

Asymmetric contribution of case marking and verb to the agent-first strategy: Comprehension of canonical active transitives for Korean-speaking children

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Abstract This study investigates 3-4-year-olds’ comprehension of a canonical active transitive (agent-NOM + theme-ACC + verb) by systematically obscuring cues from case marking and a verb. Results showed that the agent-first strategy was not manifested strongly when only two nouns were present, that an asymmetry was found involving the two factors (case marking; verb) in enhancing the agent-first interpretation, and that the NOM affected the children’s reliance on the agent-first strategy slightly more than the ACC. Implications on the findings are discussed with respect to properties of input in Korean.

Key words agent-first, case marking, verb, sentence comprehension, Korean

1. The agent-first strategy and sentence comprehension for Korean-speaking children

Cross-linguistically, children have strong inclination to map the first noun onto an agent role in sentence comprehension (e.g., Abbot-Smith, Chang, Rowland, Ferguson & Pine, 2017; Bever, 1970; Dittmar, Abbot-Smith, Lieven & Tomasello, 2008; Huang, Zheng, Meng & Snedeker, 2013), dubbed the *agent-first* strategy. When they encounter arguments of a canonical word order active sentence sequentially from the left to the right, the first argument is likely to be an agentive subject. Repeated exposure to this coalition bears a prototype in relation to thematic role ordering, which leads them to enhancing a heuristic that the first nominal in a sentence is the agent. Literature has shown children’s heavy reliance on the agent-first strategy in sentence comprehension: this strategy emerges early on (e.g., Bates & MacWhinney, 1982; Bever, 1970; Gertner, Fisher & Eisengart, 2006; Slobin & Bever, 1982), it is powerful such that it leads children down the garden-path of certain sentential patterns such as passives (e.g., Abbot-Smith et al., 2017; de Villiers & de Villiers, 1973; Huang et al., 2013), and it influences speakers’ judgment and processing even for adults (e.g., Imamura, Sato & Koizumi, 2016; Tamaoka, Asano, Miyaoka &

Yokosawa, 2014; Witzel & Witzel, 2016). These reports suggest the universality of the agent-first strategy across languages and age.

Korean is an SOV language with case marking by way of dedicated postpositions. Scrambling of pre-verbal arguments is allowed in Korean as long as that reordering preserves the original communicative intent with no ambiguity. Korean also allows for the omission of almost all elements in a sentence, such as a postposition, an argument, and even a predicate, if the omitted information can be inferred from a context (Sohn, 1999).

Despite its relatively flexible word order, Korean adopts the agent-before-theme ordering as the canonical word order for an active transitive construction (1) (Im, 2007; Shin, 2006).

(1) kyengchal-i totwuk-ul cap-ass-ta.
police-NOM thief-ACC catch-PST-SE¹
‘The police caught the thief.’

Evidence shows that a canonical active transitive is more reliably interpreted than its scrambled counterpart with less processing cost (e.g., Jin, Kim & Song, 2015; Kim, Sung & Yim, 2017). Children

¹ Abbreviation: ACC = accusative case marker; CASE = case marker (unspecified); NOM = nominative case marker; V_{act} = verb (active); PST = past tense marker; SE = sentence ender

tend to interpret the initial noun (in conjunction with case marking) in a sentence as the agent until the age of four, regardless of its canonicity (e.g., Cho, 1982; Kim, O'Grady & Cho, 1995; No, 2009). This reliance also leads to poor performance in a canonical passive, the pattern in which the theme argument occupies the first word order slot (together with case marking) (e.g., Kim et al., 2017; Shin & Deen, 2019).

Of various factors that may promote (or hinder) children's employment of the agent-first strategy in Korean, this study focuses on case marking and a verb². Case marking, which is a local cue applying to a single noun (Wittek & Tomasello, 2005), provides an informative cue for the interpretation of grammatical information about an argument in a sentence (Fedzechkina, Newport & Jaeger, 2017). Two types of case markers engage in an active transitive in Korean: a nominative case marker (NOM) indicating a subject of a sentence, and an accusative case marker (ACC) indicating a direct object of a sentence (Sohn, 1999). Previous research has shown that Korean-speaking children acquire the NOM earlier and use it more reliably than the ACC (e.g., Jin et al., 2015; cf. Chung, 1994 for production). They acquire the NOM as an indicator of the subject as early as 18 to 20 months old (e.g., Lee, 2004), and that their use of the NOM-marked nominal is linked typically to the indication of the agent of an event (e.g., Lee & Cho, 2009; No, 2009), suggesting the strong mapping between the NOM and the agent for the initial nominal.

The other factor of interest in this study is a verb. Across languages, a verb is assumed to serve as a strong disambiguation point with more interpretive values than other linguistic elements in a sentence (e.g., Altmann & Kamide, 1999). However, literature on verb-final languages argues for a reduced impact of a verb on sentence comprehension in general. Speakers of these languages utilise pre-verbal elements actively in the course of comprehension even before they encounter a verb (e.g., Kamide, Altmann & Haywood, 2003), and this predisposition develops early such that it occasionally leads to particular interpretation, independently of verb semantics (e.g., Göksun, Küntay & Naigles, 2008; Suzuki &

Kobayashi, 2017). Korean also accommodates these findings, providing evidence for the reduced responsibility of a verb as a late-arriving cue for sentence comprehension (e.g., Choi & Trueswell, 2010) and the alternative role of other structural factors such as case marking for this kind of task (e.g., Kim, 1999; cf. Hwang & Kaiser, 2014 for production).

Against this background, several predictions could be made in relation to the two factors for children's comprehension of a canonical active transitive. The agent-first strategy is considered a general cognitive bias which emerges very early on (e.g., Fisher, 2002; Pozzan & Trueswell, 2015). Korean-speaking children would thus comply to this way of interpretation, less affected by omission involving the two factors. Adding case markers and/or a verb would enhance their agent-first comprehension, the degree of which would be contingent on the factors added. In general, case marking is an important piece of information for comprehension of Korean sentences, but a verb has a restricted impact on this task in general. These characteristics would make children less affected by a non-existent verb than non-existent case markers. In particular, given the strong NOM-agent pairing that children formulate, it is further expected that the addition of the NOM would lead to an enhancement of the reliance on the strategy to a great extent.

To test these predictions, a series of picture selection tasks was conducted to explore how children rely on the agent-first strategy for sentence comprehension in Korean and how their reliance on the strategy is modulated by (the existence of) case marking and a verb. For this purpose, case markers and/or a verb were obscured systematically under relevant contexts provided.

2. Experiment: Picture selection task

2.1. Methods

Participant Monolingual 3-4-year-olds ($n = 30$, mean: 4;1) were recruited from one preschool in Seoul, South Korea. Adult native speakers of Korean ($n = 20$) were also recruited as a control group. No participant reported any learning disabilities.

Stimuli Sentences were created by using animals as agents and themes. To tease apart individual impacts of each factor on the comprehension of this construction type, cues from case marking

² For the sake of discussion, this study controlled for the word order of an active transitive as canonical (agent-NOM + theme-ACC + verb).

and a verb were manipulated by obscuring parts of test sentences strategically through two novel contexts: 1) the speaker of the sentences was sick (and coughing occurred occasionally in the sentences) and 2) the speaker was hungry and was eating food (and chewing occurred at various points in the sentences). In each context, participants heard sentences with some of the parts obscured by the masking sounds. Every pattern had six instances, which amounted to 60 test sentences in total.

Table 1. Stimuli by pattern

Case marking	Verb	Pattern	Example
no	no	$N_{CASE}N_{CASE}V_{act}$	dog*yummyum* cat*yummyum* *yummyum*
no	yes	$N_{CASE}N_{CASE}V_{act}$	dog*cough* cat*cough* kick
yes (1st)	no	$N_{NOM}N_{CASE}V_{act}$	dog-NOM cat*cough* *cough*
yes (2nd)	no	$N_{CASE}N_{ACC}V_{act}$	dog*yummyum* cat-ACC *yummyum*
yes	no	$N_{NOM}N_{ACC}V_{act}$	dog-NOM cat-ACC *cough*
yes	yes	$N_{NOM}N_{ACC}V_{act}$	dog-NOM cat-ACC kick

All the test sentences were recorded by a male native speaker of Korean. He did not know the intention of these sentences. Sounds of chewing and coughing were recorded separately from the full sentences. At every instance of recording, we controlled for the argument-argument and the argument-verb intervals within a sentence as 100 ms. Each of the complete instances was doubled with a 1000 ms inter-stimulus interval (Figure 1). All the sentences, along with their corresponding pictures and recordings, were normed by 10 native speakers of Korean prior to the experiment.

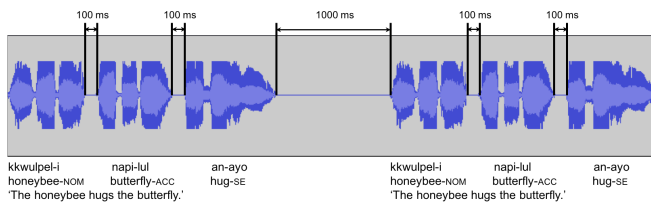


Figure 1. Structure of a recorded sentence (example from $N_{NOM}N_{ACC}V_{act}$)

Procedure One session consisted of three contextual stages: no masking ($N_{NOM}N_{ACC}V_{act}$), chewing ($N_{CASE}N_{CASE}V_{act}$ and $N_{CASE}N_{ACC}V_{act}$), and coughing ($N_{CASE}N_{CASE}V_{act}$, $N_{NOM}N_{CASE}V_{act}$, and $N_{NOM}N_{ACC}V_{act}$). The presentation order of these stages was randomised for counterbalancing. All the sentences were split into two sub-lists per context. Participants were given one of the lists in one stage randomly, and subsequently they received a different sub-list from what they did in the previous stage.

The experiment was conducted via *Psychopy* (Peirce, 2007). Every test item was accompanied by a pair of pictures involving the same action but reversed thematic roles, and a sentence corresponding to the target picture was presented aurally. Participants were asked to join the main character in learning Korean and helping him; the actual task was to listen to what the main character said and to choose the picture that matched the utterance by pressing big arrows posted on the keyboard. A training stage with three practice items (subject-verb, object-verb, and verb-only sentences) was provided before the main experiment to familiarise participants with the procedure. The main experiment proceeded only if they succeeded on all the three items. In every testing stage, two pictures were presented first, and the recorded sentence played 1000 ms after the pictures were presented. The presentation order of test items and the corresponding pair of two pictures was randomised. To block responses which might be careless or too fast, the keyboard was activated right after a test sentence was presented twice. Participants were received positive feedback, regardless of whether their choices were correct or wrong. The entire session took approximately 15 minutes.

Analysis Responses were coded as 0 (wrong) or 1 (correct) except for $N_{CASE}N_{CASE}V_{act}$ and $N_{CASE}N_{CASE}V_{act}$ (0: theme-first; 1: agent-first). The mean accuracy of response (and the mean proportion of the agent-first response in $N_{CASE}N_{CASE}V_{act}$ and $N_{CASE}N_{CASE}V_{act}$) was compared statistically across the conditions within each group. All the data were submitted to logistic mixed-effects models using the *lme4* package (Bates, Maechler, Bolker & Walker, 2015) with pattern as a fixed effect and with participant and item as random effects. The models included the maximal random effects structure with random intercepts and random slopes for all effects (cf. Barr, Levy, Scheepers & Tily, 2013). All statistical modelling and hypothesis testing were performed in R (R Core Team, 2016).

2.2. Results

3-4yr-olds were at-chance in $N_{CASE}N_{CASE}V_{act}$, showing their interpretation towards neither agent-first nor theme-first. Their agent-first interpretation improved up to the above-chance performance in $N_{CASE}N_{CASE}V_{act}$, but the change was marginal, $\beta =$

0.695, $SE = 0.379$, $p = .067$. When either the NOM or the ACC was added, children's agent-first interpretation was significantly ameliorated: $\beta = 1.798$, $SE = 0.476$, $p < .001$ for $N_{NOM}N_{CASE}V_{act}$; $\beta = 1.041$, $SE = 0.401$, $p = .009$ for $N_{CASE}N_{ACC}V_{act}$. Across these two patterns, children were marginally better in $N_{NOM}N_{CASE}V_{act}$ than in $N_{CASE}N_{ACC}V_{act}$, $\beta = 0.780$, $SE = 0.428$, $p = .068$. They performed well in both $N_{NOM}N_{ACC}V_{act}$ and $N_{NOM}N_{ACC}V_{act}$, demonstrating more than 80% of accuracy, with no statistical difference. However, comparisons between these patterns and their corresponding no-case-marking patterns showed significance: $\beta = 1.443$, $SE = 0.416$, $p = .001$ from $N_{CASE}N_{CASE}V_{act}$ to $N_{NOM}N_{ACC}V_{act}$; $\beta = 0.999$, $SE = 0.391$, $p = .011$ from $N_{CASE}N_{CASE}V_{act}$ to $N_{NOM}N_{ACC}V_{act}$.

Table 2. Performance by age group

Pattern	Mean % (SD)	
	3-4-year-old	adult
$N_{CASE}N_{CASE}V_{act}$ ¹⁾	51.52 (0.50)	81.67 (0.39)
$N_{CASE}N_{CASE}V_{act}$ ¹⁾	66.67 (0.48)	90.00 (0.30)
$N_{NOM}N_{CASE}V_{act}$	85.33 (0.36)	93.33 (0.25)
$N_{CASE}N_{ACC}V_{act}$	72.73 (0.45)	96.67 (0.18)
$N_{NOM}N_{ACC}V_{act}$	81.33 (0.39)	100.00 (0.00)
$N_{NOM}N_{ACC}V_{act}$	84.44 (0.36)	100.00 (0.00)

¹⁾ The mean score indicates the mean proportion of the agent-first response, not the mean accuracy of response. Statistical comparisons were possible since all the patterns followed agent-before-theme and thus corresponded to the agent-first interpretation.

3. Discussion and Conclusion

Three major findings were noted. First, the agent-first strategy was not manifested strongly in itself when only a sequence of two nouns were present. Second, there was an asymmetry involving case marking and a verb in enhancing children's agent-first interpretation. Third, of the two case markers, the NOM exerted a slightly bigger influence on their reliance on the agent-first interpretation than the ACC. The rest of this section revisits each point and discuss implications of the findings.

First of all, the finding that our 3-4-year-olds were at-chance in $N_{CASE}N_{CASE}V_{act}$ was at odds with the prediction that children would employ the agent-first strategy, independently of (the existence of) other structural factors — this prediction was not borne out. Rather, children seemed to be uncertain about the composition of thematic

roles for this pattern (see also Shin, 2018; Shin & Deen, 2019 for the consistent report on children's performance on the same pattern). This finding is inconsistent with the previous reports that show children's reliable, automatic employment of the agent-first strategy across languages (e.g., Abbot-Smith et al., 2017; Huang et al., 2013), the reason of which is attributed to linguistic environments to which children are normally exposed (cf. Rowland, Noble & Chan, 2014). Caregiver input is skewed towards a canonical active in Korean as well (e.g., Cho, 1982; No, 2009), but our finding implies that this property in the input may not shape a strong comprehension heuristic directly contributing to the agent-first interpretation rapidly at least in Korean (this issue relates to the third finding in this study).

Next, we found an asymmetry involving case marking and a verb for children's employment of the agent-first strategy. Whilst adding a verb yielded a marginal improvement at most ($N_{CASE}N_{CASE}V_{act}$ to $N_{CASE}N_{CASE}V_{act}$), adding case markers, regardless of the types and the number of markers, enhanced the agent-first interpretation significantly ($N_{CASE}N_{CASE}V_{act}$ to $N_{NOM}N_{CASE}V_{act}$, $N_{CASE}N_{ACC}V_{act}$, and $N_{NOM}N_{ACC}V_{act}$). Moreover, adding case markers controlling for the existence of a verb showed significance ($N_{CASE}N_{CASE}V_{act}$ to $N_{NOM}N_{ACC}V_{act}$), but the same significance was not found in adding a verb controlling for the existence of case markers ($N_{NOM}N_{ACC}V_{act}$ to $N_{NOM}N_{ACC}V_{act}$). These findings suggest a larger contribution of case marking to the employment of the agent-first strategy than a verb for sentence comprehension in Korean, which is in line with the unequal status of case marking and a verb for Korean sentence comprehension in general, as outlined above.

Last but not least, the marginal change in accuracy across the verb-less patterns with partial case markers ($N_{NOM}N_{CASE}V_{act}$ and $N_{CASE}N_{ACC}V_{act}$) implies a possibility that each case marker influences the reliance on the agent-first strategy in an asymmetric way. One possible source for this comes from the nature of input involving a canonical active transitive in Korean. Input with respect to an active transitive is heavily skewed towards subject-first than object-first patterns (Im, 2007; Shin, 2006), and the NOM is attached to the subject (e.g., Cho, 1982; No, 2009), most of which indicate the agent (e.g., Lee, 2004). The frequent

alignment between the NOM and the agent for the initial noun in a sentence may thus encourage children to get a fix on the pairing that maps the NOM-marked nominal onto agent-hood. Considering the possibility that children must take into account the number of arguments in a sentence to reliably employ the agent-first strategy (cf. Shin, Deen, & O'Grady, 2019), they may be attuned first to learning this local pairing through repeated exposure to the properties of the input prior to acquiring the distributional cue involving the number-of-NP information (cf. Wittek & Tomasello, 2005). One promising avenue for this issue is to trace how these pieces of knowledge emerge through computational modelling by employing the same quality of input to which Korean-speaking children is exposed, which is something that we pursue next (Shin & Mun, in preparation).

Future research will benefit from exploring input-output relations with respect to the interplay between structural cues (e.g., canonicity, the number of arguments, form-function pairings involving case marking, verbal morphology) for comprehension, with various constructional patterns and age groups.

5. References

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