

論文の内容の要旨

論文題目 Head Association Ambiguity in Japanese Relative Clause Processing
(日本語の関係節処理における主要部接続曖昧性)

氏名 山田 敏幸

This dissertation investigates the nature of the human language parsing mechanism (the *parser*) for comprehending sentences by examining a global structural ambiguity in certain Japanese relative clauses (RCs), as in (1).

- (1) [Isi-ga syokusinsiteiru] syôzyo-no ani-ga
[doctor-NOM palpating] girl-GEN brother-NOM
'The brother of the girl [(that) the doctor is palpating] is'

To interpret a construction as a RC in Japanese, the parser must *associate* a head noun with it. In (1), for example, when the parser encounters the first potential head noun (N1), *syôzyo* ('girl'), it has to associate it with the preceding material, which leads to a RC analysis (bracketed). At the point of the genitive case marker *-no* (GEN) or the following noun *ani* ('brother'), a second grammatically possible analysis arises. To associate the second potential head noun (N2) with the RC, the parser would have to revise its initial analysis. We call the first RC formation the *N1 association* and the second the *N2 association*. Note that revision from the N1 to the N2 association analysis is syntactically not required (i.e., if it occurs, it is *unforced*) because, even when the N2 association analysis becomes available, the N1 association analysis remains grammatical and therefore could be maintained.

Previous studies on such *head association ambiguity* in Japanese RC processing have reported varying findings. The results of on-line experiments tend to support the N1 association preference at the N1 (e.g., Kamide & Mitchell, 1997; Miyamoto, Nakamura, & Takahashi, 2004; Nakano & Kahraman, 2013), while those of off-line experiments generally support the N2 association preference at the end of the sentence (e.g., Kamide

& Mitchell, 1997; Uetsuki, 2007; Nakano & Kahraman, 2013). Although there is clear evidence that the parser considers the N1 association analysis upon encountering the N1, we still know little about the exact time course of the N2 association analysis. This dissertation asks why the parser would consider the N2 association analysis even though it does not have to revise the N1 association analysis to achieve grammaticality.

First, we consider the results of the earlier research suggesting that the parser considers the N1 association analysis initially, i.e., at the N1, and revises it to the N2 association analysis ultimately, i.e., at the end of the sentence. This leads to Research Question 1: Can the parser choose the N2 association interpretation based on the coherence of the whole sentence? A questionnaire experiment (Experiment 1) investigated comprehenders' off-line preference for RC head association. The sentence-final main clause verbs were manipulated as to whether their relationship with the RC verbs was implicitly "causal," supporting the N2 association interpretation, or "neutral," not being biased towards either the N1 or the N2 association interpretation. If comprehenders establish the N2 association interpretation based on the coherence of the whole sentence, they should choose it more frequently in the former than in the latter condition. The results support this prediction. They also indicate an overall preference for the N1 association interpretation, in contrast to the results of previous research. This finding, however, may be due to a methodological problem, as the stimuli in the "neutral" condition may have been unintentionally biased.

The results of Experiment 1 lead to Research Question 2: Can the parser consider the N2 association analysis prior to the end of the sentence during real-time processing? To investigate this question, two on-line eye-tracking reading experiments (Experiments 2 and 3) examined whether the parser considers the N2 association analysis at the N2 (Experiment 2) or earlier, at the genitive case marker attached to the N1 (Experiment 3). We also investigated whether the typicality of the N1 as the RC head noun would affect the parser's willingness to perform revision. In Experiment 2, the main predicates following the N2 were manipulated regarding their compatibility with the meaning conveyed by the N2 association analysis. If comprehenders consider the N2 association analysis at the N2 and maintain it, they should experience difficulty at the main predicate when the predicate is incompatible with the N2 association analysis. The results confirm this prediction. We also manipulated the N1s as to whether they were "typical" for the N1 association analysis or "neutral" for both N1 and N2 association analyses. If a typical N1 makes the parser more likely to retain the initial N1 association analysis, greater difficulty should be observed at the main predicates that are incompatible with the N2 association analysis when the N1 is neutral as opposed to when the N1 is typical. The results indicate the opposite pattern of interaction between the two manipulations. We discuss the possibility that our manipulation of N1 typicality did not work as intended.

In Experiment 3, the RC verbs and the N2s were newly manipulated as to whether the N2s following the genitive case marker attached to the N1 were lexico-semantically possible as the RC head nouns in terms of animacy. If comprehenders already expect the N2 association analysis at the genitive marker, which signals that another noun (i.e., the N2) will follow, they should experience difficulty at the N2 when the N2 is an impossible head noun for the RC. The results do not support this prediction, implying that it is not always the case that the parser expects the N2 association analysis in advance at the genitive case marker. We also manipulated N1 typicality as in Experiment 2. If the parser is more likely to maintain the initial N1 association analysis due to the N1's typicality, greater processing difficulty should occur at the N2 that is impossible as the RC head noun when

the N1 is neutral compared to when the N1 is typical. The results are consistent with our second prediction. This finding, however, is suspect because our manipulation of N1 typicality did not work, as we found in Experiment 2.

Experiments 2 and 3 were not able to confirm whether the parser's on-line consideration of the N2 association analysis reflects revision from the N1 association analysis because the manipulation of N1 typicality was ineffective. Hence, we next investigated Research Question 3: Can the parser consider the N1 association analysis at the N1 initially when both the N1 and the N2 association analyses are available at the N2? Two on-line probe recognition experiments (Experiments 4 and 5) adopted a post-sentential probe recognition technique. In Experiment 4, the words in the probe recognition task were manipulated as to whether they were "related" to the N1 association interpretation established by associating the N1 with the RC or not (i.e., "non-related"). Furthermore, sentence type was manipulated in the (self-paced) reading task prior to the recognition task: one sentence type contained RCs with head association ambiguity while the other used different lexical items and did not include RCs. If the N1 association analysis is considered at the N1 during on-line processing, faster response times should be found for the probe words "related" to the N1 association interpretation, which is based on that analysis, compared to the "non-related" words, when the sentence in the reading task contains a RC. The results support this prediction, showing such a priming effect. Furthermore, they indicate a bias towards the N2 association interpretation in the comprehension check task that followed the recognition task. These results imply that the parser first established the N1 association interpretation prior to the recognition task, and then later reinterpreted the RC head noun from the N1 to the N2.

In Experiment 5, the words in the probe recognition task were manipulated as to whether they were "related" or "non-related" to the N2 association interpretation constructed by associating the N2 with the RC. Sentence type was also manipulated as in Experiment 4. If the parser considers the N2 association analysis at the N2 as shown in Experiment 2, faster response times should be found for the probe words "related" to the N2 association interpretation, compared to the "non-related" words, when the sentence contains a RC. The results do not support this prediction. However, they indicate that the participants showed a preference for the N2 association interpretation in the comprehension task, and further, that they chose the N2 association interpretation more often when "related" words appeared in the recognition task prior to the comprehension task. A question remains as to why we did not observe a significant interaction of the two manipulations as a result of the priming effect. We argue that, if, as suggested in Experiment 1, the parser considers the coherence of the whole sentence to arrive at the N2 association interpretation, this interpretation may take longer to establish than the N1 association interpretation. Hence, the N2 association interpretation may not have been sufficiently established at the time of the probe recognition task to produce an effect as robust as the effect observed for the N1 association interpretation in Experiment 4.

Based on the results of Experiments 4 and 5 and earlier studies' findings of an on-line preference for the N1 association analysis, it follows that the parser considers the N1 association analysis at the N1 even when the N2 association analysis is viable at the N2. Finally, the dissertation addressed the question of why the parser considers the N2 association analysis at all, when the N1 association analysis can be retained at the N2. Research Question 4 considers a possible factor: Do RC production data show a structural frequency bias towards the N2 association? A corpus analysis was conducted, based on the assumption that if the N2 association interpretation

is more frequently intended in production, comprehenders should experience the N2 association more often than the N1 association, and thus be more likely to consider the N2 association analysis in their processing. The results of the corpus analysis show no advantage for the N2 association, suggesting that a structural frequency bias cannot account for unforced (i.e., syntactically not required) revision in ambiguous RC processing.

Based on these results together, this dissertation argues that the parser first considers the N1 association analysis immediately upon encountering the N1 and then revises it to consider the alternative N2 association analysis at the N2 when the N2 is lexico-semantically possible as the RC head noun in terms of animacy. After that, if the parser establishes the N2 association interpretation at the end of the sentence, it does so based on the coherence of the whole sentence, which leaves open the possibility of a final N1 association interpretation instead. The results of the parser's consideration of the N2 association analysis at the N2 during on-line processing are of theoretical importance because they support the claim that unforced revision exists in human language parsing, contrary to the Revision as Last Resort hypothesis, which assumes that revision is applied only when the current analysis turns out to be syntactically ill-formed or ungrammatical (Fodor & Frazier, 1980). In discussing the availability of unforced revision, we consider the tree-lowering operation (Sturt & Crocker, 1996), which results in the transition of the RC head noun from the N1 to the N2, and we consider head-finality as a key factor (Aoshima, Phillips, & Weinberg, 2004; see also Fodor & Inoue, 2000; Inoue & Fodor, 1995, for empirical data in English and Japanese), which is in line with the "tentative attachment strategy" (Mazuka & Itoh, 1995) leading to unforced revision in the processing of head-final languages and constructions. We also discuss the theoretical implications of unforced revision for parsing models, in particular the serial modular and ranked-parallel interactive models. In conclusion, our findings tell us that the parser must possess three characteristics: it permits unforced revision (syntactically not required consideration of an alternative analysis); it is driven by probabilistic processing (evaluation at each point of each possible parse according to its probability); and it is driven by interactive processing (evaluation of each possible parse based on multiple sources of information available at the point in question). Although our results were not able to tease apart serial and (ranked-)parallel parsers, these characteristics are all captured better by the latter model of parsing, which is consistent with quite a number of recent psycholinguistic studies on sentence processing.