Different interpretational preferences in pronominal resolution during off- and on-line sentence processing: Evidence from Korean with *pro* and overt pronouns

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Previous studies have argued that factors such as topichood (Ariel, 1990), recency (Ariel, 1990; Givón, 1983), grammatical function (Kaiser, 2006), structural position (Carminati, 2002), implicit causality (Kehler, 2002), and the order of mention (Gernsbacher, 1990) play a crucial role in determining referring expressions and their referential resolution. While the details may vary, the assumption is that these factors are relevant during both offline and online processing. However, pronominal resolution might differ between online and offline sentence processing. For instance, while factors related to short-term memory representation (e.g., recency; see Ariel, 1988) are likely to impact the early processing stage, not all types of information may be available during this stage. To investigate this question, we conducted three offline and two online reading time experiments.

Exp 1 included only one potential antecedent in the context sentence. The target sentences included a full NP, an overt pronoun or *pro* (1). Both the antecedent and the referential expressions appeared exclusively in the subject position. 39 participants rated the naturalness of the sentences (n=39 sets of items; 1: very unnatural; 7: very natural). The results showed the *pro* condition received significantly higher ratings than the other two conditions (p < 0.0003).

From Exp 2, we included two potential antecedents in the context sentence (2). 39 participants were asked to select the intended antecedent (36 sets of items). Results showed a significant effect of anaphor type (p < 0.01), with *pro* showing a subject bias and both overt pronouns and full NPs displaying an object bias.

Exp 3 involved a cataphoric dependency with a pronoun appearing before its antecedent (n=21; 32 sets of items) (3). The results showed a subject bias for overt pronouns as well, although the effect was stronger for *pro* (p < 0.03).

In Exp 4, we conducted a self-paced reading time experiment (E-prime) and an eye-tracking experiment (SR; EyeLink) in Exp 5. Both experiments used identical sets of sentences, but Experiment 4 manipulated referential dependency to be anaphoric (4), while Experiment 5 made it cataphoric (5). Target sentences included either an overt pronoun or *pro*, and an honorifiable (e.g., lawyer) or unhonorifiable (e.g., Tom) appeared in either the subject or object position as a potential antecedent. In these sentences, the subject-verb honorific agreement marker -*si* attached to the first verb resolves the pronominal ambiguity, as it is not compatible with an unhonorifiable antecedent (e.g., Tom). In Exp 4, we predicted processing difficulty for the *pro* condition with an unhonorifiable referent in the subject position, given *pro's* strong subject bias in Exp 2. In Exp 5, with a cataphoric dependency, we predicted difficulty for both the *pro* and overt pronoun conditions with an unhonorifiable NP (i.e., Tom) subject, based on their strong subject bias found in Exp 3. The predicted difficulty in Exp 4 was not confirmed. The *pro* condition did not show a subject bias effect until the end of the sentence, while such an effect was found earlier and persisted longer in the overt pronoun condition. In Exp 5, a processing disadvantage with the unhonorifiable subject was found for both the *pro* and overt pronoun conditions, as predicted, but the effect was not stronger for the *pro* condition, unlike in Exp 3.

These results suggest that different mechanisms underlie pronominal resolution during off- and online processing. *Pro* displays a stronger subject bias than an overt pronoun in offline, not online, processing. During online processing, the interpretation of *pro* seems less committal and more cautious than overt pronouns. This suggests that the stronger subject bias of *pro* may arise during the later interpretational stage. In addition, the results from Exp 3 and Exp 5 suggest that cataphora triggers a stronger subject bias than anaphora. This bias may be due to a parsing heuristic where a pronominal element without an antecedent triggers an active search of its antecedent (Kazanina, 2007).

(1) Target sentences of Exp 1 (sentences translated into English for an easy presentation)
Context sentence: Mary has been studying French recently.
Target sentence: The kid/She/*Pro* also became interested in studying French history.

Results of Experiment 1

	Full NP	Overt pronoun	*Pro*
Mean ratings (SE)	6.37 (0.033)	6.34 (0.033)	6.58 (0.029)

(2) Target sentences of Exp2 (sentences translated into English for an easy presentation)
Context sentence: Mary has visited Emily for a long time.

Target sentence: Then suddenly, the kid/she/*pro* behaved like a queen.

Results of Experiment 2

	Full NP	Overt pronoun	*Pro*
Subject NP choice	170 (36.3%)	206 (44%)	334 (71.4%)
Object NP choice	298 (63.7%)	262 (56%)	134 (28.6%)

(3) Target sentences of Exp3 (sentences translated into English for an easy presentation)
Target sentence: When he/*pro* attended a seminar, John asked Tom an interesting question.

Results of Experiment 3

	Overt pronoun	*Pro*
Subject NP choice	224 (64.4%)	267 (77.4%)
Object NP choice	124 (35.6%)	78 (22.6%)

(4) Target sentences of Exp 4 (sentences translated into English for an easy presentation)
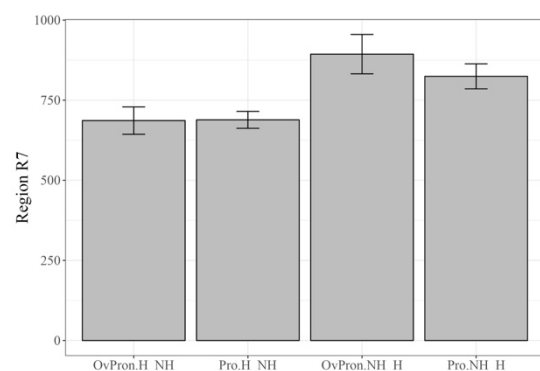Context sentence: The lawyer/Tom sent cash to Tom/the lawyer using a mobile app.
Target sentence: And he/*pro* diligently <u>cleaned-HON </u>his room<u> </u>and left for his work.

(5) Target sentences of Exp 5 (sentences translated into English for an easy presentation)
Before he/*pro* diligently cleaned-<u>HON </u>his room, the lawyer/Tom sent cash to Tom/the lawyer using an app.

Results of Exp 4 (sentence-final position)   Results of Exp 5 (spill-over region)