Competition between passive-voice heuristics and active-voice knowledge: Webcam eye-tracking of Korean monolingual children's comprehension of suffixal passive construction

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Across languages, passive voice is recognised for presenting acquisitional challenges to children (Abbot-Smith et al., 2017; Deen, 2011; Huang et al., 2013). Two competing accounts explain how children generalise grammatical knowledge: *gradual abstraction*, where generalisation is delayed until sufficient evidence is gathered (Akhtar, 1999; Tomasello, 1992), and *early abstraction*, where children actively use current input to rapidly abstract linguistic knowledge irrespective of exposure or specific items (Gertner et al., 2006; Lidz et al., 2003). Shin (2022) examined the validity of each account through Korean monolingual children's comprehension of Korean suffixal passive construction, which features a NOM-marked theme, a DAT-marked agent, and passive verbal morphology (**PSV**) (Table1). **PSV** necessitates revising the initial interpretation of associations between thematic roles and case markers (agent-NOM + recipient-DAT → theme-NOM + agent-DAT). This results in (i) the *Theme-First* heuristic (firstNP = theme) competing with the *Agent-First* strategy in the active voice and (ii) the *NOM-as-Theme* (N-NOM = theme) and DAT-*as-Agent* (N-DAT = agent) heuristics competing with agent–NOM and theme–ACC pairings in the active voice. The study revealed children's emerging sensitivity to, but late mastery of, passive-voice heuristics, requiring prolonged exposure and usage-based learning given the interplay of various (non-)linguistic cues in a stimulus. This supports the moderate version of each account.

The current study extends Shin (2022) by investigating Korean monolingual children's real-time processing of this construction using a webcam eye-tracking method (*WebGazer.js*; Papoutsaki et al., 2016). Developed during the COVID-19 pandemic to address data collection limitations in eye-tracking studies, this method has proven effective as an alternative to physical eye-trackers (Özsoy et al., 2023; Semmelmann & Weigelt, 2018; Slim & Hartsuiker, 2022). 28 3-to-6-yrs (M_{month}=56, SD_{month}=11) and 20 adult controls joined two picture-selection (PS) tasks, matching aurally presented sentences to one of two images, combined with a visual-world paradigm using webcam eye-tracking (WE; time bin: 50 milliseconds) on a portable laptop (Table2). Pictures were shown 2000 milliseconds before sentence onset. In Exp2, a novel context was introduced where the speaker was hungry and eating with a yum-yum sound to obscure case-marking in the stimuli (cf. arguments and case markers may be omitted if inferable from context). We analysed the eye-tracking data through non-parametric permutation analysis (Abbot-Smith et al., 2017; Garcia et al., 2021) and the picture-selection data through logistic mixed-effects modelling.

Results (Figures 1&2). [PS/Exp1] For actives, children showed higher accuracy in canonical (79%) compared to scrambled (67%) conditions (p=.055), with accuracy positively correlating with age (ps<.01). For passives, while accuracy was lower in canonical (45%) than scrambled (59%) conditions, this difference was insignificant and showed no correlation with age. [PS/Exp2] For actives, the mean of agent-first responses (68%) exceeded a chance level, whereas that of theme-first responses in passives (51%) did not, indicating children's limited reliance on passive-voice heuristics. [WE/Exp1] Children fixated more on target events for canonical (agent + theme) than scrambled (theme + agent) actives later at NP2 (theme-ACC for canonical; agent-NOM for scrambled), indicating facilitated processing when word order and case-marking cues aligned in a typical manner. In contrast, they fixated more on target events for scrambled (agent + theme) than canonical (theme + agent) passives at Verb, indicating persistent challenges with passives due to dominant active-voice knowledge (Agent-First strategy) despite some sensitivity to **PSV**. [WE/Exp2] Children fixated less on target events for passives (theme-first) than actives (agent-first) at Verb, confirming the weaker influence of **PSV** in processing passives.

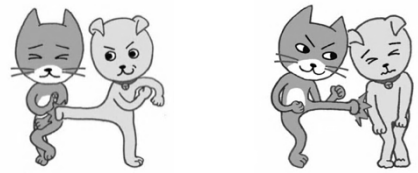
These findings suggest a limited, albeit non-zero, role for passive-voice heuristics in children's processing of the suffixal passive, attributable to the competition from more robust and entrenched active-voice knowledge. This lends additional support for the moderate versions of the gradual- and early-abstraction accounts. This study's findings further elucidate children's online processing dynamics, while mitigating sampling biases and methodological barriers in the field.

Table 1. Active transitive and suffixal passive constructions in Korean

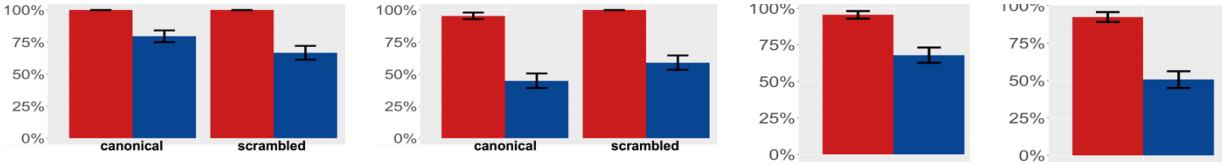
Type	Active transitive, canonical	Suffixal passive, canonical
Example	Ciwu-ka Mia-lul cap-ess-ta. Ciwu-NOM Mia-ACC catch-PST-SE 'Ciwu caught Mia.'	Ciwu-ka Mia-hanthey cap-hi-ess-ta. Ciwu-NOM Mia-DAT catch-PSV-PST-SE 'Ciwu was caught by Mia.'
Thematic role ordering	agent–theme	theme–agent
Case-marking	Typical (agent–NOM; theme–ACC)	Atypical (theme–NOM; agent–DAT)
Verbal morphology	No	Yes (-i/hi/li/ki-)

Note. A scrambled word order pattern in this study indicates reversed thematic role ordering for each construction type: theme+agent+action (active transitive); agent+theme+action (suffixal passive).

Table 2. Experimental setting

	Pictures presented	Sentence presented
Exp1		koyangi-ka kangaci-lul cha-i-eyo. cat-NOM dog-ACC kick-PSV-SE 'The cat is kicked (by the dog).'
Exp2: Chewing		kangaci-*yum-yum* koyangi-*yum-yum* cha-i-yo. dog-*yum-yum* cat-*yum-yum* kick-PSV-SE 'The dog/cat is kicked by the cat/dog.'

Note. In Exp2, this stimulus has no overt case marker to indicate the thematic role of each argument, so the thematic role ordering can be interpreted as either agent-first or theme-first.



Exp1: Active transitive | Exp1: Suffixal passive | Exp2: Active transitive | Exp2: Suffixal passive

Figure 1. Results: picture selection. Red = adults; Blue = children. Coding for Exp2: *Agent-first* response rate for active transitives; *Theme-first* response rate for suffixal passives.

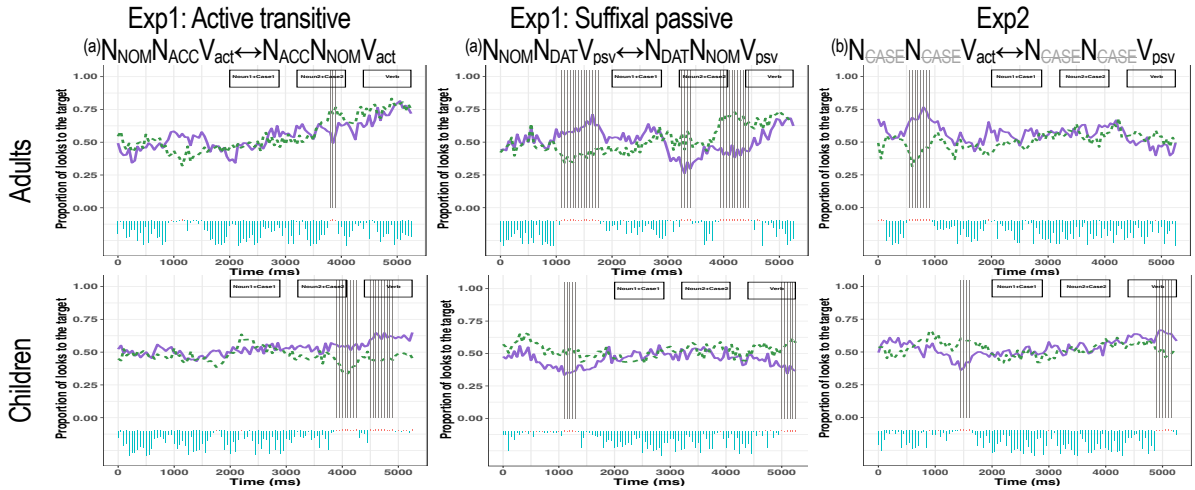


Figure 2. Results: eye-tracking. Average proportion of looks to the target event from 2000 ms prior to a sentence onset until the end of a trial. The sentence regions are indicated by the rectangles. The small light blue/orange bars below 0.00 indicate the *p*-value from the linear regression for each time bin (50 ms): light blue bars indicate a *p*-value greater than 0.05; orange bars indicate a *p*-value less than 0.05 (thus significant). The large grey shadings above 0.00 indicate the time bins which were found to be significant in the permutation analysis. Purple = (a) canonical or (b) active pattern; Green = (a) scrambled or (b) passive pattern.

ACC = accusative case marker; CASE = case marker (unspecified); DAT = dative marker; NOM = nominative case marker; PST = past tense marker; PSV = passive suffix; SE = sentence ender