Allocation of Attention During Tagalog Sentence Comprehension

Aldwin Domingo
Argosy University, Orange County

Charles Fletcher & Michael Maratsos
University of Minnesota, Twin Cities

This study investigated the cue validity of ang/si markers, along with word order and agency, on the allocation of attention during Tagalog sentence comprehension. We found that ang/si markers had a marginal effect on allocating attention during a probe recognition task. We also found that the ang/si markers reliably controlled Tagalog speakers' attention during sentence comprehension as indicated by sentence continuations and reference resolution of an ambiguous pronoun. We found that word order did control the attention of Tagalog speakers during reference resolution of an ambiguous pronoun, but only when the ang/si marker was absent. Overall, this study identifies that the ang/si marker has reliable psycholinguistic effects on drawing a reader's attention and guiding Tagalog sentence comprehension.

It has long been known that sentence comprehension is a fairly complex task because of how different sources of knowledge (i.e., syntactic, lexical, pragmatic, discourse, context) interact during sentence processing (Harrington, 2001). Despite this, most children can still master their native language by age 3 or 4. Sentence production and comprehension are even more remarkable when we consider human cognitive limitations, such as short-term working memory (Schacter, 2001). These limitations can cause difficulties in comprehension of sentences, but it is possible to compensate for this limitation within the language itself.

A theoretical model of sentence processing and language acquisition called the Competition Model (MacWhinney & Bates, 1989) was developed in order to account for how the linguistic features of languages can help guide sentence comprehension despite the limitations of short-term working memory. The Competition Model assumes that lexical knowledge is emphasized as the main controller of parsing, processing, and acquiring language (MacWhinney, 1988). This basic tenet is

_____

compatible with the dominant view of current sentence processing research, which emphasizes the role of lexical knowledge in language processing (Ellis, 1998, 2002; Harrington, 2001). The model also draws on "connectionist modeling and parameterized mathematical modeling as tools to account for input driven learning" (MacWhinney & Pléh, 1997, p.70), which mirrors cognitive science's interest in connectionist models (Gasser, 1990) to map cognitive processes.

Before expanding on the mechanisms behind the Competition Model, it is best to first understand the nature of the linguistic features that are used by the model to generate sentence comprehension. In every language, lexical items are connected to other lexical items by means of role relations. For instance, the verb "hit" functionally specifies two arguments (nominals). The first argument is the agent who does the action (e.g., John hits). The second argument involves the patient, or the entity affected or changed by the hitting action (e.g., hit the ball). The functional connections of these lexical items then specify the roles of (a) the action and the agent and (b) the action and the patient.

Bates and MacWhinney (1982, 1987) posit that the statistical and informative properties of these linguistic features (ex. frequency and information value) have an important role during language processing and acquisition. Bates and MacWhinney (1989) quantify statistical and informative properties of linguistic features in the context of cue strength and cue validity within the Competition Model. Cue strength reflects a psychological and subjective property of a cue that the language learner or child develops. Of course, the strength of a similar cue varies from language to language (Clifton & Duffy, 2001). For instance, the first noun that appears before the verb in an English sentence is strongly associated with an agent, and thus it becomes the strong cue for an agent (Gernsbacher & Hargreaves, 1989). In Italian, on the other hand, the noun that appears before the verb in a sentence is more strongly associated with a topic than with an agent. Therefore, the strength of the preverbal position cue for an agent among English speakers is much greater than that among Italian speakers.

On the other hand, cue validity is assumed to be the most predictive determinant of cue strength (Bates & MacWhinney, 1989). Cue validity is an objective property of the cue. Language learning is the process by which speakers assign and adjust cue strength (i.e., an individual's knowledge of cues) according to cue validity. One of the earliest tests of cue validity across languages was conducted by Bates and MacWhinney (1984). The methodology used in this study was an agent-identification task in which the native English, German, and Italian speaker is presented with simple transitive sentences consisting of two nouns and a verb. The participant's task is to decide which noun refers to the agent of

the sentence. The sentences used in these type of studies are constructed to represent various competing and converging combinations of cues, including word order, case-marking, subject-verb agreement, and semantic information. Some examples are listed below.

the boy ate the apple	the apple ate the boy
ate the boy the apple	the wall ate the apple

Bates and MacWhinney (1984) found that English speakers reliably choose the first noun as the agent of the sentence. Italian speakers consistently choose the animate character as the agent, while German speakers relied on animacy and a case marker to identify the agent.

Since the 1980s, a number of cross-linguistic studies based on the Competition Model have been conducted with Arabic, Chinese, Dutch, English, French, German, Italian, Croatian, French, Japanese, Russian, and Hungarian speakers (see Appendix for languages and studies). As discussed earlier, the Competition Model argues that cue strength (i.e., speakers' subjective knowledge about form-function mappings) is a function of cue validity (i.e., an objective property of a cue). This claim predicts that the hierarchy of cue strength in the adult native speaker should correspond to the hierarchy of cue validity in a language. Furthermore, cue interactions in collaboration and in competition with each other are predicted to facilitate or inhibit the speed and accuracy of sentence processing.

Purpose of the Study
The current set of studies being reported in this paper investigates cue validities of being the agent, a case marker, and word order in allocating attention and anchoring sentence comprehension within the Tagalog language. Tagalog is a language spoken in the Philippines, a Southeast Asian island group. Tagalog is a verb initial language with a relatively free word order for the sentence components (markers, noun phrases, prepositional phrases etc.) that come after the verb (Hoekstra, 1986; Ramos & Cena, 1990). Tagalog has several case markers attaching to every noun phrase of a sentence. Two of these Tagalog markers are ang and si. The marker si appears with proper names, such as Anna, Jose, or Mateo, in Tagalog (Ramos, 1971). It has a counterpart marker ang that appears with common nouns, such as carpenter, farmer or soldier. Both ang and si mark definiteness in Tagalog sentences (Ramos, 1971). Numerous claims have been put forth to explain the linguistic function of ang/si markers (For an extended review, see Reid, 2002). Some researchers have claimed that ang/si are case markers identifying syntactic subjects (Blake 1925; Bloomfield 1917). Other researchers claim that the Tagalog language lacks the category of a subject and ang/si

are case markers for sentence topics (Carrier-Duncan, 1985; Foley & Van Valin, 1984). Gerdts (1988) claims that ang/si are case markers for the absolutive arguments if Tagalog can be categorized as an Ergative language. Despite the unresolved issue of the grammatical function of ang/si markers, the key assumption for this study is their potential in drawing the reader's attention to a sentence constituent, maintaining availability of that information in working memory, and guiding the Tagalog sentence comprehension processes.

EXPERIMENT 1

The researchers tapped the availability of information in working memory related to the linguistic cues of word order (first mention vs. second mention), the ang/si marker (having an ang/si marker vs. having no ang/si marker) and agency (a word is the agent vs. a word is a non-agent) when Tagalog speakers read sentences by using a decision method. A decision method taps the immediate and automatic activation of information in working memory at the moment right after the sentence has been cognitively processed. This is often regarded as a measure of online sentence processing. In general, we hypothesized that first mentioned words would be recognized faster in a probe recognition task compared to second mentioned words. We also hypothesized that words with the ang/si marker would be recognized faster in a probe recognition task compared to words without the ang/si marker. Finally, we hypothesized that words which were the agent of the sentence would be recognized faster in a probe recognition task compared to non-agent words.

Method

Participants Eighty fluent Tagalog speakers who resided in the Metro Manila, Philippines area participated in the study. They were undergraduate students at DeLasalle University who participated for extra credit for their classes.

Apparatus and Materials In this study, the materials were presented on a Macintosh Computer and a three-button response box. A computer program called PSYSCOPE (Cohen, MacWhinney, Flatt, & Provost, 1993) was be used to present the stimuli to the participants.

A 2(an ang/si phrase vs. a non-ang/si phrase) x 2(the first mentioned character vs. the second mentioned character) x 2(the Agent vs. the non-Agent) within subjects design was used for the Tagalog materials. Forty sets of Tagalog sentences were prepared for this study. Each sentence set consists of eight versions of a prototype Tagalog sentence. For an example of the materials, see Table 1. For the eight versions of the

prototype Tagalog sentence, a probe word was presented as the agent or a non-agent, with or without the ang/si phrase, and as either first mention or second mention.

TABLE 1 Sample Experimental Materials for Experiment 1 and 2a
_____

P*um*unta   si Anna kay Natalia noong isang taon.
P*um*unta kay   Natalia si Anna noong isang taon.
P*in*unta*han*   ni Anna si Natalia noong isang taon.
P*in*unta*han* si Natalia ni Anna noong isang taon.
   "Anna visited Natalia a year ago."
P*in*unta*han* si Anna ni Natalia noong isang taon.
P*in*unta*han* ni Natalia si Anna noong isang taon.
P*um*unta kay Anna si Natalia noong isang taon.
P*um*unta si Natalia ni Anna noong isang taon.
"Natalia visited Anna a year ago."

Target word: Anna
Paraphrase: Si Anna ay pumunta noong isang taon kay Natalia.
           "Anna visited Natalia a year ago."
_____

Two common first names (Maria, Anna) or occupation terms (e.a. karpentero-"carpenter", magsasaka-"farmer") were the characters mentioned in the sentence, and they were randomly assigned to each sentence set. The two names or occupational terms were matched for gender, perceived familiarity, and relative length (in number of characters and syllables).

Another set of 40 Tagalog sentences was prepared as filler sentences. These filler items contain probe words that did not occur in the sentence sets. The filler sentences are similar to the experimental sentences in construction. Each experimental and filler sentence has a corresponding comprehension task. The comprehension task is in the form of a Tagalog paraphrase or non-paraphrase. For an example, see Table 1. These Tagalog paraphrases (and non-paraphrases) were constructed by using the Tagalog "ay" inversion (Schachter & Otanes, 1972). Tagalog paraphrases and non-paraphrases were evenly distributed across the experimental and filler sentences. An additional five Tagalog sentences were prepared with corresponding correct and incorrect paraphrases serving as practice material for the participants to familiarize themselves with the tasks involved in the study.

Eight material lists were formed by randomly assigning one of the eight versions from each sentence set (and its corresponding paraphrase

or non-paraphrase) to each material list. Across the eight material lists, each prototype sentence occurred in only one of its eight versions.

Procedure The PSYSCOPE program started out each trial by randomly assigning a subject to one of the eight material lists. At the initial screen of each trial, a page of instructions was presented to the participants informing them of the experimental tasks. Once the participant pressed any button on the response box, a signal, consisting of three plus signs, appeared for 750 milliseconds (ms) in the center of the screen. The signal was used to draw the attention of the reader to a specific part of the screen where the stimuli appeared. All stimuli appeared in the same location on the screen. After the signal disappeared, each Tagalog sentence appeared at the center of the screen. PSYSCOPE presented each Tagalog sentence at a rate of 600 ms per each word. After the Tagalog sentence flashed on the screen, there was a 150 ms interval before the participants were presented with a probe word in the middle of the screen. When the probe word appeared on the screen, the participant had to quickly press the "yes" or "no" button on the response box with his or her corresponding index finger. The probe word remained on the screen until the participant responded or 3 seconds (s) elapsed. The computer emitted a buzzing sound whenever the participant answered incorrectly. After the participants responded to the probe word, there was a 250 ms interval before the participant was shown a Tagalog paraphrase or non-paraphrase at the middle of the screen. When the paraphrase/non-paraphrase appeared, the participant had to quickly press either the "yes" or "no" button on the response box. The paraphrase/non-paraphrase remained on the screen until the participants responded or 10 s elapsed. The computer emitted a loud buzzing sound when the participant chose the wrong answer.

The study was divided into two parts. The first part included the five practice sentences that the participants used to familiarize themselves with the tasks involved. After the first section was presented, the participants continued to the second section that included one set of the 80 experimental and filler Tagalog sentences prepared for this study.

Results

The accuracy of Tagalog speaking participants responding on the sentence comprehension task (sentence paraphrases) varied between 80% - 50%. An average of 65% was calculated for the sentence paraphrase accuracy rates. Data from 32 Tagalog speaking subjects were excluded from the analysis because their accuracy rates in the sentence comprehension task were below 65 percent. Data for 48 Tagalog speaking subjects are reported below.

Outliers of reaction time responses and incorrect probe word responses for each of the corresponding 48 participants were excluded from the analysis prior to analyzing the data. Reaction times below 100 ms and 2.5 standard deviations from the average reaction time for each participant were excluded from the analysis.

The accuracy of recognizing the probe word was conducted to account for possible speed accuracy tradeoffs. Speed accuracy tradeoffs imply that participants might respond more accurately at the cost of slowing down their responses. The variability of accurately recognizing a probe word in the experimental sentences ranged from 60%-100% and the average was 96%. We calculated probe word accuracy rates for each subject and we used this as a covariate in our analyses.

The dependent variable in this study was the reaction time for recognizing the probe word in the sentence. The Tagalog speakers data were submitted to a 2 (agent vs non-agent) x 2 (ang/si marker vs. without ang/si marker) x 2 (1st mention vs. 2nd mention) within subjects ANOVA with the probe response accuracy as a covariate. All analyses below have an alpha level of .05 unless otherwise indicated.

We found a main effect for ang/si marker. Tagalog speakers were faster in recognizing probe words with the ang/si marker (M=843 ms, SE=23.5) than probe words without ang/si markers (M=846 ms, SE=22.9). This was significant by subjects $F(1,47)$=4.3, p=.04, but not by items, $F(1,32)$=0.12, p=.63. In contrast, we found no main effects for agents, $F(1,47)$=0.27, p=.61, nor order of mention, $F(1,47)$=0.06, p=.81. None of the interactions between the three variables were statistically significant.

This study provides some evidence for the effects of ang/si markers in allocating the attention of Tagalog readers, but the reliability of this finding is unclear because of the accuracy variability in the comprehension and probe recognition tasks. Other psycholinguistic methods were required to further investigate the reliability of this effect.

EXPERIMENT 2A

This study used an offline method to provide converging evidence with the online method used in Experiment 1. An offline method does tap the activation of information in working memory right after sentence comprehension, but it can also include the strategic processes in sentence processing that might guide comprehension and production of subsequent sentences. Stevenson and her colleagues (Stevenson, Knott, Oberlander, & McDonald, 2000) have used a English sentence continuation task investigating the tendency of providing continuations in relation to first-mentioned participants and the semantic role (agent vs. patient) of experimental sentences. They found that readers had an increased

probability of providing a continuation sentence referring to the first-mentioned participant when it fit with the appropriate semantic role (agent or patient) focused by the verb of the experimental sentence. This illustrates that readers rely on a default linguistic assumption of maintaining referential continuity (Givon, 1983, Segal, Duchan, & Scott, 1991) compared to having a referential shift in a subsequent sentence. This default linguistic assumption in a subsequent sentence production can help us tap the highly available information in working memory during the comprehension of an experimental sentence. The highly available information during sentence comprehension should have an increased probability of appearing in a continuation sentence because a reader might be inclined to maintain continuity. In this experiment, we investigated how the features of word order (first mention vs. second mention), the ang/si marker (having an ang/si marker vs. having no ang/si marker) and agency (agent vs. non-agent) influences the contents of the Tagalog sentence continuations. In general, we hypothesized that first mentioned words would have a higher probability of appearing in a continuation sentence compared to second mentioned words. We also hypothesized that words with the ang/si marker would have a higher probability of appearing in a continuation sentence compared to words without the ang/si marker. Finally, we hypothesized that words which were the agent of the sentence would have a higher probability of appearing in a continuation sentence compared to non-agent words.

Method

Participants Eighty fluent Tagalog speakers who reside in the Metro Manila, Philippines area were recruited to participate in the study. The participants were undergraduate students at DeLassale University and University of the East who participated for extra credit in their classes.

Materials The 40 sets of Tagalog sentences constructed for Experiment 1 were used in this study. Eight material lists were formed by randomly assigning one of the eight versions of each sentence set to each material list. Across the eight material lists, each prototype sentence occurred in only one of its eight versions. Several blank lines were provided after each printed sentence. The pages for the corresponding material lists were compiled into packets. There are 8 packet versions.

Procedure Participants were given one of the 8 packet versions. They were instructed to read each sentence at their own pace. They were asked to provide at least 1-2 complete Tagalog sentence continuations for each sentence that they read, then they were instructed to evaluate and provide

continuations for each sentence independent of other sentences in the packet.

Results

The dependent variable is the probability of mentioning the probe word in the first continuation sentence. The strict coding criteria involved the explicit appearance of the probe word in the first continuation sentence. This received a score of one (1) for the corresponding sentence. When there was no explicit appearance of the probe word, a score of zero (0) was recorded. Pronouns in the continuation sentence referring to the probe word were scored zero (0). Three independent, Tagalog-speaking judges followed the preceding coding criteria to determine the appearance of the probe word in the initial continuation sentences. Inter-judge agreement for the probability of mentioning the probe word in the first continuation sentence was 92%. Probability scores for the appearance of probe words were calculated for each of the 8 versions, 2 (agent vs non-agent) x 2 (ang/si marker vs. no ang/si marker) x 2 (1st mention vs. 2nd mention) of the experimental texts. Tagalog speakers data were submitted to a 2 (agent vs non-agent) x 2 (ang/si marker vs. without ang/si marker) x 2 (1st mention vs. 2nd mention) within subjects ANOVA. All analyses below have an alpha level of .05 unless otherwise indicated.

We found a main effect for the ang/si marker. Tagalog speakers had a higher probability of mentioning the probe words with the ang/si marker (M=69%, SE=0.02) in the first continuation sentence than probe words without the ang/si marker (M=63%, SE=0.02). This was significant by subjects, $F(1,79)$=16.3, p<0.01, and by items $F(1,32)$=7.1, p<0.01. In contrast, we found no main effects for agency, $F(1,79)$=1.18, p=.28, nor order of mention, $F(1,79)$=1.44, p=.23. None of the interactions among the three variables were statistically significant.

Overall, these results support our claim that probe words with the ang/si marker draws the attention of a Tagalog reader and keeps this information highly available in working memory for Tagalog sentence comprehension.

EXPERIMENT 2B

This study also used an offline method and relied on the default linguistic assumption of maintaining continuity as a way to tap at the active information during sentence comprehension. Fletcher (1984) has shown that first-mentioned agents tend to be chosen by default as the referent of an ambiguous pronoun. This tendency of choosing first-mentioned agents as the referent of an ambiguous pronoun decreases when there is an increased grammatical complexity for the reference.

Givon (1983) labels increased grammatical complexity as degrees of markedness. Consider the examples below from Fletcher (1984 p. 489):

1. Pete intended to go bowling with Sam last night but broke his leg.
2. Pete intended to go bowling with Sam last night but he broke his leg.
3. Pete intended to go bowling with Sam last night but the guy broke his leg

Readers had a 90% probability of choosing Pete as the referent of the ambiguous pronoun "his" in sentence (1), but readers only had a 81% probability of choosing Pete in sentence (2) and 54% probability of choosing Pete in sentence (3). Similar patterns of choosing the referent of an ambiguous pronoun were found for 3-5 year old native English speakers (Maratsos, 1973, Kertoy, 1991). We investigated how the features of word order (first mention vs. second mention) and the ang/si marker (having an ang/si marker vs. having no ang/si marker) influence how Tagalog speakers choose the referent of an ambiguous pronoun. We used the probability of the agent being chosen as the referent of the ambiguous pronoun of the sentences for this study as the dependent variable while ang/si markers and word order were the independent variables because of the choice method we employed.

Method

Participants   Forty fluent Tagalog speakers who reside in the Metro Manila, Philippines were recruited to participate in the study. The participants were undergraduate students at DeLassale University and University of the East who participated for extra credit in their classes.

Materials A sub-set of the 40 Tagalog sentences constructed for Experiment 1 was used in this study. For examples, see Table 2. Each sentence included additional context and contained an ambiguous pronoun "siya" that can refer to either character in the sentence. In Tagalog, the pronoun "siya" can refer either to a male or female character (Ramos & Cena, 1990). After each sentence, a printed question asks readers to whom the ambiguous pronoun is referring.

The target word and the non-target characters were printed after each question. Four material lists were formed by randomly assigning one of the four versions of each sentence set to each material list. Across the four material lists, each prototype sentence occurred in only one of its four versions. Each sentence from each list was printed as a list on a page of paper. The pages for the corresponding material list were compiled into packets. There are 4 packet versions.

TABLE 2 Sample Experimental Materials for Experiment 2b
_____
Pumunta si Nina kay Maria bagamat nagagalit siya.
Pumunta kay Maria si Nina bagamat nagagalit siya.
Pinuntahan si Maria ni Nina bagamat nagagalit siya.
Pinuntahan ni Nina si Maria bagamat nagagalit siya.
"Nina visited Maria even though she was angry."
Target word: Nina
Question: Sino ang nagagalit? Nina Maria
          "Who got angry?" Nina Maria
_____

Procedure Participants were given one of the 4 packet versions. They were instructed to read each sentence at their own pace. They were asked whom the ambiguous pronoun refers to by circling one of the two characters printed on the page. They were instructed to evaluate each sentence independent of the other sentences in the packet.

Results

The dependent variable was the probability of choosing the agent of the sentence as the referent of the ambiguous pronoun. Probability scores for the appearance of the probe word was calculated for each of the 4 versions, 2 (ang/si marker vs. without ang/si marker) x 2 (1st mention vs. 2nd mention) of the experimental texts. The Tagalog data were submitted to a 2 (1st mention vs 2nd mention) x 2 (ang/si marker vs. no ang/si marker) within subjects ANOVA. All analyses below have an alpha level of .05 unless otherwise indicated.

We found a main effect of the ang/si marker. Tagalog speakers had a higher probability of choosing the agent with the ang/si marker (*M*=67%, *SE*=0.02) as the referent of an ambiguous pronoun than an agent without the ang/si marker (*M*=50%, *SE*=0.02). This was significant in the analysis by subjects $F(1,39)=45.9$, $p<0.01$, and by items, $F(1,36)=15.5$, $p<0.01$. We also found a main effect of order of mention. Tagalog speakers had a higher probability of choosing 1st mentioned agents (*M*=62%, *SE*=0.02) as the referent of an ambiguous pronoun than 2nd mentioned agents (*M*=55%, *SE*=0.02). This was significant by subjects, $F(1,39)=5.85$, $p=.02$, but not by items, $F(1,36)=2.1$, $p=.15$.

We also found a significant interaction between the ang/si marker and the order of mention, $F(1,39)=9.17$, $p<.01$. Figure 1 illustrates the two way interaction. Three planned comparisons were conducted to investigate the simple effects. A Bonferroni adjustment was applied to the planned comparison analyses and we used an alpha level of .02.

Tagalog speakers had no significant differences in choosing between 1st mentioned Agents with the ang/si marker, and 2nd mentioned Agents

with the ang/si marker as the referent of an ambiguous pronoun $F(1,39)=0.02$, $p=.88$. In contrast, both combinations had higher probabilities of being chosen by Tagalog speakers as the referent of an ambiguous pronoun compared to 1st mentioned agents without the ang/si marker ($M=57\%$, $SE=0.03$), $F(1,39)=9.8$, $p<.01$. We also found that Tagalog speakers had a higher probability of choosing 1st mentioned agents without the ang/si marker as the referent of an ambiguous pronoun than 2nd mentioned agents without the ang/si marker ($M=43\%$, $SE=0.03$), $F(1,39)=12.12$, $p<.01$.

FIGURE 1 Mean Probability of Choosing the Agent as Referent of an
    Ambiguous Pronoun as a Function of ang/si Marker & Word Order
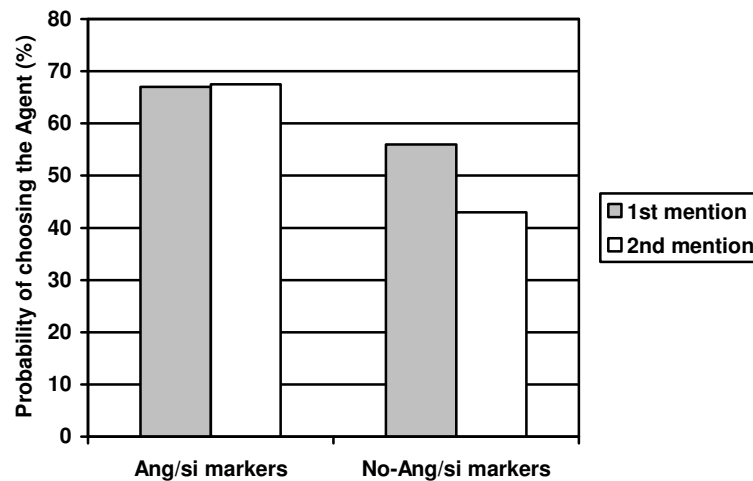
Overall, these results support our claim that characters with the ang/si marker draw the attention of a Tagalog reader and keeps this information highly available in working memory for Tagalog sentence comprehension. This study also supports our claim that first-mentioned characters draw the attention of a Tagalog reader and keeps the information highly available in working memory, but this effect occurs when the ang/si marker does not appear with the agent.

GENERAL DISCUSSION

The three experiments provide converging psycholinguistic evidence that ang/si markers are reliable cues in allocating the attention of Tagalog

readers during sentence comprehension. The decision task showed some evidence that probe words with the ang/si markers were recognized slightly faster than probe words without ang/si markers. This effect emerges when accounting for the speed accuracy trade-offs in correctly recognizing the probe word in a Tagalog sentence. The sentence continuation method showed that characters with the ang/si marker from a target sentence have a higher probability of being continued in a subsequent sentence than characters without the ang/si marker. The ambiguous pronoun resolution task showed that agents with the ang/si marker had a higher probability of being chosen as the referent of an ambiguous pronoun. These findings extend the claim of researchers that case markers can influence the cognitive sentence comprehension processes for a corresponding language (Bates & MacWhinney, 1984, Miyamoto, 2002, Yamashita, 1997). The ang/si markers can serve as reliable linguistic features that can draw a reader's attention during Tagalog sentence processing. This study does provide some evidence for the advantage of first mentioned nouns (Gernsbacher, 1990), but this only occurred when there was no ang/si marker on the agent in the ambiguous pronoun resolution. Otherwise, there were no differences in the probability of choosing between first-mentioned and second mentioned Agents when the ang/si markers were present.

A key limitation of these studies involves the language background of the participants. The participants were fluent Tagalog speakers, but they were also bilinguals fluent in English. The variability in the results in Experiment 1 could be related to the participants utilizing some implicit grammatical rules of English in guiding their Tagalog sentence comprehension. It is very rare to find strict monolingual Tagalog speakers in the Philippines because English is the standard language for the education system and the usefulness of English in cross-cultural interactions.

It might also be the case that ang/si markers are more effective in guiding comprehension beyond the bounds of the current sentence. The effects of ang/si markers are stronger in sentence continuation (Experiment 2a) and ambiguous pronoun resolution (Experiment 2b), thus it is likely that characters with the ang/si markers are kept available in working memory for the comprehension or integration of subsequent Tagalog sentences and clauses. This would be in contrast to keeping characters with the ang/si marker available in working memory for strictly understanding the current sentence itself. This implies that ang/si markers might take on a discourse level function (Givon, 1983), involving a series of sentences, rather than being limited to a sentence level function.

One way to test the claim that ang/si markers take on a discourse level function is by using a self-paced reading task. Adapting Gordon and Scearce's (1995) study, we can investigate effects of ang/si markers on Tagalog speakers' reading patterns when reading a passage of sentences. Consider the short passage below:

4. Papunta si Anna kay Natalia ngayon.
   "Anna will visit Natalia today"
5. Siya ay sumsakay sa bus papuntang Tarlac kung saan siya
   nakatira.
   "She is riding a bus traveling to Tarlac where she is living"
6a. (Continuation) Nagbabasa siya ng libro sa bus.
   "She is reading a book on the bus."
6b. (Shift) Maininip siya sa paghihintay sa Tarlac.
   "She is getting anxious waiting in Tarlac."
7. Darating sa gabi ang bus sa Tarlac
   "The bus will arrive at night in Tarlac."

The ang/si marker appears with the Agent Anna in sentence 4. The short passage has a continuation sentence version 6a. and a referent shift sentence version 6b for the pronoun siya. If the ang/si marker has an effect in guiding the comprehension of this passage, the continuation sentence version should be read faster than the referent shift version.

Another way we can the examine effects of ang/si markers in allocating attention during Tagalog comprehension is by placing ang marker with inanimate objects. Ang marker can be bound to inanimate objects in grammatical Tagalog sentences. For example:

8. Hinugasan ni Pedro ang baso.
    washed+(LF) Pedro AGT drinking glass
   "Pedro washed the drinking glass."
9. Binili ang bahay kahapon ni Lourdes
    bought+(LF) house yesterday Lourdes AGT
   "Lourdes bought the house yesterday."

Inanimate objects with the ang marker should also draw the attention of Tagalog readers and would also be active in working memory during sentence comprehension. In contrast, it might be the case that the results we found for ang/si markers in this study only apply for animate characters and do not extend to inanimate objects that can take on ang/si markers.

Overall, this study has expanded cross-linguistic research of identifying cue validities within the framework of the Competition Model (MacWhinney & Bates, 1989). In particular, this study

demonstrated the cue validity of the ang/si marker in allocating of attention during Tagalog sentence comprehension.

REFERENCES

Bates, E., & MacWhinney, B. (1982). Functionalist approaches to grammar. In E. Wanner & L. Gleitman (Eds.), *Language acquisition the state of art.* (pp. 173-217). Cambridge: Cambridge University Press.

Bates, E., & MacWhinney, B. (1987). Competition, variation, and language learning. In B. MacWhinney (Ed.), *Mechanisms of language acquisition* (pp.157-193). New Jersey: Erlbaum.

Bates, E., & MacWhinney, B. (1989). Functionalism and the competition model. In B. MacWhinney & E. Bates (Eds.), *The crosslinguistic study of sentence processing* (pp. 3-73). New York: Cambridge University Press.

Blake, F. R. (1925). *A grammar of the Tagalog language*. New Haven, CT: American Oriental Society.

Bloomfield, L. (1917). *Tagalog texts with grammatical analysis*. Urbana, IL: University of Illinois Studies in Language and Literature.

Carreiras, M., Gernsbacher, M. A., & Villa, V. (1995). The advantage of first mention in Spanish. *Psychonomic Bulletin and Review, 2*, 124-129.

Carrier-Duncan, J. (1985). Linking of thematic roles in derivational word formation. *Linguistic Inquiry, 16*(1), 1-34.

Clifton, C. Jr., & Duffy, S. A. (2001). Sentence and text comprehension: Roles of linguistic structure. *Annual Review of Psychology, 52*, 167-196.

Cohen, J. D., MacWhinney, B., Flatt, M., & Provost, J. (1993). Psyscope: A new graphic interactive environment for designing psychology experiments. *Behavioral Research Methods, Instruments and Computers, 25*(2), 257-271.

Cooreman, A. B., Fox, B., & Givon, T. (1984). The discourse definition of ergativity. *Studies in Language, 8,* 1-34.

Devescovi, A., D'Amico, S., Smith, S., Mimica, I. & Bates, E. (1998). The development of sentence comprehension in Italian and Serbo-Croatia: Local versus distributed cues. In D. Hillert (Ed.), *Syntax and semantics: A cross-linguistic perspective. Vol 31* (pp. 345-377). San Diego: Academic Press.

Dik, S. C. (1980). Seventeen sentences: basic principles and application of functional grammar, In E.A. Moravcsik and J.R. Wirth (eds.), *Syntax and Semantics*, *13*, (pp. 45-75), Current Approaches to Syntax, New York, NY: Academic Press.

Dixon, R. M. W. (1972). *The Dyirbal language of North Queensland*. Cambridge, England: Cambridge University Press.

Ellis, N. (1998). Emergentism, connectionism and language learning. *Language Learning, 48*, 631-664.

Ellis, N. (2002). Frequency effects in language processing. *Studies in Second Language Learning, 24,* 143-188.

Fletcher, C. R. (1984). Markedness and topic continuity in discourse processing. *Journal of Verbal learning and verbal behavior, 23,* 487-493.

Foley, W. A., & Van Valin, R. D. (1984). *Functional syntax and universal grammar*. New York, NY: Cambridge University Press.

Gasser, M. (1990). Connectionism and universals of second language acquisition. *Studies in Second Language Acquisition, 12*, 179-199.

Gerdts, D. B. (1988). Antipassive and causatives in Ilokano: Evidence for an ergative analysis. In R. McGinn (ed.) *Studies in Austronesian Linguistics* (pp 295-351). Athens, OH: Ohio University Press.

Gernsbacher, M. A. (1990). *Language comprehension as a structure building*. Hillsdale, NJ: Lawrence Erlbaum.

Gernsbacher, M. A. & Hargreaves, D. (1988). Accessing sentence participants: The advantage of first mention. *Journal of Memory and Language, 27*, 699-717.

Gernsbacher, M. A. & Hargreaves, D. (1992). The privilege of primacy: Experimental data and cognitive explanations. In D.L. Payne (ed.), *Pragmatics of Word Order flexibility*.(pp. 83-116), Philadelphia, PA: John Benjamins.

Givon, T. (1983). (ed.) *Topic Continuity in Discourse: A Quantitative Cross Language Study*. Amsterdam, Netherlands: John Benjamins.

Gordon, L. & Scearce, R. (1995). Pronomilization and discourse coherence, discourse structure and pronoun interpretation. *Memory and Cognition, 23*(3)*, 313-323.

Haberlant, K. (1995). Methods in reading research. In Gernsbacher M.A. (ed.) *Handbook of Psycholinguistics*,(pp. 1-31), New York, NY: Academic Press.

Hakuta, K. (1981). Grammatical description versus configurational arrangement in language acquisition: The case of relative clauses in Japanese. *Cognition, 9*, 197-236.

Hakuta, K. (1982). Interaction between particles and word order in the comprehension and production of simple sentences in Japanese children. *Developmental Psychology, 18*, 62-76.

Harrington, M. (2001). Sentence processing. In P. Robinson, (Ed.), *Cognition and second language instruction* (pp. 91-124). Cambridge: Cambridge University Press.

Hoekstra, E. (1986). On the structural subject position in Tagalog. *Lingua, 70*, 41-56.

Kail, M., & Charvillat, A. (1988). Local and topological processing in sentence comprehension by French and Spanish children. *Journal of Child Language, 15*, 637-662.

Kempe, V., & MacWhinney, B. (1998). The acquisition of case marking by adult learners of Russian and German. *Studies in Second Language Acquisition*, *20*, 543-587.

Kertoy, M.K. (1991). Listening comprehension for sentences: The accessibility of referents for pronouns as a function of age, topic continuity, and pronoun emphasis. *Journal of Experimental Child Psychology 52*, 344-353.

Kroeger, P.R. (1993). Another look at subjecthood in Tagalog. *Philippine Journal of Linguistics, 24(2)*, 1-15.

Li, P., Bates, E., & MacWhinney, B. (1993). Processing a language without inflections: A reaction time study of sentence interpretation in Chinese. *Journal of Memory and Language*, *32*, 169-192.

Lorch, R. F., Lorch, E. P., & Matthews, P. D. (1985). On-line processing of the topic structure of a text. *Journal of Memory and Language, 24*, 350-362.

MacWhinney, B., Bates, E., & Kliegl, R. (1984). Cue validity and sentence interpretation in English, German, and Italian. *Journal of verbal learning and verbal behavior, 23,* 127-150.

MacWhinney, B., & Pléh, C. (1988). The processing of restrictive relative clauses in Hungarian. *Cognition*, *29,* 95-141.

Maratsos, M.P. (1973). Effects of stress on the understanding of pronominal coreference in children. *Journal of Psycholinguistic Research, 2,* 1-8.

McDonald, J. (1986). The development of sentence comprehension strategies in English and Dutch. *Journal of Experimental child psychology, 41*, 317-335.

McDonald, J. (1987). Assigning linguistic roles: The influence of conflicting cues. *Journal of Memory and Language, 26*, 100-117.

McDonald, J., & Heilenman, K. (1991). Determinants of cue strength in adult first and second language speakers of French. *Applied Psycholinguistics*, *12*, 313-348.

Mimica, I., Sullivan, M., & Smith, S. (1994). An on-line study of sentence interpretation in native Croatian speakers. *Applied Psycholinguistics, 15*, 237-261.

Palmer, F. R. (1984). Grammatical roles and relations. New York, NY: Cambridge University Press.

Ramos, T. V. (1971). *Tagalog structures*. Honolulu, HI: University of Hawaii Press.

Ramos, T. V. & Cena, R. M. (1990). *Modern Tagalog: Grammatical Explanations and Exercises for Non-Native speakers*. Honolulu, HI: University of Hawaii Press.

Reid, L. A. (2002). Determiners, nouns or what? Problems in the analysis of some commonly occurring forms in Philippine languages. *Oceanic Linguistics, 41*(2), 295-309.

Schachter, P. (1976). The subject in Philippine languages. In C.N. Li (ed.) *Subject and Topic*, (pp. 491-518). New York: Academic Press.

Schachter, P., & Otanes, F. (1972). *Tagalog Reference Grammar*, Los Angeles, CA: University of California Press.

Schacter, D. L. (2001). *Seven sins of memory*. New York, NY: Houghton, Mifflin Company.

Schafer, A. J., Speer S. R., Warren P., & White, S. D. (2000). Intonation disambiguation in sentence production and comprehension. *Journal of Psycholinguistic Research, 29,* 169-182.

Segal, E. M., Duchan, J. F., & Scott, P. J. (1991). The role of interclausal connectives in narrative structuring: Evidence from adults' interpretations of simple stories. *Discourse Processes, 14*, 27-54.

Sokolov, J. (1989). The development of role assignment in Hebrew. In B. MacWhinney & E. Bates (Eds.), *The crosslinguistic study of sentence processing* (pp. 118-157). New York, NY: Cambridge University Press.

Stevenson, R., Knott, A., Oberlander, J., & McDonald, S. (2000). Interpreting pronouns and connectives: Interactions among focusing, thematic roles and coherence relations, *Language and Cognitive Processes, 15*(3), 225-262.

Taman, H. (1993). The utilization of syntactic, semantic, and pragmatic cues in the assignment of subject role in Arabic. *Applied Psycholinguistics, 14*, 299-317.

Vaid, J., & Pandit, R. (1991). Sentence interpretation in normal and aphasic Hindi speakers. *Brain and Language*, *41*, 250-274.

Yamashita, H. (1997). The effects of word-order and case marking information on the processing of Japanese. *Journal of Psycholinguistic Research, 26,* 163-188.

APPENDIX A
Order of Cue Strength of Adult and Child Speakers across Languages

Language   Cue strength   Study
_____

Arabic   Gender agreement > case marking > animacy   (Taman, 1993)
Chinese Passive marker bei > animacy > word order >object marker ba > indefiniteness marker   (Li, Bates, & MacWhinney, 1993)
Croatian Case marking> word position (Initial position) = Gender Agreement>Animacy
                                                     (Mimica, Sullivan, & Smith, 1994)
Dutch   Case inflection > SVO > animacy   (McDonald, 1986)
English   Word order (SVO) > VOS, OSV > Case inflection> Agreement, Animacy
                                                     (McDonald (1987)
French   Subject/object clitic pronoun agreement> Verb agreement> Noun animacy>
Word Order   (McDonald & Heilenman,1991)
Spanish   Accusative preposition *a*> SV Agreement> Clitic Agreement> Word order
                                                     (Kail & Charvillat, 1988)
German   Case marking> Animacy>Agreement> Word order
                                                     (MacWhinney, Bates, & Kliegl,1984)
Hebrew   Object marker> Word order > Subject-verb gender Agreement (Sokolov,1989)
Hindi   Case marking   (Vaid & Pandit,1991)
Hungarian   Case>SV Agreement > SVO, SOV> Animacy> V-O agreement
                                                     (MacWhinney, Pléh, & Bates, 1985)
Italian   SV Agreement> Clitic Agreement> Animacy>SVO> Stress, Topic
                                        (Devescovi, D'Amico, Smith, Mimica, & Bates,1998)
Japanese Case Marking > Animacy > SOV   (Hakuta,1981)
Russian   Case marking=verb agreement> animacy> SVO> SOV > VSO
                                                     (Kempe & MacWhinney, 1998)