

Processing ambiguous object clefts in Mandarin Chinese

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Abstract

Object cleft constructions in Mandarin Chinese are an understudied case of syntactic ambiguity. A self-paced reading experiment was employed to test whether readers of Mandarin Chinese would show more difficulties in processing indirect object (IO) clefts compared to direct object (DO) clefts and whether semantic cues would facilitate disambiguation. The results confirmed both our hypotheses, supporting a non-modular account of syntactic processing, together with Keenan & Comrie's (1977) Noun Phrase Accessibility Hierarchy. Thus, our findings suggest that readers integrate different modules in sentence processing, while also confirming the cognitive basis of a hierarchy operating when accessing theta roles in sentence parsing.

Keywords: self-paced reading, object clefts, ditransitive structure, Mandarin Chinese

Introduction

The canonical constituent order for ditransitive structures in Mandarin Chinese is Subject – Verb - Indirect Object - Direct Object (henceforth S V IO DO). Clefting the DO to form a DO-cleft produces “DO *shi* S V IO *de*” as the constituent order, while clefting the IO (IO-cleft) produces a sentence of the form “IO *shi* S V DO *de*”, as seen in example (1) with two grammatical readings. It is unclear if native speakers prefer one reading over the other, and whether any semantic cue like animacy can influence their judgments.

(1)	小狗	是	兔子	给	小猫	的	动物。
	<i>xiǎogǒu</i>	<i>shì</i>	<i>tùzi</i>	<i>gěi</i>	<i>xiǎomāo</i>	<i>de</i>	<i>dòngwù</i>
	puppy	COP	rabbit	gave	kitten	DE	animal

Reading 1: The puppy is what the rabbit gave to the kitten. (DO-cleft)

Reading 2: The puppy is who the rabbit gave the kitten to. (IO-cleft)

Keenan & Comrie (1977) introduce the “Noun Phrase Accessibility Hierarchy” according to which the DO is easier to topicalise than the IO. Moreover, according to interactive models of sentence parsing (Ferreira 2003; Townsend & Bever 2001), different modules interact during sentence processing.

Therefore, this study hypothesised that participants presented with an object cleft would find the DO-cleft analysis easier overall, though within IO-clefts,

those with an animate DO were hypothesised to be more difficult to process than those with an inanimate DO.

Method

Participants

44 adult native speakers of Mandarin Chinese (12 male, 4 left-handed, mean age = 24;1, SD = 5.4) participated in this study.

Materials

There were 4 conditions: IO-cleft animate DO, IO-cleft inanimate DO, DO-cleft animate DO, and DO-cleft inanimate DO. For each condition, 32 scenarios were applied, and in total, 128 stimuli were created. A Latin Square design was employed to make 4 test lists assigned at random to participants. Eight ditransitive verbs were used, appearing four times each in the list of scenarios: 送给 *sònggěi* (send), 给 *gěi* (give), 交给 *jiāogěi* (deliver), 奖励 *jiǎnglì* (award), 提供 *tígòng* (provide), 借给 *jiègěi* (lend), 给予 *jǐyǔ* (offer), and 传给 *chuángěi* (pass). After each target sentence, a disambiguating sentence with a disambiguator was included, which made only one analysis of the clefts compatible, shown in Example (2) with disambiguating words in bold. Either the IO or the DO of the target sentence was adopted as the subject for the disambiguating sentence, in order to diminish the learning effect.

(2)	IO-cleft	DO-cleft
Animate DO	慢吞吞的乌龟是黄色的蜥蜴给长长的蛇的动物。乌龟非常 感激 ，因为蜥蜴为这个礼物花了很多心思。 The slow tortoise is who the yellow lizard gave the long snake to. The tortoise was very grateful , because the lizard had put a lot of thought into the gift.	长长的蛇是黄色的蜥蜴给慢吞吞的乌龟的动物。乌龟非常 感激 ，因为蜥蜴为这个礼物花了很多心思。 The long snake is what the yellow lizard gave the slow tortoise. The tortoise was very grateful , because the lizard had put a lot of thought into the gift.
Inanimate DO	慢吞吞的乌龟是黄色的蜥蜴给长长的绳索的动物。乌龟非常 感激 ，因为蜥蜴为这个礼物花了很多心思。 The slow tortoise is who the yellow lizard gave the long rope to. The tortoise was very grateful , because the lizard had put a lot of thought into the gift.	长长的绳索是黄色的蜥蜴给慢吞吞的乌龟的东西。乌龟非常 感激 ，因为蜥蜴为这个礼物花了很多心思。 The long rope is what the yellow lizard gave the slow tortoise. The tortoise was very grateful , because the lizard had put a lot of thought into the gift.

Procedure

A non-cumulative self-paced reading (SPR) task was designed to study disambiguation in sentence parsing, reflected in reading times recorded per word. For eight random stimuli per participant, a comprehension question also followed the SPR trial in order to ensure that participants paid attention. Participants could either do the experiment in the Utrecht Institute for Language Science (ILS) laboratory ($n = 7$) or online ($n = 37$). Prior to

beginning the task, background information was collected on sex, age, whether participants were native speakers of Mandarin Chinese, which other languages or (Chinese) dialects they spoke fluently, and handedness. Three practice sentences were also presented before the experiment. Participants were instructed to read as fast as possible, using the spacebar to proceed from one word to the next, and were warned that comprehension questions could appear on the screen.

Results

This study used a linear mixed-effects regression analysis by means of R in RStudio. The primary measures in this study were the response times for the disambiguating word as well as the six words following it. The outliers were removed and reading times were transformed using \log_{10} .

Figure 1 illustrates that in general, IO-clefts had a longer reading time than DO-clefts, with participants being 1.6ms slower in reading time 2 ($t=3.02$, $p=.004$). This corresponds to the first hypothesis that DO-clefts are easier to process overall. The graph also shows that at reading time 1, IO-clefts with animate DOs were read more slowly than IO-clefts with inanimate DOs ($t=-1.99$, $p=.047$). This addresses our second hypothesis that within IO-clefts, those with an animate DO are more difficult to process.

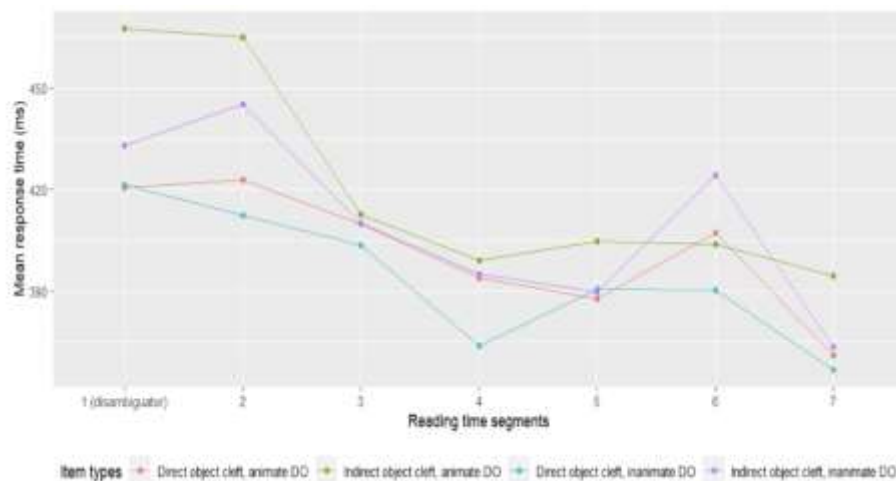


Figure 1: Mean response time for each segment per item type.

Discussion

Our results are in line with both our hypotheses. As predicted, based on the Accessibility Hierarchy, IO-clefts were harder for our participants to process, providing evidence in favour of Keenan and Comrie's (1977) hypothesis that

the hierarchy has a cognitive basis. However, it is not clear why IO-clefts should be incorrectly parsed as DO-clefts. Previous explanations such as canonical constituent order (Ferreira 2003) or so-called *Distance effects* (see Gibson 1998; Hawkins 2004) do not explain our findings, since the canonical constituent order for IO and DO-clefts is identical (Noun-Noun-Verb-Noun), and the clefted IO is both linearly and hierarchically closer to its original position in the unclefted structure (immediately following the verb). Further research should be conducted in order to explain the asymmetry we find.

Our results also showed that the parser does use semantic information in processing and thus favours a non-modular theory of sentence parsing. Specifically, it would appear that when the DO is inanimate, the parser assigns theta roles correctly to the three nouns before receiving explicit disambiguating information, presumably because inanimate nouns are less likely to be recipients of animate noun themes.

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