The Acquisition of Declarative and Procedural Knowledge on Korean Causative Constructions by Chinese Learners of Korean

Sun Hee Park
(sunheepark@ewha.ac.kr)
Ewha Womans University, South Korea

Hyunwoo Kim
(hyunwoo2@hawaii.edu)
University of Hawai'i, USA

Abstract

This study investigated whether Chinese-speaking L2 learners of Korean can acquire Korean causative constructions (i.e. morphological and analytic causatives) and make use of the relevant knowledge in real-time sentence comprehension. Korean morphological causatives allow the causee to be marked by an accusative case, but not by a nominative case. In contrast, Korean analytic causatives allow both accusative and nominative case marking for a causee. In an acceptability judgment task, L2 learners as a whole group (n = 60) failed to reject morphological causative sentences when the causee was marked by a nominative case. However, a subset of L2 learners (n = 28) showed target-like performance, rejecting the infelicitous morphological causatives that involved a nominative-marked causee. In a self-paced reading task, the same subset of L2 learners did not show sensitivity to the infelicitous morphological causatives with a nominative-marked causee, indicating their limitations in applying the knowledge to real-time language processing. We discuss these findings from the perspectives of L2 learners' declarative and procedural knowledge of the Korean causative constructions and provide suggestions to teach the target constructions.

1 Introduction

One major issue in second language (L2) learning and teaching is how L2 learners can acquire declarative and procedural knowledge associated with certain structures in a target language (Ullman, 2005, 2015). Declarative knowledge involves grammatical representations of target structures that are stored in learner's long-term memory, while procedural knowledge is more concerned about automatized, implicit knowledge that is necessary for processing explicit knowledge for real-time language use (Sorace, 1985; Ullman, 2005; for a review, see Paradis, 2009). Researchers claim that the L2 grammar largely consists of explicit, declarative knowledge, and the acquisition of procedural knowledge is extremely challenging for L2 learners (e.g. Clahsen & Felsor, 2006; Ellis, 2005; Jiang, 2007; Ullman, 2001).

The present paper aims to add to the growing body of literature regarding L2 acquisition of declarative and procedural knowledge by investigating how adult Chinese speakers acquire causative

constructions in Korean and utilize relevant linguistic knowledge in real-time sentence comprehension. As will be reviewed in the next section, the Korean causative constructions can cause learning problems for Chinese-speaking learners in several aspects. First of all, the linguistic features of the target structures in Korean are substantially different from those of their Chinese counterparts, making it impossible for learners to derive the relevant knowledge from their L1. In addition, Chinese learners of Korean should newly acquire restrictions of case markings for Korean causative constructions due to absence of a case marking system in their L1. Korean case particles are widely attested to be a major source of learning difficulties, especially for learners from a null case-marking background such as Chinese and English speakers (e.g. Brown & Iwasaki, 2013; Park & Kim, 2017). Therefore, it is conceivable for Chinese speakers to experience great difficulty in learning how to integrate case marking information with individual types of causative constructions in Korean. To further complicate this problem, the information of the target constructions is not fully accessible from instruction or input. Despite the potential difficulties with causative constructions, Korean language classrooms have paid little attention to teaching syntactic and semantic restrictions underlying the causative constructions in Korean (Park, 2017b). Chinese learners of Korean also have difficulties in obtaining sufficient information of the target structures because certain types of causative sentences in Korean are very rare in the input.

Given such difficulties expected for Chinese speakers learning Korean causative constructions, we seek to provide a detailed picture of whether Chinese speakers can acquire the declarative and procedural knowledge of Korean causatives and suggest ways to help learners overcome their difficulties with acquiring the target structure. This paper also addresses some gaps found in previous studies on Korean causatives. Although a few studies have investigated L2 speakers' production and understanding of Korean causative sentences (e.g. Lin, 2015; Zhou, 2014) and examined L2 learners' grammaticality judgment on the target sentences (Park, 2017a, 2017b), very little has been done to explore the L2 acquisition and processing of the target structures, particularly in association with declarative and procedural knowledge (e.g. Ellis, 2005; Jiang, 2007; Ullman, 2005, 2015).

In this paper, we report the results of two experiments – acceptability judgment and self-paced reading tasks – conducted with advanced Chinese-Korean bilinguals. An acceptability judgment task probed learners' declarative knowledge of Korean causative constructions, and a self-paced reading task tested learners' procedural knowledge, that is, whether learners can make use of their declarative knowledge of target structures in real-time sentence processing. We expect the findings and conclusions drawn from these experiments to provide a better understanding of how L2 learners acquire the two types of knowledge underlying Korean causative constructions as well as highlight the importance of teaching these sets of knowledge in Korean language classrooms.

2   Realization of causative constructions in Korean and Chinese

Causative constructions denote events of cause and effect by involving an agent causer resulting in a change of state of a patient causee (Comrie, 1989; Lemmens, 1998; Payne, 1997; Shibatani & Pardeshi, 2002). Causation can be expressed by means of several linguistic devices that establish a causative relationship between the cause and the effect in distinct ways. Consider (1), for example.

(1)   a. Tom made Mary die.
       b. Tom killed Mary.

Both sentences in (1) involve causative situations where the causer *Tom* manipulates the causee *Mary*, but the specific manner in which causation is delivered differs in the two sentences. In (1a), the cause-and-effect event is depicted using two separate predicates: The cause event is denoted by the verb *make*, and the effect is expressed by the verb *die*. Since this causative type allows each event of cause and effect to be conveyed by separate clauses, it is called the syntactic or analytic causative construction (Comrie, 1989). In (1b), in contrast, the relation between the cause and effect events is encoded in the single lexical verb *kill* without any additional operator. This construction is referred to as a lexical causative (Comrie, 1989).

Korean and Chinese have analytic and lexical causatives like (1). However, unlike English and Chinese, Korean has the morphological causative construction where causative information is delivered through a morphological affix attached to a non-causative predicate[1] (O'Grady, 1991; Park, 1994; Shibatani & Pardeshi, 2002; Sohn, 1999), as in (2).

(2) Peter-ka   mul-ul   el-li-ess-ta.
     Peter-NOM   water-ACC freeze-CAUS-PAST-DECL[2]
     'Peter froze the water.'

In the example above, the intransitive verb *el* (intransitive 'freeze') is followed by the causative morpheme *-li*, constituting a causative predicate *el-li* (transitive 'freeze'). In Korean, three types of suffixes function as morphological causative markers: the *i*-type suffixes (*-i*, *-ki*, *-li*, *-hi*), the *wu*-type suffixes (*-wu*, *-kwu*, *-chwu*), and the combination of the *i*-type and *wu*-type suffixes (*-i-wu*) (Kim, 1984; Park, 1994). The specific type of causative morphemes is contingent on the morphophonemic characteristics of the final sound of the non-causative predicate to which the causative morpheme attaches (Kim, 1984).

One noteworthy restriction underlying the realization of Korean morphological causatives is that a morphological causative predicate allows an accusative case, but not a nominative case, to license a causee (e.g. *mul-ul*, 'water-ACC'). This restriction is rooted in the morphological causative being syntactically mono-clausal, with the verb taking two arguments of causer and causee as the grammatical subject and object in the same clause. As will be reviewed below, this case marking restriction imposed on Korean morphological causatives contrasts with the relatively wider range of case markers allowed for a causee in Korean analytic causatives.

The restriction of Korean morphological causatives is predicted to pose learning difficulties for Chinese speakers. First, the Chinese language does not instantiate a morphological causative, requiring Chinese-speaking learners to newly acquire the syntactic form of the target construction, the realization of various types of causative morphemes that correspond to individual verbs, and the restriction of the case marking for arguments, all without recourse to their L1 knowledge. Moreover, Korean morphological causatives are lexically restricted to a limited number of verbs of Korean origin (Park, 1994), and in modern Korean, more cases of causatives are expressed using analytic instead of morphological causatives (Choe, 2014; Park, 1994), which presents even greater difficulty for learners since they cannot easily derive information of the target construction from Korean input.

Another cross-linguistic difference between Korean and Chinese causatives that can potentially cause learning problems is the realization of analytic causatives. In Korean, the analytic causative is constructed using a combination of two verbs, a matrix verb *ha-* ('do') that denotes causation and an embedded verb that expresses the caused event. The two verbs are linked by the resultative complementizer *–key* (O'Grady, 1991; Park, 1994; Sohn, 1999). Notably, the causee in Korean analytic causatives can be marked using three types of case markers: nominative, accusative and dative (O'Grady, 1991; Park, 1994), as shown in (3).

(3) John-i   Mary-ka/lul/ekey   cepsi-lul   ssis-key-ha-yss-ta.
     John-NOM   Mary-NOM/ACC/DAT   dish-ACC   wash-COMP-do-PAST-DECL
     'John made Mary wash the dishes.'

Depending on the status of the case marking for a causee, the syntactic structure of Korean analytic causatives is analyzed in different ways. The nominative marker for a causee in analytic causatives clearly shows that cause and effect events belong to separate clauses. In (3), the matrix verb *-ha* ('do') takes the causer *John* in the subject position and denotes the cause event while the embedded verb *ssis-*('wash') takes the causee *Mary* as the subject in the subordinate clause. In contrast, a bi-clausal analysis of the analytic causatives becomes less clear when the causee is marked by a dative or an accusative case. For this reason, an analytic causative sentence with a causee modified by a dative or accusative case is sometimes analyzed as a periphrastic or mono-clausal instead of a bi-clausal construction (Gerdts & Youn, 1990; O'Grady, 1991).

In Chinese, on the other hand, the analytic causative construction only allows a causee as the grammatical object of a verb, as in (4).

(4) John   rang   Mary   xi   -le   panzi.
     John   make   Mary   wash PAST   dishes
     'John made Mary wash the dishes.'

If Chinese speakers rely entirely on their knowledge of L1 when they learn the Korean analytic causative construction, we can envisage their selective acceptance of the target construction depending on the type of case markers for the causee. They will accept analytic causatives when the causee is modified by an accusative marker similar to their Chinese counterpart. However, they will reject causative sentences when the causee is marked by a nominative or a dative marker. Purported learner difficulties arising from these different aspects between Chinese and Korean analytic causatives are well-supported by Tokowicz & Macwhinney (2005), who provided EPR evidence that L2 learners experienced greater processing difficulties when the target structure was different from the learners' L1 counterpart than when the target structure was unique to L2.

Taken together, Chinese lacks morphological causatives and allows analytic causatives only when the causee is licensed by an accusative case, whereas Korean has morphological causatives and allows a causee of an analytic causative to be marked not only by an accusative but also by a dative or a nominative case, as summarized in Table 1. These cross-linguistic differences, along with the infrequency of morphological causatives in the Korean input and a lack of explicit instruction on the causative constructions in Korean classroom, may lead to a major problem for Chinese speakers to acquire these constructions. In the two experiments reported below, we explored whether Chinese speakers can learn both declarative and procedural knowledge associated with the Korean causative constructions. Before we present our results, we review previous studies on L2 acquisition of the Korean causative constructions.

Table 1. Cross-linguistic differences between Korean and Chinese causative constructions

Causative type	Case marker for a causee	Korean	Chinese
Morphological causative	Nominative	unacceptable	nonexistent
	Accusative	acceptable	nonexistent
Analytic causative	Nominative	acceptable	unacceptable
	Accusative	acceptable	acceptable

3 The role of declarative and procedural knowledge in the acquisition of Korean causative constructions

In the literature of L2 acquisition, two types of knowledge have received a broad attention – declarative and procedural knowledge (Ullman, 2005, 2015). Researchers have made clear distinctions between the two types of knowledge as each knowledge type taps into different systems of language learning and processing mechanisms. Declarative knowledge builds on the stable, explicit representation system that subserves long-term memory storage. This type of knowledge system, often captured by offline tasks such as a untimed acceptability judgment task, is responsible for acquiring grammatical rules regarding target structures. However, it is not always the case that declarative knowledge is converted to procedural knowledge, a tacit and automatic knowledge system responsible for the computation of grammatical rules stored in learners' declarative knowledge.

It is generally accepted that native speakers can utilize both declarative and procedural knowledge (Ullman, 2005), whereas there is no consensus on whether both types of knowledge are available for L2 learners. Several studies have shown that declarative knowledge of L2 grammatical rules can be easily learned by L2 learners, as indicated by their target-like performance in acceptability judgment tasks (e.g., DeKeyser, 2000, see Jiang, 2007, for a discussion). However, in online processing tasks such as the self-paced reading paradigm, which is assumed to be suitable for measuring procedural, implicit knowledge (Jiang, 2007), L2 learners often fail to converge on native speakers in their processing patterns (Clahsen & Felsor, 2006; Jiang, 2004, 2007). For example, in a self-paced reading study, Jiang (2007) found that Chinese ESL students showed no sensitivity to an agreement error in

a noun phrase (e.g. The visitor took several of the rare [coins/*coin] in the cabinet), which was significantly different from the processing pattern of native speakers who had increased reading times on the ungrammatical relative to the grammatical condition. Despite the fact that the English plural morpheme is taught at the early stages of language learning, the L2 learners' failure to deploy the knowledge for sentence processing led Jiang (2007) to the conclusion that L2 learners' explicit knowledge does not always proceed into automatic competence or procedural knowledge.

Still, other studies suggest evidence that L2 processing can become native-like, particularly when L2 proficiency is sufficiently high, indicating that procedural knowledge may be attainable in advanced L2 learners (e.g. Kim, 2018; Omaki & Schulz, 2011; Park & Kim, 2017; Witzel, Witzel, & Nicol, 2012). For instance, Park and Kim (2017) demonstrated that highly advanced Chinese learners of Korean can process Korean locative constructions as efficiently as native Korean speakers. In their self-paced reading study, L2 learners at lower and higher Korean proficiency levels were presented with sentences including Korean locative verbs that selectively license a certain locative configuration. Lower-level learners processed both felicitous and infelicitous locative configurations in the same speed, indicating their insensitivity to the locative violation, whereas higher-level learners and native speakers spent longer reading times in the locative structure unlicensed by a locative verb than in the legitimate locative structure. Their findings suggest that these highly advanced learners were able to automatize their explicit knowledge of Korean locative constructions and draw upon such procedural knowledge during real-time sentence processing.

While the issue of whether procedural knowledge can be acquirable in L2 learners remains unsolved, this question has not been fully addressed in the acquisition of Korean causative constructions. Several studies have investigated Chinese speaking L2 learners' acquisition of Korean causative constructions, but exclusively testing learners' declarative knowledge (e.g. Hua, 2018; Lin, 2015; Yan & Kim, 2014). These studies employ untimed written tasks, such as a sentence-completion task (Lin, 2015), a force-choice task based on Korean-Chinese translations (Hua, 2018), an acceptability judgment task (Hua, 2018), and an action-sound verification task (Yan & Kim, 2014). Since these offline tasks are far from measuring L2 learners' online processing behaviors (see Jiang, 2007), no definitive answer has been given to the question of L2 learners' acquisition of procedural knowledge regarding Korean causative construction. In the study reported below, we address this gap by investigating L2 learners' declarative and procedural knowledge of the target construction through an acceptability judgment and a self-paced reading task.

4   Research questions

This study investigates Chinese-Korean bilinguals' declarative and procedural knowledge underlying the Korean causative constructions. Our research focuses on whether advanced Chinese-Korean bilinguals can acquire the restrictions of case markers in morphological and analytic causatives in Korean and whether they show sensitivity to violations of such restrictions in real-time sentence processing. These points are reflected in the following research questions (RQs).

RQ1. Do advanced Chinese-Korean bilinguals have declarative knowledge of morphological and analytic causatives in Korean?

RQ2. Can they apply the relevant knowledge to real-time sentence comprehension?

To address these questions, we conducted an acceptability judgment and a self-paced reading task with adult Chinese speakers learning Korean. Explicit L2 knowledge of the target constructions was assessed through an acceptability judgment task in which the participants provided written judgment on Korean causative sentences in different case marking conditions for a causee. A self-paced reading task was run to investigate whether knowledge of the target constructions can be effectively put to use in online sentence comprehension. In what follows, we report the findings from each task and discuss potential implications drawn from these results on the acquisition of Korean causative constructions.

5   Experiment 1: Acceptability judgment task

5.1   Method

5.1.1   Participants

This study recruited 60 Chinese-Korean bilinguals (mean age of 23.7 years, range 19–28) and 28 native Korean speakers (mean age of 27.9 years, rang3 20–43) from the population of undergraduate and graduate students at a college in South Korea in the year 2017. The learner population included participants with high proficiency levels, as indicated by their scores on the Test of Proficiency in Korean (TOPIK), which ranged within the top two tiers defined by the test developers as having language skills necessary to conduct research and work in professional areas. According to the results of a language background questionnaire, the average length that the learners studied Korean is 2.5 years, and their age of onset of learning the language is around 18 years (ranging from 16 to 26 years), suggesting that the learners started learning Korean as a second language at adulthood. This ensures that any evidence of their acquisition of the target constructions in our experiments should not be ascribed to the age effect. Child L2 acquisition is often assumed to involve different learning mechanisms from adult L2 acquisition, and learners who started learning a target language since childhood may end up with a better attainment of target grammar compared to late L2 learners. In this regard, our inclusion of L2 learners who were exposed to Korean after childhood enables us to effectively avoid any potential confounding effect resulting from the age of onset. All participants received the Korean equivalent of $10 for their participation. They completed all tasks (untimed acceptability judgment task, self-paced reading task, language background questionnaire) in a single visit to the lab. Table 2 presents detailed information of the participants.

Table 2. Participant information of native Korean speaker (L1) and Chinese-speaking learner (L2) groups

Group	Age	Length of stay in Korea (years)	Length of studying Korean (years)	Self-reported Korean proficiency (1-10)
L1 group	27.9 (5.65)	-	-	8.7 (1.35)
L2 group	23.7 (2.41)	1.8 (1.35)	2.5 (1.62)	7.3 (1.02)

Note. The values in the parentheses indicate standard deviations

5.1.2   Materials

The materials for the untimed acceptability judgment task included 24 sets of Korean causative sentences. As illustrated in (5), each set contained four causative sentences that differed in causative type (i.e., morphological or analytic causatives) and type of case marker attached to the causee (i.e. accusative or nominative), yielding two types of morphological causatives with the accusative-marked (5a) and nominative-marked causee (5b) and two types of analytic causatives containing the accusative-marked (5c) and nominative-marked causee (5d).

(5) a. Halmeni-ka   ai-**lul**   phyenci-lul   **ilk-hy-esse-yo**.
       grandmother-NOM   child-ACC   letter-ACC   read-CAUS-PAST-DECL
       'The grandmother made the child read the letter.'
     b. *Halmeni-ka   ai-**ka**   phyenci-lul   **ilk-hy-esse-yo**.
        grandmother-NOM   child-NOM   letter-ACC   read-CAUS-PAST-DECL
     c. Halmeni-ka   ai-**lul**   phyenci-lul   **ilk-key-hay-sse-yo**.
        grandmother-NOM   child-ACC   letter-ACC   read-COMP-do-PAST-DECL
     d. Halmeni-ka   ai-**ka**   phyenci-lul   **ilk-key-hay-sse-yo**.
        grandmother-NOM   child-NOM   letter-ACC   read-COMP-do-PAST-DECL

The experimental items were counterbalanced in a 2 × 2 Latin square design that crossed causative type (morphological vs. analytic) with case marking manipulation for a causee (accusative *-ul/-lul* vs. nominative *-i/-ka*). This design resulted in four lists, and each participant was assigned to one list and saw only one version of an item in each experimental set.

Twenty-four experimental items in each list were intermixed with 48 fillers consisting of different types of locative constructions and *that*-clause sentences. The order of the items was pseudo-random-ized so that no more than one experimental item appeared in a row. Half of the fillers were grammat-ical, and half were ungrammatical. The ungrammatical sentences in the fillers were constructed by pairing locative arguments with incorrect case markers in locative constructions and attaching an honorific marker for an inanimate NP for *that*-clause sentences.

For the experimental and filler items, all words were retrieved from vocabulary lists for beginner and intermediate Korean learners provided by the International Standard Curriculum of Korean Lan-guage (Kim et al., 2011) to ensure the learners' familiarity with lexical items.

5.1.3   Procedure

The acceptability judgment task was conducted using a web-based questionnaire provided in Google Forms. Prior to the main experiment, each participant completed a language background ques-tionnaire. Then, they read instructions for the task and worked through two practice items. In the main task, the participants were prompted to read each sentence appearing on the computer screen, with a single item per each page, and to provide their acceptability judgment of the item on a Likert scale from 1 (quite unnatural) to 4 (quite natural). When they could not determine their judgment on an item, they were directed to click a checkbox labelled "I am not sure" provided along with the four scale options. During the task, the participants were not allowed to move back to the previous items and/or change their judgment. The overall task took approximately 20–30 minutes.

5.1.4   Data analysis

For the participants' responses to the experimental items, we screened for the choice of "I am not sure". This option was selected two times in the native speaker group (0.3% of the entire data) and 20 times in the L2 group (1.4% of the entire data). The data from these responses was eliminated from the analysis.

For the remaining data, we compared L1 and L2 groups in their judgment rates of the experimental items across the four conditions. For statistical analyses, we converted the acceptance rates into z-scores to meet the requirements of a normal distribution of the data (e.g. Sprouse, Caponigro, & Greco, 2016). The converted data were then analyzed using a linear mixed-effects regression model (Baayen, Davidson, & Bates, 2008; Barr, Levy, Scheepers, & Tily, 2013) run on the program *lmer* in the R package *lme4* (R Core Team, 2015). We opted for this statistical method instead of traditional statistical analyses such as t-tests or ANOVAs because, compared to these conventional methods, a mixed effects model allows for a better statistical power when there are any missing data (Baayen et al., 2008) and considers both the effects of experimental manipulations and individual variability as-sociated with the participants and items (Kliegl, Wei, Dambacher, Yan, & Zhou, 2011). In the linear mixed-effects model, we added group (L1, L2), causative type (morphological, analytic) and case markings for the causee (accusative, nominative) as fixed effects, and participants and items as ran-dom effects. The model also included the maximal random effects structure allowed by the design, with random intercepts and slopes for the participants and items (Barr et al., 2013). The fixed effects were contrast-coded and centered.

5.1.5   Predictions

As shown in (5) above, the morphological causative construction is compatible only with the accusative-marked causee (5a) but not with the nominative-marked causee (5b), whereas the analytic causative construction allows the causee to be marked with either an accusative (5c) or nominative case (5d). A learner who acquired knowledge of Korean causative constructions is expected to reject sentences like (5b) while accepting sentences in the other conditions (5a, 5c, and 5d). This sensitivity will be signaled by the interaction between causative type and case marking with a significant difference between the two case marking conditions found only in morphological causative, not analytic causative sentences.

5.2   Results and discussion

Table 3 shows descriptive statistics of participants' rates on the experimental items in the acceptability judgment task. In general, the L1 participants were more likely to accept morphological causatives with an accusative-marked causee (ACC-marked) (mean acceptance rate of 2.2) than those with a nominative-marked causee (NOM-marked) (mean acceptance rate of 1.3). In the analytic causative conditions, the L1 group's acceptance rates for the ACC-marked (mean acceptance rate of 2.5) and NOM-marked conditions (mean acceptance rate of 2.7) seemed very comparable. A different tendency was observed in the performance of the L2 group, with their acceptance rates between ACC-marked and NOM-marked conditions identical for morphological causative sentences (mean acceptance rate of 2.3, respectively) as well as for analytic causative sentences (mean acceptance rate of 2.5, respectively).

Table 3. Mean acceptance rates (standard deviations) in acceptability judgment tasks

Group	Morphological causative		Analytic causative	
	ACC-marked	*NOM-marked	ACC-marked	NOM-marked
L1 group (n=28)	2.2 (1.03)	1.3 (0.53)	2.5 (1.01)	2.7 (1.10)
L2 group (n=60)	2.3 (1.00)	2.3 (0.99)	2.5 (0.96)	2.5 (1.02)

* = unacceptable

A detailed analysis was carried out using a linear mixed-effects model including group, causative type, and case markings as fixed effects, and participant and items as random effects. The model demonstrated a main effect for *causative type* ($ß = 0.52$, SE = 0.05, $p < .001$) with higher acceptance rates for analytic causatives compared to morphological ones. This tendency reflects the fact that morphological causatives are less frequent than analytic causatives in Korean. There was also a main effect of *case marking* ($ß = 0.18$, SE = 0.07, $p = .008$), which was driven by higher acceptance rates for ACC-marked than NOM-marked conditions. Critically, the main effects of *causative type* and *case marking* were qualified by an interaction between the two effects ($ß = 0.45$, SE = 0.10, $p < .001$), indicating that the acceptance rate difference between ACC- and NOM-marked conditions differed across the two causative types. Also, the effects of *causative type* and *case marking* and the interaction of the two interacted with the effect of *group*, suggesting that overall judgment patterns were different across groups. To unpack these interactions, we conducted a separate analysis for each language group, using a linear mixed-effects model with causative type and case marking as fixed effects and random intercepts and slopes for participants and items.

The model for the L1 group showed the main effects of *causative type* ($ß = 0.81$, SE = 0.08, $p < .001$) and *case marking* ($ß = 0.34$, SE = 0.14, $p = .019$), qualified by the interaction of the two effects ($ß = 0.92$, SE = 0.16, $p < .001$). The post-hoc analyses for each causative type showed that this group had significantly higher acceptance rates for ACC-marked than NOM-marked conditions in morphological causatives ($ß = 0.80$, SE = 0.15, $p < .001$), whereas the acceptance rates between ACC- and NOM-marked sentences in analytic causatives were not statistically different ($ß = -0.11$, SE = 0.16,

p = .490). These results indicate that these Korean speakers were less likely to accept morphological causatives with a nominative-marked causee compared to the other conditions.

On the other hand, the model for the L2 group only showed the main effect of *causative type* (ß = -0.24, SE = 0.05, p < .001), but there was no effect for *case marking* (ß = 0.02, SE = 0.07, p = .734) or any interaction of *causative type* and *case marking* (ß = -0.03, SE = 0.11, p = .796). In other words, this group had higher acceptance rates for the analytic rather than the morphological causatives, yet they failed to show sensitivity to the grammatical violation associated with the NOM-marked causee in morphological causatives.

We further inspected the effect of learners' Korean proficiency in their judgment of target sentences by including their TOPIK scores as an additional factor in the mixed-effects model. However, the proficiency effect did not interact with causative type or case marking (all ps > .1), suggesting that the observed judgment tendency of the L2 group was not correlated with their Korean proficiency.

Finally, among the 60 L2 learners, we identified 28 participants who provided higher rates for morphological causatives with an ACC-marked causee than morphological causatives with a NOM-marked causee. When we ran a mixed-effects model with this subset of L2 group, we found a significant interaction between *causative type* and *case marking* (ß = 0.48, SE = 0.13 p < .001). Similar to the results of the L1 group, this group had significantly higher acceptance rates for sentences with an ACC-marked causee (mean acceptance rate of 2.6) than a NOM-marked causee in morphological causatives (mean acceptance rate of 2.1) (ß = 0.57, SE = 0.09, p < .001), whereas the acceptance rates for analytic causatives were not statistically distinguished between the ACC-marked (mean acceptance rate of 2.6) and NOM-marked conditions (mean acceptance rate of 2.5) (ß = -0.07, SE = 0.15, p = .646). Figure 1 shows the results from the L1 group and the subset of the L2 group in the acceptability judgment task.

In summary, the results of the acceptability judgment task showed that the native speakers and a subset of the L2 learners (n = 28) had explicit knowledge of Korean causative constructions, as evidenced by their distinct acceptance rate depending on the causative type and the case marker type attached to the causee; they were less willing to accept morphological causatives with the nominative-marked causee compared to the other conditions. These findings suggest that at least this subset of L2 learners successfully attained native-like knowledge of causative constructions in Korean, indicating their acquisition of declarative knowledge of the target structures. In the following self-paced reading study, we tested whether the same learners could use such knowledge during real-time sentence processing.

MEAN ACCEPTANCE RATE	L1 (n = 28)	subset of L2 (n = 28)
Mor_ACC	2.2	2.6
Mor_NOM	1.3	2.1
Ana_ACC	2.5	2.6
Ana_NOM	2.6	2.5
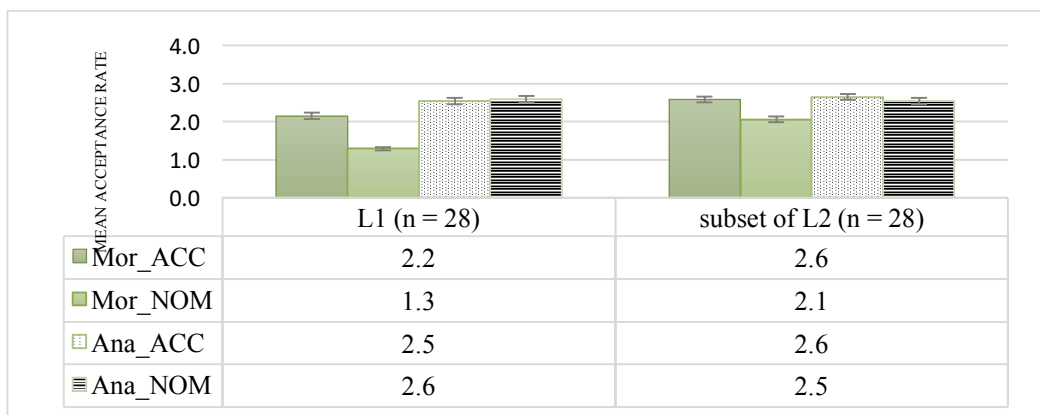
Note: Mor = Morphological causative; Ana = Analytic causative; ACC = Accusative-marked condition; NOM = Nominative-marked condition

Figure 1. Mean acceptance rates in the acceptability judgment task for the L1 group and a subset of the L2 group; error bars indicate 95% CIs.

6   Experiment 2: Self-paced reading task

6.1   Method

6.1.1   Participants

Twenty-eight native Korean speakers who completed the acceptability judgment task also participated in a self-paced reading task as a control group. For the L2 group, we selected 28 L2 learners (subset group) who were shown to have necessary linguistic knowledge of Korean causative constructions, as indicated by their performance in the acceptability judgment task. The remaining 32 learners (remaining group) were excluded in the analysis of the self-paced reading task. Table 4 presents participant information in the subset and the remaining groups.

Table 4. Participant information of the subset and the remaining group

Group	Age	Length of stay in Korea (years)	Length of studying Korean (years)	Self-reported Korean proficiency (1-10)
Subset group (n=28)	23.2 (2.57)	1.9 (1.43)	2.5 (1.77)	7.2 (0.91)
Remaining group (n=32)	24.2 (2.19)	1.8 (1.29)	2.5 (1.49)	7.3 (1.12)

Note. The values in the parentheses indicate standard deviations

6.1.2   Materials

Experimental stimuli for a self-paced reading task were constructed by modifying 24 experimental items used in the acceptability judgment task. As in the acceptability judgment task, we established a 2×2 Latin square design for the items, manipulating causative type (morphological, analytic) and case marking for a causee (accusative, nominative).

For each sentence, we added an additional clause, as in (6). This additional clause enables us to capture any delayed effects spilling over to the following regions due to a 'button-press' rhythm induced by a self-paced reading task (e.g. Omaki & Schulz, 2011). Depending on the content of the experimental sentence, the additional clause had two types of endings for the sentence-final region (region 8): *kipwun-i acwu cohasseyo / nappasseyo* ('I felt so good / bad').

(6) Halmeni-ka   ai-lul   phyenci-lul / -ka   ilk-hye / key-hay-se
     grandmother-NOM   child-ACC   letter-ACC / NOM   read-CAUS / COMP-do-and
        Region 1   2   3   4
     nan-un   kipwun-I   acwu   coha-sse-yo.
     I-TOP   feeling-NOM   very   be good-PAST-DECL
        5   6   7   8
     'The grandmother made the child read the letter, and so I felt so good.'

The experimental items were presented on a word-by-word basis, resulting in eight regions for each sentence. Among the regions, region 4 (i.e. verb-and) was analyzed as the critical region since this is the part where readers integrate the case marking information from nominal arguments with the verbal information and thus possibly detect an acceptability of the sentence. We also analyzed regions 5, 6 and 7 as spill-over regions.

In addition to the experimental sentences, 48 filler sentences were retrieved from the acceptability judgment task. For both experimental and filler sentences, a yes-no comprehension question was constructed to estimate participants' understanding of the critical sentence and to draw their attention to the content of the sentence.

6.1.3   Procedure

The self-paced reading task was conducted using a web-based interface with the ibex 0.3.9 software (Drummond, 2013). Experimental stimuli were presented on a computer screen in a non-cumulative manner (Just, Carpenter, & Woolley, 1982), such that each region in the sentence was revealed one word at a time. During the task, each press of the spacebar on the keyboard revealed a word, and the next key press revealed the next word replacing the previous word with dashes.

Prior to the main task, the participants were instructed on the task and asked to complete five practice trials. Then, they read the target sentences at their own pace, and their reading time for each region was automatically recorded with the ibex program. After each sentence, a comprehension question appeared, asking participants to answer it by pushing buttons on the keyboard designated for "yes" and "no". The entire task lasted approximately 20 minutes.

6.1.4   Data analysis

For the statistical analyses, the participants' reading time (RT) for each region was trimmed by replacing extreme values with the mean RTs by participant per condition (e.g. Pliatsikas & Marinis, 2013). Extreme RTs were defined as those below 100 milliseconds (ms) and above 5000 ms (0.1% in the L1 and 1.2% in the L2 data) and those beyond the range of two standard deviations from the mean (1.5% in the L1 and 1.2% in the L2 data).

As in the analysis of the data from the acceptability judgment task, we analyzed RT data using a linear mixed-effects regression model. Unlike in the acceptability judgment task, however, we built separate models for the morphological and analytic causative conditions to circumvent potential confounding effects resulting from the variability between the two causative types in terms of the length of the letters in the verbal region and the frequency of the causative predicates. For example, the predicates in the analytic causative construction usually involve a more number of letters than the morphological causative predicates, which may affect the reading times of these predicates. In addition, analytic causatives are more frequent than morphological causatives in the input, possibly leading to shorter reading times for the analytic causative than morphological causative sentences. Since we have no clear predictions regarding the consequences of these effects in participants' RT patterns, we inspected the reading time differences between the two case marking conditions for each causative type separately. As a result, two linear mixed-effects models were defined for each causative construction, and they included group (L1, L2) and case marking (ACC-marked, NOM-marked) as fixed factors and random effects for participant and item with random slopes and intercepts.

6.1.5   Predictions

The main regions of interest are the predicate (region 4) and the following three words as spill-over regions (regions 5, 6 and 7). Any sensitivity to the unacceptability of using a nominative case marker for a causee in morphological causative sentences will lead to increased RTs in the nominative-marked condition (NOM-marked) compared to the accusative-marked condition (ACC-marked) for morphological causatives in any of the critical or spill-over regions, yielding a significant effect of case marking. In contrast, no RT difference between the case marking conditions is expected for any of the regions for analytic causative sentences because this construction allows both accusative and nominative case markers for the causee.

6.2   Results and discussion

We first inspected the accuracy of each group on the comprehension questions. Both L1 and L2 groups demonstrated high accuracy rates in these questions (mean accuracy of 92% in the L1 and 83% in the L2 group), indicating that participants generally paid attention to the content of the target sentences during the task.

Tables 5 and 6 show descriptive statistics for morphological and analytic causatives, respectively. We report the results from a mixed-effects model on regions 4, 5, 6 and 7 for each causative type. First, the model for the morphological causative condition showed main effects for *group* (ß = 402.97, SE = 48.43, *p* < .001) and *case marking* (ß = 65.63, SE = 28.27, *p* = .022) in region 4, and a marginal effect of case marking (ß = 41.22, SE = 21.92, *p* = .065) and a marginal interaction of group and case marking (ß = 79.68, SE = 43.85, *p* = .075) in region 5. There was no main effect of *group*, *case marking* or interaction of *group* and *case marking* in any other regions. The effect of *group* found in region 4 reflects the well-attested difference in processing speed between L1 and L2 readers, mirroring the tendency for L1 processing to be generally faster than L2 processing. Critically, the effect of *case marking* in the same region suggests that the participants spent longer time in reading the nominative-marking condition than reading the accusative-marking condition, showing evidence of their sensitivity to the unacceptability of a nominative marking for the causee in morphological causatives. However, a closer look at the data by each group revealed that the significant effect of case marking in region 4 was found only in the L1 group (ß = 91.46, SE = 40.32, *p* = .031), but not in the L2 group (ß = 42.53, SE =42.34, *p* = .317). The marginal effect of *case type* and the marginal interaction of *group* and *case type* in region 5 more clearly reflect the asymmetry between the groups in their reading time differences for the two case marking conditions. By-group analyses in region 5 showed that the L1 group had a longer reading time in the nominative-marking than accusative-marking condition (ß = -81.76, SE = 34.42, *p* = .025), but the L2 group showed little statistical difference in their reading times for the two conditions (ß = 3.61, SE = 27.43, *p* = .896).

Table 5. Mean RTs in milliseconds (Standard Deviations) per region in morphological causatives

| Group | Condition | Region | | | | | | | |
		1	2	3	4	5	6	7	8
L1	ACC-marked	481	513	566	545	511	404	401	579
		(218)	(240)	(301)	(262)	(276)	(130)	(145)	(269)
	NOM-marked	463	563	567	576	581	552	474	612
		(163)	(319)	(305)	(363)	(318)	(308)	(261)	(292)
L2	ACC-marked	941	799	921	861	614	489	433	637
		(420)	(346)	(391)	(366)	(276)	(239)	(163)	(334)
	NOM-marked	953	795	933	886	616	463	413	639
		(383)	(349)	(385)	(405)	(320)	(206)	(141)	(312)

Table 6. Mean RTs in milliseconds (Standard Deviations) per region in analytic causatives

| Group | Condition | Region | | | | | | | |
		1	2	3	4	5	6	7	8
L1	ACC-marked	474	534	588	553	485	405	414	593
		(204)	(277)	(351)	(269)	(258)	(185)	(182)	(324)
	NOM-marked	480	534	569	644	566	433	400	582
		(196)	(279)	(326)	(394)	(349)	(200)	(163)	(286)
L2	ACC-marked	929	873	975	979	567	453	422	611
		(387)	(424)	(435)	(384)	(260)	(187)	(146)	(280)
	NOM-marked	930	814	952	1022	571	469	438	649
		(375)	(381)	(375)	(428)	(231)	(194)	(184)	(321)

Turning to the results of analytic causatives, the model showed a main effect for *group* in region 4 (ß = 313.24, SE = 44.54, *p* < .001) and region 5 (ß = 74.98, SE = 36.37, *p* = .044), induced by faster processing by the L1 compared to the L2 group. In addition, the main effect of *case marking* was found in region 6 (ß = 51.37, SE = 23.39, *p* = .029) and region 7 (ß = 55.08, SE = 21.30, *p* = .013),

each of which was qualified by a significant interaction of *group* and *case marking* (in region 6: ß = 174.30, SE = 42.67, $p < .001$; in region 7: ß = 98.55, SE = 32.61, $p = .004$). The main effects of case marking and interactions in these regions were driven by a longer reading time for the NOM-marked condition than for the ACC-marked condition in the L1 group. This reading time pattern of the L1 group was somewhat unexpected since Korean analytic causatives allow both nominative and accusative case markers to modify the theme NP. One possible interpretation of this result is the bi-clausal nature of the analytic causative construction when the causee is marked by a nominative case. As reviewed above, the use of a nominative case marker for the causee makes an analytic causative bi-clausal, which may have caused more processing time for the L1 group. The L2 group, on the other hand, did not show any difference in their RTs between the two case marking conditions in any of the regions.

Figures 2 and 3 show the mean RT profile for each group.
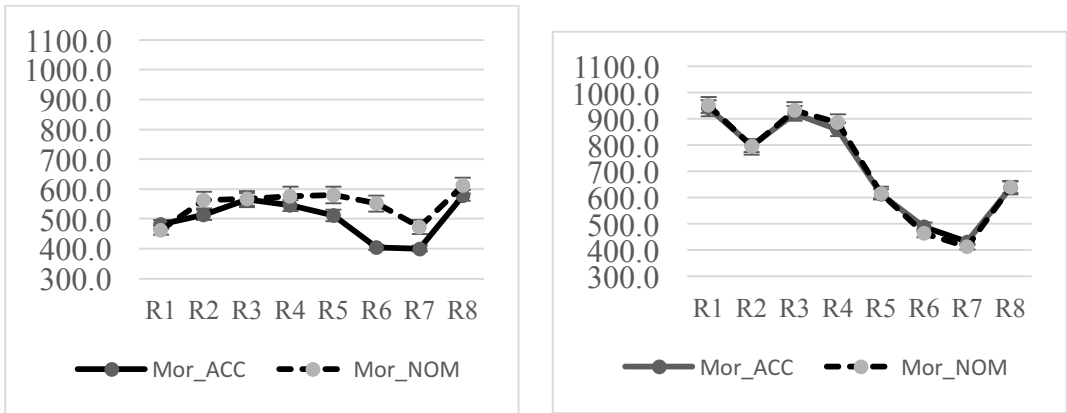
Note. R = Region; Mor = Morphological causative; ACC = Accusative-marked condition; NOM = Nominative-marked condition

Figure 2. Mean RT Profile for morphological causatives by the L1 (left) and L2 group (right); error bars indicate 95% CIs.
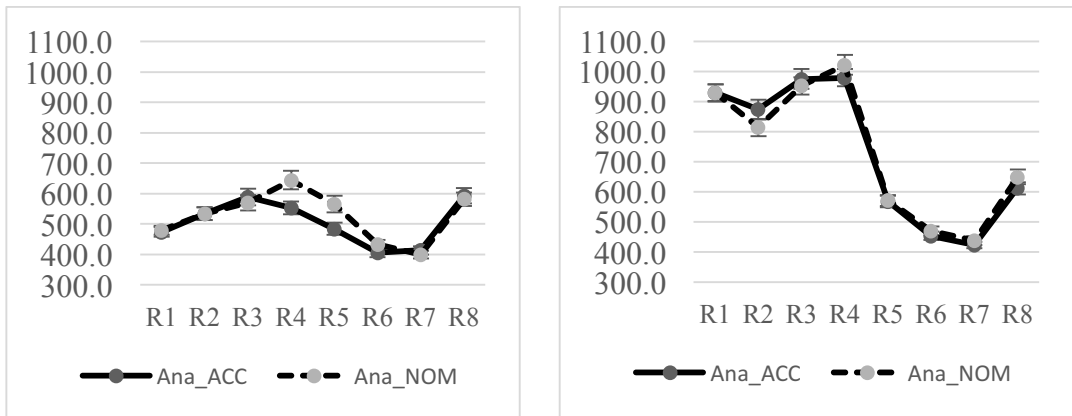
Note. R = Region; Ana = Analytic causative; ACC = Accusative-marked condition; NOM = Nominative-marked condition

Figure 3. Mean RT Profile for analytic causatives by the L1 (left) and L2 group (right); error bars indicate 95% CIs.

Altogether, the results of the self-paced reading task demonstrated that the L1 participants were sensitive to the violation of the case marking for the causee in morphological causatives, whereas the L2 learners failed to show such sensitivity despite their target-like knowledge of the morphological causative construction shown by their performance in the acceptability judgment task. For analytic causatives on the other hand, the learners showed no RT difference between the two case marking conditions, suggesting that they knew that both case marking conditions were felicitous in Korean analytic causatives and thus applied this knowledge in real-time processing of the target sentences.

7 General discussion

In the two experiments, we investigated Chinese speakers' declarative knowledge of Korean causative constructions and their facility of the knowledge in incremental sentence processing. The results from the experiments furnished evidence of learners' persistent difficulties with target constructions, particularly in terms of the acquisition of procedural knowledge. In this section, we discuss possible interpretations of the current findings and provide directions for Korean language teachers to help resolve potential problems with the target constructions in L2 classrooms.

The results of the acceptability judgment task showed that many L2 learners indexed lack of explicit linguistic knowledge necessary to integrate morphosyntactic information from particles with a morphological causative construction, as reflected in their insensitivity to the violation of marking the causee with a nominative case. Considering that our L2 participants were recruited among the most highly proficient Korean learners, these results suggest that the target constructions, particularly morphological causatives, pose an insurmountable challenge to Chinese speakers, which is consistent with previous findings that this learner population has particular difficulties with constructions in production (e.g. Lin, 2015; Zhou, 2014).

Learners' difficulty with the target constructions observed from the acceptability judgment task points to the need for explicit instruction in the Korean classroom, accompanied by several opportunities for learners to use the target structure in diverse contexts. As outlined in the introduction section, Chinese speakers' difficulties with Korean causatives may come from several sources, including cross-linguistic differences between L1 and L2, insufficient information derivable from the target input, and lack of explicit instructions on the target structures. Controlling the effects of the first two factors – lack of relevant knowledge in learners' L1 and an insufficient input on the target construction – are obviously beyond the capability of language teachers. However, difficulties arising from these inevitable problems may be offset by teachers' attempts to provide explicit instruction on the target constructions as well as providing learners with various in-class activities where learners have extensive practice with the target structure to improve their automization skills (DeKeyser, 2015). For instance, teachers may focus on the types of verbs that allow causative affixation and demystify the case marking restrictions imposed on the causee when these verbs are used in the causative construction. At the same time, learners should be informed that Korean analytic causatives allow a causee to be modified not just by an accusative but also a nominative and dative marker. These instructions may be followed by focus-on-form tasks, such as a consciousness-raising task (e.g. Ellis, 1991; Rutherford & Sharwood Smith, 1985) and input enhancement (e.g. Sharwood Smith, 1993) in order to raise learners' awareness of the target structures in comparison to their L1 counterparts, particularly with regard to the case marking restrictions on a causee. Moreover, teachers should provide direct and indirect negative evidence of the target structures on learner production, as a form of corrective feedback (e.g. Aljaafreh & Lantolf, 1994) and recast (e.g. Sato, 2016), to optimize learners' noticing of the target constructions. At the same time, learners should be afforded many opportunities to reflect on their production through self-directed activities, such as dictogloss (e.g. Wajnryb, 1990) where learners are asked to reconstruct target structures in their own way. As such, a future study is needed to investigate the effects of explicit instruction and diverse types of activities regarding the Korean causative constructions.

The results from the self-paced reading task helped us identify an additional problem for L2 learners. Unlike many of the L2 participants, who failed to represent explicit knowledge of the target constructions, a subset of 28 learners, who were sorted out of the whole L2 group, demonstrated target-like performance in the acceptability judgment task, suggesting that they had acquired the target knowledge. However, these learners did not converge on the target-like processing in the self-paced reading task, indicating that they did not fully draw on their explicit knowledge during sentence processing. Learners' incapability of making use of explicit knowledge in real-time comprehension can be captured by a distinction between explicit or *declarative knowledge* and implicit or *procedural knowledge* (Crowell, 2004; Ellis, 2002; Paradis, 2009; Ullman, 2005). It is assumed that while declarative knowledge is explicit and relatively easy to acquire, procedural knowledge is automatic and implicit in nature, making it extremely challenging for L2 learners to acquire such knowledge. The deficient performance of the subset of learners in the self-paced reading task provides supporting evidence of this claim.

The lack of procedural knowledge found in these learners highlights the role of providing iterating learning opportunities and rich input. As an attempt to foster L2 learners' development of procedural knowledge, Dekeyser (2015) emphasized continuous use of the target structures, pointing out that a huge amount of language practice can "decrease the time required to execute the task ("reaction time"), the percentage of errors ("error rate"), and the amount of attention required" (pp. 95–96). In this regard, teachers teaching the Korean causative constructions need to offer numerous opportunities for L2 learners to practice the target constructions in diverse contexts. For example, they may ask learners to describe causative events (denoted through the medium of, for example, images, animations, etc.) using a variety of causative predicates as well as helping them use the target constructions in a real-time conversation through tasks and activities. As in teaching explicit knowledge of the target constructions, teachers' corrective feedback and/or recast following each practice may be beneficial for learners to develop gradual automization of the target knowledge.

8   Conclusion

This paper explored Chinese speakers' acquisition and real-time processing of Korean causative constructions. The results obtained from the acceptability judgment and self-paced reading tasks revealed that the L2 learners exhibited deficiencies in declarative or procedural knowledge of Korean causatives. Despite the fact that Korean causative constructions are widely used in daily conversations, there has been little attention to the acquisition of these constructions in association with case marking use. Given that little research has been done on L2 acquisition of the Korean causative constructions, our findings call on the importance of teaching causative constructions in an L2 classroom to help L2 learners acquire declarative and procedural knowledge regarding these constructions. Future research is needed to examine the effects of various types of instructions and activities to further advance our understanding of these issues.

Notes

[1] Payne (1997) pointed out that the English verb lay could be considered as a type of morphological causative derived from lie if "this stem change were at all productive (p. 178)". However, this case is very rare, and thus it is generally assumed that English lacks morphological causatives.

[2] The abbreviations used in the glosses throughout this paper are as follows: ACC = Accusative case marker; CAUS = Causative morpheme; COMP = Complementizer; DAT = Dative case marker; DECL = Declarative marker; NOM = Nominative case marker; PAST = Past tense marker; TOP = Topic marker.

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