The Role of Tagalog Voice Information on Sentential Argument Order in Production and Gaze Patterns in Comprehension

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This study examined whether the verbal affixation of *voice morphology* is utilized to order (in production) and anticipate (in comprehension) upcoming elements in a verb-initial and flexible word order language, Tagalog. Unlike more familiar active/passive voice systems, Tagalog sentences allow multiple transitive patterns for the same set of nominal arguments. Verbs contain a voice-marking affix that identifies one of the arguments as syntactically prominent (the *pivot*, further indicated by the nominal marker *ang*); see examples (1)-(4) [1,2,3]. Sentential word order has been claimed to depend on voice morphology [4], suggesting voice could strongly constrain predictions for word order in online comprehension. While earlier psycholinguistic work has provided important evidence for predictive processing [5,6,7,8,9], questions remain about how routinely predictions are made [10]. This study aimed to contribute to this line of investigation by testing an understudied type of linguistic information: voice morphology.

Experiment 1: Production. Tagalog permits multiple orders for nominal arguments, but there is controversy regarding word order preference and canonicity. We tested the effect of voice on word order using a sentence continuation task. 30 native Tagalog adults viewed a visual scene containing 4 prototypical arguments (agent, patient, benefactive, and instrument) (Fig1). They then completed a sentence fragment containing a verb in one of the 4 possible voice alternations (Agent Voice [AV], Patient Voice [PV], etc), using all 4 depicted elements. 36 verbs were crossed with 4 voice conditions and 2 scene arrangements in a counterbalanced design. Extending previous studies [10,11] to tests of more voices and arguments, we observed a strong and significant preference for …Agent-Pivot-… word order in all voices except AV, and two highly frequent word orders in AV (Fig2, confirmed via maximal mixed-effects logistic regression models; critical *t*'s >3.07). These results help clarify proposals in the theoretical literature [4,12], especially for sentences that include understudied benefactive or instrument arguments, and support a cognitive preference for word order patterns that allow high accessibility to elements relevant to syntactic computations (here, agent and pivot arguments) [13,14,15]. Importantly, the results verified a strong effect of voice morphology on word order when all other factors were controlled, and thus voice can be anticipated to be a strong predictor of word order.

Experiment 2: Visual-world comprehension. We next tested whether speakers use voice morphology upon hearing the verb (and a following adverb) to anticipate upcoming sentential arguments in real-time comprehension. Recent work has suggested that Tagalog speakers use only verbal semantics and not morphosyntactic information from voice morphology when anticipating arguments [16], but did not control for argument animacy. Given the agent/pivot saliency in Tagalog in Exp1, we predicted increased looks to both agents and pivots at the verb region, with highest looks to the agent/pivot in AV. 34 native Tagalog adults participated in a visual-world experiment. Visual scenes (Fig1) received 1500ms of preview, and remained during sentence presentation (1.5-8s). 36 critical verbs, counterbalanced across 4 voices and 2 visual scene arrangements were interspersed with 72 fillers. Argument animacy was controlled (agents/benefactives were animate; patients/instruments were not). The results of mixed-effects linear regression models revealed no significant effect of voice on looks to agent or pivot AOIs in the critical verb+adverb region (all *t*'s <0.93). Instead, a strong animacy effect was observed (Fig3). In contrast to the findings in Experiment 1, the results suggested an absence of a voice effect on anticipation of upcoming arguments, converging with findings from previous research [16]. These findings suggest the possibility that non-syntactic information (event representations) dominates the processor's capacity to use syntactic information to predict upcoming input.

Agent Voice (AV)

(1) **Nag**-luto kani-kanina lang **ang nanay** ng spaghetti para_sa anak gamit_ang kawali.
AV-cook a while ago **PVT mother** NPVT spaghetti BEN child INS pan
'The mother cooked spaghetti for the child with the pan.'

Patient Voice (PV)

(2) L<**in**>uto kani-kanina lang ng nanay **ang spaghetti** para_sa anak gamit_ang kawali.
<**PV**>cook a while ago NPVT mother **PVT spaghetti** BEN child INS pan
'The mother cooked spaghetti for the child with the pan.'

Benefactive Voice (BV)

(3) **Ip**in**ag**-luto kani-kanina lang ng nanay **ang anak** ng spaghetti gamit_ang kawali.
BV-cook a while ago NPVT mother **PVT child** NPVT spaghetti INS pan
'The mother cooked spaghetti for the child with the pan.'

Instrumental Voice (IV)

(4) **Ip**in**an**-luto kani-kanina lang ng nanay **ang kawali** ng spaghetti para_sa anak.
IV-cook a while ago NPVT mother **PVT pan** NPVT spaghetti BEN child
'The mother cooked spaghetti for the child with the pan.'

GLOSS: AG(agent), AV(agent voice), BEN(benefactive), BV(benefactive voice), INS(instrument), IV(instrument voice), NPVT(non-pivot), PAT(patient), PV(patient voice), PVT(pivot)

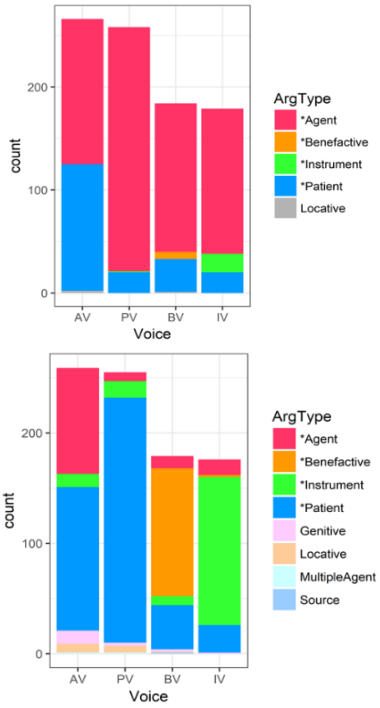

FIGURE 2. Counts of argument choices for the first argument position following the verb (top panel) and the second position (bottom), by voice.

FIGURE 1. Sample visual scene for the verb cook '*luto*', displaying the arguments mother, spaghetti, child, and pan.

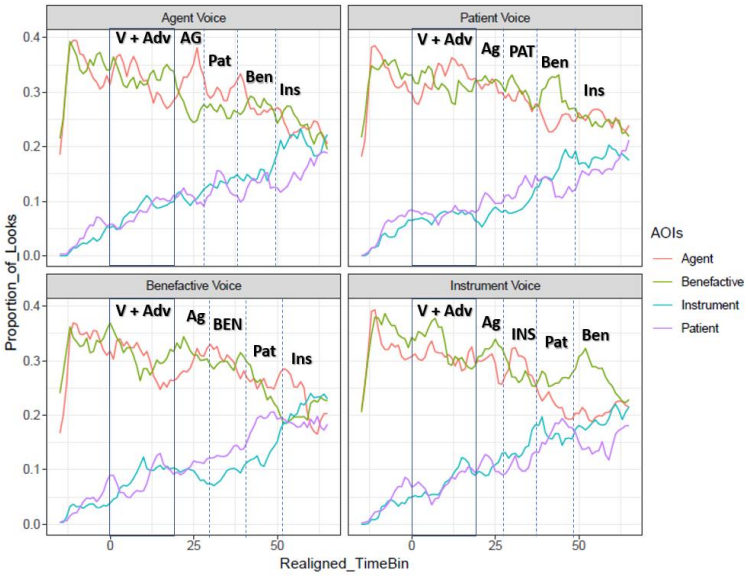

FIGURE 3. Proportion of looks to AOIs depicting the agent, benefactive, instrument, and patient arguments, by voice condition. Time is aligned with the onset of the verb. The solid box indicates the verb-adverb region. Subsequent argument regions are marked by dotted vertical lines; the pivot label is fully majuscule. Note that word orders vary by voice to reflect the most frequent order found in Exp1.

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