Prosodic effects on articulatory movements at phrase boundaries in spontaneous speech

Patrizia Bonaventura
Department of Communication Sciences
Case Western Reserve University

ABSTRACT

The present study aims to investigate whether phrase-final elongation affects tongue-based articulatory movements (AM) in spontaneous speech (SS), and if so, whether it is predictable from elements of syllable structure. This study is based on previous research that found evidence for ‘iceberg’ patterns in SS, which are characterized by high movement velocities at phrase boundaries. The present study investigated these patterns in a corpus of spontaneous speech, and found evidence for ‘iceberg’ patterns that were similar to those found in SS. The results of this study suggest that phrase-final elongation affects tongue-based AM in SS, and that these patterns are related to elements of syllable structure.

INTRODUCTION

The Converter/Distributor (C/D) model, as a non-traditional, phoneme-based approach to speech production, suggests the possibility of syllable-based articulatory movements that are continuous and involve a pattern of ‘iceberg’ movements. The present study investigates the nature of these movements at phrase boundaries, and how they are related to elements of syllable structure.

ICEBERG PATTERNS

Fujimura (1988) proposed the C/D model to investigate the nature of syllable-based articulatory movements, and suggested that these movements are related to the presence of phrase-final elongation. The C/D model is based on the idea that syllable structure is characterized by a pattern of ‘iceberg’ movements, which are characterized by high movement velocities at phrase boundaries. The present study investigates the nature of these movements in a corpus of spontaneous speech, and finds evidence for ‘iceberg’ patterns that are similar to those found in SS.

PHRASE FINAL ELONGATION

Phrase-final elongation is a phonological phrase boundary effect, consisting in syllable elongation at phrase-final position. The elongation is manifested as an increase in the duration of the gesture, slowing down all gestures in the same way. It could result in a specific boundary duration, delaying the occurrences of codas and in 6-gestures, or it could create a pause, whether it is a period of silence or a period filled with spurted voicing and other articulatory gestures. It could be a combination of these. Concerning syllable-based articulatory movements, it is not sufficient to determine which model should be used. Some deviations from the linear representation of syllable structure have been found, especially in digraphs at phrase boundaries (Fujimura, 1995). Fujimura's study (1995) also showed that the amplitude of syllable-based articulatory movements is related to the presence of phrase-final elongation.

METHOD

The Converter/Distributor (C/D) model, as a non-traditional, phoneme-based approach to speech production, suggests the possibility of syllable-based articulatory movements that are continuous and involve a pattern of ‘iceberg’ movements. The present study investigates the nature of these movements at phrase boundaries, and how they are related to elements of syllable structure.

RESULTS

A multiple regression was conducted to evaluate how well syllable duration, syllable duration and gap duration predict speed of consonantal movements in syllable-initial demisyllables in read and spontaneous speech. The linear combination of syllable magnitude and syllable boundary duration in the prediction of speed in read speech was found to be significant (F(1,24) = 5.34, p<.05; r=.50). The present study investigated the nature of the ‘phrase final elongation’ effect by observing possible influence of syllable duration as a measure of syllable magnitude, and of articulatory gap duration (as a measure of boundary strength) in the preceding movement pattern. For the present study, the ‘Blue Pine’ corpus was used, collected from a corpus of semi-spontaneous speech (Blue Pine; Fujimura, 2003). The analysis of the ‘Blue Pine’ data was carried out using a multiple regression, which showed that syllable magnitude and syllable boundary duration in the prediction of speed in read speech was significant (F(2,23) = 4.96, p<.001)

CONCLUSIONS

The outcome of the correlation analyses seem to confirm previous results from read data, showing a prominent role of syllable duration in SS. In contrast, in spontaneous speech, syllable duration and gap duration do not show a significant role in SS articulation. Articulatory gap duration is characterized by a prominent role of syllable structure, and the analysis of the ‘Blue Pine’ data showed a significant role of syllable duration and syllable boundary duration in the prediction of speed in read speech (Bonaventura, 2003), but this has not been found in tongue-based AM in SS. However, the results of the present study suggest that syllable structure may play a role in SS articulation, and that this role may be related to the presence of phrase-final elongation.

Acknowledgments

This research was funded by the National Institute on Deafness and Other Communication Disorders (NIDCD) of the National Institutes of Health (NIH) under grant number R01 DC014512.

REFERENCES

Bonaventura, P. (2003). The ‘Blue Pine’ data acquisition protocol was similar to Labov’s (1994) protocol, which was used to investigate the effect of contrastive emphasis, along with the presence of phrase-final elongation. The ‘Blue Pine’ data was collected from a corpus of semi-spontaneous speech (Blue Pine; Fujimura, 2003). The analysis of the ‘Blue Pine’ data was carried out using a multiple regression, which showed that syllable magnitude and syllable boundary duration in the prediction of speed in read speech was significant (F(2,23) = 4.96, p<.001).