Prosody and Clause Boundaries in Korean

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Abstract

This study explores the effect of prosody on the interpretation of temporarily and globally ambiguous sentences in Korean. The head-final and pro-drop nature of Korean can generate both temporary and global ambiguity. Two experiments were conducted to investigate the effect of prosody on these ambiguous strings. Results showed that prosody can influence the meaning recovered from ambiguous string, and can also influence the processing difficulty of a particular syntactic analysis.

1.   Introduction

This study explores the effect of prosody on the interpretation of temporarily and globally ambiguous sentences in Korean. Korean is a relatively free word order, pro-drop and head-final language, which allows multiple analyses during and even after the end of sentences. Relevant examples crucially involve relative clause constructions, which can be realized as plain gap type relative clauses or pro type relative clauses. To investigate the effect of prosody, two experiments were conducted: a written norming study and an auditory perception study.

2.   Ambiguity and prosody

The head-final and pro-drop properties of Korean can generate temporary and global ambiguity in sentences involving relative clause constructions. In those ambiguous sentences, the spoken form of language utilizes prosodic information, which listeners can adopt to reach the intended meaning interpretation. Based on the intonation model suggested by Jun (1993), we propose that the prosodic marking in ambiguous sentences is used by listeners during the parsing process. This proposal predicts that a clash between syntax and prosody will exert an interfering effect on the final meaning representation in sentences with temporary ambiguity.   If also predicts that prosodic structure can influence the final interpretation assigned to standing syntactic ambiguity.

2.1. Data

The experiments conducted are based on the following material.

(1) Minseng-ika e_i amsaltangha-n   twomok-ul$_i$
    Minseng-NOM e_i got-killed-REL   boss-ACC$_i$
    palkyenhaysse.
    found.
    'Minseng found the boss who got killed.'

(2) Minseng-ika   amsaltangha-n   tosi-lul
    Minseng-NOM got-killed-REL   city-ACC
    phakoyhaysse.
    destroyed.
    a. '(pro) destroyed the city where Minseng got killed.'
    b. 'Minseng destroyed the city where (pro) got killed.'

Until the third word in both of sentences, the strings are ambiguous between plain gap type relative clauses (1) and pro type relative clauses (2a) and (2b).

Only at the head noun positions is the ambiguity resolved toward one structure or the other. Then, in pro type relative clauses another kind of ambiguity still exists; namely, between (2a) and (2b). The crucial difference between (2a) and (2b) lies in the fact that in the former, the initial nominative (NOM) marked NP is the subject of relativizer (REL) marked verb whereas in the latter, it is not. Another way of interpreting this is that in (2a), there is no clause boundary between the initial nominative marked NP while (2b) does have a clause boundary at the same position. Since the ambiguity crucially involves the first two words, one of the ways to resolve this ambiguity is to ask who is the subject of the REL marked verb.

2.2. Korean Intonation model

According to Jun (1993), there are two phrasal prosodic units higher than phonological words. One of such units, the Accentual Phrase (AP) consists of one or more phonological words. APs are characterized by both initial and final tonal patterns. Typically, APs begin with either a High or Low tone, depending on the laryngeal feature of initial segments. APs are also marked by a final rising tone. The larger unit, the Intonational Phrase (IP) consists of one or more APs and have several boundary tones, which can carry diverse pragmatics connotations. A pause is often inserted at the end of IPs.   When an AP coincides with the end of an IP, the rising tone is replaced by one of IP boundary tones.   In this paper, the AP final rising tone is marked by attaching the small letter 'a' after each tone.

According to Jun (1993), the actual phrasing of sentences depend on several different factors including syntactic, semantic, and speech rate, among others.

2.3. Prosodic marking

Based on the intonation model suggested in Jun (1993), we propose that the clause boundary in complex sentences should be marked prosodically. In spoken language, this syntactic and semantic juncture should be marked prosodically for maximal informativeness. The lack of such information can mislead the parser while its presence might be used in beneficial ways. For ambiguous sentences this may be used to resolve that ambiguity.

Following Jun (1993), the ideal candidate for this break would be an IP. The presence or absence of this boundary can exert different effects on both types of sentences under discussion. For gap type sentences, the lack of an IP boundary will temporarily mislead parsers toward a wrong interpretation. For pro type sentences, the lack of an IP boundary will signal the lack of clause boundary, and the initial nominative NP will be interpreted as the subject of the REL marked verb.

2.4. Experiment 1

Experiment 1 was a norming study which investigated offline interpretation of the strings in (1) and (2). As discussed earlier, the crucial information is, who is the subject of the REL marked verb? We examined the proportion of NP choices to this question. Sentences were presented to participants to read and each sentence was followed by a question related to the subject of the REL marked verb (e.g., "Who got killed?" for (1) and (2)). Responses for (1) were 'Minseng'(NP1), 'boss'(NP2), and 'don't know', and responses for (2) were 'Minseng'(NP1), 'I', and 'don't know'. As shown in figure 1, NP2 was interpreted as the subject of the REL marked verb 97.8% of the time in gap constructions. Hence, in gap sentences, the syntactic bias is very strong, not allowing other options. NP1 was interpreted as the subject of the REL marked verb 50.7% of the time in pro sentences. The next most frequent response in pro sentences was 'don't know', supporting the unresolved ambiguity of pro sentences. The 'I' response was hardly chosen, perhaps because participants were not likely to consider themselves as possible subjects of the REL marked verbs.
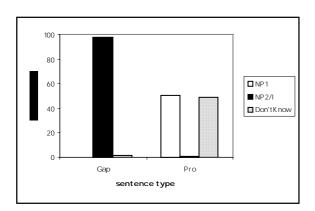

Figure 1: Response choice from the written questionnaire

2.5. Experiment two: perception study

Experiment 2 investigated the influence of prosody on the interpretation of (1) and (2). This auditory study has a two (two syntactic types; gap vs. pro) by two (prosodic structures;

IP vs. no IP) factorial design. Sentences were presented over headphones, and the presence or absence of an IP break after NP1 ('Minseng') was manipulated. Figure 2 and figure 3 show the spectrograms and intended tone specifications. Note the presence of HL% in figure 3 showing the presence of an IP boundary following the first NP, and its absence in figure 2 in the comparable location. Phonetic analyses of fundamental frequency and duration, as well as phonological transcription confirmed the presence of the claimed prosodic structures in all conditions
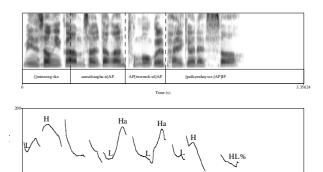

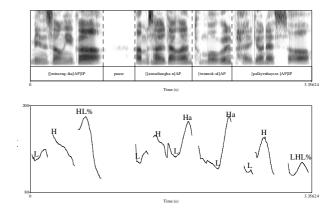*Figure 2: Spectrogram and tone specifications in NoIP gap condition*

Figure 3: Spectrogram and tone specifications in IP gap condition

After hearing each sentence, subjects had to do two things; first, they had to push either the first button of the SR box to indicate that they understood sentences or the second button to indicate that they did not understand sentences. This was followed by the comprehension question (the same format as used in the written questionnaire), which appeared in the center or the computer monitor in Korean orthography. Three responses were also given with the comprehension question. The three responses were the same as the ones from the written questionnaire except that the response 'someone other than NP1' was substituted for 'I' in the pro condition, to correct for the response difficulty in experiment 1. We

measured the reaction time to the first task and calculated the proportion of each response to the second task.

For gap sentences, it was predicted that the NP2 choice would be predominant. As can be seen in figure 4, this prediction was borne out. We also predicted that the IP condition would be easier to process than the no IP condition for gap sentences because the IP is aligned with a clause boundary. Reaction time results showed that participants took significantly longer to indicate that they understood the NoIP conditions (mean response time for IP conditions was 507.4 ms vs. NoIP condition was 881.46 ms) [F1(1, 39)=41.762, p<.01; F2 (1, 35)=40.609, p< .01)]).

It was also hypothesized that an IP boundary would disambiguate pro sentences in favor of interpretation (2b) where the initial nominative marked NP is not the subject of the REL marked verb, but the subject of the main verb. We predicted that no IP boundary would disambiguate in favor of (2a) where the NOM marked NP and the following REL marked NP belong to the same clause. As can be seen in figure 4, the predictions were partially supported. In the pro no IP conditions, participants chose (2a) interpretation 82.6% of the time. However, in the pro IP condition, (2b) interpretation was selected only 43.6% of the time. We also predicted slower processing time, indicating additional processing difficulty, if there was no IP boundary between the first NP and the REL marked verb, but listeners indicated that NP1 was not the subject of that verb. Reaction time analyses supported this prediction. When 'someone other than NP1' was chosen, response time tended to be faster for pro IP sentence (mean = 542.11 ms) than for pro NoIP sentences (mean = 1023.35 ms), [F1(1, 18)=3.50, p=.078; F2(1,15)=8.92, p< .01].
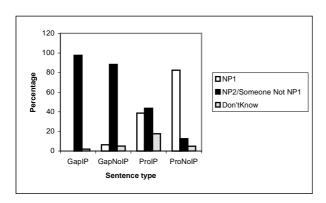

Figure 4: Response choice from auditory perception study

3.   Discussion

These two studies show that when there is a strong syntactic bias, such as in gap sentences, prosodic information can induce a facilitating or interfering effect on the ultimate meaning representation. Pro type sentences were different from gap sentences in that they were still ambiguous even after the completion. For these ambiguous strings, the hypothesis was that an IP break could disambiguate strings into one or the other interpretation. When no IP boundary was present between the first NP and REL marked verb, this

prediction was confirmed. Listeners overwhelmingly chose the first NP as the subject of the verb included in the same prosodic constituent. However, when an IP boundary was present after the first NP, listeners showed that the sentence remained ambiguous, with comparable selection of NP1 and a referent other than NP1, and substantial choice of the 'don't know' option.

4.   Conclusions

Unlike written language, spoken language can carry prosodic information, which listeners can use to construct a meaning. The results from two experiments showed that this prosodic information can influence syntactic processing. For temporarily ambiguous sentences, such as gap sentences prosodic structure can influence the processing difficulty of particular syntactic analyses. For globally ambiguous sentences, such as pro sentences, prosodic structure can influence the meaning chosen for the ambiguous string and in addition, can reduce the processing difficulty when syntactic and prosodic boundaries coincide.

These data from processing of two types of ambiguous sentences from Korean add to a growing body of results demonstrating the influence of prosodic structure on the processing syntactic ambiguity.

References
[1] Jun, S., 1993. *The phonetics and phonology of Korean prosody.* Unpublished doctoral dissertation. The Ohio State University.