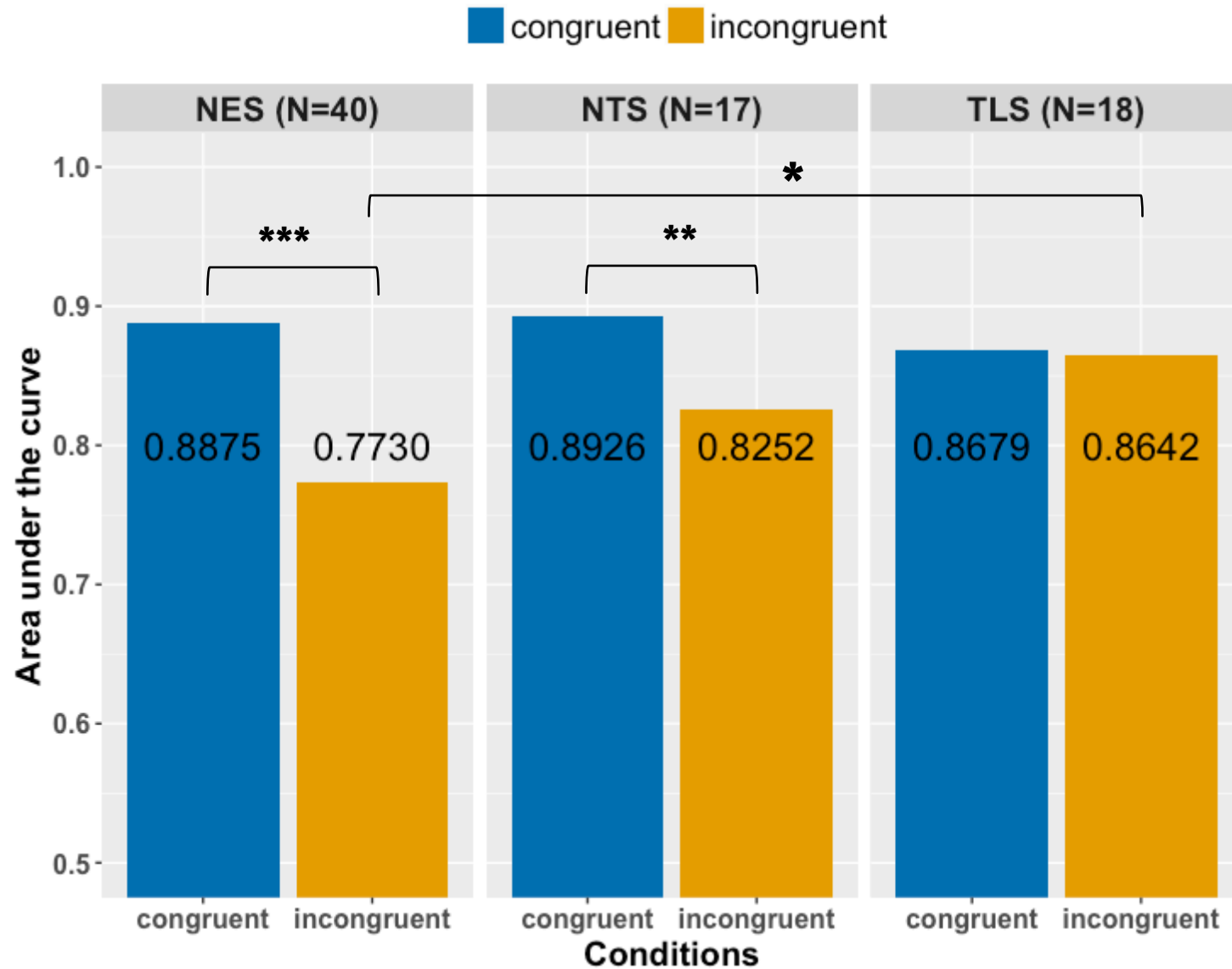
NNS group:

- ▶ There was a smaller congruency effect.

Results: NES, NTS, & TLS



Results: Area under the curve (Az)



Discussion

- ▶ Consistent with previous research, native English speakers use distal prosodic cues to group downstream syllables into words.
- ▶ Effects of distal prosody were also present for speakers of some other languages as well, but not for native speakers of tonal languages.
 - ▶ Speakers of languages with lexical tones use different segmentation units from native speakers of non-tonal languages, e.g., syllables.
 - ▶ Speakers of tonal languages ignored distal prosodic cues for speech segmentation.

Discussion

- ▶ The study highlights the importance of cross-linguistic research in general and on prosody in particular.
- ▶ Future studies:
 - ▶ When and how children become tuned or immune to distal prosodic cues?
 - ▶ How would children with specific language impairment perform in this task?

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THANK YOU

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Bonus

