

The Prominence Degree of Word-Initial Pretonic Syllables with Full Vowels in English: An Introspective Rating Study*

Mariko Sugahara

Doshisha University

Sugahara, Mariko. (2021). In R. Okabe, J. Yashima, Y. Kubota, & T. Isono (eds.) *The Joy and Enjoyment of Linguistic Research: A Festschrift for Takane Ito*. Kaitakusha: Tokyo. (pp.441-450)

1. Introduction

English is a language that prefers a stressed and an unstressed syllable to appear alternately within a word. For example, the primary stress of *Apalachicola* /æ.pə.læ.fə.kóó.lə/ is on the penultimate syllable, and the secondary stress is placed on every two syllables from the penultimate one. Those stressed syllables have full vowels, whereas the unstressed syllables have a reduced vowel, schwa, pronounced with a mid, central vowel quality. It is, however, not always the case that full and reduced vowel syllables alternate. Consider the word *audition* /ɔː.dɪ.ʃn/, of which main stress is on the penultimate syllable. One question that arises here is whether the word-initial pretonic syllable with a full vowel in *audition* bears secondary stress or no stress. Liberman and Prince (1977), and Selkirk (1980) regard word-initial pretonic syllables with a full vowel as stressed assuming that all full vowels are in principle stressed.¹ That is, they consider the initial syllable of *audition* secondarily stressed. However, according to Ladefoged and Johnson (2015: 105), and the three major English pronunciation dictionaries by

* This study is supported by JSPS KAKENHI (Grant-in-Aid for Scientific Research (C)), Grant Number 17K02828, and by the NINJAL collaborative research project "Cross-linguistic Studies of Japanese Prosody and Grammar."

¹ Non-low full vowels in word-final or prevocalic position are exceptionally unstressed as in *potato*, *city*, *Sunday*, *hindu*, *radiate*, even for those who consider full vowels stressed (Chomsky and Halle (1968: 111)), Teschner and Whitey (2004: 150)). Segmental alternations of the onset consonants preceding those vowels serve as diagnostics for the presence or absence of stress. For example, flapping is evidence for a lack of stress (Kahn (1976: 58), Hayes (1995: 12)).

Johns (2011), Upton and Kretzschmar, Jr. (2017), and Wells (2008), pre-tonic full vowel syllables are unstressed in principle. Although not clearly stated in their works, they assume that word-initial or word-medial full vowel syllables are stressed only if they are immediately followed by a reduced syllable, forming a trochaic foot. They consider the initial and the third syllable of *Apalachicola* secondarily stressed, whereas the initial syllable of *audition* unstressed. Even Liberman and Prince (1977), and Selkirk (1980), who agree on the stressed status of word-initial pretonic full vowel syllables, disagree about the prominence degrees of those syllables. According to Liberman and Prince, pretonic syllables with a full vowel are labeled as “weak” in metrical tree structure, whereas full vowel syllables immediately followed by a reduced syllable forming a trochaic foot are labeled as “strong” in the structure. Selkirk, on the other hand, does not make such a distinction: She treats all full vowel syllables in a unified way that they are the “head” of a foot constituent regardless of whether or not they are in a pretonic syllable or immediately followed by an unstressed syllable with a reduced vowel.

In this way, there is little agreement among theories as to the prominence degrees of full vowels in pretonic syllables, and the main goal of the current study is to reveal the intuition of native English speakers about the prominence degrees of word-initial pretonic syllables with full vowels by conducting an introspective questionnaire-based survey.

An introspective method was adopted because native speakers’ intuition about prosodic prominence is not necessarily acoustically manifested in their production. Furthermore, native speakers do not necessarily judge the prominence patterns of English words based on the acoustic properties of auditory stimuli presented to them. For example, in their study on stress shift in English, Grabe and Warren (1995) found little acoustic evidence for prominence alternation between syllables which had originally carried primary stress and those which had originally carried secondary stress. Nonetheless, native speakers still perceived alternation in certain contexts. Given this, the current study attempts to reveal native English speakers’ competence about the prominence degrees of pretonic syllables with full vowels by adopting an introspective prominence rating method without using auditory stimuli.

2. Production and Perception Experiments by Fear et al. (1995)

Fear et al. (1995) carried out production and perception experiments on an issue closely related to the current study. In their production study, they compared the acoustic properties of word-initial pretonic syllables with full vowels (e.g., *audition*) with those of word-initial full vowel syllables carrying primary stress (e.g., *audiences*) and canonical secondary stress (e.g., *auditoria*), and those of word-initial syllables with reduced vowels (e.g., *addition*).² They found that in terms of duration, intensity and formant characteristics, pretonic full vowels were distinguished from both stressed full vowels and reduced vowels: They were significantly more reduced than stressed full vowels, whereas they were significantly less reduced than reduced vowels. In their perception study, however, they found that pretonic full vowels were grouped more consistently with full vowels with canonical stress than with reduced vowels. They spliced the vowels of word-initial syllables across the four types of words within each set (e.g., *audition*, *audiences*, *auditoria*, *addition*), and asked the listeners to rate the naturalness of the stimuli. As it turned out, the stimuli in which pretonic full vowels were interchanged with primarily stressed or secondarily stressed full vowels received higher naturalness ratings than those in which they were interchanged with reduced vowels. They concluded that although pretonic full vowels were distinguished from stressed vowels and reduced vowels in production, they were categorized in a binary way in perception, i.e., what mattered in perceptual categorization is whether the vowel quality was full or reduced. Their perception results, however, do not necessarily show how native English speakers rate the *prominence degrees* of pretonic full vowel syllables.

3. The Current Study: Introspective Ratings of Prominence Degrees

A questionnaire-based survey was conducted in which native American

² They assumed that pretonic full vowels were unstressed, and called them ‘U’, taking the initial letter of “unstressed full vowels.”

English speakers were asked to introspectively rate the prominence degrees of word-initial syllables: pretonic full vowel syllables, full vowel syllables with primary stress, those with canonical secondary stress, and reduced vowel syllables.

3.1. Participants

27 native speakers of American English (10 males, 17 females) participated in the survey. They were all undergraduate or graduate students of universities or colleges in the US, ranging from 18 to 29 year-old, joining the Japanese program of KCJS (Kyoto Consortium for Japanese Studies) or that of AKP (Associated Kyoto Program) at Doshisha University. They had been in Japan for one month to one year when the survey took place. None of them reported reading nor hearing problems, and all of them were paid for their participation.

3.2. Materials

Ten sets of words with the four types of initial syllables were constructed, which are shown in Table 1.

Sets	Full Vowels			
	Primary Stress	Secondary Stress	Pretonic	Reduced /ə/
1 /æ/	asphalt	aspiration	asphaltic	asparagus
2 /ɔ:/ or /ɑ:/	audiences	auditoria	audition	addition
3 /ɔ:/ or /ɑ:/	authorize	authenticity	authentic	Athens
4 /ɔ:/ or /ɑ:/	autumn	automation	autumnal	atomic
5 /ɔ:/ or /ɑ:/	causative	causativity	causality	casino
6 /aɪ/	idleness	ideology	idolater	adoption
7 /oʊ/	local	localization	locality	laconic
8 /oʊ/	motive	motivation	motif	Matilda
9 /oʊ/	motorize	motorization	motel	maternal
10 /u:/	unity	unification	unique	y'know

Table 1: Word sets used in the current study

Most of the words in Sets 2, 3, 4, 6 and 10 were borrowed from Fear et al. (1995) except for *Athens* in Set 3, *autumnal* in Set 4, *idolater* in Set 6.

The item in the fourth column of Set 10 *y'know* is not a morphological word: The subject pronoun *you* is reduced into a weak form /jə/ without forming a prosodic word on its own, and is cliticized to the following verb *know*. Nonetheless, we included the item because it satisfied the prosodic condition we imposed on the items in the fourth column of Table 1: An unstressed initial syllable with a reduced vowel is immediately followed by a primarily stressed syllable and there is no phrasal boundary between the them. The full vowels and their reduced counterparts in each set were identical in terms of their syllable structure and surrounding phonemes.³

3.3. Procedure

The participants were presented with questionnaire sheets, and each sheet consisted of two blocks. Each block in turn consisted of (i) the orthographic representation of a word from Table 1 presented in the first line, (ii) the same orthographic representation with syllable breaks in the second line, (iii) numbers from 5 to 1 aligned vertically below each syllable, and (iv) questions asking whether or not the participants knew the word ("yes" or "no") and how familiar to them the word was ("very familiar," "familiar," "not so familiar," "not familiar at all"). Presentation order of the blocks was randomized for each participant, and about 60 blocks of filler words were also inserted randomly. No auditory stimuli were used. The participants were told to introspectively judge the prominence degree of every syllable and circle the number matching the degree: 5 for "extremely strong," 4 for "strong," 3 for "middle," 2 for "weak" and 1 for "extremely weak." After the questionnaire task, the participants read aloud the words. The results of the production task, however, are not reported in this paper.

3.4. Analyses and Results

The rated prominence degrees were compared among the four types of initial syllable: "primary stress full" (e.g. *au.tho.rize*), "canonical secondary stress full" (e.g. *au.then.ti.ci.ty*), "pretonic full" (e.g. *au.tho.ri.ty*) and "re-

³ In Set 5, the segmental environment of the reduced vowel in *casino* differed from that of the full vowel counterparts: The reduced vowel was followed by a voiceless alveolar fricative /s/, whereas the full vowel counterparts were followed by a voiced alveolar fricative /z/.

duced" (e.g. *A.the.na*), by carrying out a Friedman test in SPSS, which is non-parametric equivalent to repeated measures ANOVA (Friedman (1937)). Before carrying out the test, the data from two speakers who consistently assigned lower prominence scores to primarily stressed syllables than to reduced syllables were excluded because our assumption was that the participants had an intuition that stressed syllables are more prominent than unstressed syllables. We also decided to conduct two analyses, i.e. those with and without the data from the word-sets (Sets 1, 2, 6 and 7) that contained less-known/less-familiar words: *asphaltic* (the percentage of the word known by the participants = 67%, the mean familiarity score = 2.22), *auditoria* (63%, 2.78), *idolater* (67%, 2.56) and *laconic* (59%, 2.70).⁴ Given those, the total number of the initial syllable prominence scores used in the test was (a) 1000 when Sets 1, 2, 6 and 7 were included (4 words*10 sets*25 speakers), and (b) 600 when they were excluded (4 words*6 sets*25 speakers).

The Friedman test requires the prominence scores of the four conditions obtained from each speaker for each set to be converted into ranks. For example, imagine that Speaker X's prominence scores given to the initial syllables of the four words in Set Y were 5 for the syllable with primary stress, 4 for the syllable with canonical secondary stress, 3 for the pretonic full vowel syllable and 3 for the reduced syllable. Those scores were converted into ranks from 1 to 4, i.e. 4, 3, 1.5 and 1.5 respectively.⁵ Figure 1 shows the histograms of prominence score ranks obtained from each of the four conditions, and their mean ranks (all sets included).

⁴ The familiarity scores were 4 for "very familiar," 3 for "familiar," 2 for "not so familiar," 1 for "not familiar at all." Other words were known by more than 95% of the participants, of which mean familiarity scores were above 3.

⁵ Tied scores were assigned with averaged ranks.

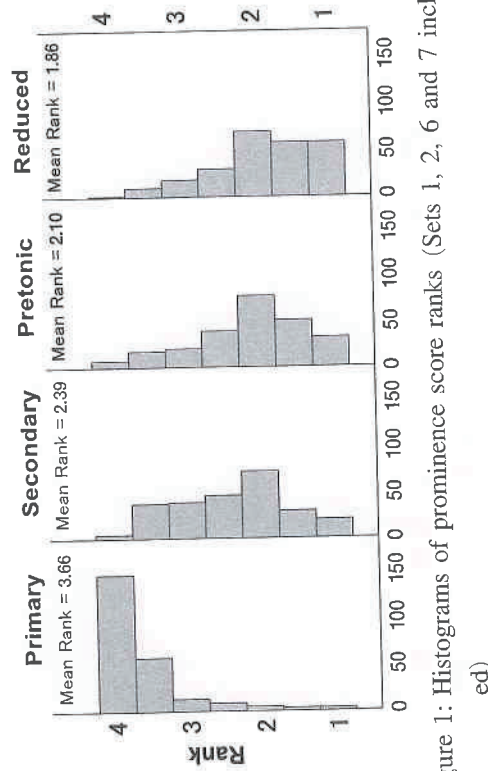


Figure 1: Histograms of prominence score ranks (Sets 1, 2, 6 and 7 included)

The mean rank of the primarily stressed syllables was 3.66 when Sets 1, 2, 6 and 7 were included (a), and 3.62 when they were excluded (b), which was the closest to 4, meaning that their prominence scores were distributed in the highest range. The mean rank of the reduced syllables was 1.86 for (a) and 1.85 for (b), which was the closest to 1, meaning that their prominence scores were distributed in the lowest range. The mean rank of the secondarily stressed syllables and that of the pretonic full vowel syllables were in between: The former was 2.39 for (a) and 2.43 for (b), and the latter was 2.10 for both (a) and (b).

According to the Friedman test, there was a significant difference in the mean ranks of the four syllable conditions for both (a) and (b) ($(a) \chi^2(3) = 367.17, p < .001$; $(b) \chi^2(3) = 207.55, p < .001$). Dunn's pairwise post hoc tests with a Bonferroni correction for multiple comparisons were carried out. All the comparisons between the primarily stressed syllables and the other three conditions were significant for both (a) and (b) ($p < .001$). The comparison between the secondarily stressed and the reduced syllables was also significant for both (a) and (b) ($p < .001$). The comparison between the secondarily stressed and the pretonic syllables, and that between the pretonic and the reduced syllables were not significant for (a) nor (b), however.

4. Discussion and Conclusions

Our major observation is that in terms of their prominence degrees introspectively rated, the primarily stressed, the secondarily stressed and the reduced vowel syllables were unquestionably distinguished from each other. The pretonic full vowel syllables, however, were betwixt and between the secondarily stressed and the reduced syllables. This is visually summarized in Figure 2. What the result indicates is that having a full vowel is not enough for pretonic syllables to form a single category of "stressed" with stressed syllables, and being in pretonic position is not enough for them to form a single category of "unstressed" with reduced vowel syllables.

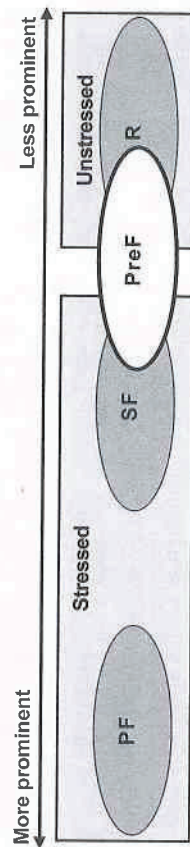


Figure 2: The four types of syllable in English and their prominence-based groupings inferred from the results of the current study: PF=primarily stressed full, SF=secondarily stressed full, PreF=pretonic full, R=reduced

There are also additional findings in our study. One of them is that whether or not the words used in the study were known or familiar to the participants was not a crucial factor. Analysis (a), in which less-known/less-familiar words were included, and Analysis (b), in which they were excluded, yielded the same results. This indicates that the participants were good at inferring correct stress patterns from the orthographic representations of the less-known/less-familiar words.

Another finding is that the prominence ratings of the primarily stressed syllables were higher by a sizable margin than those of the secondarily stressed syllables in spite of the fact that they were both stressed. The prominence rank distribution of the former was steeply skewed to 4, whereas no such steep skew was present in the distribution of the latter as shown in Figure 1. One question that arises here is where the outstandingly high rat-

ings of the primarily stressed syllables came from. I speculate that the participants relied on their knowledge about the presence or absence of a pitch accent when distinguishing the prominence degrees of the primarily stressed syllables and those of the secondarily stressed syllables. In English, only primarily stressed syllables bear a nuclear pitch accent. Furthermore, the most frequently appearing pitch accent in English is a high tone (Daimora (2006)). It is very likely that the primarily stressed syllables were associated with high pitch in our participants' memories, and that is why they introspectively gave overwhelmingly high prominence ratings to the primarily stressed syllables.

Although we stated in the first section that native speakers did not necessarily judge the prominence patterns of English words based on the acoustic properties of auditory stimuli, citing Grabe and Warren's (1995) work, it does not of course mean that their internal competence about prosodic prominence has no correlation with the acoustic properties of linguistic units externally manifested. Their competence must have been fostered in part by accumulating the exemplary acoustic patterns of linguistic units inputted to their memories during the course of language acquisition. Furthermore, their competence also affects the acoustic properties of their production when proper contexts are provided. One of those contexts might be the one in which speakers produce citation or near citation forms. We also recorded our participants producing all of the words used in the current study as near-citation forms, and it will be useful to look into the details of their acoustic patterns in our future study, e.g., how the acoustic data points of the pretonic full vowel syllables are distributed in comparison with those of the secondarily stressed syllables and those of the reduced ones. Although Fear et al. (1995) have already looked into some of the acoustic properties of the four types of syllable, they only considered their mean values, not having taken into consideration the distribution of actual data points.

In conclusion, we can say based on the main result of the current study that pretonic full vowel syllables are hybrid between stressed and unstressed syllables in terms of introspectively rated prominence degrees. This indicates that the theory of Liberman and Prince (1977) introduced in Section 1 is the most tenable, which states that pretonic full vowel syllables are "stressed" and at the same time "weak."

References

- Chomsky, Noam and Morris Halle (1968) *The Sound Pattern of English*, MIT Press, Cambridge, MA.
- Dainora, Andra (2006) "Modeling Intonation in English: A Probabilistic Approach to Phonological Competence," *Laboratory Phonology 8*, ed. by Louis Goldstein, Douglas H. Whalen and Catherine T. Best, 107-132, Mouton de Gruyter, New York.
- Fear, Beverly D., Anne Cutler and Sally Butterfield (1995) "The Strong/Weak Syllable Distinction in English," *Journal of Acoustical Society of America* 97, 1893-1904.
- Friedman, Milton (1937) "The Use of Ranks to Avoid the Assumption of Normality Implicit in the Analysis of Variance," *Journal of the American Statistical Association* 32, 675-701.
- Grabe, Esther and Paul Warren (1995) "Stress Shift: Do Speakers Do It or Do Listeners Hear It?" *Phonology and Phonetic Evidence: Papers in Laboratory Phonology IV*, ed. by Bruce Connell and Amalia Arvaniti, 95-110, Cambridge University Press, Cambridge.
- Hayes, Bruce (1995) *Metric Stress Theory: Principles and Case Studies*, University of Chicago Press, Chicago.
- Joans, Daniel (2006) *Cambridge English Pronouncing Dictionary*, Cambridge University Press, Cambridge.
- Kahn, Daniel (1976) *Syllable-Based Generalizations in English Phonology*, Doctoral dissertation, MIT.
- Ladefoged, Peter and Keith Johnson (2015) *A Course in Phonetics*, 7th ed. Cengage Learning, Stanford.
- Lieberman, Mark and Alan Prince (1977) "On Stress and Linguistic Rhythm," *Linguistic Inquiry* 8, 249-336.
- Selkirk, Elisabeth (1980) "The Role of Prosodic Categories in English Word Stress," *Linguistic Inquiry* 11, 563-605.
- Teschner, Richard V. and M. Stanley Whitely (2004) *Pronouncing English: A Stress-Based Approach with CD-ROM*, Georgetown University Press, Washington, D.C.
- Upton, Clive and William A. Kretschmar, Jr. (2017) *The Routledge Dictionary of Pronunciation for Current English*, 2nd ed., Routledge, Oxford.
- Wells, John C. (2008) *Longman Pronunciation Dictionary*, 3rd ed., Longman, Harlow.