

Effects of Processing Factors on the Child Second Language Acquisition of Quantifier Scope in Korean*

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ABSTRACT Sentences involving negation and quantifiers can introduce ambiguity, and speakers from different languages often exhibit varying preferences for scope interpretation. This study investigated to what extent Chinese- and Russian-speaking children, who learned Korean as a second language (L2), demonstrate native-like scope interpretations. Additionally, we examined whether their interpretive biases in L2 were modulated by various processing factors, including L2 word retrieval speed, L2 proficiency, and working memory. Results from truth-value judgment tasks revealed that the learners displayed interpretation patterns that closely resembled those of native Korean-speaking children. Furthermore, the L2 children were less likely to converge on native-like interpretations as they encountered greater challenges in L2 word retrieval. In contrast, neither their L2 proficiency nor working memory capacity modulated the learners' scope interpretation tendencies. The findings suggest that the ability to efficiently retrieve words from memory may play a significant role in L2 scope interpretation, lending support to the hypothesis that lexical processing can impact sentence comprehension.

Keywords Scope Interpretation, L2 Acquisition, Lexical Retrieval, L2 Proficiency, Working Memory

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1. Introduction

Over the last two decades, there has been a burgeoning interest in the construction of mental representations in bilingual speakers (Dijkstra and Heuven 2002; Kroll and Tokowicz 2005; Pavlenko 2014). Previous research converges on the finding that bilingual activation of language information occurs at various levels of representation, including orthographic, phonological, lexical, morphological, syntactic, and semantic dimensions. The general idea emerging from these investigations is that bilingual memory representation constitutes an integrated system that stores linguistic information from both the first (L1) and second (L2) languages, enabling bilinguals to access information from both languages simultaneously, in a parallel and language-non-selective manner (e.g., Chambers and Cooke 2009; Dijkstra et al. 2019; Duyck et al. 2007; Gollan, Forster, and Frost 1997; Spivey and Marian 1999).

Despite the mounting evidence supporting the phenomenon of non-selective access in bilingual representation, it remains less clear how such parallel activation interacts with other factors. For instance, it is plausible that bilinguals' ability to activate lexical information may exert a significant influence on the integration of syntactic or semantic information during sentence comprehension (e.g., Hopp 2018). Recent studies have shown that bilingual syntactic processing is facilitated when bilinguals encounter less difficulty in retrieving lexical items. This facilitation can arise from various factors, such as the presence of high-frequency words or the existence of cognate words that share both form and meaning with their L1 counterparts (e.g., Hopp 2014). In addition, it is widely documented that L2 learners' proficiency and working memory

can affect L2 sentence comprehension (e.g., Cunnings 2016). However, the intricate interplay of these factors and how they jointly contribute to bilingual sentence comprehension remains less well understood, particularly among young bilinguals.

Against this background, the present study aims to investigate how various factors, including lexical retrieval speed, L2 proficiency, and working memory capacities, can explain the extent to which bilingual children inhibit sentence interpretation patterns from their L1 during quantifier scope resolution in L2 Korean. As will be reviewed in the subsequent section, Chinese and Russian speakers manifest quantifier scope preferences in their language that diverge from the scope interpretation preference observed among Korean speakers. Our investigation is designed to shed light on how the interpretative bias of Chinese- and Russian-speaking children, when engaging in quantifier scope resolution in L2 Korean, is influenced by their ability to retrieve Korean words, their proficiency in the Korean language, and their working memory capacity. To gain a clearer picture on the role of individual variability in lexical retrieval ability, we administered a real-time word naming experiment, the Hawaii Assessment of Language Access task (HALA task, O'Grady et al. 2009). Furthermore, we conducted independent tasks to assess the L2 proficiency and working memory capacity of the participants, as these factors are recognized for their potential influence on bilingual word and sentence processing (Linck, Hoshino, and Kroll 2008; Van Hell and Tanner 2012).

Taken together, we ask the following research question: How do lexical retrieval speed, L2 proficiency, and working memory capacity influence the interpretation of quantifier scope in L2 Korean by L1 Chinese and Russian children?

2. Quantifier Scope Interpretations in Russian, Chinese, and Korean

Sentences involving both negation and quantifiers, often referred to as scope operators, give rise to semantic ambiguity. The resolution of the scope of a quantifier varies across languages, depending on the specific syntactic and semantic operations occurring during sentence interpretation. Examples illustrating this variability can be found in (2).

- (2) a. Tāngmǔ méiyǒu kǎn diào suǒyǒu de shù. (Chinese)
 Tom not cut all of tree
 ‘Tom did not cut all the trees.’
- b. Tom ne sрубil vse derev’ya. (Russian)
 Tom not cut-3SG all trees-PLU
 ‘Tom did not cut all the trees.’
- c. Thom-i motun namwu-lul an call-ass-ta. (Korean)
 Tom-NOM all tree-ACC not cut-PST-DECL
 ‘Tom did not cut all the trees.’

In the surface syntax of both Chinese (2a) and Russian (2b), the negation, *méiyǒu* and *ne* ‘not’, precedes the quantified object, *suǒyǒu de shù* and *vse derev’ya* ‘all the trees’, thus inducing a preference for an interpretation where not all trees were cut (partitioned-set reading). Conversely, in the surface syntax of Korean (2c), the quantified object, *motun namwu* ‘all the trees’, precedes the negation word *an* ‘not’, preferentially leading to an interpretation that Tom did not cut any of the trees (full-set reading, Han, Lidz and Musolino 2007). However, these same sentences may receive

different interpretations if quantifier movement occurs after processing surface syntax during the comprehension process. Specifically, when quantifier raising takes place at the level of (logico-)semantic representation (May 1977, 1985), the linear order is reversed, potentially inducing the full-set interpretation in Chinese and Russian (Lidz and Musolino, 2002), and the partitioned-set interpretation in Korean (Han et al. 2007).

Previous studies indicate that adult native speakers in each language exhibit distinct and relatively rigid interpretation preferences, which typically align with the surface syntax of their respective languages. Both Chinese- and Russian-speaking adults tend to favor the partitioned-set interpretation (Ionin, Luchkina, and Stoops 2014; Musolino and Lidz 2006; O'Grady 2013; Wu and Ionin 2019, Zhou and Crain 2009), while Korean adults exhibit a strong bias toward the full-set interpretation (Han et al. 2007; O'Grady 2013; O'Grady et al. 2009; O'Grady et al. 2011). In the case of children, however, the patterns of resolution are less straightforward. For example, Zhou and Crain (2009) found that Chinese-speaking children aged 3;4 - 4;3 accepted both full-set and partitioned-set interpretations, displaying no clear preference. Zhou and Crain interpreted these results as an indication of children's flexibility in mapping syntax to semantics, allowing them to consider both scope readings. Conversely, Korean children generally exhibit a strong interpretative bias toward the full-set reading, resembling adult speakers. Han et al. (2007) reported that children aged 4;0-4;11 accepted the full-set interpretation over 80% of the time, whereas they accepted the partitioned-set interpretation only 36% of the time. Han et al. focused on the individual variability in interpretive preferences and proposed the existence of two types of grammars among Korean speakers, depending on whether the speaker preferred the full-set or partitioned-

set reading. Nonetheless, the higher acceptance rates for the full-set interpretation compared to the partitioned-set interpretation in children suggest that the grammar employed by Korean-speaking children tends to align with the surface syntax interpretation, where the quantifier object takes scope over the negation.

The discrepancies in scope interpretation preferences among children in previous studies raise questions about which factors exert a stronger influence on scope interpretation. In addition to children's flexible grammar (Zhou and Crain 2009), various factors have been identified as responsible for the divergent interpretation patterns among children as well as adults. For example, Anderson (2004) proposed the Processing Scope Economy principle, which states "the human sentence processing mechanism prefers to compute a scope configuration with the simplest syntactic representation (or derivation)" (p. 31). According to this principle, the scope interpretation following the surface syntax is preferred over the inverse scope interpretation by virtue of the simplicity of the syntactic representation.

Another influential factor is the consideration of entailment and/or the computation of scalar implicature (Chung 2013; Musolino and Lidz 2006). Knowledge of entailment relations assumes that the full-set interpretation inherently entails the partitioned-set interpretation, making the full-set interpretation more salient and leading to an overall preference for this bias. Conversely, scalar implicature predicts a preference for the partitioned-set interpretation. These theories suggest that speakers adhere to the Gricean quantity maxim, which posits that information should be provided to the extent necessary (Grice 1989). For example, in *Tom did not cut all the trees*, the full-set reading involves strong terms such as 'not any' or 'none', while the partitioned-set reading does not require these

strong terms. Thus, a reader may prefer the partitioned-set reading, as it aligns with the quantity maxim by avoiding the inclusion of additional information associated with strong terms. The issue of identifying specific mechanisms underlying scope interpretation is complex (Kang 2021) and goes beyond the bounds of the present paper. Instead of attempting to pinpoint the primary sources for differing scope interpretations among children from different language backgrounds, our focus will be on investigating the distinctive scope interpretation preferences between Chinese- and Russian-speaking children learning L2 Korean and native Korean-speaking children.

Previous research on L2 quantifier scope interpretations has primarily focused on L2 learnability issues, specifically assessing whether L2 learners can attain target-like interpretations and overcome contrastive interpretations present in their L1 (Chung 2013; Ionin et al. 2014; Marsden 2009). These studies have consistently identified the effect of L2 proficiency, with higher proficiency L2 learners more likely to adopt target-like interpretation. For example, Chung (2013) examined whether adult Korean learners of L2 English could achieve the partitioned-set interpretation in English sentences featuring negation and quantified objects, despite their preference for the full-set interpretation in their L1 Korean. She found that high-proficiency L2 learners showed the partitioned-set interpretation, patterning with native English speakers, thus overcoming the contrastive L1 interpretation bias.

Despite the evidence that adult L2 learners advance toward target-like quantifier scope interpretations as their proficiency improves, it is less clear whether and how other potentially influential factors, such as lexical retrieval ability, L2 proficiency, and working memory capacity, interact

with L2 quantifier scope interpretations. Moreover, few studies have explored the impacts of these factors on quantifier scope resolution in the context of child L2 acquisition. To address these gaps, this study conducted a truth-value judgment task with child L2 learners and investigated how their lexical retrieval speed, L2 proficiency, and working memory influenced their L2 resolution patterns.

3. Methods

3.1. Participants

The study involved 34 intermediate-to-advanced child L2 learners of Korean (L2 group) and 34 child native speakers of Korean (L1 group). The L2 group consisted of 23 L1-Chinese and 11 L1 Russian-speaking children (mean age = 12, $SD = 0.8$) from immigrant families in Korea. The Chinese speakers were born and raised in mainland China and spoke Mandarin Chinese as their native language. The Russian-speaking children immigrated from Russia or nearby countries, and all spoke Russian as their native language. According to their parents' report, the L2 children had almost exclusively spoken their native language at least during the first four to five years of their life, with only minimal exposure to simple English words through media. They had their first exposure to Korean when they came to Korea with their parents at the mean age of 7-8, thus considered as early L2 learners of Korean. Given that the primary focus of this study did not include the children's L1s, and more crucially, both language groups exhibited identical preferences for both full-set

and partitioned-set interpretations in their native languages, as observed in our preliminary study and previous research (Zhou and Crain 2009), we merged the two language groups into a single L2 group when analyzing their interpretation patterns in L2 Korean.

The children in the L2 group had stayed in Korea for an average of 3.6 years ($SD = 1.0$). They were recruited from a public school in Korea at the time of data collection. In accordance with the school's system, they were integrated into regular classes alongside their Korean-speaking peers after completing a year-long intensive Korean language course provided by the school which involved two hours of instruction in the Korean language each day. According to the students' teacher at the school, they demonstrated fluency in Korean and had little difficulties in listening, speaking, reading, and writing in L2 Korean after completing the intensive language course. When we measured the L2 participants' Korean proficiency through an independent picture-narration task, their scores ranged from high-intermediate to advanced levels (see the result section below for more information). The native Korean children, who served as a control group, were recruited from the same school.

3.2. Materials and Procedure

Participants were individually tested in a quiet room. The L2 participants completed four tasks in the following order: (a) Korean picture-narration task, (b) HALA task in Korean, (c) operation span task, and (d) Truth-value judgment task. The L1 group completed only the Korean truth-value judgment task. We first introduce the truth-value judgment task as it constitutes the main task of the study.

Main task: truth-value judgment task

To assess the participants' interpretive preferences for quantifier scope, this study employed a truth-value judgment task (TVJT) (Jo 2020; Jo, Kim, and Kim 2021). This task consisted of six items, each of which included a short story, a target sentence, and a corresponding visual image (see Figure 1). The stories and target sentences were all presented in Korean. Each target sentence was paired with a story and a visual image designed to support either a full-set interpretation (full-set condition) or a partitioned-set interpretation (partitioned-set condition). The two conditions were counterbalanced across items in a Latin Square design so that each participant encountered only one condition of each item. The experimental items were interleaved with four distractor items. The distractor items were identical to the experimental items in their overall format but did not feature quantifier scope distinctions in the target sentence.

Prior to the task, participants received both oral and written instruc-

Today, Tom made up his mind to clean six windows and cut down three trees. Tom cleaned the six windows right away. Next, Tom tried to cut down the first tree, but it was too tall to cut down. Then, Tom tried to cut down the next tree, but it was also too tall to cut down. After that, Tom tried to cut down the third tree. Again, it was too tall to cut down, so he decided not to do it.



Today, Tom made up his mind to clean six windows and cut down three trees. Tom cleaned the six windows right away. Next, Tom cut down the first tree, and it was very easy. Then, Tom cut down the second tree. It was a bit harder, but it was still fine. After that, Tom tried to cut down the third tree. It was too tall to cut down, so he decided not to do it.



[Figure 1] Sample items in the TVJT translated in English: Full-set condition (left) and partitioned-set condition (right)

tions and worked through four practice items. During the task, participants were asked to read the story and judge whether the following target sentence corresponded to the provided visual image. They responded to each question by circling either “yes” or “no” on a task sheet.

Measuring proficiency: picture narration task

To measure L2 participants’ Korean proficiency, we adopted a picture-narration task (Kim and Schwartz 2022; Song and Schwartz 2009). This task comprised three sets of images, each depicting a sequence of daily events involving a character (e.g., washing, eating, reading, sleeping, etc.). Within each set, four serial pictures illustrated the event in chronological order. Participants were instructed to view these images displayed on a computer screen and provide oral descriptions of the events in Korean. During the task, participants received no feedback on their descriptions. Their responses were audio-recorded and then transcribed by the researchers. Following Song and Schwartz, we analyzed participants’ utterances in terms of syntactic complexity and accuracy. The syntactic complexity score was calculated by dividing the total number of words by the total number of T-units in the utterances. The accuracy score was determined by calculating the rate of error-free T-units out of all T-units produced by each child. Once the syntactic complexity and accuracy scores were computed for each participant, they were converted into z-scores and then averaged to derive a combined proficiency measure (Song and Schwartz 2009).

Measuring lexical retrieval speed: HALA task

To evaluate individuals’ ability to retrieve lexical information in L2 Korean words, we employed the HALA task (O’Grady et al. 2009), a real-time

picture naming task. Originally developed to gauge a bilingual's language dominance, the task measures the speed of lexical retrieval in one language over the other. The underlying idea of the HALA task is that the latency of retrieving target words can serve as an indicator of the level of activation for these words in bilingual mental lexicon. Aligning with the central tenet of the Weaker Links Hypothesis (Gollan et al. 2008, 2011), the task assumes that slower retrieval of target words reflects a bilingual's limited ability to establish associations between word forms and their meanings. Therefore, we assessed the participants' speed in activating L2 words via the HALA task and explored its role in L2 quantifier scope interpretation to determine if lexical retrieval predicts their ability to resolve sentences with quantifier scope during L2 sentence interpretation, as seen in a study linking the results of the HALA task and L2 sentence comprehension (Coşkun Kunduz and Montrul, 2022).

The HALA task comprised 31 items that contained pictures describing various human body parts (see Table 1). Prior to the main task, participants completed a practice session involving six practice items. In the beginning of each trial, a picture depicting a specific body part was displayed on a computer screen accompanied by a beep sound. The image remained visible for 4000 milliseconds (ms) for higher-frequency words and 4500 ms for lower-frequency words (Kang 2011; Kim and Kim 2022). Within this time frame, participants were prompted to verbally name the body part highlighted in a red circle within the image, using Korean. Participants' responses were audio-recorded and analyzed for both accuracy and retrieval speed. Incorrect responses, constituting 10.9% of the entire data, were excluded from further analyses. Naming speed for each item was determined by measuring the elapsed time in ms from the onset of the

[Table 1] Items used in the HALA task (translated in English)

ankle, arm, back, cheek, chin, ear, elbow, eye, eyebrow, face, fingers, fingernail, foot, forehead, hand, head, heel, knee, leg, lips, mouth, neck, nose, palm, shoulder, stomach, teeth, thumb, toe, tongue, wrist

image to the onset of the participant's verbal response.

Measuring working memory capacity: Operation span task

Participants' working memory capacity was measured using a nonverbal operation span task. We chose this task among various types of working memory measures since this task taps into the domain-general executive control component of working memory, thus mitigating potential confounding effects specific to language skills (Linck et al. 2014). The task was run using PEBL, a computer-based psychology experiment software (Mueller and Piper 2014).

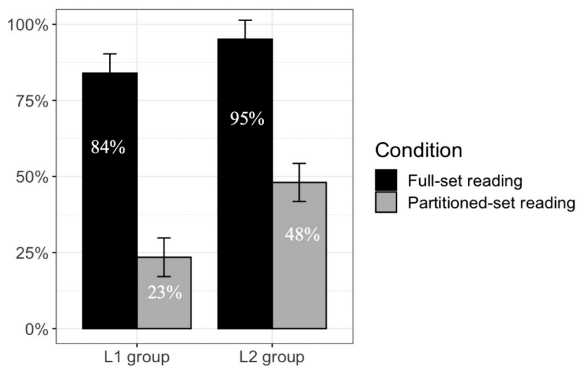
A total of 42 items were presented in varying numbers of sets (2, 3, 4, and 5 sets). The set size indicated the number of items, and the presentation of these sets was randomized for each participant. In each item, participants were presented with a simple arithmetic equation (e.g., $3 + 8 - 2 = ?$) on the screen and asked to verify the correctness of the following answer (e.g., 9) by clicking either "true" or "false". Subsequently, an alphabet letter was displayed on the screen, prompting participants to remember and recall it at the end of each set. The software recorded participants' accuracy in verification, the number of correctly recalled alphabet letters, and the reaction time for recall. To derive a composite operation span score for each participant, the z-scores of these measures were averaged (Leeser and Sunderman 2016).

4. Results

4.1. Results of the TVJT

We compared the interpretive patterns between the L1 Korean speakers and the L2 Korean learners. Given the identical interpretive patterns observed among Chinese and Russian language groups, and to enhance the statistical power of our analysis, we combined these two groups into a single L2 group for the evaluation of TVJT data. The results of both the L1 and L2 groups are presented in Figure 2. In the case of the L1 group, the acceptance rate was higher for the full-set interpretation than for the partitioned-set interpretation. Similarly, the L2 group showed greater acceptance rates for the full-set interpretation compared to the partitioned-set interpretation, albeit with a smaller difference between the two conditions when compared to the results of the L1 group.

Participants' interpretation patterns were analyzed in detail using a logistic mixed-effects model. The model included group (L1, L2), condition



[Figure 2] Proportion of YES responses in each condition in the TVJT; error bars denote 95% confidence intervals.

(full-set, partitioned-set), and their interactions as the fixed effects (centered using deviation coding with L2 and full-set conditions coded as $-.5$), along with the random effects of participant and item. The maximal random effects structure was simplified in a stepwise manner by comparing the models using a likelihood ratio test. The modeling was conducted in R version 3.6.3 (R Core Team 2020).

The results of the model are summarized in Table 2. The model showed robust effects of both group and condition without their significant interaction. The main effect of group indicated that the L2 group was more likely than the L1 group to accept the target sentences. Furthermore, the main effect of condition without its interaction with group suggests that both the L1 and L2 groups demonstrated a higher propensity to accept the full-set reading compared to the partitioned-set reading condition. The two groups' convergent interpretive patterns were further supported by follow-up analyses that focused on each group. There was a main effect of condition both in the L1 ($\beta = -3.670, SE = 0.897, p < .001$) and the L2 group ($\beta = -4.385, SE = 1.087, p < .001$) in the same direction. These results suggest that the L2 group exhibited target-like interpretations of the L2 Korean sentences.

[Table 2] Model summary of outputs in the TVJT

	β	SE	z	p
(Intercept)	1.159	0.445	2.605	.009**
Group	-1.679	0.547	-3.070	.002**
Condition	-4.104	0.860	-4.770	< .001***
Group Condition	0.003	0.776	0.004	.997

***: $p < .001$, **: $p < .01$

However, caution needs to be raised in interpreting these results as indicative of individual performance. Although the L2 participants as a group exhibited target-like interpretations in the TVJT, there may exist some individual variability among them, contingent upon factors such as one's L2 proficiency, lexical retrieval ability, or working memory capacity. To address this point, we investigated how the performance of L2 participants in the TVJT interacted with scores from the picture narration task, the HALA task, and the operation span task.

4.2. Effects of L2 Proficiency, Lexical Retrieval, and Working Memory Capacity

Table 3 presents the summary of the L2 participants' scores from each task.

When we compared the Chinese- and Russian-speaking groups in the picture narration task, the Chinese-speaking children had slightly higher scores than the Russian-speaking children ($t(32) = 1.965, p = .058$, Cohen's $d = 0.237$). This suggests that the Chinese speakers exhibited a somewhat higher level of proficiency in Korean compared to the Russian speakers. In the HALA task, which measured the L2 lexical retrieval speed, the Chinese speakers outperformed the Russian speakers ($t(32) = -3.065, p = .004$, Cohen's $d = 4.337$), indicating that the Chinese group was faster in retrieving the

[Table 3] Scores on the picture narration, HALA, and operation span tasks

Task	Mean	SD	Range
Picture narration	18.8	3.1	14.1 - 24.9
HALA (ms)	1347.1	306.6	1016.0 - 2252.0
Operation span	0.24	0.60	-1.01 - 1.21

target Korean words. The two group's scores on the operation span task were not significantly different ($t(32) = 0.541, p = .592$, Cohen's $d = 0.327$), suggesting the comparable working memory capacity between the two groups.

Pearson correlation tests showed that the children's reaction times in the HALA task moderately correlated with their L2 proficiency ($r = -.55, p < .001$) and with their working memory capacity ($r = -.32, p < .001$). In addition, there was a moderate correlation between L2 proficiency and working memory capacity ($r = .42, p < .001$).

To explore the potential impact of each score on the L2 participants' performance in the TVJT, we entered each measure as a continuous variable into a model that focused on the L2 participants. Each model involved the fixed effects of condition (centered using deviation coding with the full-set condition assigned to $-.5$) and scores from each measure (centered around the mean), and the random effects of participant and item. A maximal random effects structure was initially generated by adding a by-participant slope for condition and a by-item slope for each measure. The model was then simplified using stepwise likelihood ratio tests.

The model including the proficiency scores from the picture narration task showed a main effect of condition ($\beta = -4.011, SE = 1.241, p = .001$), but no main effect of proficiency ($\beta = 0.236, SE = 0.136, p = .082$) and no interaction between condition and proficiency ($\beta = -0.181, SE = 0.235, p = .442$). The lack of interaction between these two factors indicates that L2 proficiency did not affect the participants' interpretation patterns in the TVJT. Similarly, the model including the operation span task scores showed only the main effect of condition ($\beta = -3.763, SE = 1.187, p = .002$), without a main effect of working memory ($\beta = -0.407, SE = 0.655, p = .535$)

or an interaction between the two factors ($\beta = 0.108, SE = 1.050, p = .918$). In sum, the L2 participants' preference for the full-set reading remained consistent, regardless of their L2 proficiency or working memory capacity.

In contrast, the model involving the reaction times from the HALA task yielded distinct outcomes. It revealed a significant effect of condition ($\beta = -5.638, SE = 1.503, p < .001$) and no main effect of the reaction times from the HALA task ($\beta = -2.890, SE = 2.375, p = .224$). Crucially, we found a significant interaction between the two factors ($\beta = 9.336, SE = 3.701, p = .012$). This interaction was driven by a trend where longer reaction times in HALA task were associated with decreased acceptance rates for the full-set condition and increased acceptance rates for the partitioned-set condition, resulting in a narrower gap in acceptance rates between the two conditions. Considering that the acceptance rates between the two conditions differed to the greater extent in the L1 than the L2 group, these results suggest that the learners were less likely to exhibit native-like interpretations as they were slower in retrieving the L2 Korean words in the HALA task.

5. Discussion and Conclusion

The primary goal of this study was to investigate whether lexical retrieval speed, L2 proficiency, and working memory played a role in affecting child L2 learners' sentence comprehension in Korean. To this end, we administered a truth-value judgment task (TVJT) to Chinese- and Russian-speaking children who were learning Korean as an L2. We found that while bilingual children as a group displayed native-like interpretations,

their resolution patterns were significantly affected by their lexical retrieval efficiency. Specifically, the children were less likely to converge on native-like sentence resolution as they spent longer times retrieving L2 Korean words. In contrast, the children's L2 proficiency and working memory capacity did not exhibit any significant impact on their sentence interpretation patterns.

Our findings suggest that the bilinguals were successful in adopting target-like strategies during L2 sentence interpretation. In the TVJT, their interpretations showed a strong bias towards the full-set reading over the partitioned-set reading, a pattern that closely resembled the interpretations of the native speakers. These results are consistent with previous findings that adult L2 learners, particularly those at advanced levels, tend to employ target-like parsing strategies when interpreting quantifier scope in L2 English (e.g., Chung 2013; Kwak 2014; Lee 2010). It appears that language experience and proficiency play crucial roles in this process. The bilingual children in our study had been exposed to Korean in a naturalistic setting for a substantial period (3 to 4 years in average), which likely contributed to their ability to exhibit target-like performance in the TVJT. These results reflect a general language development pattern where L2 children advance toward converging with the target grammar when they receive consistent exposure to the target language, particularly in an immersive context (e.g., Paradis et al, 2017; Unsworth 2016).

The main question addressed in this study was whether individual factors, such as word retrieval speed, L2 proficiency, or working memory capacity, modulate L2 quantifier scope interpretations in bilingual children. Despite the bilingual children as a group demonstrating native-like performance, our findings revealed individual variations in their ability to

adopt target interpretive strategies, particularly contingent on their lexical retrieval speed. The finding that L2 learners who exhibited faster L2 word retrieval in the HALA task showed more native-like performance in the TVJT suggests a close association between the capacity to retrieve lexical information and L2 quantifier scope interpretations. As predicted by the Weaker Links Hypothesis (Gollan et al. 2008, 2011), enhanced lexical retrieval ability indicates the strengthening of associations between word forms and their meanings. This augmented association can, in turn, facilitate the retrieval and integration of lexical information for constructing an overall sentence meaning. Consistent with previous research that highlights a systematic connection between bilingual lexical access and sentence processing (Hopp 2018), our findings showed that efficient L2 lexical retrieval may have alleviated cognitive demands on our bilingual children, allowing them to allocate more memory resources to resolve quantifier scope in the L2.

In contrast, the relatively slower lexical retrieval in the L2 Korean may imply that lexical retrieval speed in the learners' L1s (Chinese and Russian) was comparatively faster (Kang 2011; O'Grady et al. 2009). Considering the stronger association between L1 word forms and meanings compared to the L2, it is plausible that bilingual children with slower L2 lexical retrieval may unconsciously activate L1 words and L1 sentence patterns during their comprehension of L2 Korean sentences, ultimately influencing their semantic integration. Given the distinct preference for both full-set and partitioned-set interpretations in Chinese and Russian, it can be speculated that the bilingual children in our study had greater difficulty inhibiting scope interpretation patterns in their L1s, leading to less native-like performance in L2 scope interpretation. Further research exploring

the relationship between word retrieval speed and L2 scope interpretations in a broad range of learners and learning contexts could provide deeper insights into the interplay between lexical access, L1 influence, and L2 sentence processing in bilingual populations.

Unlike the lexical retrieval speed, participants' L2 proficiency or working memory capacity did not interact with their sentence interpretation patterns in the TVJT. This outcome may seem surprising given the extensive evidence of the role of L2 proficiency and/or working memory in L2 sentence comprehension and processing (e.g., Chambers and Cooke 2009; Dussias et al. 2013; Dussias and Piñar 2010; Frenck-Mestre 2002; Hopp 2014). However, it should also be noted that the effects of L2 proficiency and working memory on L2 acquisition and processing remain controversial. Several studies report null effects of L2 proficiency (e.g., Dijkgraaf, Hartsuiker, and Duyck 2017; Kim 2018; Kim, Ko, and Yang 2020; see Van Hell and Tokowicz 2010 for review) or working memory capacity (e.g., Felser et al. 2003; Papadopoulou and Clahsen 2003) on L2 processing. These studies suggest that L2 learners show a consistent processing pattern irrespective of their L2 proficiency or working memory capacity. Aligning with this line of research, our bilingual children showed a more definite preference for assigning a full-set reading to the target Korean sentences, regardless of their L2 proficiency and working memory measures. Since the effects of L2 proficiency or working memory capacity on L2 processing may depend on several factors such as learner characteristics, task types, and the type of integrated information within a sentence (e.g., Mitsugi, 2020; Roberts 2012), it is difficult to identify primary sources that led to the outcomes in this study. One likely factor that might have led to the null effects of proficiency and working memory may be a ceiling effect due to the children's high L2 proficiency. We may

speculate that the participants were proficient enough to display target-like interpretations (but not enough to be entirely free from the effect of lexical retrieval ability) so that the effects the L2 proficiency and working memory may not have been apparent in our study. Whether these factors modulate L2 quantifier scope interpretations for lower proficiency learners remains for further studies to pursue.

Collectively, the current finding suggests that a reduced lexical retrieval ability may prevent child bilinguals from fully adopting native-like interpretations. Since lexical retrieval constitutes a necessary preliminary process that precedes and sub-serves sentence comprehension (Hopp 2018), the challenges associated with lexical retrieval may have placed a cognitive burden on the learners, hindering their ability to effectively adopt the target-like interpretive strategies during the task. Specifically, the children with faster L2 lexical retrieval may have devoted more memory resources to building a syntactic representation employing L2 syntax, resulting in native-like interpretations. Conversely, the children with reduced L2 lexical retrieval, who could have resorted to L1 translation equivalents to get access to the meanings of L2 words (Kroll and Stewart 1994), may have experienced a greater difficulty building a syntactic representation, resulting in less native-like performance. Future studies will have to extend the scope of the hypothesis by testing it with child bilinguals from a broader range of L1 backgrounds as well as employing various testing methods including measures of real-time comprehension.

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초록

제2언어 한국어 아동 화자의 양화사 작용역 습득에 미치는 언어 처리 요인의 효과

김현우*

김기택**

조규희***

부정어와 양화사가 동시에 존재하는 문장은 해당 문장 성분이 각각의 작용역을 가짐에 따라 해석에서의 모호함을 유발할 수 있다. 또한 모국어가 다른 화자들은 부정어와 양화사가 포함된 문장의 작용역 해석에 있어 다양한 양상을 보이는 것으로 알려져 있다. 본 연구는 한국어를 제2언어로 학습하는 중국어 및 러시아어 아동 화자들의 한국어 문장 부정어, 양화사 작용역 해석 양상을 한국어 모국어 아동 화자와 비교하여 살펴보았다. 특히, 제2언어 어휘 인출 속도, 제2언어 능숙도, 작업기억용량과 같은 다양한 처리요인이 해당 작용역 해석에 미치는 영향을 탐구하였다. 작용역 해석 양상을 확인하기 위한 진위판단과업 결과, 제2언어 한국어 아동 화자의 작용역 해석 양상은 전반적으로 한국어 모국어 화자와 유사하였다. 그러나 제2언어 어휘 인출에 어려움을 겪는 아동의 해석 양상은 한국어 모국어 화자와 차이를 보였다. 한편, 제2언어 능숙도, 작업기억용량은 작용역 해석 양상에 영향을 미치지 않는 것으로 나타났다. 이와 같은 연구 결과는 제2언어 어휘 인출 능력이 작용역 습득과 관련된 제2언어 문장 해석에 중요한 역할을 할 수 있음을 시사한다. 나아가 제2언어 화자의 어휘 처리 능력이 제2언어 문

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장의 해석에 영향을 미칠 수 있다는 가설을 뒷받침한다.

주제어 작용역 해석, 제2언어 습득, 어휘 인출, 제2언어 능숙도, 작업기억
용량

