

An Experimental Study on the Assignment of Focus Accent in Mandarin

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Abstract

This paper investigates the distribution of focus-related accents in the broad focus domain in Chinese Mandarin through 300 natural sentences. The results show that focus-related accent tends to be assigned to the predicate in a subject-predicate structure, to the object in a predicate-object structure, and to the head in an adjunct-head structure unless the head is highly predictable. From these observations, we conclude that, in a broad focus structure in Chinese Mandarin, the focus-related accent is normally assigned to the innermost constituent of the sentence if this constituent has enough semantic weight; otherwise, the accent is placed in the constituent that has the closest syntactic relationship to the innermost one.

1. Introduction

It is widely accepted that information structure and prosody structure are correlated in many languages. For instances, Gussenhoven developed the Focus-to-Accent theory, claiming that a semantic focus in a sentence is expressed by a pitch accent [1] [2]; conversely, Selkirk raised the Basic focus rule, arguing that a constituent to which a pitch accent is assigned is a focus [3]. There exist different types of focus depending on the difference of information structure; yet, semanticists have not reached any unanimity on the classification of focus. This paper adopts Ladd's narrow-broad classification, that is, a narrow focus contains only one content word and a broad focus contains two or more. According to this classification, the breadth of broad focus is variable and a sentence focus is the broadest. As pointed by Ladd, there are two interrelated questions to approach in the studies on prosody-focus relationship: A) where do we assign the accent, given focus? B) How do we know the breadth of the focus, given the position of the accent? This paper aims to answer question A) with respect to Chinese Mandarin.

There are two issues that are closely related to our research aim. The first one is that if focus-related accent assignment is language-specific. Some researchers claimed that there exist cross-language differences of accent placement, for instance, Ladd argued that there is a basic division between languages that normally locate the main accent on the rightmost content word in a sentence (e.g. Italian and Catalan) and those that allow the main accent to be placed on a non-rightmost content word (e.g. English and German) [2]. The most famous opponent to the language-specific view may be Cinque, who held that no language-specific proviso is necessary in predicting accent (in his paper "stress" was used) placement, and in all languages, the main stress of a structure is on its most deeply embedded constituent [4]. We do not intend to get involved in the theoretical dispute; instead, we will use our empirical data to

investigate how focus-related accent is assigned in natural speech in Chinese.

The second issue related to this study is that if purely syntactic or phonological rules are sufficient for predicting the location of sentence accent. The theories based on *normal stress* view used purely syntax-based or phonology-based rules to explain the distribution of sentence accent (stress), such as Chomsky and Halle's Nuclear Stress Rule in SPE [5] and Cinque's null theory. Bolinger may be the most radical criticizer to *normal stress* view and its followers, saying that "the distribution of sentence accent is not determined by syntactic structure but by semantic and emotional high-lighting" [6]. Bolinger put forward an important notion *relative semantic weight* and argued that a constituent that is highly predictable (has relatively low semantic weight) is usually de-accented. Selkirk and Ladd held eclectic views on this issue, namely, they accepted semantic impact on accent location, and they also admitted that accent distribution is closely related to syntax structure [2] [3]. In this paper, we will probe to what extent the location of sentence accent in Chinese can be explained by syntax-based rules and to what extent a semantic explanation is necessary.

There is a traditional notion "*syntax stress*" in Chinese linguistics [7]. *Syntax stress* has the similar meaning to semantic accent in a broad focus, referring to the stress in a phrase or sentence that is spoken out of the blue. The rules of syntax stress assignment (SSAR) cited in many Chinese linguistics textbooks are: (1) The syntax stress is usually assigned to the predicate in a subject-predicate structure; (2) The syntax stress tends to be located in the object in a verb-object structure; (3) The adjunct rather than the head in an adjunct-head structure (no matter whether the phrase is a VP or NP) is usually stressed. Nevertheless, these theoretical rules were seldom validated by empirical evidence. Discussions, such as if these rules are syntactically recursive and to what extent these rules are consistent with the corresponding rules derived from other languages, are hardly found in literatures. In this paper, we try to check these rules by our empirical data.

Chinese is a tonal language, in which the primary function of pitch is to differentiate tones for all the syllables. Because of this, Xu argued that, for expressing a semantic focus, pitch accent is not necessary unless the focused constituent is not most deeply embedded in a sentence [8] [9]. Xu and Shen's phonetic studies, however, proved that, in Chinese Mandarin, the semantic focus contributes to the alignment of F0 contour in a sentence, and that pitch prominence plays a very important role in marking focus [10] [11]. Their conclusions confirm the prosody-focus relation in Chinese. We conducted two accent-labeling experiments and found that sentence accent is perceptible in Chinese (see next section), and the present study is based on the result of the labeling.

2. Method

2.1. Material

The material contains 300 sentences selected from a large speech corpus for speech synthesis. Most of the sentences have only one clause and some have two or more. The material was read by a professional female broadcaster. Since all the sentences are semantically isolated, theoretically, in most cases, the speaker should have regarded the whole sentence as being focused, i.e. most sentences should have a broad focus. Yet, in some cases, narrow focus appeared because of a special syntax structure. Moreover, in multi-clause sentences narrow focus occurred more frequently because in these cases the clauses have context.

The clauses in the material are classified into four categories, i.e. subject-verb-object (SVO), subject-verb (SV, since no object within the predicate), verb-object (VO), and the others, according to their syntactic structure.

2.2. Finding focus-related accents

Since we did not give any introduction to the speaker to place the semantic accent, we must find which word was accented for express the focus in each clause. Two perceptual experiments were conducted to identify all accented words, from which the focus-related accents are derived.

In the first experiment, a relative prominence score was obtained for each syllable in each sentence. Sixty Mandarin native speakers participated in the experiment to judge which syllables were prominent. The details of the experiment were reported in Chu et al. [12].

Although both semantic accentuation and rhythmic stressing result in perceptual prominence of a speech unit, it is very difficult for a subject who has no linguistic knowledge to differentiate accented syllables from stressed ones. That is to say, the prominent score in the first experiment was insufficient for us to judge whether a syllable got a semantic accent. Thus, the second experiment was conducted to determine which syllables were semantically accented and which were only rhythmically stressed. Three experts in phonetics labeled all accented syllables and stressed ones without referring the prominence scores obtained in the first experiment. The procedure of the labeling was also reported in Chu et al. [12]. The results of the second experiment were consistent with those of the first experiment. Specifically, the mean prominence score of the accented syllables and that of the stressed ones were significantly larger than that of the syllables that were neither accented nor stressed, and the mean score of the accented syllables was larger than that of the stressed ones. The consistency testified the reliability of the experts' labeling.

Since more than one accent were identified in most clauses, we regard the accented syllable that obtained the highest prominence score in a clause as having the focus-related accent. There are a few clauses having no focus-related accent and a few having two or more. A clause having no accent is usually a part of a multi-clause sentence, in which the focus-related accent of the sentence is located in the other clause(s). In a clause having two or more focus-related accents, the two (or more) accents have the same prominence score. In the second experiment, 408 focus-related accents distributing in 397 clauses were identified. We regard a word within which a syllable has the largest prominence score as the accent bearing unit.

3. Results and Discussion

3.1. The distribution of focus accents

The distribution of focus-related accents in the material is shown in Table 1, in which subject, predicate, object, and complement are abbreviated as S, P, O, and C respectively, and adjunct (modifier or qualifier) and head as A and H respectively. The subscript of an abbreviation denotes the phrase that the constituent is in. For an SVO or VO clause, the most deeply embedded constituent in the table (might not be the genuinely innermost in a clause) is the head within the object (Ho) in the predicate verb phrase, and for a SV clause, the verb and its following complement (V and C, respectively) are the innermost. We do not choose to go to the genuine innermost word in each clause to observe the general tendency of accent assignment because the deepness of syntax stress varies across clauses.

Table 1: *The distribution of focus-related accents.*

Structure Constituent		SVO	SV	VO	Others		
		Pre-core	2	0	2	1	
S	A _s	13	9				
	H _s	34	12				
P	A _p	29	24	14	7		
	H _p	V	10	39	3	3	
		O	A _o	61			25
			H _o	75			38
		C	0	6	1		1

Beginning from the outermost structure, we can see in Table 1 that the speaker seldom placed accents in the pre-core constituents such as “同时(meanwhile),” “实际上(actually),” and so on. In the cores of the clauses, accent distribution ratios between the subjects and the predicates are 47:175 ($\approx 1:3.7$) and 21:69 ($\approx 1:3.3$) in SVO and SV clauses, respectively. The result show that the speaker tended to assign the accent to the predicate rather than the subject. Within the predicates, accent distribution ratios between the adjuncts and the heads are 29:146 ($\approx 1:5.0$), 24:45 ($\approx 1:1.9$) and 14:67 ($\approx 1:4.7$) in SVO, SV and VO clauses, respectively. It seems that the speaker tended to place the accent in the head of the predicate. Nevertheless, we find that some predicates do not contain adjuncts, thus it is necessary to exclude these cases to see the true location tendency. The numbers of the predicates containing no adjuncts in SVO, SV and VO clauses are 6, 20 and 2, respectively. These cases being excluded, we can see that, the speaker did tend to place the accent in the head in SVO and VO clauses (the distribution ratios are 1:4.8 and 1:4.3, respectively), while she had no significant tendency in processing SV clauses (the distribution ratio $\approx 1:1.0$).

Now we observe accent location within the head of the predicate. In SVO and VO clauses, the speaker had a strong tendency to allocate the accent to the object. The distribution ratios between the verbs and their objects are 10:136 ($\approx 1:13.6$) and 3:63 ($\approx 1:21$) in the two kinds of clauses, respectively. The tendency to assign the accent to the object is evident. In SV clauses, the accent was located much more frequently in the verb than it was in the complement, the distribution ratio between the verbs and the complements being 39:6 ($\approx 1:0.15$). Yet, there are only 12 clauses containing a complement within

the predicate, so we cannot say that the verb has the priority to be accented over the complement. Since the semantic relationship between verbs and their complements is very complicated in Chinese and we don't have enough samples in the material, we leave the accents on complements out of consideration in the following analysis.

Finally, we observe accent distribution between the adjuncts and the heads within the object in SVO and VO clauses. As in processing the predicate verb phrase, we must exclude the objects containing no adjuncts when investigating the assignment tendency. There are 59 and 28 such cases in SVO and VO clauses, respectively. After these cases are excluded, the distribution ratios between the adjuncts and the heads are 61:16($\approx 1:0.26$) and 25:10 ($\approx 1:0.4$) in SVO and VO clauses, respectively, indicating that the speaker tended to assign the accent to the adjunct in an object noun phrase.

Standing on the syntactic layer shown in Table 1, we can generally say that focus-related accent is normally assigned to the relatively inner constituent in a clause in Chinese Mandarin. That is to say, the results of this study confirm Cinque's null theory to some extent. However, two phenomena that do not support the null theory are notice-worthy. The first one is that, within the predicate in SV clauses, the speaker had no significant tendency to place the accent on the head, which is syntactically deeper than the adjunct. The second one even conflicts with the null theory, that is, within an object noun phrase contained in an SVO or VO clause, the accent tended to be assigned to the adjunct that is less deeply embedded than the head. We attribute the phenomena to a semantic factor and leave it to be discussed in next section.

The results in Table 1 confirm SSAR (1) and (2) to a larger extent, i.e., predicates or objects have the priority to be accented over their corresponding subjects or verbs, respectively. Accent distribution in adjunct-head structured objects also confirms SSAR (3). The distribution in adjunct-head structured predicates, however, is a counterexample for SSAR (3). It is very interesting that, with respect to adjunct-head structures, the evidence supporting the null theory is exactly the counterexample to SSAR (3), and vice versa. In the following section we will discuss the relationship between SSAR and the null theory and will give a semantic account for the variation of accent distribution within the adjunct-head structures.

3.2. Syntax-based and semantic-based accounts

Theoretically, SSAR (1) and (2) are consistent with the null theory, and SSAR (2) is even the necessary result as the null theory works because the object in a subject-verb-object structure is the innermost constituent. Yet SSAR (3) obviously conflicts with the null theory and so does the accent assignment tendency in adjunct-head structured objects, since the most deeply embedded constituent should be the head in an AH structure (see Cinque, 1993 [4]). In example (1), the accent was assigned to the adjunct within the object, the accented word being in black broad Chinese characters and capitalized English letters.

(1) 国际清算银行 将 发挥 **重要** 作用。

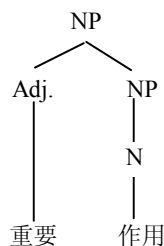
BIS will play **IMPORTANT** role.

'Bank of International Settlements will play an important role.'

The object in clause (1) is actually structured as (2). The

innermost constituent of the sentence is "作用 (role)" that is the head of the object noun phrase. Using Bolinger's semantic theory on accent assignment, we can easily explain accent location within the phrase "发挥重要作用 (play an important role)". Because the noun "作用 (role)" is one of the most frequently used objects of the verb "发挥 (play)" and is frequently modified by the adjective "重要 (important)", it is highly predictable from its two preceding words. In other words, the semantic weight of the head is relatively lower than that of the adjunct within the object. Therefore, "重要" got the accent.

(2)



The view of relative semantic weight can also account for the other results in Table 1. One of the obvious evidences is that focus-related accents were seldom located in the pre-core constituents in the clauses, since the semantic weight of the preceding constituent is usually much lower than that of the following core. Another strong supporting evidence to the semantic view is that the accent tended to be assigned to the predicate in an SV structure and to the object in an SVO/VO structure because the posterior constituent is usually more informative (and is more deeply embedded in syntax) in a predicate-argument structure (including SV, SVO and VO structures) in Chinese. From the semantic view, it is also explainable that the speaker had a strong tendency to locate the accent in the H_p within the predicate in an SVO clause while had no location tendency between the A_p and the H_p in an SV clause. The head of the predicate in an SVO clause contains a deeper structure, i.e. the object phrase, while in an SV clause the head does not, thus, the semantic weight of the H_p in an SVO clause is usually higher than that of the A_p , and the usual relationship between the A_p and the H_p does not exist in SV clauses. Consequently, an H_p in an SVO clause has a larger possibility to be accented than that in an SV clause does.

Thus far, we have confirmed SSAR (1) and (2) by the empirical results of the present study, and consider that SSAR (3) should be modified as follows.

Focus-related accent is usually assigned to the head in an adjunct-head structure unless the head is highly predictable.

We think that the revamped rule can work in an adjunct-head structure on any syntactic tier, and thus can be used repeatedly in a syntax tree. For instance, in an SVO clause, on the node of the predicate, the head is usually accented because it contains sub-constituents and therefore is not easy to be predicted from the preceding constituents; while on the object node, the head has a smaller possibility to be accented because it often contains only one word and thus is highly predicable.

3.3. The recursiveness of SSAR

In this section we will mainly investigate the recursiveness of

SSAR (1) and (2). In Chinese Mandarin, there is a special type of sentence structure, in which the predicate is a subject-predicate phrase. Such a sentence is named as subject-predicate predicated sentence (SPP sentence). SPP sentences are the right material for us to see if SSAR (1) is recursive in a syntax tree.

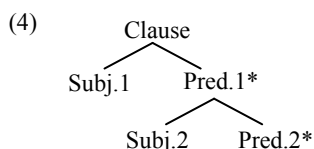
In our material, there are 12 SPP clauses, five of them contain narrow foci because of special syntax structures or being contained in multi-clause sentences. In the other seven clauses, five of them have the accent in the inner predicate, (3) being an example.

(3) 两国之间的关系前景美好。

Two countries between relationship prospect GOOD.

'The prospect of the relationship between the two countries is good.'

The predicate “前景美好 (the prospect is good)” in (3) is a subject-predicate phrase and the inner predicate (in the syntax tree the lower one) “美好(is good)” was accented. We attribute the accentuation to the repetitive performance of SSAR (1) that is shown by (4) (the accent is in the constituent with the asterisk).



As the subject-predicate structure, a verb-object structure can also be imbedded recursively in a Chinese sentence, and this is the right material for us to see if SSAR (2) is recursive. In our material there are 32 SVO/VO clauses within that the objects contain inner verb-object phrases, and in 16 cases the accent was located within the outer object. The other 16 clauses in which the accents are not in the outer objects have narrow foci because of special syntax structures or being contained by multi-clause sentences. What is meaningful to the topic discussed here is that, when the accent was assigned to the outer object, if it was finally assigned to the inner object; in other words, if SSAR (2) performed recursively in the 16 clauses that have broad foci. The result is positive, all the 16 clauses having the accents in their inner objects. Example (5) and (6) are two examples.

(5) 这种言论只会引发社会混乱。

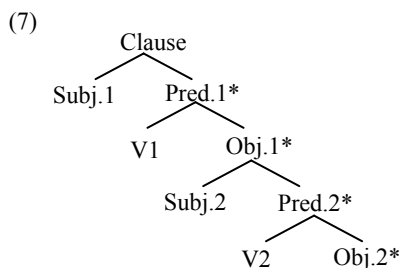
Such kind speeches only can cause society IS DISORDERED.

'Such kind of speeches can only cause social disorder.'

(6) 历史证明这是一条铁律。

History proves this is an IRON RULE.

'The history proves that this is an iron rule.'



The object of (5) is a verb-object phrase, and that of (6) is

a sub SVO clause. Focus-related accent was placed in the inner object in both cases. We regard (5) as the result of repetitive performance of SSAR (2), and (6) as the result of both SSAR (1) and (2) that is shown by (7).

Thus far we have proved the recursiveness of SSAR (1) and (2) and the recursiveness of revamped SSAR (3). Now that all the SSARs are recursive, it can be deduced that focus-related accent should be finally assigned to the innermost constituent in a sentence if semantic factors are excluded, though we did not genuinely observe the innermost constituents in the clauses because of the limitation of paper space.

4. Conclusions

By observing the results of the present empirical study, we found that the assignment of focus-related accent is related to both syntax relationship and semantic relationship among the constituents in a sentence in Chinese Mandarin. Generally speaking, the accent tends to be on the relatively inner constituent; yet, if a constituent is semantically highly predictable, it will be de-accented even if it is most deeply embedded in the sentence. We also found that SSAR (3) conflicts with the general location rule because it is semantically based and asks constrained conditions. We revamped SSAR (3) to make it consistent with the general rule and work well under different semantic conditions. Finally, we proved the recursiveness of SSAR (1) and (2) by our empirical data, and hold that because of the recursiveness of SSARs, it can be deduced that in a sentence focus structure the focus-related accent tends to be on the innermost constituent if the constituent is not semantically redundant.

5. References

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