

Top-down Processing of Intonational Boundaries

Andrés Buxó-Lugo & Duane Watson

Department of Psychology, University of Illinois at Urbana-Champaign

Introduction

- The distribution of syntactic boundaries and intonational boundaries are correlated (Cooper & Paccia-Cooper, 1980; Ferreira, 1993; Watson & Gibson, 2004).
- Listeners use boundaries to decipher the linguistic structure of a message (e.g. Snedeker & Trueswell, 2003).
- However, prosody has its own representation that must be parsed. What types of information affect how prosodic information is structured?
- Recent research has shown that syntactic context (not acoustic cues) is the best predictor of whether a boundary is perceived in a speech corpus (Cole, Mo, & Baek, 2010).
- We investigate whether expectations about likely locations for boundaries influence listeners' perception.

Hypotheses

Hypothesis 1

- Perception of boundaries is based on acoustic cues alone.

Hypothesis 2

- Perception of boundaries is influenced by sentences' syntactic structure.

Experiment 1

Participants

- 18 monolingual American English speakers from Amazon Mechanical Turk.

Conditions

- Boundary Spectrum: 1-9
- Boundary Position: Natural vs. Unnatural

Materials

Recorded 28 sentences:

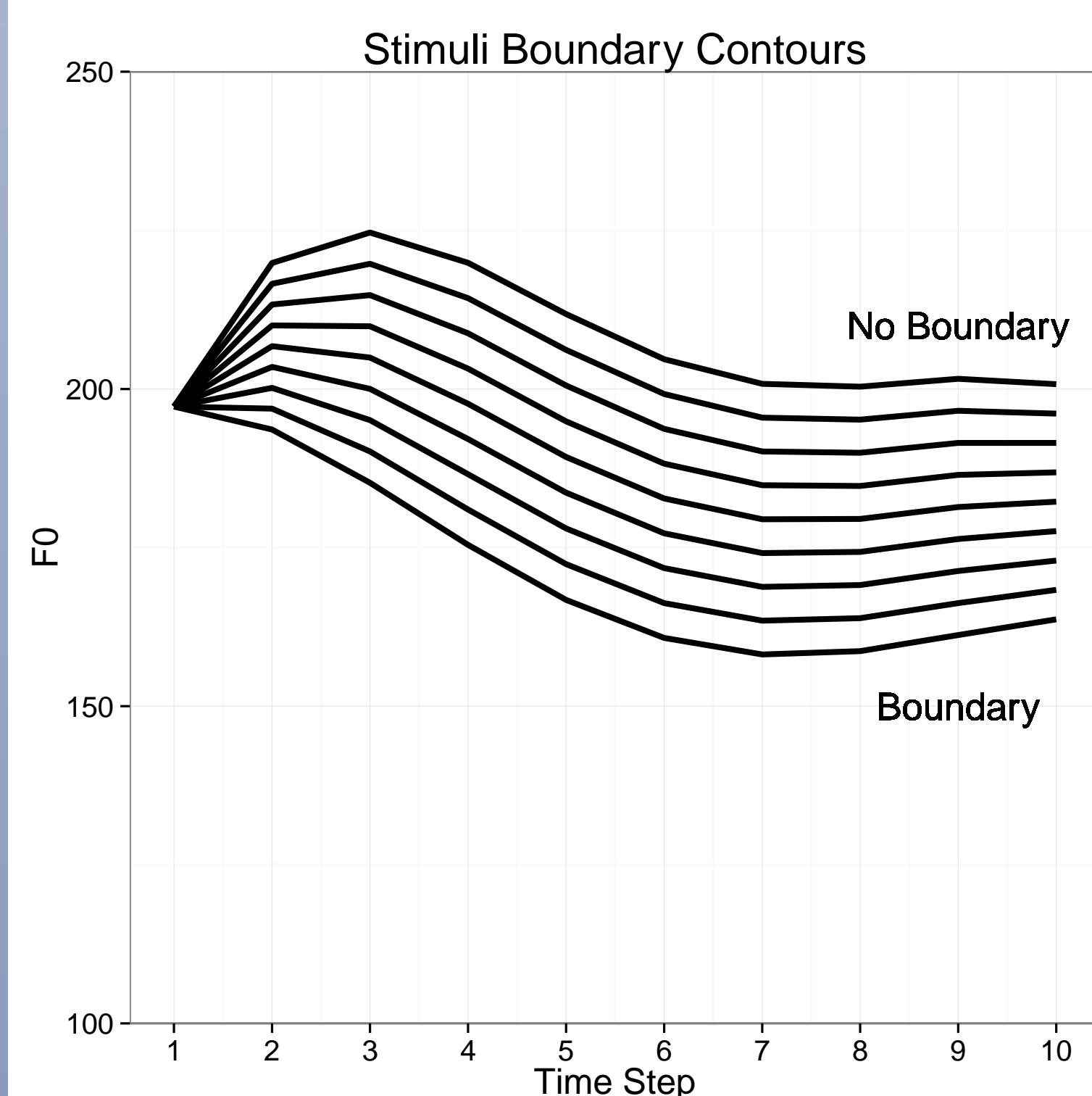
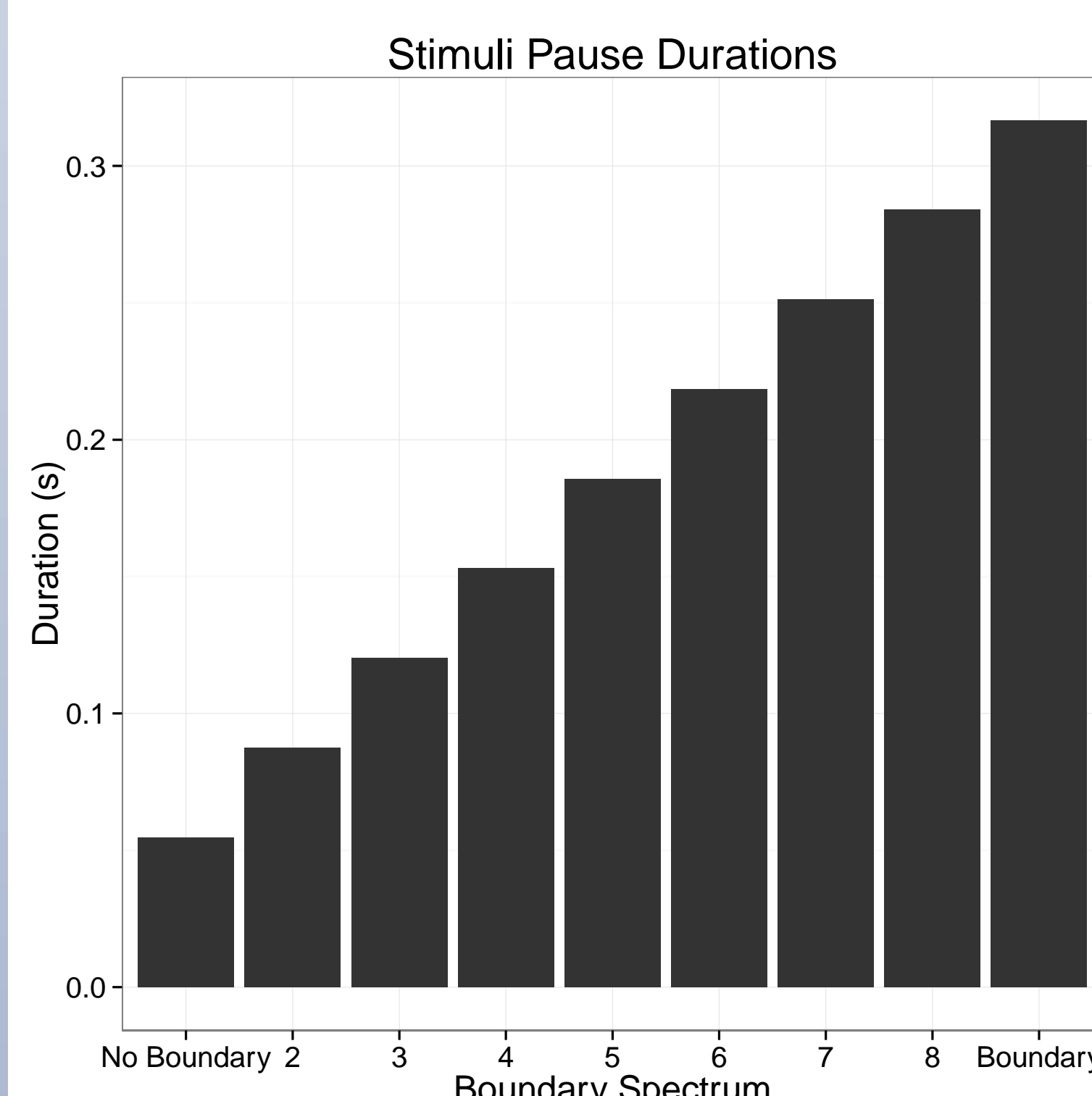
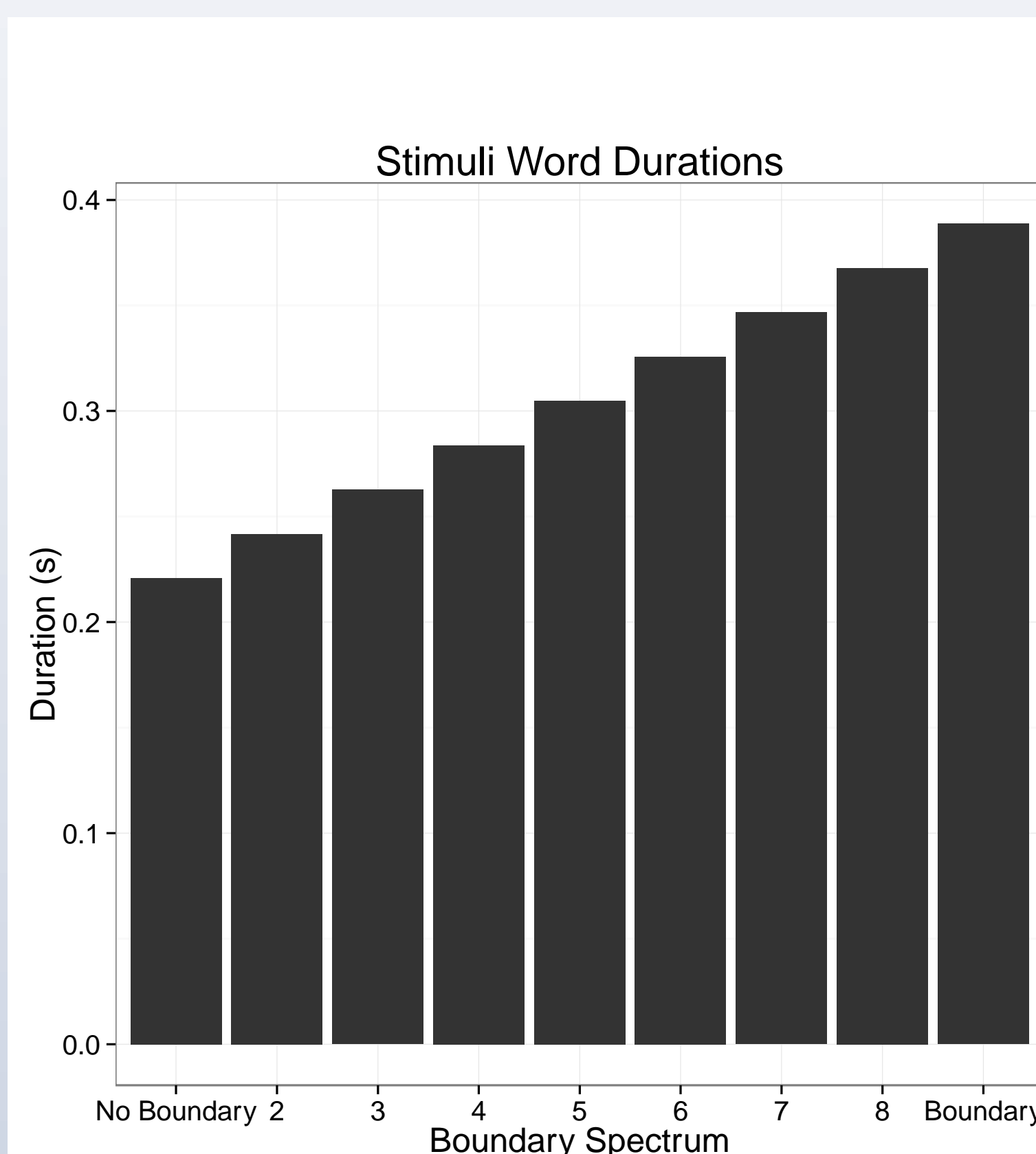
- Put the big bowl on the tray.
- Put the bowl that's big on the tray.

Each was produced once with a boundary at a syntactically expected location, and once with a boundary at a syntactically unexpected location:

- Natural: Put the big bowl | on the tray.
- Unnatural: Put the big | bowl on the tray.

We used the average word duration, pause duration, and F0 contours from these sentences as the endpoints of a spectrum that varied in its cues to a boundary.

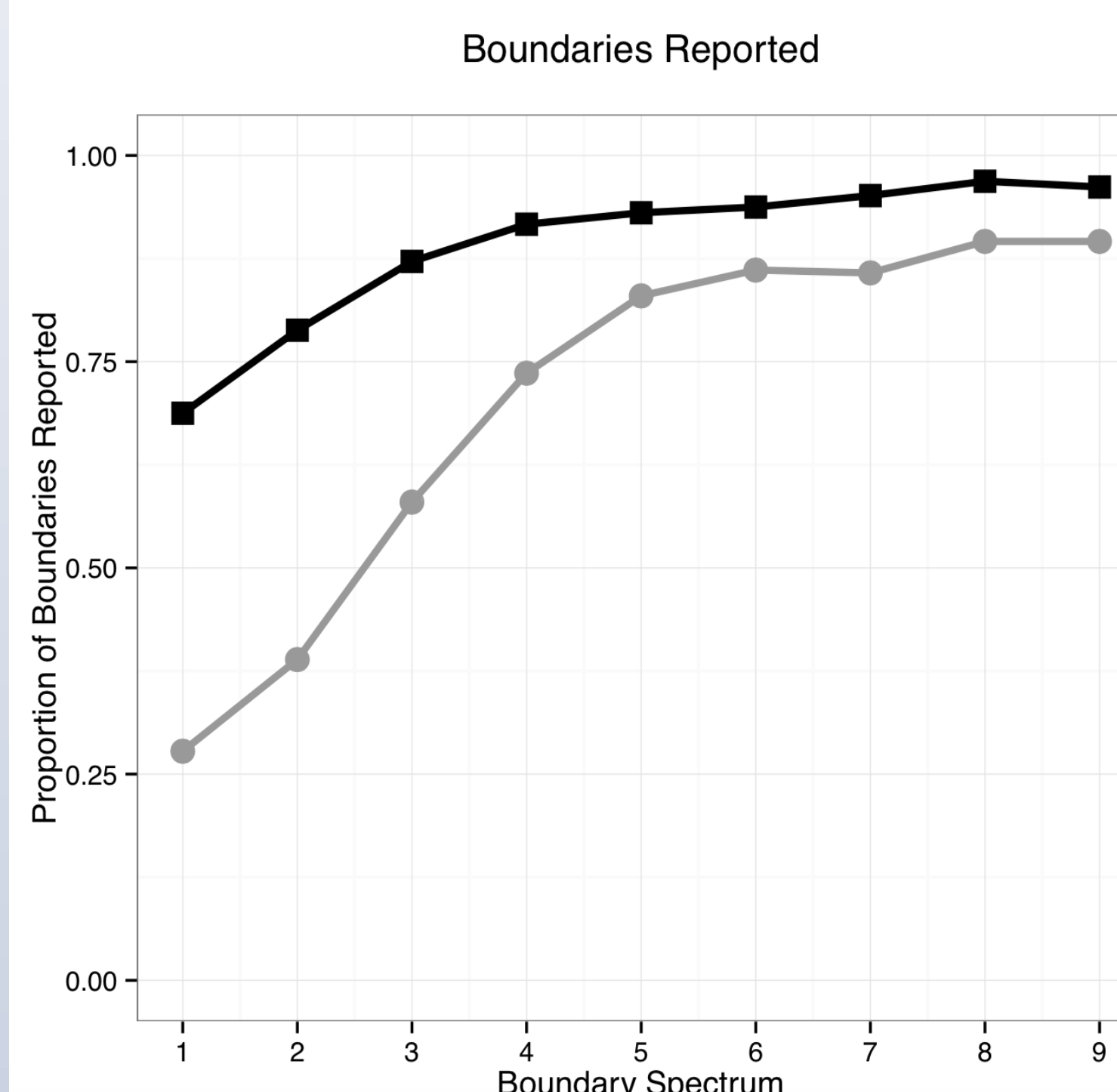
272 recordings in total.



Methods

- Survey posted on Amazon Mechanical Turk.
- Subjects heard examples of naturally produced boundaries during instruction phase.
- For each trial, participants heard a recording and were asked after what words they heard boundaries (Mo, Cole, & Lee, 2008).
- Every subject made judgements on all 272 recordings in random order.
- Not a forced choice task.

Results



Reports at syntactically licensed location in black; reports at syntactically unlicensed location in gray.

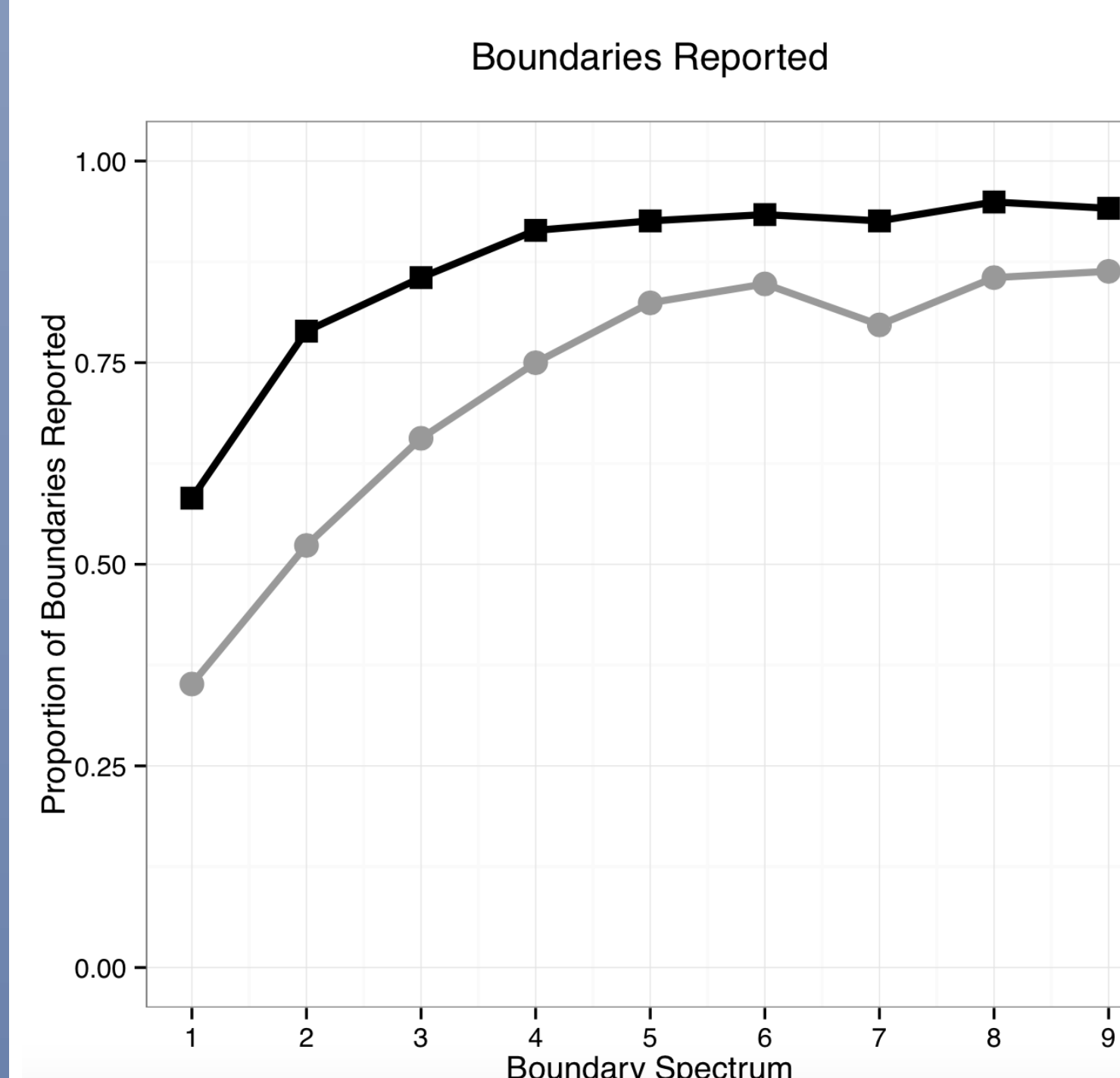
Experiment 2

- Maybe our instructions biased listeners?
- Subjects in Experiment 1 only heard examples of boundaries at syntactically licensed locations during the instruction phase.
- Ran experiment again, this time with examples of boundaries in syntactically licensed and syntactically unlicensed locations during the instruction phase.

Participants

- 16 monolingual American English speakers from Amazon Mechanical Turk.

Results



Reports at syntactically licensed location in black; reports at syntactically unlicensed location in gray.

Conclusions

- Listeners' perception of intonational boundaries is guided by their expectations about where boundaries should occur.
- Whereas boundaries are often thought of as cues that aid syntactic parsing, the data suggest that this relationship is bidirectional.
- These results have important implications for human labeling as a tool for coding prosody: when labelers mark a boundary, is the label driven by the acoustic input or is it driven by the labelers' expectations?

References

- Cole, J., Mo, Y., & Baek, S. (2010). The role of syntactic structure in guiding prosody perception with ordinary listeners and everyday speech. *Language and Cognitive Processes*, 25, 1141-1177.
- Cooper, W. E., & Paccia-Cooper, J. (1980). *Syntax and speech*. Cambridge, MA: Harvard University Press.
- Ferreira, F. (1993). Creation of prosody during sentence prosody. *Psychological Review*, 100, 233-253.
- Mo, Y., Cole, J., & Lee, E-K. (2008). Naïve listeners' prominence and boundary perception. In P. A. Barbosa, S. Madureira, & C. Reis (Eds.), *Proceedings of the Fourth International Conference on Speech Prosody* (pp. 735-736). Campinas, Brazil, May 6-9, 2008.
- Snedeker, J., & Trueswell, J. (2003). Using prosody to avoid ambiguity: Effects of speaker awareness and referential context. *Journal of Memory and Language*, 48, 103-130.
- Watson, D. G., & Gibson, E. (2004). The relationship between intonational phrasing and syntactic structure in language production. *Language and Cognitive Processes*, 19, 713-755.

Acknowledgments

This project was supported by Grant Number R01DC008774 from the National Institute on Deafness and Other Communication Disorders, Grant Number T32-HD055272 from the National Institutes of Health, and a grant from the James S. McDonnell Foundation.

