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Processing Relative Clauses in Chinese: Commentary on Paper by F. Hsiao and E. Gibson

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This paper is a peer commentary on Hsiao, F., & Gibson, E. (2003). Processing relative clauses in Chinese. *Cognition*, *90*(1), 3-27.

Keywords: Chinese, processing, relative clause, relativizer.

Çincede ilgi tümceciklerinin işlenmesi: F. Hsiao and E. Gibson'un çalışması üzerine bir eleştiri

Bu çalışma, Hsiao, F., & Gibson, E. (2003). Processing relative clauses in Chinese. *Cognition*, *90*(1), 3-27. makalesi üzerine bir eleştiridir.

Anahtar sözcükler: Çince; ilgi tümceciği, ilişkilendirici; işleme.

In the journal article "Processing relative clauses in Chinese" the authors, Franny Hsiao, Edward Gibson, discuss the difficulties associated with processing subject relative clauses (SRC) vs. object relative clauses (ORC) in Chinese, an SVO language in which relative clause precedes the head noun. Unlike many relative clause processing studies carried out till that time, this study replicated the theories in the literature with a language which requires head nouns before relative clauses. In this respect, this paper is accepted as one of the well-known initiatory non-English papers in the field. It aims to account for what a complex syntactic structure is for natural language processing in the context of relative clauses, and it does it by controlling the criteria, such as discourse context, lexical information and real-word plausibility of

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the sentence meaning, so that it is taken for granted that no other factors except for the complex word order have an impact on processing difficulty. Furthermore, its specific purpose is to question to what extent the current theories succeed in explaining the SRC-ORC asymmetry. When we look at the method part, we see that native speakers of Mandarin Chinese of Taiwan have participated in it. In the experiment design, sentences in Chinese are used. The sets have four conditions (singly embedded SRC, singly embedded ORC, doubly embedded SRC, and doubly embedded ORC) along with the fillers. Before putting the last touches on the latest form of the stimuli, the researchers carried out a plausibility norming survey on a separate group of Chinese-speaking participants to control the naturalness of the events used in the experimental items, i.e. the participants rated the semantic plausibility of the stimuli based on their real world knowledge. The first step of the procedure is self-paced reading, where stimuli are presented word by word. As might be expected, reaction time differences are used to measure the processing difficulty. The second step is a comprehension test which requires participants simply to choose the options “yes” or “no” based on the questions related to the stimuli. Statistic were conducted for analyzing reaction times on various regions of the stimuli, and the analysis was written down in a way that makes it possible to compare the participants’ performance on the four conditions. The findings show that the reaction time associated with SRCs was greater than ORCs on the first two words of the relative clause, meaning that SRCs are more complex than ORCs in Chinese, which is the total opposite of the results from other languages.

The authors summarize the various theories stated by other researchers of the field, the most relevant ones (as to the findings of the study) of which are related to storage resources, integration resources and word order. The Dependency Locality Theory, for example, attaches great importance to storage resources, and presumes that participants would need these resources to follow the heads in comprehending the sentences. In an ORC such as “*-the reporter who the senator attacked*”, after reading *the reporter who the*, a participant would wait for four syntactic heads in order to construct a grammatical sentence (a noun for the determiner *the*, a verb for the relative clause, a verb for the matrix clause, an empty noun element associated with the filler *who*). However, in the corresponding SRC “*-the reporter who attacked the senator*”, after reading *the reporter who attacked,* only two syntactic heads are predicted (a noun for the object of the relative clause and a verb for the matrix clause). Therefore, as the theory goes, ORC requires more storage cost than an SRC does. As for theories based on the word order, they claim that the type of relative clause fitting in the word order of the language it belongs to decides the processing cost. We can analyze *Marry who Don loves hates Joe*, in

which the object of the RC is seen by the participant to be *who*. As can be figured out, the word order is OSV here, which is non-canonical for English language, and this means more processing load. Lastly, theories based on integration resources consider the head-dependencies on phrase structure level to calculate the processing load. Here integration means attaching a lexical unit to its dependent or head. Again these theories also support that an ORC is more complex because of longer distance integration it has. For instance, when reading *attacked* in the example above, if it is an ORC, the reader needs to attach the object position to the wh-filler, which crosses an NP. However, while reading *attacked* in an SRC, there is a more local integration.

Contrary to the predictions of these theories for English relative clauses, the predictions are reversed for Chinese. This is because of the specific word order associated with Chinese relative clauses. Specifically, in Chinese, the canonical word order is SVO, which is also followed in ORCs but violated in SRCs. While comparing the findings of the study, the authors conclude that the Storage-based Resource Theory, one of the theories related to storage resources, can explain the difference between doubly-embedded clauses and singly-embedded ones. The Integration-Distance Resource Theory, according to the findings, is successful in explaining the difficulty of processing ORC vs. SRC, but it fails to explain where the source of the difficulty is in the clause. On the other hand, the Canonical Word Order Theory successfully predicts processing difference both in ORC/SRC and in singly/doubly-embedded constructions. However, this theory needs to be formalized to make more elaborated predictions. Hsiao and Gibson (2003) claim that the findings of this study are important for two reasons. Firstly, the ORCs have advantage over SRCs although a temporary ambiguity occurs in object-extraction process. Secondly, they claim that there is probably no empty wh-pronoun preceding RCs in Chinese.

The authors make a strong case for the fact that ORCs are less complex than corresponding SRCs. They also present excellent evidence to argue for and against the present theories in the current literature. This result renders the study unique in relative clause processing literature since previous studies until that time revealed a universal pattern for relative clause processing in which SRCs are easier to process than ORCs. For instance, SRC processing advantage was reported for different languages including English (e.g., Caplan et al., 2002; Traxler et al., 2002), Dutch (e.g., Frazier, 1987), French (e.g., Cohen & Mehler, 1996), German (e.g., Schriefers, Friederici & Kuhn, 1995) and Spanish (Betancort, Carreiras & Sturt, 2009). Therefore, until that time it was given that ORCs are more complex and thus more

difficult to process than SRCs and theories were put forth to account for this difference. Thinking of the added-value provided by Hsiao and Gibson (2003), we can say that this article did an exceptional job of providing detailed data and graphs to replicate the current theories with a language like Chinese. The findings regarding the advantage of ORC make clear sense and provide support for that ORC processing difficulty in English does not count for Chinese. This study is said to be one of the first processing studies looking into doubly-embedded head-final RC. As this being the case, it has some drawbacks related to experimental design, which mostly has been criticized by other studies, such as Lin and Bever (2007b). When looking at the materials of Hsiao and Gibson's study, one might question the actual reason for the advantage of ORC that they found. Syntactically speaking, they are incrementally easy to attach. On the other hand, the items with SRC are sentences whose arguments cross, which result in a complex syntax tree. So the authors probably missed this crucial detail. "They compared only between doubly-embedded subject RCs (a) and doubly-embedded object RCs (d), and found double object RCs read faster. This was actually an effect of serial dependencies (double ORCs) being easier than nested dependencies (double SRCs). It says nothing about the extraction effects." (Lin and Bever, 2007a, p. 1). In short, this study is confounded by dependency types across conditions.

As Mak et al. (2002) showed, the semantic factor of animacy of the subject or object in a relative clause might have an influence on the processing difficulty of relative clauses. When analyzing the experimental items in Appendix A of the original article, we realize that the protagonists in all the sentences are people. Thus, the authors have obviously controlled the animacy criterion without stating it explicitly in the study, which brings a good score for the study. In addition, the authors also controlled the word length differences across their comparisons. Specifically, they applied a regression analysis of residual reading time (RRT) which is used as a procedure to correct for phrase or word length difference. For example, a sentence with four words is read faster than one with eight; a sentence with ten long words is read faster than one with ten short words, etc. By calculating residual reading time, the authors revealed that this did not change their results and thus eliminated a potential source of bias.

After checking the experimental items in Appendix A, we can realize that the RC structure in Chinese is pre-nominal. To explain it with an example, in Item 2.a. the participant reads *boss trust*, the first two words, and then he reads the relativizer *de*, when he detects the RC structure. Until this point, he probably thinks that he is reading a sentence with the subject *boss*, which is the same as real time sentence processing, but upon reading the relativizer, he

needs to reanalyze what he has just read. In short, we can argue that there is garden-path effect happening on that spot causing a temporary ambiguity, and it would be expected that this might have had some impact on the findings. However, the study does not report any effect of this temporary ambiguity and ORC advantage is found in spite of this potential processing cost associated with ORCs. The authors argue that this lack of garden-path effect might inform theories of sentence reanalysis (e.g., Fodor & Ferreira, 1998). Still, it is not clear how such temporal ambiguity found in one of the two conditions might affect sentence processing dynamics. The ideal contrast would be between two factors that are matched in as many dimensions as possible.

In addition to the issue of temporal ambiguity, it is also worth mentioning that in Chinese subject-modifying SRCs, such as the ones used in the study, start with a verb whereas subject-modifying ORCs start with a noun. Since the canonical word order is SVO in Chinese as pointed out above, it is arguable that Chinese readers encounter sentences and phrases that start with a noun phrase more often than those that start with a verb phrase. This being the case, reading ORCs might be facilitated simply due to relative frequency of word category of the sentence-initial word. This is especially reasonable when we consider that the ease of reading associated with ORCs in the relevant paper was shown on the first few words, which might well be caused by the more frequent word order associated with ORCs than SRCs regardless of the type of RC. This point was not addressed in the relevant study as a potential source of confound.

Lastly, when we have a glance at the style of the paper, it is to our understanding that allocating only one page to explain the theories in the whole literature is too economical. The reader might have difficulty understanding “the integration of head-dependencies in phrase structure” and especially “Dependency Locality Theory”, for which he might need to refer to external sources explaining them better and with more examples. Another eye-catching detail is a number of typos in the first paragraph on the page 5. While explaining Dependency Locality Theory under the subheading ‘Storage resources’ on page 5, the authors give the example of *the reporter who…* by referring to the sample materials in (2) on page 4. However, they label these examples as (1a) and (1b) on page 5. Furthermore, the filler is mentioned as *who* on page 5, while it is written as *that* in (2) on page 4. Together these might cause some confusion for the reader trying to understand the issue concerning storage resources with the mistyped examples.

In conclusion, Hsiao and Gibson (2003) provided the literature on the psycholinguistic study of relative clauses with a fresh perspective from a typologically different language. Being a head-final language with prenominal relative clauses, Chinese allowed the researchers to test a number of theories attempting to account for relative clause processing in a language in which predictions of some of these theories reversed when compared to English. Importantly, the authors showed that processing advantage for SRCs over ORCs is not a universal phenomenon and that depending on structural configurations of particular languages, there is no intrinsic difficulty associated with processing ORCs. These findings strongly challenge theories which take a strictly syntactical and hierarchical stance in explaining sentence-level phenomena.

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Conflict of Interest Statement

The authors declare that the peer commentary was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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