Acoustic Properties of Prominence in Hungarian and the Functional Load Hypothesis

This paper examines the acoustic properties of two types of linguistic prominence in Hungarian, stress at the word level and focus at the phrase level. This investigation is part of a cross-linguistic study of prominence phenomena aimed at, among other things, testing a version of the Functional Load Hypothesis (FLH) regarding the distribution of acoustic properties at different levels of phonology. Since the same properties (e.g. F0, duration, amplitude, spectral properties) typically viewed as the cues to stress and focus are also used to signal lexical contrasts (with the exception of amplitude), the question underlying our research is to what extent the use of specific acoustic properties at the contrastive lexical level affects the use of the same properties for expressing prominence, and to what extent the same properties may (may not) be used to express prominence at the word and phrasal levels.

Hungarian offers a particularly interesting test case since it makes use of contrastive vowel length at the lexical level. The FLH as applied to our study predicts that this lexical use of duration would preclude (or at least reduce) its use in the manifestation of prominence.

We present data from 9 native speakers of Hungarian. The stimuli include 10 instances each of long and short /i, u, a/ (abstracting away from the quality difference between long and short /a/). Each such vowel is placed in a stressed and unstressed position and in a neutral and a focused position, yielding a total of 2160 vowel tokens.

Our study makes use of an elicitation technique that avoids a serious confound observed in much of the previous research on the acoustic properties of prominence, the fact that measurements of stress properties were made on words placed in carrier phrases such as "Maria said the word XXX three times." This type of structure causes the target to be focused, and thus any measurements of lexical level stress also include the effects of phrasal level focus.

To permit cross-linguistic generalization in our larger study, the stimuli are constructed in as similar a way as possible for all languages, with minimal differences to accommodate the structures of each language. The targets appear in dialogues that either involve focus on the target or on a subsequent word that thus draws the focus away from the target. Specifically, with regard to Hungarian, we use the following two types of dialogues (target underlined):

(1) Focus on Target (target V = /a/ stressed, focused)

Q: Mit mondott Mária reggel? *('What did Maria say in the morning'?)*
A: Mária a "katona" szót mondta reggel. *('Maria said the word "katona" in the morning.')*

(2) Focus Following Target (target V = /a/ stressed, unfocused)

Q: Mária délután mondta azt, hogy "katona"? *('Did Maria say "katona" in the morning?')*
A: Nem. Mária a "katona" szót reggel mondta, nem délután.
('No. Maria said the word "katona" in the afternoon, not in the morning.')

Results from 5 speakers are given in Figure1 for vowels in the non-focus position, allowing examination of the properties of stress without the confound of focus. As can be seen, the results support the FLH since there is essentially no difference in duration between stressed and unstressed vowels, as is predicted due to the use of contrastive vowel length in Hungarian. It can also be seen that duration is not a cue for focus, through the comparison of the focused and unfocused (stressed) vowels. By contrast, there is a substantially greater mean F0 and intensity in stressed vowels compared to unstressed vowels and in focused vs. unfocused vowels. These additional patterns will be shown in the full paper.

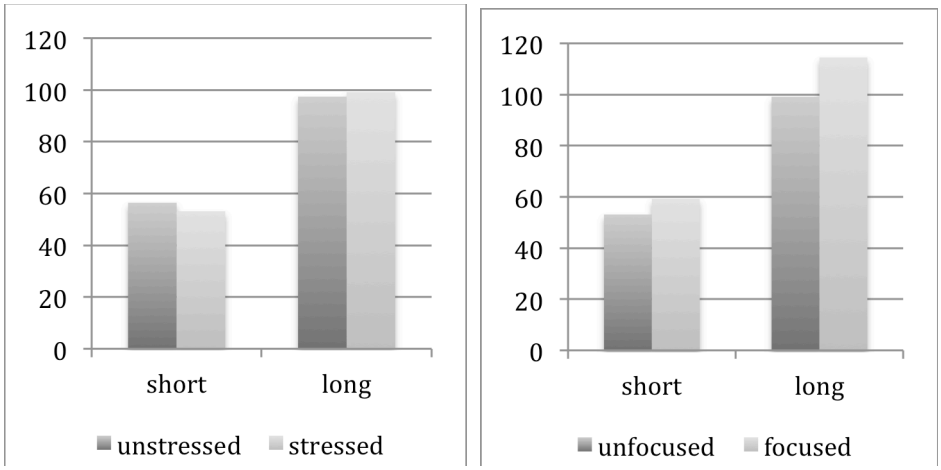

Figure 1. Mean Duration (ms): Stressed vs. Unstressed Vowels (without focus) and Focused vs. Unfocused (stressed vowels).

While most studies of the acoustics of stress and focus present only production data of the type just seen, this information does not indicate to what extent each of the properties contributes to the identification of prominence. This could be tested experimentally by artificially manipulating each property; however, in the context of our large scale cross-linguistics study, this is not feasible. Instead, we use binary logistic regression (BLR) analyses to assess the relative contributions of each of the properties (Ramus et al. 1999). Our classification results show that in non-focused position, stressed and unstressed long vowels are not reliably distinguished at all. The BLR minimally distinguishes stressed and unstressed short vowels (overall 66%) on the basis of F0, but not duration. Overall correct classification of both long and short (stressed) vowels as focused vs. unfocused is 74%, but again, F0 is the crucial property, not duration.

In further support of the FLH, we have compared the Hungarian results with those of two languages that do not use contrastive vowel length, Spanish and Greek. In both of these languages, duration is used to express prominence: in Spanish at the phrasal level (focus) and in Greek at both the lexical and phrasal levels (stress and focus) – along with varying contributions of the other properties.

Finally, we address an additional question with the Hungarian data, in comparison with the Spanish and Greek data. Specifically, we consider whether the predictability of a property such as stress or focus (both of which are predictable in Hungarian) may result in less systematic acoustic expression of these phenomena. Indeed, the overall success of the BLR in classifying stressed and focused vowels in Hungarian is substantially lower than in Spanish and Greek.

Reference

Ramus, F., M. Nespor, M., & J. Mehler, J. (1999). Correlates of linguistic rhythm in the speech signal. *Cognition 73*, pp. 265-292.