Developmental effects in the real-time use of morphosyntactic cues: Evidence from Tagalog

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How children acquire and use different cues to rapidly process language is a matter of intense debate. On the one hand, *early abstraction* accounts predict that children process sentences using early emerging (or innate) adult-like linguistic generalizations (Özge, Kuntay, & Snedeker, 2019; Phillips & Ehrenhofer, 2015; Snedeker, 2013). In contrast, *experience-based* accounts assume a greater role of children's input, predicting that both acquisition and parsing decisions are input-driven (Chang, Dell, & Bock, 2006; MacDonald, 2013). In this research, we tested the predictions of these accounts in Tagalog (Austronesian), an understudied verb-initial language that uses pre-nominal morphosyntactic markers to assign thematic roles (i.e., voice-marking on the verb and a prenominal marker).

In Tagalog, the agent voice *-um-* indicates that the *ang*-marked noun is the agent [Table 1a, b], while the patient voice *-in-* marks the *ang*-phrase as the patient [Table 1c, d]. Post-verb word order is relatively flexible. Evidence from child-directed speech shows that the patient voice is overall more frequent, as well as the agent-initial order (Garcia, Roeser, & Höhle, 2019). Given this distribution, experience-based accounts predict that children would learn the patient voice mapping before that of the agent voice, as children have more exposure to the former than the latter, facilitating the rapid implementation of online parsing decisions. In contrast, early abstraction accounts do not predict a voice difference.

To test these predictions, we conducted an eye-tracking experiment with 32 adults (controls) and 151 children (fifty-three 5-year-olds, forty-nine 7-year-olds, forty-nine 9-year-olds), who saw a picture depicting a transitive action between two animals. After 1500ms of silence, they heard an audio-recorded sentence [Table 1a-d] that corresponded to the picture. They were told to pay attention because there would be questions about what they had seen and heard. There were 32 experimental items (8 per sentence condition) and 32 fillers. Our independent variables were voice and the order of the thematic roles; and the dependent variable was the proportion of fixations to the agent in the picture. Our analyses determined whether participants looked at the referent of the upcoming noun before it is mentioned (Noun1 region), based on the voice-marking on the verb and the noun marker that they had previously encountered.

A permutation analysis revealed that the ability to use morphosyntactic markers to assign thematic roles develops with age. The 5-year-olds showed divergence in the looks to the agent between agent-initial and patient-initial conditions only after the noun onset (Figure 1). However, similar to adults, 7- and 9-year-old children showed predictive use of the morphosyntactic markers in the patient voice. Thus, in Figure 2 (bottom panel), 7-year-olds looked more to the agent during the pre-noun regions when the sentence was agent-initial than when it was patient-initial (significant regions are shaded grey). However, in the agent voice we only found divergence after noun onset.

Our results showed that children's online use of morphosyntactic markers develops with age, with adult-like online predictive processing only beginning to emerge at 7 years. Furthermore, we found that the real-time use of the markers is modulated by voice—with the patient voice being used more efficiently than the agent voice. We interpret this to reflect the participants' sensitivity to the distributional properties of the language in line with experience-based accounts.

Table 1. Sample stimuli sentences

(a) Agent voice	H<um>uhuli	noong Martes	ang	malusog	na	unggoy	ng	baka
agent-initial	<AV>capture	last Tuesday	SBJ	healthy	LIN	monkey	NSBJ	cow
	'The healthy monkey was capturing a cow last Tuesday.'							
(b) Agent voice	H<um>uhuli	noong Martes	ng	malusog	na	baka	ang	unggoy
patient-initial	<AV> capture	last Tuesday	NSBJ	healthy	LIN	cow	SBJ	monkey
	'The monkey was capturing a healthy cow last Tuesday.'							
(c) Patient voice	H<in>uhuli	noong Martes	ng	malusog	na	unggoy	ang	baka
agent-initial	<PV> capture	last Tuesday	NSBJ	healthy	LIN	monkey	SBJ	cow
	'The/A healthy monkey was capturing the cow last Tuesday.'							
(d) Patient voice	H<in>uhuli	noong Martes	ang	malusog	na	baka	ng	unggoy
patient-initial	<PV> capture	last Tuesday	SBJ	healthy	LIN	cow	NSBJ	monkey
	'The/A monkey was capturing the healthy cow last Tuesday.'							

Note. The vertical lines show the division between the sentence regions namely, verb + temporal adverb, first noun marker + adjective, first noun, second noun marker + second noun. Abbreviations: AV (agent voice), PV (patient voice), SBJ (subject), NSBJ (non-subject), LIN (linker).

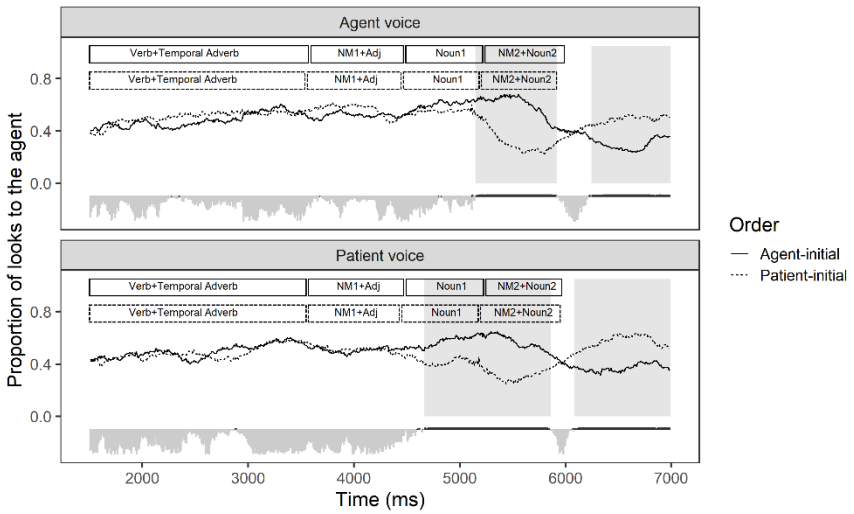

Figure 1. Five-year-olds' average proportion of looks to the agent. The sentence regions are indicated by the rectangles (NM1=1st noun marker; Adj= adjective; NM2=2nd noun marker). The small grey/black bars around -0.01 indicate the *p* values for each time bin. The large grey bars indicate the time bins which were found to be significant in the permutation analysis.

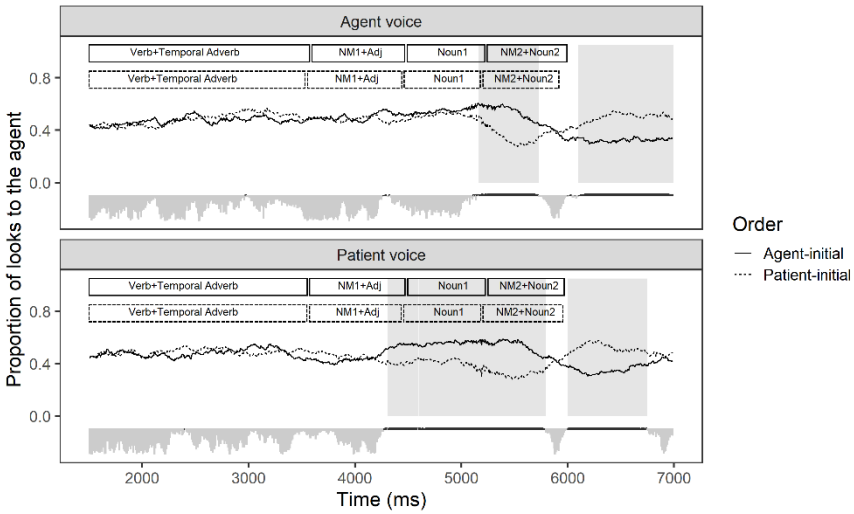

Figure 2. Seven-year-olds' average proportion of looks to the agent from verb onset until the end of the trial.