

# Can Semantic Information Guide Parsing in Korean: Effect of Animacy of the Sentential Subject

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## Abstract

To understand the time course over which syntactic and semantic information contribute to sentence comprehension, the influence of the animacy of initial NPs of ambiguous (Garden-path) sentences and non-ambiguous complement clause sentences in Korean were tested. The results showed that semantic and syntactic information are used during the comprehension of Korean sentences with each being used by readers as soon as it becomes relevant. A constraint-based model of sentence processing can explain the results.

Understanding the time course over which syntactic and semantic information contribute to sentence comprehension has been central to evaluating the relative merits of modular and interactive models of language processing (Clifton, et al, 2003; Trueswell, et al, 1994). Syntax-driven models, such as the garden path model (Frazier, 1987; Frazier & Rayner, 1982), suggest that only syntactic information is processed to build up the initial sentence analysis. In contrast, parallel models, such as constraint-based models reject the exclusive role of structural information (MacDonald, Pearlmutter, & Seidenberg, 1994). According to the constraint-based models, various constraints are ranked according to various criteria. Therefore, semantic effects are expected during the initial sentence analysis if semantic constraints are stronger than the syntactic constraints.

This research focuses on the influence of the animacy of initial NPs of complex sentences in Korean to test these models. If the constraint-based model is correct, both the structural information about an NP's syntactic role and the semantic information about the NP's thematic role will be used as cues to the organization of a sentence. If the syntax-driven model is correct, the semantic information will show effects only after initial syntactic processing.

Korean writing is an alphabetic system which represents the sound of a word. It is more regular than English but visually more compact. As a left-branching, head-final language with SOV (subject-Object-Verb) structure, Korean provides additional opportunities for examining how syntactic

information (conveyed by particles attached to an NP) and semantic information (conveyed by the meaning of an NP) contribute to sentence comprehension. The structure of Korean means that syntactic and semantic information are available at nearly the same time and can potentially guide sentence comprehension processes during the structurally ambiguous regions of a sentence that occur before the verbs are encountered at the end of a complex sentence.

## Experiment 1

The experiment reported here examined the effects of animacy on processing of Korean garden-path sentences as illustrated in the example below((1), (2)). This experiment tested animate and inanimate nouns with typical (*ka*) and less typical (*nun*) case markers in sentences containing an empty embedded subject. For the sentences like (1), the animate name "Chulsu" can be interpreted initially as the subject of the verb "found" since SOV is the canonical sentence structure in Korean. However, when readers encounter "at the park", they need to revise the initial interpretation because they realize that "Chulsu" is not the subject of "found" and there is an empty subject. For the sentences like (2), if readers use the semantic information for initial structure building, readers will not treat the inanimate noun "swing" as the subject of "found" because inanimate noun cannot be a subject of the verb "found".

1. "Chulsu was at the park where there was difficulty finding the boy."

|                    |                 |          |             |
|--------------------|-----------------|----------|-------------|
| 철수가/철수는            | e <sub>i</sub>  | 소년을      | 힘들게         |
| 찾은                 | 공원에(resolution) | 있었다.     |             |
| S                  | e <sub>i</sub>  | (O       | adv         |
| V+that)            | adv             | V        |             |
| Chulsuka/Chulsunun |                 | sonyunul | himdelge    |
| chajeun            | gongwone        | issesda. |             |
| Chulsu+nom         |                 | boy+acc  | difficultly |
| found+that         | at the park     | was      |             |

2. “There was a swing at the park where we found the boy difficultly.”

|                  |                |          |             |
|------------------|----------------|----------|-------------|
| 그네가/그네는          | e <sub>i</sub> | 소년을      | 힘들게         |
| 찾은 공원에           |                | 있었다.     |             |
| S                | e <sub>i</sub> | (O       | adv         |
| V+that)          | adv            | V        |             |
| Guneka/Gunenun   |                | sonyunul | himdelge    |
| chajeun gongwone |                | issessda |             |
| Swing+nom        |                | boy+acc  | difficultly |
| found+that       | at the park    | was      |             |

**Results**

Sentences with initial animate NPs took longer to read in the resolution region than did those with inanimate initial NPs on early measures of processing (e.g., first fixation times; F1(1,22)=9.70, p<.005; F2(1,23)=4.86, p<.05). In addition, there was an interaction between animacy and type of case marker for gaze duration on the second NP (object) position (F1(1,22)=7.62, p<.01; F2(1,23)=10.27, p<.005) consistent with a spillover effect where the typical associations of case markers and NPs (*ka* with animate NPs and *nun* with inanimate NPs) led to more rapid processing of the subsequent constituent.

**Experiment 2**

Experiment 2 used the complement clause sentences with an overt embedded subject (4) as well as sentences used in Experiment 1 (3). Although the syntactic structures of the two types of sentences are different, the surface forms of the two sentences are exact except for the case maker of the second NP (Noun+accusative case marker for empty embedded subject sentences and Noun+nominative case marker for explicit embedded subject sentences). Because of the explicit embedded subject, sentences like (4) bring no syntactic ambiguity and, therefore, the ambiguity and animacy did not covary.

3. “Chulsu was at the park where there was difficulty finding the boy.” Or “There was a swing at the park where we found the boy difficultly.”

|                      |                |             |            |
|----------------------|----------------|-------------|------------|
| 철수가/그네가              | e <sub>i</sub> | 소년을         | 힘들게        |
| 찾은 공원에(resolution)   |                | 있었다.        |            |
| S                    | e <sub>i</sub> | (O          | adv        |
| V+that)              | adv            | V           |            |
| Chulsuka/Guneka      |                | sonyunul    | himdelge   |
| chajeun gongwone     |                | issessda.   |            |
| Chulsu+nom/Swing+nom | boy+acc        | difficultly | found+that |
| at the park          | was            |             |            |

4. “Chulsu/A swing was at the park that the boy found difficultly.”

|         |  |      |     |
|---------|--|------|-----|
| 철수가/그네가 |  | 소년이  | 힘들게 |
| 찾은 공원에  |  | 있었다. |     |

|                      |             |             |
|----------------------|-------------|-------------|
| S                    | (S          | adv         |
| V+that)              | adv         | V           |
| Chulsuka/Chulsunun   | sonyuni     | himdelge    |
| chajeun gongwone     | issessda.   |             |
| Chulsu+nom/Swing+nom | boy+nom     | difficultly |
| found+that           | at the park | was         |

**Results**

The results for the Experiment 2 showed the same pattern of results as Experiment 1. Type of sentence structure interacted with animacy in the resolution region for first fixation times ((F1(1,41)=4.36, p<.05; F2(1,23)=8.04, p<.01); the animate null subject condition took the longest time and the animate overt subject condition took the least time. Also, animacy effects were found in the second NP region in gaze duration (F1(1,41) =4.92, p < .05; F2(1,23) = 6.49, p < .05) such that inanimate conditions took more time to read than animate conditions. These results again showed that Koreans use semantic information as well as syntactic information for their initial parsing.

**Discussion**

The results of these experiments showed that both semantic and syntactic information are used during the comprehension of Korean sentences with each being used by readers as soon as they become relevant. These results are not consistent with results from English that semantic information had no effect for the initial sentence parsing and served only for the reanalysis (Clifton et al., 2003). Constraint-based models which view the grammatical structure as one of multiple interacting constraints on sentence interpretation (e.g., MacDonald, Pearlmutter, & Seidenberg, 1994; Tanenhaus & Trueswell, 1995) can fit with the results of these experiments.

**References**

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