The role of voice morphology in processing Tagalog A-bar dependencies

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1 Preliminaries

1.1 Psycholinguistics

Comprehenders attempt to link a moved DP with a gap even before there is any direct evidence in the input (Crain & Fodor, 1985; Frazier, 1987; Garnsey, Tanenhaus, & Chapman, 1989; Stowe, 1986).

(1) (a) Which book did you read last night?
✓

(b) Which book did you read a review of last night?
✗✓

Frazier (1987) referred to this as the active filler strategy.

Predictive association is a systematic risk that comprehenders take when interpreting A-bar dependencies in real-time.

BIG QUESTION: What types of linguistic cues do speakers employ to guide their predictions and ease the uncertainty, and facilitate their interpretations of FGDs?

1.2 Tagalog morphosyntax

Verbs carry overt morphology that encodes on the verb information about the thematic relation and structural position of the “subject” (Rackowski & Richards, 2005; Schachter & Otanes, 1983).

(2) (a) -um- signals that the subject is the agent and the EA

\[ \text{Bumili ng=lalaki ng=isda sa=tindahan} \]

buy man fish store

‘The man bought fish at the store’

(b) -in- signals that the subject is the theme and the IA

\[ \text{Binili ng=lalaki ng=isda sa=tindahan} \]

buy man fish store

‘The man bought the fish at the store’

Two analyses treat -um- and -in- differently: Aldridge (2012) as spellouts \( \nu \); Rackowski and Richards (2005) as Case-agreement with the highest DP in [Spec, \( \nu P \)]. They propose comparable structures

1This project has benefited from discussions with Sandy Chung. We are indebted to Soleil Davíd and other Tagalog-speakers for their help with the facts of the language. We extend our gratitude to Grant McGuire, Edith Aldridge, Maria Polinsky, Eric Potsdam, the Linguistics Department at the University of the Philippines – Diliman, and members of s/lab, and Linguistics 290 research seminar cohort at UC Santa Cruz. We also thank the audiences at the Linguistic Summer Institute poster session at the University of Chicago, and at the 29th Annual CUNY Conference on Human Sentence Processing for their questions and insights. The usual disclaimers apply. This material is based upon work supported by UCSC Department of Linguistics, and the NSF BCS #1251429 (to M. Wagers).

2We abstract away from the controversial status of subjecthood in Philippine languages. We use the term subject for expository ease.
A NARROWER QUESTION: Can voice morphology guide the comprehender’s prediction by allowing them to infer the position of the gap in A-bar dependencies, and in particular, wh-questions?

1.3 Roadmap

§ 2 provides more information about Tagalog morphosyntax
§ 3 describes the two experiments conducted
§ 4 presents and discusses the results
§ 5 concludes by outlining follow-up experiments

2 More Tagalog morphosyntax

2.1 Extraction restriction on A-bar dependencies

Only the subject can undergo extraction (Aldridge, 2002; Rackowski, 2002; Sabbagh, 2005).

(4) (a) Verb has -um-; agent/EA is extracted

Aling babae (ba) ang=sumipa ng=bata?
which woman Q kick child
‘Which woman kicked a child?’

(b) Verb has -um-; theme/IA is extracted

*Aling bata (ba) ang=sumipa ang=babae?
which child Q kick woman
Intended: Which child did the woman kick?

(c) Verb has -in-; theme/IA is extracted

Aling bata (ba) ang=inipa ng=babae?
which child Q kick woman
‘Which child did the woman kick?’

(d) Verb has -in-; agent/EA is extracted

*Aling babae (ba) ang=sinipa ang=bata
which woman Q kick child
Intended: Which woman kicked a child?

Patterns of restriction on extraction can be schematized below:

(5) Schematization of how voice morphology interacts with A-bar dependencies

<table>
<thead>
<tr>
<th>Voice</th>
<th>Extracted DP</th>
</tr>
</thead>
<tbody>
<tr>
<td>-um-</td>
<td>Good</td>
</tr>
<tr>
<td>-in-</td>
<td>Bad</td>
</tr>
</tbody>
</table>

HOWEVER, offline acceptability judgment ratings revealed that patterns of extraction restriction are not as clear.

(6) Breakdown of ratings per condition.

Starting from top left and going clockwise: (a) verb has -um- and EA is extracted; (b) verb has -um- and IA is extracted; (c) verb has -in- and IA is extracted; and (d) verb has -in- and EA is extracted.
2.2 Without voice

To isolate the contribution of voice in real-time processing, we need to compare how sentences with voice and those without it are processed.

In iteratives and recent perfectives, the verb does not (obligatorily) exhibit voice, but comparable restrictions on A-bar dependencies are imposed.

2.2.1 Facts about the iterative aspect

It denotes repeated or prolonged actions.

Form: complete reduplication of the verb where the original and the reduplicand are separated by nang.

(7) (a) Iterative with -um-

\[ \text{Bumati-nang-bumati ng=mga=visita ang=hostes} \]
\[ \text{ITERATIVE: greet visitors hostess} \]

‘The hostess kept on greeting visitors’

(b) Iterative with -in-

\[ \text{Binati-nang-binati ng=hostes ang=mga=visita} \]
\[ \text{ITERATIVE: greet hostess visitors} \]

‘The hostess kept on greeting the visitors’

Iteratives showing voice have the same restrictions as the ones outlined in § 2.1

Voice is optional in iteratives (Schachter & Otanes, 1983, pp. 398–9). Without voice, the subject can only be interpreted as the EA.

(8) (a) DP hostes is the subject and the EA

\[ \text{Bati-nang-bati ng=mga=visita ang=hostes} \]
\[ \text{ITERATIVE: greet visitors hostess} \]

‘The hostess kept on greeting visitors’

*The visitors kept on greeting a hostess.

(b) DP mga visita is the subject and the EA

\[ \text{Bati-nang-bati ng=hostes ang=mga=visita} \]
\[ \text{ITERATIVE: greet hostess visitors} \]

‘The visitors kept on greeting a/the hostess’

*The hostess kept on greeting visitors.

Like -um-marked verbs, only the EA can be extracted when iteratives do not exhibit voice.

(9) (a) Mataba ang=hostes na bumati ng=mga=visita

\[ \text{Fat hostess LNK greet visitors} \]

‘The hostess who greeted visitors is fat.’

*The hostess who the visitors greeted is fat.

(b) Mataba ang=hostes na bati-nang-bati ng=mga=visita

\[ \text{Fat hostess LNK ITERATIVE: greet visitors} \]

‘The hostess who kept on greeting visitors is fat.’

*The hostess who the visitors kept on greeting is fat.

∴ We can use iteratives to isolate the contribution of -um-

2.2.2 Facts about the recent perfective aspect

It denotes events that have occurred in the recent past.

Form: Prefix ka- followed by CV-reduplication of the verb root (formal) or the prefix kaka- (informal)

Verbs in this aspect have two quirky properties:

- No voice morphology (Kroeger, 1993);
No DP is *ang*-marked; both EA and IA are generally *ng*-marked.

Lack of voice morphology and same morphological case for both co-arguments renders sentences globally ambiguous. Ambiguity also arises in A-bar dependencies.

(10) (a) Ambiguous in a “run of the mill” declarative sentence

\[
\text{Kaka-yakap lang ng=bata ng=guro} \\
\text{REC.PERF-hug just child teacher} \\
\text{‘The child just hugged the teacher.’} \\
\text{‘The teacher just hugged the child.’}
\]

(b) Ambiguous in topicalization

\[
\text{Ang=guro kaka-yakap lang niya/ni=Maria} \\
\text{teacher REC.PERF-hug just 3SG/Maria} \\
\text{‘The teacher, the child just hugged him.’} \\
\text{‘The teacher, he just hugged the child.’}
\]

When one of the co-arguments is a personal pronoun or a proper name, it must be construed as the EA. Thus, the extracted DP must be construed as the IA because the pronoun/proper name that remains in situ must be parsed as the EA.

(11) (a) Proper name or pronoun must be parsed as the EA

\[
\text{Kaka-yakap lang niya/ni=Maria ng=guro} \\
\text{REC.PERF-hug just 3SG/Maria teacher} \\
\text{‘She/Maria just hugged the teacher.’} \\
\text{*The teacher just hugged her/Maria.}
\]

(b) Extracted DP must be parsed as the IA

\[
\text{Ang=guro kaka-yakap lang niya/ni=Maria} \\
\text{teacher REC.PERF-hug just 3SG/Maria} \\
\text{‘The teacher, she/Maria just hugged him.’} \\
\text{*The teacher, he just hugged her/Maria.}
\]

Like *-in*-marked verbs, extraction can be restricted to only IAs.

(12) (a) \text{Ang=guro niyakap niya/ni=Maria kani-kanina lang} \\
\text{teacher hug 3SG/Maria recently just} \\
\text{‘The teacher, she/Maria hugged him recently.’} \\
\text{*The teacher, he just hugged her/Maria recently.}

(b) \text{Ang=guro kaka-yakap lang niya/ni=Maria} \\
\text{teacher REC.PERF-hug just 3SG/Maria} \\
\text{‘The teacher, she/Maria just hugged him.’} \\
\text{*The teacher, he just hugged her/Maria.}

\[\text{∴ We can use recent perfectives to isolate the contribution of *-in-}]](2.2.3 Summary)

(13) Pairwise comparisons to isolate the effect of voice

<table>
<thead>
<tr>
<th>Extracted DP</th>
<th>EA</th>
<th>IA</th>
</tr>
</thead>
<tbody>
<tr>
<td>+VOICE</td>
<td>-<em>um</em>-marked verbs</td>
<td>-<em>in</em>-marked verbs</td>
</tr>
<tr>
<td></td>
<td><em>kumakanta</em></td>
<td><em>kinanta</em></td>
</tr>
<tr>
<td>-VOICE</td>
<td><em>iteratives</em></td>
<td><em>recent perfectives</em></td>
</tr>
<tr>
<td></td>
<td><em>kanta nang kanta</em></td>
<td><em>kakakanta lang</em></td>
</tr>
</tbody>
</table>

3 The experiments

3.1 The hypothesis

Voice morphology facilitates processing by allowing comprehenders to sharpen their predictions.

- Morphologically encodes information about the thematic relation and structural position of the subject
- Allows comprehenders to project the structure of vP akin to the structures proposed by Aldridge (2012) and Rackowski and Richards (2005), as in (3).
  - This is a generalized version of the Active Filler Strategy (Wagers, Borja, & Chung, 2015)
We claim the following:

- Input: *Aling dalaga ang umiinom...* →

```
  vP
  DP  v'  VP
  dalaga v  V  DP
    inom ...
```

- Input: *Aling alak ang ininom...* →

```
  vP
  DP  v'  VP
  alak v  V  DP
    inom ...
```

3.2 Methods

**Participants:** 80 Tagalog speakers (40 F and 40 M; 18-35 years old; $M_{age}=23.33; SD_{age}=4.53$)

**Task:** STOPS-MAKING-SENSE (SMS; Boland, Tanenhaus, & Garnsey, 1990; Boland, Tanenhaus, Garnsey, & Carlson, 1995) paradigm

- SMS is a modified version of the SELF-PACED READING (SPR; Just, Carpenter, & Woolley, 1982)
  - Participants are presented with sentences that start out as a row of dashes;
  - When they press space, the first word appears;
  - When they press space again, the next word appears and the previous word becomes a row of dashes again
  - Rinse and repeat until the end of the sentence
- How SMS differs: after the presentation of a word/phrase, participants are given the option to continue with the presentation or reject the sentence because it no longer makes any sense

3.3 Materials

**Design:** 2 (VOICE: ± ) × 2 (PLAUSIBILITY: ± )

Two 12-item sets distributed evenly across four lists via Latin Square

3 items per condition

3.3.1 EA-extraction: Comparing -um-marked verbs and iteratives

(14) (a) +VOICE, +PLAUSIBILITY

```
Aling dalaga ang=umiinom parati ng=tubig...?
which woman drink always water
‘Which young woman always drinks water...?’
```

(b) +VOICE, –PLAUSIBILITY

```
Aling tubig ang=umiinom parati ng=dalaga...?
which water drink.AGR:EA always woman
#Which water always drinks a young woman...?
```

(c) –VOICE, +PLAUSIBILITY

```
Aling dalaga ang=umor-nang-inom ng=tubig...?
which woman ITERATIVE:drink water
‘Which young woman keeps on drinking water...?’
```

(d) –VOICE, –PLAUSIBILITY

```
Aling tubig ang=umor-nang-inom ng=dalaga...?
which water ITERATIVE:drink woman
#Which water keeps on drinking a young woman...?
```

Start out with a plausible sentence, as in (14a).

Manipulate plausibility of (14a) by switching the animacy of the first DP, as in (14b).
Change verb form of (14a) but keep plausibility constant, as in (14c).

Manipulate plausibility of (14c) switching the animacy of the first DP, as in (14c).

3.3.2 IA-extraction: Comparing *-in*-marked verbs and recent perfectives

(15) (a) +Voice, +Plausibility
   Aling alak ang=ininom niya...?
   which wine drink 3.SG
   ‘Which wine did he/she just drink...?’

(b) +Voice, –Plausibility
   Aling babae ang=ininom niya...
   which woman drink 3.SG
   #Which woman did he/she just drink...?’

(c) –Voice, +Plausibility
   Aling alak ang=kaka-inom niya...
   which wine rec.perf-drink 3.SG
   ‘Which wine did he/she just drink...?’

(d) –Voice, –Plausibility
   Aling babae ang=kaka-inom niya...
   which woman rec.perf-drink 3.SG
   #Which woman did he/she just drink...?’

Start out with a plausible sentence, as in (15a).

Manipulate plausibility of (15a) by switching the co-arguments, as in (15b).

Change verb form of (15a) but keep plausibility constant, as in (15c).

Manipulate plausibility of (15c) by switching the co-arguments, as in (15c).

4 Results

4.1 EA-extraction

(16) Cumulative % rejections of EA-extractions at each region by plausibility and voice

![Graph showing cumulative rejections across regions]

The dashed line represents plausible sentences, and the solid line, implausible sentences; the blue line represents verbs with *-um-* and the gold line, verbs in the iterative aspect

MAIN FINDINGS
- In the first three regions, nothing much is going on
  – All conditions are all licit beginnings of WH-questions
- At V and subsequent region, solid lines and dashed lines start to pull apart
  – Implausible sentences were rejected more than their plausible counterparts

In order to calculate the effect of voice in rejecting, we calculated a DISCRIMINABILITY SCORE for each participant. This measures how...
well they are rejecting implausible sentences relative to rejective plausible sentences.

- A DS = 0 suggests that the rates of rejection at a given region of analysis for implausible and plausible sentences were the same.
- A positive DS suggests that the rates of rejection at a given region of analysis for implausible sentences were greater than those for plausible sentences.
- A negative DS suggests that the rates of rejection at a given region of analysis for plausible sentences were greater than those for implausible sentences.

(17) Discriminability scores of EA-extractions at each region by voice

MAIN FINDINGS

- In the first three regions, nothing much is going on
  - DS of -um-marked verbs and that of iteratives are comparable
- At V, DS of -um-marked verbs is significantly greater than that of iteratives
  - Participants were more reliable at rejecting implausible sentences when the verb had -um- than when it did not

4.2 IA-extraction

(18) Cumulative % rejections of IA-extractions at each region by plausibility and voice

The blue line represents verbs with -um-, and the gold line, verbs in the iterative aspect.

The dashed line represents plausible sentences, and the solid line, implausible sentences; the blue line represents verbs with -in-, and the gold line, verbs in the recent perfective aspect.
MAIN FINDINGS

- In the first three regions, nothing much is going on
  - All conditions are all licit beginnings of wh-questions
- At V and subsequent region, solid lines and dashed lines start to pull apart
  - Implausible sentences were rejected more than their plausible counterparts

In order to calculate the effect of voice in rejecting implausible sentences, we calculated a DISCRIMINABILITY SCORE for each participant.

4.3 Summary of Results

We found that:
- There was evidence that -um- facilitated the comprehension of wh-questions
- There was no evidence that -in- did.

These results leave us with two questions:
- Why is there an -um-/in-asymmetry?
- Why are the overall rejection rates attenuated?

4.4 Discussion

We will offer an explanation for the attenuation question first because it will be relevant for our account of the -um-/in-asymmetry.

4.4.1 Attenuation: Blame the syntax!

A summary of the rejection rates is provided below:

(20) Rejection rates summary

<table>
<thead>
<tr>
<th>Voice</th>
<th>-um-</th>
<th>-in-</th>
</tr>
</thead>
<tbody>
<tr>
<td>+PLAUS</td>
<td>7%</td>
<td>2%</td>
</tr>
<tr>
<td>-PLAUS</td>
<td>61%</td>
<td>31%</td>
</tr>
</tbody>
</table>
These results are unexpected because they are attenuated. By hypothesis, voice morphology is a rich source of information because it encodes the thematic and the structural position of the subject.

Our claim: attenuation is a product of the syntax of *wh*-questions

Tagalog *wh*-initiality is derived using a PSEUDO-CLEFTING STRATEGY (Aldridge, 2002, among others), as in (21)
- The *wh*-phrase functions as the predicate
- The rest of the material is a headless relative

\[(21)\]

\[
\begin{array}{c}
\text{Predicate} \\
\text{Which N_i} \\
\ldots \\
\text{DP} \\
\text{DP} \\
\text{CP} \\
\text{ang Ø} \\
\text{Opi V ti}
\end{array}
\]

Based on the structure of *wh*-questions in Tagalog, the relation between the *wh*-phrase and the gap is mediated via predication
- If we assume that there is a temporal lag between the time at which we access syntactic structure and assign interpretation, then we have a potential explanation for the attenuation

\[\therefore\] We call this **Blame the Syntax Hypothesis (BSH)**

**BSH makes a prediction:** if the relation between the *wh*-phrase and the gap is direct (i.e., as part of a movement chain), we expect little or no attenuation.

**A comparison:** *wh*-questions in Chamorro
- *Wh*-questions are derived via direct movement (Chung, 2010)

A summary of the rejection rates in Chamorro is provided below:

\[
\begin{array}{c|c}
\text{Voice} & \\
\text{-in-} & \\
\text{+PLAUS} & 21\% \\
\text{-PLAUS} & 80\%
\end{array}
\]

Even though their results are only for *-in-*, the rejection rates of implausible sentences are still quite high!

\[\therefore\] We take this as evidence supporting BSH. Follow-up experiments need to be conducted to assess its tenability.

4.4.2 Asymmetry: Decomposing the results

We found an asymmetry between the effect of *-um- and -in-*.
- Not unique to this study!
- Has been reported in relative clause acquisition studies (Pizarro-Guevara, 2014; Tanaka et al., 2014, 2015)
- Should we conclude then that *-um- facilitates A-bar comprehension, while *-in-* does not?

**No! We stick to our original hypothesis:** Both *-um-* and *-in-* facilitate A-bar comprehension but their facilitatory effect is mediated by a slew of other things

We argue that the results can be decomposed into the interaction of the following:
- Facilitatory effect of voice
- Attenuating effect of the syntax of *wh*-questions
- Temporal ambiguity found in IA-extractions
The observed effect of *-um*- follows from the interaction of the first two: we see the facilitatory effect of voice but this is attenuated due to the syntax of *wh*-questions.

The apparent lack of effect of *-in*- follows from the interaction of all three: we see the facilitatory effect of voice but this is attenuated due to the syntax of *wh*-questions and it is further dampened by ambiguity.

**How does ambiguity dampen the results?** Recall the following:

(23) There is considerable variation when the verb has *-in*- and the EA is extracted (§ 2.1).

> Aling babae ang=ininom...
> Which woman drink

(a) Implausible continuation
> niya  kani-kanina lang...?
> 3SG recently just ...
> #Which woman did s/he just drink recently...?

(b) Plausible continuation
> ang=alak kani-kanina lang...?
> wine recently just ...
> ‘Which woman just drank wine recently...?’

If the speaker has a permissive grammar, it could be that they are entertaining both the possibilities of extracting the IA and the EA when the verb has *-in*-

- They reserved rejecting the sentence until there was disambiguating evidence (i.e., the co-argument)

(24) Recent perfectives generally allow both EA- and IA-extraction. The way it was construed to be IA-extraction in our experimental items is by having a co-argument that is, a proper name or a pronoun (§ 2.2.2).

> Aling babae ang=kaka-inom lang...
> Which woman REC.PERF-drink

(a) Implausible continuation
> niya  ...?
> 3SG  ...
> #Which woman did s/he just drink recently...?

(b) Plausible continuation
> ang=alak  ...?
> wine  ...
> ‘Which woman just drank wine recently...?’

Similarly, the speaker could also be entertaining both possibilities of extracting the IA and the EA when the verb is in the recent perfective.

- They reserved rejecting the sentence until there was disambiguating evidence (i.e., the co-argument)

**Our claim:** Participants were entertaining alternative analyses at the V-region. Consequently, this was delaying their rejections of implausible sentences.

We have some evidence from their unrejected reading times (RTs)³

³Segment-by-segment reading times of those who chose to continue the presentation at each region were also collected. We refer to these reading times as unrejected reading times (URTs). It should be noted that URTs are akin to reading times from traditional self-paced reading, except under the SMS paradigm, each subsequent region could have fewer observations than the region prior. Recall that data-collection terminated as soon as the participant rejected the sentence.
(25) Mean (unrejected) reading times in ms for IA-extractions at each region by plausibility and agreement.

The dashed line represents plausible fillers, and the solid line, implausible fillers; The blue line represents verbs showing -in-, and the gold line, verbs in the recent perfective aspect.

**Relevant finding:** There was a plausibility effect at the V-region!

That’s nice, but how is this relevant?

- The plausibility effect suggests that speakers were registering a potential semantic anomaly in terms of their RT
- This was not rejected in their rejection rates

∴ Taken together, speakers could have the intended parse already, but because there is an alternative parse available (i.e., the possible continuations), they are delaying their rejections.

5 **Follow-up experiments**

We are thinking of ways to improve the design of our experiments.

- Add more “padding” in between the verb and the co-argument, like temporal adverbs and other bona fide adjuncts
  - It could be that external arguments are just easier to process or there’s some sort of EA-advantage. See Sauppe (2016) for the relevant discussion
  - We might not be seeing the effect of -in- because we did not give it enough time to demonstrate its effects
- Compare -um-marked verbs and the irrealis form of the actor voice
  - There could be an objection that they -um-marked verbs and verbs in the iterative aspect without voice are not true minimal pairs

We are also thinking of determining the tenability of BSH (Blame the Syntax Hypothesis, § 4.4.1)

- Compare the results of experiments where the relationship between the filler and the gap is direct
- Constructions in mind: Topicalization or ay-inversion
- Prediction: We will see stronger facilitatory effects because the relation between the filler and the gap is not mediated, but rather it is direct

**References**


Evidence from wh-questions. *Journal of Memory and Language, 34*(6), 774–806.


