PROSODIC INDICATORS OF PHRASE STRUCTURE IN TAGALOG TRANSITIVE SENTENCES*

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To date, there has not been much consensus regarding the phrase structure of Tagalog despite the amount of research done and evidence brought to bear on this issue. This paper contributes to this ongoing discussion by presenting experimental data from the prosody of this language. The major finding of this study is that in Tagalog transitive sentences, verbs are durationally shorter when directly followed by the less syntactically prominent argument, suggesting that these arguments form tighter constituents with the verb.

1. Introduction

As with many verb-initial langauges, much attention has been given to the phrase structure of Tagalog and its derivation. In addition to verb-initial word order, Tagalog exhibits a number of interrelated phenomena that are typically thought to interact with phrase structure. These are the so-called voice system, the case marking patterns, and the A-bar extraction restrictions. The variation between analyses proposed to account for Tagalog phrase structure is very wide. This is likely due in part to the number of interrelated phenomena that need to be accounted for, and in part to the amount of conflicting evidence, such as constituency tests, binding facts, and definiteness/specificity, that has been used to argue for the different analyses.

The main point of interest for this study is constituency. What parts of a Tagalog sentence (if any) form tighter syntactic units? Do any patterns correlate with properties of the syntactic objects involved (e.g., linear position, verb form, thematic role, case marking, etc.)? To answer this question, this paper presents experimental data on the prosody of Tagalog. As we will see, facts pertaining to word duration suggest that the answer to the first question is yes, and that the major determining factor of the grouping is case marking.

This paper is organized as follows. Section 2 presents the necessary background on Tagalog and the literature on its phrase structure. Section 3 outlines the experimental methods. Section 4 presents and discusses the findings, including

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the aforementioned duration results, as well as experimental confirmation of certain word order preferences. Section 5 concludes.

2. Background

Aside from its verb-initial word order, one of Tagalog's most prominent features is the so-called Philippine-type voice system. In a Tagalog clause, voice[1] morphology on the verb tracks the thematic role of the syntactically prominent DP, marked *ang*. This is illustrated by the pair of examples in (1).

In (1a), the verb bears the infix <*um*>, signaling agent voice (AV), so the agent *bata* 'child' is marked *ang*. In (1b), the verb bears the infix <*in*>, signaling patient voice (PV),[2] so here the patient *isda* 'fish' is marked *ang*. Core arguments that are not *ang*-marked are marked *nang*,[3] as is the case in the pair below. At least two more voices are identifiable in Tagalog, but this study focuses on AV and PV.

(1) a. *Agent Voice* (AV)
K<um>ain ang bata nang isda.
<AV>ate ANG child NANG fish
'The child ate fish.'

b. *Patient Voice* (PV)
K<in>ain nang bata ang isda.
<PV>ate NANG child ANG fish
'The child ate the fish.'

There is also some degree of variablilty with regards to the relative order of the post-verbal DPs. Thus, the verb-patient-agent orders in (2) are also grammatical alongside the verb-agent-patient orders in (1).

(2) a. *V-Pat-Agt order* (AV)
K<um>ain nang isda ang bata.
<AV>ate NANG fish ANG child
'The child ate fish.'

b. *V-Pat-Agt order* (PV)
K<in>ain ang isda nang bata.
<PV>ate ANG fish NANG child
'The child ate the fish.'

Given the four configurations shown above, it is natural to ask whether or not there are structural differences between them, and what determines any such differences. Considering the range of different approaches taken to explain the patterns above (i.e., voice morphology, case marking, argument order), two different predictions are made with respect to this question. Here I will assume that the level of syntactic representation relevant for constituency is surface structure (i.e., after all necessary movements are made, resulting in the surface word order).[4]

The first is the prediction that [V *nang*-DP] forms a constituent to the exclusion of the *ang*-DP. This constituency is adopted by Guilfoyle, Hung, and Travis

[1]Alternatively called focus or topic.

[2]The infix <*in*> also appears with other non-agent voices, but PV can be identified here because no other morphology is present on the verb.

[3]This marker is spelled *ng* in the standard orthography. The spelling used here better reflects its phonological form to avoid potential confusion.

[4]It should be noted, however, that some analyses account for surface structure and word order (and subsequently constituency) more explicitly than others.

(1992), who propose that the *ang*-DP raises to a right-side Spec-IP position in sentences like (1b,2a). A similar constituency is adopted by Kaufman (2009), who views the [V *nang*-DP] constituent as base-generated (as opposed to resulting from evacuation of the *ang*-DP). The two analyses also differ in how they treat (1a). Guilfoyle et al. argue that the *ang*-marked agent does not move in this example, resulting in the two DPs forming a constituent excluding V, which has raised to I. On the other hand, Kaufman does not explicitly account for the possibility of (1a). Kaufman's analysis also does not explicitly account for (2b), but this gap is shared with Guilfoyle et al., who note that this is a marked configuration.

The second prediction is that the *ang*-DP and the *nang*-DP consistently form a constituent to the exclusion of the verb, the same constituency that the Guilfoyle et al. analysis assigns to just (1a). This is the route taken by Kroeger (1993), who uses flexible post-verbal word order as evidence for a flat, non-configurational VP from which V raises to I. The same goes for the ergative approach taken by Aldridge (2004) and the Case agreement approach of Rackowski (2002), which derive verb-initial word order via head movement of the verb, leaving both argument DPs in (a configurational) *v*P. Similar to Kaufman (2009) however, the details of how the latter two analyses account for the word order variation among the DPs is unclear, so it is hard to say if these analyses predict any difference between (1b,2a) and either of (1a,2b), like Guilfoyle et al. do.

Given these predictions, the goal of this paper is to provide evidence that will hopefully help adjudicate between them. This study thus rigorously investigates the prosodic properties of "transitive" (or two-argument) sentences in Tagalog, taking (1-2) as a model, to see whether or not systematic differences between the various configurations exist.

3. Experimental Methods

The data for this study was collected via an experimental procedure where participants produced various sentences based on text prompts. Spoken sentences were recorded and then analyzed using the following procedure.

3.1. Stimuli

The stimuli consisted entirely of verb-initial sentences with roughly an agent and a patient argument, which were constructed by controlling three variables:

- voice morphology: AV vs PV,
- order of arguments: whether the *ang*- or *nang*-marked DP came first, and
- presence or absence of adjectives on both arguments.

Crossing the first two variables results in the small paradigm in (1-2). The third variable was included in an effort to help ensure ample time for potential pitch contours to be realized.[5] The result is a template of eight ($2 \times 2 \times 2$) different sentences (con-

[5]The discussion will largely ignore the third variable since pitch is not discussed in this paper.

ditions) as illustrated by the sample experimental item in Table 1. Following this template, 16 experimental items (sets of eight sentences) were constructed for a total of 128 (8×16) sentences.[6] No fillers were used.

Table 1: Sample Experimental Item

Verb	Det	Adjective	Noun	Det	Adjective	Noun
'killed'		'brave'	'whale'		'ferocious'	'shark'
P<um>atay	ang		balyena	nang		pating
P<um>atay	nang		balyena	ang		pating
P<in>atay	ang		balyena	nang		pating
P<in>atay	nang		balyena	ang		pating
P<um>atay	ang	matapang na	balyena	nang	mabangis na	pating
P<um>atay	nang	matapang na	balyena	ang	mabangis na	pating
P<in>atay	ang	matapang na	balyena	nang	mabangis na	pating
P<in>atay	nang	matapang na	balyena	ang	mabangis na	pating

Note that verbs with interchangeable arguments were chosen, to allow changing of the relative order of agent and patient by changing just the positions of the DP markers *ang* and *nang* and keeping the nouns in place. The sentences above all involve a killing event with a (brave) whale and a (ferocious) shark, but differ with respect to which animal is the killer. Care was also taken to avoid verb forms that had any suffixes.

3.2. Procedure

16 native speakers of Tagalog participated in this study. All unavoidably had some degree of proficiency in another language, particularly English. Participants were 18–45 years old at the time of the study, and were living in the capital Manila (they were either natives of the city, or of the surrounding provinces).

Data was collected through a self-paced production task, carried out via Psychtoolbox in Matlab (Brainard 1997; Pelli 1997; Kleiner et al. 2007). Each participant was shown all 128 stimulus sentences. For each sentence, participants were instructed to do the following:

- read the sentence silently to familiarize themselves with it,
- initiate recording by pressing a key,
- read the sentence aloud,
- terminate recording by pressing a key again, and
- rate the naturalness of the sentence on a 1 (worst) – 7 (best) scale.

Tokens were presented to participants in a pseudorandom order: no consecutive items were from the same item or the same condition, a token from each condition appeared exactly once in every block of eight, and a token from each item appeared exactly

[6] A summary of all 16 experimental items is given in Appendix A.

once in every block of sixteen. Finally each sentence was presented with one of four frame sentences to anticipate late starts and early stops of the recording. These frames were pre-determined for each item.[7] Below in (3) is an example.

(3) *Alam mo?* Pinatay nang balyena ang pating. *Yun ang kwento sa akin.*
'*Did you know?* The whale killed the shark. *That's the story I was told.*'

3.3. Data Processing

A total of 2048 (128×16) sound files were collected. For each sound file, leading and trailing silence was manually truncated with the assistance of a Praat (Boersma and Weenink 2013) script. During truncation, bad sound files were identified and excluded. These included cases of stuttering, disfluency, or the recorded token not matching the stimulus sentence.

Annotation of word and phone boundaries was carried out automatically using the Prosodylab Forced Aligner (Gorman et al. 2011). This procedure requires a list of transcriptions of all words contained in the dataset. A phonemic transcription based on the dialect of Tagalog spoken by the author was used.

With another Praat script, acoustic measures were extracted from (up to) seven words of interest in each annotated file. These words of interest were the verb, the markers *ang* and *nang*, both adjectives, and both nouns.

Finally, analysis of these measures was carried out using mixed effects linear regression models (via the R `lmerTest` package). This was done with the intention of filtering out any by-item and by-participant variability. Models with uncorrelated by-item and by-participant random terms were used, as correlated random terms caused non-convergence. In order to make effect sizes more comparable, all predictors were standardized by subtracting their means and dividing by two standard deviations (via the `rescale` function of the R `arm` package). To account for outliers, all models were generated by first fitting on all data, excluding datapoints whose residuals for that model fell outside 2.5 standard deviations from the mean residual value, then refitting the same model on the subset data.

4. Results and Discussion

Three major results are reported in this paper. The first is experimental confirmation of word order preferences between the four configurations exemplified in (1-2). The remaining two pertain to the durations of the verb and the first noun, which do differ between the various configurations. It will be argued that the patterns described here support the view that the verb and the *nang*-marked DP form a constituent (excluding the *ang*-marked DP) when they are linearly adjacent.

[7] A summary of all frames and which items they correspond to is also given in Appendix A.

4.1. Word Order Preference

The results from the naturalness ratings confirm the word order preference occasionally noted by some authors (Guilfoyle et al. 1992; Rackowski 2002, e.g.,): an *ang*-marked DP immediately following a PV verb is dispreferred. This is illustrated by the plot in Figure 1, which also shows that the highest-rated word order was PV verb followed by the *nang*-DP. The two AV configurations were rated between the two PV configurations.

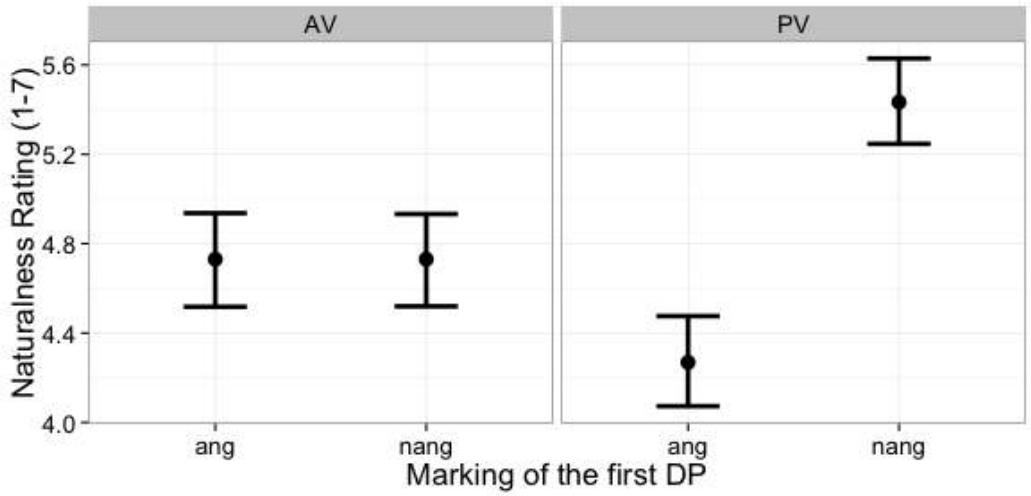

Figure 1: Means and 95% confidence intervals of naturalness ratings (1–7 scale) separated by voice and argument order

The pattern illustrated in Fig. 1 is confirmed by the model reported in Table 2 below. Five predictor variables were selected for this model: three single predictors (corresponding to the three manipulated variables listed in section 3.1: Voice, First DP, Adjective) and two interactions (for Voice–First DP and First DP–Adjective).[8] In the table below, text in parentheses indicate the value of the variable with respect to which the numbers of that row should be interpreted. For example, "Voice (PV)" means that the effect size of 1.55×10^{-2} represents the increase in (rescaled/standardized) naturalness rating *from* AV *to* PV (i.e. PV is rated higher, although not statistically significantly so, as it turns out).

Table 2 shows that the largest effect on naturalness is the interaction of voice and first DP, whereas only voice or only first DP do not have a significant effect. These results intuitively mean that while there is no relative difference between *ang*-first and *nang*-first sentences overall, we do find a difference when we separate the two voices. In PV, *nang*-first sentences are rated higher than *ang*-first sentences,

[8]The remaining interaction, between voice and presence of adjectives, did not appear to be a relevant predictor in initial inspection of the data, so it was not included in the model.

Table 2: Mixed-effects linear regression model results for rescaled naturalness rating

	Fixed Effects			Random Effects	
Predictor	Effect Size	Std. Error	p-value	by-item σ	by-part. σ
Voice (PV)	1.55×10^{-2}	2.44×10^{-2}	0.536	5.74×10^{-2}	3.75×10^{-2}
First DP (*nang*)	1.31×10^{-1}	8.02×10^{-2}	0.122	1.01×10^{-2}	3.13×10^{-1}
Adjective (None)	6.68×10^{-2}	2.06×10^{-2}	0.006 **	4.46×10^{-2}	2.28×10^{-8}
Voice–First DP	2.41×10^{-1}	1.06×10^{-1}	0.032 *	3.02×10^{-1}	2.63×10^{-1}
First DP–Adjective	1.07×10^{-3}	3.46×10^{-2}	0.975	—	—

***: $p < 0.001$ **: $p < 0.01$ *: $p < 0.05$

and this difference in rating is greater than in AV. We also find the largest by-item and by-participant random effects for this predictor (indicating that there was a good amount of variation item-to-item and participant-to-participant), but this is likely due to the varying pragmatic naturalness of the different items and idiosyncratic rating heuristics adopted by each participant.

4.2. Verb Duration

Figure 2 below illustrates the results pertaining to duration of the verb (split again into the four conditions). Notice that the verb is consistently shorter when it is immediately followed by the *nang*-marked DP. Interestingly, between the two *nang*-first conditions, the verb appears to be shorter in PV.

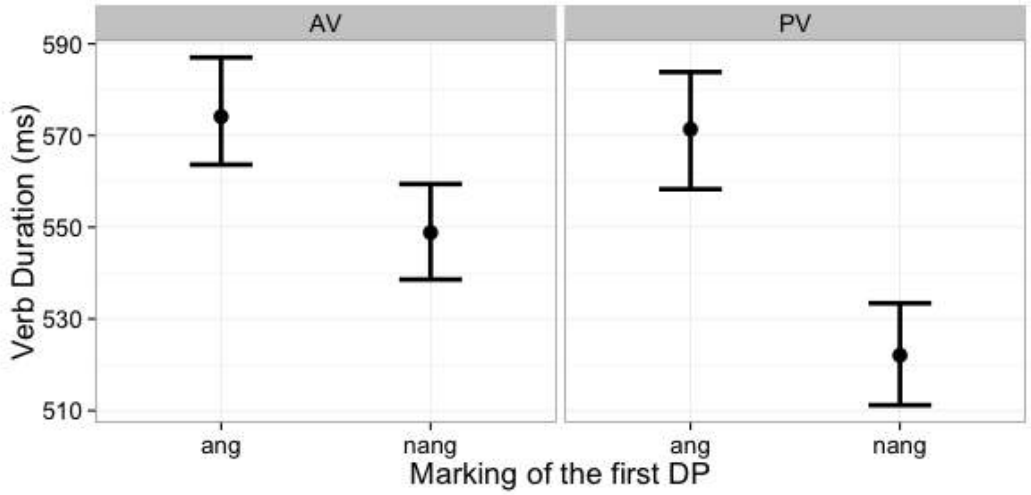

Figure 2: Means and 95% confidence intervals of absolute verb duration (ms) separated by voice and argument order

Results from the regression model run on (log) verb duration are reported in Table 3. This model uses the same predictors as the model reported in Table 2,

with the addition of a predictor corresponding to rating (standardized in the manner described in section 3.3). This predictor was added to account for the possibility that the verb duration pattern shown in Fig. 2 might be explained in part by naturalness.

Table 3: Mixed-effects linear regression model results for log verb duration

	Fixed Effects			Random Effects	
Predictor	Effect Size	Std. Error	p-value	by-item σ	by-part. σ
Voice (PV)	-2.89×10^{-2}	1.22×10^{-2}	0.032 *	4.33×10^{-2}	—
First DP (*nang*)	-6.00×10^{-2}	8.92×10^{-3}	< 0.001 ***	1.84×10^{-2}	2.04×10^{-2}
Adjective (None)	-3.22×10^{-2}	6.61×10^{-3}	< 0.001 ***	1.38×10^{-2}	1.26×10^{-8}
Stdized. Rating	-1.64×10^{-2}	1.06×10^{-2}	0.138	3.17×10^{-2}	1.47×10^{-8}
Voice–First DP	-3.98×10^{-2}	1.53×10^{-2}	0.021 *	3.41×10^{-9}	4.07×10^{-2}
First DP–Adjective	1.97×10^{-2}	1.12×10^{-2}	0.080	2.87×10^{-8}	1.01×10^{-8}

***: $p < 0.001$ **: $p < 0.01$ *: $p < 0.05$

The results from this model show that the order of arguments (First DP) has the largest effect on verb duration, such that it is much shorter when the immediately following DP is *nang*-marked. Note that like in the previous subsection, the interaction of voice and argument order has a large significant effect, confirming the difference between the two *nang*-first columns illustrated in Fig. 2. Finally, the model shows that naturalness rating is not a significant predictor of verb duration.

The effect of voice is also significant in this model, but has a large by-item random effect. In another model where verb duration is normalized by dividing by the number of phones, the effect of this predictor is no longer significant. This may be due to the specific phonological form of the voice morphemes used. For example, the difference in duration between *p<um>atay* and *p<in>atay* ('killed') might be different from the difference between *nag-dala* and *d<in>ala* ('brought').

4.3. First Noun Duration

Finally, we have the following picture from the duration of the first noun. Figure 3 below shows a mirrored picture of Figure 2. That is, the first noun is *longer* if it is *nang*-marked (compared to the shorter verb in the *nang*-first condition). While there also appears to be a difference between the two *nang*-first conditions, this does not turn out to be a significant effect.

Table 4 shows the model results for (log) duration of the first noun, using the same predictors as the model for verb duration. The largest effect (after presence of adjectives) is that of the order of arguments (First DP): the first noun is durationally longer if it is *nang*-marked. On the other hand, the interaction between voice and order of arguments did not have a significant effect, as previously mentioned. Additionally, naturalness had an effect on first noun duration (shorter for tokens rated as being more natural), although this is the smallest of the significant effects.

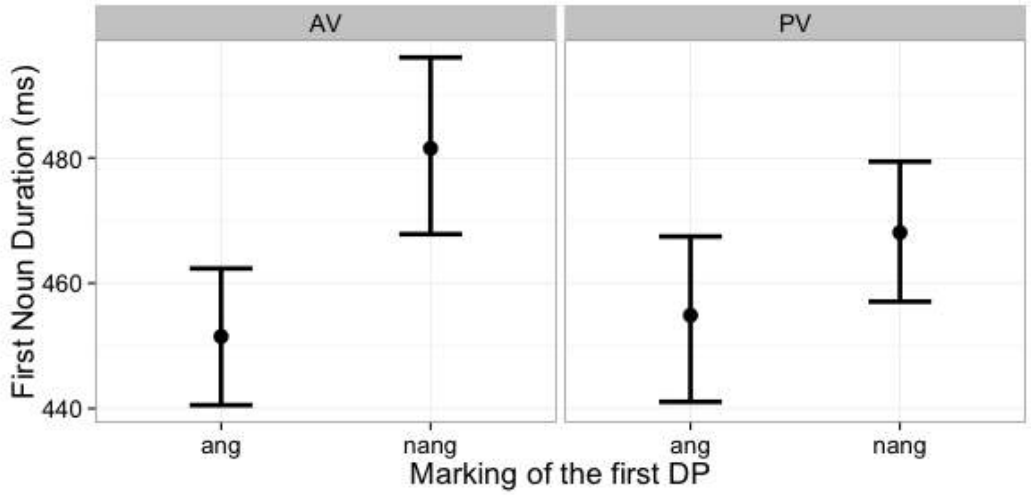

Figure 3: Means and 95% confidence intervals of absolute duration of the first noun (ms) separated by voice and argument order

Table 4: Mixed-effects linear regression model results for log first noun duration

	Fixed Effects			Random Effects	
Predictor	Effect Size	Std. Error	p-value	by-item σ	by-part. σ
Voice (PV)	-1.17×10^{-2}	6.62×10^{-3}	0.098	3.20×10^{-9}	1.50×10^{-3}
First DP (*nang*)	3.76×10^{-2}	1.23×10^{-2}	0.007 **	3.23×10^{-2}	2.56×10^{-2}
Adjective (None)	-1.31×10^{-1}	1.80×10^{-2}	< 0.001 ***	2.78×10^{-2}	6.10×10^{-2}
Stdized. Rating	-2.53×10^{-2}	1.02×10^{-2}	0.026 *	2.35×10^{-2}	4.45×10^{-3}
Voice–First DP	-2.13×10^{-2}	1.99×10^{-2}	0.302	3.17×10^{-2}	4.92×10^{-2}
First DP–Adjective	1.54×10^{-2}	1.60×10^{-2}	0.360	1.33×10^{-2}	3.37×10^{-2}

***: $p < 0.001$ **: $p < 0.01$ *: $p < 0.05$

4.4. Discussion

The results from verb duration and first noun duration taken together support the claim that the verb and the *nang*-marked DP form a constituent to the exclusion of the *ang*-marked DP when they are adjacent to each other. Recall that in the *nang*-first conditions, the verb is shorter and the first noun is longer. Taking longer duration to be an instance of phrase-final lengthening suggests that the first noun in the *nang*-first conditions is at the right edge of a phrase. Furthermore, the lack of such lengthening on the verb indicates that it is part of the same phrase as the first (*nang*-marked) DP.

On the other hand, the longer duration of the verb in *ang*-first conditions suggests that this element is a constituent by itself, as *it* is subject to phrase-final lengthening. In these cases, it would appear that the first (*ang*-marked) DP does not undergo lengthening, suggesting that it forms a constituent with the following (*nang*-marked) DP.

These results are the most in line with the predictions made by Guilfoyle et al. (1992) and Kaufman (2009), as discussed in section 2. Both analyses assign closer constituency between the verb and the *nang*-marked DP when they are adjacent. However, neither analysis immediately predicts the correct behavior for both of the *ang*-first conditions. For Kaufman (2009), even the possibility of *ang*-first sentences is not addressed directly (other than by scrambling), while for Guilfoyle et al. (1992), *ang*-first PV sentences are explicitly not generable.[9]

The data here also raise a question regarding the potentially exceptional behavior of PV verbs and their *nang*-marked agents. As previously mentioned, it has been noted that there is a preference for *nang*-marked agents to appear adjacent to the verb. This was confirmed by the data from the naturalness ratings. The duration data also seems to suggest that there is an acoustic correlate to this preference, even though preference itself did not directly have an effect on duration (at least for the verb).

5. Conclusion

This paper presented prosodic data corroborating one competing claim in the literature regarding constituency in Tagalog, namely that verbs form constituents with adjacent *nang*-marked arguments to the exclusion of *ang*-marked ones. While less has been said about the status of verbs with adjacent *ang*-marked arguments, this study suggests that these form separate constituents, the verb on its own and the *ang*-marked DP with the following *nang*-marked one.

Future work in this area might focus on the more complex, but potentially more informative pitch data. Additionally, eventual expansion to more sentence types (e.g., involving different voice forms) would yield a more complete picture of the prosodic behavior of these constructions. Finally, given that the differences dealt with here are relatively small, more work specifically designed to rule out potential phonetic explanations of the patterns discussed might be of use. For example, we might construct stimuli with adverbs or second position clitics intervening in between the sentence-initial verb and the first DP to help neutralize any potential effect the difference in phonological shape between *ang* and *nang* might cause.

A. Appendix: Summary of Stimuli

Sentence frames:

1. *Alam mo? <Target Sentence> Yun ang kwento sa akin.*
   "Did you know? <*Target Sentence*> That's the story I was told."
2. *May nalaman ako. <Target Sentence> Ang galing!*
   "I found something out. <*Target Sentence*> Wow!"

[9]These results also line up with Tagalog's coordination behavior, pointed out by Kroeger (1993). VP-like coordination may consist of two [V *nang*-DP] constituents with a shared *ang*-DP, but not with two instances of [V *ang*-DP] and a shared *nang*-DP.

3. *Sabihin ko daw sa iyo. <Target Sentence> OK?*
   "I was told to tell you. *<Target Sentence>* OK?"
4. *Sabi daw: <Target Sentence> Totoo kaya?*
   "They say: *<Target Sentence>* I wonder if it's true."

Table 5: Summary of experimental items

AV form	PV form	English	Adjectives	Nouns
p<um>atay	*p<in>atay*	'killed'	*matapang na* 'brave'	*balyena* 'whale'
Frame: 1			*mabangis na* 'fearsome'	*pating* 'shark'
nag-dala	*d<in>ala*	'brought'	*itim na* 'black'	*pusa* 'cat'
Frame: 2			*puting* 'white'	*daga* 'rat'
k<um>ain	*k<in>ain*	'ate'	*matandang* 'old'	*lalaki* 'man'
Frame: 3			*malaking* 'big'	*buwaya* 'crocodile'
h<um>ipo	*h<in>ipo*	'touched'	*makulit na* 'persistent'	*sanggol* 'baby'
Frame: 4			*maamong* 'tame'	*aso* 'dog'
na-ngiliti	*k<in>iliti*	'tickled'	*mabait na* 'kind'	*doktor* 'doctor'
Frame: 1			*masayang* 'happy'	*bata* 'child'
b<um>i~bili	*b<in>i~bili*	'buying'	*matabang* 'fat'	*lapu-lapu* '(fish species)'
Frame: 2			*masiglang* 'lively'	*talaba* 'oyster'
na-ngurot	*k<in>urot*	'pinched'	*pikuning* 'upsettable'	*nars* 'nurse'
Frame: 3			*masamang* 'wicked'	*pasyente* 'patient'
h<um>uli	*h<in>uli*	'caught'	*matalinong* 'smart'	*lobo* 'wolf'
Frame: 4			*maliit na* 'small'	*tigre* 'tiger'
k<um>agat	*k<in>agat*	'bit'	*pulang* 'red'	*ahas* 'snake'
Frame: 1			*mabagal na* 'slow'	*pagong* 'turtle'
b<um>ati	*b<in>ati*	'greeted'	*matangkad na* 'tall'	*guro* 'teacher'
Frame: 2			*masipag na* 'hardworking'	*estudyante* 'student'
nang-gulat	*g<in>ulat*	'surprised'	*galit na* 'angry'	*unggoy* 'monkey'
Frame: 3			*malungkot na* 'sad'	*ibon* 'bird'
nag-luto	*l<in>uto*	'cooked'	*mabahong* 'smelly'	*manok* 'chicken'
Frame: 4			*dilaw na* 'yellow'	*baboy* 'pig'
na-nuntok	*s<in>untok*	'punched'	*maruming* 'dirty'	*ipis* 'cockroach'
Frame: 1			*malinis na* 'clean'	*langgam* 'ant'
b<um>angga	*b<in>angga*	'crashed into'	*bagong* 'new'	*sasakyan* 'car'
Frame: 2			*magarang* 'extravagant'	*dyip* 'jeepney'
nag-be~benta	*b<in>e~benta*	'selling'	*malakas na* 'strong'	*pabo* 'turkey'
Frame: 3			*malinis na* 'clean'	*maya* 'sparrow'
na-na~nakot	*t<in>a~takot*	'scares'	*masungit na* 'grumpy'	*bayawak* 'monitor lizard'
Frame: 4			*magandang* 'beautiful'	*paniki* 'bat'

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Contents