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The place of pragmatics in the syntactic and semantic organization of language[1]

Introduction

In *Languages of the Brain* (Pribram, 1971, Chaps. 17, 18 and 19), I made some preliminary proposals concerning the relationship between human language and the functional organization of the brain. These proposals were based on clinical experience with aphasic patients and on the analysis of the structure of language by Charles Peirce (1934). The proposals were incomplete in many respects and raised problems that have persistently plagued me in trying to understand linguistic processing by the brain. The current conference thus presents an opportunity to enlarge on the earlier views which have been especially enriched by attendance at a conference on the origins of speech and language sponsored by the New York Academy of Sciences in 1976, by an interdisciplinary conference on the nature of human language sponsored by the Society for the Interdisciplinary Study of the Mind in 1978, and by the participants of this conference on 'pausology'.

Perhaps the most important problems concern the relationship between brain organization and Peirce's categories of semantics, pragmatics and syntactics. The connection between semantics and syntactics appeared to be relatively easy to establish: grammar and meaning mutually imply each other much as partitions on a set determine the organization into subsets (Pribram, 1973a). Thus, no separate brain locus would be expected to distinguish disturbances of semantics from those of syntax.

Two problems immediately arise from this formulation: one, it is incomplete since it ignores pragmatics; and two, it contradicts the clinical observation that semantic aphasias more often follow parietal lesions while agrammatism is found most often in patients with more anteriorly placed damage in the temporal lobe or adjacently at the foot of the central fissure.

The problems concerning semantics, pragmatics and syntactics are intimately related to another set of distinctions that Peirce makes, i.e.,

those that characterize signs and symbols. Signs refer to icons, i.e., images that outline or caricature the sensory input. Signs may also become indices that point to, categorize or classify that input into groups, i.e., sets and subsets. Symbols, on the other hand, are tokens that bear only an indirect and completely arbitrary relationship to the events or objects symbolized. In *Languages of the Brain* I focused on this distinction between the direct, deictic nature of iconic and indexal signs and the indirect tokens that compose symbols as fundamental. However, the criticism has often been voiced that signs are also tokens, and furthermore, that in *Languages*, Peirce's differentiation between icon and index was not pursued.

These difficulties are compounded by the generally held opinion by philosophers, linguists and cognitive psychologists that signs and symbols are hierarchically related. Peirce is not altogether clear on this issue, but in *Languages of the Brain*, sign and symbol are conceived to originate from the operation of separate neural systems: signs are processed by the posterior convexity of the brain, symbols by frontolimbic formations. Thus, the neuropsychological formulation has been at variance with accepted linguistic conceptualizations.

Finally, in *Languages of the Brain* I suggested that the ordinary distinction between nouns and verbs in terms of nominalization and predication is in error. Both nouns and verbs are seen as nominalized: verbs refer to nominalized actions while nouns refer to objects, the difference between objects and acts being their relative stability over time and place. Predication is defined neuropsychologically as expressing a relationship, a proposition, a belief about how objects and acts have become momentarily related. Predication, therefore, demands syntax, in English, for example, the use of only a restricted range of verbs such as "is". Linguists, on the other hand have tended to identify predication with action per se and to consider all verbs as predicates. Verbs are thus instrumental, procedural referents to actions of objects referred to by nouns.

One may be tempted to ignore these differences. After all, differences in disciplinary approach may well produce different analyses. But, if understanding human language is to be of a piece, the different approaches ought to shed light on a commonality of problems, and the discrepancies listed above should be resolvable. The following attempt toward resolution is made in this spirit.

Linguistic processing: A proposal

Resolution of these issues rests on the following proposals: 1) Icons and indices are processed by the posterior convexity of the brain. 2) Icons are

images and when an arbitrary representation is made of an icon it is called a sign. 3) *Image processing* and sign (significant) communication is ordinarily processed primarily by the right hemisphere. 4) Indexing involves *information processing* and when an arbitrary representation is made of an index it is called a symbol. 5) Information processing and symbolic communication are ordinarily processed primarily by the left hemisphere. 6) Since indexing often, though not always, subsumes imaging, symbols are often, though not always, hierarchical to signs. 7) Image and information processing is semantic. 8) The frontolimbic forebrain is concerned with expressing the relationship of the organism's internal state to that which is being communicated. 9) Expressive communication molds language and is responsible for its modifications.

Semantic processing: Image and information

Note that in this formulation the distinction between image processing (iconicity) and information processing (indexing) rests on hemispheric specialization. The evidence for such specialization has been repeatedly reviewed (e.g., Dimond & Beaumont, 1974) and has become common knowledge. Less well articulated are the relationships between image and information processing and the construction of linguistic signs and symbols. As Peirce makes clear, icons and indicants bear a direct relationship to what is being signified. In today's parlance, images (see e.g., Paivio, 1971) and information, considered as alternatives (see e.g., Miller, 1953) are also rather directly derived from sensory input. Signs and symbols, on the other hand, are higher order categorizations, which can become arbitrary with use. This arbitrariness stems from the modification of language by expressions of internal states that give form to the language.

The hierarchical nature of linguistic processing is most likely derived from the beginnings of hemispheric specialization and later from the audiovocal nature of human language. There is considerable evidence that initially primate communication proceeded by establishing a reciprocal relationship between icon and index using visual-gestural mechanisms. Thus, apes have been taught to indicate their communications by American Sign Language (e.g., Gardner & Gardner, 1969) and the cave paintings of early man suggest considerable skill at iconic symbolization. A plausible scenario of the origins of *speech* might be that frustrations with visual-gestural communication due to darkness in caves, distance, or other awkward circumstances became expressed in vocalizations which then became differentiated into tokens for the unseen gestures. In

this fashion, the expressions became signs and symbols initially standing in lieu of icons and indexes and then supplanting them because of their overwhelming adaptive advantage. In short, the expressions became words.

It is likely that these first expressions of frustrations were related to actions and were, therefore, verbs. Verbs are words that denote actions (Miller, Galanter & Pribram, 1960, Chap. 14). "A hole is to dig" a child will tell you and an aphasic patient will gesture only "to dig". Later in evolution verb words became nominalized and objectified. Thus, whether one wishes to call words symbols or signs is a matter of convention. Because the meaning of words is ordinarily processed by the posterior convexity of the *left* hemisphere and because indices are usually hierarchical to icons, it does seem most appropriate to call them symbols as is the custom in linguistics and philosophy (e.g., Morris, 1946) and not signs as in *Languages of the Brain.*

Pragmatic procedures: Language formation

But by what mechanism are these higher order arbitrary signs and symbols achieved? The proposal made here is that pragmatic procedures involving the functions of the frontolimbic forebrain continuously modify icon and index once vocal expression becomes involved in the communication. The limbic systems are primarily concerned with monitoring the states of the organism that are expressed as hunger, thirst, sex, etc. (for review see Pribram, 1971, Chaps. 9 and 10). In addition, the intensive aspects of pain and temperature are regulated by these systems (see Pribram, 1977c). These basic functions are reflected in higher order processes as establishing the needs and desires, i.e., the bases for the utilities that determine what reinforces the organism's behavior (see e.g., Douglas & Pribram, 1966; Pribram, Douglas & Pribram, 1969; Pribram, 1977a). In essence, therefore, these systems establish an internally determined pragmatic *context* within which the organism approaches the world about him.

The limbic forebrain shares regulation of context-dependent behavior with the pole of the frontal cortex which can be considered as the "association" area of the limbic systems (Pribram, 1958). The functions of the frontal cortex make possible the distribution of behavioral responses according to the probability that the behavior will be reinforced (Pribram, 1961). Thus, frontal cortex participates in determining the utilities which, as noted above, organize the context within which an organism approaches his world. (Utilities are defined in economic theory as derived multiplicatively from desires and probabilities.)

Linguists and psycholinguists have up to now paid little heed to the pragmatics of language. The line of evidence and reasoning pursued here suggests that pragmatic procedures are derived from processes that establish desirabilities and the probabilities of reinforcement given a particular state of desire. The linguistic expression of such pragmatic processes would therefore be episodic, i.e., would be dependent on momentary state. Some mnemonic mechanism must also be involved since state change is monitored and outcome (reinforcement) probability estimates are made. Cognitive psychologists often refer to such mnemonic processes as short term but more recently, and accurately, the process has been identified as "episodic" memory (Tulving, 1970, 1972) to distinguish it from longer term, more universally applicable semantic stores.

Forming a language: The role of pausing and parsing

In non-human primates, lesions of the frontolimbic forebrain but not of the posterior convexity, interfere with the performance of a task which can be used as a model for relating episodic, context dependent constructions to linguistic processing. This task is the delayed alternation procedure during which a subject is reinforced for alternating his responses between the two boxes. During the interval between opportunities for response an opaque screen hides the boxes. The screen is kept in place for from 5 sec. to a minute or longer depending on how difficult one chooses to make the task. When the interval between opportunities is equal, subjects with frontolimbic lesions invariably fail the task; i.e., they seem to forget which box they previously chose, successfully or unsuccessfully. When, however, the intervals between opportunities are made unequal though regular – e.g. 5 sec. before box one must be chosen and 15 sec. before box two is the correct choice – then the deficit is quickly overcome (Pribram & Tubbs, 1967; Pribram, Plotkin, Anderson & Leong, 1977).

The reason for performing the above experiment was that it seemed as if a monkey failing the alternation task were in much the same situation as a person hearing or reading a paragraph in which letters and words were separated by equal intervals. Thus, MARESEATOATSANDDOESEATOATSANDLITTLELAMBSEATIVY is unintelligible until parsed into words. In general, chunking (Miller, 1956; Simon, 1974) has been found to be an essential processing mechanism when the limits of competency are involved (Pribram & McGuinness, 1975).

It is remarkable that the same parts of the brain are responsible for the operations that determine context by way of pragmatic procedures and

those that determine the *pauses* necessary to parsing utterances, i.e., expressions into words. This identity of neural substrate suggests that *pauses* in speech provide the contextual cues within which the content becomes related to the speaker's state: his mood, his momentary desires and probability estimates of success in meeting those desires. From these contextual cues, therefore, signification and symbolization derive – pragmatic processing *forms* (gives form to) the linguistic production. Pauses, inflections and the dynamic range of speech form the context in which the content of the communication occurs. This idiosyncratic aspect of language formation may therefore be responsible for the rapid transformation of a language into dialect by an intimate group and thus the variety of languages used by man.

Further, this relationship between pragmatics and the *form* of language expression may underlie the process of predication. Making words into sentences would be unnecessary unless a statement about state, about desire and belief (probability), etc. were at stake. Thus, predication stems from pragmatic procedures while nomination, i.e., making words more universally meaningful, results from semantic image and information processing.

Syntactics: The motor aspects of language

What then is the role of syntax? Syntax must reflect both the pragmatic form of language and its semantics. Neurologically, both the frontolimbic forebrain and the posterior convexity of the brain are directly connected to such subcortical motor structures as the basal ganglia which are known to regulate postural and sensory sets (for review, see Pribram, 1977b). These basal structures are, in turn, intimately connected with the centrally located motor cortex which organizes skills.

Over the past three decades, a great deal has been learned about the hierarchical nature of processing information by the use of symbols (e.g., Miller, Galanter & Pribram, 1960). The construction of programs that make serially operating computers into effective data storage and retrieval mechanisms has shown that such programs must categorize data into items which can be universally retrieved and are thus essentially context free. Hierarchies of such context free items (bits → bytes → words) are then compiled into assemblers which in turn are the elements of more complex programming languages.

More recently, cognitive psychologists interested in simulating human experience and behavior have found that exclusive reliance on such hierarchical organization does not reflect the full nature of human perception, action, and communication. Even the relatively simple process

of compiling demands arbitrary decisions that are specific to the "episode" or situation, e.g., the particular computer in *use*. More and more, these investigators have resorted to the construction of "procedures", episode specific program *clusters* that can be flexibly switched into an ongoing program whenever a situation so demands (see Miller & Johnson-Laird, 1976; Winograd, 1977; Schank & Abelson, 1977). As noted earlier, in primates, evidence has accummulated to support the hypothesis that the frontal cortex operates such a context sensitive noticing mechanism and becomes, in this sense, therefore, the executive organ of the brain (Pribram, 1973b).

Conclusion

The import of this recent attention to context sensitive, pragmatic procedures in all cognitive operations, does not exclude psycholinguistics or neurolinguistics. In a sense, this paper has summarized a set of conceptualizations that has benefited substantially from recognition of the role of pragmatics, its definition in terms of current issues, and the possibility of constructing a reasonable model of the brain processes involved. Pragmatics has thus proved the key concept in resolving a set of issues and problems that grew from an interest in relating semantics to syntax. Pragmatics provides the context and form within which image and information become meaningful. Syntax must thus be accountable to both hierarchical, essentially context free semantic considerations, and to episode specific, context sensitive procedures. Brain mechanisms exist for semantic processing in its posterior convexity and for procedural organization in the frontolimbic systems. Syntactic collation becomes the burden of the motor systems to accomplish, for the linguistic act is little different in this respect from the achievement of other actions (Pribram, 1971, Chaps. 16, 19).

Note

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