Sentence Production in Japanese

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Introduction

To communicate verbally, speakers must produce a grammatical sequence of words, that is, a sentence that conveys a meaning. The meaning activates syntactic, morphological, and lexical representations, which insure the production of a grammatical sentence. The process is surprisingly complex, because the speaker must select elements that are appropriate for the meaning and find a way to sequence these elements in a language-appropriate way.

To explain how speakers produce sentences, an architecture for sentence production has been proposed (e.g., Bock, 1995; Bock & Levelt, 1994; Garrett, 1988; Levelt, 1989). The architecture has three main components: the message, which represents the meaning of a sentence, the grammatical component, which is responsible for the generation of word sequences, and the phonological component, which retrieves the phonological content of words from the lexicon. Our discussion will focus on the mechanism of the grammatical component, that is, how a sentence is formulated in production (for discussion of the phonological component, see Terao, this volume).

Production Methods

Both observational and experimental techniques have been used to study production. Observational techniques examine the distribution of speech errors or syntactic structures in naturally occurring utterances (Garrett, 1988). While observational data reflects natural language use, the lack of experimental control has made it difficult to get precise answers about production processes. To get these answers, experimental methods have been developed (see Bock, 1996, for an exhaustive summary of existing techniques).

Experiments take advantage of the fact that similar message content can be conveyed with different structures, called structural alternations. Transitive (1) and dative (2) alternations are commonly used.

(1) a. active: Lightning struck the church.

b. passive: The church was struck by lightning.

(2) a. double object dative: The rancher sold the cowboy the horse.

b. prepositional dative: The rancher sold the horse to the cowboy.

These sentences have similar meanings, but they use different structures. In the transitive alternation (1), the active and passive differ in the order of thematic roles, verb morphology, and the use of function words such as the auxiliary verb and the preposition by. In the dative alternation (2), the double object and the prepositional dative differ in the order of thematic roles and the preposition to. Given the similarity of the messages in these alternations, the question is how do speakers select the appropriate structure. To study this, researchers have manipulated the raw materials for production (words, meanings, structures) to see how changes in these materials influence how speakers create structures.

Grammatical characteristics of Japanese

The architecture of sentence production is mainly supported by studies in European languages (e.g. English). Because these languages have similar matrix-clause word order (SVO) and limited use of null pronouns, it is difficult to isolate universal features of production from the features of the languages that have been studied. Only by testing languages that have substantially different syntax can we come to a better understanding of the universal aspects of production.

Japanese provides a good opportunity to test the universality of the architecture, because it differs from English in several syntactic dimensions. First, Japanese is a relatively free word-order language that makes use of particles (case markers, postpositions) to mark the grammatical function of each phrase in a sentence. The language allows phrases to trade places via scrambling (word permutation) without changing grammatical functions. Second, the verbs in Japanese appear at the end of clauses, and have been found to exert less influence on structural decisions than in some SVO languages in comprehension (Kamide & Mitchell, 1999; Yamashita, 1997; Yamashita, 2000). Third, English requires overt arguments, while in Japanese any arguments may be omitted. These features allow experiments to be conducted in Japanese that would be difficult to accomplish with English.

Factors that influence structure selection

Experimental studies of sentence production can be grouped into three domains according to the sources that influence the produced sentences. The first two concern the way in which the properties of words or phrases influence

the choices of the syntactic structures. The third is the influence of preceding sentence, which affects subsequent sentences, a phenomenon called structural priming.

Word-level factors: Accessibility of words influences phrase order

In English, the ease of accessing lexical items influences structure selection. For example, Bock (1986a) presented speakers with a picture of lightening striking a church, which could be described by either the active or passive structure in (1). This picture description was preceded by a prime word that was semantically related to either lightning ("thunder") or church ("worship"). To see how this prime word influenced structure selection, the proportion of one structure (e.g. active) out of both possibilities (actives and passives) was measured. The results showed that when "thunder" was the prime, speakers produced more active voice descriptions (i.e. The lightening is striking the church) than when "worship" was the prime. These results suggest that the priming of the concept made the word easier for the speakers to retrieve, that is, made it more accessible than other words.

The notion that planning of the sentence is piecemeal, or incremental (Bock, 1982; Ferreira, 1996) is critical in explaining why the accessibility should lead to earlier placement in the sentence and the change in syntactic structure. If sentence planning is incremental, then words that are more accessible will occur earlier in sentences. These choices then require that speakers adjust their syntactic structure to convey the appropriate meaning.

A variety of factors have been found to influence the accessibility of words and their placement in English sentences, such as animacy (Clark, 1965),

definiteness (Grieve & Wales, 1973), salience (Osgood & Bock, 1977), imageability (Bock & Warren, 1985), and prototypicality (Kelly, Bock, & Keil, 1986). In several studies, Bock and colleagues manipulated the discourse status (given/new) of two words in question-answer pairs (Bock, 1977; Bock & Irwin, 1980). Bock and Irwin (1980) used a study-test protocol, where participants first heard a randomized list of question sentences and a randomized list of answers. The questions described different events, all of which introduced one of the participants as old information. As shown in (3), the first sentence introduces a particular cowboy, Roy Rogers, as given.

(3) Question: A rancher received an inquiry from Roy Rogers about something he needed for his act. What did the rancher do?

For the question in (3), the appropriate answer was either (4a) or (4b).

(4) Answers:

a. The rancher sold the cowboy the horse.

b. The rancher sold the horse to the cowboy.

Upon hearing all questions and answers, the questions were read again and participants were asked to write down the answer that matched this question. Because the production of the answer was separated in time from the study situation, participants were likely to change the structure based on their preferences at the test, and this allowed the discourse status to influence their responses. They found that participants were likely to answer using the structure that placed the given word earlier in the structure. Because the question (3) introduced a particular cowboy, participants were more likely to use a structure which placed the cowboy before the horse (4a).

Bock and Irwin also manipulated lexical identity of the target word, by using

the same lexical item in both question and answer (e.g. Roy Roger). This lexical identity had an effect that was greater than that with the discourse identity, suggesting that discourse givenness and lexical givenness have separate influences on accessibility and on word order.

Ferreira and Yoshita (2001) replicated the Bock and Irwin study in Japanese using scrambled sentences and spoken responses. Below are examples of their question/answer items.

(5) Question:

a. Okusan-ga meedosan-ni kansyasiteita. Sorekara doosita?
the housewife-nom housemaid-dat thanked then what happened
"The housewife thanked the house maid. What happened next?"

(6) Answers:

a. Okusan-ga otetudaisan-ni purezento-o okutta.
the housewife-nom housekeeper-dat present-acc sent
"The housewife sent the housekeeper a present."

b. Okusan-ga purezento-o otetudaisan-ni okutta.
the housewife-nom present-acc housekeeper-dat sent
"The housewife sent the present to the housekeeper."

Ferreira and Yoshita found that Japanese speakers tended to answer with the given word before the new word. And the effects were stronger when the identical lexical item was used. Together, these results suggest that the accessibility of elements at both discourse and lexical levels can independently influence the order of phrases (changing grammatical function in English, scrambling in Japanese).

Phrase-level factors: Phrase length and heavy NP shift

Accessibility and incrementality provide a production explanation for a variety of structural ordering tendencies such as "given before new" preference (Gundel, 1988). Another phenomenon is "heavy NP shift" (e.g., Kimball, 1973) which is a tendency for long "heavy" phrases to be postponed to after short "light" phrases (short-before-long tendency). For example, the sentence with a short PP ahead of a short NP, Bill sang with friends a song, is awkward. When the short PP increases in length as in Bill sang with friends a song that was written by a Texan, the phrase becomes more acceptable. Such tendencies were found independent of discourse (Arnold, Wasow, Losongco, & Grinstorm, 2000) and without the presence of discourse (Stallings, MacDonald, & O'Seaghdha, 1998), suggesting that such tendency is an automatic outcome of the production architecture.

Japanese studies suggest that the short-before-long tendency might not be a universal feature of production. Japanese corpus studies have shown a tendency for heavy phrases to come before short phrases, via scrambling (Dryer, 1980; Hawkins, 1994). Yamashita and Chang (2001) found this long-before-short tendency in an on-line task that was similar to the one used by Stallings, et al. (1998, Experiment 3). When subjects were presented with a condition where each phrase was short, Keezi-ga hannin-o oikaketa. "The detective chased the suspect," the speakers maintained this canonical order. However, when the object becomes long, as in Keezi-ga se-ga takakute gassiri sita hannin-o oikaketa. "The detective chased the suspect who was tall and big-boned," the proportion of scrambled sentences, placing the long object ahead of the short subject, increased by 25%.

One account of these phenomena is that the head-direction of the language determines the preference direction (Gibson, 1998; Hawkins, 1994). But since theories of sentence production do not directly use head-direction for structure selection, Yamashita and Chang formulated an account of these language-specific preferences that made use features of an incremental accessibility-oriented production system. They argued that long noun phrases are both rich in meaning and complex in form. Since accessibility of meaning and form can have different influences in production (Bock, 1982), it could be that Japanese speakers are focusing more on conveying meaning (putting enriched material earlier), while English speakers are focusing on sequencing forms (putting easily accessed word earlier). Connectionist models of Japanese and English sentence production have suggested that this type of account might be feasible (Chang, 2002; Chang & Yamashita, 2001, March)

Sentence-level factors: Structural Priming

Another factor that influences structure selection is one's recent experience with syntactic structures. Evidence for this comes from a phenomenon called structural priming, a tendency for speakers to reuse previously produced or comprehended sentence structures (Bock, 1986b). For example, suppose speakers are given a picture that can be described with the double object dative as in (2a) or the prepositional dative as in (2b). The production of this picture is preceded by either a prime sentence, a sentence with totally unrelated semantic content to the pictures but expressed either in the prepositional dative or double object structure. After the prepositional dative prime, speakers are more likely to describe the picture with a prepositional dative

relative to the double object prime, and structural priming refers to this increased likelihood of using the primed structure.

Structural priming can occur between sentences with different verb transitivity and different thematic overlap. Bock and Loebell (1990) compared how much dative structure is primed by the prepositional locatives (7a) versus the prepositional datives (7b).

(7) a. The wealthy widow drove an old Mercedes to the church

b. The wealthy widow gave an old Mercedes to the church.

Prepositional locatives are similar in surface form to prepositional datives, but the prepositional locative verbs are transitive and the prepositional phrase is a goal location rather than a recipient. Despite these differences, Bock and Loebell found that the prepositional locatives and prepositional datives primed prepositional datives (relative to double object dative primes) equally well. These results suggest that priming can occur even when there are differences in transitivity and thematic roles between prime and target (although see Chang, Bock, & Goldberg, 2002 for evidence that thematic roles can matter in some structures). A phonological account (both sentences sharing the preposition “to”) is also unlikely, because prepositional datives such as “Stella brought a book to Sally” prime differently from the phonologically similar “Stella brought a book to study” (Bock & Loebell, 1990; Exp 3).

In preliminary work in Japanese, Yamashita, Chang, and Hirose (2002, March) report structural priming with dative sentences. They used a sentence repetition task that has been shown to be sensitive to structural priming (Potter & Lombardi, 1998). In this task, speakers read sentences on a computer and were asked to produce them after a secondary distractor task. The target sentences

were in the order of topic (Agent) marked by wa, object (Theme) marked by o, and indirect object (Goal) marked by ni (wa-o-ni order), as shown in (9). Each target sentence was preceded by either a control prime sentence (also in wa-o-ni order) with a full set of dative arguments (8a), or two structures that were marked as wa-ni-o on the surface. One of these structures had the same content as the control prime (wa-ni-o, 8b) and one had the ni-marked adverb in place of an argument (wa-(adjunct) ni-o, 8c).

(8) a. Akiko-wa kagi-o tomodati-ni ageta.
Akiko-top key-acc friend-dat gave
"Akiko gave the friend the key"

b. Akiko-wa tomodati-ni kagi-o ageta.
Akiko-top friend-dat key-acc gave
"Akiko gave the friend the key"

c. Akiko-wa sinya-ni kagi-o ageta.
Akiko-top midnight-at key-acc gave
"Akiko gave the key at midnight."

(9) Taro-wa hana-o onnnanoko-ni okutta
Taro-top flowers-acc girl-dat sent

"Taro sent the flower to the girl."

The results show that speakers produced more wa-ni-o structures after wa-ni-o primes than after wa-o-ni primes. Furthermore, speakers produced more wa-ni -o structures after wa-(adjunct)ni-o primes than after wa-o-ni primes. Although the source of the priming in the wa-(adjunct)ni-o condition still needs investigation, the study shows that structural priming is sensitive to the order of arguments.

Notice that scrambling in Japanese differs from the structural changes such as the dative alternation in English in that there are no differences in grammatical function assignment or the order of surface syntactic categories. Since existing accounts of priming tend to emphasize these types of representations (Bock & Loebell, 1990; Hartsuiker, Kolk, & Huiskamp, 1999), the finding that priming is sensitive to the order of case-marked phrases could be potentially important for a universal account of structural priming.

Conclusion

The study of sentence production in Japanese is still in its infancy. Work on accessibility and on structural priming has suggested that structural selection in English and Japanese are operated on by similar mechanisms, even though their linguistic characterization (scrambling, grammatical function assignment) differs. The heavy NP shift work suggests that there are some differences in how these mechanisms influence structure selection in different languages. Determining how the architecture explains these similarities and differences will be important for future work in cross-linguistic sentence production.

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