Neural Correlates of Scrambling in First and Second Language Processing: An ERP Challenge to the Shallow Structure Hypothesis

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1. L2 Sentence Processing

An ongoing topic in second language (L2) research concerns how L2 learners process input in real time (Clahsen & Felser, 2006a, 2006b, 2018; Cunnings, 2017; Dekydtspotter, Schwartz, & Sprouse, 2006; Hopp, 2016; Swanson, 2021; Swanson & Miller, 2026, among many others). On the Shallow Structure Hypothesis (SSH), Clahsen and Felser (2006a, 2006b, 2018) argued that adult L2 processing relies more on lexical-semantic cues than on syntax unlike first language (L1) processing. As structural processing is delayed under SSH, real-time L2 sentence processing involves shallow representations, with less detailed hierarchical syntactic structure than L1 processing. In contrast, other researchers argued that the same core sentence processing mechanism underlies L1 and L2 comprehension and that adult L2 learners can compute complex syntactic representations in real time (Cunnings, 2017; Dekydtspotter, Schwartz, & Sprouse, 2006; Hopp, 2006, 2022; Swanson, 2021; Swanson & Miller, 2026). Within these approaches in which syntactic operations are viewed as the core of language, Cunnings (2017) proposed that L2 sentence processing is 'more susceptible to interference' in retrieval because comprehension relies on information from memory (p. 659). In contrast, other accounts emphasize processing load differences with efficiency-related constraints under reduced L2 processing capacity together with distinct allocation of resources in L2 computations (Dekydtspotter et al., 2021, 2023, 2024, 2025; Hopp, 2016, 2022).

Considering the neurocognitive bases of L2 sentence processing, this study situates full structure-based parsing within an adaptive network framework (Green & Abutalebi, 2008), within a Minimalist approach to language (Chomsky, 1995). Under the Full Parse Hypothesis (Dekydtspotter, Schwartz, & Sprouse,

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2006) [1], observed L1-L2 differences in online measures do not entail fundamentally different parsing mechanisms. Building on this hypothesis, we further draw on Minimal Brain Adaptation for Representational Prioritization (MBARP; Dekydtspotter et al., 2021). MBARP characterizes L2 sentence processing differences as minimal adaptations of the language network dynamics in the allocation of limited processing resources. These adaptations implicate a prioritization of the lexically defined interface representations necessary to ensure processing preservation under reduced resources. On this view, 'lexically encoded grammatical requirements' are prioritized, at the potential expense of computations that extend beyond lexical requirements (p.2).

Dekydtspotter et al., (2021) reported the beta rhythm (12.5-30Hz) at the clause-boundary subordinator in L1 and L2 French, exhibiting both shared and different power effects of *wh*-filler structures. The beta rhythm is crucially implicated in the maintenance of sentential representations (Lewis, Wang, & Bastiaansen, 2015; Lewis, Schoffelen, Schriefers, & Bastiaansen, 2016), hence playing a crucial predictive role in long-distance dependencies (Murphy, 2021). Shared effects at 15-16Hz at the subordinator across L1 and L2 suggested that both groups implemented similar core syntactic computations in *wh*-filler-gap dependencies. However, a group difference emerged at 17-22Hz: L2ers showed greater power to lexically specified representations (i.e., gender specified pronouns), whereas L1ers showed greater power linked to inferential processes beyond lexical marking (i.e., gender unspecified pronouns). These asymmetries are consistent with MBARP's prediction that L2 sentence processing reallocates resources toward lexically encoded requirements, while maintaining full structural parsing.

Korean long-distance scrambling offers a particularly informative testing ground for shallow vs. full structure processing: Korean is a Subject-Object-Verb head-final language, so that key thematic predicate information is delayed until the clause-final verb. The nature of the input in long-distance scrambling limits early predicate-based interpretive cues and places greater weight on hierarchical computations, unless processing is significantly delayed as per the SSH.

2. Scrambling in Korean

Scrambling is associated with relatively flexible word order and with discourse-driven interpretations: information structure such as topic/focus triggers scrambling (Choi, 1996; Kiss, 2008; Ko, 2018). It is more commonly attested in languages with rich case morphology (e.g., Dutch, Japanese, Korean). In generative syntax, scrambling is analyzed as syntactic movement (A- or A-bar movement), rather than as base generation, since it is subject to locality and movement constraints (Bailyn, 2001, 2020, Ko, 2018; Mahajan, 1990; Miyagawa,

[1] 'Full Parse Hypothesis' abbreviates the Full Transfer/Full Access/Full Parse Hypothesis (Dekydtspotter, Sprouse, & Sprouse, 2006), highlighting the claim that 'fundamental mechanisms of L1 and L2 processing are the same' (p. 33).

2001, 2003; Saito, 1985, 1992). In parsing, displaced constituents associated with topic/focus structures in scrambling are linked to their base thematic positions, consistent with an interpretation implicating a lower copy. Crucially, long-distance A-bar scrambling in Korean also requires linking a scrambled noun phrase to its thematic position across a clause boundary, but with no clause-boundary marking until the final verb. In grammar, scrambling is characterized as an upward movement to topic/focus. Figure 1 (English gloss) provides the bi-clausal hierarchical structure of Korean long-distance A-bar scrambling. The real-time incremental processing of this structure by a left-corner parser, however, implicates both bottom-up and top-down processes predicting operations across the matrix and embedded clause.

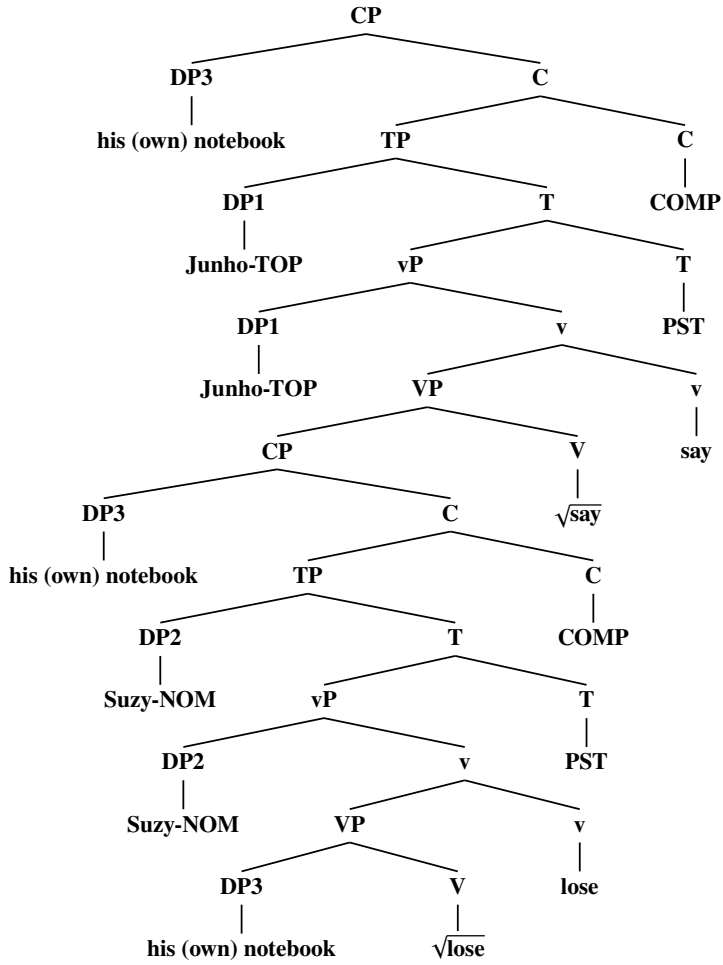

Figure 1. Syntactic structure for Korean long-distance scrambling

In Korean long-distance scrambling, the embedded dependency of a scrambled expression is not overtly morphologically marked beyond the presence of two subject expressions, with key predicate information delayed until the final verb. Korean long-distance scrambling can therefore highlight the need for top-down structural computations in online parsing and provide a stronger test of current L1 and L2 sentence processing accounts. Using EEG, this study examines event-related potential (ERP) waveforms across various anaphora-resolution conditions in long-distance scrambling, as ERPs provide precise temporal information about neurophysiological responses to linguistic input, together with a reflection of processing costs. In the materials presented in this study, we examined syntax-based vs. discourse-based referential relations in anaphoric dependencies associated with long-distance scrambling to test the issues of timing (SSH) and resources (MBARP) in L1 vs. L2 sentential processing.

Under the Full Parse and MBARP frameworks, L1 and L2 processing is expected to show well-timed ERP waveforms in response to L1 and L2 input with L2 waveforms reflecting greater processing costs for more complex referential processing. Hence, scrambled structures with anaphora resolution implicating syntax- and discourse-based vs. purely syntactic processes are expected to show ERP condition-differences timed with top-down syntactic computations in both L1 and L2. Likewise, scrambled structures with anaphora resolution implicating later resolution of referential dependencies are also expected to show significant waveforms across L1 and L2 with ERP condition-differences associated with processing cost for embedded vs. matrix clause resolution. In contrast, under SSH, L2 processing lacks real-time syntactic computations, and referential processes in anaphora resolution are reduced to discourse-driven relations (Felser & Cunnings, 2012; Felser et al., 2016), since L2 processing relies more on discourse-level cues rather than syntax structure. ERP effects tied to real-time syntax vs. discourse-based referential processes in L1 waveforms are expected to be sustainably delayed in L2 waveforms, yielding fundamentally different L1 vs. L2 ERP waveform patterns. We report L1 and L2 ERP waveforms time-locked to anaphora-resolution in Korean long-distance scrambled structures and argue that these characteristics reflect referential computation costs predicted by the Full Parse and MBARP frameworks.

3. Study

To examine the predictions of the SSH vs. Full Parse/MBARP frameworks, the present ERP study employs a 2x2 design, targeting the real-time computation of anaphoric dependencies in Korean long-distance scrambling. This design manipulated referential expressions (a pronominal possessive determiner phrase (DP), e.g., *geuui* N 'his N', vs. an anaphoric possessive DP marked with *jasin-ui* 'own', e.g., *geu jasin-ui* N 'his own N') and the position of gender-matching antecedents (matrix clause subject, DP1 vs. embedded clause subject, DP2). It aims to examine ERPs tied to referential processes in a structurally demanding long-distance scrambling dependency comparing L1 and L2. Moving forward, we

use the terminology 'anaphoric possessive DP' to refer to nominal scrambled expressions involving possessive pronouns marked with *jasin-ui* 'own' constraining the interpretation (Charnavel & Sportiche, 2016) to a local syntactic antecedent (Binding Principle A-type locality; Chomsky, 1981). They contrast with DPs with plain possessive pronouns that permit broader discourse coreference and syntactic binding, with the noun phrase *geuui* N 'his N' satisfying Binding Principle B in pronoun interpretation (Chomsky, 1981). We follow analyses of anaphoric possessive DPs (i.e., Anaphor DP) vs. plain possessive pronouns (i.e., Pronoun) and in matrix- vs. embedded clause anaphora resolution. Two groups of participants (L1-Korean speakers and L1-English L2-Korean learners) took part in an online rapid serial visual presentation (RSVP) task to ensure that the timing and nature of the ERP effects could accurately map onto the input presentation.

3.1. Research Questions

Building on the Full Parse vs. SSH expectations, we consider the extent to which waveforms for L1-English L2-Korean learners in the processing of Korean scrambled sentence structures exhibit similarities and differences compared to L1 native speakers of Korean, with research questions (RQ1 and RQ2).

> RQ1: Will ERPs for L1 and L2-Korean speakers show asymmetries in processing scrambled DPs involving (coreferential or bound) pronominal vs. (bound) anaphoric interpretations under gender match with matrix-clause subject (DP1)?
>
> RQ2: Will ERPs for L1- and L2-Korean speakers show asymmetries in processing scrambled anaphoric DPs consistent with local clausal binding, under gender match/mismatch with matrix- (DP1) vs. embedded (DP2)-clause subject antecedent?

On a Full Parse account across L1 and L2, hierarchical, structure-dependent dependencies and referential relations are computed in real time showing condition-based ERP asymmetries for (coreferential or bound) pronominal vs. (bound) anaphoric interpretations together with matrix- vs. embedded-clause subject antecedent in gender match. On the Shallow Structure account, L1 ERPs for these pronominal vs. anaphoric interpretations will not be echoed in L2 ERPs. It is expected that referential processes in anaphora resolution will be reduced to discourse processes, since syntactic structures will not be available in the real-time processing of scrambled structures. Likewise, L1 ERPs for matrix- vs. embedded-clause local syntactic binding under gender match will also not be echoed in L2 ERPs, since lexical-thematic based syntactic processing is delayed occurring at the end of the sentence only when the predicate appears. L2-Korean learners' processing of long-distance scrambling in which verbal cues are delayed can therefore potentially provide significant additional information about

movement-dependency processing. Typical English-style *wh*-movement, in which thematic matrix-clause verbs, such as *say*, and morphological sentential cues, such as *that*, occur within the *wh*-filler-gap dependency cannot address the interaction of filler-gap dependencies and predicate-base thematic information as clearly as long-distance Korean-style scrambling.

3.2. Participants

Participants included 25 native speakers of Korean (L1-Korean group, M_{age} = 28.44) and 25 L1-English learners of Korean (L2-Korean group, M_{age} = 22.12), all recruited from a Midwestern university. On a 50-point Korean proficiency C-test (Son, 2018), the L1 group averaged 49.04 (*SD* = 1.02), while the L2 group averaged 39.24 (*SD* = 4.94), indicating intermediate-to-advanced proficiency. Both groups had an identical handedness distribution (22 right-handed, 3 left-handed). No participants in either group reported dyslexia.

3.3. Design and Materials

The 2x2 factorial design involved two independent variables: (i) Referential Expressions (Pronoun | Anaphor DP), and (ii) Antecedent Gender Match Binder Positions (DP1 | DP2). The test consisted of 192 items, of which 128 were scrambled Korean experiment items and 64 were canonical word-order control items. Addressing RQ1 & 2, four conditions were manipulated. Condition A (Table 1) and Condition B (Table 2) began with a scrambled object extracted from the embedded clause. This object contains a (coreferential & bound) pronoun within a nominal binding domain (e.g., *geuui* or *geunyoeui seongelullaseu* 'his or her sunglasses') or a (bound) noun phrase anaphor (*geu jasin-ui* or *geunyoe jasin-ui seongelullaseu* 'his own or her own sunglasses') interpreted with a local clausal binding domain. The difference between Conditions A and B lies in whether a pronoun enables both syntactic binding and discourse coreference (Condition A), whereas a noun phrase anaphor requires syntactic binding (Condition B) across L1 and L2. Both conditions involve an antecedent in the DP1 matrix-clause subject, indicating the appropriate gender cue via the referential names in Korean (*geuui* 'his' - *Junho*, a Korean male name[2]). Binding/coreference (Condition A) and binding (Condition B) differences address the availability of syntactic binding vs. discourse co-references processes across L1 and L2.

[2] To ensure a clear gender distinction in Korean names, multiple rounds of selection and validation were carried out, including judgments by 10 native Korean speakers, Korean language textbook checks, and final verification by two Korean language instructors.

Table 1. Condition A Example

Condition A: Pronoun x DP1-antecedent gender match condition							
Geu-ui	seongeulla seu-leul	suyoil-e	Junho-neun	Suzy-ga	wolyoil-e	tteol-eotteuly-eoss-da-go	malha-ess-da.
His	sunglasses ACC	Wednesday-on	Junho TOP	Suzy NOM	Monday-on	drop PST-DEC-COMP	say PST-DEC
'Junho said on Wednesday that Suzy dropped his sunglasses on Monday.'							

Table 2. Condition B Example

Condition B: Anaphor DP x DP1-antecedent gender match condition							
Geu jasin-ui	seongeulla seu-leul	suyoil-e	Junho-neun	Suzy-ga	wolyoil-e	tteol-eotteuly-eoss-da-go	malha-ess-da
His own	sunglasses ACC	Wednesday-on	Junho TOP	Suzy NOM	Monday-on	drop PST-DEC-COMP	say PST-DEC
'Junho said on Wednesday that Suzy dropped his own sunglasses on Monday.'							

Conditions A and C with the structure 'his N' involve genitive pronouns inside a nominal binding domain. Under Binding Principle B (Chomsky, 1981), the pronoun can therefore be co-referential in discourse or bound in syntax by a matching antecedent during anaphora resolution. The structure 'his own N' (Conditions B and D) makes the noun phrase 'his own N' function as an anaphor, requiring local binding within its clausal domain under Binding Principle A (Chomsky, 1981). Conditions B and D involve local binding within a clausal binding domain. Table 3 and 4 provide an example of Condition C and D.

Table 3. Condition C Example

Condition C: Pronoun x DP2-antecedent gender match condition							
Geu-ui	seongeulla seu-leul	suyoil-e	Suzy-ga	Junho-neun	wolyoil-e	tteol-eotteuly-eoss-da-go	malha-ess-da.
His	sunglasses ACC	Wednesday-on	Suzy NOM	Junho TOP	Monday-on	drop PST-DEC-COMP	say PST-DEC
'Suzy said on Wednesday that Junho dropped his sunglasses on Monday.'							

Table 4. Condition D Example

Condition D: Anaphor DP x DP2-antecedent gender match condition							
Geu jasin-ui	seongeulla seu-leul	suyoil-e	Suzy-ga	Junho-neun	wolyoil-e	tteol-eotteuly-eoss-da-go	malha-ess-da.
His own	sunglasses ACC	Wednesday-on	Suzy NOM	Junho TOP	Monday-on	drop PST-DEC-COMP	say PST-DEC
'Suzy said on Wednesday that Junho dropped his own sunglasses on Monday.'							

Genitive pronouns allow both discourse coreference and syntactic binding, whereas anaphoric DPs permit structurally dependent binding only within a local clausal binding domain. Under Full Parse accounts, structurally dependent anaphoric processes are expected, whereas under the SSH, reduced sensitivity to fine-grained structural constraints in real-time is expected (Clahsen & Felser, 2018; Dekydtspotter, Schwartz, & Sprouse, 2006). Thus, when genitive pronouns in Conditions A and B encounter a gender-matching antecedent at the DP1 position, different referential processes is not expected to be resolved immediately across these conditions; rather, information that bears on the embedded clause dependency becomes fully available only when DP2 is encountered.

In DP2 match structures (Conditions C and D), the genitive pronouns initially encounter a gender-mismatching antecedent at DP1, and only later a matching DP2 antecedent. More specifically, in Condition D, the mismatch between the anaphor DP (e.g., 'his own N') and DP1 (e.g., *Suzy*, female) is expected to immediately trigger the parser to construct an embedded clause structure, if syntactic processing can be immediate. Comparisons of L1 and L2 ERP waveforms in Korean scrambling can therefore address the timing and nature of the referential processes available in L2 vs. L1 real-time sentence processing. L1 ERPs should align with top-down syntactic representations in parsing, providing support for timing of syntax-based processes and addressing cost of anaphora processing for multiple (discourse coreference and syntactic binding) vs. single (binding) referential processing. The degree to which L2 learners' ERPs echo similar cost asymmetries and align with well-timed processing can provide strong evidence for either the SSH or the Full Parse/MBARP approach.

3.4. Procedures

After completing a basic language background questionnaire and taking a Korean proficiency C-test (Son, 2018), participants took an approximately one-hour, four-block online RSVP task (8-word sentences; 500ms duration; 150ms interstimulus interval (ISI)). EEG data were recorded via a 64-channel EGI HydroCel Geodesic Sensor Net. Brief breaks between blocks were allowed to refresh the cap sensors to keep electrode impedance below 50kΩ. During the task, participants silently read sentences presented with one word at a time.

3.5. Data Preprocessing and Statistical Analysis

Raw EEG files were preprocessed, using the EEGLAB toolbox (Delorme & Makeig, 2004; version 2023.1) in MATLAB (version 2023b). Channel-level noise, epoch-level noise, and AC 60Hz line noise were removed during preprocessing: The *Clean Rawdata* plugin was used for automated detection and removal of excessive noisy channels. Up to 10% of the 64 channels were allowed to be rejected. On average, 4.84 channels were removed in the L1 group, and 4.28 in the L2 group. Following the cleaning of channels, manual visual (epoch) inspection was conducted to reject contaminated epochs, with a maximum rejection rate of 30% of total trials. On average, 24.76 out of 192 epochs were

removed in the L1 group, and 23.04 out of 192 epochs in the L2 group. Artifact-related Independent Component Analysis (ICA) rejection yielded comparable levels of component removal across groups, with an average of 7.68 independent components removed for the L1 group and 8.84 components for the L2 group. ICA rejection targeted components associated with ocular artifacts, (eye-related) muscle activity, and cardiac activity. After preprocessing, a median of 27-28 out of 32 epochs per condition was retained for the L1 group and a median of 28-30 epochs were retained for the L2 group per condition for subsequent analyses.

ERPs were analyzed using linear mixed-effects models across six regions of interest (ROIs, see Figure 2). Baseline correction was performed using the final 500ms out of 650ms presentation interval of the first adverbial phrase (e.g., *mogyoil-e* 'Thursday-on'). The baseline interval (500ms) served only as a reference and was not included in the statistical analyses of the time windows of interest. It revealed no significant effects in either group. Statistical analyses focused on the fourth word (DP1, the subject of the matrix clause) through the sixth word (the adverbial phrase of the embedded clause) prior to the verbal information. This interval (DP1 to AdvP2) was selected because sentence processing computation demands are expected to increase between the matrix clause subject (DP1) and the embedded clause adverbial phrase (AdvP2), especially when the embedded clause subject (DP2) appears. The total duration of this analysis window was 1,950ms (650ms*three words). Nineteen consecutive time windows were analyzed at 100ms increments, with the final window spanning 50ms. The primary analyses tested the interaction between Referential Expression (Pronoun | Anaphor DP) and Gender-Match Position Condition (DP1 | DP2).

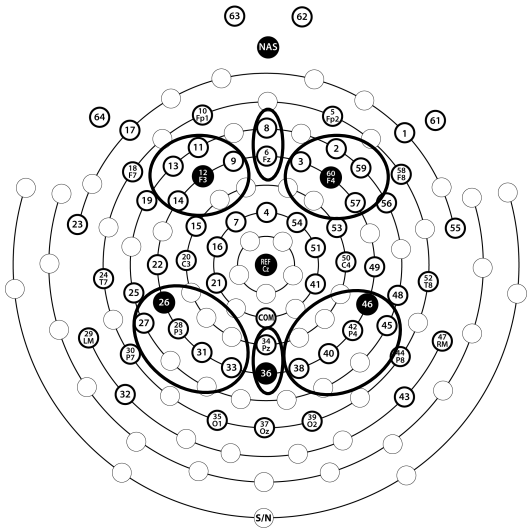

Figure 2. Regions of Interest (ROIs)

Crucially, abstract morphosyntactic and conceptual-semantic processes reliant on full lexical retrieval typically arise after 250ms following stimulus onset in reading (Friederici & Kotz, 2003). Hence, ERPs starting before 250ms into the DP2 would constitute evidence of scrambled expression reinstatement in top-down predictive processing of embedded clause dependencies. ERPs after 250ms following DP2 onset would then reflect the integration of the embedded clause and evaluation of binding-domain constraints. Thus, our analysis and discussion focus on the nature of ERPs with respect to the time necessary to retrieve the lexical information for DP1 and DP2.

4. Results

Addressing RQ1, with DP1 as the gender match antecedent position and referential expression type manipulated, the waveforms for Conditions A vs. B (Pronoun vs. Anaphor DP) contrast with the DP1 position in Figure 3. The L1 group exhibited a sustained significant positivity for pronouns relative to anaphoric DPs. Linear mixed-effects models confirmed the effects across three temporal clusters: an early window from 401-600ms (p <.05), a mid-latency window from 1001-1300ms (p <.05), and a late window from 1501-1950ms (p <.05 to p <.01). Across the windows, model estimates remained positive with all t-valued exceeding 2.0.

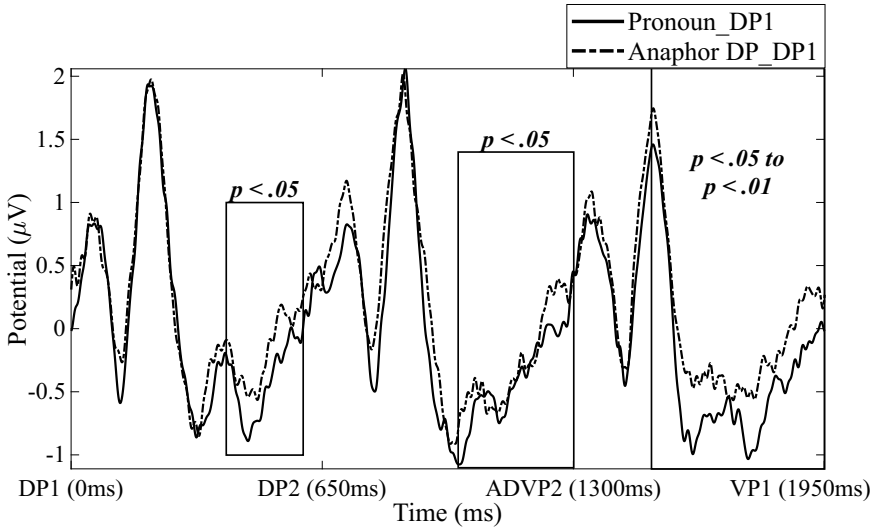

Figure 3. Pronoun vs. Anaphor DP_DP1 (Conditions A vs. B) in L1

The waveforms for Conditions A vs. B in the L2 group revealed a significant effect of conditions across three temporal clusters, mirroring the pattern observed in the L1 group. The first significant cluster appeared at 201-600ms (p <.01), the second at 801-1200ms (p <.05 to p <.01) and the third at 1701-1950ms (p <.05 to

p <.01). Across all clusters, positive model estimates indicate that the Pronoun_DP1 condition elicited greater positivity than the Anaphor DP_DP1 condition. Relative to the L1 group, these amplitude differences were smaller and more gradual.

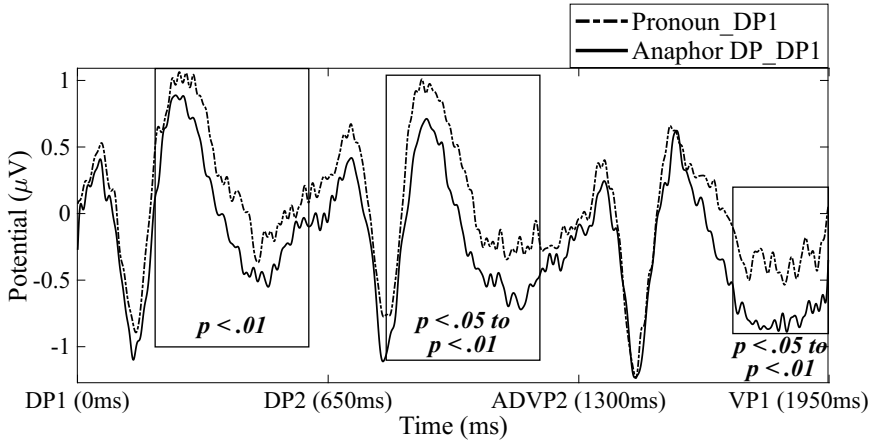

Figure 4. Pronoun vs. Anaphor DP_DP1 (Conditions A vs. B) in L2

Addressing RQ2, with the referential expression (Anaphor DP) constant across conditions while the antecedent position (DP1 vs. DP2) was manipulated, the L1 group waveforms for Conditions B vs. D revealed a short-lived effect emerged late in the analysis window at 1701-1800ms (β= -.319, t = -2.125, p = .034), with the immediately preceding window (1601-1700ms) showing a marginal effect (β = -.29, t = -1.93, p = .054). The negative estimates indicate lower amplitudes for Anaphor DP_DP1 (Condition C) relative to Anaphor DP_DP2 (Condition D).

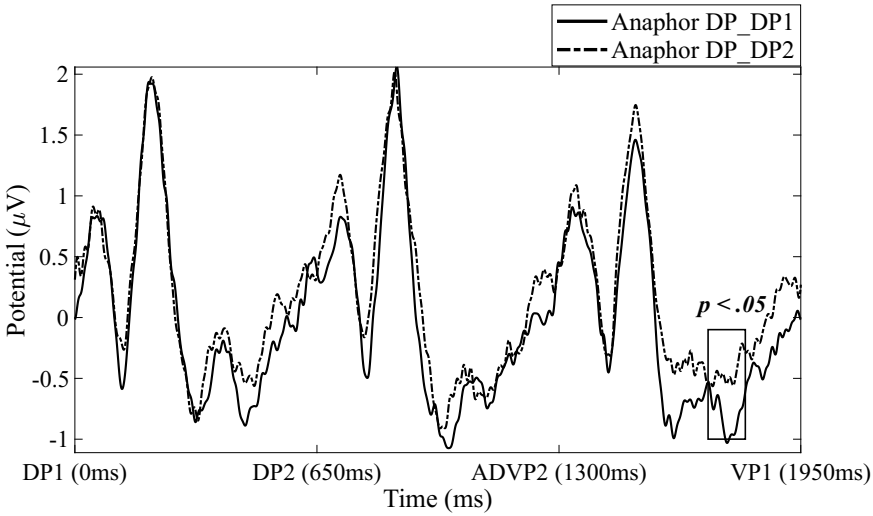

Figure 5. Anaphor DP_DP1 vs. _DP2 (Conditions B vs. D) in L1

The L2 group exhibited two extended clusters of significant ERP effects as illustrated in Figure 6. The first cluster spanned 801-1300ms (p <.05 to p <.01), followed by a second cluster spanned 1701-1950ms (p <.01 to p <.001). Across both clusters, model estimates were negative and highly significant.

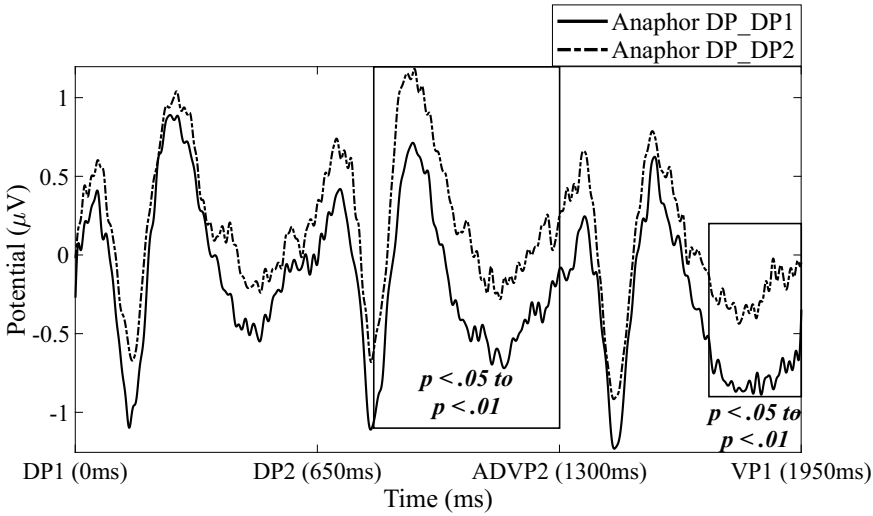

Figure 6. Anaphor DP_DP1 vs. _DP2 (Conditions B vs. D) in L2

5. Discussion

In response to RQ1, the results showed that both L1 and L2 processing reliably distinguished pronouns and anaphor DPs, with more positive waveforms for genitive pronouns than for anaphor DPs, involving genitive pronouns marked by *jasin-ui* 'own'. In the contrast between Condition A and Condition B, ERP effects in the L1 group emerged at 401-500ms whereas in the L2 group first significant effects appeared earlier at 201-300ms, as soon as DP1 (matrix-clause subject) was processed. These L1-L2 effects align with grammatical theory in which genitive pronouns as in 'his N' allow both discourse coreference and syntactic binding, whereas anaphoric expressions as in 'his own N' require local binding as anaphors. Scrambled noun phrases including genitive pronouns and anaphoric structures therefore clearly involve incremental top-down sentence processing across L1 and L2. These waveforms thus do not support failure to compute structure in real time, postponing computation until the lexical cues provided by the complementizer and verb information becomes available at the end of the sentence.

In response to RQ2, similar asymmetries of waveforms were observed for anaphor DPs matching DP1 vs. DP2, with greater costs for DP2 across L1 and L2, emerging as early as 150ms early after DP2 onset in L2, before DP2 can be fully accessed (Friederici & Kotz, 2003). A similar pattern of early effect prior to the full processing of DP2 was observed. In the L1 group, effects emerged only marginally at 1601-1700ms at AdvP2, whereas the L2 group showed effects, beginning at 801-900ms at DP2. These temporal ERP effects in L2 processing suggest that L2 learners may engage clausal computation of syntactic binding on top-down syntactic processing in long-distance hierarchical dependencies with statistically significant effects sooner than L1 speakers, reflecting a well-timed structural mechanism. In Figure 6, Anaphor DP_DP2 relations elicited a larger positive amplitude than Anaphor DP_DP1, indicating more increased processing demands and costs in L2 with longer windows than L1. It suggests an anticipatory computation of an embedded clause required by an anaphor needing a local binding domain. The evidence across RQ1 and RQ2 therefore suggests that L1-English L2-Korean learners' parsing successfully computed syntactically supported referential dependencies in scrambled structure much as native speakers of Korean did.

6. Conclusion

The current study provides counterevidence to the Shallow Structure Hypothesis and supports the Full Parse/MBARP model. ERP patterns in the L2 group demonstrated the ability to build full hierarchical representations required for distinct syntax-based vs. discourse-based referential processes and to compute filler-gap dependencies under purely structural constraints. Moreover, the L2 results exhibited earlier statistically significant ERP effects than those observed in the L1 group. These findings support the claim that the L2 parsing can anticipate syntactic dependencies in real time and that L2 learners processed full

hierarchical grammatical representations in long-distance scrambled sentential structures, contrary to the prediction of the SSH.

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