85-310 Research Methods in Cognitive Psychology

Assignment 6 (Journal format paper)

Sentence Interpretation of Adult Native English Speakers:

How do English Speakers Process Pronouns in the Competition Model?

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Abstract

This study examined how adult native English speakers interpret sentences that contain pronouns, and how it differs from sentence interpretation with common nouns based on the theory of the Competition Model. The major interest of the study is to look at which cue, word order and case-marking cue, the native English speakers rely on more when there is competition of the two cues in interpreting a sentence. Thirteen adult native English speakers were asked to interpret sentences with common nouns and pronouns in the pilot study. The interim result shows the significant overall effect of word order cue, while it also suggests the strong tendency of using case-marking cue when accusative pronoun appears in a sentence. The study is still under the process of the pilot study, and thus this paper focuses on explaining the method.

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A number of studies in the Competition Model produced cross-linguistic differences on sentence interpretation both for L1 and L2 sentences (Bates & MacWhinney, 1989; McDonald, 1987; Rounds & Kanagy, 1998; Sasaki, 1994, 1997; Kempe & MacWhinney, 1999). The major finding of the theory is that people use different cues, such as word order, case-marking, animacy, and subject-verb agreement cues, to interpret sentences in different languages. Sentence interpretation in the Competition Model is mainly measured by the identification task of subject/agent in sentences. For instance, in a sentence like “the boy the girl chased.”, native English speakers choose “the girl” as a subject in the sentence, because they rely strongly on word order and use the SV cue, in another word, preverbal cue to identify the agent in the sentence. The example sentence only contains word order cue, so native English speakers have less problems interpreting it in terms of deciding an agent. However, in a sentence like “the boy the eraser kicked.”, there is competition between two cues, i.e., word order and animacy cue in a sense that word order cue tells “eraser” as an agent based on preverbal cue, while animacy cue tells “boy” as an agent because it is more likely that living thing takes an action in the real world. Even if there is such competition, native English speakers tend to rely on word order cue more than animacy because English allows non-living things to be an agent in a sentence. On the other hand, in other languages such as Japanese, non-living things are not allowed to be an agent whereas word order is quite flexible. Thus, in Japanese, animacy cue is more important than word order, and so native Japanese speakers choose “boy” as an agent in the sentence “the boy the eraser chased.”. Another feature about Japanese is that a case marker becomes a very important cue just like word order in English. Even if there is animacy cue such as “eraser” as a

non-living thing, and “boy” as a living thing in a sentence, the presence of case markers dramatically changes native Japanese speakers’ interpretation of the sentence “the boy the eraser chased.”. For instance, “otokonoko (boy) *o* keshigomu (eraser) *ga* oikaketa (chased).” “*ga”* is a subject marker and “*o”* is an object marker in Japanese. When there is competition between animacy and case-marking cue, Japanese speakers rely strongly on case-marking cue to decide an agent in a sentence. Hence, “eraser” is more likely to be considered to be an agent with case markers even though eraser is an inanimate object. In Japanese, case marker gives the strongest and the most reliable information for subject identification. In sum, sentence interpretation in terms of subject identification differs depending on which cue people rely on in each different language.

Bates & MacWhinney (1989) showed a nice summary of the cue strength in various languages. According to their study, word order is the strongest cue for adult native English speakers. Animacy and subject-verb agreement cues come second followed by stress and topic cues. There are also several other studies which confirmed that word order is fairly strong in English in comparison to second language sentence interpretation using bilinguals or L2 learners (McDonald, 1987; Sasaki, 1994, 1997). Major cues that are used in many English sentence interpretation studies in the Competition Model are only three cues, i.e., word order, animacy, and subject-verb agreement cues, using common nouns such as “boy”, “eraser”, and “deer” with various word orders, e.g., NNV, NVN, VNN. Other than these three cues, case markers can also be one of central cues as we have seen in Japanese. Case markers play an important role in several other languages such as German and Dutch (Bates & MacWhinney, 1989). Although common nouns in English do not carry case, English in fact has case in pronouns such as *she, he* as nominative and *him, her* as accusative. If case marking is that essential in several other

languages, it is natural to assume there would be an significant influence of case in English, too. However, there has been no systematic study on English sentence interpretation thus far that focused on case-marking cue in comparison to other major cues. Therefore, the major purpose of the study is to look at how native adult English speakers interpret sentences that contain pronoun, i.e., case, compared to those that do not contain case.

One problem with considering pronouns as general case-marking cue is that the function of case embedded in English pronouns is not exactly the same as general case markers such as “ga” (nominative case marker) and “o” (accusative case marker) in Japanese. Case markers in Japanese can be used to mark any common nouns, modified nouns from verb, and pronouns, whereas pronouns in English, e.g., him, her only function by themselves and do not mark any common nouns. In other words, when a sentence consists of common nouns, case is simply absent and is unavailable to use as a cue in English. Thus the availability of case-marking cue might be exceptionally lower than the other three major cues, word order, animacy, and agreement. Therefore, even if English pronouns carry case, and they can be considered as case markers in English in comparison to typical case markers in Japanese for instance, we may assume that English speakers are not likely to rely on the case-marking cue because of its limited cue availability. Based on this assumption, we can hypothesize that word order is still the strongest cue in interpreting English sentences that contains pronouns because case marking cue is generally not available in English sentences. If so, it is reasonable to expect to get result that shows the preference of choosing an agent in a sentence that should come out based on the characteristics of word order cue. Word order cue in English consists of SV (preverbal cue), and VO (post-verbal cue). Hence, in NVN condition, most native English speakers choose the first noun for an agent, and in NNV condition, many English speakers choose the second noun as an

agent because they use SV cue in both word orders. In contrast, in VNN condition, VO cue becomes stronger because SV (preverbal cue) is not available, and English speakers tend to choose the first noun as an agent. To clarify the effect of word order and case marking cue, this study focuses on the comparison between word order and case marking specifically on sentence interpretations with pronouns in various word order conditions.

Method

Participants

13 adult native English speakers of staff, undergraduate, graduate, post doctoral students and research associates at Carnegie Mellon University were randomly asked for their voluntary participation in the experiment to get Japanese candies. All of them are over 18, but ages are not controlled in the pilot study. All participants' first language is English, but some of them were fluent in a second/foreign language, and participants' L2 background is not controlled in the pilot study. All of them were asked whether they were native English speakers before the experiment.

Materials

All sentences consist of one verb and two of either noun or pronoun,

e.g., he the girl chased. he chased she.

Three factors in this study are word order with three levels (NVN, NNV, VNN), case marking for the first noun/pronoun with three levels (noun, nominal pronoun, accusative pronoun), and case marking for the second noun/pronoun with three levels (noun, nominal pronoun, accusative pronoun). There is no case marking when nouns are used both for first and second noun/pronoun position. The design of 3 x 3 x 3 with the total number of 27 sentence types was formed. There were two sentences in each cell, and so the total number of sentences

used in the experiment was 54 followed by 5 practice sentences. 7 simple action verbs (e.g, pushed, visited, saw, kissed) were randomly used to avoid specific semantic effect of one particular verb. Also all verbs were used in the past tense form that is to avoid the usage of subject-verb agreement cue. For common nouns, words with clear gender, i.e., 5 male and 5 female nouns, were selected as much as possible (e.g., father, son, mother, daughter). There are only four pronouns, she, he as nominative and him her as accusative. Each sentence was set by E-Prime to consist of one female and one male noun or pronoun, which is to avoid the confusion of identifying two pronouns as a single actor in a sentence that contains two pronouns such as "he pushed him" "he him pushed". In other words, when the first noun/pronoun is male, E-Prime was controlled to choose a noun or pronoun with the opposite gender for the second noun/pronoun. All verbs, nouns and pronouns are selected randomly by E-Prime for each sentence as well as word order. Each sentence was presented on the computer screen programmed by E-Prime followed by 1000 ms fixation.

Procedure

Participants were given the instruction that they would see sentences with a simple action verb and two of either nouns or pronouns that are not necessarily grammatical on the screen, and only one sentence appear on the screen at a time. When a sentence appears on the screen, they were asked to choose a person who does the action corresponding to a verb in each sentence. To choose the first actor in the sentence, they were instructed to press 1 on the computer keyboard, and 2 for the second actor in the sentence. They were asked to put their left hand on the keyboard during the experiment. If they were not sure which person to choose, they were asked to choose either of the persons in the sentence intuitively during the practice session.

Results

The percentage of choosing the first noun in each sentence type was analyzed by ANOVA. Overall ANOVA including word order, first noun/pronoun, and second noun/pronoun yielded the significant interaction, F (8, 96) = 2.55, p = .05. The main effect or word order was also significant, and the percentage of choosing the first noun in NVN condition was 91%, and 32% for NNV, and 29% for VNN conditions, F (2, 24) = 46.3, p = .0001 (Figure 1). The post hoc analysis showed the difference between NVN and NNV, and NVN and VNN were both significant ($p < .05$, Tukey). The main effect of the first noun/pronoun position was also significant, F (2, 24) = 27.1, $p < .0001$ (Fiture 2). First noun/pronoun was chosen by 53% for first common noun condition, 31% for first accusative pronoun, and 68% for first nominative pronoun. Post hoc analysis showed the significant difference among all three levels by Tukey ($p < .05$). The main effect of second noun/pronoun position was significant, F (2, 24) = 16.32, $p < .0001$ (Figure 3), with the percentage of 48% for second common noun condition, 64% for second accusative pronoun, and 40 % for second nominative pronoun. The difference between common noun and accusative pronoun, and also between accusative pronoun and nominal pronoun was significant ($p < .05$, Tukey).

Discussion

Most adult native English speakers strongly relied on word order cue regardless of the case effect of the first and second noun/pronoun, F (2, 24) = 46.3, $p < .0001$. 91% of choosing the first noun in NVN condition tells that most English speakers used simple SVO or either of SV or VO word order cues to decide the subject/agent in NVN condition. In NNV condition, first noun/pronoun was chosen only by 32 % which is significantly different from 91% of NVN

condition, which indicates that English speakers used SV (preverbal) cue in this sentence type, and thus ended up choosing the second noun/pronoun in NNV word order. In VNN condition, similarly the first noun/pronoun was chosen only by 29%, which is not significantly different from NNV word order (32%), and significantly different from NVN condition (91%). The similar analysis can be applied here. In VNN condition, it is assumed that English speakers relied on VO (post-verbal) cue to interpret sentences, and so they chose second noun/pronoun as an agent in VNN sentences. In sum, despite of the effect of case marking such as she, he for nominative, and her, him for accusative, the main effect of word order indicates that most English speakers after all used word order cue, the result of which replicated the results of previous studies (Bates & MacWhinney, 1989, McDonald, 1987).

However, the effect of fist noun/pronoun trait also shows an interesting tendency. When the first actor is described by accusative pronoun such as him, her, the percentage of first noun/pronoun choice dramatically decreases (31%). When the first actor is described by noun and nominative pronoun, the first actor choice becomes a lot higher, 53% and 68% respectively. The difference between noun, accusative pronoun, and nominative pronoun for first actor is all significant ($p < .05$, Tukey). This indicates when the first actor posses the nominative case such as he and she, English speakers are more likely to choose first actor as an agent, whereas they are likely to choose the second actor when the first actor posses the accusative case. When the first actor posses no case with common noun, it is totally neutral, i.e., the percentage of first noun/pronoun choice is 53% which is around the chance level.

Similarly, the effect of second noun/pronoun yielded the influence of case marking over the choice of the first noun as an agent. When the second actor in a sentence carries accusative case, English speakers tend to choose the first actor as an agent by 64%, whereas when the second

actor posses nominative case, they like to choose the first actor as an agent (40%). The difference between nominative pronoun and accusative pronoun for the second noun/pronoun position is significant ($p < .05$, Tukey). Yet when the second actor is illustrated by common noun without case, the choice of the first noun is about chance level (48%).

Therefore, there is significant overall word order effect regardless of the insertion of pronouns in sentences, which partially support the hypothesis of the study. Yet the results of the case marking effects both for first and second noun/pronoun position indicates that there is case marking cue in English when the actors are described by pronouns that carrry case even though the availability of using the case-marking cue might be lower than that of word order cue.

The detailed analysis of the availability of case-marking cue in English, and also more detailed analysis for the strength of case-marking cue in comparison with the word order cue are needed in the actual study.

Reference

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Figures

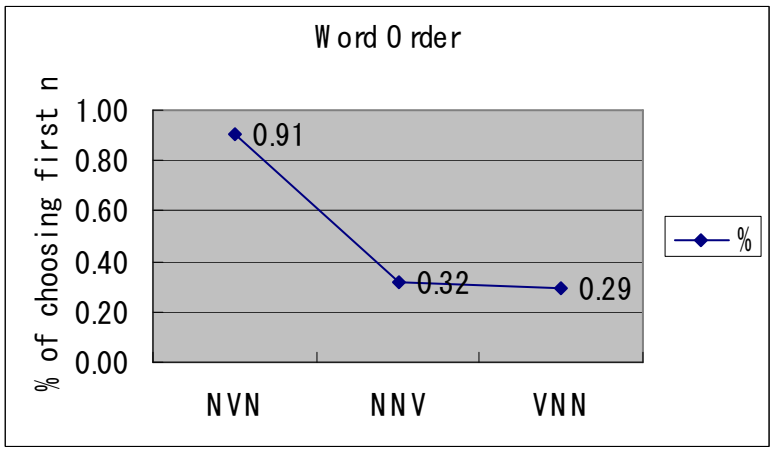

Figure 1. Cue strengths in word order

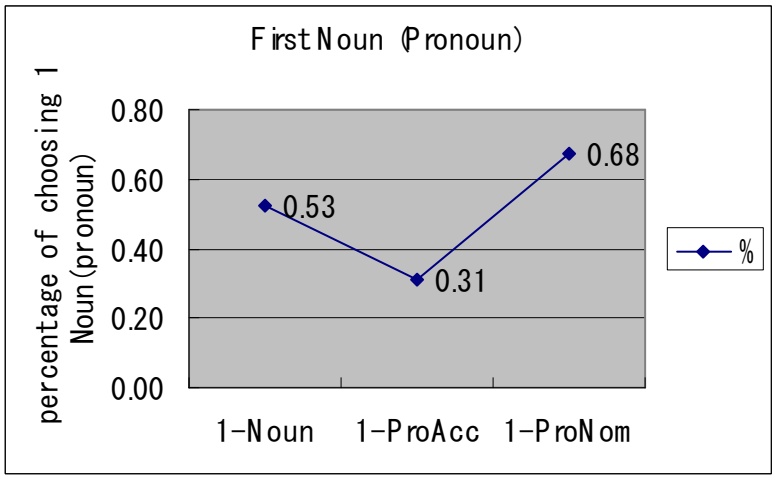

Figure 2. Cue strengths in first noun/pronoun position

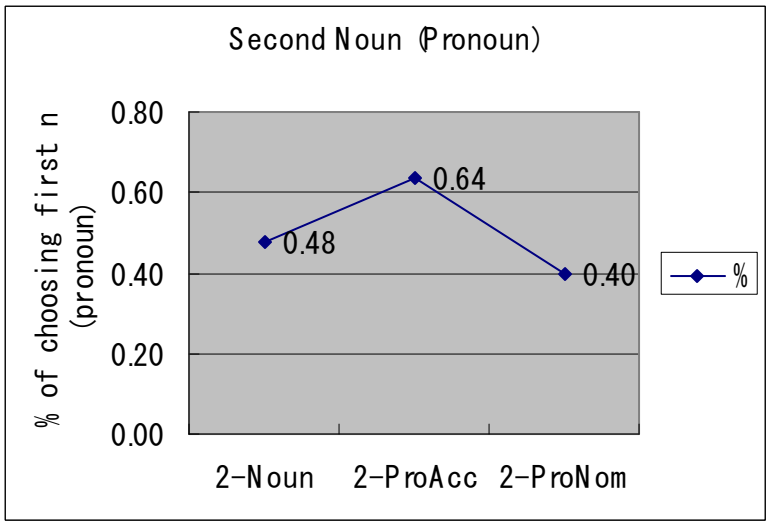

Figure 3. Cue strength in second noun/pronoun position