DO APES HAVE LANGUAGE?

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Thirty years ago, the answer to the question “Do apes have language?” was obviously “No.” Hockett and Ascher, in a famous essay, laid down the terms of “the human revolution”: Human language has a unique combination of “design features” that differentiates it from all other animal communication systems. Today, new information about wild and captive great apes suggests to many scientists that the human revolution was not so revolutionary after all. In this chapter I will try to show why most linguists still believe in some version of a “revolution,” despite evidence for a capacity for language in great apes. In my review of this evidence I focus on chimpanzees: _Pan troglodytes_, the common chimpanzee, and _Pan paniscus_, the pygmy chimpanzee or bonobo. 

The common ancestors of humans and chimpanzees may have lived as recently as five million years ago, and we share about 99 percent of our genetic material. Wild chimpanzees live in complex social groups, make and use simple tools, and communicate through intricate systems (which are by no means completely understood) of sounds, gestures, and other means. These systems exhibit individual variation and local dialects. Young chimpanzees need several years to acquire the range of communicative and other behaviors characteristic of their home group.

Captive chimpanzees have learned to use signs based on American Sign Language, the language of the Deaf community in the United States. Other chimpanzees have learned to use artificially constructed signs. In both cases, the animals use their signs to communicate with one another and with human companions, and come to use novel combinations of these signs. A few chimpanzees have learned signs from conspecifics, without obvious human intervention. This evidence suggests that chimpanzee intellectual potential includes something very much like the human capacity for “language.”

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**The Subsystems of Language**

In order to see why the question “Do apes have language?” remains controversial in the face of this exciting new evidence, we must understand that linguists do not consider human “language” to be a single unitary phenomenon. Instead, linguistic knowledge and behavior in humans is the result of the interaction of many different subsystems. While parts of these subsystems
are probably learned by children (for instance, they have to learn the words specific to their language), other components are almost certainly part of the genetic makeup of speakers, and emerge during maturation as they are triggered by environmental stimuli. Linguists do not all agree on the most theoretically profitable way to distinguish the major subsystems of human language. Here I will review chimpanzee linguistic accomplishments in terms of five major clusters of systems: (1) pragmatic systems; (2) conceptual systems; (3) phonological systems; (4) syntactic systems; and (5) discourse systems.

PRAGMATIC SYSTEMS

Linguists often separate the linguistic code itself from the encoded messages. These messages come, not simply from the material stuff of the code, but from inferences that listeners must make about speakers’ purposes: whether a string of code is intended to question, to command, to promise, to joke, or simply to inform. Pragmatic systems constrain these inferences.

The most fundamental pragmatic inference is that the speaker is a meaning-producing being who is speaking a language. The philosopher Daniel Dennett states that humans, in interpreting the utterances of children, assume an “intentional stance.” Consider our interpretive position when a tiny baby cries and grabs for the breast. We do not assume that the crying and grabbing are “about” the breast. Instead, we take them to index the child’s inner state, hunger. But when a little child sees an apple and says [bab oo], we take this to be “about” something that is outside the child: the apple. We hear the sequence as a “name,” a communicative act dominated by the pragmatic function called “reference.” Whether or not apes, like children, can “refer” has been intensely controversial.

Many ape-language researchers feel that the “intentional stance” is the most useful position from which to interpret the utterances of sign-trained chimpanzees, just as it is for early child speech. They argue that when these chimpanzees make a sign glossed APPLE, they “mean” apple in the same sense that we think the child “means” apple. They are using their signs to “refer,” even when they want the apple, just as the pragmatic
function of reference is technically present when the child wants the apple. This is controversial because many scientists argue that in interpreting animal behavior we should assume the intentional stance only as a last resort, when other interpretations fail.

Why do we assume the intentional stance in interpreting the first words of children? First, while the child who says [bab oo] may be asking for the apple, we know we will soon hear her use this “word” even when she does not want the fruit. We expect her to use this sequence of sounds to designate apples of many shapes and colors (or even to make the mistake of using the sign for pears or pomegranates), and we know that soon she will be able to mention apples even when there are no apples, or pictures of apples, in her presence (so-called “displacement”). Ape language researchers argue that all of these behaviors also appear in chimpanzees, albeit at a lower frequency than in children. For instance, Kanzi, a male bonobo in Sue Savage-Rumbaugh’s laboratory, sometimes uses lexigrams (artificial symbols accessible on a computerized board) for food and then turns down the offered reward. Kanzi began to use the lexigram keyboard without prompting from human trainers (he was present while his mother was being trained). He plays with the lexigram board by himself when no human is present. A second bonobo, Panbanisha, has also shown these behaviors. Chimpanzees have been observed to use ASL signs when alone; Washoe enjoyed naming pictures in magazines and books, and often preferred to do this by herself.*

An important argument for the capacity to “refer” in chimpanzees is that they, like the human child, sometimes spontaneously generalize, for instance, signing APPLE for similar fruits. This suggests that their internal state includes a “representation,” a mental category “roundish, reddish fruit.” Additional strong evidence for such a mental category is that chimpanzees can learn that a category like APPLE can be subsumed under a more inclusive category, FOOD. Sue Savage-Rumbaugh taught two common chimpanzees, Sherman and Austin, to sort food items and simple tools into separate bins. She then taught them lexigrams for these items, and, finally, taught “generic” lexigrams for FOOD and TOOL. Sherman and Austin learned to sort the “specific” lexigrams alone, without any stimulus objects, by lighting up either FOOD or TOOL on their computer display. Savage-Rumbaugh claims that this means that the lexigrams were signs for mental representations: Thus, Sherman and Austin were “referring.”10

If we take a conservative position, assuming the “intentional
stance” toward chimpanzee signing only as a last resort, what other accounts besides “reference” are available? One is that the signs of chimpanzees, like the hunger cry of the human baby, are not “about” anything outside the animals, but are about their interior physiological (not mental) states. In the presence of a stimulus item, the chimpanzee experiences desire for food or play, and learns that making a sign will cause that desire to be satisfied. The sign could be associated with the food or toy as a “paired associate,” an automated response instilled by conditioning.

The most famous example of such conditioning is an experiment by the great Russian psychologist, Ivan Pavlov, who trained dogs to salivate at the sound of a bell. Training took the following form: First, whenever a bell was sounded, food was presented to the dogs, who salivated in reaction. Less and less food was presented when the bell was rung, until the food was absent altogether. But the dogs continued to salivate when they heard the bell. Knowing this history, we do not want to claim that the salivation was a “sign” for the bell, or an “answer” to its call.

Imagine a chimpanzee who has repeatedly, over many trials, been shown an apple and asked to make a certain sign that the experimenter thinks of as “the sign APPLE.” When the chimpanzee succeeds in making the sign, she is given a reward. This reward “reinforces” the behavior. The reward is gradually withdrawn, but the chimpanzee continues to make the sign when an apple is shown. How is this different from the case of Pavlov’s salivating dogs?

Even Savage-Rumbaugh’s “sorting” experiment with Sherman and Austin is vulnerable to this criticism. These results were achieved by training in many stages. First, real food and real tools were sorted; then the chimpanzees were taught to match food items, tools, and lexigrams. Then the stimulus objects were gradually withdrawn (photographs of the objects were used in an intermediate stage) until only the lexigrams remained. The “generic” lexigrams were first introduced as labels on the bins that had been used in sorting; after several trials the bins were removed. The possibility thus remains that what happened to Sherman and Austin was a particularly intricate version of Pavlov’s classic training regime, and not training in “meaning” or “categorization.” However, while remaining cautious, most scholars now believe that the weight of the evidence does support the claim that chimpanzees share with humans the pragmatic
capacity for reference, even though instances of “pure” reference may be rarer among chimpanzees than children.

Another important controversy over the “intentional stance” involves repetition. Herbert Terrace and his co-workers found that a very high frequency of the signs and sign sequences used by the chimpanzee Nim were repetitions of signs used by his trainers. They took this to be evidence that Nim was merely “imitating” the trainers, and was not producing signs and sentences of his own.\(^\text{13}\) Human children also repeat the utterances of conversational partners, but researchers assign diverse pragmatic functions to these repetitions, of which “imitation” is only one. Adopting the same standards of pragmatic interpretation used by child-language researchers, Patricia Greenfield and Sue Savage-Rumbaugh found examples of many of the same functions in the “repetitive” utterances of both common and pygmy chimpanzees. For instance, they interpreted the following sequence, produced by Kanzi and his caretaker Rose, as “choosing an alternative.” The lexigrams are glossed in capital letters. Rose is also speaking English, shown in small letters.

Rose: You can either PLAY or watch TV.
Kanzi: TV (Kanzi watches after Rose turns it on).\(^\text{14}\)

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**PHONOLOGICAL SYSTEMS**

Phonological systems organize the physical realization of speech. In deaf and hard-of-hearing humans, physical realization is accomplished through gesture (for this reason we can see that the term “phonology,” from Greek phóné “sound,” may now be a misnomer). In hearing people, speech produced through sound begins to dominate from the first year of life. Phonological systems include principles for the timing, types, and sequences of movements of the speech-production organs (diaphragm, lungs, vocal cords, tongue, lips, etc., or, in the deaf and hard-of-hearing, the hands).

Chimpanzees share very little of the human anatomical and perceptual substratum for sound production.\(^\text{15}\) Chimpanzee hearing is most acute at different frequencies from those where humans hear best. The shape of the chimpanzee oral cavity and
the musculature of the tongue make it impossible for them to articulate human consonants. The chimpanzee soft palate cannot be raised to close off the nasal cavity. The relative lack of flexion in the chimpanzee vocal tract, and the high position of the larynx, means that chimpanzees cannot imitate the vowels of human languages. Perhaps most important, chimpanzee sound production is very closely tied to their emotional state, and it is very difficult for them either to suppress sounds, or to produce them on command.16

One of the great breakthroughs in the exploration of chimpanzee linguistic capacity occurred when Allen and Beatrix Gardner showed that Washoe, an infant common chimpanzee, could be trained to use gestural signs from American Sign Language.17 American Sign Language (ASL) as used by humans definitely is constrained by a “phonological” system: The meaningful signs of ASL are made up of meaningless elements, including hand position relative to the body, hand shape, and motion of the hand. Workers with ASL-trained chimpanzees use these standards for scoring sign production, and native ASL speakers can interpret the signs.18 But the chimpanzees exhibit many deviations from human ASL standards, and it is not clear what principles shape these.

The “lexigrams” used by chimpanzees trained by Savage-Rumbaugh are made up of combinations of a dozen meaningless elements (straight lines, open circles, solid circles, squiggles, etc.), but the algorithm for combining these to construct meaningful elements—any combination of these elements that can be distinguished by chimp vision can occur—is not at all like the constraints on phonological systems in human languages, where certain components are never combined with one another (this is true in both sign and oral languages).

In summary, the systems of communication used by chimpanzees are probably not, strictly speaking, “phonological,” even though superficially they may seem to satisfy the criterion of “duality of patterning” (meaningful signs are made up of meaningless components) proposed by Hockett as one of the “revolutionary” design features of human language. This is not trivial, since Philip Lieberman argues cogently that the speed of communication permitted by the phonological substratum in human language (whether spoken or signed) is an important reason why language can be used effectively in reasoning: Large amounts of information can be packaged within the span of human short-term memory.19
CONCEPTUAL SYSTEMS

Human knowledge includes much that is not encoded through language: It is “unspoken.” Conceptual systems specify the categories of human thought and knowledge that can be represented in language, making these accessible to other linguistic systems. Conceptual systems specify the possible propositions about these categories, and the logical relations into which they can figure.

Like humans, chimpanzees know many things. We are concerned here, however, not with knowledge in general, but with “conceptual structure,” the principles that sort knowledge so that it is available for “linguistic” purposes. Thus, we restrict ourselves to considering the evidence for chimpanzee conceptual systems that is revealed when they use signs.

Sign-trained chimpanzees can acquire vocabularies of up to at least 168 signs (the number recorded for chimpanzee Moja). However, in comparison even to quite young human children, these sign repertoires are very small. Before age three, human children go through a “vocabulary explosion,” going from under one hundred words to over a thousand in a very short period. The large size of the lexicon of a typical three-year-old, let alone an adult human, means that this system must have a complex internal structure; it is unlikely that all of this vocabulary could be acquired and stored if it were organized as a single long list. This internal structure is one aspect of the human conceptual system. The small vocabularies of sign-using chimpanzees, though, may be listlike. Is there any evidence to the contrary?

First, as noted above, chimpanzees often spontaneously extend the meaning of signs to novel cases, evidence for the creation of conceptual categories. Preferred word orders may give evidence for conceptual structure. Kanzi showed a decided preference for sequencing lexigrams for transitive actions like BITE or CARRY before the entity acted upon, with twenty-nine examples of this type compared to six of the reverse order. However, this was also the order preferred by Kanzi’s human caregivers, so it may not project an event-entity distinction for Kanzi himself, given the small number of signs involved. ASL-using chimpanzees apparently respond to questions as if their signs were organized in conceptual categories. For instance, they respond to WHO questions with names of persons and chimpanzees, and to
WHERE questions with signs like HOME or OUT.23 Chimpanzees can sort objects for color, number, shape, and other attributes.24

An ingenious alternative account has been proposed for one famous case of sorting: Savage-Rumbaugh’s claim that Sherman and Austin were able to sort lexigrams into abstract conceptual categories (FOODS and TOOLS). Robert Epstein suggests that Sherman and Austin depended on food-related physiological responses (transferred in training from the literal foods to the lexigrams for them) to correctly sort “foods” from “tools.” Most of the mistakes they made in sorting tools on early trials involved assigning tools that were used in food preparation, like pans, juicers, and knives to the FOOD category (Sherman and Austin were even accustomed to licking some of these items). This pattern of errors is accounted for neatly by Epstein’s conjecture.25 However, this “physiological” account is not available for many other kinds of chimpanzee sorting behavior, or for vocabulary generalizations that do not involve food items.

In summary, the evidence thus far suggests that chimpanzee “conceptual structure” may overlap at least partially with that of humans. Chimpanzee fluency with signs offers an opportunity to explore concepts that chimpanzees form by themselves, rather than to train chimpanzees in concepts provided by humans. For instance, we could see Sherman and Austin’s early category “food and tools used to prepare food” not as a deviation from a human category, but as evidence for a concept in chimpanzee intelligence, suggesting, for instance, that “termites” and “termite sticks” may go together for wild chimpanzees in a way that they do not for humans.

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**Syntactic Systems**

Syntactic systems restrict the possible meaningful combinations of the elements of the linguistic code (most linguists distinguish morphology, the principles for the formation of words from smaller elements, from syntax, but morphology is not relevant for our purposes here). Thus, in English, “Jane raised Eric” has a different meaning from “Eric raised Jane.” Syntactic systems are the reason why, if someone says, “The boys knew that the girls thought a lot of one another,” he means that the girls liked other
girls, not the boys. Some syntactic constraints yield distinctions that seem quite arbitrary: We can ask, “What are you eating with?” but not “What are you eating and?”

In the early years of modern syntax linguists often spoke of syntactic “rules,” a way of thinking about these systems that was a carryover from traditional grammar. Many linguists now no longer speak of “rules” (except loosely), preferring to think of syntactic systems as a set of “principles” that limit the kinds of combinations of elements that are meaningful.

Most linguists feel very confident in drawing a sharp qualitative line between the syntactic systems of human languages and the combinations of elements seen in chimpanzee signing. As with vocabulary, human children seem to cross some sort of great syntactic divide before they are three years old. In the earliest stages of acquisition, human children utter only one word at a time. Then, for a few months, they make two-word combinations. Some time before they are three years old, they suddenly begin to produce long and complex utterances. Instead of “No night-night!” we hear, “Harold no wanna go night night now!” By age three children control a wide range of construction types, and the difference between the syntactic abilities of a six-year-old and those of an adult is subtle indeed.

Sometimes the relationship between syntactic constraints and spoken utterances is rather subtle. For instance, consider one theory about the constraints that yield meaningful word order. Human-language sentences are made up of phrases. The structure of each phrase includes a “head” and a “complement.” The major lexical categories—nouns, verbs, prepositions, and adjectives—can function as heads of phrases. Human languages seem to come in two types: “head-final” languages, where heads follow their complements (like Japanese) and “head-initial” languages, where heads precede their complements (like English). A second important underlying principle is that every noun must have an abstract property known as “case.” Verbs and prepositions can assign case—but only to nouns that are in their phrases, not to other nouns. In English, the result of the interaction of the principle “heads are initial” with the principle “nouns must have case” is that a noun that follows a verb is understood as the object of that verb. In Latin, the case requirement is satisfied by case “inflections,” markers on the nouns themselves. Therefore, in Latin an object need not be adjacent to the verb, and so-called “free word order” is permitted.
Many scholars think that Greenfield and Savage-Rumbaugh’s analysis of word order patterns produced by the bonobo Kanzi provides the strongest evidence for syntactic competence in chimpanzees. While workers with chimpanzees who use ASL have reported many sign combinations used by these animals, only in the case of Kanzi has a complete record been published. By the time Kanzi was five-and-a-half years old, analysis of his two lexi-gram sequences showed that he had acquired from his trainers a preference for the order “action-object,” as in BITE BALL. He had also invented two new preferences (which the researchers call “rules”). The first is “place gesture after lexigram,” as in CHASE (gesture toward dog), where the dog is supposed to chase Kanzi. The second is “order expressions for action in the order in which they will be performed,” as in CHASE HIDE and HUG BITE.28

Are these preferences syntax? One problem is that Kanzi’s order preferences are statistical, not categorical. Human syntactic word order, except in the very earliest stages of language acquisition, is notoriously not a quantitative matter. “Kanzi bite” is one English sentence; “bite Kanzi” is another. (In the early stages of child language, we do see order variation; researchers interpret this to mean that the children are not yet sure whether their language is of the “head-final” or “head-initial” type.)

A more serious problem for a “syntactic” interpretation is the incorporation of gestures into Kanzi’s combinations. The gestures that Kanzi uses are like those used by wild chimpanzees. Laura Pettito, studying two deaf children learning sign language, found that they had trouble learning how to use the ASL words for “me” and “you,” even though the signs (pointing to self and pointing to addressee respectively) are not arbitrary, and even though the children had been using pointing gestures for several months prior to the emergence of “real words.” Her results suggest that prelinguistic gesturing by human children (which is probably evolutionarily related to gesturing by chimpanzees) is “discontinuous” with both verbal language and the linguistic gestures of ASL.29

Lois Bloom’s work also suggests that Kanzi’s gestures are not “linguistic” and so should not be part of a syntactic analysis. Bloom analyzed videotapes of thirty children who had just begun to use words. The analysis showed that the frequency of expressions of emotion (or “affect”) exhibited a “dip” before a child said a word, and rose to a peak immediately after the word. This is Bloom’s interpretation:
We are interpreting the dip before the word as the time during which the mental activity associated with the experience and expression of emotion is, essentially, suspended. This is the time the child uses for the cognitive work that saying a word involves.... The peak in affect expression comes after having said the word, when the child’s cognitive resources are now free once again for constructing the representations associated with feeling states.

The order of Kanzi’s gestures, which are probably part of the chimpanzee system with its “emotional” foundation, in relation to his lexigrams can be accounted for in Bloom’s terms. Kanzi’s “emotional” gestures follow his lexigrams because at that point his “cognitive resources are...free once again” for emotional expression. This is not a “syntactic” principle of word order, but instead exemplifies a different kind of constraint on human capacities, the kind that make it difficult for people to pat their heads and rub their stomachs at the same time.

Bickerton (1990) has suggested that we credit chimpanzees with “protolanguage,” the system seen in one- and two-word stages of child language. For Bickerton, “protolanguage” is based on principles that are discontinuous with those that appear during the “syntax explosion” that emerges in the child between two and three years of age. Whatever the nature of this change, there is no evidence that chimpanzees, at any age, can be trained to go through it.

**DISCOURSE SYSTEMS**

Finally, discourse systems organize our utterances into sequences and distinguish different types of sequences: lists from stories, call-and-response from conversation. Discourse systems organize the strategies of “economy” that allow us to summarize what has already been said (“Amy likes chocolate mint ice cream. So does Jane.”) and the strategies of “iconicity” that sometimes seem to make sentences look like small diagrams of the world (“Ken has to change planes in Chicago and New York on the way to London,” a sentence that names the cities in west-to-east order, is preferred to “Ken has to change planes in New York and Chicago on the way to London.”).
Chimpanzee “discourse” is organized according to a few simple principles. Chimpanzees do not make lists, or tell narratives, or construct arguments. They can chain signs together to intensify requests, as in the sequence YOU ME SWEET DRINK GIMME, and use repetition in many functions; my personal favorite is chimpanzee Tatu’s ICE CREAM, ICE CREAM, ICE CREAM, ICE CREAM, ICE CREAM, ICE CREAM. Greenfield and Savage-Rumbaugh suggest that chimpanzees observe an important discourse principle, the “strategy of economy”: not mentioning what is unchanged in a situation, while mentioning what is new or changed. Kanzi’s preference to “order expressions for action in the order in which they will be performed” may exemplify the discourse strategy of iconicity, not syntax in the strict sense.

CONCLUSION

Many chimpanzee researchers believe that skepticism about their claims comes from ideological bias, the unquestioned assumption of human superiority. Such an assumption is unwarranted. Human language is not necessarily “superior.” It is highly specialized, a bit like echolocation in bats and dolphins, or locomotion by brachiation in gibbons. From this specialization comes experiences that we humans value, like the pleasures of complex reasoning, poetic rhythm, stirring oratory, and good detective stories. But the role of language in whatever our success as a species may be is not obvious.

Has research with chimpanzees shown that “apes have language”? My own answer is, “Some apes seem to share with humans some parts of some subsystems that play a role in human language.” If researchers can show that this sharing is at the level of deep principle, not superficial resemblance, then we will have identified a component of our common evolutionary heritage, and will have greatly refined our understanding of what happened in “the human revolution.”
NOTES


Joel Wallman, *Aping Language* (Cambridge: Cambridge University Press, 1992). One of the leading sign-language laboratories issues a quarterly newsletter intended for nonprofessional audiences, with many pictures and updates on research; information can be obtained from Friends of Washoe, Central Washington University, Ellensburg, WA 98926.


8. This is how my first child pronounced “apple.” The vowel in the first syllable [a] should sound like the vowel in “cap.” The vowel in the second syllable [oo] sounds like the vowel in “put.”


11. I leave aside here the possibility that the trainer unconsciously “cues” the animal to make the correct sign.

12. Great importance was placed on the fact that the signs used by chimpanzees are “arbitrary”: No property of the sign itself, only
the decision of the researcher, determines what a sign means. However, arbitrary relationships have long been demonstrated in research with animals; animals like pigeons can easily learn to press a black button for seed, and a white button for water.


15. Apes can apparently understand a good deal of spoken language, which suggests that the neurological and aural substratum is to some degree “preadapted” for human-style speech. Hopkins and Rumbaugh suggest that Kanzi, who has produced several vocalization types otherwise unattested in bonobos, may even be imitating human intonation: William D. Hopkins and E. Sue Savage-Rumbaugh, “Vocal Communication as a Function of Differential Rearing Experiences in *Pan paniscus*: A Preliminary Report,” *International Journal of Primatology* 12 (1991): 559–583. (I thank Irene Pepperberg for calling my attention to this reference).


20. Here is a useful experiment that reveals “unspoken” knowledge. If you play a musical instrument well, or are good at some athletic endeavor (e.g., gymnastics or sprinting), try to explain your skill to someone else. Use only words: No demonstrations or touching the other person is permitted in the experiment!


26. Linguists use the asterisk or “star” (*) to mark sentences that are not syntactically well-formed (this is different from the kind of “ungrammaticality” people have in mind when they tell you not to use double negatives or say “ain’t”).

27. In expressing these stages in terms of “number of words” we are biasing our account toward kinds of human languages that have relatively short and simple words, like English. In languages like Eskimo or Mohawk, where words are as long and complex as sentences are in English, the “one-word” stage is often a “one-syllable” stage, and in the “two-word” stage the earliest complex words (words made up of multiple meaningful parts) appear.

28. Greenfield and Savage-Rumbaugh, “Grammatical Combination in *Pan paniscus*: Processes of Learning and Invention in the Evolution and Development of Language” and “Imitation, Grammatical Development, and the Invention of Proto-Grammar by an Ape,” in Krasnegor, Rumbaugh, Schiefelbusch, and Studdert-Kennedy, eds., *Biological and Behavioral Determinants of


31. Savage-Rumbaugh, Ape Language: From Conditioned Response to Symbol, p. 27.


**Suggested Readings**


language research.

