The role of resumptive pronouns in comprehension of Korean double relative clauses

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Resumptive pronouns (RPs) are well-known for their role in ameliorating island violations across languages by replacing the covert gap [1,2]. While extensively studied for their role in sentence production, the question of whether RPs aid comprehension as effectively as they do in production remains unresolved. Some studies suggest that RPs enhance comprehension [3,4], while others found evidence that RPs may either hinder or, at best, not significantly aid comprehension [5,6].

In this study, we examine the role of RPs in a novel structural configuration in Korean, which has not been extensively explored concerning the function of RPs. Unlike many other languages, Korean double relative clauses (DRCs) allow relativization out of another relative clause, seemingly violating island-constraints (see (1)). Our aim is to investigate the role of RPs in DRC structures where double gaps are acceptable yet pose processing demands. This study specifically examines whether the role of RPs is contingent on the parallelism of their grammatical role with fillers. As Korean is a *pro*-drop and head final language, RPs ("self") for the first gap can serve as an overt cue indicating the presence of double gaps.

Experiments: We conducted two self-paced reading tasks (Exp1 N=77; Exp2 N=39, 16 sets), as in Table 1, manipulating dependency (gap/RP) and its grammatical-role parallelism with fillers, i.e., the high head noun (parallel/non-parallel). The basic structure is presented in (2). The grammatical role of the gap/RP was always a subject, while the grammatical role of the high head noun was manipulated, either as a subject with nominative case marker (parallel conditions) or as an object with an accusative case marker (non-parallel conditions). The gap of the low head noun was always an object, and its role at surface structures (e.g., *shoes*) was always a subject within the most deeply embedded relative clauses.

We further manipulated the animacy of low head nouns across experiments (*inanimate* in Exp1, *animate* in Exp2) to examine impacts of processing demands. As a *pro*-drop and head final language, the grammatical role of animate low head nouns (Exp 2) at gap sites becomes temporarily ambiguous, as it is conceivable for them to be either a subject or an object (of the verb '*respect'*). When low head noun is inanimate (Exp 1), causing unambiguous object at its gap site (e.g., an object of '*steal'*), the processing of the high head noun is relatively easy-to-process. We measured both online reading time and offline accuracy of interpretation to address the relationship between processing difficulty and actual comprehension [6].

Results: For *interpretation,* analysis used logistic mixed effect regression model showed a main effect of RPs in both Experiments 1 and 2, leading to lower accuracy than gaps. Experiment 1 showed a parallelism effect (z=9.2, p<0.001), while Experiment 2 revealed an interaction, highlighting a greater RP/gap difference in non-parallel conditions (z=2.5, p=0.01). During *online processing*, linear mixed effect regression model showed a main effect of grammatical-role parallelism at the spillover region (after the high head noun) in both experiments: longer reading time for non-parallel conditions than parallel conditions (all $p \leq 0.001$). Notably, both experiments exhibited interaction with RPs, but with opposite patterns. In Experiment 1 (inanimate low head noun), RPs resulted in *slower* reading times than gaps in non-parallel conditions at the spillover regions (t=2.6, p=0.07), whereas in Experiment 2 (animate low head noun), RPs led to *faster* reading times than gaps in non-parallel conditions (t=-2.2, p=0.02).

Discussion: The overall results suggest that RPs hinder accurate interpretations, regardless of grammatical-role parallelism and the animacy of low head nouns. However, its role in real-time processing was sensitive to grammatical-role parallelism and dependent on the animacy of low head nouns. When the low head noun is unambiguously object at its gap site (Exp1), RPs inhibited processing. In Experiment 2, RPs assist in resolving temporary ambiguity by signaling the presence of a subject gap in dependencies with high head nouns. This facilitates the identification of the gap position for low head nouns as objects, particularly in non-parallel conditions. Our findings imply that RPs rather disrupt the real-time processing in easy-to-process structures, assisting only in hard-to-process structures.

(1) [$_{RC2}$[$_{RC1}$ ___$_i$ ___$_j$ coaha-nun] kangaci$_j$-ka cwuk-un] ai$_i$
___$_i$ ___$_j$ like-ADN dog $_j$ -NOM die-ADN kid$_i$
low head noun high head noun
'the kid who the dog which [the kid] liked died'

(2) [$_{RC1}$[$_{RC2}$ ___$_{i(Subj)}$ ___$_{j(Obj)}$...v] NP$_{j(Subj\text{-}NOM)}$ ....v] NP$_{i(Subj\text{-}NOM/Obj\text{-}ACC)}$
low head noun high head noun

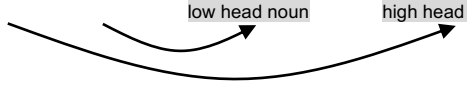


Table 1. A sample set of items for Experiment 1. Word orders are flexible in Korean

	Parallelism of the high head noun (subject gap)	Dependency type	Examples
(a)	Parallel (subject)	Gap	[$_{RC1}$[$_{RC2}$___$_i$ ___$_j$ mollay hwumch$_i$-n] *sinpal*$_j$ -i manhi telewu-n] *ai* $_i$-ka… sneakily steal-ADN shoes-NOM very (be) dirty-ADN kid$_i$-**NOM**
(b)	Parallel (subject)	RP	[$_{RC1}$[$_{RC2}$ caki$_i$-ka ___$_j$ mollay hwumch$_i$-n] *sinpal*$_j$ -i manhi telewu-n] *ai* $_i$-ka… self-NOM sneakily steal-ADN shoes-NOM very (be) dirty-ADN kid$_i$-**NOM**
(c)	Non-parallel (object)	Gap	[$_{RC1}$[$_{RC2}$___$_i$ ___$_j$ mollay hwumch$_i$-n] *sinpal*$_j$ -i manhi telewu-n] *ai* $_i$-lul… sneakily steal-ADN shoes-NOM very (be) dirty-ADN kid$_i$-**ACC**
(d)	Non-parallel (object)	RP	[$_{RC1}$[$_{RC2}$ caki$_i$-ka ___$_j$ mollay hwumch$_i$-n] *sinpal*$_j$ -i manhi telewu-n] *ai* $_i$-lul… self-NOM sneakily steal-ADN shoes-NOM very (be) dirty-ADN kid$_i$-**ACC** 'the kid$_i$ [who the shoes$_j$ [that (the kid)$_i$ sneakily stole ___$_j$] is dirty]'

Table 2. A sample set of items for Experiment 2. Word orders are flexible in Korean

	Parallelism of the high head noun (subject gap)	Dependency type	Examples
(a)	Parallel (subject)	Gap	[$_{RC1}$[$_{RC2}$_$_i$ _$_j$ manhi conkyengha-te-n] sensayngnim$_j$-i choykuney unthoyha-n] colepsayng$_i$-i… a lot respect-PST-ADN *teacher*$_j$-NOM recently retire-ADN *graduate*$_i$-**NOM**
(b)	Parallel (subject)	RP	[$_{RC1}$[$_{RC2}$ caki$_i$-ka _$_j$ manhi conkyengha-te-n] sensayngnim$_j$-i choykuney unthoyha-n]colepsayng$_i$-i… self-NOM a lot respect-PST-ADN *teacher*$_j$-NOM recently retire-ADN *graduate*$_i$-**NOM**
(c)	Non-parallel (object)	Gap	[$_{RC1}$[$_{RC2}$_$_i$ _$_j$ manhi conkyengha-te-n] sensayngnim$_j$-i choykuney unthoyha-n] colepsayng$_i$-ul… a lot respect-PST-ADN *teacher*$_j$-NOM recently retire-ADN *graduate*$_i$-**ACC**
(d)	Non-parallel (object)	RP	[$_{RC1}$[$_{RC2}$ caki$_i$-ka _$_j$ manhi conkyengha-te-n]sensayngnim$_j$-i choykuney unthoyha-n]colepsayng$_i$-ul self- NOM a lot respect-PST-ADN *teacher*$_j$-NOM recently retire-ADN *graduate*$_i$-**ACC** 'the graduate$_i$ [who the teacher$_j$ [who (the graduate)$_i$ respected___$_j$ a lot] recently retired]'

Figure 1. Mean accuracy and reading time at the spillover region in Experiment 1

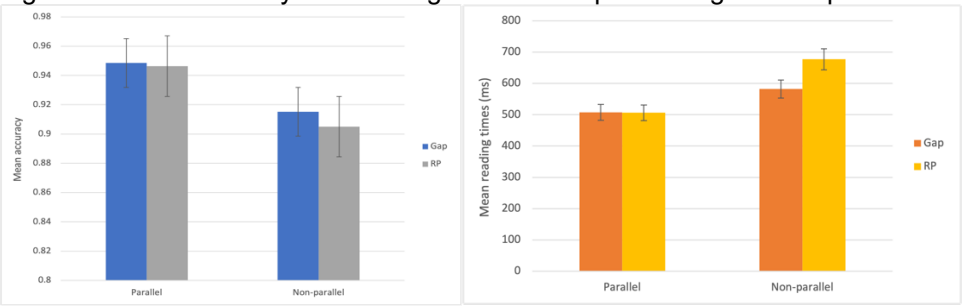
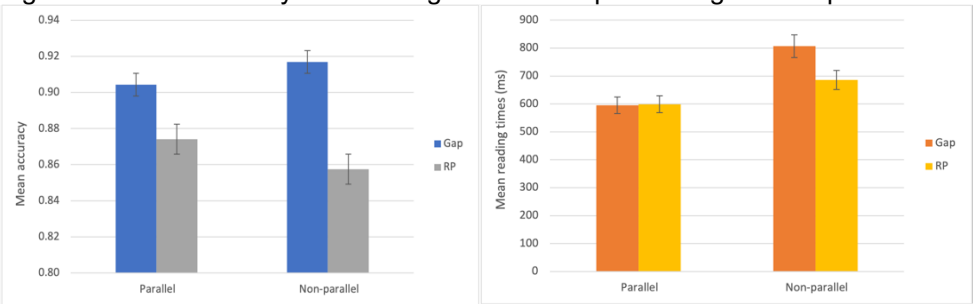


Figure 2. Mean accuracy and reading time at the spillover region in Experiment 2



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