

EFFECTS OF FOCUS UPON DURATIONAL PATTERNS OF FIVE-SYLLABLE WORDS IN STANDARD CHINESE

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ABSTRACT

This paper explicitly examines the influence of focus on durational patterns of five-syllable words with various positions and different tones in Standard Chinese. Target sentences were constructed with the focused constituents locating at the beginning of the sentences. For the within-word syllables of the focused constituents, they were designed in various positions in the words and associated with the tones of tone1, tone2 and tone4. Results of the experiments show that although focus induces significant lengthening of the focused constituents, the internal durational adjustment of each focused syllable is by no means symmetric and the magnitude of such lengthening is determined by the metrical structure of the focused constituents.

Keywords: focus; five-syllable words; durational pattern

1. INTRODUCTION

Focus, the notion of which was adopted in, e.g., Nooteboom & Kruyt [1], Ladd [2] and Gussenhoven [3], to name just a few, as the linguistic mechanism, employed by the speaker to indicate new or contrastive information to the listener. In languages such as English, Dutch and Swedish, the primary correlate of focus is a pitch accent associated with the prosodic head of the focus domain. However, studies of these languages also demonstrate that duration, the secondary cue, exhibits both universal and language-specific features under the effect of focus. In English, e.g., when a word is focused, all syllables within the word are lengthened, and the magnitude of the increase of each focused syllable depends to some extent, on the within-word syllable position (Cambier-Langeveld & Turk [4]); Dutch is also reported that all syllables in accented words are longer than comparable syllables in unaccented words, although all segments and syllables contribute to the change in word duration due to accent. The extent to which each syllable participates in the lengthening, however, seems to depend at least partly on its position in the word (Eefting [5]); For Swedish, it is shown that words with focal accents are longer than non-focal words in general, but the amount of lengthening varied greatly, primarily due to speaker differences but also syllable position in the phrase and the word distinction (Mattias & Eva [6]).

In the study of focus-induced lengthening in Standard Chinese, many researches present that when a mono-syllabic word is focused, both onset and rhyme are lengthened significantly (Chen [7]; Shih & Ao [8]); and

when a disyllabic word is focused, both syllables are lengthened (Xu [9]). For the poly-syllabic focused constituents, i.e., a four-syllable word, although all the syllables become lengthened under focus, the distribution of lengthening within the focus domain is not uniform (Chen [10]). She further points out that the pattern of lengthening within the focused words is determined together by two principals, one is that the increase of duration is sensitive to the metrically stronger syllables, which obtain more lengthening than the metrically weaker ones; the other is the edge-effect of lengthening which requires that the edges of a focused constituent should lengthen more than the rest of the constituent.

The above-mentioned existing analyses on the cross-language durational change exerted by focus demonstrate that duration increase varies significantly in different within-word positions. However, factors such as segmental and tonal compositions for each focused syllable in different within-word positions which may contribute differently to the magnitude of lengthening are still far from being clear-cut. Therefore, the purpose of the present study is to address the question with respect to focus-induced lengthening, specifically the lengthening pattern of five-syllable words associated with various positions and different tones in Standard Chinese. It further endeavors to provide the answers to a couple of questions: Firstly, when the five-syllable words are focused as the whole entity, how do the internal syllables contribute to the lengthening when it is located in various positions and associated with different tones? Secondly, what are the underlying causes for restricting the durational distribution of within-word syllables of the five-syllable words?

2. METHOD

2.1. Test materials

In the experiment, we intend to test the durational adjustment of the within-word syllables under focus condition. The important factors considered in the material design are the syllable positions and tones of the target segment. We therefore selected three groups of five-syllable translated foreign names which have the tonal combinations as High tones (tone1), Ring tones (tone2) and Falling tones (tone4). Within each group, the target segment “ge” locates in five positions of the words, namely, the first, the second, the third, the fourth and the fifth position. All the focused words are presented as follows:

- (1) all High tones: *ge1bo1di1ba1ga1*
bo1ge1di1ba1ga1
bo1di1 ge1ba1ga1
bo1di1ba1 ge1ga1
bo1di1ba1ga1 ge1
- (2) all Rising tones: *ge2di2de2bo2da2*
di2 ge2de2bo2da2
di2de2 ge2bo2da2
di2de2bo2 ge2da2
di2de2bo2da2 ge2
- (3) all Falling tones: *ge4ba4da4di4bu4*
ba4 ge4da4di4bu4
ba4da4 ge4di4bu4
ba4da4di4 ge4bu4
ba4da4di4bu4 ge4

It is well-known that the same linguistic unit displays different durational patterns due to the different prosodic context in the template sentences (Fougeron & Keating [11]). And in this study, all the focused words are set at the beginning of the target sentences in order to counterbalance interact of the prosodic context and the internal elements within the focused constitutes in the distribution of duration. Finally, target words are embedded in the sentence: *bu2dui4, [focused words] shi4 qi2 da2 nei4 de0 da4 biao3 ge1*". The focus is elicited on the focused words by the question of "heng1 li4 shi4 qi2 da2 nei4 de0 da4 biao3 ge1?"

2.2. Subjects and recording

Totally four Standard Chinese speakers, two men and two women who were born and raised in Beijing were invited as the subjects in the experiment. They all speak Standard Chinese and work in the Chinese Academy of Social Sciences. The subjects were divided into two groups, one containing two men and the other two women. Recording was conducted in the sound booth in the Phonetic Lab in the Linguistic Institute of CASS. During the recording procedure, all the template sentences appeared three times. They were randomized and presented on the computer screen, and one of the two subjects was asked to read the question and the other was required to read the template sentences as the answer to the question in natural state. And in case of any unnatural or wrong pronunciation of target words, the speaker was asked to repeat the sentence. After the presentation of the materials, the subjects were asked to change the asking-answer role. Thus, for each focused words we got 12 samples for further analysis.

2.3. Data extraction and statistical analysis

All the sound files were first segmented by automatic segmentation software, and then syllable boundaries¹ of target words were modified by hand. Before the extraction of the data, textgrid files were carefully checked in order to

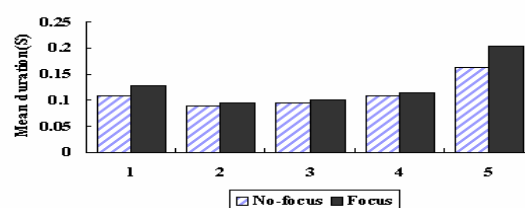
¹ The duration of silent phase is not included in calculating the duration of the target segment.

confirm the accuracy of data. Duration information from each textgrid file was extracted by praat script for further analysis. Repeated One-Way ANOVA was conducted separately for the syllable which has various positions and different tones through SPSS.

3. RESULTS

The following figure 1 gives the comparison among the duration means of the syllable "ge" in different positions of the five-syllable words (i.e., the 1st syllable, the 2nd syllable, the 3rd syllable, the 4th syllable and the 5th syllable), presented by the column bundles numbered 1, 2 to 5 respectively. For each position, duration means are obtained from the duration of the syllables which have three various tones, namely, tone1, tone2 and tone4. The left column displays the no-focus condition, and the right, the focused one.

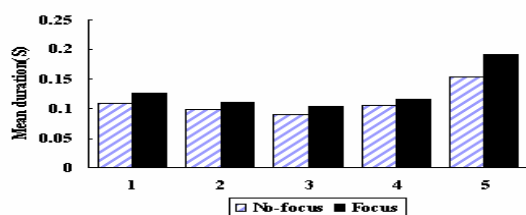
Figure 1: Mean duration of syllables with different tones.



Examination of the above graph demonstrates that no matter where the syllable "ge" locates in the five-syllable word, the under focus constituent exhibits longer duration than those under no-focus condition when the words are treated as a whole entity to be focused. However, although all the syllables lengthened under the influence of focus, the average amounts indicate that the distribution of lengthening is not uniform. Rather, the magnitude is different among syllables in various positions both in terms of absolute lengthening and percentage of lengthening. It is told from the graph and the specific values that the syllable in the final position lengthened (0.041s and 25%²) more than the syllables in other positions (the 1st position: 0.02s, 19%; the 2nd position: 0.008s, 9%; the 3rd position: 0.005s, 5%; the 4th position: 0.006s, 6%). One-Way ANOVA analysis (by-focus) is also conducted to examine the effect of focus on the syllables locating in different positions. In the 1st and the 5th positions, it induces obvious influence on the lengthening of syllables [by-Focus: the 1st $F(1,70)=16.95$, $P=0.00$; the 5th $F(1,68)=23.09$, $P=0.00$; for the 2nd, 3rd and the 4th syllable position, focus has no significant effect on lengthening [the 2nd $F(1,69)=3.3$, $P=0.05$; the 3rd $F(1,70)=2.35$, $P=0.1$; the 4th $F(1,70)=3.41$, $P=0.07$].

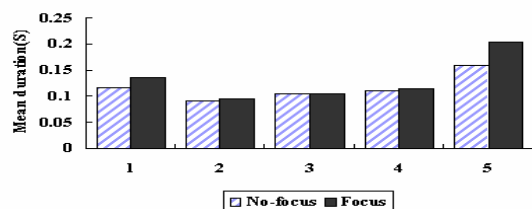
In figure 2, mean duration of the syllable "ge" which is associated with tone1 and are set in various within-word positions. 1, 2 or 5 also refer to the syllable positions and the left column is under no-focus condition while the right ones under the focus condition.

² The absolute amount of lengthening is calculated from the difference between the focused syllable and its unfocused counterpart. And the percentage of lengthening is obtained from the absolute amount which is divided by the mean duration of the unfocused syllable.

Figure 2: Mean duration of ge1 syllables in different positions.

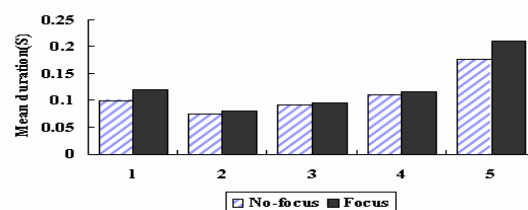
Closer examination of figure 2 illustrates that all the “ge1” show longer duration in focus condition than their counterparts in no-focus condition. However, the magnitude of lengthening is not identical, specifically, the syllable in the final position observes the greatest lengthening, and the first position syllable obtains the secondary. Specific values of both absolute lengthening amount and percentage are respectively, (the 1st position: 0.018s, 17%; the 2nd position: 0.011s, 11%; the 3rd position: 0.014s, 14%; the 4th position: 0.011s; 10%; the 5th position: 0.038s, 25%). One-Way ANOVA analysis suggests that focus exerts significant effect on the syllables in the first and final positions [by-Focus: the 1st $F(1,22)=4.58$, $P=0.04$; the 5th $F(1,22)=9.26$, $P=0.00$]. Focus shows no obvious effect on the syllables in the 2nd, 3rd and 4th positions [the 2nd $F(1,22)=1.66$, $P=0.2$; the 3rd $F(1,22)=3.72$, $P=0.07$; the 4th $F(1,22)=3.0$, $P=0.1$].

The following figure3 describes the case in which the focused syllable “ge2” in different positions indicated by the column bundles 1, 2 and 3, etc.

Figure 3: Mean duration of ge2 syllables in different positions.

Apparently, it can be seen from this graph that under the focus condition, the durations of “ge2” in both initial and final positions are elongated obviously. However, when the “ge2” dwells in the 2nd, 3rd and the 4th positions, focus status imposes minor effect on the duration of the syllables. Lengthening is also observed with the greatest magnitude in the final position (0.045s, 28%). The amount of lengthening for other syllables displays as: (the 1st position: 0.02s, 17%; the 2nd position: 0.005s, 6%; the 3rd position: no lengthening; the 4th position: 0.003s, 3%). It is also indicated through the One-Way ANOVA analysis that the effect of focus is only remarkable in the 1st and 5th positions [the 1st $F(1,22)=6.46$, $P=0.02$; the 5th $F(1,20)=12.84$, $P=0.00$]; otherwise, focus gives no significant effect on the 2nd, 3rd and 4th positions [the 2nd $F(1,21)=3.44$, $P=0.08$; the 3rd $F(1,22)=0.02$, $P=0.9$; the 4th $F(1,22)=0.98$, $P=0.3$].

The figure 4 beneath is applied to describe the situation in which the focused syllable “ge4” located in various positions.

Figure 4: Mean duration of ge4 syllables in different positions.

Identical with the previous figure 3, under focus condition, the initial and final syllables show apparently longer duration than their counterparts in no-focus condition. What distinguishes this graph from the previous one is that, in the 3rd position, the focused “ge4” is slightly longer than the unfocused “ge4”. The absolute amount and percentage of lengthening tells that the 1st syllable is enlarged (0.02s and 20%; the 2nd position: 0.07s, 9%; the 3rd position: 0.002, 2%; the 4th position: 0.007, 6%; the 5th position: 0.044s, 25%). Results of One-Way ANOVA gives similar results to that of tone1 and tone2 syllables in the way of the effect of the focus, concretely, it significantly effects 1st and the 5th positions [the 1st $F(1,22)=7.53$, $P=0.02$; the 5th $F(1,22)=7.87$, $P=0.01$]; and focus shows no obvious effect on the 2nd, 3rd and the 4th positions: [the 2nd $F(1,22)=1.22$, $P=0.3$; the 3rd $F(1,22)=0.09$, $P=0.8$; the 4th $F(1,22)=3.41$; $P=0.08$].

4. CONCLUSION AND COMPLEMENTARY DISCUSSION

Results of the experiment show that in Standard Chinese, given a five-syllable word, focus introduces lengthening on the syllables no matter where the syllable is located and what tone it is associated with. However, the absolute amount of lengthening seems to be different when the syllable is located in the different positions and associated with different tones. Concretely, although different tones were set with the final syllables, they observe the greatest amount of lengthening and the first syllables obtain the secondary lengthening. In addition, focus has the minor effect on the syllables dwelling in the 2nd, 3rd and 4th positions and when the tones of syllables are tone2 and tone4 the effect is even weaker. These facts strongly indicate that for five-syllable focused constituents in Standard Chinese, it is treated as a whole entity and not separated into smaller prosodic units. Therefore, we highly agree with Xu [9] and Chen [10] that the lengthening pattern can be comparable with variously sized focused constituents, i.e., one-syllable, two-syllable and four-syllable words of Standard Chinese exhibit different amounts of lengthening. The final syllable observes the greatest lengthening in the five-syllable words under the influence of focus can be explained through the observation of Chao [12] and Chen [10]³ that the rightmost syllable is the most prominent syllable of a constituent which requires that metrically strongest syllable lengthens most. In addition, the initial syllable achieves the subordinate amount of lengthening, which indicates that this syllable is metrically stronger than the other three syllables. Therefore,

³ For four-syllable words, the most prominent syllable is the rightmost syllable.

taking all these together, it is appropriate to suggest that in Standard Chinese, when the five-syllable constituent within the focus domain undergoes lengthening, the distribution of lengthening is sensitive to the metrical structure of the whole focused entity i.e., metrically strongest syllable deserves the greatest lengthening and the secondary stronger syllable observes the secondary. Thus, in this research, the durational pattern is different from languages that have enormously been studied in English (Turk & Sawusch [13]), Dutch (Cambier-Langeveld [14]), and Swedish (Heldner & Strangert [15]), the focused-induced lengthening of these languages are sensitive to the stressed syllable in that it is the stressed syllable lengthened most.

This study is open for later refinement on increased scale of data when the focus constituents are located in the different positions of the target sentences.

5. ACKNOWLEDGEMENTS

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6. REFERENCES

- [1] Nootboom, S.G., Kruyt, J. G. 1987. Accents, focus distribution, and the perceived distribution of given and new information: an experiment, *Journal of the Acoustical Society of America*, 82, 1512-1524.
- [2] Ladd, D. R. 1996. *Intonational phonology*. Cambridge: Cambridge University Press.
- [3] Gussenhoven, C. 2004. Types of focus in English. *Intonational and meaning, theoretical and crosslinguistic perspectives*. Dordrecht: Kluwer Academic Publishers.
- [4] Cambier-Langeveld, T., Turk, A. 1999. A cross-linguistic study of accentual lengthening: Dutch vs. English. *Journal of Phonetics*, 27, 255-280.
- [5] Eefting, W. 1991. The effect of “information value” and “accentuation” on the duration of Dutch words, syllables, and segments. *Journal of the Acoustical Society of America*, 89, 412-424.
- [6] Mattias, H., Eva, S. 2001. Temporal effects of focus in Swedish. *Journal of Phonetics*, 29, 329-361.
- [7] Chen, Y. 2003. *The phonetics and phonology of corrective focus in Standard Chinese*. PhD dissertation, State University of New York at Stony Brook, Stony Brook.
- [8] Shih, C., Ao, B. 1997. Duration study for the Bell laboratories Mandarin Text-to-Speech system.
- [9] Xu, Y. 1999. Effects of tone and focus on the formation and alignment of F0 contours. *Journal of Phonetics*, 27, 55-105.
- [10] Chen, Y. 2006. Durational adjustment under corrective focus in Standard Chinese. *Journal of Phonetics*, 34, 176-201.
- [11] Fougerson, C., Keating, P. A. 1997. Articulatory strengthening at edges of prosodic domains. *Journal of the Acoustical Society of America*, 101, 3728-3740.

[12] Chao, Y. 1968. *A grammar of spoken Chinese*. Berkeley: University of California Press.

[13] Turk, A.E., Sawusch, J. R. 1997. The domain of accentual lengthening in American English. *Journal of Phonetics*, 25, 25-41.

[14] Cambier-Langeveld, T. 2000. *Temporal marking of accents and boundaries*. Holland Institute of Generative Linguistics.

[15] Heldner, M., Strangert, E. 2001. Temporal effects of focus in Swedish. *Journal of Phonetics*, 29, 329-361.