THE DEVELOPMENT OF ON-LINE PREDICTIVE PROCESSING FROM MORPHOSYNTACTIC CUES: EVIDENCE FROM TAGALOG

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There is evidence that children are able to rapidly use morphosyntactic markers for thematic role assignment during online processing (e.g., Huang et al., 2013). However, this has only been demonstrated for languages in which voice markers that assign agent and patient roles occur *after* an initial noun. Thus it is unclear whether children can use purely morphosyntactic information to predict and assign thematic roles. In this study, we investigated children's and adults' real-time interpretation of transitive sentences in Tagalog (Austronesian), a verb-initial flexible word order 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 [Ex. 1, 2], while the patient voice *-in-* marks the *ang*-phrase as the patient [Ex. 3, 4]. Post-verb word order is relatively flexible: evidence from naturalistic speech and sentence production experiments shows that the patient voice is overall more frequent and it is overwhelmingly used with an agent-initial order, whereas the order of arguments in the less frequent agent voice is more variable and thus less predictable (Garcia et al., 2018; Garcia et al., 2019). A purely cue-based approach would argue that children's ability to predict on the basis of morphosyntactic information does not vary across different voices (e.g., Bates & MacWhinney, 1989). However, other usage-based approaches predict that the use of the morphosyntactic cue is tied to its appearance in frequently occurring sentential frames (e.g., Chang et al., 2006), so children will 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.

To test these hypotheses, we conducted an eye-tracking experiment with 32 adults 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 (Fig. 1). After 1500ms of silence, they heard an audio-recorded sentence [Ex. 1-4] 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 even 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 adults showed predictive use of the morphosyntactic markers in the patient but not the agent voice. Thus, in Fig. 2 (bottom panel), adults 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. The children's data suggested that the ability to use morphosyntactic markers to predict thematic roles develops with age: the 5-year-olds showed divergence only upon hearing the first noun (Fig. 3), while the 7- and 9-year-olds, like the adults, anticipated the agent in the patient voice agent-initial condition (figures not included).

Our results showed that adults and older children use morphosyntactic markers to assign a thematic role to the upcoming first noun. However, this result was found only in the patient voice. We interpret this to reflect the participants' sensitivity to the distributional properties of the language in line with usage-based approaches (e.g., Chang et al., 2006): predictions are possible for the patient voice because it is both frequent and has a stable ordering of arguments. Additionally, children's online use of morphosyntactic markers develops with age, with adult-like online predictive processing only emerging at 7 years.

References:

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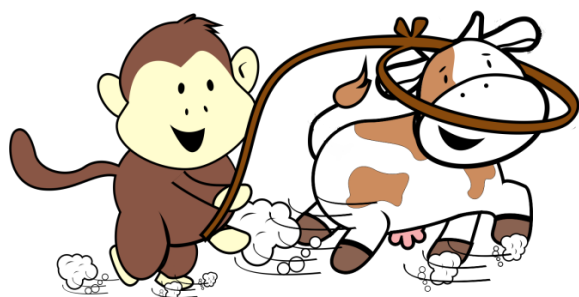
Figure 1. Sample stimulus picture

Sample stimuli sentences for Figure 1:

(1) Agent voice agent-initial
| H<um>uhuli | noong Martes | ang | malusog | na | unggoy | ng | baka |
| <AV>capture | last Tuesday | SBJ | healthy | LIN | monkey | NSBJ | cow |

'The healthy monkey was capturing a cow last Tuesday.'

(2) Agent voice patient-initial
| H<um>uhuli | noong Martes | ng | malusog | na | baka | ang | unggoy |
| <AV> capture | last Tuesday | NSBJ | healthy | LIN | cow | SBJ | monkey |

'The monkey was capturing a healthy cow last Tuesday.'

(3) Patient voice agent-initial
| H<in>uhuli | noong Martes | ng | malusog | na | unggoy | ang | baka |
| <PV> capture | last Tuesday | NSBJ | healthy | LIN | monkey | SBJ | cow |

'The/A healthy monkey was capturing the cow last Tuesday.'

(4) Patient voice patient-initial
| H<in>uhuli | noong Martes | ang | malusog | na | baka | ng | unggoy |
| <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. AV refers to agent voice, PV to patient voice, SBJ to subject, NSBJ to non-subject, LIN to linker.
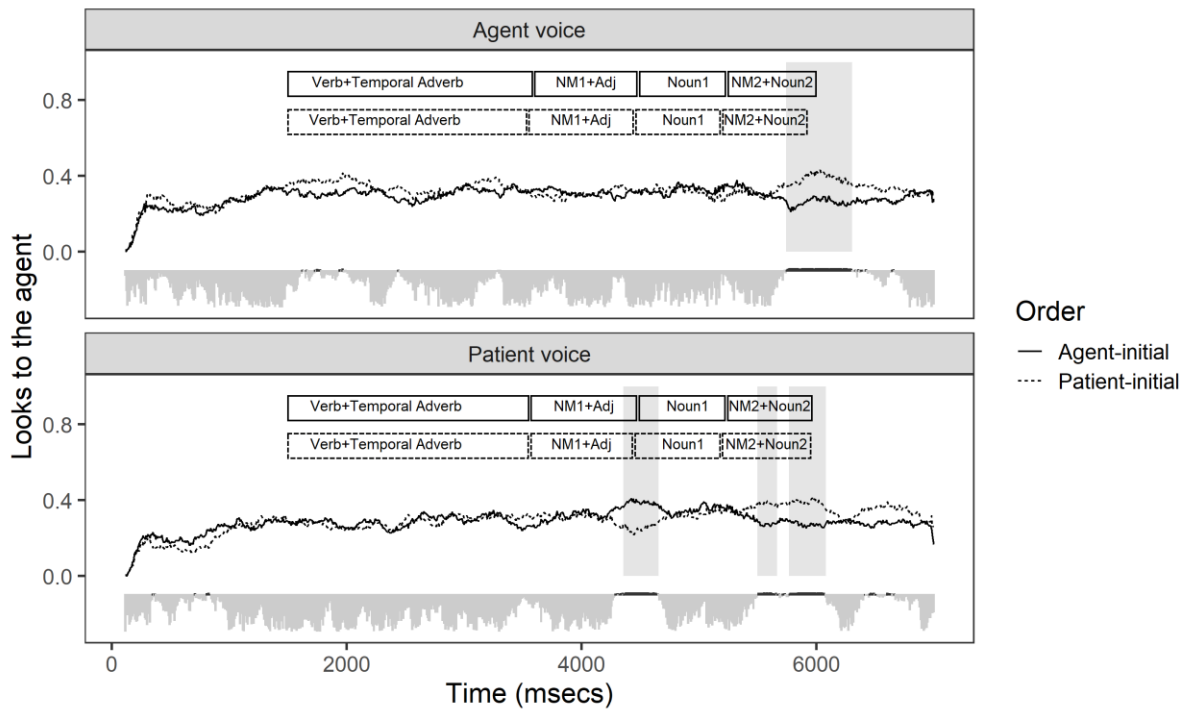
Figure 2. Adults' average proportion of looks to the agent throughout the trial. The sentence regions are indicated by the rectangles (NM1 refers to the first noun marker, Adj to adjective, NM2 to the second noun marker). The small grey/black bars around -0.01 indicate the p values for each time bin. The large grey bars indicate the time bins which were found to be significant in the permutation analysis.
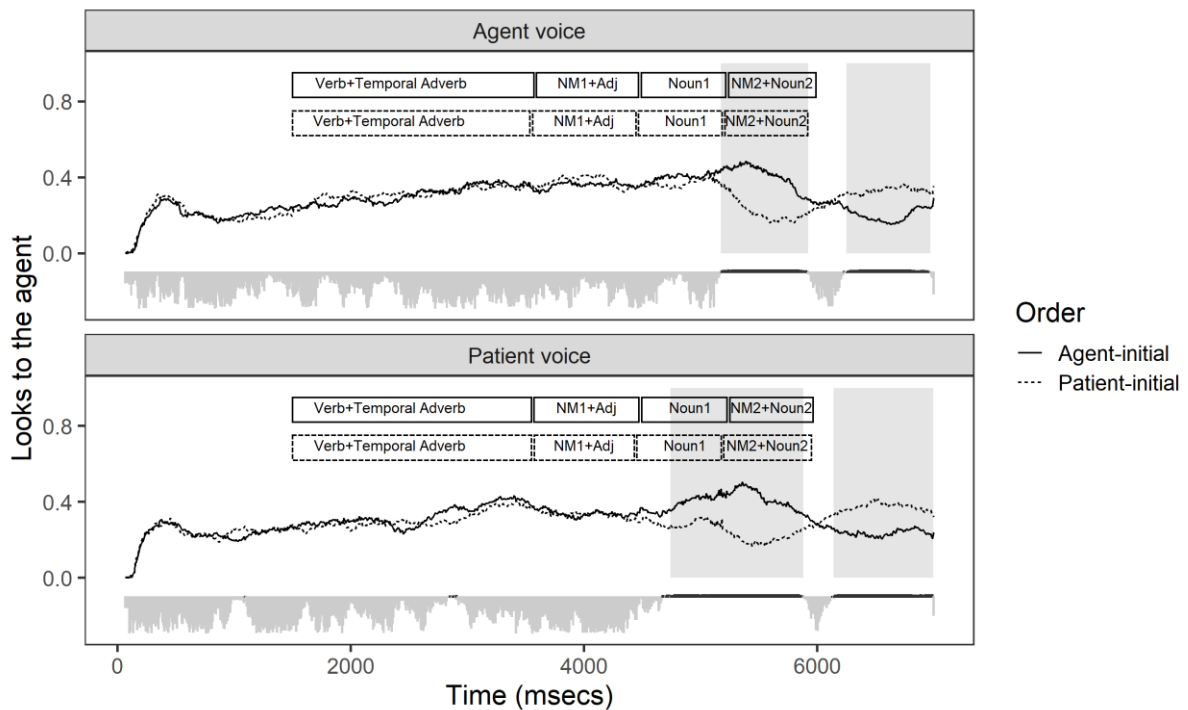

Figure 3. Five-year-olds' average proportion of looks to the agent throughout the trial. The sentence regions are indicated by the rectangles (NM1 refers to the first noun marker, Adj to adjective, NM2 to the second noun marker). The small grey/black bars around -0.01 indicate the p values for each time bin. The large grey bars indicate the time bins which were found to be significant in the permutation analysis.