

CHAPTER THREE

THE COGNITIVE APPROACH TO LANGUAGE AND THOUGHT

It has been maintained (e.g., Baars, 1986) that the so-called cognitive approach to explaining the nature of language and thought began as a reaction to the entrenched behaviorism of the 1950's. The reader will recall that during the period from roughly 1930 to 1957, strict behavioral interpretation of animal and human activities of all sorts was challenged both from within and without. Edwin Tolman (1927) — who called himself a behaviorist — spoke of “cognitive maps” developing in rats who were given certain learning tasks. Wolfgang Köhler (1959) described “insight” in chimpanzees, in contrast to the step-like learning processes described by Hull (1943). What I hope to do in this chapter is summarize some of the most important contemporary cognitive interpretations of the last forty years regarding the nature of language and thought with the intent of contrasting them with the behavior analytic interpretation of language acquisition and use presented in Chapter 2.

The single event that seems to have given contemporary cognitive psychology its impetus was Noam Chomsky's 1959 review of Skinner's *Verbal Behavior*. His general criticism of Skinner's position was that relatively simple concepts, such as reinforcement, stimulus, response, and deprivation, do not capture the complexity of verbal behavior. Chomsky accepted Skinner's proposition that, in the absence of detailed information about the central nervous system which is relevant to language and thought, the only recourse is to study the response of the organism to various environmental inputs. Recognizing that Skinner emphasized the history of reinforcement and the current environmental conditions of the organism as the core of information required for predicting the acquisition of language, Chomsky doubted the adequacy of the reinforcement concept in explaining what he believed to be

a very complex phenomenon. Even though Chomsky grasps some of Skinner's major concepts, he misinterprets what Skinner clearly intended. For example, Chomsky states that (1959, p. 29) "Another variable that can affect the rate of bar pressing is drive, which Skinner defines operationally in terms of hours of deprivation." "Drive" is not a variable for Skinner and there is no sense in which it can be said to affect the rate of bar pressing. Skinner (1953, 143 ff.) is careful to refer to drive as a mediational concept which has no place in psychological theorizing although he does refer to the reasonable operational meanings some psychologists attach to the term.

The ideas of "stimulus," "response," and "reinforcement" also posed a problem for Chomsky. For example, "stimulus," although defined clearly in any specific experiment, also had the general connotation of being a physical stimulus to which the organism could respond. When the stimulus was specifically indicated, as in a bar pressing experiment, then it seemed to have little generality and did not allow one to attend to factors that Chomsky labeled, "attention," "set," "volition," and "caprice," which also may have been relevant to the acquisition of language. Chomsky's further charge is that Skinner uses such a term as "stimulus" in both the general and specific sense.

What Chomsky has identified is that although Skinner bases his arguments on evidence gleaned from controlled experiments on animals, his description of how language is acquired is essentially interpretive although it rarely strays from the processes that Skinner understood controlled and accounted for animal behavior. This is true enough and acceptable, so long as the interpretations are both useful and superior to interpretations built on other premises. Chomsky's belief was that Skinner's were no better than more traditional interpretations of the nature of language and were, indeed, inferior to some.

Chomsky then leveled the charge of circularity against Skinner's concept of reinforcement by indicating that any given non-predicted response is said to have had a past history of reinforcement even though this history is unknown. If someone says "Dutch" when looking at a painting, that response had to have been under the control of certain aspects of the painting. If we, instead, said, "Beautiful" or "Hanging too low," these responses had to also have been under the control of other aspects of the painting. Chomsky is disturbed by Skinner's inability either to predict which response will be made or to indicate the specific properties of the stimulus which control each of the responses. Of course, the only way Skinner can construct such successful accounts is either to have witnessed or to have actually controlled the appropriate events in the first place. That is, any system which purports to be able to predict a response from previous environmental conditions must be able to assess those conditions either by creating them or by witnessing their formation. Skinner never claimed otherwise. Chomsky, however, is on reasonable

ground if, having recognized the fundamentally hermeneutic approach to language which Skinner takes, he chooses to suggest that other interpretations may be more accurate.

Skinner, however, does claim that by controlling appropriate stimuli it is possible to determine verbal responses. The mother who holds a ball in front of her child and speaks "ball" is attempting to do just that. We have seen in Chapter 2 how Skinner explains the acquisition of such a response. Obviously we need Chomsky's version to judge its efficacy compared with Skinner's. Unfortunately, Chomsky misses Skinner's point when he counters Skinner's example of response strength, or probability of emission of a response with one of his own. Chomsky (1959, p. 35) quotes Skinner as saying "... if we are shown a prized work of art and exclaim 'Beautiful,' the speed and energy of the response will not be lost on the owner." Chomsky counters by saying that pausing before the painting for several seconds and then quietly muttering "Beautiful" in a very soft voice may have the same or even a stronger effect on the owner. While Skinner gives a specific example as to how an owner might be reinforced for possessing and showing the painting, he does not exclude other possibilities for reinforcing the same behavior, that is, in the manner suggested by Chomsky's example. Which approach to admiring the painting will best reinforce some behavior on the part of the owner is dependent on the previous circumstances of relevant environmental conditions. In short, the same problem arises here as was discussed above. Skinner never claimed he could predict behavior without knowing the relevant contingencies of environment and response. Skinner's example is interpretive, suggesting only one way that these contingencies between environment and response might have been arranged.

Nevertheless, the general thrust of Chomsky's criticism of Skinner's interpretation of language acquisition has merit. Skinner is interpreting, not doing experiments; consequently, his examples of environment-response arrangements have roughly the same epistemological strength as those that are based upon different assumptions. At least we may conclude this at our present point in the discussion. When Chomsky analyzes Skinner's notion of the autoclitic he is on more solid ground. The autoclitic, as we have seen, involves a speaker largely reinforcing his or her own verbal responses. Chomsky concludes, not without some justification, that the notion of reinforcement "has totally lost whatever objective meaning it may have had" (1959, p. 37). Self reinforcement apparently places the environmental consequences that determine a response inside the organism, a development that Skinner always wished to avoid. However, as we have seen, the autoclitic has connections to the external environment in that a speaker will have the use of autoclitics reinforced at some point by their being directed at a listener (see the discussion in Chapter 2). From this social reinforcement, the

speaker is able to transfer the autoclitic response from one used socially to one used only by the speaker in thinking or in writing, both solitary events. This transfer of the autoclitic from its socially reinforced beginnings to its use solely by the speaker (or writer), however, poses further questions such as "How does the speaker operate as his or her own source of reinforcement when verbally responding?" Chomsky's interest in this issue led him to seek an alternative explanation to Skinner's regarding the development and use of language.

At roughly this point in his criticism, Chomsky introduces the idea that the ability of a child to ". . . generalize, hypothesize, and 'process information . . .'" (1959, p. 42) may very well be innate or develop through some type of learning or developmental process. He suggests that genetically determined maturation may be more important than reinforcement as a factor in the development of language ability, specifically the ability to discriminate phonologically relevant information from a complex auditory environment. Chomsky admits that the neural structures necessary to account for ability to comprehend and to use language have not been discovered, but he points out, neither have they been for even simple kinds of learning. We shall see below that Chomsky built his explanation of the acquisition of language on behavioral data as did Skinner although in a very different manner.

Skinner's definition of verbal behavior, behavior reinforced through the mediation of other persons, is extremely broad; consequently, it includes behavior that many, including Chomsky, do not consider to be truly verbal. In his definition, behavior is established through the mediation of other persons such that the respondent (listener) is responding in ways that have already been established in order to reinforce the behavior of the speaker. This definition includes the situation when a rat, after pressing a bar, is presented with food. The experimenter is the other person who reinforces the rat's behavior which in turn reinforces the experimenter's behavior of continuing to release food pellets after the rat has pressed the bar. In part, Skinner provided such a definition of verbal behavior to show that it, indeed, was acquired in a manner no different from that of bar pressing. However, the definition of verbal behavior is not crucial, and can be adjusted to come closer to what most people mean by it by adding the word "vocal" before "behavior" in the first part of the definition.

Chomsky's criticism of the notions of mand and tact is generally inadequate because he focuses too keenly on Skinner's particular examples and suggests other ways that these mands and tacts could have come into existence. The mand "Pass the salt" is elicited, according to Skinner, when the speaker has a past history of having uttered this phrase and it has been followed by the presentation of salt by a listener. Presumably the speaker has spoken this phrase when under salt deprivation. Chomsky's criticism focuses

upon the sometimes difficult task of determining relevant conditions of deprivation which might have set this sequence off in the first place. But this is beside the point. *If* one is able to determine a state of deprivation, as in an experiment where an animal is kept from salt or food for a certain amount of time, then the sequence resulting in the reinforcement of a mand is established. In Skinner's interpretation of how a mand might be acquired, he need only give one example and need not specify all possible acquisitions since no one can be privy to such information. The key aspect of Skinner's description of the acquisition of a mand is not the specification of the appropriate condition of deprivation, although it would be helpful to know it, but rather a description of the vocal interchange between speaker and listener. Parents reinforce their children to utter "Please pass the salt" precisely by either providing salt after they hear the words spoken or withholding it when they do not, for example, when the child merely points to the salt or says "Pass the salt." The child's salt deprivation may be reasonably assumed without further analysis. Even if the parents have incorrectly guessed the significance of the child's pointing, this does not disturb Skinner's interpretation of the acquisition of a mand. It simply means that an error has been made by the listener.

Chomsky's criticism of the tact suffers from similar difficulties. He questions why a verbal community would reinforce tacting in a child in the first place since ". . . the parent does not have the appropriate history of reinforcement" (1959, p. 48). However, parents have undoubtedly experienced the same reinforcement of tacting involving their parents early in their own linguistic life, and this process has been repeated far back in the history of the species. Tacting is under the control of some characteristic of an object or event. When a tact is uttered it is reinforced by a listener because the information provided is useful (reinforcing). The tact "Without a battery the car will not run" reinforces someone who wishes to use an automobile which has no battery to change her behavior (she buys a battery). The tact "It certainly is a nice day," although containing essentially useless (non-reinforcing) information, reinforces what is generally called "pleasant social behavior" which is in itself reinforcing.

Tacts can be formed in a number of different ways, not only in the way Skinner presents. So long as the reinforcement sequence defining tact can be clearly shown, the definition is solid. Skinner offers the example of someone speaking "Fox" followed by the listener looking about. The looking about occurs because looking about after having heard the verbal stimulus "Fox" has been accompanied in the past by seeing a fox and the listener has had an interest in seeing a fox. Chomsky's objection to this example of a tact is that the listener may have seen a fox and may not be interested in seeing a fox. If a listener had never seen a fox nor a picture of one, or had never heard or read one described, then her response to "Fox" may very well be an uncompre-

hending stare. Again, Chomsky falsely assumes that Skinner's example exhausts the possible ways that a functional part of speech can be reinforced.

Skinner's autoclitic does not have the empirical clarity of his concepts of mand and tact largely because the speaker-listener reinforcement sequence occurs within the same individual. The external reinforcement referent is the verbal community, an idea which is sound, but which does not sufficiently account for the complexities of autoclitic use. Chomsky's criticism of the autoclitic is, therefore, more telling than those invoked against the mand and tact. In Skinner's example of the quantifying autoclitic "all" in the sentence "All swans are white," Chomsky rightly indicates that this statement is the same as "Swans are white" and that can be reconstructed into "X is white is true, for each swan X." Additionally he points out that there is no place for "true" in Skinner's system. In short, Skinner has not sufficiently reduced "All swans are white" to those verbal elements which make up its most important components.

Chomsky objects to Skinner's contention that various lexical items are selected by a speaker and then placed into a grammatical frame which involves the use of autoclitics because grammatical frames can be the same and yet not necessarily be sentences. The expressions "Struggling artists can be a nuisance" and "Marking papers can be a nuisance" have the same grammatical frame, but are quite different in sentence structure. "Struggling artists" is a plural subject and "Marking papers" is singular activity. Chomsky's conclusion is that the composition and acquisition of an utterance is not simply a matter of stringing together the mands, tacts, intraverbals, and autoclitics under the control of environmental stimulation and that syntax is not directly represented in the way that Skinner says it is in this process.

Chomsky's summary of his criticism of Skinner's theory of language development is captured in the following paragraph:

The behavior of the speaker, listener and learner of language constitutes, of course, the actual data for any study of language. The construction of a grammar which enumerates sentences in such a way that a meaningful structural description can be determined for each sentence does not in itself provide an account of this actual behavior. It merely characterizes abstractly the ability of one who has mastered the language to distinguish sentences from non sentences, to understand new sentences (in part) to note certain ambiguities etc. These are very remarkable abilities. We constantly read and hear new sequences of words, recognize them as sentences, and understand them. It is easy to show that the new events that we accept and understand as sentences are not related to those with which we are familiar by any simple notion of formal (or semantic or statistical) similarity or identity of grammatical frame. Talk of generalization in this case is entirely pointless and empty. It appears that we recognize a new item as a sentence not because it matches some familiar item in any simple way, but because it is generated by the grammar that each individual has somehow and in some form internalized. And we understand a new sentence, in part, because we are somehow capable of determining the process by which this sentence is derived in this grammar. (1959, p. 56)

In accounting for the nature of language by attempting to describe an internalized grammar, Chomsky set himself on a path that has had a major influence on the development of modern cognitive psychology.

Chomsky's System

For Chomsky, language ability is genetically determined and specific to human beings. We are innately endowed with an intellectual organization that is manifested at a particular stage of physical development and triggered by appropriate environmental stimulation. Although recognizing these three elements as determiners of language, Chomsky chose to focus on the description of the innately endowed intellectual organization. In particular, he took a stand opposite to Skinner's by considering environmental triggering stimuli to be trivial in their contribution to the acquisition and use of language.

Chomsky's task was to describe the generative grammar that was manifested through, but not determined by, natural language. A grammar attempts to describe and account for the ability of an individual to understand a sentence of his natural language which he has not heard before, and to produce a related sentence which he may never have spoken. This competence can be described as a system of rules which relate verbal signals to an interpretation of the meaning of those signals. This creative ability is usually explained by a behavior analyst by referring to one of the forms of the principle of generalization. Chomsky, however, denies the possibility of response generalization in accounting for the ability to construct new sentences based on their similarity to old ones. He believes that the chronological evolution of linguistic possibilities in a child indicates that physiology is more important than habit in producing language.

The syntactic description of a sentence which can convey information beyond its phonetic (speech sounds) form and semantic content is called its deep structure. The surface structure of a sentence is that part of the syntactic description that determines its phonetic form. In order to uncover the deep structure of a non ambiguous sentence (ambiguous sentences have more than one deep structure) it is necessary to analyze the sentence's components. Consider the following sentence (Chomsky, 1964):

- (1) I expected the man who quit work to be fired

This sentence can be transformed into three kernel sentences.

- (2) a. I expected it
b. someone fired the man
c. the man quit work

In order to form sentence (1) the three base structures underlying sentences (2a), (2b), and (2c) are constructed as follows: sentence (2c) is transformed so that it converts to "wh (the man) quit work." This new structure is labeled K_1 . The "wh" represents a generalized morpheme (a meaningful linguistic unit) that would appear in any sentence of the type (1) regardless of natural language. The letter designation "wh" is arbitrary. In the case of this English example, the "wh" that is appropriate is "who." In other sentences containing the same morpheme, "which" or "what" might be appropriate. By considering this new structure (K_1) with sentence (2b), and deleting the occurrence of the man in K_1 , we get "someone fired the man who quit work," which we label K_2 . K_2 is transformed into a passive form which yields "the man who quit work was fired by someone," and is labeled K_3 . A deletion transformation is applied to K_3 which yields "the man who quit work was fired," which is labeled K_4 . K_4 and (2a) are combined yielding "I expected the man who quit work was fired," which is labeled K_5 . We apply a transformation (T), to K_5 which refers to the infinitive that was found in the original sentence. This completes the analysis. By the application of such transformations Chomsky presumably may describe the deep structure of all natural languages since the concentration of the analysis is on language's morphological character. Since the kinds of transformations needed to isolate the qualities of any natural language are specifiable without exception, the acquisition of language cannot be explained by concepts involving only functional variables such as those emphasized by Skinner. Although there seems to be evidence for deep structure, the transformations suggested by Chomsky are problematic. If there are transformation rules that are operative between the comprehension of the surface and deep structures of a sentence it should be possible to measure that process. In an attempt to discover whether or not there was any psychological reality to the rules of transformation, Anderson (1985) presented subjects with three sentences:

1. John smelled the cookies
2. The cookies were smelled by John
3. The cookies were smelled

He reasoned that the first sentence should be processed fastest; the second sentence should take more time than the first to process since it has one more transformation; and the third sentence should take the longest time because it has an additional transformation in the deleting of "by John" from sentence 2. Subjects, however, verified sentences 1 and 2 in the same amount of time and sentence 3 took the longest time to process. Processing time did not increase with the number of transformations as it should have if Chomsky was correct. Thus the meaningful parsing of sentences is itself evi-

dence for deep structure, but the existence of transformations which form the core of Chomsky's argument are in doubt.

One of the characteristics of language that is central to Chomsky's approach is that it is dependent upon structure for its meaning. He gives the following example: we can form a question out of a declarative sentence by a simple operation. We first identify a subject noun phrase and move the occurrence of "is" following this phrase to the beginning of the sentence. "The dog in the corner is hungry" contains the noun phrase "The dog in the corner." Moving the "is" that follows this phrase to the beginning of the sentence, we form the question "Is the dog in the corner hungry?" This is a structure-dependent operation since it considers not only the sequence of elements that form the sentence, but also the elements' structure. That is, the fact that "The dog in the corner" is a noun phrase indicates that the rule of this formation is dependent on this structure. A parallel structure-independent operation on the same sentence will not work. For example, the rule may be "take the left most occurrence of is and move it to the front of the sentence." This would yield by this structure-independent operation the question "Is the dog that in the corner is hungry?" Clearly, this is not acceptable. In applying the structure-dependent operation, we locate the noun phrase "the dog is in the corner" then invert the occurrence of "is" that follows it forming the sentence "Is the dog that is in the corner hungry?"

Through this example we can see that, although there is no differential communicative efficiency or simplicity between the structure-dependent and structure-independent operations, there is a difference in accurately describing the way people actually use language. The formation of sentences proceeds in speakers of a natural language in a direct manner without persistent teaching which, to Chomsky, indicates that thought has language-determining properties.

Chomsky also points out that the ability to create sentences which no one has ever spoken or heard, yet which are recognized as sentences of a natural language, illustrates the independence of semantics from syntax. He gives the following as an illustration (now well known) of our understanding of the two English expressions:

- (1) Colorless green ideas sleep furiously
- (2) Furiously sleep ideas green colorless

Both have the same semantic content and we have never read these sentences before yet the first is easily seen as a grammatical English sentence and the second is not. In addition, the sentences are nonsensical in terms of daily experience in the world so they cannot be said to be linguistic representations of actual events in our world. However, what cannot be overlooked is

that the noun phrase “colorless green ideas” could have, in part, been the product of generalization from other more usual uses of “ideas” modified by adjectives such as “clear,” “exciting,” or from similar poetic uses. The contradictory “colorless green” is similar to oxymorons such as “thunderous silence” or “sweet sorrow” etc. In turn, “sleep furiously” is not distant from “sleep disturbedly” even though the phrase is awkward. Nevertheless, Chomsky’s conclusion is that semantic content cannot determine grammatical structure. That leaves only the workings of human physiology to account for our ability to discriminate the grammatical from the ungrammatical and, consequently, linguistic meaning from nonsense. Chomsky then sets his program for the analysis of language to be the understanding of the acquisition and use of syntactical structures or how we come to form linguistic utterances about either the world around us or about other linguistic utterances.

As we have seen, his descriptive approach takes the form of a kind of sentence parsing such that the sentence “The man hit the ball” is divided into the subject, “The man,” the verb “hit,” and the object of the verb “the ball.” Chomsky points out that the parsing is less crucial than the rules by which one accomplishes it. These various rules are limited in a number of ways, for example, we cannot use “a” instead of “the” if what follows is plural “balls” instead of “ball.” Chomsky sets his task as the determination of the underlying system of rules that has been acquired by the speaker and listener from the more chaotic and error-prone experience of actual everyday language. Chomsky sought “the underlying mental reality underlying actual behavior” (1964, p. 4). These principles of grammar are not necessarily verbalizable by the speaker even though he is governed by them. This places their origin, as we have seen, in the genetic code of the organism.

What perhaps sets Chomsky’s approach to understanding language clearly apart from Skinner’s, which neither individual apparently acknowledged, is seen in one of Chomsky’s analyses that indicated the difference between language performance and language grammar. In considering the following sentences Chomsky (1964, pp. 10–11) makes an important distinction:

(1)

- a) I called up the man who wrote the book that you told me about
- b) quite a few of the students who you met who come from New York are friends of mine
- c) John, Bill, Tom, and several of their friends visited us last night

(2)

- a) I called the man who wrote the book that you told me about up

b) the man who the boy who the students recognized pointed out is a friend of mine

It is obvious that sentence (1a) is more acceptable, less clumsy, more easily understood, and more likely to be reproduced than sentence (2a) yet the pair conveys exactly the same information and contains the same morphemes. Chomsky makes the point that "acceptable" is not the same as "grammatical." Acceptability is a characteristic of performance while grammaticalness is a characteristic of competence. The sentence is not acceptable, but is grammatical even though most of us would perceive it to be awkward. The generative rules of language, some of which are illustrated above, assign the same meaning or interpretation to the sentences of (1) as they do to those of (2). Consequently all sentences of (1) are easily understood while those of (2) are understood with some difficulty. Chomsky suggests that one might develop certain operational tests for acceptability, but not for grammaticalness. Such "tests" might be those suggested by Skinner's operational system of the acquisition and use of verbal behavior, but we have already seen that Chomsky had difficulty accepting that, in part because Skinner proposed to interpret not only the acceptability of natural sentences, but their syntactical and grammatical character as well. Nevertheless, the separation of the notion of acceptability from grammaticalness by Chomsky highlights, perhaps, the reconcilable differences between the two theorists.

As we saw in Chapter 2, Skinner's theoretical focus is upon the environmental influences operating on speaker and listener. Chomsky apparently agreed that an operational analysis of what he called acceptability was possible and, presumably, desirable. Conceivably the differences in sentences (1) and (2) come about because speakers and writers are reinforced differentially by the listeners around them. Generally, those modes of speech and writing which most members of a verbal community call acceptable are understood by more people than those modes of speech which are considered unacceptable. There are, of course, exceptions as when a speech pattern that the larger verbal community considers unacceptable is considered acceptable by a small sub-group of the community. This issue has been discussed above and is also relevant here. As we have seen, criminals often deliberately develop a patois which linguistically separates their speech from the rest of the verbal community. However, it remains true that acceptable patterns of speech are more frequently reinforced by listeners because these are more easily understood.

Grammaticalness, rather than acceptability, may be generative in that it is a product of the innate linguistic capabilities of the human organism. This would place grammaticalness in the behavioral repertoire of Skinner's system. Both Skinner and Chomsky apparently divided language into behavior which was acquired through its environmental consequences (acceptabil-

ity for Chomsky) and behavior which was innate to the organism (characteristic of the behavioral repertoire for Skinner). Skinner focused on the first and Chomsky on the second. Chomsky's task of describing the details of innate grammaticalness constituted his major program of linguistic research. He did, however, propose an interpretation of operational performance in addition to his description of grammaticalness. In describing this interpretation of performance Chomsky again implicitly rejects an environmental influence explanation in favor of a description of the linguistic arrangements which occur when one is said to be linguistically performing. In short, the description is of the arrangement of words which distinguish differences in linguistic performance or behavior and not of the external contingencies reinforcing one or the other type of verbalization. The description remains internal and non-functional in Skinner's sense.

Chomsky lists five types of sentence constructions (1959, 1965):

- (1) nested constructions
- (2) self-embedded constructions
- (3) multiple-branching constructions
- (4) left-branching constructions
- (5) right-branching constructions

Two phrases are nested if one falls totally within the other. From (1a) the phrase, "the man who wrote the book that you told me about" is nested in the (2a) phrase "called the man who wrote the book that you told me about up." Self-embedded constructions consist of one phrase being nested within the other and both being of the same type. Thus the phrase "who the students recognized" is embedded in and is the type of relative clause as in the phrase (2b) "who the boy who the students recognized pointed out." Sentence (1c) "John, Bill, Tom, and several of their friends visited us last night" is a multiple-branching construction because it has no internal structure in that the subject noun phrase including "John," "Bill," "Tom," and "several of their friends" have no other relationship to one another. There are no nested and no embedded phrases. Left- and right-branching constructions (1965, p. 13) are of the form where phrases are connected in a clear manner either at the left or the right of the sentence as in (left branching) "{John's} {brother's} {father's} {uncle,}" or (right branching) "this is {the cat that caught} {the rat that stole} {the cheese}."

From this analysis the following conclusions can be drawn: frequent nesting and embedding yield unacceptable sentences. Multiple-branching constructions are ideal in forming acceptable sentences. Left- and right-branching

constructions are more or less acceptable, but not as acceptable as multiple-branching constructions. The limitations of the nested, embedded and branching phrases is seen to be, in part, a function of memory that makes them difficult to understand and use. However, this is a rather trivial limitation and Chomsky carries his analysis a step further by suggesting that there is a "perceptual device" with a number of analytical capabilities corresponding to each kind of construction. Skinner might have responded to Chomsky's analysis by making two points. The first is that Chomsky has described the arrangement of words within phrases that are likely to be reinforced by a verbal community which he considers to be somewhat, but not completely, independent of the grammatical nature of the sentences. Skinner would have had no difficulty with this. The second point is that the idea that there is a corresponding perceptual device associated with each construction, or phrase within a construction, is based on the observation that people use acceptable language in the manner described. This exhausts what Chomsky knows of the situation. The postulation of "devices" is totally reducible as a concept to the observation of sentence use. In short, Chomsky has invoked a mediational concept which is not independent in any way from the observation used to indicate its presence.

Generative Grammar, the Study of Language Competence

There is an implicit ability to understand an indefinite number of sentences in a natural language. This suggests that a reinforcement theory of language acquisition alone, such as that proposed by Skinner, can not be adequate in explaining the nature of language. Conversely, a generative grammar, being a system of rules, can be used to generate this indefinite number of sentences the way any new number can be created by utilizing the rule, "add one to the previous number." Generative grammars have three components: the syntactical, the phonological and the semantic. The phonological component of a grammar is a signal, sometimes but not always a word, that is determined by the syntactical nature of the sentence. The syntactical component of a sentence relates a structure to a certain semantic representation. The phonetic interpretation of a sentence is determined by its surface structure, and the semantic interpretation of a sentence is specified by its deep structure. These structures are determined by the syntactical nature of the appropriate grammar. An example of the analysis of the deep structure of a sentence has been given above, but another of Chomsky's examples (1964, p. 22) might be profitably presented here. Consider the sentences:

(3a) I persuaded a specialist to examine John

(3b) I persuaded John to be examined by a specialist

and

(4a) I expected a specialist to examine John

(4b) I expected John to be examined by a specialist

The surface structure of the sentences in (3) and (4) are the same. However, it is equally clear that (4a) and (4b) have the same meaning in that if one is true the other must be, but this is not the case with (3a) and (3b) where one could be true and the other not. The only difference between (4a) and (4b) is that the first is in the active voice while the second is in the passive voice. However, the deep structure of (3b) must show that "John" is the direct object of the verb phrase as well as the grammatical subject of the embedded sentence. Hence:

(5a) Noun Phrase	Verb	Noun phrase	Sentence
I	persuaded	John (will examine John)	a specialist
		(John direct object of verb phrase)	
		(John grammatical subject of embedded sentence "a specialist will examine ____")	

In (3a) "a specialist" is the direct object of the verb phrase and the logical subject of the embedded sentence. Hence:

(5b) Noun phrase	Verb	Noun Phrase	Sentence
I	persuaded	a specialist	a specialist (will examine John)
		(a specialist direct object of verb phrase)	
		(a specialist grammatical subject of embedded sentence "_____ will examine John")	

The (4a) and (4b) sentences are revealed to have the same deep structure by the following analysis:

(6a) Noun phrase	Verb	Noun phrase	Sentence
I	expected	a specialist	a specialist (will examine John)
(6b) Noun phrase	Verb	Noun phrase	Sentence
I	expected	a specialist	a specialist (will examine John)

The sentences of (3) and (4) as written have the same surface structure. Sentences (4a) and (4b) also have the same deep structure as revealed by sentences (6a) and (6b). However, sentences (5a) and (5b) have different deep structures which account for the difference in meaning between the two. Chomsky concludes that the superficial or surface quality of a sentence can mask its underlying meaning which is fundamentally syntactical and which, as in these examples, influences its semantic quality. Chomsky regards grammar as a theory of language. This grammar, as is obvious, is not often as articulate as Chomsky shows in his analysis, yet the ideal native speaker handles this grammar quite well in that the semantic distinctions among superficially similar sentences are perceived quickly and efficiently. Chomsky concludes that this rapid processing must be attributed to grammatical mechanisms of some sort already present in the speaker. In short, one must already know something about the way language works before one can learn a language.

The Acquisition of Language

Chomsky concludes that the Skinnerian behavior analytic position maintains that language is relatively independent, *in its structure* (italics mine) of any innate mental faculties. In addition, empiricist (e.g., Skinnerian) speculation assumes that only "the procedures and mechanisms for the acquisition of knowledge constitute an innate property of the mind" (1964, p. 5). This latter conclusion is, I believe, not entirely true. Skinner, for one, has left open the possibility that there are innate conceptual structures of some sort that, in part, direct the acquisition and use of language when he refers to the limitations that are imposed by certain "Kantian a priori's" (1957, p. 451). Consequently, Chomsky's criticism of Skinner is suspect since a Kantian a priori has a structure in addition to any structures which may govern "the procedures and mechanisms for the acquisition of knowledge." The question turns on precisely what Chomsky is referring to when he uses the term "faculties." If by "faculty" he is referring to "a linguistic structure or structures as identified in an analysis of grammar," it may be possible to separate such structures from procedures and mechanisms for the acquisition of knowledge. However, if Skinner had accepted, for example, the Kantian concept, if not the details, of cause and effect, he would also believe that an innate property of mind exists. Based on Skinner's position expressed in *Verbal Behavior*, this is a relatively safe assumption to make. There are two ways in which human beings understand causation. The first way is sub-linguistic and is shared with non-human animals. The operant conditioning process is a clear example of how this works. When an animal presses a bar and this is followed by food falling into a cup which the animal then consumes, the probability that the same response will occur in the future, *mutatis mutandis*, is increased. Putting it in

less precise, but more recognizable form, an animal knows how to bring about (i.e., cause) an event in the future because of its effect on the environment. Only human beings, apparently, know the other way of expressing a cause and effect relationship and this is linguistic in nature. Humans think, write and speak in a manner which indicates that they have a conception of causation which is general and, therefore, abstract. A principle of causation applied to specifically observed phenomena is expressed as a prediction as to what will happen in the future based on an observation of what has happened in the past. This prediction is solidified as a viable causal statement when there are no contrary instances and when the causal statement can be shown to be logically and empirically related to other causal statements which, taken together, form a theory (see Lana, 1991, for a more detailed analysis of the nature of cause and effect). In short, one way in which human beings use the concept of causation is thoroughly linguistic and is subject to a priori considerations, a position which Skinner apparently accepted in principle if not in detail. This being said, it is nevertheless true that Skinner was more interested in the details of the non-innate acquired processes of language than he was with its innate qualities. It is equally clear that Chomsky is more interested in carefully describing those innate qualities of language structure that constitute grammar and syntax than he is in investigating the external contingencies present when a natural language is acquired. Further, Chomsky believes these external contingencies play a minor, even trivial, role in language acquisition and use.

Skinner placed external contingencies at the center of the language process. Grammar and syntax were considered autoclitic responses which Skinner relegated to "remaining verbal responses" (1957, p. 331), while Chomsky placed them at the very center of language. The "formal" analyses of grammar and syntax were of no interest to Skinner and he concluded that "no *form* (italics Skinner's) of verbal behavior is significant apart from its controlling variables" (1957, p. 331).¹ As discussed above, Skinner then described the grammatical and syntactical aspects of a sentence in terms of relational and manipulative autoclitics. In a book of 478 pages he devotes thirteen of them specifically to grammar and syntax. Conversely, these subjects are central to Chomsky's analysis. Both theorists are focused upon very different aspects of language, and there are irreconcilable differences in their systems. There is no possible resolution to the positions taken by two systems of explanation, one of which insists upon the primacy of the genetic code in determining behavior, that is, language, and the other of which insists upon the primacy

¹Grammar is defined as the classes of words, their inflections, or other means of indicating relations to each other, and their functions and relations in the sentence as employed according to standard usage. Syntax is the arrangement of word forms to show their mutual relations in a sentence, the part of grammar that treats of the expression of predicative, qualifying, and other word relations according to established usage in the language under study.

of the influence of the consequences of behavior on language development. This is so because both systems formally recognize the limits of their explanatory emphasis and these limits are central to the other position. Skinner has his behavioral repertoire and Chomsky has his environmental performance determiners. The question that remains is what system will prove to be the most fruitful in its heuristic quality and in its influence on practical matters associated with the formal presentations of language in various cultural institutions such as the verbal community's educational system? However, the answer to this question still does not allow us to choose between the systems, because even though the difference between their emphases is real, they are also consistently focused on different aspects of the acquisition and use of language (see also Catania, 1998, p. 262).

For Chomsky, human language is a mental organ no different in operative principles than, for example, the heart, which is constructed to pump blood and does so without training of any sort. As the heart must have blood to pump, the language mental organ must have words of a natural language to arrange into meaningful units. This process begins with perception. It is necessary to see and hear words in order to have the language organ function. When a child is first exposed to such words what she is linguistically capable of will be more limited than what she is capable of when older and more physiologically developed. Since Chomsky took his position in opposition to Skinner's functional analysis of the acquisition and use of language, much has been written about these issues, some of which will be considered in the next chapter.