Disambiguate or not? – The role of prosody in unambiguous and potentially ambiguous anaphora production in strictly Mandarin parallel structures

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Abstract

It has been observed that the interpretation of pronouns can depend crucially on their accentuation patterns in parallel sentences as “John hit Bill and then George hit him”, in which ‘him’ refers to Bill when unaccented but shifts to John when accented. While accentuation is widely regarded as a means of disambiguation, some studies have noticed that it also extends to unambiguous anaphors [13-15]. From the perspective of production, however, no strong experimental confirmation was found for the ‘shift’ function of accented pronouns, which is due to the fact that production research has mainly focused on corpora [5, 6]. Hence, the nature of the accent on anaphors still remains obscure. By manipulating referential shift and ambiguity, this study explores the role of prosody in anaphora production in strictly Mandarin parallel structures. The results reveal a significantly higher F0 and longer duration for anaphors in referentially shifted conditions, suggesting that anaphoric accentuation signals a referential change in strictly parallel structures in Mandarin. No evidence was found that ambiguity plays a role in anaphoric accentuation. This finding challenges the general view on accented pronouns and will deepen our understanding on semantics-prosody relationship.

Index Terms: pronoun, anaphora, production, ambiguity, accent, prominence, F0

1. Introduction

1.1. Background

It has been noted that the interpretation of pronouns may depend crucially on prosody in spoken language [1]. As illustrated in (1) – a coordinated sentence with a parallel structure, the potentially ambiguous pronoun ‘him’ has different antecedents under different patterns (capitalization indicates accentuation): it refers to ‘Bill’ when unaccented but to ‘John’ when accented.

(1) John hit Bill and then George hit him (Bill).

John hit Bill and then George hit HIM (John).

Studies on pronoun resolution propose that listeners employ a parallel function strategy: an unaccented pronoun co-refers with a prior constituent in the same syntactic position, while an accented pronoun shifts this preference to the competitor in a different position [2-4]. Since listeners are unable to resolve the correct antecedent of a pronoun in sentences like (1) via cues other than prosody, pronominal accentuation is pervasively assumed to be a disambiguation strategy [5-12]. Different from this ambiguity-oriented view, some studies point out from a generalized perspective that accentuation also extends to unambiguous anaphors [13-15], as illustrated in Lakoff’s example (2) [16] with unambiguous pronouns and (3) with full NP. Moreover, it is argued that disambiguating information cannot surpass prosodic cue in resolution [2, 14], as shown in (4), in which the unaccented ‘he’ cannot be identified with ‘Bill’ and listeners are forced to associate ‘he’ with ‘Mary’. These examples show that the connection between prosody and ambiguous pronouns may be an instance of a broader relationship between prosody and referential shift, which is defined as the anaphor and its antecedent in different syntactic positions.

(2) John insulted Mary and then SHE insulted HIM.

(3) John hit Bill and then George hit JOHN.

(4) Mary hit Bill, and then he hit HARRY.

Though referential shift is a more plausible trigger of accentuation on pronouns than ambiguity, the role and the exact nature of anaphoric accentuation in parallel structures still remain obscure.

On the one hand, the possibility has not been ruled out that ambiguity jointly plays a role with referential shift. Moreover, the disambiguation effect of prosody seems so self-evident that accented unambiguous anaphors has been much ignored, and many studies have modified Lakoff’s example by only using ambiguous pronouns, which runs the risk of establishing and reinforcing a causal relationship between ambiguity and accentuation. Hence, experimental work is needed to assess the respective contributions of referential shift and ambiguity. To our knowledge, ambiguity has never been investigated as a potential factor in anaphora production.

On the other hand, though intuitively convincing, experimental evidence is still lacking relating accentuation and referential shift. Most experimental studies on production have failed to find a distinct ‘shift’ function of accented pronouns [9, 17]. A major reason is that almost all those studies used corpus materials, in which there may be limited cases of referential shift and there exist many uncontrolled confounding factors. Studies on perception have demonstrated various strategies and factors in pronoun resolution. For instance, some evidence indicates that a subject assignment preference is the dominant strategy other than parallel function strategy [18, 19]. Smyth’s result [2] shows that lack of control over parallelism accounts for the conflicting results. Besides sentence structure, there are other factors involved such as discourse coherence [8, 20, 21] and causality [22] introduced by the verb or conjunctions. For example, in ‘John hit Bill and then he fell’, contrary to either the parallelism or the subject assignment account, ‘he’ refers to ‘Bill’ due to coherence; in ‘John impressed Bill because he …’ and ‘John admired Bill because he …’, ‘he’ is more expected to refer to ‘John’ in the first sentence but to ‘Bill’ in the second sentence due to the direction of causality implied within the verbs. Factors affecting resolution may also...
influence production. Hence, in order to check for the role of referential shift, it is necessary to use strictly controlled parallel structures.

1.2. The Current Study

The current study aims to answer the much-neglected questions about anaphoric accentuation in production in strictly parallel structures: first, does ambiguity play a role in the prosodic patterns? Specifically, does the degree of accentuation differ when other strong disambiguating cues are present? Second, is there a systematic correlation between accentuation and referential shift?

Previous studies are based on intonational languages such as English. It is noted that the interaction between prosody and anaphors may be universal [14]. To add cross-linguistic data, this study tackles the above questions via a production experiment in a tonal language – Mandarin. Results on the interaction of tone and information structure in Mandarin show that Mandarin indicates prosodic prominence by use of duration, intensity, and F₀ range for high tone at varied focal positions as in English [23]. Hence, this paper restricts all concerned anaphors to high tone, which, combined with the same canonical word order as English, makes it directly comparable with previous observations on English. For this reason, this paper will continue to use ‘accent’ to denote prosodic prominence at phrase level in Mandarin to avoid terminological confusion, though it remains an issue of debate. Meanwhile, the interaction between tone and accentuation is eliminated, making it also directly comparable among different anaphors and conditions.

To minimize confounding factors, experimental materials are strictly controlled. Elicited sentences are always triplets of short sentences. The first sentence sets the scene, and the other two sentences depict certain actions that happened in temporal order in strictly parallel structures, in which the verbs are identical, as shown in (5) (S-subject; V-verb; O-object). In previous studies, negative verbs such as ‘hit’ and ‘insult’ were most frequently used. To achieve a semantic balance, three verbs with no perceived causal bias are selected: one positive verb ‘help’, one neutral verb ‘carry’ and one negative verb ‘push’ (push). ‘Then’ (and then) is used as the conjunction. All the verbs have a high tone so that different verbs will not influence the prosodic pattern of the sentence frame (5).

(5) 大家在…… 开始 S₁VO₁, 然后 S₂VO₂, Everyone (present article) first S₁ and then S₂. then S₂VO₂.

Everyone was doing… First S₁VO₁, then S₂VO₂.

Three types of anaphors are under investigation, including the third person singular pronouns ‘他 tā/’ (he/him) and ‘她 tā/’ (she/her), the plural pronoun ‘他们 tāmen/’ (they/them) and proper names. In Mandarin, the third person singular pronouns share exactly the same pronunciation with a high tone, thus this paper treats them as the same pronoun. There are five characters involved – 小当 ‘Xiao Dang, male’; 小当 ‘Xiao Dang, male’; 小汤 ‘Xiao Tang, male’; 小汤 ‘Xiao Tang, female’ and 小康 ‘Xiao Kang, female’. ‘Xiao’ indicates hypocorism, while ‘Gang’ ‘Dang’ ‘Tang’ ‘Fang’ and ‘Kang’ are either first names or surnames. The selection of these names meets the following criteria: 1) they are all typical Chinese names; 2) their last syllables share the same rhyme; 3) the last syllables share the same tone with the third person singular pronouns.

To approach the research goal, Referential Status and Ambiguity are manipulated in both subject and object positions for three types of Anaphoric Form (the third person singular pronouns, plural pronoun and proper names):

Referential Status is defined as the relative syntactic position of an anaphor and its antecedent. It has three values: Unchanged means that an anaphor remains in the same position as its antecedent; Shifted means that an anaphor and its antecedent are in opposite positions; Switched means that the syntactic positions of anaphors in the last sentence and their antecedents are switched. The reason for making a distinction between Shifted and Switched is that information structure may influence the prosodic patterns. In the Shifted condition there is one anaphor and a new character in the last sentence, while there are two anaphors and no new characters in the last sentence in the Switched condition. Referential shift is involved in both Shifted and Switched conditions.

Ambiguity has two values: Ambiguous and Unambiguous. Ambiguity is manipulated by anaphoric form and number agreement of a pronoun: in the Ambiguous condition the antecedent of a pronoun and its competitor (S₁ and O₁) are of the same number, while in the Unambiguous condition the antecedent of a pronoun and its competitor are of different number, or S₁ and O₁ are both proper names.

Table 1 illustrates the examples for the last two sentences under different conditions within each factor (the bolded elements are co-referential):

Table 1. Examples under different conditions.

<table>
<thead>
<tr>
<th>Proper name: Subject; Unchanged; Unambiguous</th>
<th>Subject: Switched; Ambiguous</th>
<th>Singular pronoun: Object; Switched; Ambiguous</th>
<th>Plural pronoun: Object; Shifted; Unambiguous</th>
</tr>
</thead>
<tbody>
<tr>
<td>开始 小当 帮了小芳.</td>
<td>开始 小当 帮了小芳.</td>
<td>开始 小当 帮了小芳.</td>
<td>开始 小当 帮了小芳.</td>
</tr>
<tr>
<td>然后 小当 帮了小当.</td>
<td>然后 小当 帮了小当.</td>
<td>然后 ……</td>
<td>然后 小当 帮了小当.</td>
</tr>
<tr>
<td>Then Xiao Dang helped Xiao Fang, and then Xiao Gang helped Xiao Dang.</td>
<td>Then Xiao Dang helped Xiao Fang, and then Xiao Gang helped Xiao Dang.</td>
<td>Then Xiao Dang helped Xiao Fang, and then Xiao Gang helped Xiao Dang.</td>
<td>Then Xiao Dang helped Xiao Fang, and then Xiao Gang helped Xiao Dang.</td>
</tr>
</tbody>
</table>

Fundamental frequency F₀ and duration are taken as parameters indicating prosodic prominence. In accordance with previous observations on accentuation of unambiguous anaphors [7-10], it is hypothesized that accentuation occurs whenever there is a referential shift regardless of ambiguity; hence higher F₀ and longer duration are expected for the Shifted and Switched conditions. For the potential influence of ambiguity, if ambiguity does not play a role, it is anticipated that anaphors in the Ambiguous condition have a higher F₀ and longer duration than anaphors in the Unambiguous condition.
2. Methodology

2.1. Experimental Design

To elicit utterances as naturally as possible, a cooperative story-telling-and-understanding game is designed. The speaker first looks at three pictures on the screen and then describes what happened to a listener using the fixed sentence frame (5). The three pictures correspond to the three sentences in (5): the first picture sets the scene — climbing a mountain, playing basketball or playing a game; the other pictures depict certain actions with different agents and patients. The occurrence of the five characters is balanced. The presentation of stimuli and auto-recording are achieved using ZEP [24], a system for implementing and running (psycholinguistic) experiments.

All anaphors are balanced in both subject and object positions. For pronouns, there is only one concerned pronoun in the last sentence in conditions Unchanged and Shifted, but it is possible to have two pronouns in the Switched condition. This study focuses on cases with maximally one pronoun in the last sentence. There are 53 stimuli for the purpose of this study. These stimuli (together with 10 other stimuli for a related study) are divided into four tasks, in which the speakers are instructed to follow a specific constraint on using a certain type of anaphors in a fixed syntactic position.

2.2. Data Collection

2.2.1. Participants

36 Mandarin Chinese speakers (18 male and 18 female; ages 18-26, mean age 20.4) at Beijing International Studies University and Communication University of China participated in the experiment. All the speakers began to speak Mandarin Chinese before or when they entered primary school (7 native speakers of Mandarin, 22 native speakers of Beijing dialect, 7 native speakers of other dialects in north China). An experiment assistant acted as the listener throughout the 36 experimental sessions. Participants received a financial compensation.

2.2.2. Procedure

The participants were tested in a quiet room. In the experimental setting, the speaker sat in front of the screen and the listener sat back to back with the speaker so that they could not see each other, which prevented other non-verbal communications such as eye contact and gestures. There was a short oral introduction before the experiment. The listener was asked to fill in an answer sheet based on the descriptions and the participants were told that their cooperation would be graded based on both the speaker’s fluency and the listener’s correct rate. In this way, the speakers would be more involved. No communication was allowed between the speaker and the listener throughout the experiment.

The experiment began with a familiarization practice. The images of the five characters were presented followed by two rounds of a name-figure mapping test. Then the tasks began. In the first task, the speaker was asked to use full names to refer to all the characters; in the last two tasks, the speaker was asked to use a pronoun to refer to either the agent or the patient in the last picture, respectively (the second task is irrelevant to this study). In each trial, three pictures were firstly presented. When the speaker clicked the start button, the pictures disappeared and the audio recording began. There were four practice trials in each task. The whole experiment was self-paced.

2.3. Data extraction and analysis

The obtained audio recordings (in wav format) were annotated and labelled via Praat [25]. Since the names share the same rhyme, only the rhymes in the second syllables were annotated to reduce the duration difference introduced by different onsets. The same method also applied to pronouns. Mean F0 and duration of annotated syllables were extracted after manual correction of F0. In order to eliminate individual difference, the mean F0 was normalized into Z-score. SPSS was employed for statistical analysis and the Generalized linear mixed model (GLMM) was adopted, which suits best to the categorical data in current study (random effects factors are speaker ID and sentence ID; fixed effects factors are Referential Status, Ambiguity and Anaphoric Form, which is not a concerned factor in this study but needed for GLMM).

3. Results

3.1. F0 analysis

![Figure 1: Interaction between Referential Status and Ambiguity for normalized F0 in Subject.](image1)

![Figure 2: Interaction between Referential Status and Ambiguity for normalized F0 in Object.](image2)

GLMM analysis of the normalized F0 mean of subject anaphors shows: 1) F0 for Shifted and Switched is significantly higher than Unchanged (p < 0.001) and there is no significant difference between Shifted and Switched (p = 0.331). 2) No significant difference is found between the Ambiguous (A) and Unambiguous (U) conditions (p = 0.431). The results for
object anaphors show: 1) $F_0$ for Shifted and Switched is significantly higher than for Unchanged ($p < 0.001$) and $F_0$ for Switched is significantly higher than for Shifted ($p = 0.012$). 2) No significant difference is found between the Ambiguous and Unambiguous conditions ($p = 0.361$). No interaction ($p > 0.05$) between Referential Status and Ambiguity is found for either subject or object, as illustrated in Figures 1 and 2.

3.2. Duration analysis

The results for duration demonstrate a similar pattern. For subject anaphors: 1) Duration in the Shifted and Switched conditions is significantly higher than Unchanged ($p = 0.005$) and there is no significant difference between Shifted and Switched ($p = 0.911$). 2) There is no significant difference between the Ambiguous and Unambiguous conditions ($p = 0.322$). For object anaphors: 1) There is no significant difference the Ambiguous and Unambiguous conditions ($p = 0.619$). 2) Duration in the Shifted and Switched conditions is significantly higher than in the Unchanged ($p < 0.001$) condition; and there is no significant different between Shifted and Switched ($p = 0.141$). No interaction ($p > 0.05$) between Referential Status and Ambiguity is found for both subject and object, as illustrated in Figures 3 and 4.

4. Discussion

In $F_0$ analysis, the main effects and interactions for both subject and object demonstrate that anaphors receive an accent in the referentially shifted (Shifted and Switched) conditions, and no evidence shows that ambiguity plays a role in the accent assignment. The results for duration exhibit the same pattern: both subject and object anaphors are significantly longer in referentially shifted conditions, and ambiguity does not influence duration. These results provide evidence from Mandarin for the observations (1) – (3): anaphors undergoing a referential shift acquire an accent. Since no significant difference is found between the Ambiguous and Unambiguous conditions for both $F_0$ and duration, the ‘disambiguation effect’ of accent on ambiguous pronouns in strictly Mandarin parallel structures comes from a generalized relationship between prosody and referential status. There are several accounts of this correlation between prosody and referential shift, such as repetition-based account [26], centering-based account [27] and stress-shift account [28], but no consensus has been made as to why referential shift triggers anaphoric accentuation. Hence, more theoretical work is needed in future studies.

Despite the consistent patterns in both syntactic positions, both $F_0$ and duration exhibit a distinct asymmetry in different positions, as illustrated in Figures 1-4. Subject anaphors have an overall higher $F_0$ and a shorter duration than object anaphors, which we attribute to the declination effect and boundary tone. In addition, $F_0$ differences in subject position are much smaller than in object position, which indicates that subject anaphors have a narrower range in signalling accentuation while object anaphors have a wider range. In the Unchanged condition, the anaphor becomes given information and thus is de-accented. Because a subject anaphor is at the beginning of a sentence, $F_0$ cannot be lowered to a large extent, whereas for object anaphors, the subject in the utterance is contrastive focus, and object anaphors become attached to the verb and $F_0$ is much lowered due to post-focus $F_0$ drop [29]. This implies that referential shift of object anaphors may be more easily indicated by prosody, which is supported by the significant $F_0$ difference between Switched and Shifted in object position. Whether this asymmetry also influences perception calls for further study.

5. Conclusions

Through a production experiment, this study explores the role of prosody on anaphors in Mandarin. On the basis of the findings, it can be concluded that in strictly Mandarin parallel structures, accent on anaphors is introduced by a referential shift. No evidence was found that ambiguity plays a role in anaphoric accentuation influence accentuation, hence the role of prosody in anaphora production is not to disambiguate but to signal different referential statuses. Whether this is a language universal conclusion needs further investigation in other languages. This finding challenges the general view on accented pronouns and will deepen our understanding on semantics-prosody relationship. Considering the possible wide misunderstanding on accented ambiguous pronouns, it is time to reconsider the nature of accented anaphors, and future studies should treat the interaction between prosody and pronouns with more caution.

6. Acknowledgements

This study is supported by the China Scholarship Council – Utrecht University (CSC-UU) PhD-Programme. We express our thanks to Chris van Run, Kirsten Schutter and Wenyong Hu for their technical and statistical support, and Xiaoli Dong for her practical suggestions.
7. References


