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Cognition and Sentence Production: A Cross-Linguistic Study

By S. N. Sridhar. Springer Series in Language and Communication: No. 22. New York: Springer-Verlag, 1988. 118 pp. $42.50.

Spoken language epitomizes human creativity. Speaking requires formulating messages based on the ideas we want to express and the communicative goals we want to achieve. We formulate a message by choosing a grammatical structure, inserting words into that grammatical skeleton, inflecting the words, and then producing the sounds.

Most psycholinguistic research on sentence production focuses on the processes that occur later in this sequence. For instance, most research deals with how words are chosen, inserted, inflected, and produced (Garrett, 1988).

The questions of how speakers formulate messages and how they choose grammatical structure are not as thoroughly studied; consequently, they are not nearly as well understood. Perhaps it is not surprising that the most creative aspect of sentence production is also the most elusive. But the questions remain: How is a grammatical structure chosen? How does that structure reflect our ideas and communicative intent?

Sridhar's study addresses these questions using an experimental approach: He manipulates visual arrays, asks subjects to describe those visual arrays, and measures how his manipulations affect his subjects' choice of grammatical structure.

Cognition and Sentence Production: A Cross-Linguistic Study is a revised and enlarged version of Sridhar's doctoral dissertation. Although Sridhar is a linguist, he began his work while studying with Charles Osgood, and his work reflects Osgood's influence. For instance, Sridhar is reformulating Osgood's (1980) "Naturalness Principle" when he writes: "Many of the properties crucial to the structure and function of language . . . reflect universal properties of human perception and cognition and the function of language as a system of communication" (p. 2). Thus, Sridhar, like Osgood,

adopts a functional approach. He argues that nonlinguistic cognitive processes and communicative intent are reflected in grammatical structure.

The study

Sridhar investigates how nonlinguistic cognitive processes and communicative intent are reflected in grammatical structure by exploring how "universal properties" of perception and cognition affect sentence production. To do this, Sridhar presented a film to native speakers of 10 diverse languages: Cantonese, American English, Finnish, Modern Israeli Hebrew, Hungarian, Slovenian, Mexican Spanish, Japanese, Turkish, and Kannada. Each scene in the film presented a visual array. Sridhar manipulated different aspects of the arrays. For example, he manipulated the perceptual salience of the different objects in the visual array by varying their size, shape, and orientation.

The subjects' task was to describe each scene with a single written sentence. Sridhar examined how his manipulations (e.g., perceptual salience) affected the grammatical structures his subjects produced. For instance, he measured his subjects' choice of word order and clause order, their use of active versus passive sentences, and their choice of sentence topic.

Sridhar's study makes several valuable contributions. First, it adds to the sparse cross-linguistic psychological research on sentence production. Second, it resolves some of the more vexing methodological problems inherent in sentence production research. Production research requires carefully constraining the input that elicits the subjects' productions and carefully measuring the output that subjects produce. The scenes in Sridhar's film were designed to be as cross-culturally neutral as possible. Each was created with an astute sense of the grammatical structures that would be comparable cross-linguistically and likely to be elicited. Sridhar's study joins Chafe's (1980) discourse production research in demonstrating that comparative cross-linguistic production research is possible.

Finally, Sridhar's study is important because his experimental psycholinguistic data corroborate naturalistic, descriptive data from cross-linguistic studies of discourse (Givón, 1979; Tomlin, 1986). Indeed, his success at eliciting experimental data encourages further collaboration between psychologists and linguists in cross-linguistic contexts.

Functional principles

As we mentioned above, functional grammarians argue that grammatical structure (syntax) reflects the way we perceive, organize, and communicate information. Functional approaches contrast with the generative tradition of Chomsky (1957) and others, who view syntax as an autonomous component structured according to the principles of the "language faculty" (Fodor, 1983). Although Sridhar does not directly address the differences between functional and generative theories, he does spend more than half the book surveying issues in functional grammar. In particular, he identifies the functional principles that motivate his study's hypotheses.

Sridhar classifies the functional principles into three categories: *perceptual,*

saliency, and *pragmatic* principles. He uses these principles to predict the grammatical structures that his subjects will choose when they describe the film.

Perceptual principles account for how nonlinguistic perceptual factors, such as figure-ground organization, influence grammatical choice. For example, Sridhar assumes that when viewing scenes, speakers attend to figures over grounds, sources over recipients, and actions over states. These factors influence sentence formulation and grammatical form: Speakers prefer to mention figures before grounds, sources before recipients, and actions before states. For instance, the two sentences "The rug is under the cat" and "The cat is on the rug" describe the same scene. But perceptual principles predict that subjects are more likely to say "The cat is on the rug," because it captures the figure-ground relations.

Perceptual principles also account for speakers' preferences for describing events in their chronological order. In addition, Sridhar suggests that speakers scan arrays from top to bottom and from front to back. Therefore, speakers prefer to describe visual arrays in that order.

Whereas perceptual principles reflect nonlinguistic "perception-based cognizing," saliency principles reflect a speaker's "transient motivational states." For example, saliency principles account for speakers' preferences for emphasizing humans over nonhumans, and animate over inanimate objects. Saliency principles also account for speakers' choice in selecting and maintaining topics. Previous or ongoing reference to a concept increases its saliency and, therefore, its likelihood of occurring as a sentential topic. So, passive sentences like "The marine was indicted by the special prosecutor" occur when *the marine* and not *the special prosecutor* is the topic.

Finally, pragmatic principles reflect the function of language "as an instrument of interpersonal communication." Among other things, pragmatic principles manifest the Gricean conversational maxims. For example, according to the maxim of quantity, speakers make their utterances as informative as necessary, but no more than is necessary. Imagine two cubes on a table. The utterance "the black one" would be sufficient if only one cube was black. However, the utterance "the big black one" would imply that both size and color were necessary to distinguish the two cubes. Thus, pragmatic principles account for how speakers choose to describe referents.

With these three categories of functional principles, Sridhar accounts for speakers' responses to his film. The perceptual factors do indeed correlate with word order and grammatical structure. Salience hierarchies are, in fact, reflected in speakers' choices of word order and grammatical structure. And pragmatic factors do appear to influence the way speakers choose to elaborate when describing scenes. Subjects' performance generally matches the predictions, regardless of their native language.

Unanswered questions

That grammatical structure reflects speakers' ideas and communicative intent seems obvious. But *which* nonlinguistic cognitive factors determine language-specific structure and *how* do they do that? In other words, the

interesting question is not whether the use of a particular grammatical structure is motivated by a nonlinguistic cognitive process. Rather, the interesting questions are *which* cognitive processes affect *which* grammatical structures, and *how* nonlinguistic processes actually interact with linguistic (more aptly, syntactic) processes (Bock, 1982). These more complex questions are frequently asked in language comprehension research. For example, language comprehension researchers do not question whether context helps us recognize words; rather, they ask *how* and *when* context affects word recognition (Garfield, 1987).

Sridhar suggests that his functionalism is similar to what Bates and MacWhinney call "Level 2" functionalism: "In ongoing processing, linguistic forms are associated with one or more communicative functions, in a manner that suggests a causal relationship" (1982, p. 80). However, Sridhar's approach does not help to refine what is meant by the crucial term *associated with*. This is what we shall call "a mapping problem."

A mapping problem occurs when Sridhar's functional principles compete. The functional principles are not mutually exclusive. For example, Sridhar claims that the initial position in the sentence manifests several principles. Initial position reflects (a) a perceptual principle that accounts for why speakers prefer locating figures before grounds, (b) a perceptual principle that accounts for why speakers prefer locating objects on top versus bottom, (c) a perceptual principle that accounts for why speakers prefer to describe events in their temporal sequence, (d) a saliency principle that accounts for speakers' preferences for mentioning humans over nonhumans, and animate over inanimate objects, (e) a saliency principle that reflects the speakers' transient motivational states, and (f) a saliency principle that reflects the discourse prominence of a concept.

These principles are likely to conflict. A perceptual principle might predict that one concept should occur in sentence initial position, whereas a saliency principle might predict that another concept should. Functional explanations will be successful when they can account for how competing factors ultimately determine a single grammatical structure (Dubois, 1985; MacWhinney, 1987; Silverstein, 1987).

Furthermore, a mapping problem occurs when a single functional principle predicts more than one grammatical structure. For example, if John were the topic, the saliency principle could predict all of the following utterances: "John was chosen by the committee," "It was John whom the committee chose," "John is the one whom the committee chose." How does a single functional principle predict the choice of one structure and exclude another?

Unfortunately, Sridhar stops short of addressing these mapping problems. In the next section, we illustrate a particular mapping problem and its ramifications for a functional approach.

Grammatical relations versus word order: An example of the mapping problem

In English and many other languages, the grammatical relations of *subject* and *direct object* are identified largely by their order in sentences. In English,

subject noun phrases come directly before verbs, and direct object noun phrases come after verbs. Although this regularity sometimes leads to the assumption that grammatical relations (subject, direct object) are identical with word order, the mapping of grammatical relations onto word order varies cross-linguistically. This variation implies that the two factors (word order and grammatical relations) need to be distinguished.

For instance, Japanese and Turkish have the order subject-object-verb (SOV). Irish and Arabic have the order verb-subject-object (VSO). The three most frequent word orders are SVO, SOV, and VSO. Other orders (VOS, OSV, OVS) are also observed among different languages, but far less frequently.

Languages also vary in how "freely" the grammatical relations can occur in different orders. For example, in English, the grammatical relations cannot occur in different orders. English is a rigid SVO language; any alteration in word order requires adjustments. For example, if speakers want to express the idea "John ate the beans" while focusing on "beans," they must adjust the grammatical structure of the sentence. That is, speakers cannot say, "The beans ate John" when they mean "The beans are what John ate" or "The beans were eaten by John."

In contrast, consider Japanese. Although the canonical word order in Japanese is subject-object-verb, in fact, either the subject or the direct object can occur in first position. That is, speakers can place the subject and direct object in different orders without syntactic adjustments. This is because grammatical relations in Japanese are not identified by word order (Farmer, 1984); rather, they are identified by suffixes on the noun phrase.

In contrast to English and Japanese, Warlpiri, an aboriginal language of Australia, allows all possible word orders (Hale, 1983). The only restriction is that a tense-marking auxiliary element appear in second position (e.g., an auxiliary that marks past tense). This flexibility in word order is allowed because the grammatical relations are identified via agreement affixes on the auxiliary. These markers indicate the person (I, you, he, she, it) and number (we, you [plural], they) of the subject and direct object. In addition, nouns have case suffixes indicating their role as agent, affected patient, recipient, and so forth. Thus, all of the information as to "who does what to whom" is expressed independently of word order.

What are the mapping relations between the functional principles and the syntactic variables of grammatical relations and word order? In rigid word order languages like English, grammatical relations like subject and direct object are indicated primarily by their order. This rigidity restricts how much word order can reflect functional principles. In "free" word order languages, the grammatical relations are marked primarily via other mechanisms (e.g., case marking and verb agreement). This allows greater word order variation in response to the functional principles.

Unfortunately, Sridhar does not exploit this cross-linguistic variability to full advantage. For instance, there are no verb initial (VSO) languages in his data base. Had Sridhar explored this cross-linguistic variability, he might have found that the two variables are affected by *different* factors. Perhaps,

perceptual principles account for the selection of grammatical relations, and saliency principles account for word order. In fact, two of the languages in Sridhar's study, Hungarian and Finnish, have relatively "free" word order. Unfortunately, he does not use the "free" word order languages to investigate whether word order and grammatical relations manifest different functions.

Conclusion

Sridhar's study demonstrates both the value and vulnerabilities of a functional approach to cross-linguistic research in sentence production. Most important, he demonstrates how grammatical structure reflects the way speakers perceive and organize information. In particular, he identifies three categories of functional principles and demonstrates how these functional principles can account for speakers' choice of grammatical structure. However, Sridhar does not account for how competition among the different functional principles is resolved or how a single functional principle predicts the choice between two similar grammatical structures.

Sentence production models must incorporate Sridhar's findings. But, although his results demand attention, his own position regarding what we have called the mapping problem remains underspecified. For this reason, readers unsympathetic to functional approaches may be less enamored with his results.

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Plans and Situated Actions: The Problem of Human-Machine Communication

By Lucy A. Suchman. New York: Cambridge University Press, 1987. 203 pp. Cloth, $34.50. Paper, $11.95.

Professional training tends to induce tunnel vision and fixed modes for solving problems. When you have a hammer, it is easy to believe that the whole world is composed of nails. Any book that causes scientists to pause and consider the key assumptions that underlie their approach is an innate good. This is such a book, designed to make cognitive scientists aware that other disciplines can also contribute to the problem of human-machine communication.

Woven throughout the book is a wonderful comparison of European versus Trukese navigation across the open sea; indeed, one of the strongest impressions I came away with after reading this book is that the study of Micronesian navigation is a staple in the diet of anthropologists. The European navigator, course and sextant in hand, exemplifies the role of cognitive science as it relentlessly prowls from subgoal to subgoal under the guidance of an overall plan. The Trukese navigator does not sail under control of an a priori plan, but instead modifies his behavior as wind, waves, and weather conspire to alter his local environment.

This distinction is crucial in understanding the approach offered by Suchman. The European navigator (and cognitive science) starts with an abstract plan based upon fundamental principles, a plan that essentially ignores such local events as coconut husks floating in the sea. The Trukese navigator moves from one local event to the next using what anthropologists call "situated actions." "By situated actions I mean simply actions taken in the context of particular, concrete circumstances" (p. viii).

A belief in the propriety of situated actions carries many implications for the correct study of human behavior. In general, one must avoid "unsituated actions." So using a laboratory to study abstract principles of human vision is less useful than observing a person interact with a real visual interface in a real machine doing real work. Abstract accounts and abstract situations are too contrived to be of real use. After a great deal of jargon, the proof