Word Order Doesn't Matter: Relative Clause Production in English and Japanese

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Abstract

Comparatively little is known about how semantic properties (such as animacy) and syntactic properties (such as word order) affect production of complex sentences. Relative clauses were elicited using a picture description task that manipulated head noun animacy in both English (which has head-first relative clauses and Japanese (head-final relative clauses). Participants of both languages produced more passive relatives with animate than inanimate heads, suggesting that a common underlying production constraint motivates structure choice. Different proportions of passive relatives with inanimate heads across languages suggest a role for both cognitive constrains as well as language-specific patters as factors that affect structure choice in language production.

Keywords: language production; relative clauses; animacy; cross-linguistic studies

Introduction

When turning thoughts into language, a speaker can express a single non-linguistic idea with different lexical choices (*couch* vs. *sofa*) and different sentence structures, such as active sentences (*The cat scratched the sofa*) or passive sentences (*The sofa was scratched by the cat*). In many cases, speakers implicitly make structure choices in order to make the planning and production process easier (V. Ferreira & Dell, 2000). For example, speakers appear to plan their utterances to allow more "accessible" or salient nouns to be placed earlier in the utterance. This arrangement allows words that are more fully planned to be uttered earlier, leaving more planning time for longer or more complicated nouns later in the sentence. On this view, syntactic structure of an utterance is not a deliberate decision but is rather a consequence of these noun ordering choices (Bock, 1982). Primed nouns (Bock, 1986, 1987) and given versus new nouns in English (Bock & Irwin, 1980), Spanish (Prat-Sala & Branigan, 2000) and Japanese (V. Ferreira & Yoshita, 2003) as well as animacy, with animate nouns being more accessible than inanimate nouns (F. Ferreira, 1994; McDonald, Bock & Kelly, 1993) have all been identified as factors that affect noun accessibility and therefore noun ordering of speakers' sentence structure.

While it is clear that noun accessibility correctly predicts active versus passive word order in simple sentences (Bock 1982, 1986, 1987; F. Ferreira 1994), relative clause sentences such as (1-2) are interesting because the head noun (ball, baby) is necessarily fixed as the first noun in both active relative clauses (also called object relative clauses, 1a and 2a) and also in passive relative clauses (1b, 2b). Thus, whereas structure choices between actives and passives in simple sentences vary with the order of the agent and patient nouns, in these relative clauses, the noun order does not vary in the active and passive relative clause forms. Thus any preferences for active vs. passive relative clause forms that vary with animacy may not be ascribed purely to noun ordering.

1a. Active: *The ball (that) the woman is holding.*
b. Passive: *The ball (that is) being held by the woman.*
2a. Active: *The baby (that/who) the woman is holding.*
b. Passive: *The baby (that/who is) being held by the woman.*

Interestingly, there do appear to be effects of noun animacy on relative clause structure. Gennari and MacDonald (2009) used a phrase based production task and found that both the animacy of the head noun and of the agent of the action (e.g., woman) affected structure choice in relative clauses, but they did not examine inanimate headed relatives such as those in (1). Gennari and MacDonald interpreted their animacy results in terms of accessibility affecting assignment to grammatical roles. In simple sentences, where more accessible nouns become grammatical subjects and are thus uttered first, similar accessibility constraints exist as in relative clauses and similarly affect sentence structure by encouraging more accessible nouns to assume the role of the grammatical subject.

This animacy effect in relative clauses is particularly interesting in light of Japanese which is grammatically very different than English. Japanese is a head-final language, which means that the head noun of a relative clause is the final element of the relative clause. Thus, the head noun, which as the sentential topic is arguably the most accessible noun, is produced last.

Even with this profound structural difference, Japanese object relative clauses can also occur as either active object relative or passive relative clauses. As in English there is no noun order change between the active and passive relative clause forms, but unlike the English, examples in (1-2), Japanese active and passive relative clauses have identical order across *all* words of the relative clause. The only difference between the active and the passive forms is the case marker after the embedded noun (woman) and the addition of the passive verb suffix. Some examples can be

seen in (3), which are relative clauses describing the man being thrown in a judo match, shown in Figure 1.

3a. Active: 女の人が投げている男の人
Onnanohito-ga nage-te-iru otokonohito
woman-NOM **throw**-Pres-Prog **man**
"The man (that) the woman is throwing"

3b. Passive: 女の人に投げられている男の人
Onnanohito-ni nage-rare-te-iru otokonohito
woman-BY **throw**-Pass-Pres-Prog **man**
"The man being thrown by the woman"

We examine the effects of animacy in relative clause production with both native English and native Japanese speaking individuals. We used a modification of a picture-based production task (Gennari, Mirkovic & MacDonald, 2005) which allowed the same picture prompts to be used for both languages. If speakers of different languages make similar structure choices, it is possible that understanding these particular choices will be a means toward understanding structure choice and language production more generally, independent of language-specific idiosyncrasies. Experiment 1 tested English speakers, and Experiment 2 used the same materials and method with Japanese speakers. Comparing the production frequencies of active and passive relative clauses of the two languages will aid development of a theory that can account for the data obtained for both English and Japanese object relative clause sentences.

Experiment 1: English

The goal of this study was to examine the effect of animacy on the production of English relative clauses in a picture description task. We used a relative clause elicitation method that was similar to the one developed by (Gennari, et al., 2005) but modified the task to familiarize the participants with the materials before conducting the production phase of the experiment. This pre-training encouraged all participants to use the same verb to describe each picture. An effect of animacy comparable to that of previous relative clause production studies would be realized as more passive being produced with animate than with inanimate head nouns.

Methods

Participants Eighteen undergraduates at the University of Wisconsin, Madison participated in this experiment in exchange for course credit in an introductory psychology course. All were native speakers of American English.

Materials Twenty verbs that can each take both an animate or inanimate grammatical object were selected. Color pictures were created that illustrated each of these twenty verbs. In each picture, there were two instances of that particular verb, once acting upon an animate grammatical object and once acting upon an inanimate grammatical object. These grammatical objects were the target items in the experiment. For example, the picture for the verb 'throw' (Figure 1) incorporated both a man being thrown and a ball being thrown, and the animacy of these target items was an independent variable of the experiment.

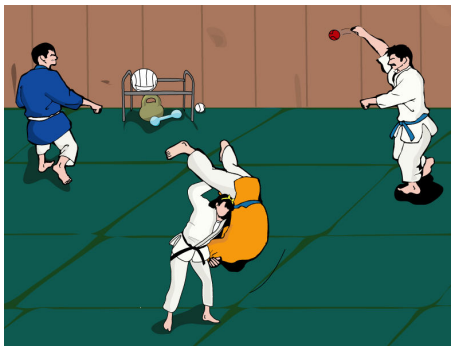

Figure 1: Test picture for verb "throw"

In addition to the twenty test pictures, there were 43 filler pictures for a total of 63 trials. Fillers were included to reduce strategic effects and structural priming (the repetition of structure from one trial to the next).

To elicit relative clauses, spoken questions were recorded that asked participants to describe a particular target person or object in the picture. For example, questions corresponding to Figure 1 would be "Who is wearing orange" for the animate 'man' target and "What is red" for the inanimate 'ball' target. There is more than one man in the picture and more than one ball, so the participants needed to produce relative clauses to sufficiently differentiate the target from the other items in the picture. For the target item 'man' in this picture, a good response would be "the man being thrown by the woman" or "the man that the woman is throwing" because these responses distinguish the target man from the second man in the picture. For filler trials, participants were asked to describe what a particular person was doing or identify a particular object. While the test pictures and questions were created such that participants needed to produce a relative clause with a verb as their response to completely answer the question, filler pictures and questions were created so that participants had no reason to use a relative clause in their responses. All spoken materials were recorded in a quiet room by a native English speaker.

Procedure Participants first completed a pre-training task designed to encourage them to use the specified verb associated with each picture (for example, to use "carry" as opposed to "hold" for a picture with carrying events) when describing the pictures in the later task. Different verbs tend to occur in active and passive sentences with different frequencies so the verb pretraining was designed to limit the effects of these verb-specific tendencies. In pretraining, participants viewed only the segments of each test picture that illustrated the verb. All participants saw both the animate and inanimate uses for each verb so they would not be able to anticipate their target when viewing the complete picture in the main task. After two seconds of exposure, a

verb describing the action appeared underneath the picture. Participants were instructed to simply read aloud the word underneath the picture. For filler pictures, participants viewed a segment of picture containing a person or object and a corresponding noun. The order of presentation was randomized.

After completing the pre-training task, participants performed the main task of the experiment. Detailed instructions with a cover task were utilized to prompt relative clause productions. Participants were told that the experiment was about interpreting pictures, and that their responses would be shown to a later group of participants who would try to guess which pictures their responses described. They were told that because colors or clothing might be changed, or items in the picture might be rearranged, describing the actions in which the people and objects were taking part would be the best strategy to employ in order to complete the task.

In each trial, a color picture appeared on the screen. After three seconds, participants heard a question asking about the target person or object in the picture. Participants were instructed to answer the question by speaking into a microphone. Each participant saw ten pictures with a question about an animate patient (e.g., the man being thrown in Figure 1) and ten pictures with questions about inanimate themes (e.g., the ball in Figure 1). A different set of participants saw the other half of the animate-inanimate target pairs, so that participants saw each picture only once. Test and filler trials were pseudo-randomized such that there were always at least two filler trials between any two test trials.

Results

The data consisted of participant productions on the twenty test trials. Responses were coded for sentence type: active or passive, in order to generate frequencies of production types given the animacy of the target item. Trials were excluded if a participant failed to produce a relative clause or failed to include a verb in their response. For animate targets, 17% of 180 trials were excluded for a total of 149 trials responses included in the analysis. For inanimate targets, 23% of 180 trials were excluded for a total of 139 trials included in the analysis. Of these trials, 134 (animate) and 115 (inanimate) trials consisted of productions in which participants used the verb prompted in pre-training. The pattern of data described below did not change when relative clauses with the "wrong" verb were included in the data set, so the reported data includes these trials.

Participants produced almost exclusively passive sentences when the target item was animate and both active and passive sentence when the target item was inanimate. For animate targets, 2.0% of coded responses were active and 98.0% were passive. For inanimate targets, passive structures were more common; 38.8% we active while 61.2% were passive.

This result confirms that the animacy of the target noun, which would become the head of the produced object relative clause, did in fact influence the structure of the production. Even when the position of the animacy-manipulated noun was fixed (the manipulated noun was always the head noun) there was an effect of animacy on the produced structure.

Discussion

In the presence of a fixed initial noun and in the absence of a noun order change, participants reliably made structure choices based on target (head) noun animacy.

This pattern of results is consistent with previous findings (Gennari et al., 2005). Gennari and MacDonald, (2009) argued that accessibility can account for these structure choices, even though as relative clauses they are restricted in word order. In the case of the inanimate head noun, the accessibility of the head noun is driven by it being the topic of the sentence (promoting a passive relative). This noun competes with the accessibility of the embedded animate noun, whose accessibility encourages it to take the role of the grammatical subject (of an active object relative clause). This causes both the active and passive construction to be used. In the case of the animate head noun, neither is more accessible than the other so there is no motivation to use an active structure, hence the high proportion of passives.

An alternative account is that two animate nouns (woman and man) both make plausible thematic agents and are more similar to each other than an animate and an inanimate noun (man and ball) so production is aided by further distinguishing the animate nouns. It is possible that increasing the distance between the nouns in these sentence aids planning and helps keep the agent and the theme noun separate. Smith and Wheeldon (2004) found that semantically interfering elements tended to move later in a sentence. A passive relative clause structure would allow the two animate noun phrases to be placed farther apart than an active structure in English. However, in Japanese, the active and passive relative clauses do no differ in word order, and so any effects of animacy in Japanese relative clauses could not be attributed to word order strategies. We tested this hypothesis in Experiment 2

Experiment 2: Japanese

In Japanese, all word order remains the same between active and passive relative clause sentences so investigating production in Japanese is an opportunity to investigate planning processes that do not necessarily drive noun ordering. If production frequencies of Japanese are similar to those of English, the motivation to choose the passive over the active construction should be able to be accounted for by single cause that is compatible with the data obtained for both English and Japanese object relative clause sentences. If, however, frequencies of active and passive constructions are not similar across languages it is likely that different cognitive processes are underlying structure choices in both languages.

Methods

Participants Eighteen native speakers of Japanese participated. This sample included university students and community members. The mean age was 27.6 (SD=7.1) and mean number of years in the United States was 3.2 (SD=3.7). All participants were paid for their participation.

Materials and Procedure All materials and methods were identical to those used in the English study, with the exception that all printed and spoken materials were presented in Japanese and participants were tested by an experimenter who was fluent in Japanese. Audio materials were recorded by a native speaker of Japanese.

Results

Responses were coded or eliminated in the same way as they were in English. For animate targets, 25% of 180 trials were excluded for a total of 135 responses included in this analysis. For inanimate targets, 39% of 180 trials were excluded for a total of 110 trials included in the analysis. (Of these utterances 94 animate and 85 inanimate trials contained the pre-trained verb.) It is unclear why the exclusion rate was somewhat higher in Japanese than in English.

Similar to English participants, Japanese participants produced almost exclusively passive relative clauses when the target item was animate and a mix of active and passive relatives when the target item was inanimate. For animate targets, 0.7% of productions were active and 99.3% were passive. For inanimate targets, 69.9% were active while 30.1% were passive.

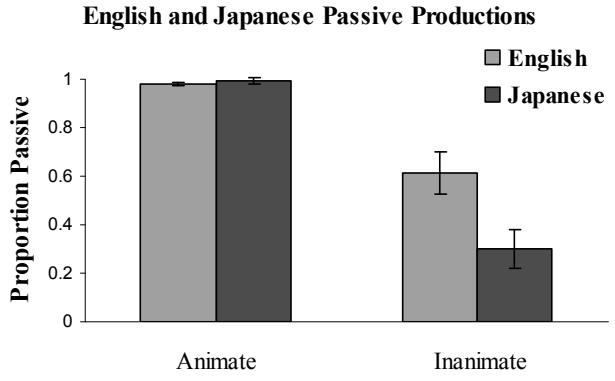

Figure 2: English and Japanese production frequencies

Both English and Japanese utterances showed an animacy effect; production frequencies of active and passive sentences differed by target (head) noun animacy. However, the nature of this effect was not identical in the two languages ($F(1,68)=7.33$, $p<0.01$). While in both English and Japanese animate head nouns yielded almost exclusively passive relatives, the proportions of active and passive sentences produced for inanimate heads differed across the two languages. Figure 2 shows that proportions of passives produced with animate heads did not differ across languages ($t(34)<1$), but with inanimate heads, more passives were produced in English than in Japanese ($t(34)=2.62$, $p=0.013$).

Discussion

The Japanese data underscore the finding in the English data that speakers' structure choices cannot be accounted for simply by noun ordering driven by accessibility. While there is room for accessibility as a partial explanation for the data because speakers did in fact produce different structures with animate and inanimate head nouns, accessibility alone would predict similar rates of passive productions with inanimate heads in both English and Japanese, which is not the case.

The Japanese data also contradicts the assumption that the passive structure is chosen to physically separate and thus ease production of similar nouns. Japanese speakers made similar structure choices as the English speakers in the absence of any word rearrangement.

General Discussion

In both English and Japanese, head noun animacy had an effect on relative clause structure choices. In both languages, speakers produced almost exclusively passive relative clauses with animate head nouns and a mix of active and passive relative clauses with inanimate nouns. Further, with inanimate head nouns, English speakers produced more passive relative clauses than did Japanese speakers.

In order to understand the reasons for the structure choices made by speakers of both languages, it is important to consider both similarities and differences in structure choices. The English-speaking and Japanese-speaking participants' productions both showed a main effect of head noun animacy on produced structure but the two languages differed in the relative frequencies of active and passive productions for the inanimate heads. Understanding the motivations behind the structure choices made by English and Japanese speakers will aid the understanding of how semantic factors (such as animacy) interact with syntactic properties (such as head direction) in language production. Below we discuss possible explanations for these cross-linguistic similarities and differences.

Similarities: Animacy Effect

In both English and Japanese, head noun animacy affected the proportion of active and passive sentences produced. There are several potential explanations for this phenomenon.

Semantic Interference Animate headed object relative clauses with animate agents (as in 2a) are more difficult to comprehend than object relatives with inanimate heads (1a) in English (Traxler, Seely & Morris, 2002; Gennari & MacDonald, 2008) and Dutch (Mak, Vonk & Schriefers, 2002). Gennari and MacDonald, (2008) attributed this difference to semantic indeterminancy; the animate head affords more potential continuations of the sentence. Our

data, as well as Gennari and MacDonald's (2009), show that speakers almost never produce this difficult structure. It is possible that the semantic similarity between the two animate nouns also causes difficulty for the speaker as well. Animate nouns pairs that are similar to each other and can both act as reasonable agents in a sentence (a girl can kiss a boy and a boy can kiss a girl) may be more easily confused and thus more difficult to plan. English speakers might differentiate the two nouns by moving them physically farther apart in the sentence by employing the passive to a greater degree with two animate nouns than with nouns of mismatching animacy. Alternatively, this interference could reduce the accessibility of the agent of the action, and a passive structure would allow this noun to appear later in the sentence than in an object relative clause.

This explanation is less satisfying in the Japanese case because word order does not change between active and passive sentences. Speakers are clearly not "separating" noun combinations that are difficult to plan. However, though word order does not change, the sentences are by no means identical; the case marker on the first noun (the agent of the action) differs, and it is possible that the semantic interference between two nouns could vary with their case marking. Thus it may be that both English and Japanese speakers are responding to planning difficulty from semantic similarity in different ways—changes in word order in English and changes in the case marking in Japanese, where no word order changes are permitted. There is some work suggesting that case markers affect relative clause processing (Ishizuka, 2005), suggesting that case marking could modulate interference and planning difficulty. This account is highly speculative, as there is no independent evidence to date on the role of case marking in interference, or even that semantic interference is the source of planning difficulty in animate headed relative clauses.

Pragmatics of animate and inanimate nouns Another possible explanation for the animacy effect is that animate and inanimate nouns are generally spoken about differently, and different types of messages lead to different structure choices. This view is very similar to the one offered in Gennari and MacDonald (2009) but rather than animacy/accessibility affecting relative clause structure directly in Gennari and MacDonald's view, animacy affects structure in simple sentences, and these patterns prime structure choices in relative clause sentences.

Pragmatically, speakers talk about and focus on animate and human things more than inanimate things. For example, speakers are more likely to use active sentences when describing animate subjects with action verbs, as demonstrated in the preference of *The girl carried the computer* over *The computer was carried by the girl.* However, passive sentences are produced more often with theme-experiencer verbs to maintain the animate entity as the subject. For example, *The boy was delighted by the cupcake* is preferred over *The cupcake delighted the boy* (F. Ferreira, 1994). Passive preferences for inanimate patients or experiencers in main clauses may promote similar structure choices in relative clauses.

In the inanimate condition, the topicalization of the inanimate head noun (e.g., ball) encourages a passive sentence (The ball that was thrown by the man), while the tendency to maintain animate items as the grammatical subject (as they are in simple sentences) encourages active productions (The ball that the man threw). These conflicting forces bring about a combination of active and passive productions. In the case of two animates, the topicalization of the animate head noun (man) encourages a passive production (The man that was thrown by the woman). In this case, both "woman" and "man" are equally animate, so simple sentences show no tendency toward making a particular one the subject, so there is no push toward an active sentence.

This explanation can account for the effect of animacy on produced structures in both English and Japanese. However, it requires evidence of structural priming from simple structures to relative clauses, and that evidence is currently lacking.

Differences: Inanimate Productions

The inanimate heads yielded a mix of structures in both the English and Japanese studies here, but the passives were predominant in English and active object relatives were more common in Japanese There are a number of possible explanations for this difference.

Active/Passive baseline If there is structural priming from main clauses to relative clauses, then the different proportions of active and passive productions in relative clauses in English and Japanese might be due to different frequencies of active and passive constructions in simple sentences in these languages. Though we know of no controlled study comparing production choices in simple sentences in the two languages, there are some suggestions that base rates of passives may be different in English and Japanese. For example, Japanese often allows subjects (agents) to be dropped in active sentences, whereas English speakers must use a passive (e.g. *the man was thrown*) to drop the agent. This means that many messages that would be expressed with the passive construction in English in fact appear in the active construction in Japanese (Fujii, 2008). It is possible that in main clauses, the use of active in Japanese, where a passive would be used in English, increases the overall frequency of actives in Japanese relative to English. These patterns from main clause sentences may then be reflected in relative clause sentences.

A simple picture description task could provide insight into whether or not patterns of frequencies of active and passive main clauses match those of relative clause sentences in English and Japanese.

Priming We have invoked structural priming in several explanations above, but it is not necessarily the case that priming effects would be equally strong in both English and

Japanese. The word order differences between structures could affect the degree of structural priming in English and Japanese. There is some evidence that priming is facilitated in sentences with similar structural configurations (Traxler, 2008), so the structural similarity of the active and passive constructions in Japanese could promote more priming among the inanimate headed constructions. Alternatively, priming tendencies from main clauses may affect relative clauses. Further priming studies could determine whether structural differences in English and Japanese might affect the degree of structural priming or even the role of animacy in structural priming.

Conclusions There are many potential explanations for both the similarities and the differences seen in the English and Japanese production data. The alternatives presented here are plausible but largely untested, owing to the general shortage of production studies of complex sentences, and the shortage of production studies comparing the two languages.

The available data do suggest that despite the enormous differences in relative clause word order in the two languages, speakers of English and Japanese make the same structural choices for animate headed relative clauses. This finding suggests that production choices cannot stem solely from pressures to choose different word orders (such as moving the agent to the end of the clause). Production choices in relative clauses likely reflect both cognitively-motivated production demands such as accessibility as well as language-specific constraints faced by the speaker. In gaining a better understanding of the choices speakers make when producing utterances, we can better understand how more general message-based factors and language-specific factors conspire to shape speakers' choices.

This understanding of speaker choices is also important for language comprehension, including potential differences in comprehension patterns between English and Japanese. Gennari and MacDonald (2009) have argued that the reason animate headed object relatives are hard in English is due to their rarity. Speakers and writers who want to convey a message of this type avoid active object relative structures and instead use a passive. They found that comprehension difficulty for object relative clauses with several different verb types and animacy configurations were well correlated with production patterns. Thus it is possible that cross-linguistic production differences will offer insight into cross-linguistic comprehension patterns as well.

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