Interaction of Syntax-marked Focus and Wh-question Induced focus in Standard Chinese

Yuan Jia¹, Aijun Li¹

¹ Phonetics Lab, Institute of Linguistics, Chinese Academy of Social Sciences, China

sumeryuan_2003@126.com, liaj@cass.org.cn

Abstract

The present study mainly investigates the interaction of syntax-marked focus and wh-question induced focus on the formation of F0 patterns in Standard Chinese (Hereinafter, SC). Acoustic experiment demonstrates that the syntax-marked (lian or shi) focus can co-exist with the wh-question induced focus. The results are two folds: (i) the two kinds of focuses can add together to trigger more obvious F0 prominence on the under-focus constituents and F0 compression on the post-focus constituents; (ii) they can realize prominences simultaneously on difference constituents in one sentence. Therefore, the F0 pattern of SC presents itself to observe the nuclear prominence and pre-nuclear prominence classification as in English. Specifically, the single focus induces the nuclear prominence and the dual focus triggers both nuclear prominence and pre-nuclear prominence.

Index Terms: Syntax-marked focus, Wh-question induced focus, nuclear prominence, pre-nuclear prominence

1. Introduction

In Chinese literatures, the ‘lian...dou’ and ‘shi...de’ constructions are considered to be the typical structures to mark focus (refer to Fang [1], Liu and Xu [2], Xu [3] and Liu [4]). In grammatical studies, the ‘lian...dou’ structure is adopted to mark contrast, i.e., Fang [1] states that only the constituent immediately following lian is the focus bearing unit, and lian can be taken as the contrastive focus marker. She further explains the nature of the ‘NP’ after the marker lian: (i) within the lian sentence, the NP marked by lian is the most extreme element; (ii) the non-nominal element after lian bears the nature of a nominal. With regard to the ‘shi...de’ structures, shi is the closed equivalent of English copula “be,” and de is a particle with various functions: modification marker (Ross [5]), nominalizer (Chao [6]), and past-tense marker (Song [7]). Previous grammatical studies on the ‘shi...de’ construction mainly discuss its focus marking function, i.e., Liu [4] lists three kinds of strong focus marking of shi...de structure: (i) shi; (ii) shi+...+de, and (iii) shi+...+f+de+ NP. In addition to the discussion in grammatical aspect, Jia et al [8] deals with the phonetic realization of shi-marked focus at the sentential level, results of the study show that the intonational prominence bears corresponding relationships with the shi-marked items. The pitch range of the focused item is expanded and the pitch registers of constituents immediately following the shi-marked focus being compressed successively.

In regard with the acoustic analysis of wh-question elicited focus, previous studies have nevertheless show that the F0 and durational patterns exhibit both universal as well as language-specific features. Related to the F0 patterns, both English and Chinese show that the focus extensively modulates the global shape of the F0 curve, i.e., the pitch range of the pre-focus constituents are expanded and the pitch range of the post-focus are compress while leaving the pitch range of the pre-focus constituent largely intact. Due to the existence of the tones in SC, the essential causes for the expansion of the pitch range of the focused item lie in the raising of the H tones and the lowering of the L tones (Xu [9] [10]). Further, when the focused constituent extends to more syllables, the whole constituents bears F0 changes, i.e., when five-syllable words are correctly focused and the whole focused constituents are affected by the focus, specifically, focus raises the H tones of each focused syllable and the magnitude of such rising is largest in the final syllable (Jia et al [11]).

From the previous studies on ‘lian...dou’ and ‘shi...de’ constructions in SC, it can be obtained that the analysis mainly concentrates on their syntactic or semantic function. The phonetic and phonological natures of the interaction of syntax-marked focus and wh-question elicited focus have not been clearly discussed. Therefore, the purpose of this study is to systematically explore the nature of prominences triggered by different kinds of focuses. i.e., the co-existences and conflicts of syntax-marked focus (‘lian...dou’ and ‘shi...de’ marked focus) and wh-question induced focus (hereinafter, wh-focus) on the formation of the F0 patterns in SC. The study further addresses the following questions: i) what is the effect of syntax-marked focus on the F0 prominence? ii) what constituents the differences of shi-marked focus and lian-marked focus? iii) what is the co-existing and conflicting manner of syntax-marked focus and wh-focus in one sentence? iv) what is the phonological nature of the prominences induced by the combined effects of focuses?

2. Methods

2.1. Materials

The aim of the experiment is to test the co-existences and conflicts of the syntax-marked focus and the wh-elicited focus. The important factors to be considered in the design of the materials are how to include these focuses in the target sentence so that we can observe various kinds of phonetic functions of them. The core set of the test-sentences is formed by the word order of “subject-verb-object” as the unmarked sentence, given in (i), specifically, S–Liumin, V–Tiba, O–Maolan, the lian... dou and shi...de sentence is composed by lian and shi being inserted into the proceeding position of the subject constituents in the unmarked sentence (Fang [1]). The insertion of Le0 in unmarked and lian...dou structure is to keep the phonetic balance with the shi...de construction, the sentences are listed in (ii)-(iii):

(i) Liu2 Min2 Ti2 Ba2 Mao2 Lan2 Le0.
   liu min elevate mao lan le
   (Liumin elevated Maolan).

(ii) Lian 2 Liu2 Min2 Dou1 Ti2 Ba2 Mao2 Lan2 Le0.
   even liu min all elevate mao lan le
   (Even Liumin elevated Maolan).

(iii) Shi4 Liu2 Min2 Ti2 Ba2 Mao2 Lan2 De0.
A number of factors influence the choice of syntactic structure, e.g., word order of the sentence, lexical items and segmental compositions. As for the former, the following two aspects were considered: (i) the intonation of neutral sentence with the word order as SVO has been studied by different authors (e.g. Xu [10]); (ii) It is also proposed that the word order of SVO is the least marked word order in SC in the sense that they impose the fewest constraints on the object referent (Xu [12]). As for the tonal combinations, "tone2+tone2" were employed onto each syntactic constituent that can observe the entire changes of F0 from L-H tones permutation in one sentence. The reason for the selection of the initial of each word as the sonorant is to control the segmental effect upon F0 (Xu [10]).

The sentence in (i)-(ii) was preceded by different wh-questions in order to elicit the production of utterances with various focus readings. The wh-question together with the target sentences are listed in part 3.

2.2. Subjects and recordings
All the asking-answering sentences were included in the recording schema with two times repetitions. The orders of these sentences were automatically randomized by computer software. Eight Standard Chinese speakers, four females and four males, aged within 20-45, were recruited as the subjects. These subjects were divided into four groups, each contains two women or two men. They were totally native to the purpose of this experiment and were told to read the answering-answer pairs fluently.

Recording was conducted in the sound treated booth in Phonetics Lab, Institute of Linguistics Chinese Academy of Social Sciences. Sound files were digitized at 16kHz. During the recording procedure, each wh-question and target sentence pair appeared on the screen. The speakers were instructed to read the sentences as naturally as possible, and they were free to repeat them in case they considered their reading not fluent or unnatural. After the presentation of the materials, the subjects were asked to change the asking-answer role. Finally, we got 32 samples for each target sentence for further examination.

2.3. Data labeling and extraction
All the sound files were annotated and extracted from the following steps: i) firstly, all ‘wav’ files were segmented by automatic segmentation software, and then syllable boundaries of each syllable were modified by hand to ensure the accuracy of the data; ii) the ‘PitchTier’ file for each target sentences was modified automatically by praat script; iii) The extraction of F0 data was based on the PitchTier files with each syllable in the target sentence being selected ten points.

2.4. Measurements and statistical analysis
Since the global range of each target sentence is defined as the difference between maximum and minimum of values of tones, and the local range of every tonal sequence is defined as the difference between the values of the H and L targets. F0 values of the following set of points in the contour were obtained according to the specific aim of the analysis: (i) the mean F0 contour of each constituent in the sentence; (ii) the maximum value of H tones and minimum of L tones of target items; (iii) Bonferroni post hoc test was adopted to examine the significance of differences among the constituents in various focus conditions.

3. Phonetic realization of interaction of different kinds of focuses
This part is concerned with the F0 patterns formed by the interaction of syntax-marked focus and wh-question elicited focus. In order to explore the co-existence and conflict of the focuses, specific context was designed so that the syntax-marked focus and the wh-elicited focus can form various relationships, e.g., co-existence on the same constituents or conflict with each other in the formation of the F0 patterns. Consequently, the F0 patterns conveyed by different kinds of focuses can be defined by phonological means. Further, a consistent correlation between the F0 patterning and syntax-marked focus can be expressed in terms of the phonological categories and not in terms of variation in physical continua.

3.1. Phonetic realization of syntax-marked focus
The major aim of this part is to explore the specific manner of the effect from lian and shi marked focus. F0 is taken as the parameter to investigate this effect. In particular, if the syntax-marked focus (lian or shi marked) is found to be consistently signaled by distinctive F0 means in SC, the effect of the focus should be captured in phonological means. In order to approach this goal, the following asking-answering pairs are adopted:

(i) Asking: Fa1 Sheng1 Le0 Shen2 Me0 Shi4? happen le what case (What happened?)
Answering:
a. Lian2 Liu2 Min2[+LianF] Dou1 Ti2 Ba2 Mao2 Lan2 Le0.

b. Shi4 Liu Min2[+ShiF] Ti2 Ba2 Mao2 Lan2 De0.

c. Liu2 Min2 Ti2 Ba2 Mao2 Lan2 Le0.

It can be observed that the lian and shi marked focuses always locate on the subject items “liu min2”, and through the selection of the wh-operator ‘Fa1 Sheng1 Le0 Shen2 Me0 Shi4?’ the three target sentences locate in the same context. The only difference of these three sentences is the syntactic structure. Therefore, we can compare the effect from the syntax-marked focus and the unmarked sentence.

Figure 1 is adopted to illustrate the mean F0 in three syntactic structures: Lian2 Liu2 Min2[+LianF] Dou1 Ti2 Ba2 Mao2 Lan2 Le0, Shi4 Liu Min2[+ShiF] Ti2 Ba2 Mao2 Lan2 De0, and Liu2 Min2 Ti2 Ba2 Mao2 Lan2 Le0. The top part of the X-coordinate describes the contents of each syllable in the sentence, and the bottom illustrates the syntactic structure and the utterances, concretely, ‘LianSB’ denotes an utterance that contains a lian-marked focus distributing on the subject constituent. The designation ‘ShiSB’ denotes a shi-marked sentence with the subject item serving as the focused item, and ‘Un’ means the sentence is unmarked. The Y-coordinate illustrates the pitch range of the graph, and has a range of 110Hz-260Hz based on the average range of all the speakers.

![Figure 1: Mean F0 of Lian, Shi and unmarked sentences](image)

It can be obtained clearly from the above graph that there appears an F0 prominence in the contour ‘LianSB’. The prominence in the
sentence distributes on the subject constituent; i.e., the word “liu2min2”. Concretely, the “H” tones of the two syllables are obviously higher than the other syntactic elements within the sentence, while the “L” tones are a little bit higher. Compared to the ‘Un’ contour, the subject constituent in a lian-marked sentence also exhibits a higher pitch register. The constituents locating after the lian-marked focus (e.g., Dou1 Ti2Ba2 Mao2Lan2 Le0) undergo compression and exhibit a lower pitch register than the unmarked sentence. With regard to the shi-marked sentence, the item that locates immediately after shi-marked focus exhibits the most obvious prominence among the three subject constituents. The pitch register distributing after the shi-marked subject obtains the lowest pitch register. A further One-Way ANOVA was conducted to compare the signficance of the minimum and maximum pitch value differences induced by shi and lian focuses on the positions of subject, verb, and object. Results of the Bonferroni post hoc test shows that the maximum pitch values of all the syntactic entities in the contour are different from each other with $P_{\text{max}}$<0, however, the minimum value of the L tones of the LiuminShi is not significantly different from LiuminShi with $P_{\text{min}}$>0.

The study of the F0 patterns in various syntactic structures developed here shows that the syntax-marker can affect the global F0 patterns of the sentence. Specifically, the marked focus exhibits similar effect with the single wh-focus that it can exert F0 prominence in under-focus position and compresses the F0 ranges in post-focus positions. In comparison with the focus marker shi, lian shows a slight effect upon F0 rising under focus and F0 compression in the positions after the focus.

### 3.2. Syntax-marked focus and wh-focus on the same item

This part mainly deals with the additive effect from the syntax-marked focus and the wh-focus on the formation of the F0 patterns in SC. Specifically, it concerns with the following issues: (i) the physical correlates of the effect from the addition of lian-marked focus or shi-marked focus with the wh-focus; (ii) the domain over which the focused constituents may extend; and (iii) the phonological means to represent the additive focus in the surface form. The target sentences for the examination of additive focuses are:

(i) Lian2 Shi2 Dou1 Ti2 Ba2 Mao2 Lan2 Le0? 
   even who all elevate mao lan le 
   (Even who elevated Maoalan?)

Lian2 Liu2 Min2 LiangKnF Dou1 Ti2 Ba2 Mao2 Lan2 Le0.

(ii) Shī4 Shi2 Ti2 Ba2 Mao2 Lan2 De0? 
   is who elevate mao lan de 
   (It is who that elevated Maoalan?)

Shī4 Liu2 Min2 ShīKnF Ti2 Ba2 Mao2 Lan2 De0.

The other two target sentences are identical with the (i)-a and (i)-b in part 3.1.

Figure 2 is the mean F0 of the utterances with four kinds of focus conditions: the addition of lian-marked focus and wh-focus; the addition of shi-marked focus and wh-focus; the shi-marked focus and lian-marked focus. These focus conditions are described by the symbols in the bottom part of the graph. Specifically, ‘LianSB-F’ and ‘ShīSB-F’ denote the case in which the lian and shi marked focuses combine with the wh-focus. The designations ‘LianSB’, ‘ShīSB’ and the Y-coordinate denote the identical content with Figure 1.

The mean F0 contour of ‘LianSB-F’ shows that the subject bearing units clearly exhibit pitch register rising and it is more obviously than the one in contour ‘LianSB’. Moreover, the pitch registers of the successive syllables are significantly compressed, which indicate a compressive effect from the focused subject items. As for the F0 contour of ‘ShīSB-F’, it replicates the effect of the focus in ‘LianSB-F’ in the way that the sentential prominence locates on the word “liu2min2” and the pitch registers of the following syllables are compressed. The difference found between the two F0 contours lie in the overall pitch range values. The additive focus from the wh-focus and the shi-marked focus exert more F0 expansion on the prominence position and more reduction on the post-focus items. A One-Way ANOVA was conducted to investigate the significance of F0 differences of the same constituents in various focus conditions, i.e., ‘LianSB-F’, ‘ShīSB-F’, ‘LianSB’, and ‘ShīSB’. Results of the Bonferroni post hoc tests are also used to explore the significance of the minimum and maximum pitch values. Further evidence is found from the Bonferroni post hoc test in which the pitch registers of the constituents under the additive focus are significantly different from the single focus condition, with all the $P_{\text{max}}$<0 and $P_{\text{min}}$<0.

Thus, the result is that the lian-marked focus and shi-marked focus can combine with the wh-focus in the way that the entire pitch register is raised higher than the single lian or shi marked focus. And the post-focus constituents observe more compressive effects from the additive focus.

### 3.3. Co-existence of two kinds of focuses on different constituents

In the previous part, the mechanism of the additive effect upon the F0 pattern is of main concern. This part mainly deals with the conflicts of the syntax-marked focus and the wh-focus on the formation of the F0 patterning in the surface form. The following issues are addressed: (i) the acoustic correlates of two kinds of focuses in one utterance; i.e., syntax-marked and wh-focus; (ii) the phonological characteristics of the entities involved in expressing two kinds of focuses. In order to approach this goal, the following asking-answering pairs are adopted:

(i) Lian2 Liu2 Min2 Dou1 Ti2 Ba2 She2 Le0? 
   even liu min all elevate who le 
   (Even Liumin elevated whom?)

Lian2 Liu2 Min2 LiangKnD Dou1 Ti2 Ba2 Mao2 Lan2 De0.

(ii) Shī4 Liu2 Min2 Ti2 Ba2 She2 De0? 
   is liu min elevate who de 
   (It is Liumin that elevated whom?)

Shī4 Liu2 Min2 ShīKnD Ti2 Ba2 Mao2 Lan2 De0.

The other sentence is identical with (i)-c in part 3.1. Figure 3 depicts mean F0 of the contours with a double focus condition in

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1 The asking pair violates the Unique Strong Focus Principle which forbids the wh-operator after the shi.
It is claimed by Xu [10] and Jia et al [8] that wh-focus in SC exerts a compressive effect upon the F0 register after the focus. The discussion in section 3.1 demonstrates that the syntax-marked focus can trigger F0 rising in focus position and compress the F0 after the focused constituents. In the investigation of the co-existence of syntax-marked focus (lian-marked focus or shi-marked focus) and wh-focus, the following aspects need to be considered: (i) whether the syntax-marked focus can realize F0 prominence simultaneously with the wh-focus; and (ii) the F0 variation of pitch register in the position between two prominences. Further investigation of the phonetic nature of the lian-marked focus in the ‘LianSB+F’ contour in Figure 3 reveals that the most obvious prominence distributing on the object position with the whole pitch register of the object item being raised. And, secondary prominence is due to the effect of the lian-marked focus which also exerts a prominence. There is no obvious pitch register lowering between the two focuses. It is apparent in the ‘ShiSB+F’ contour, that the F0 in Figure 3 exhibits obvious pitch register lowering between the two focuses. It is marked focus which also exerts a prominence. There is no focus can trigger F0 rising in focus position and compress the F0 in terms of a prosodic aspect.

4. Conclusion and Discussion

The present study mainly investigates the co-existence and conflicts of syntax-marked focus and wh-focus question induced focus on the formation of F0 patterns. Results of the experiment demonstrate that the syntax-marked focus can trigger F0 prominence in the target sentence, and they can also co-exist with the wh-focus in one target sentence. Specifically, (i) the single syntax-marked focus, i.e., shi-marked focus or lian-marked focus can realize F0 prominence, and the prominence corresponds with the marked focus, (ii) the syntax-marked focus (shi or lian marked focus) and the wh-induced focus can co-occur with each other on one item, and the focus bearing unit shows the most obvious F0 prominence; (iii) syntax-marked focus and the wh-induced focus can co-exist with each other on difference items in one sentence, and they can realize F0 prominences simultaneously. Evidences of F0 patterns of various kinds of focus obtain the phonological entities of nuclear accent and pre-nuclear accent as in English (Ladd [13], etc.). When there is no wh-question induced focus, the syntax-marked focus can serve as the major cause for the generation of the nuclear accent. When the syntax-marked focus and the wh-focus locate on one item, they generate nuclear prominence together. Although the single focus (shi or lian marked focus) and the additive focus varies in the specific acoustic manifestations, they corresponds with the same phonological entity, nuclear prominence. When the wh-focus is inserted into the target sentence, the syntax-marked focus loses its effect on the generation of the nuclear prominence with the wh-focus serving as the anchor for nuclear prominence. Alternatively, the syntax-marked focus performs as pre-nuclear prominence in the sentence.

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6. References