2: The onset of language

Orlando Taylor and David Swinney

While there are numerous definitions of language disorders, most state, in one form or another, that such disorders are deviations from normal language expectations. These definitions implicitly require knowledge of normal language behavior in order that valid judgments can be made about pathological language. Since, among other factors, linguistic "normalcy" is a function of age, the topic of language disorders must be viewed from a developmental framework.

Although a substantial number of language pathologists have articulated a recognition of the importance of language acquisition data to the diagnosis and management of language disorders, few have attempted to transfer recognition into specific application. Even worse, many language pathologists have approached their missions with little contemporary information on language acquisition. This situation is related, in part, to the abundance of language acquisition research being done in disciplines outside of speech and language pathology, especially in linguistics, psycholinguistics, and sociolinguistics.

As stated elsewhere in this book, linguists are interested in writing theoretical grammars for an idealized language system which will account for all grammatical and novel sentences of a language. Psycholinguists are interested in determining the psychological principles which permit human beings to do such things as acquire, comprehend, produce, store, and perceive a language. Sociolinguists are interested in the interaction between language and culture and, therefore, in the nature and history of linguistic variations within a specified sociocultural setting.

Before presenting the status of research and theory on the acquisition of American English, it should be noted that the topic has almost always been approached from the context of the vocalizations of white, middle-class children. The importance of this point is obvious in light of contemporary sociolinguistic theory which supports the legitimacy of all variations (dialects) of American English. These dialects, which result from the history and culture of their speakers, are realized as identifiable ethnic, regional, and social markings on the English language. Thus, if one is to make valid judgments about linguistic pathologies in children, the judgments must be made in the context of the language system of the child's linguistic community.

LANGUAGE ACQUISITION DATA

Philosophies'and Methodologies

During the past half century there has been an abundance of research on language acquisition. Prior to the late 1950s, most of this research focused on the establishment of developmental milestones for a predetermined set of linguistic categories in the. areas of phonology, lexicology, and grammar. In general, the research was designed without regard to a particular theory of language or language learning. Results were frequently rationalized in a post hoc manner by employing such arguments as experience, learning, and biological maturation.

In addition to theoretical insufficiencies of the more traditional types of language acquisition research, there were several other shortcomings. First, most of this research focused on linguistic production, not comprehension-the aspect of linguistic performance which (1) precedes and exceeds production, and (2) may provide a clearer insight into users' linguistic competence than production. Second, there were substantial variations in experimental design. For example, some of the research was of a laboratory type in which language behavior was elicited and recorded from a cross section of carefully controlled children with respect to such variables as intelligence, age, geography, and so on. These data were typically generalized into a normal developmental sequence. Other researchers observed and recorded spontaneous language of a small number of children (frequently one) over a specified time period. Examples of the former type of work are seen in the research of Irwin and his colleagues (1948) and Templin (1957). Research of the latter type is exemplified by Weir (1962). Because of variations in such areas as sampling techniques, experimental designs, measurement criteria, and dialectic differences, many differences are observable in data generated from traditional language acquisition research.

The emergence of transformational generative theory in the form of Chomsky's (1957) *Syntactic Structures* had a great influence on language acquisition research. Fundamental to the theory was the assumption that language users operate with a set of rules which permit production and comprehension of a nearly infinite number of grammatical sentences of a specified language system. This theory, and its more recent refinements, has caused most contemporary language acquisition scholars to raise serious questions about the importance and validity of traditional language development research which failed to focus on the underlying grammatical rules children must use to produce and comprehend increasingly complex sentences.

The use of a model of language which might be applicable to explanations of how human beings actually use linguistic symbols has resulted in significant improvements in the understanding of language acquisition processes. Data derived from experimental designs based on the model have also been useful for evaluating the "psychological reality" of rules posited by transformational grammarians. Further, they contribute to the broader goals of psycholinguistic theory, i.e., development of a theory of language use with respect to production, comprehension, memory, perception, and so forth.

Though contemporary research in language acquisition has profited from developments in linguistics and psycholinguistics, there has been a continued tendency to study only white, middle-class subjects. As a result, the work has a definite Standard English orientation. There has also been a continued overemphasis on language production (rather than comprehension) as a valid indicator of underlying linguistic competence. (Distinctions among competence, performance, production, and comprehension are presented in Chapter 1 of this book.)

Most recent psycholinguistic work in acquisition has been longitudinal and observational in character, rather than of a laboratory type. Relatively few subjects have been used, although this tendency may not be much of a problem since there seems to be great similarity among acquisition patterns observed in children studied.

Data on Phonological Acquisition

In studying phonological maturation in children, distinctions should be made between sound productions during early life which appear to have a nonsocial purpose (i.e., babbling) and sound production following the onset of language. In other words process should be viewed as development from a general phonetic to a language specific phonemic system. Obviously, there is a point at which these two systems overlap. The most frequently articulated generalities about the acquisition of the entire system by American children (white, middle-class) are as follows. [Data on phonological acquisition are presented in more detail by McCarthy (1954), Wood (1964), and Winitz (1969).][2]

1. Type and frequency of phoneme production increase with age, with the number of different phonemes increasing from 7 during the first I or 2 months of life, to 27 by age 30 months. ("Phoneme" in this context has almost always been from the framework of the phonemic system of adult Standard English.)

2. In early life, vowels are more common than consonants. After the first year of life, the pattern shifts until approximations of adult vowel-consonant patterns are reached.

3. Newborn infants utter three front vowels, primarily: /i/, /e/, and (A/. With increasing age, the proportion of back vowels increases while the proportion of front vowels decreases. Middle vowels maintain a stable level. Adult vowel approximations are reached around age 2%.

4. Infants produce a preponderance of back (mainly glottal) consonants, presumably related io reflexive chewing, sucking, and swallowing activity. Progressively fewer back consonants are produced with advancing age. Postdentals, labials, and labiodentals increase with age. Velars and dentals remain relatively unaffected by age.

[1] In the present context, sound productions in the language period include echolalia (the repetition of a verbal stimulus), jargon (simulations of mature verbal behavior with recognizable intonational contours and some distinguishable articulatory features), single words, and sentences.

[2] These general patterns show an obvious shift from nonsocial vocal play to increasingly more accurate approximations to the language of the child's environment. For this reason, the phenomena which have been reported are, indeed, expected.

5. Stops, mainly /k/ and /g/, and fricatives, generally /h/, are the major manners of articulation of young children. Glides, semivowels, and nasals appear around the fourth month of life. With advancing age, the latter three categories show increases, while the proportion of fricatives decreases.

Despite many differences in experimental procedures and measurement criteria, research on speech sound development after the onset of language has produced extremely stable results. In general, data reported by researchers such as Wellman et al. (1931), Poole (1934), and Templin (1957) reveal that maturation for the Standard English phonological system occurs between the third and seventh years of life. Further, analysis of speech sound acquisition data as a function of age clearly shows that certain sounds tend to reach adult levels before other sounds.

Winitz (1969) notes that it is difficult to make generalities on the maturation of Standard English phonemes by traditional notions of place and manner of articulation. For example, because of inconsistencies in the acquisition pattern, stops (with the exception of /t/) are acquired before the development of other sounds. Conversely, continuants (with the exception of /f/ and /h/) are mastered relatively late. Voicing elements for cognate sounds are typically separated by 2-year intervals, but the patterns are inconsistent. In some cases, the voiced parallel is mastered initially (e.g., /d/ before /t/), while in other instances the devoiced element is acquired first (e.g., /s/ before /z/).

Jakobson and Halle (1956) assert that there is an identifiable hierarchy of distinctive, phonological features which are acquired by children. (Sounds are characterized as groups of distinctive features, whereby each sound is distinguishable from every other sound on the basis of at least one feature.) The most generic distinctions are presumed to occur in early life with differentiation occurring with age. Thus, Jakobson and Halle argue that the consonant-vowel distinction is the first to be made by children.

Winitz (1969) has summarized in Fig. 1 Jakobson and Halle's claims on the development of distinctive features. Winitz's pictorial representation suggests the following hierarchy of feature acquisition:

1. nonvocalic vs. vocalic
2. consonantal vs. nonconsonantal
3. nasal consonants vs. oral consonants
4. acute consonants vs. grave consonants
5. narrow vowels vs. wide vowels
6. narrow vowels (diffuse): palatal vowels vs. velar vowels
7. wide vowels (compact): palatal vowels vs. velar vowels
8. compact consonants vs. diffuse, grave diffuse, and acute diffuse consonants
9. interrupted consonants vs. continuant consonants; tense consonants vs. lax consonants; and mellow consonants vs. strident consonants

Menyuk (1969) has also commented on the role of distinctive features in phonological acquisition. Her observations of five features in both American and Japanese children revealed a remarkable degree of similarity among the children, the order of feature acquisition being nasal, grave, voice, diffuse, continuant, and strident. The work, though admittedly preliminary, suggests some universal aspects of phonological acquisition, at least on the production side.

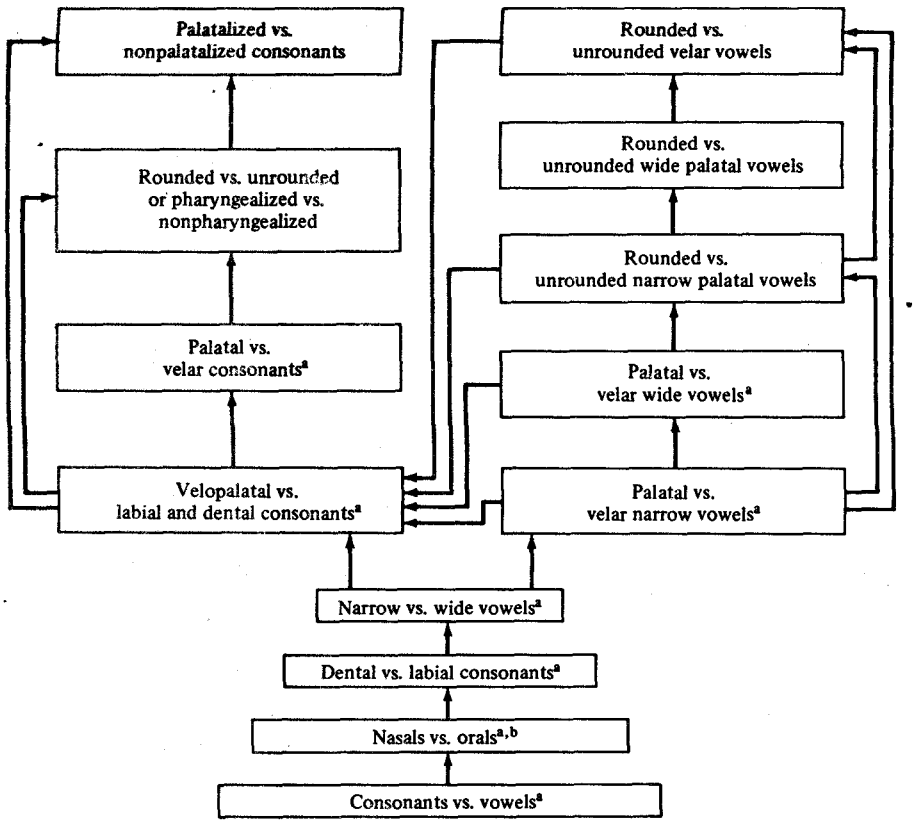


Figure 1. Pictorial representation of Jakobson and Halle's model for the development of phoneme contrasts. Some contrasts are prerequisites for other contrasts. These prerequisites are indicated by an arrow. For example, the fourth contrast, narrow versus wide vowels, cannot occur until the first three contrasts are learned. After the narrow versus wide vowel contrast is learned, one of two contrasts is learned: either velopalatal versus labial or dental versus velar narrow vowels. From here on the reader can trace the phoneme splits that can occur, using the arrows to direct himself and remembering that not all contrasts occur in every language. Adapted from R. Jakobson and M. Halle (1956). Source: Winitz, H., Articulatory Acquisition and Behavior, © 1969, p. 91. By permission of Appleton-Century-Crofts, Meredith Corporation, New York.

Menyuk has argued further that the acquisition of features in children is different from adult norms on frequency of feature usage, the adult order being diffuse, nasal voice, continuant, strident, and grave. This observation gives rise to a suspicion that imitation alone cannot explain the pattern of phonological acquisition by children.

Traditional research in phonemic acquisition often focused on speech sounds outside the context of other developmental aspects of language. Transformational theory suggests that the phonological component of the grammar is best understood and rationalized on the basis of the strings generated by the syntactic and semantic components. In other words, phonological rules are applied to the surface structures generated by the grammar. Thus, it seems reasonable to postulate that phonological development is related to grammatical development. It is also reasonable to argue that sound elements must be psychologically real, at least from a perceptual standpoint, in order for syntax to develop. Since comprehension precedes production, as will be shown later, serious questions can be raised as to when a phoneme becomes a psychological reality. One could easily make the argument, for example, that a phoneme becomes a reality when it is used as a perceptual unit. Winitz (1969, p. 122) states this position as follows:

> In this treatment of phoneme acquisition, no clear distinction has been made between the child's passive understanding of the adult phoneme system and the active use of his own phoneme system. His understanding of the adult phoneme system, or portion thereof, no doubt antedates any attempt by the child to utter language units. When a child begins to talk he has some understanding of the adult phoneme system but at the present time we do not know the level of passive development, either phonological or grammatical, that is necessary before attempts to talk are made.

A final point is that phonemic development is obviously influenced by the language being acquired. It should be obvious, therefore, that the same phonemes will not necessarily develop in all linguistic communities. For example, most American children do not develop the /x/ phoneme (the final sound in the German pronunciation in the word Bach). Likewise, some black children do not develop a medial /0/ phoneme in words like "bathtub" and some Spanish children do not use a /z/ phoneme in words like "zebra. " In all these instances, phonological differences are related to legitimate linguistic patterns, not pathologies.

Data on the Development of Spoken Vocabularies

Research on vocabulary acquisition in children has suggested that words first make their appearance sometime between months 12 and 18. There is a great variation in this aspect of verbal measurement because of differences in determining when a word attains psychological reality. Some experimenters have used a fairly loose definition, stating that a child's utterance need only approximate real words in adult language. Others have used word imitations as a criterion. Still others require spontaneous use of an utterance to denote a specified referent. Practically all definitions focus on linguistic *production,* not comprehension. Since several researchers have noted that comprehension precedes production in most phases of language growth, it is reasonable to postulate that words are actually acquired *before* their actual production. Thus, most developmental norms on vocabulary are probably conservative.

After the onset of the first words, vocabulary appears to increase rather slowly at first, quite rapidly throughout the preschool period, and then more slowly during later mental maturity. Vocabulary growth never ceases since the individual constantly learns new words and new usages of familiar words throughout life.

Some quantitative studies of vocabulary have focused on size. Smith (1941), for example, gives a typical set of figures for vocabulary growth, suggesting that the average vocabulary of first-grade, middle-class children is 23,700 (ranging from 6,000 to 48,000) words, while twelfth-grade, middle-class children frequently have vocabularies of 80,300 (ranging from 36,700 to 136,500) words. While there are numerous other figures, it is clear that children's vocabularies grow very rapidly and that their actual sizes are probably related to such factors as motivation, experiences, and, of course, the tools used to measure vocabulary.

Qualitative aspects of vocabulary growth are reflected in traditional research on "parts-of-speech" analyses. Since words have little meaning outside their grammatical context, it is very difficult to make statements about parts of speech without making statements about grammar. For this reason, parts-of-speech analyses in children can best be made by discussing child grammars.

Data on the Acquisition of Grammar

As stated earlier, much of the traditional work on the acquisition of grammar was done without sophisticated theoretical notions about natural languages. The result was that many of the measurement categories used in this research focused on surface and, in some cases, trivial aspects of linguistic performance. Perusal of this literature reveals, for example, an overabundance of data on such topics as mean length of response, amount and rate of talking, and sentence "complexity." Of course, judgments in the above areas are related to implicit assumptions about "normal" sentence length, quantity, and complexity. Readers with interest in these approaches to grammatical maturity are referred to McCarthy (1954).

Irrespective of methodological or philosophical orientation, practically all researchers agree that most children begin to form two- and three-word utterances (sentences) sometime between months 18 and 24. In addition, most contemporary writers have demonstrated that children's utterances are not random, but have underlying grammatical rules which permit generation of a large number of sentences.

Berko (1958) was among the first writers after the publication of Syntactic Structures (Chomsky, 1957) to document the fact that children operate with grammatical rules which appear to result from inductions from linguistic data provided by the environment. In a study of the ability to control certain elements of English inflectional morphology in the environment of nonsense "words," Berko found a definite hierarchical sequence for the acquisition of morphological rules. The rules, many of which were not completely acquired by first-grade children, seemed to be associated more with grammatical than with phonological factors. For example, the /s/ and /z/ allomorphs were used more correctly in the context of possessive and plural nouns than in the third-person singular of verbs, despite phonological similarity.

Berko's work was important in the sense that it demonstrated that children operated with a substantial amount of linguistic competence. The major criticism of it, however, might be that it was done from the framework of an adult grammar, rather than from a unique child grammar.

Besides Berko, other early linguistically oriented researchers of language acquisition used adult. grammar orientations. For example, Ervin (1964) reported that children's grammars were reductions[3] of adult grammars where, within memory constraints, (1) the most recent and stressed words (mainly content words) are maintained, and (2) word order is preserved. Nevertheless, these researchers recognized two important aspects of child language. First, children have more advanced grammars than they demonstrate in their productions (Fraser et al., 1963). Second, sentence reductions, if they in fact exist, require some knowledge (competence) of the most important portions of sentences. For these and other reasons (e.g., children's utterances include linguistic features which they have probably never heard), several researchers (see Ervin, 1964) began to question the long-believed notion that imitation plays an important role in the acquisition of grammar. Ultimately, research was designed which made no a priori assumptions concerning the relationship between child and adult language.

Brown and Fraser (1964a, b), Ervin (1964), Braine (1963), McNeill (1966a, b), Klima and Bellugi (1966), and Menyuk (1969) are among those who have reported some of the most extensive data on early child grammars from a nonadult perspective. Though several rules have been advanced to rationalize the grammatical characteristics of these constructions, McNeill (1966a, 1967) argues that the child's first grammar can be explained adequately by the following rule:

$$\text{Sentence} \longrightarrow (\text{P}) + \text{O} \qquad \text{(rule 1)}$$

[P = optional pivot word

O = mandatory open word]

Pivot-word classes typically have fewer members than open-word classes; however, each pivot word is used more frequently than individual open words. Further, pivot-word classes are relatively slow to take in new members. As Braine (1965) observed, pivot words have characteristics similar to function words (e.g., prepositions, articles) in adult grammar. [Open-class words behave more like adult content words (e.g., nouns, adjectives, and so on).] However, the actual class of words which are used as pivot words apparently contains many members which are not typically a part of the function-word category for adults. Indeed, many words children use as function words are similar to adult content words. This observation leads one to again raise serious questions as to whether the grammatical rules children use could be imitations of what they have heard from adults.

[3] Children's oral reductions of language are thought to be followed by oral expansions by the adult environment in which *suspected* missing elements are supplied. Reductions, and subsequent expansions, are thought by some scholars to be important aspects of child language growth (see Brown, 1964; Slobin, 1964). The precise role of reductions and expansions, especially with respect to how close they have to be to the child's intended message, is unclear.

The $S \longrightarrow (P) + 0$ rule asserts that children's first sentences are constructed by optionally producing a pivot word plus a mandatory open-class word. This means that pivot words cannot stand alone, although open-class words can. In short, the rule permits production of both one and two-word sentences by children, e.g., *shoe, green boot, here baby*, and so on.

Brown and Bellugi (1964) report that open-class words seem to be established before month 18. However, pivot-class words seem to undergo a differentiation process which does not begin until month 18. Approximately 2½ months after the onset of pivot words, articles (e.g., *a,* and *the*) and demonstratives (e.g., *that* and *this*) have differentiated from the remainder of the pivot category. At this time it is possible for sentences to occur with an optional demonstrative, plus an optional article, plus an optional pivot word, plus a required noun (rule 2). Five months after the onset, adjectives and possessives separate from the pivot class to form independent classes. This additional differentiation permits sentences by using either:

1. An optional article, plus an optional adjective, plus a required noun (rule 3).
2. An optional pivot word, plus a required noun; or an optional possessive, plus a required noun; or an optional demonstrative, plus a required noun (rule 4).
3. An optional article, plus a required noun, plus an optional adjective (rule 5).

The whole process of pivot class differentiation is presented in Fig. 2.

McNeill (1966a) has also summarized data from other sources to generate three additional early grammatical rules[4]

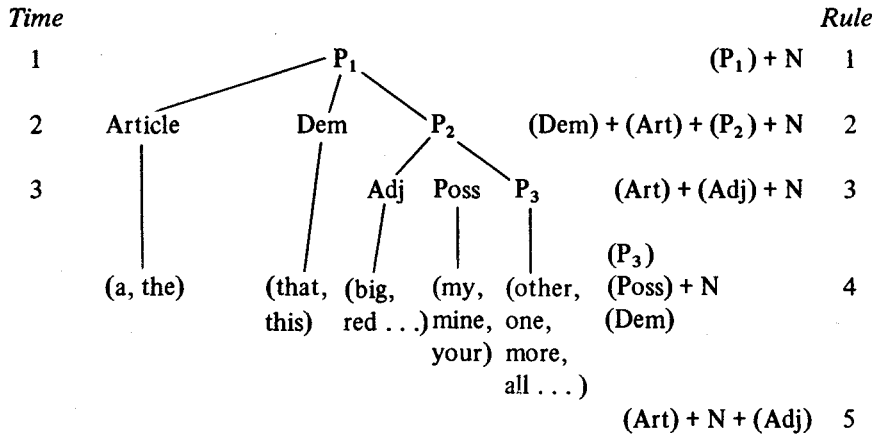
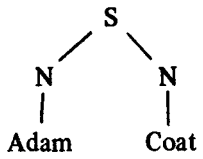


Figure 2. Differentiation of the pivot class. Abbreviations are as follows: N = noun (i.e., one of the open classes); Art = articles; Dem = demonstrative pronouns; Adj = adjectives; Poss = possessive pronouns; P_1, P_2, and P_3 = pivot class at times 1, 2, and 3, respectively. Reprinted from "Developmental Psycholinguistics" by D. McNeill. In Smith, F., and G. Miller, eds., The Genesis of Language, by permission of The MIT Press, Cambridge, Mass. Copyright © 1966, by the Massachusetts Institute of Technology.

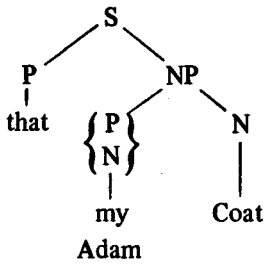
[4] Reprinted from "Developmental Psycholinguistics" by D. McNeill in Smith, F., and G. Miller (eds.), The Genesis of Language, by permission of The MIT Press, Cambridge, Mass. Copyright © 1966, by the Massachusetts Institute of Technology.

1. $S \rightarrow N + N$ rule 6



2. $S \rightarrow (P) + NP$ rule 7

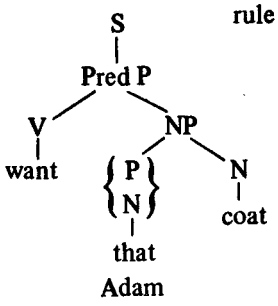
$NP \rightarrow \begin{Bmatrix} (P) + N \\ N + N \end{Bmatrix}$



3. $S \rightarrow Pred\ P$ rule 8

$Pred\ P \rightarrow (V) + (NP)$

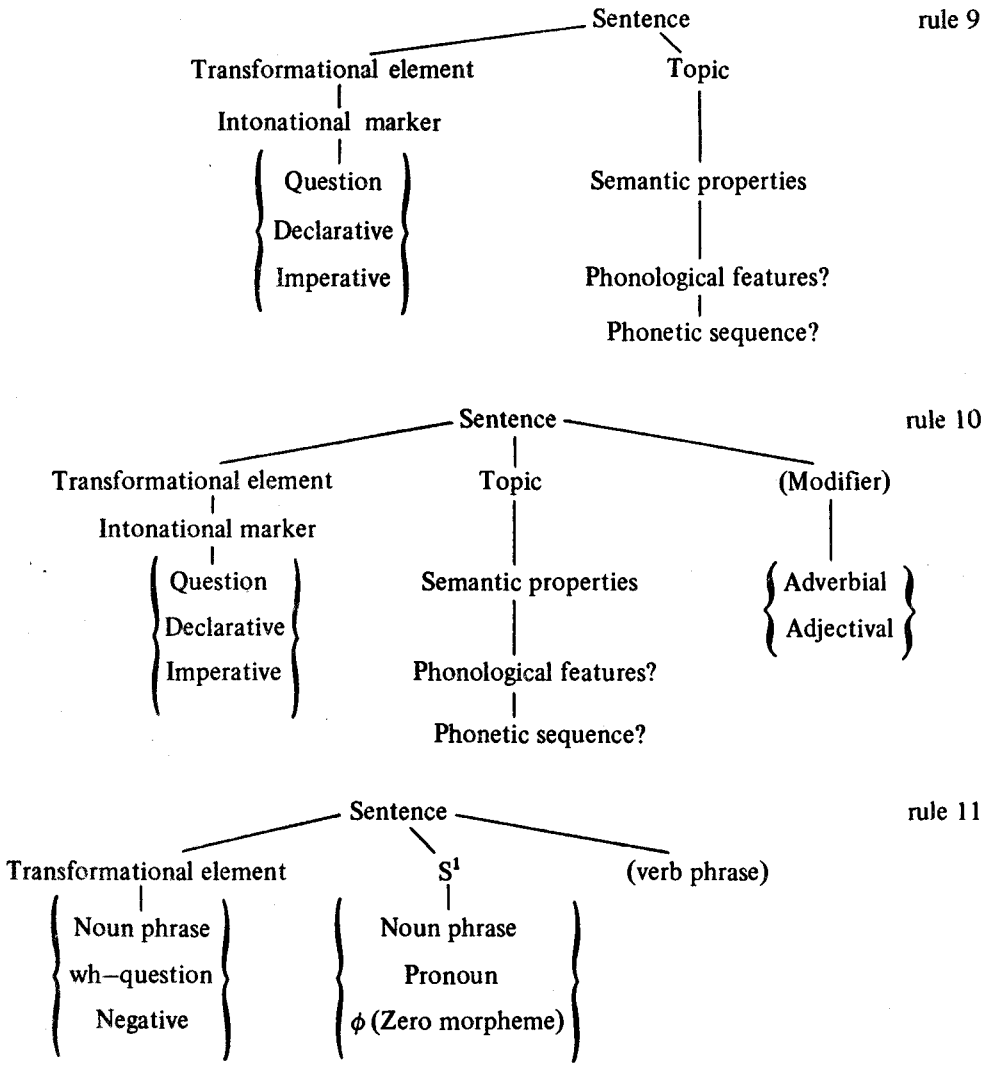
$NP \rightarrow \begin{Bmatrix} (P) + N \\ N + N \end{Bmatrix}$



Menyuk (1969) added the intonational component of child language and the notion of the "sentence topic" to write rules for early child utterances. She asserts that children's earliest sentences frequently contain a single morpheme. They are "sentences" in that they reflect a competence for the concept of a sentence. They typically utilize a specific topic in the form of a phonetic or phonological string (usually a word), plus one of three available intonational markers (question, declarative, or imperative) (rule 9). Later, sentences add such components as (1) adverbial and adjectival optional modifiers (rule 10) and (2) morphological replacements for intonational markers in the form of NP, wh, or negative morphemes (rule 11).

Menyuk's early grammatical rules are as follows:

[5] Reprinted from Sentences Children Use by P. Menyuk by permission of The MIT Press, Cambridge, Mass. Copyright © 1969 by the Massachusetts Institute of Technology.



In making a case for the legitimacy of early child grammars, it should be pointed out that an argument is not being made that there is no relationship whatsoever between the kinds of sentences adults produce and those produced by children. Though different, there are certain universal features of both grammars. The notion of universals in language acquisition has been discussed by Chomsky (1964) in the form of an hypothesis which states that the first stages of linguistic development are sensitive to universal hierarchies of syntactic categories. Chomsky (1961, 1965) and Katz (1966) discuss the universal features in the form of something called a Language Acquisition Device (LAD). LAD can be imagined as being an innate structure which contains all the language universals. Linguistic data from the child's environment are fed into LAD, which has the task of

selectively filtering out all the universals it contains which are unnecessary for acquiring the particular language the child will ultimately use. Thus, the child's task is to move from a set of general grammatical rules to a set of rules specific for his language. In other words, he must induce a grammar. This notion will be discussed further in a later section.

On the basis of these early two- and three-word grammars, both McNeill (1966b, c) and Menyuk (1969) argue that the early grammars of children are characterized by universal elements of the basic grammatical relations of the deep structure. McNeill asserts that the following basic grammatical relations appear in children's earliest utterances: the concepts of subject and predicate of a sentence; main verb and object of a verb phrase; and a modifier and head of a noun phrase. Menyuk supports the claim and has added that the basic grammatical elements cited by McNeill, plus others, are typically acquired by the age of three years. Slobin (1966) and McNeill (1966b) have presented data from Russian and Japanese children to support the universality of the claim. For Menyuk and McNeill these elements must be established before more complex operations (transformations) can occur.

Among other things, the above notions suggest that every word which is acquired by the child must be acquired in the context of some grammatical function, as each word is capable of assuming more than one grammatical role in a sentence. For example, a given word might assume the role of head of a noun phrase in one sentence and object of a verb phrase in another sentence.

After establishment of basic grammatical relations, children begin to apply transformational rules to generate more complex sentences. These rules either rearrange, delete, or add elements to the basic grammatical relations just discussed. Their application permits generation of a number of new, more complex sentences. The use of transformations may be related to establishment of left cerebral dominance for language. Bever (1968) suggests, however, that the shift of cerebral laterality for language from a bilateral to a left-sided function may result from changes in linguistic performance, not the reverse.

On the whole, there has been little work on the growth of transformations in children. This failure is related, in part, to the fact that a large amount of language acquisition research has focused on the language of very young children. Also, until the last few years there has been no adequate linguistic model of syntax or vocabulary, a fact which left much doubt concerning what a valid language acquisition theory need rationalize. For whatever reason, the fact is that much language acquisition research (especially in the area of grammar) has overlooked developmental patterns in children after the first 4 or 5 years of life. There have been three exceptions to this trend: the work of Klima and Bellugi (1966), Menyuk (1963,1964b,1969), and C. Chomsky (1968).

Klima and Bellugi's research focused primarily on the acquisition of the negative transformation. The negative transformation, in its various forms, is one of the more difficult to explain linguistically. Nevertheless, negative sentences, in one form or another, are present in children's language almost from the outset of sentence generation. Klima and Bellugi suggested four stages in the acquisition of negatives. The first stage, which is pretransformational, occurs early in the acquisition process and involves a grammatical rule similar to one of the early rules described by Menyuk (rule 11). At this

stage, there are no negatives within the sentence and there are no auxiliary verbs. Negation is signaled by the presence of a *no* or *not* outside the nucleus of a sentence. Further, there is no evidence to suggest that the child even understands the negative embedded in the auxiliary of adult speech. The rule for stage I negation can be written as follows:

(rule 12)[6]

$$\left[\begin{Bmatrix}\text{no}\\ \text{not}\end{Bmatrix} \text{———} \text{Nucleus}\right] \quad S \quad \text{or} \quad \left[\text{Nucleus} \text{———} \begin{Bmatrix}\text{no}\\ \text{not}\end{Bmatrix}\right] \quad S$$

Examples of negative sentences generated by this rule are *no singing song; not a teddy bear; wear mitten no.*

Stage II, which appears 3 to 6 months after the onset of negatives, still shows no use of transformations. However, auxiliaries (*don't* and *can't*) are used uniquely before nonprogressive main verbs in negative constructions; i.e., they are not used elsewhere in the grammar. It is also clear that children understand the negative embedded in the auxiliary at this stage. Stage II negation can be considered as follows:

$$S \longrightarrow \text{Nominal} \text{———} \text{Aux}^{neg} \text{———} \text{Predicate Main Verb}$$

$$\text{Aux}^{neg} \longrightarrow \begin{matrix}\text{Neg}\\ \text{V}^{neg}\end{matrix}$$

$$\text{Neg} \longrightarrow \begin{matrix}\text{no}\\ \text{not}\end{matrix}$$

$$\text{V}^{neg} \longrightarrow \begin{matrix}\text{can't}\\ \text{don't}\end{matrix}$$

Examples of stage II negative sentences are *That no mommy, He not little, he big, I can talk,* and *I don't want it.*

In stage III, another 3 to 6 months later, modal auxiliaries *can* and *will, do* and *be* appear in negative sentences, as well as in declarative and interrogative sentences. In the sentences *be* is optional, but restricted to predicate and progressive. *Can* and *do* are restricted to nonprogressive main verbs. Stage III negation can be considered as follows:

(rule 13)[6]

$$S \longrightarrow \text{Nominal} \text{———} \text{Aux} \text{———} \begin{matrix}\text{Predicate}\\ \text{Main Verb}\end{matrix}$$

$$\text{Aux} \longrightarrow \text{Tense} \text{———} \text{V}^{aux} \text{———} (\text{Neg})$$

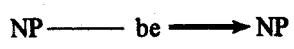
$$\text{V}^{aux} \longrightarrow \begin{matrix}\text{do}\\ \text{Modal} \quad (\text{will or can})\\ \text{be}\end{matrix}$$

[6] Figures from Klima, E., and U. Bellugi. Syntactic Regularities in the Speech of Children. In Lyons, J., and R. Wales (eds.), Psycholinguistic Papers, The University Press, Edinburgh, 1966. By permission of The University Press, Edinburgh, Scotland.

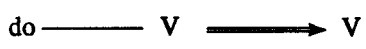
Examples of stage III negatives are as follows: *You didn't caught me, I can't see it, That was not me, and I gave him some so he won't cry.*

At the fourth stage, two main types of transformations are reported. They are

Optional *be* deletion **(rule 14)**[6]



***Do* deletion**



At this stage, negative auxiliaries are no longer limited to *don't* and *can't.* Further, auxiliary verbs now appear in other kinds of sentences and, therefore, can be considered as being separate from the negative element of sentences. Another feature of this early transformational stage is the appearance of indeterminates in affirmative and negative sentences, e.g., *I want some supper* and *I don't want some supper.*

Klima and Bellugi have discussed the development of the interrogative transformation in a manner similar to the one used to describe negation. In fairly great detail, they trace the growth of questions from an early stage in which yes/no and *wh*-like (e.g., *See hole?, Where milk go?,* etc.) questions are produced through the acquisition of interrogative proposing, interrogative inversion, and *do* deletion transformations.

Menyuk (1969) has made observations similar to those of Bellugi concerning transformational growth. While recognizing that sentences requiring transformations are generally not produced until the establishment of deep structures, Menyuk notes that even the earliest utterances of children have some elements to which transformations would apply, although they are not used in production. For example, in the growth of negatives it seems as though the negative transformation concept is recognized by the child even though his production of negation is marked only by intonation on a deep structure string. Thus, one might postulate a competence for certain transformational elements, even when oral performance does not necessarily reveal it. This point reinforces the need for data on comprehension acquisition in order to induce valid judgments of child linguistic competence.

Carol Chomsky (1968) has also addressed herself to the topic of late grammatical development. Though her work focused on comprehension, the results show that some grammatical constructions are not acquired until the fifth year of life. In view of the lead comprehension has over production, it is probable that production of these same constructions will not appear until after the age of 5. Chomsky's work will be discussed in the following section.

Data on the Acquisition of Linguistic Comprehension

Most authorities agree that comprehension of a specific linguistic unit precedes the ability to produce that same unit. (In fact, comprehension is thought to remain superior to

production throughout life.) McNeill (1966a) argues that this phenomenon should be expected since passive control (comprehension) of a given linguistic unit has less obstructing and distorting factors separating it from competence than active control (production). For example, motor programming and execution are not possible sources of "noise" during comprehension, though they are during production. This assumption, if correct, provides support to the notion that data on comprehension acquisition might provide more valid insights into children's linguistic competence than production.

Despite general agreement with the above assertions, few researchers have reported data on the acquisition of linguistic comprehension. This dearth of research may be related to the absence of adequate psycholinguistic models and experimental paradigms for assessing comprehension in any group of subjects, irrespective of age.' Obviously, it will be difficult if not impossible, to obtain valid data on comprehension acquisition during childhood until these problems are resolved. One of the most complete studies of linguistic comprehension is reported by Fraser et al. (1963)8 They presented paired sentences representative of 10 grammatical contrasts (e.g., *the sheep is jumping/the sheep are jumping*) to a group of twelve 3- to 3'-year-old boys and girls. Subjects were required to (1) imitate the sentences, (2) point to appropriate pictures to indicate comprehension of the sentences, and (3) produce sentences from the same pictures to indicate active control of the contrasts.

Fraser, Bellugi, and Brown's results provide formal support for many of the theoretical notions stated throughout this chapter.

Specifically, they show that imitation ability exceeds comprehension, which, in turn, exceeds production. The data also suggest a performance hierarchy for grammatical complexity. The grammatical hierarchy for comprehension, shown in comparison with imitation and production, is presented in Table 1.

Gaer (1969) has also studied comprehension in terms of modern grammatical theory. He reports that children's relative abilities to comprehend certain transformations vary as

[7]A major exception is the "decoding" hypothesis (see Gough, 1965). It states that linguistic comprehension involves the inverse of the processes used to generate sentences. Thus, comprehension is achieved by (1) perceiving the phonological representation of an utterance by assigning appropriate phonological rules to it; (2) assigning appropriate surface structure to phonological information; (3) discovering the transformational rules which were obviously necessary to generate the surface structure; (4) assigning the proper deep structure to the surface structure, based on the application of (3); and (5) assigning the appropriate semantic and conceptual categories to the basic grammatical relations of the deep structure. Obviously, memory and perception influence the efficiency with which the entire system operates.

[8] There has been work (mainly of the normative type) in acquisition of vocabulary comprehension (e.g., Peabody, 1959; Templin, 1957) and the comprehension of grammatical form classes (e.g., Wolski, 1962; Carrow, 1968). This research has been based generally on Standard English expectations. Obviously, the data generated from research of this type should not be generalized or considered "normal" for children from all linguistic communities in the United States.

Table 1. Grammatical Hierarchy for Imitation, Comprehension, and Production.

	Feature	Comprehension rank	Imitation rank	Productio rank
1.	Affirmative/Negative	1	5	1
2.	Subject/Object, in active voice	2	4	2
3.	Present Progressive tense/future tense	3 3	2 2	5 5
4.	Singular/Plural, of 3rd-person possessive pronouns	4	1	3
5.	Present progressive tense/past tense	5	6	6
6.	Mass noun/count noun	6	8	9
7.	Singular/Plural, marked by is and are	7	3	4
8.	Singular/Plural, marked by inflections	8	7	10
9.	Subject/Object, in passive voice	9	9	8
10.	Indirect object/direct object	10	10	7

a function of age. At age 3 they seem to understand active, passive, question, and negative transformations more or less equally well, performing at about 58 percent accuracy. By age 4 active sentences are understood better than questions, which, in turn, are better understood than passives and negatives. For 5- and 6-year-old children actives, questions, and passives show no difference, all being understood better than negatives. Adults, on the other hand, tend to understand all these transformations at about 95 percent accuracy.

Carol Chomsky (1968) has reported an experiment on late grammatical acquisition which focused primarily on comprehension. Her task required a group of children to manipulate dolls, pictures, objects, and so on, to indicate comprehension, and in some cases production, of a set of sentences of the following structural types:

Structure	*Category*
1. John is easy to see.	Easy to see
2. John promised Bill to go.	Promise
3. John asked Bill what to do.	Ask/tell
4. He knew that John was going to win the race.	Pronominization

Chomsky's data show that syntactic development continues until at least the ninth year of life. While there were individual variations in the exact time children seemed to acquire the above structures, as well as differences in the acquisition pattern for each structure, the following developmental hierarchy emerged:

1. Pronominization-about 5.6 years
2. Easy to see; promise-between the ages of 5.6 and 9 years
3. Ask/tell-often past year 10

Though incomplete, data presently available on comprehension provide some very important insights into the process of language maturation. Unfortunately, not enough data are available. Specifically, all structures have not been studied, all ages have not been assessed, and dialectic considerations have largely been ignored. Therefore, application of these data must be done with caution.

SUBSYMBOLIC SYSTEMS RELATED TO LANGUAGE ACQUISITION

A crude, but topically comprehensive, model of the total communication system is displayed in Fig. 3. The model is relevant to language acquisition research in that, it

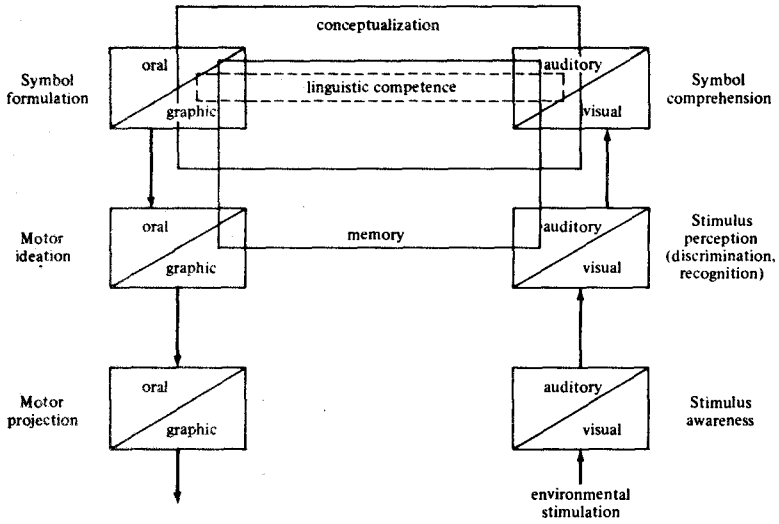


Figure 3. Model of a human communication system based, in part, on models of Osgood (1953) in Osgood, C., and M. Miron, Approaches to the Study of Aphasia, © 1953. Permission for publication of adaptions by University of Illinois Press, Urbana, Illinois.

indicates the several sensory, cognitive, and motor systems necessary for normal linguistic performance (i.e., symbol comprehension and production). These prerequisite systems can be called "subsymbolic" in that they are required for normal symbolic behavior though, in and of themselves, they are not symbolic. Their status and acquisition can affect the child's development of language. Some general information in these areas will be summarized.

Memory

Some comprehension research has been based on a theoretical model which suggests that sentences are understood by assigning appropriate deep structures to surface structures through inverse application of the transformational rules used to generate them (e.g., Gough, 1965). It is assumed that grammatical structures must be coded into some storable unit(s) and retained in memory so as to make comprehension possible (see Miller,

1962; Savin and Perchanock, 1965). Presumably, sentence decoders retain sentences in their short-term memory and subject them to linguistic rules stored in their long-term memory, [Evidence is given for this dichotomization of memory in Milner's (1959) research on hypocampal lesions. She reports that there is apparently a breakdown of both retrieval and input to long-term store, but that short-term store remains intact. Production does not seem to require the short-term memory aspect, but depends on a long-term memory process which permits appropriate selection of linguistic symbols and grammatical rules.

Atkinson and Shiffrin (1968) have offered one of the most comprehensive theoretical models of human memory. Their model suggests a memory which consists, among other things, of permanent structural features, which include

1. A sensory register in which information is first perceived but, thereafter, decays rapidly (within several hundred milliseconds).
2. A long-term memory which stores information relatively permanently.
3. A short-term store into which information can be selectively shifted from either the sensory register or long-term memory. Thus, short-term memory is the "working" component of memory. Short-term stored information decays in about 15 to 30 seconds, but a control process called "rehearsal" can maintain a limited number of information units as long as desired. Regardless of the form of sensory input, most information in short-term storage appears to be coded in an auditory-verbal-linguistic form.

Rohrman (1968), among others, has postulated that transformational rules may be stored in long-term memory. Thus, language comprehension requires (1) a sensory register scan of auditory inputs which allows them to be "chunked" into usable, storable sequences in short-term memory and (2) comparison and interpretation of "chunked" materials on the basis of basic grammatical relations and transformational rules stored in long-term memory.

Perusal of the literature reveals little research on memory development as it relates to language acquisition. Zinchenko's work (1969) is an exception. He has described research on memory development which suggests that involuntary memory plays a more important role than voluntary memory in language acquisition. McNeill (1966a), in related research, has suggested three progressively longer memory spans (those for grammatical production, grammatical comprehension, and phonological production) to account for the relative order of accomplishment of children in imitation, comprehension, and production tasks. The concept, however, appears to be totally ad hoc and insufficient in light of known data on memory. The facts appear more easily explained by a concept of perceptual set or expectancy.

Perception

Memory is linked directly to perceptual aspects of cognition. It has been shown by Smirnov (1969) and Zankov (1969), for example, that the form of preattentive set influences the orientation to material that is being remembered in terms of its content, structure, and oral form. For instance, Mishkin and Forgays (1952) have found a left-to-right perceptual set important to recognition of English words and, thus, to the processing of written language. Neisser (1967) suggests that speech perception is

accomplished by analysis-by-synthesis. Basically, auditory synthesis can produce units of varying size. A person can ask "What was meant?" or "What sounds are uttered?" and synthesize accordingly. Neisser (1967) discusses a "preliminary analysis of the signal," or a preattentive perceptual process, which guides and chooses the units the person uses in analysis.

The elements of language that are perceived, perhaps as determined by the hypothesized preattentive process, have long been a point of contention for researchers in the area of speech science. The International Phonetic Alphabet has been used to describe the total *sound* system of languages. In this research, phonemes have been hypothesized as being the raw perceptual materials of language. Speech sounds are classified by manner of production and by the position of the articulators in making the sound. These classifications, and others, e.g., voicing classifications, have been shown by Jakobson and Halle (1956) and Jakobson, Fant, and Halle (1967) to represent a group of distinctive features in which each separate sound can be classified and distinguished by at least one feature from every other sound. All features are defined in physical terms by the amount and concentration of energy in the frequency spectrum and by time. These physical correlates correspond roughly to the sensory perceptions of loudness of voice, pitch of voice, and subjective judgments of duration.

Acceptance of the phoneme as the basic unit of language perception has often been challenged. It is difficult to explain, for example, how allophones can be perceived as being the same or similar when the acoustic characteristics of each differ greatly (Carroll, 1964). Perhaps it is the phonemic environment, in addition to the phoneme under discussion, which is actually the perceived unit of speech. If the child depended only on phonemic discrimination, he would have to possess an enormous amount of innate knowledge concerning sound wave analysis to comprehend a language.

Jakobson and Halle (1956) suggest that the phonemic syllable appears to be the perceptual unit of language. This hypothesis follows from evidence which shows that syllables have rule-like determinability and predictability. Vowel-consonant contrasts often render the syllable prominent and permit predictions of subsequent syllables, although there are other important cognate contrasts.

Although this argument will not be pursued further, it should be noted that the syllable is by no means the universally accepted perceptual unit of speech. There are excellent arguments, using evidence of suprasegmental phonemes (e.g., stress, pitch, juncture), which indicate that the word, phrase, or even the underlying grammatical structure may well be the units of perception the human senses use in comprehending and, ultimately, in acquiring oral production (see Fodor and Bever, 1965). Obviously, further research is needed to determine the actual unit(s) of speech perception.

Three final observations concerning perception merit some discussion in relation to language acquisition. The first concerns evidence that the suprasegmental phonemes appear to be learned, or perceived, by the child in advance of some of the other patterned phonemic and syllabic units. Weir (1962) has discussed this fact in terms of the child learning the intonational contours of his language.

Second, Bever (1970) has pointed out that certain strategies basic to all perceptual processes are innate while others undoubtedly grow out of linguistic experience. Thus, perception changes with age and experience. In fact, Bever (1968) suggests that cerebral

dominance for language may develop, in part, in response to external language experiences. That is, dominance for speech may be related to the behavioral strategies used by individuals in listening to sentences.

Third, Whorf (1956) has shown through the example of Indo-European languages that different linguistic communities perceive reality in different ways and that the language spoken by a community aids in structuring the cognitive processes of those speaking that language. Given that the child utilizes data provided by his environment in acquiring language, this point suggests that the language the child acquires will be molded by the perception of the world that his parents and his community share. This postulation forms the basis for a substantial amount of contemporary sociolinguistic theory.

Motor Speech Development

Motor development, much like perceptual development, appears to be largely a process of maturation. Lenneberg (1967) has indicated that the pattern of general motor development corresponds with the onset of speech and that speech is dependent upon this coordination. Miller (1951), for example, specifies that Broca's area (the part of the brain which controls motor speech) does not typically develop until the month 17, although other cortical motor centers are differentiated by month 11. In considering motor development in terms of speech development, there appear to be corresponding "stages" of motor development for each "stage" of speech development. These "stages" are really not separate, distinct steps. Rather, they are distinctive points on a developmental continuum. The physiological correlates of these speech development stages are related to changes in size and structure of the articulating and resonating apparatus, as well as to development of motor coordination.

The earliest sounds of the child appear to be a part of nondirected bodily reflex responses to new physical environments. During the first month of life the child uses crying, whimpering, and contented vocal behavior, which are believed to serve as prerequisites for later phonetic development. [Van Riper (1963) has itemized the phonetic sounds that occur during the earliest period of differentiation.] At about 8 weeks of age, the child usually begins to engage in babbling (nonsocial sound production). These random sounds are governed by the maturation of the motor mechanisms which control the movements of the lips, tongue, and so on. For instance, few, if any, back vowels are produced during this period because of the apparent difficulty in coordinating the musculature well enough to lower the tongue in the back of the mouth.

Following babbling, vocal play (social sound productions) appears around the sixth to eighth month. This activity generally includes echolalia, which Van Riper (1963) discusses as occurring in month 10 to 11, and contouring (utilization of correct adult inflection patterns with nonsensical articulatory utterances). Contouring has been discussed as one of the first linguistic features of adult language that a child acquires. Weir (1962) discusses two forms of stress and four separate distinct pitch patterns as occurring prior to articulatory features, at about the eighth month. Vocal play overlaps into the stage of purposive utterances, in which appropriate use of words or syllables occurs. This stage begins sometime near or before the end of the first year.

Theories of First Language Acquisition

Several theories of language acquisition have been advanced to rationalize the reported "facts" surrounding language development during childhood. In varying degrees, these theories take into account certain anthropological, sociological, biological, and psychological principles. The more recent ones attempt to explain assumptions implicit in contemporary linguistic (transformational) models. Regardless of viewpoint, however, a theory has not yet been presented which sufficiently accounts for both the theoretical assumptions of contemporary linguistics and the large body of empirical data on language development. Perhaps the answer will come from more descriptive data on patterns of linguistic maturation, or, possibly from refinement or restructuring of some of the present theories. Most likely, however, both are needed. Nonetheless, within the total range of present theories, attempts have been made to explain both the necessary process and the facts associated with language growth.

Loosely speaking, there are three basic postures concerning first language acquisition. (In-depth expositions of many of these theories are found in numerous sources; see Jenkins, 1967; McNeill, 1966c; and Staats, 1968.) All deal primarily with linguistic production, not comprehension. In light of some of the points discussed in preceding sections of this chapter, this fact is unfortunate since comprehension seems to always exceed production and is probably a more valid indicator of linguistic competence.

One theory might be categorized as having an empiricist or *learning* theory orientation. The term empiricist is derived from the manner in which data used to construct behavior models are collected. Only empirical, or observable, data are considered in the building of learning theories of language growth. These theories have the most extensive history and corpus of data. They are derivatives of performance learning models of observed behavior in animals and include various systems of stimulus-response contiguities. The theories in this classification range from single-stage chaining (conditioning) of stimuli and responses to complex combinations of all learning theories (see Staats, 1968). In nearly all the learning-oriented theories, the single word and its acquisition of "meaning" has been the basic linguistic unit examined and explained. Grammatical elements of the language have generally been relegated to secondary considerations by these theories (DeCecco, 1967). In essence, learning theorists assert that language is acquired through pairing of verbal behavior with proper reward situations, thus ensuring continued usage of these verbal behaviors.

The second posture concerning language acquisition is a derivative of transformational generative grammar. The theory appears to have developed out of a belief that human language behavior cannot be sufficiently expressed by descriptions of observable environmental events alone. Further, this reaction against learning theories also involves rejection of generalizations from lower animal species to humans. Close analysis of the writing of these theorists, who advocate a *nativist* or "innate propensity" orientation, reveals a preponderance of speculative and logical arguments which attempt to refute various points of learning theories. Nativists argue that the "facts" of a complex language system of linguistic rules which generate a nearly infinite number of sentences and which

develops over a short number of months can only be explained by *a competence* or *innate propensity* for language. A major portion of this assumption is based on the fact that many grammatical elements the child produces are never heard by the child and, therefore, have never been reinforced.

Finally, there is a posture which represents a mixture of the above two stances. While the theorists discussed in this regard may feel more attached to one or the other of the above viewpoints, their arguments include combinations of the learning and nativist viewpoints-utilizing the most logical and persuasive points of each.

A more detailed summary and review of the principles of the above-mentioned theories follow.

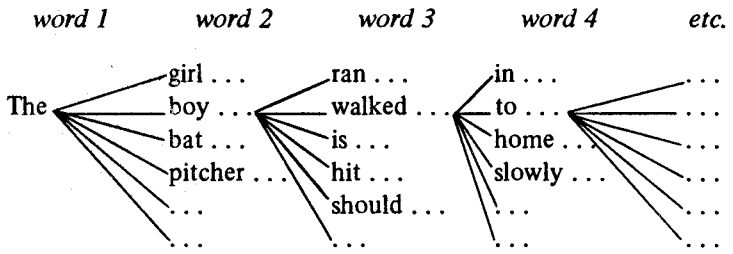
Learning Theories

Learning theories of language acquisition range from simplistic to complex and have a lengthy history of development. They arose from the great need for psychology to extract itself from "mentalistic" reasoning and to evade the necessity for introspection in which much of human behavioral research was entrenched until the turn of the twentieth century. In order to implement this change, many psychologists postulated that behavioral processes should be studied in organisms less complex than man, that is, in animals. Since the origin of the empirical era in psychology, some of the extreme reaction against mentalism has changed, but present-day learning theories still tend to reflect this posture of antimentalism. In this section, we will examine learning theories in order of increasing complexity of the major stimulus-response mechanisms held as responsible for first language learning. This order of classifications does not necessarily reflect upon the quality of the explanations used to substantiate a particular model, or its ability to account for known linguistic "facts."

Markov Processes The simplest of the learning theories, and perhaps potentially the most appealing to many psychologists (as it comes closest to molding information theory[9] with behavior theory), is one which holds that any word in an utterance is dependent upon and determined by those words which have preceded it.[10] This model is derived from the area of *Markov processes.* The process consists of the occurrence of left-to-right *chaining* of words through conditioned S-R connections. Each word has a simple, theoretically determinable, probability of occurrence based on the strength of previous associations (habit formation) between any one word and those words preceding it. Thus, based on previous experience, any word has a certain probability for eliciting future words. The following model is an example of a possible set of words elicited by preceding words:

[9] Information theory discusses transfer of information by means of reducing uncertainty (probability) through binary sampling techniques.

[10] The learning theories presented in this chapter are examples of behavior theories.



Thus, the sentence "The boy walked to . . ." could be generated in the manner illustrated above. In this model, there is no *plan* by which words might occur in the future (it is a nonariticipatory grammar), only probabilities of future developments. This structure has been demonstrated to be an insufficient model of language behavior and of syntactic acquisition on several grounds (see Miller et al., 1966). For example, the left-to-right generator only has the "grammatical" rule that once a word (or group of words) is produced, the next word(s) is chosen from a set of probabilistically related words. Chomsky (1957) has shown that English sentences are not generated through serial dependencies, but through nested dependencies (for example, think of the sentence *The dog the boy saw bit the mailman.*). This "fact" eliminates Markov processes from serious consideration as an explanation of syntactic development. Further, since both the lexicon and syntax arise only through previous experience, a speaker (or listener) would obviously have to hear *each* variation of word combinations at least once to establish sufficient contingencies to enable him to speak the potentially unlimited set of sentences he has been shown to be capable of producing. Miller et al. (1966) have shown that it would take over 100 years of continuous listening to be exposed just once to all the word combinations necessary for a man to produce all variations of sentences up to 20 words in length. Finally, the Markov process would generate many drastically ungrammatical utterances, a fact which does not occur in reality, and for which the Markov model provides no controls.

It has been noted, however, that, in contrast to the transformational model, the Markov model does provide a potentially useful theory of decision making processes for language. As will be discussed later, the transformational model only explains decisions in terms of selecting "optional" transformations, a basically mentalistic concept which imparts no predictive information.

Operant Conditioning Skinner (1957) discusses language acquisition in terms of extensions of the principles of instrumental (operant) conditioning which he and others

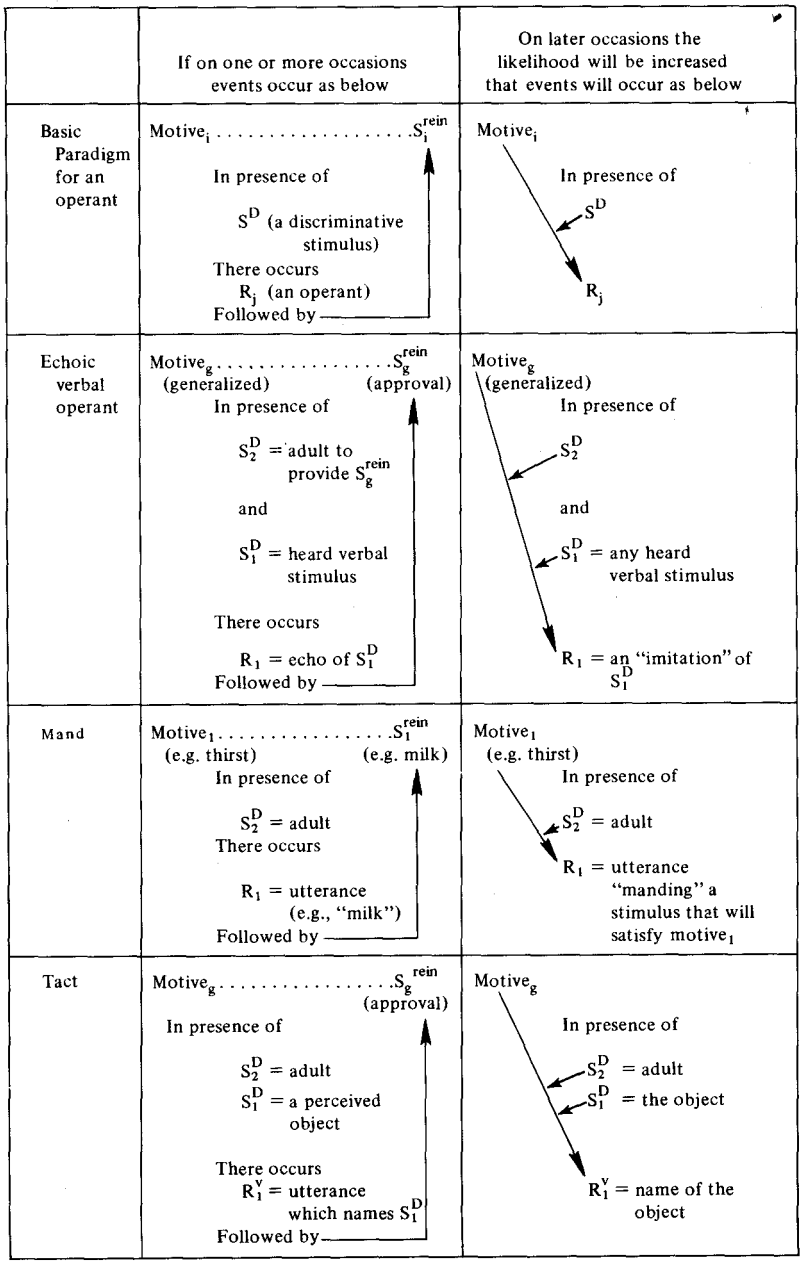


Figure 4. Operant paradigms for the learning and maintenance of verbal responses. Source: J. Carroll. Language and Thought, © 1964. By permission of Prentice-Hall, Inc., Englewood Cliffs, N. J.

developed through laboratory research with animals. Operant conditioning consists of a model wherein responses are first emitted and then rewarded. This reinforcement contingency assures further occurrence of the rewarded response. The emitted response, for which there is no observable stimulus, is termed an *operant*. Skinner classifies verbal operants into different functional categories.

A wand is a verbal operant wherein the response is reinforced by a characteristic consequence and is therefore under the control of relevant conditions of deprivation or aversive stimuli. Mands include such utterances as commands and questions. *A tact* is a verbal operant wherein the response is evoked (or at least strengthened) by a particular object (or part of an object). In other words, this response is under stimulus control. A tact is the response a child might emit when he sees an object, say a dog, in his room. *Echoic* operants are those wherein the response is under the control of prior verbal stimuli. Thus an echoic operant is a response which generates a sound pattern similar to that of a prior stimulus. In essence, this accounts for the occurrence of imitation. Each of the above points is shown schematically in Fig. 4. In addition to these operants, Skinner reports

1. *Textual* operants, which are verbal responses to a written stimulus (e.g., reading).
2. *Intraverbal* operants, which are verbal responses to verbal stimuli (e.g., the response "four" in answer to the verbal stimulus "two plus two").
3. *Autoclitic* operants, which are highly complex manipulations of verbal "thinking" which include assertions and various sentence structures.

Operants are subject to processes and manipulations such as response shaping (a change in behavior caused through selective reinforcement), stimulus discrimination ("shaping" of a response so that it is only emitted in the presence of a particular stimulus), secondary reinforcement (reinforcement by association of a stimulus, perhaps a word, with an already reinforcing stimulus, e.g., food), and response strength (the probability of emission of a response).

The basis of Skinner's approach to language acquisition is contiguity between response and reward (reinforcing stimulus). Laws of operant behavior stress that the strength of an operant is increased if the operant is followed by a reinforcing stimulus and, if not, it decreases. The frequency of response-reward pairing determines the magnitude of its probability of occurrence in the future. Thus, Skinner's system, in many ways like a Markov process, specifies the verbal unit with greatest response strength in a particular situation. In this system, lexical and phonological acquisition are presumed to result from verbal (or physical) rewarding of the child for saying a word-like sound(s). Rewarding, again, gives the word a certain probability of future occurrence. Mass undifferentiated verbal responses of a child are basically seen as being shaped by appropriate stimulus reinforcment.

Operant principles can account for the development of syntax through the use of "chaining" of operants, where each operant is induced by its own specific cue. These cues may be inherent in previously spoken words. In effect, succeeding words are emitted in the form of discriminate operants which have been rewarded in the presence of these stimulus situations. The hypothesis is enhanced by the argument that when an operant

has been conditioned in one stimulus situation, it may occur, without further conditioning, in another stimulus condition by the process of generalization. Generalization may presumably occur with sentences as well as with words.

Chomsky (1967), in his review of *Verbal Behavior* (Skinner, 1957), criticize& Skinner on many levels, both specific and general. He asserted, for example, that verbalizations cannot be adequately discussed in terms of response strength as Skinner described it. Skinner's response strength was defined as "probability of emission" and was determined primarily by frequency of occurrence of the R-S association. Chomsky noted, however, that response frequency is directly attributable to the frequency of occurrence of the controlling variables and, thus, there is no "probability" involved in response strength- rather, each response is uniquely determined by occurrence of variables. In short, Chomsky argues that the term "response strength" is merely used to give the appearance of objectivity to Skinner's theory. Fodor (1965) discusses the operant principles and points out pitfalls as related to language. He asserts, for instance, that according to R-S theory there is a nonverbal response, R, such that presentation of X (a physical item) increases the probability of R and the probability of the utterance of a word, W (standing for physical object). There are no data, however, to indicate that the name of an object which is present in the room where a person is speaking will be spoken with any greater frequency than the name of an object not present. Fodor also notes that one cannot know whether any two behavioral acts are part of the same response or not because there is no way of determining if two verbal utterances are functionally equivalent. Chomsky summarizes his criticism of Skinner by stating that the operant model has yet to explain the fact that all normal children acquire essentially comparable complex grammars in a very short period of time and that the operant model does not adequately account for novel utterances. Further, the model fails to account for the acquisition of comprehension of syntax.

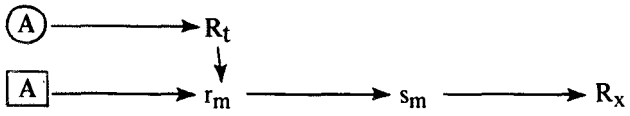
Mediation The apparent insufficiency of a single stage S-R theory has led theorists to attempt to adapt two-stage learning models, as suggested by the research of Hull (1943), to the topic of first language acquisition. The result is the *mediation* model.

A major proponent of Hullian theory as applied to language is Osgood (1967). He has proposed and defended both two- and three-stage mediation to explain language acquisition. Expansion of the two-stage model to a three-stage model was done to accommodate perceptual and motor behavior. The three-stage model is based, however, on the two-stage model and for this reason, and the reason that it must face most of the basic objectives a two-stage model faces, only a discussion of a two-stage model will follow. The basic two-stage model involves the following:

1. [A] –an originally neutral stimulus (sign).
2. (A) –another stimulus which will occur contiguously with [A] and which regularly elicits R_t (significate).
3. R_t –a total response which is elicited regularly by (A).
4. r_m –some portion of the total response, R_t, which will become associated with [A] (r_m is the mediating response).
5. s_m–a mediation stimulus which can become associated selectively (under self-control) with various instrumental acts.

6. R_X-instrumental acts with which s_m becomes associated.

The entire mediation process can be diagrammed as



The overall process is one similar to single-stage conditioning, the difference being that the mediating reaction to the sign, A , is not identified with the reaction of the significate to the total response, Rt, but rather consists of the conditioning of the most effortless and least interfering components of the total reaction, Rt. Thus, the mediating response is a part of the total response. The self-stimulation. s,. then becomes associated with various instrumental acts, R_X, which are theoretically relevant to the signitl-cate, A .

In reality, mediation theory is a combination of two single-stage S-R models; "s_m" is seen as self-stimulation, and "r_m" may be part of. the total response. Any sign, A , conditioned contiguously with an object may come to trigger a reaction (the mediating response, r_m) which then leads to a linguistic response through self-stimulation. Thus, the presence of a cow (Q) might come to elicit a response of "desire for milk" (r_m) similar to the total response (Rt) which occurs in the presence of milk (AO). The s,, related to the r_m, may then elicit a reaction, R, such as the linguistic utterance "milk." The sign, ®, may also be a verbal unit.

Obviously, the explanatory power of the mediation model appears to be much increased over that of the single-stage model. Specifically, the model can account for the production of an appropriate linguistic response in the absence of an overt stimulus. This process is particularly useful in accounting for the acquisition of "word meaning."

Criticism of mediation models has dealt primarily with specifiable behaviors for which mediation theory appears unable to account. Fodor (1965) has posed the most direct threat to mediation theory by showing that a distinct mediator (r_m) must be postulated for each distinct total response (Rt). This assertion appears logically correct; otherwise there is no method for determining which Rt is being anticipated by a particular r_m. If true, the significate (OA) is only redundant information, as the total response (R_t) is unequivocally specified. With the Rt and r_m in apparent one-to-one correspondence, the only difference between single-stage and mediation theory is that some members of the S-R chain in mediation are unobserved. [Osgood (1966) has countered this argument by asserting that the difference in observability is important because it accounts for the fact that conditioned responses have been shown to transfer across words of similar content with no observable r_m.] Thus, there appears to be essentially no difference between single-stage and mediation theories. Fodor (1965) further states that mediation theory is insufficient in that the components of the R_t most likely to become the r_m are the broad but distinctive overt responses common to all mankind. Thus, it would appear impossible to determine a one-to-one correspondence

between each R_t and r_m, a fact violating a necessary law of the theory just discussed. [Osgood (1966), however, sees the r_m as multicomponential (a number of patterns linked into a code) where only one feature difference in the code is necessary to differentiate it from other r_m's. This argument, however, still must concede a one-to-one correspondence such as Fodor (1965) has suggested.]

Other authors have also cited behaviors which the mediation model does not explain. In general, they are topics which single-stage theories also fail to handle, e.g., comprehension, novel utterances, and the development of grammatically complex sentences.

Imitation (autism) Model Mowrer (1954, 1966) presents an S-R theory of language acquisition based on imitation and derived from behavior observed in animals. The theory, based on behavior of so-called "talking birds," postulates the following learning procedure. First, in order for a sound to be learned for production, the sound has to be repeatedly produced in an agreeable, pleasant context (such as linking it with a food reward). When this situation occurs, the bird, during babble play, will make sounds similar to the word and hear himself saying it. Imitation then takes on secondary reinforcement properties, and, more important, the reinforcer is "built in" to the bird itself. The secondary reinforcement (originally conditioned to the words the trainer utters) generalizes to the word stimuli the bird utters. The better the imitation of the trainer's words, the stronger the reinforcement and consequent continuation of the behavior. If one replaced "bird" with "child" and "trainer" with "parent" in the above discussion, the reward contingencies can be seen which, by Mowrer's reasoning, account for language acquisition. (For Mowrer, words acquire *meaning* by second-order conditioning. In first-order conditioning some part of the total reaction gets shifted to the word, and in second-order conditioning this same part of the reaction gets shifted to another word in context with the first conditioned response.) Generally, Mowrer feels that through reinforced practice, muscular and neural patterns are established and, later, the motion of saying words triggers self-satisfying reinforcement. It is for this latter reason that the theory may be termed *autistic*. Mowrer further states that for learning to take place the child does not even have to be reinforced for producing the words-though he may be-since secondary reinforcement only requires a pattern of stimulation occurring contiguously with a primary reinforcer.

While imitation models are open to many levels of criticism, the most obvious and important is that the models by themselves provide no means of accounting for comprehension and novel utterances. A sentence may be imitated orally but, obviously, comprehension cannot be imitated. Further, children's spontaneous productions cannot be explained by an imitation model, since children's utterances have been shown not to be precise replications of adult sentences.

Contextual Generalization Braine (1963, 1965) has explored contextual generalization as an explanation of the acquisition of grammatical structure. The basic premise of this theory is that when a segment of a sentence has been experienced in a certain position and context, it will later be planed in the same position in other contexts on the basis of S-R generalization (where the mediating property is the temporal location of an utterance). The theory grew out of the recognition that while mediational properties in

S-R generalization are usually *intrinsic,* this occurrence is not mandatory. [Miller (1951) described *extrinsic* properties of contextual constraint as appearing in controlled word-association tests.] Braine (1963) sees the 2-year-old as using two sets of cues to define borders which indicate segment or phrase position in language. One set is intonation patterns (pitch, stress, juncture, etc.). The second is "closed-class" morphemes (articles, prepositions, etc.). For example, in a sentence such as *The boy rides his bike,* presumably two things occur in the listener who recognizes the fact that the subject or noun phrase frequently comes first in a sentence and the verb phrase follows it. The closed-class morpheme *The* and the intonational stress on the verb serve to indicate the boundaries of the noun phrase, while the verb stress and intonational pattern indicating the end of the sentence provide cues for discrimination of the verb phrase. With larger or more complicated sentences a process of binary fractionation may occur. That is, a child may learn the location of a unit within the next larger containing unit of a hierarchy of units. For example, a child may learn that within a verb phrase. the verb and its modifiers frequently occur first, followed by the object and its modifiers. Such a hierarchy of positions is learned for each of the transformations. (Braine sees each transformation as having fairly standard word order, and claims that simple declarative sentences are the "kernels" of Chomsky's 1957 grammar.)

Bever et al. (1965), in a critique of Braine's position, have argued the following major points:

1. A theory of syntax should explain the fact that no one language appears harder to learn than any other language. Russian and German, for 'example, appear no harder to learn than English, yet because they have less constrained surface ordering of words, the contextual generalization model would suggest they are harder to learn.

2. Braine's (1965) use of suprasegmental cues as a delineating factor for position boundaries of phrases fails to account for the extreme problems in learning that should occur from listening to everyday, nonfluent speech with its accidental acoustic gaps and incorrect stress.

3. Simple declarative sentences are not the underlying form in the production of sentences. Rather, a generative grammar produces only abstract structures (basic grammatical relations of the deep structure), which are then transformed into sentence types. Thus, in failing to distinguish between surface and underlying structure, Bever et al. (1965) feel that Braine loses the mechanism accounting for rapid acquisition of comprehension and for easy transformation of one structure to another. [Braine (1965), in replying to this last argument of Bever, Fodor, and Weksel, asserts that the looseness of transformational rules and their consequent lack of empirical validity prevent him from accepting the "necessary properties" of natural language that transformational grammars demand.]

Integrated Theories of Learning As the traditional learning models have failed to explain all aspects of language acquisition, several theorists, notably Staats (1968) and Jenkins and Palermo (1964), have felt that an integration of many of the learning principles is necessary. In these cases the authors have not attempted to postulate a total theory of verbal behavior but, rather, have been content to describe which learning principles work best for various aspects of language behavior. In general, researchers and

reviewers (see Kagan, 1964) have found fault with these positions much as they did with individual learning positions-on the basis of insufficiencies. For example, adequate use has not been made of known features of verbal behavior (such as loudness contours) and, further, there has been no reasonable explanation of comprehension behavior or of *grammatical novel* sentence production.

It shoud be noted in concluding a discussion of learning theories that recent learning theories have expressed disapproval with the "mentalistic" proposals of generative grammarians concerning language acquisition and behavior. Staats, for one, makes the point that linguistic theory cannot make explanatory statements, as it does not have sufficient contact with data on the conditions which determine behavior. For example, the linguistic assumption that there are cognitive structures corresponding to phrase-structure rules is weak, as it can only be validated through bioneurological observations which, presently, do not exist. Staats (1968) also provides one of the few learning arguments which account for the fact of language universals. (Nativists use these universals as a foundation for their arguments against learning theory, as well as for the existence of innate structures) Staats states that languages, after all, should have commonalities in that they have evolved to relate to essentially the same world of events, a world common to all men. [Some scholars (see Whorf, 1956) have argued, however, that different cultures view reality differently.]

Nativist Theory

In general, nativist theories of language acquisition hold that language maturation must be explained in terms of certain innate properties of the human organism, not on the basis of experience and learning.

Chomsky (1965, 1967) asserts that the induction learning paradigms advanced by empirical psychologists are insufficient for producing grammars within the constraints of time, access, and uniformity which data have shown to exist. Instead, he holds that a rationalist approach, i.e., one which assumes an innate system capable of handling language, is more tenable. A major problem with this assumption is found in developing an hypothesis about acquired structure that is able to account for both the universals and diversities of language. Chomsky's basic hypothesis is that children have no more control over the processes governing the development of linguistic rules for generating sentences than they have for, say, their visual perception. As stated earlier, Chomsky (1965) and Katz (1966) have assumed the existence of a Language Acquisition Device (LAD) as one component of a total system of intellectual structures. LAD is presumed to have various formal universals as its intrinsic properties. These universals provide a schema that is applied to data so as to determine, in a highly restricted way, the general form and feature of the grammar that emerges upon presentation of language samples from the environment. Obviously, the grammar can change over time since the child continues to receive new linguistic data.

Lenneberg (1964), using some data from Greenberg (1966), has listed many traits of language which, to him, totally and sufficiently categorize language as being a species-specific trait, based on a number of biologically given and genetically transmitted mechanisms.

To support this claim, Lenneberg cites the following facts:

1. The onset and development of speech in the child is a regular, fixed sequence (McCarthy, 1954).

2. All languages of the world seem to conform to a set of universal semantic, syntactic, and phonological features.

3. Any child is capable, at birth, of acquiring any language in the world.

4. Man has anatomic and physiologic correlates with language activities, e.g., cerebral dominance and coordination centers for motor speech.

5. Propensity for language is a specific and genetically founded capacity, as demonstrated by the fact that language acquisition is independent (beyond minimal levels) of what is currently labeled intelligence.

McNeill (1966a, 1966b, 1968) also argues that the child must bring both formal and substantive linguistic universals to the language acquisition situation.[11] As stated earlier, these universals are representations of basic grammatical relations and of hierarchical classification systems. McNeill advances this hypothesis on the basis of the apparent fact that one must know the deep structure of a sentence in order to comprehend its meaning. Surface structure alone will not supply the referents necessary for comprehension. For example, in the constructions *John is easy to please, John is eager to please,* meaning is only *easily* determined, by reference to the deep structure of these similar surface constructions. Occurrence of contextual generalization or S-R habit formations would cause difficulty in distinguishing that *John is* an object in the first sentence, while *John is* the subject of the second sentence. Thus, for McNeill, a theory of language acquisition must explain development of deep structures and the transformational rules which transform them into more complex surface structures. He also postulates that a comprehensive theory of language acquisition must account for both comprehension and production. For these reasons, McNeill also uses Chomsky's LAD in his theory of acquisition. According to McNeill, the universals of LAD are such that verbal behavior is comprehended or generated at the deep-structure level according to one of the six basic universal grammatical relations discussed earlier (see page 43). What is then *"learned"* by the child are the basic transformations needed to produce grammatical sentences. This process occurs presumably as a result of LAD taking a corpus of utterances and creating a grammatical system (the transformations) according to the innate universals it already has.

McNeill's assumptions permit prediction of what will constitute a future grammatical utterance (verbal behavior). Further, it accounts for the fact that (1) the child's acquisition is rapid and regular, and (2) language performance is realized as both comprehension and production.

[11] McNeill makes this argument on the basis of claims advanced by Chomsky (1965). Chomsky defines substantive universals as the fixed linguistic classes from which all items of a particular language must be drawn. For example, all languages select phonemes from a small set of fixed, universal phonetic features. Formal universals are certain abstract features (i.e., they do not exist in an empirical sense) which presumably characterize all language systems. For example, the syntactic component of all grammar must contain certain transformational rules which translate semantically interpreted deep structures into phonologically interpreted surface structures.

While expressing an interest in McNeill's assertions, Fraser (1966) feels that they fail to account for some important aspects of verbal behavior, the role of primary and secondary reinforcement. In making this case, Fraser cites the work of a Japanese linguist on the speech of a Japanese child. He found the child began to speak not as a result of hearing normal adult conversation, but by imitating words and short utterances produced clearly by adults. (The child failed to learn Tata, a rapid conversation language used by the mother, but acquired the type of "Japanese" that was explicitly and clearly presented.)

Even if innate structures account for the facts of syntactic development, the mechanisms by which this occurs must be spec ied. Lenneberg (1964) has even argued that innate models of language acquisition must include specific anatomical and physiological correlates for language. To date, little progress has been made in discovering such correlates.

Fodor (1966) also believes that the child is born with an innate propensity for learning specific principles and with some intrinsic structure for language. He views the child as receiving an enormous sample of grammatical and ungrammatical utterances from his environment from which he must induce and extrapolate the correct subset which constitutes grammaticalness. In other words, the child must *induce* deep structures for various sentence types. Fodor has shown this concept to be necessary for a theory of language acquisition inasmuch as there is no way to learn *simple* rules or S-R contingencies for transforming, for example, an active sentence to a passive sentence. Fodor argues that the only way to resolve the apparent conflict between the relatively easy *act* of transforming such a sentence and the theoretically large number of rules S-R theory requires to perform such a transformation is to postulate an underlying deep structure from which these sentence types are specified. However, the child never actually hears deep structures. If this hypothesis is true, learning theories for the acquisition of syntax are rendered useless. Fodor posits that the child innately has the rules to assure that (1) only a small number of possible analyses is performed on a corpus of data (to fit with time considerations) and (2) the correct analysis is *among these*. Thus, the child is thought to have many rules for analyzing surface structures and changing them to their corresponding deep structure. With them, the child is able to select syntactic descriptions which maximize the probability of determining the underlying and derived structural relationship.

Thus, Fodor's "innate mechanism" is in the form of *specific inference rules* that work in specific cases, rather than a list of total solutions to all language data. In this sense, Fodor is a part of the final group of first-language acquisition theorists who will be discussed-the mixturists.

Mixture Theories

Recently, various authors have attempted to bridge the gaps between the nativist and learning viewpoints. DeCecco (1967, p. 309), for instance, states:

> If Chomsky and Skinner could accept the *cue function* of words as external stimuli that mediate internal processes, and if they could accept the possibility of behavior chains capable of both horizontal and vertical arrangements, their positions would not be as opposed as they now seem to be.

Fodor et al. (1967, p. 198) feel that

> . . . the question about innateness is sometimes raised not in terms of the evidence for or against some particular theory about what is innate, but rather in terms of whether anything need be innately contributed at all. The answer to this question must be obvious. Any organism that generalized its experiences at all must, on pain of infinite regress, have some unlearned principles for extrapolation. The dispute between associative theories of language learning and the kinds of theories we have been discussing [nativist] is not over whether there are some innate principles, it is only over the content and complexity of the innate endowment." [12]

Slobin (1966), in commenting on McNeill's position, agrees that a LAD is necessary for a viable approach to language acquisition. However, he prefers a "process approach" (i.e., whereby generalized cognitive processes induce language universals) to LAD, while McNeill prefers a "control approach" (i.e., where universal characteristics of language are part of the innate structure). Slobin feels further that McNeill's idea of giving the child credit for having all the rules with which it is necessary to process language has flaws shown by empirical behavioral data. For instance, McNeill's work suggests that the child would innately have an *entire* hierarchy of adult word classes, whereas evidence from Miller and Ervin (1964) indicated otherwise (in that subjects placed adjectives in *both* their pivot and open classes). A control approach to LAD would account for this data discrepancy, since the structure would consist of a set of procedures and inference rules used to process data. Thus, there would be progressive definement of word classes as the inference rules had an increasingly larger corpus of data on which to work. The use of these innate rules on the corpus of linguistic data presented the child could develop the linguistic universal-as well as produce an appropriate grammar. Slobin postulates that the semantic nature of words and word classes would then specify the hierarchy of word classes which McNeill posits as innate. For instance, if the inductive rules develop a sense of the universal class of nouns, the semantic nature of the nouns would, by these same processes, subdivide into animate-inanimate, masculine-feminine-neuter, and so forth. Slobin suggests that learnable semantic features develop the underlying grammatical categories which the innate LAD inferred, and thus Slobin bridges the gap of nativist and learning theorist.

[12] From Fodor, J., J. Jenkins, and S. Saporta. Psycholinguistics and Communication Theory. In Dance (ed.), Human Communication Theory, (C) 1967, by permission of Holt, Rinehart and Winston, Inc.

Some Closing Remarks

Analysis of the above theories shows many favorable and unfavorable features. The major criticism of learning theories of language acquisition is that they do not explain the child's potential for generating and comprehending an enormous number of novel grammatical sentences. Further, learning theories do not satisfactorily explain language universals. Learning theories rarely, if ever, deal with the fact that comprehension of linguistic units seems to be acquired before production, or why items which,have been comprehended are not immediately producible. The only way in which comprehension might be handled appears to be through assertion of an innate (unlearned) mechanism for decoding and manipulating verbal output. On the other hand, learning theories appear adequate for describing acquisiton of meaning for words, short phrases, and phonological rules.

Nativist theories tend to suffer from a lack of specificity in their explanations. In their most extreme form, they fail to explain the occurrence of certain overt linguistic phenomena (e.g., imitation). To claim that phenomena such as these are unimportant is purely judgmental and denies explanations of many features of linguistic performance. Nativists are also in the precarious position of losing explanatory power by positing too much as innate. Without neurologically supportive data, they are in the position of having all their arguments dismissed as being good imagination or sophisticated opinions. Obviously, more developmental neurolinguistic data are needed of the type being generated by Bever and associates in New York (1970).

For these, and other reasons it seems most profitable to consider the case presented in a mixture point of view. Here the universals of language are accounted for by means of innate mechanisms and the principles of S-R conditioning, with all its varieties, are seen as aiding in the child's acquisition of an intricate language system. In this regard, Slobin's ideas appear to be quite reasonable and exciting. Positing a general organization of the mind which allows for inductive reasoning, and which can be applied specifically to language (among other things), appears to be the most parsimonious organization of such a varied, all-pervading, integrated organ as the human brain.

CONCLUSION

The goals of linguistic, psycholinguistic, and sociolinguistic approaches to the study of first language acquisition have not been oriented toward the language pathologist. In general, the goals, which were discussed in the introduction to this chapter, have been to develop theories of language and language use. If the data are to assume relevance for language pathologists, they themselves must determine the implications. In so doing, language pathologists can possibly make contributions to the understanding of human language systems. The present authors believe that data and theories on language maturation have important implications for the study, diagnosis, 'and management of language disorders in a number of areas.

First, utilization of language acquisition data should improve the validity of norms used to determine the presence or absence of language pathology. Present information on acquisition suggests that norms must be established for both comprehension and production of language at increasing levels of phonological, lexical, and syntactic complexity within, the context of the various linguistic communities of the United States. This point cannot be overemphasized since application of a single set of normative data to all speakers, irrespective of their dialectic communities, may result in erroneous judgments of language pathology when, in reality, only legitimate differences exist.

Second, normative data on language acquisition should be used by language pathologists to develop valid and dialectically unbiased test instruments to assess the aspects of language discussed above.

Further, application of these tests to nonstandard speakers is likely to yield invalid judgments about their true linguistic competence (see Gerber and Hertel, 1969). Resolution of this problem is not to be found by simply translating existing tests into the various dialects of American English. Legitimate answers can only be secured by developing tests based on normative language and cognitive information secured from speakers of the linguistic communities for which the tests are intended.

Third, language acquisition data and theory, together with normative data and valid tests, can be used to determine the characteristics of various types of language disorders. This information can be helpful in the diagnosis, prognosis, and management of language disorders.

Finally, innovative approaches to language therapy might ensue from application of language acquisition data and theory. In general, therapy should probably focus, depending on degree of neurological and linguistic integrity, on the following items, in the order presented: (1) memory/perceptual/motor systems, (2) comprehension, and (3) production. Function in these levels should progress through increasingly complex control of phonology, lexicon, and syntax. It is logical to argue that teaching of these features in therapy situations should occur in an integrated way: the teaching of phonology and vocabulary in the context of increasingly complex grammatical units.

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