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Basic Syntactic Processes

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MacWhinney (1978) presented a computational model of the acquisition of morphophonology. The present chapter attempts to extend the model presented in that earlier paper to the acquisition of word-order patterns. This extension is supported by an examination of the previous research on syntactic acquisition. In the final section of the chapter, further possible extensions to phonology and semantics are considered.

The crucial claim underlying the basic approach to both morphophonology and syntax is that use of a given rule system is governed by a system of alternative strategies. Within such a multileveled model, alternative strategies can be compared in terms of their relative complexity. In the present chapter, these alternative strategies are evaluated through application of the following analytic technique:

1. A relatively simple strategy that can account for at least some of the observed data is presented.

2. It is shown that there are at least some data that are best explained by this strategy.

3. It is shown that, at some point in development, the child produces forms that cannot be explained by this simple strategy alone.

4. A strategy of somewhat greater complexity and power is introduced and it is shown that this strategy can account for at least some of the data not explained by the simpler (and weaker) strategy.

This line of argumentation proceeds until evidence has been presented for six alternative strategies in word-order processing.

The six strategies examined are: (1) rote; (2) analogy; (3) predispositions; (4) bound patterns; (5) free patterns; and (6) class-bound patterns. The last four strategies constitute four levels of the general strategy of combination. Thus, the three basic strategies considered are: rote, analogy, and combination. These are the same three strategies proposed by MacWhinney (1978) for morphophonological processing. Moreover, as we see in this chapter, the four strategies within combination correspond to the four strategies for morphophonological combination suggested by MacWhinney (1978). In accord with this division of syntactic processing into strategy types, the chapter has the following organization. The first three sections examine the strategies of rote, analogy, and combination. Within the four subsections of the third section, the four types of combinatorial strategies are discussed. Then, the fourth and final section compares the results of the analysis of word-order mechanisms with the analysis of the morphophonological system proposed by MacWhinney (1978). In that section, it is shown how the six ways of governing word order stand in a one-to-one relation with the six ways of controlling morphophonological alterations noted in MacWhinney (1978).

ROTE

The first of the three processing mechanisms proposed by MacWhinney (1978) is *rote*. The simplest way of controlling the order of a string of words is to memorize the string as a single rote unit. In word learning, it is generally the case that the articulatory gestures constituting the word are learned as a fixed rote string. This is because, in the word, articulatory gestures occur in sequence, and their order is fully specified. The word is, in effect, a finite state process in which all states have one entry and one exit. The initial state enters from the higherlevel program and the final state returns control to the higher-level program.

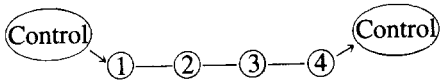

FIG. 3.1.

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This definition of rote in terms of unitization (Hayes-Roth, 1977) is deceptively simple. In practice, it is useful to clarify this definition in five additional ways. First, it is important to relate the notion of rote to the notion of structural levels. For an item to be learned by rote, all that is necessary is that it not be analyzed on the next lower structural level. Thus, if a word is not analyzed into its morphs, it functions as a rote item on the morphophonological level. If a word is not analyzed into its lexes (meaning components), it functions as a rote item on the level of lexical analysis (MacWhinney, in press (a)). And, if a phrase is not analyzed into its component words, it functions as a rote item on the syntactic level. It is also possible that an item could remain unanalyzed for several structural levels down. For example, in the extreme case, a Fulani who speaks no Arabic could still memorize large sections of the Koran as single articulatory gestures.

Second, it must be recognized that items whose pieces are ordered by rote may still be susceptible to occasional errors in linear order. Thus, ShattuckHufnagel (1979) argues that the order of phonemes within a word must be actively controlled during speech production. However, it is possible for the production mechanism to generate errors in segment order such as psghetti for spaghetti even though the basic order of the segments in morphemes is controlled by rote. A similar argument applies on the syntactic level. Thus, having learned a string of words as an unanalyzed item, a speaker could still make an occasional production error in ordering the phonological pieces of that item. This suggests that rote memorization of a string actually involves two types of knowledge. The first is a coding of the presence of an element that occurs in a string and the second is a coding of the position of that element in relation to the other elements in the string.

A third qualification on rote is that a rote item may be analyzed semantically before it is analyzed morphologically. For example, as R. Brown (1973) and MacWhinney (1975b) have noted, a child may know that shoes refers to a plural although he or she does not know which piece of shoes encodes plurality. In such cases, the item still functions as a rote unit on the morphological level. Eventually, semantic analysis serves as a stimulus to morphological analysis (MacWhinney, 1978).

A fourth qualification on rote is that it is important not to confuse rote memorization with imitation. "Imitation" is a general mode of linguistic processing much like expression, reception, or play. "Rote," on the other hand, is being used here to refer to a strategy in string formation. Thus, imitation contrasts with expression, reception, and play, whereas rote contrasts with analogy and combination. Of course, the identification of rote with imitation espoused by some writers (R. Clark, 1977; Skinner, 1957 is not entirely without basis. It is certainly true that rote implies imitation, because all strings that are produced by rote can ultimately be viewed as deferred imitations. However, it is not true that imitation necessarily implies rote, because material can be imitated and not learned. In any case, the main point is that if we believe that a string has been learned by rote, we should be able to specify some actual input of which it could conceivable be an imitation. For example, the string allgone sticky could conceivably be derived from the child's (deferred) imitation of the sentence say 'all-gone' to the sticky stuff. Note that the reduction of the larger sentence to allgone sticky is based only on intonational prominence (du Preez, 1974) and not on grammatical processing (Slobin & Welsh, 1973). Such examples indicate that it will be exceedingly difficult in a given case to prove that a string of real words was not produced by rote.

Fifth, it is important to remember that rote can function in either short-term or long-term memory (Atkinson & Shiffrin, 1968). Unanalyzed items in short-term memory may also become unanalyzed lexical items in long-term memory. However, it may also happen that short-term rote items are not entered into long-term memory. In the next two sections, we examine evidence for the use of rote in both types of memory. We begin with a consideration of rote items in the long-term or lexical store.

Evidence for Long-Term Syntactic Rote

When a series of words functions as a single word, then we can say that it has been learned by rote. Such rote strings would be, in effect, single lexical items. If all syntactic productions were controlled in this way, then there would be no syntax, and syntax would, in effect, be replaced by the lexicon. This would amount to an extremely simple and parsimonious account of word order. Therefore, following the logic presented in the introduction to this chapter, we consider how far one can push an account of word order based on rote.

Researchers have offered 14 different arguments in support of the analysis of certain word strings as rote items. These 14 arguments are based on the use of three types of evidence: (1) evidence relating to the form of the interaction during which the item was presumably acquired; (2) evidence on the sequence in which forms emerge in production; and (3) evidence on the structure of forms in production. In a given case, any number of these arguments may or may not apply, and some of the arguments are inherently stronger than others. However, even when none of the 14 arguments apply, we cannot be sure that a word string is not being used as an unanalyzed whole. Thus, the l4 arguments tell us when rote should be suspected. They tell us nothing about when to reject a rote analysis of a given word string. It is also important to note that the 14 lines of evidence bear only on the issue of the use of rote in production. At present, the issue of the use of rote in comprehension by children is essentially unexplored.

Intonation as Evidence for Rote

Of the 14 lines of evidence that have been offered to support role analyses, four are based on aspects of the input. The first of these is one offered by Brown, Cazden, and Bellugi (1968, p. 51) to support a rote analysis for I'm, that-a, drop-it, put-it, get-it, want-to, have-to, going-to, another-one, what- that and let-me. Brown et al. argue that, because the source of these items was a single intonational unit, they may have been acquired as wholes. A similar argument is offered by MacWhinney (1978). The assumption in both cases is that the intonational unit represents a perceptual unit or package and that it is often easiest to pick up this package as a whole. Experimental support for this hypothesis has been provided by du Preez (1974). Although the exact shape of the process that MacWhinney (1978) calls "intonational packaging" remains to be specified, some further data constraining this specification can be found in MacWhinney (in press (a)) and Peters (1980).

Incorrect Imitation as Evidence for Rote

The second line of evidence in support of a rote analysis has been suggested by R. Brown (1973, p. 99), and R. Clark (1977, pp. 344,349). This line of argumentation can best be illustrated by an example. R. Clark (1977, p. 349) found that her son used intit to refer to an elephant. Evidently, this was an imitation of the last part of the sentence that's an elephant, isn't it? Similarly, R. Brown (1973, p. 99) reports that the child's item put b'long from the adult sentence put it where it belongs was used in a "noncomprehending way."

Rituals as Evidence for Rote

A third type of evidence for rote has been offered by a variety of writers over the years (R. Brown, 1973, p. 99; R. Clark, 1974, p. 4,6; R. Clark, 1977, p. 350; Fillmore, 1979; Gruber, 1973, p. 442; Kenyeres, 1938; Leopold, 1949b, p. 56; Nelson, 1973, p. 25; Peters, 1977, pp. 564, 566). According to this analysis, word strings that are used as parts of stereotyped rituals or games are probably rote items. For example, off with shirt was one of my son Ross's phrases during his bathing ritual. Because of its frequent repetition in a constant context, it appeared to be a single item. However, this analysis is supported largely by an impressionistic judgment. Although the relation between ritual and rote is undoubtedly of great importance (Fillmore, 1979; Ratner & Bruner, 1978), it would be a mistake to consider ritual as a sufficient condition for rote. Certainly, adults participate in a wide variety of social rituals. However, this is not usually taken as prima facie evidence for a rote characterization of adult speech.

Prizant (1978, pp. 39-42, 90-92) reports a number of rote-memorized ritual oriented statements from the speech of 5- and 6-year-old autistic children. These rote items differ from those of younger normal children in that they tend to use long rote strings where normal younger children would use single words. Examples of such rote strings include comb your hair for "comb," brush your teeth for "toothbrush, " rest is over for "all finished, " let's go for a walk for "I want to get out," and I hope you're feeling better for "I feel sick."

Pronoun Errors as Evidence for Rote

The fourth line of evidence is related to the third, although it is somewhat more powerful. Evidence of this fourth type occurs when the child repeats a sentence that had been said to him or her as a part of a ritual. However, in the child's sentence, pronominal reference is incorrectly reversed. Phrases of this type have been reported by R. Clark (1974, pp. 4, 6), Gruber (1973, p. 442), Prizant (1978, p. 42) and van der Geest (1977, p. 98). For example, Clark's son used the phrase I carry you to request that the adult carry him. The incorrect pronominal references suggest that this phrase is a direct imitation of an adult sentence. However, one can never be sure in such cases that the child does not mean to call himself or herself you and the adult I (see MacWhinney, 1974, pp. 562-5, 584-5).

Production of the Whole Before its Parts

Three further types of evidence for a rote analysis of certain phrases are based on the fact that larger units often appear in production before their component pieces emerge. In the first argument of this type, writers have noted that certain phrases, contractions, and conjunctions appear before their parts. Brown, Cazden, and Bellugi (1968, p. 41) report use of *can't, won't,* and *don't* at a time when *can, will,* and *do* were absent; Hatch, Peck, and Wagner-Gough (1979, p. 278) report *it's* when is is absent; Leopold (1949a, p. 8) reports use of *sandbox* when *sand* was absent; and R. Clark (1977) reports use of I *could easily do that* when *could* was absent. MacWhinney (1974, 1978) presents a similar analysis for morphological underanalysis in Hungarian. *Eldobott is* considered to be a rote item, because the child does not use the suffix *-ott* with new verbs and makes no errors in its use, although errors would be unavoidable if the suffix were being used productively.

Brown (1973), Burling (1959), MacWhinney (1975b), and Ingram (1979) have noted that there is often evidence for preservation of a unit intact without substitution of parts. R. Clark (1974, p. 4) provides an example of a long phrase with parts that are not yet analyzed. Thus, her subject said *wait for it to cool* for several weeks before any element became free. Finally, the child said *wait for it to dry,* demonstrating at least some morphemic analysis of the phrase.

Production of Contractions Before Expansions

A related argument can be used to interpret contractions as rote items. Menyuk (1969, p. 82) reported use of *I'm* before I *am* had ever been used. Similarly, Brown, Cazden, and Bellugi (1968, p. 49) report *he's, can't,* and *don't* before *he is, cannot,* and *do not* appear. If *I'm is* formed by combination of I and *am,* one would expect I *am* to appear before *I'm*. Thus, when the analytic form fails to emerge before the contraction, one suspects that the contraction is an unanalyzed whole.

Precocious Strings

A third type of evidence based on acquisitional sequence was offered by Peters (1977, p. 564). Peters noted that when her 14-month-old subject had control of only six to 10 words, he said quite clearly *open the door*. Nelson (1973), makes a similar analysis for her four "expressive" children. In my own child Ross, I observed the strings *No, Mommy, I don't want to go bed* and I *like it; I love it* at a time when the first types of productive pivot-type two-word combinations had not yet emerged**.** However, one cannot necessarily assume that precocious sentences of this type are produced by rote. Quite to the contrary, at that time, Ross had never heard a sentence of exactly the form of *no, Mommy, I don't want to go to bed* and it is clear that, in this case, the precocious utterance was not produced by rote.

One possible way of understanding precocious control of this type is to claim that comprehension abilities develop far in advance of production abilities and that, under certain circumstances, knowledge may be transferred directly from comprehension to production. However, in most cases, production strategies must be constructed without intense reliance on comprehension. Thus, even though a child may produce a few surrendipitous forms in this way, the main thrust of development must focus on the construction of a more reliable set of techniques for controlling sentence production.

The remaining seven lines of evidence for the rote analysis of word strings are based on various aspects of the use of linguistic structure. These seven arguments can be divided into one that relates to phonological structure, two that relate to grammatical structure, and four that relate to semantic structure.

Phonological Structure as Evidence for Rote

Guillaume (1927) was the first to suggest that prosodic integration may be taken as evidence for the rote use of strings. More recently, Peters (1977, p. 563) has claimed that some children "learn the tune before the words." Peters claims that these children are in fact using gestalt speech rather than analytic speech. However, it is difficult to use prosodic data in this way as clear proof that a phrase has been learned by rote. Certainly, adult speech has good prosodic integration, and we do not conclude on this fact alone that adults speak sentences by rote. On the other hand, even in adult speech, we would expect that highly preplanned phrases would receive a stereotypic, unit-like intonation. Thus, it may be possible to use prosody as evidence for rote, but exactly how this evidence should be developed remains unclear.

Order Errors as Evidence for Rote

Order errors provide one line of evidence for underanalysis of word strings. Menyuk (1969, p. 94) reports these errors: You *pick up it, he took out her, Joanne took off them,* and *he beat up him.* Along a similar vein, Labov and Labov (1978) have noted that their daughter omitted the auxiliary in the phrases *what that means* and *why not.* In other structures, auxiliaries were often inserted. Thus, the omission of the auxiliary in these small phrases may be taken as evidence for rote. MacWhinney (1974, 1978) reports a large number of similar order errors for German and Hungarian. However, these errors only provide evidence for fairly small rote chunks. For example, you *pick up it is* evidence that *pick up* may be *a rote* unit.

Positional Frames as Evidence for Rote

A second line of evidence from word-order patterns emphasizes the ways in which small strings of words can serve as positional frames. For example, Bellugi (1965, p. 129) noted that, at Stage 2, Adam produced sentences like *why not me sleeping, why not . . . cracker can't talk, why not . . . we can't dance,* and *why not me break dat one.* The combination of *why not* with these various additional phrases suggests that it may be a positional frame. In these sentences, this analysis is further supported by the redundant negatives and the erroneous word order. In most cases, however, the proposal is based simply on the fact that certain word strings tend to be used together.'

The last five lines of evidence relate to five types of errors in semantic structure. The five types include errors involving contradiction and four types of errors involving superfluity.

Contradictions as Evidence for Rote

Semantic contradictions seem to constitute fairly good evidence for rote. Some of the reported contradictions involve locatives. R. Clark (1977, p. 350), for example, reports *hat on off* and Ferrier (1978, p. 306) reports *shoes on off.* The other reported semantic contradictions involve articles. Gruber (1967, p. 40) reports the error *where's the a truck* in which either *where's the* or *a truck* could be units. Similarly, Leopold (1949a) reports the error I *want a my shoes* in which *want a* seems to function as a unit.

Contradictions also arise when agreement is violated. Kuczaj (1976, pp. 424, 426) has reported several sentences in which the tense of the auxiliary disagrees with the tense or number of the main verb. They are as follows: *this don't had a map, don't he wanted to help somebody, what's was that, I'm want some dinner, that's are pretty ladies aren't they, it's have two,* and *it's went.* Similarly, R. Brown (1973, p. 263) reports the sentence *it's will go,* and Menyuk (1969, p. 76) reports the error *what's these things* in which it appears that *what's is* a rote item. A variety of parallel errors in Hungarian can be found in MacWhinney (1974). In these sentences, the contractions seem to be used even when their tense is incorrect, possibly because no other devices are available. Although such examples do not prove that the contractions are rote units in this case, they do suggest a rote interpretation.

Superfluity in Context

Semantic superfluity has also been used as evidence for underanalysis. We can distinguish at least three types of superfluity in which there is some evidence for rote. In the first type, an element is not clearly redundant, but seems to be unnecessary in the particular context. For example, Ferrier (1978, p. 306) reports the utterances *say bye-bye* and *there's Ursie* in which *say* and *there's* were apparently superfluous. The child used *say bye-bye* to simply say "goodbye" and *there's Ursie* when she meant to say simply "Ursie." Such phrases seem to involve the same type of inaccurate imitation previously discussed. R. Clark (1977, p. 350) reports *cat name* and *picture of* in which *name* and *of* were superfluous in a similar way. And Leopold (1949b, p. 16) reports that *away* was superfluous in *my go away* and that is was superfluous in *my mommy is*. In each of these cases, the superfluity is evident not so much in the surface structure as in the use of the utterance in context. Thus, it seems strange to say *my mommy is* when what is meant is only *my mommy*. According to this analysis, we would then say that *say bye-bye, there's Ursie, go away,* and *mommy* is are all functioning as single units.

Presence of an Unusual Element

In the second type of superfluity, one of the elements, although not actually redundant, is clearly strange. For example, R. Clark (1977, p. 350) reports the utterance *hat on gone now* in which *hat on is* apparently a unit. Similarly, Ferrier (1978, p. 306) reports *bye-bye shoes on* in which *shoes on* seems to be a unit. Note that there is no contradiction here between, say, *shoes* and *on,* but there is something unusual about the use of the locative after the direct object *shoes*.

Redundancy as Evidence for Rote

In the third type of superfluity, a redundancy on the surface makes it entirely clear that at least one item is not needed, and that it may have been included as a part of a rote item. There seem to be at least nine constructions in which superfluity gives evidence for rote:

1. The direct object. Menyuk (1969, p. 48) reports *she took it away the hat;* Brown and Bellugi (1964, p. 151) report *saw it ball, mommy get it ladder, mommy get it my ladder, miss it garage,* and I *miss it cowboy boot;* and Braine (1976, p. 36) reports *have it egg, have it milk,* and *have it fork*. In these sentences, *took it, saw it, get it, miss it,* and *have it* seem to be rote units.

2. *Verbal particles.* Menyuk (1969, pp. 49, 56) reports *she put on the dress on, the barber cut off his hair off,* and *put on some rouge on.* Similarly, Leopold (1949b, p. 52) cites *zubinde mir meine Schuhe zu (on-tie me my shoes on).* In these sentences *put on, cut off,* and *zubinde* seem to be rote units.

3. Quantifiers. Menyuk (1969, p. 48) reports I *want some lots of flour* in which *lots of flour* seems to be a rote unit.

4. *Contractions.* Kuczaj (1976, p. 424) reports I *like to listen to who's is on this tape, that's makes a truck, it's don't have any oil in here, it's look like a bus*

I think it's have a pile, that's means "get hawks, " and *that what's the witch says to her brother.* Hurford (1975, p. 300) reports *what's that* is? and *what's this is?* Maratsos and Kuczaj (1978, p. 342) report *know what's this* is; and Menyuk (1969, pp. 49, 108) reports *he's go there everyday, he'll might get in jail, he's already's in the house,* and *he's now is copying him.* In these sentences, the contractions appear to be units. In a related set of errors, it may be that the "excess" auxiliary is in fact a marker of the progressive and that the error is due to an omission of *-ing.* Some examples of this type of error are as follows: Menyuk (1969, p. 73, 75): *he's make it?* and *what's this plays?;* Mayer, Erreich, and Valian (1978, p. 12): *I'm feed the baby meat;* Gruber (1967, p. 41): *he's put* and *I'm go; R.* Brown (1973, p. 86): *it's go;* and Kuczaj (1976, p. 424): *he's do take his clean pants off* and *what's happen with Santa Claus?*

5. *Negatives.* Bellugi (1965, p. 117) reports *why not . . . me can't dance* and *why not . . . cracker can't talk* in which *why not* seems to be a rote unit, because there is a double negative.

6. *Modals.* Two redundant uses of models have been reported in the literature. Bellugi (1971, p. 100) cites *what shall we shall have?* and Menyuk (1969, p. 76) cites *how can he can look?* In these errors, *shall have* and *can look* appear to be rote units.

7. *Copula.* Three redundant uses of the copula as both uncontracted auxiliary and as main verb have been reported. Menyuk (1969, p. 73) cites is *this is the powder?;* Hurford (1975, p. 300) cites *whose is this is?;* and Hatch et al., (1979, p. 242) cite *what is this is?* Hatch et al. believe that *what is this* could be a rote unit. In the other examples, is *this* and *whose is this* may also be rote units.

8. *Past tense.* There are four types of errors in which past tense is redundantly marked on the main verb. Double past-tense marking errors in questions such as *what did you found?* and *did l caught it?* are frequent. Hurford (1975, p. 300) reports five errors of this type; Kuczaj (1976, p. 423-424) reports eight; Klima and Bellugi (1966, p. 205) report one; Maratsos and Kuczaj (1978, p. 341) report 12; and Bellugi (1965, p. 122) reports four. In this first type of past-tense error, the main verb is almost always an irregular verb. A second type of past-tense redundancy involves negative declaratives such as *she didn't goed.* These errors are somewhat less frequent than those of the first type. Kuczaj (1976, p. 426) reports eight such errors and Klima and Bellugi (1966, p. 196) report three. Still less common is redundancy in affirmative declaratives such as *I did broke it.* Kuczaj (1976, p. 426) reports one such error and Mayer et al. (1978, p. 2) report three. The fourth type of error involves redundant marking of tense on the main verb, accompanied by incorrect tense on the auxiliary. Kuczaj (1976, p. 424,426), for example, reports *don't he wanted to help somebody, can you broke these,* and *this don't had a map.* In many of these past-tense redundancies, the redundant unit is a piece of an irregular verb. Because we know that *caught* and *took* are units in any case, we learn fairly little about rote from these redundancies.

9. *Present tense.* Present-tense redundancies occur only in the third person singular. And they appear mostly in yes-no questions such as *does it rolls?* Maratsos and Kuczaj (1978, p. 341) report nine errors of this type, Bellugi (1965, p. 122) reports two, and Menyuk (1969, pp. 73, 76) also reports two. Kuczaj (1976, p. 426) also reports the related error *it don't hurts* in which redundancy is accompanied by an error in agreement, and the error *it didn't has any* in which the redundant present tense cooccurs with an error in the tense of the auxiliary.

For each of these nine types of redundancies, we have noted how the presence of rote units can explain at least some aspects of the error. For example, in *she put on the dress on,* one could argue that the child wanted to say *she put the dress on,* but that *put on* was the only way the child has to say *put.* However, this is often not the case. Children who use *put on, why not,* or *shall have* may also use *put, why,* and *have* in other sentences. If this is true, why do we find both *put on* as a main verb and *on* as a separable particle? The question seems to be parallel to the question of why children produce forms like *duckses* and *footses.* Menn and MacWhinney (1980) have argued that, in *duckses,* the plural *ducks is* a rote item and that *-es is* added to it as part of the productive plural rule. The point is that, although the child knows that *ducks is* plural, he or she still has difficulty suppressing the productive plural. In general, redundancy can occur whenever the child has two ways of saying the same thing. In the case of *she put on the dress on,* the verb *put on is* a rote unit and the particle *on is* a productive device. The child must learn to suppress *on* when using *put on* and to use *put* when saying *on.*

In addition to these 14 basic types of evidence for rote, there is a further type of evidence that is only relevant to the detection of the use of rote in second language acquisition. This type of evidence occurs when a child refers to a sentence as a whole entity. For example, Kenyeres (1938) noted that his six year- old Hungarian-speaking daughter would ask the meanings of whole French sentences. For instance, she would ask her parents to explain the meaning of school rituals such as *tout le monde a sa place ("everyone* to his seat") and song titles such as *feuille d'ou viens-tu?* ("leaf, where do you come from?"). Such items have only a generalized meaning attached to them for the young second language learner. Rather than preserve these longish items as rote forms, the child tries to enlist the adult's help in breaking these items down into their component pieces.

Evidence for Short-Term Syntactic Rote

For an item to be used by rote, it is not necessary that it be stored in long-term memory. All that is necessary for syntactic rote is that an item not be fully analyzed into its component words. Thus, one important alternative to long-term rote is the rote use of strings that occur in immediately

preceding discourse and that have not yet faded from short-term memory. We can distinguish two types of evidence for short-term rote: replacement sequences and discourse borrowing.

Replacement sequences, also known as build-ups and elaborations, have been studied by Braine (1973, p. 422), R. Clark (1974, p. 2), Francis (1969, p. 299), Gvozdev (1961), Iwamura (1980), MacWhinney and Osser (1977), and Weir (1962). To illustrate the phenomena, consider this sequence from R. Clark (1974, p. 2): *Baby Ivan have a bath, let's go see Baby Ivan have a bath.* In this sequence, the child produces the chunk *Baby Ivan have a bath* and then stores it in short-term memory. He then adds *let's go see* to this item in short-term memory and produces the final sentence. By breaking the problem down into its pieces and by remembering the solution to a piece of the problem by rote (Jacoby, 1978), the child may be able to produce strings that go just beyond his or her normal processing span. This basic strategy may be extended over several utterances, as in these sequences cited by Iwamura (1980, pp. 61, 88):

1. Are you come to our house, Suzy?
Do you come to our house?
Does Suzy come to our house, Mommy?
Is Suzy come to our house?

2. I don wan she.
I don wan she to talk to me.
I don wan him, she to talk to me.
Don wan Suzy to talk to me.
I don wan you to talk to me.
Don wan.
Don talk to me.

The second type of short-term memory rote involves the borrowing of a piece of the previous adult utterance to be used in the child's own utterance. For example, Clark (1974), pp. 3-4) cites these sequences.

3. Adult: We're all very mucky.
Child: I all very mucky too.

4. Adult: Do you want to get off?
Child: No, I want to get on.

5. Adult: That's upside down.
Child: No, I want to upside down.

Clark (1977, p. 356) cites this sequence:

6. Adult: You want to have a bath?
Child: I want Teddy have a bath.

Hatch et al. (1979, p. 272) cite these sequences from young second-language learners:

7. Adult: Come here.
Child: No come here.

8. Adult: Don't do that.
Child: Okay don't do that.

9. Adult: Where are you going?
Child: Where are you going is house.

R. Brown (1968, p. 282) cites these:

10. Mother: He was playing a little tune.
Adam: Why he play little tune?

11. Mother: I see a seal.
Adam: Why you see a seal?

12. Mother: You bent that game.
Adam: Why me bent that game?

13. Mother: Well, because she wanted to.
Adam: Why she want to?

14. Mother: I think it's resting now.
Adam: Why it's resting now?

15. Mother: I guess I'm not looking in the right place.
Adam: Why not you looking right place?

16. Mother: Because you weren't careful.
Adam: Why not me careful?

17. Mother: I don't see any.
Adam: Why not you see any?

18. Mother: You can't dance.
Adam: Why not me can't dance'?

19. Mother: . . . you're breaking that one.
Adam: Why not me break that one?

Finally, Iwamura (1979, p. 3) cites this sequence:

20. Child A: Don't throw. Don't throw.
Child B: I don wanna don throw.

Before concluding this section on evidence for rote, we should note, at least in passing, the important role of rote phrasal items in the adult lexicon. For example, Becker (1975) estimates that at least half of the items in the average adult lexicon are polymorphemic. Included in this count are ritual phrases *(what do you know?),* extended syntactic frames (X *gives Y a piece of X's mind),* frozen metaphors *(dead as a door nail),* and phrases with words that are no longer productive as individual items *(arms akimbo, short shrift, run amok).* Many of these adult items are used in ways that closely resemble the more primitive rote items used by children.

Evidence Against Rote

Whenever there is no evidence supporting any of these 14 lines of evidence, one begins to suspect that a string is not being produced by rote. However, there are also four more positive lines of evidence that can be used to limit the importance assigned to rote. First, it can be shown that rote is not being used when a string contains an error that could not be derived from imitation. The error may be one in word order, affix choice, or morphophonology. For example, if a child says I *didn't want to get uped,* we may assume that *get up is* a rote substring. However, the larger string could not be a rote formation, because it could not be a (nonaltered) imitation of an adult sentence. Formal errors of this type are reported quite widely (R. Brown, 1973, p. 98; Brown & Bellugi, 1964; p. 149; MacWhinney, 1974) and constitute the most widely used evidence that children's sentences cannot be produced by rote alone.

However, recently, Platt and MacWhinney (1980) have demonstrated how formal errors of this type could occur in items that had been learned by rote. A child could produce a word like *foots* as a productive combination of *foot* and -s. Having produced this word, the child could then learn his or her own error. Subsequent uses of *foots* could then be simple rote uses. Moreover, this process can also operate to produce correct rote items; *cats* may be initially produced by combination and subsequently controlled by rote. In general, this kind of learning follows the principle of unitization or redintegration discussed by Horowitz and Prytulak (1969), Hayes-Roth

(1977), Shiffrin and Schneider (1977), and many others. As Jacoby (1978) puts it, after a learner has solved a problem once, he or she can then simply remember the solution, instead of actually solving the problem again from scratch. Note that such learning by rote can occur without any imitation of another speaker. All that is required is that the child listen to him- or herself. Clark (1977, p. 353) cites examples that indicate that learning one's own productions may be an important mechanism even for sentence-length strings. Her child Adam, for instance, used to say *Adam turn a light on* and would receive the answer *soon.* Eventually, he came to say *Adam turn a light on soon.* Or, having said *where's Adam? . . . upstairs* many times, he came to say *where's Adam upstairs?*

A second, more powerful, line of evidence against rote is based on the child's use of nonce words (Braine, 1963). Strings that contain nonce words whose meaning is arbitrarily assigned by the experimenter cannot possibly be produced by rote, unless the experimenter presented them. Thus, if the experimenter keeps an accurate record of the use of each nonce word, he or she can determine with some certainty whether a given string with the nonce word could conceivably have been produced by rote. In practice, this technique has not been extensively applied. This is unfortunate, because it means that when children do not make errors, we have little evidence demonstrating that the sentences they form could not be produced by rote. Moreover, even when they do make errors, those errors could be rote repetitions of forms that had once been productive.

Researchers have often devoted more attention to two somewhat more general lines of argumentation. In the third line of argumentation, it is claimed that rote is, in principle, incapable of accounting for all the sentences of a language. N. Chomsky (1957), G. Miller (1965), and Postal (1964) argue that the number of possible grammatical sentences for a given language far exceeds the capabilities of rote-based production. Although these arguments clearly prove that all of the utterances produced by an adult community cannot be based on rote alone, they place no important limits on the use of rote in the speech of preschoolers.

The fourth line of argumentation emphasizes the ways in which mnemonic processing limits the size of what can be learned by rote. Short-term memory is certainly capable of storing full sentences in their complete surface form. However, some studies (Sachs, 1967) have suggested that, after a few minutes, recognition memory for surface structure declines sharply. Recall is even more sharply affected. On the other hand, more recent data (Keenan, MacWhinney, & Mayhew, 1977) indicate that, under certain conditions, recognition memory for surface structure may be present even several days after the initial exposure. In any case, it is generally recognized that, for school-age children and adults, rehearsal (Conrad, 1972) can allow speakers to commit huge texts (Rubin, 1978) to memory. Thus, the question is not so much what the mnemonic system can commit to rote. Rather, the question is what does it commit to rote, and how much of this is available in production as opposed to comprehension.

So far, we have considered one very simple strategy for ordering words into strings, and it has been shown that there are at least some strings that are probably produced or comprehended through use of this strategy. However, there is also evidence that at least some other strings are not produced by rote, but by some more complex strategy or strategies. Although there are clear upper limits on the role of rote in language acquisition, these limits are not yet well understood It would be a mistake to offer a more complex account for phenomena that can be accurately described as instances of rote application. This is to say that, when a given phenomenon can be explained equally well either by rote or by some more complex mechanism, the rote account is preferrable because it is simpler.

How Much Rote Do Children Use?

It is important to distinguish three formulations of this question:

1. How much rote do we know that children use?
2. How much rote might children be using?
3. How much rote might children know but not use expressively?

The data previously cited provide an answer to the first question only. They show that small word strings such as *put on,* or *say goodbye,* may be learned by rote and that contractions and complex words are often rote units. However, we have almost no evidence for rote units that extend beyond the level of the kinds of prosodic units that can be perceived as if they are words.

On the other hand, it may well be that we have not found large rote units because the kinds of evidence we have tended to accept are not suitable for longer strings. Or, it may be that we have

not found large rote units because we have not been looking for them. Data from second-language acquisition (Fillmore, 1979; Hakuta, 1977) suggest that older children may have longer rote units. However, the answer to the second question is not simply that children may form all sentences by rote. In the next section, we show why rote must have limits.

A third possibility is that large rote chunks are used in comprehension but not production. Certainly, we know that recognition far surpasses recall. Thus, there is good reason to suspect that rote should play an important role in comprehension. However, no tests of this possibility have yet been conducted.

ANALOGY

We noted in the preceding section that the rote account for syntax fails on four grounds: (1) it cannot explain neologisms and errors; (2) it cannot explain the use of nonce forms; (3) too many sentences would have to be memorized; and (4) these sentences would be too long. In this section, we examine a simple strategy for producing sentences that meets the first two objections. However, as we see, this strategy also fails to meet the last two objections.

The strategy we consider is *analogy,* the second of the three processing mechanisms proposed by MacWhinney (1978). Analogy is defined as a process that operates on one or more items in memory to extract a pattern that can then be used to control a new formation. The crucial characteristic of analogy that distinguishes it from the system of rules or *combination is* that in analogy, the pattern is implicit in a set of lexical items, but is not available apart from an analysis of those items. For example, a neologism like *leadsel* could be produced on analogy with *tinsel.* In such a case, no one would argue that *-sel is* a productive suffix denoting "an object made from a metal." Thus, the pattern isolated by analogy in such cases is essentially ad hoc. In combination, on the other hand, the pattern or rule has developed a life of its own apart from the lexical items from which it developed. However, no sharp line should be drawn between analogy and combination, and it may be best to view analogy as one aspect of the first stages of rule development.

Occasionally, there are clear cases of analogical processing in syntax. Most of these examples involve operation on rote strings by the processes of replacement or conversion that were discussed earlier. For example, R. Clark (1974, p. 1) reports the production of *wait for it to dry,* on apparent analogy with *wait for it to cool.* In this particular case, it was reasonable to imagine that the rote item *wait for it to cool* was stored in short-term memory and that the *wait for it to* section was analyzed out and subsequently added to *dry* to produce *wait for it to dry*. Reporting on the acquisition of French by his 6-year-old Hungarian-speaking daughter, Kenyeres (1938) notes that the sentence ou *vent les mamans?* ("where are the mothers?") for "where is my mother?" must have been derived from the sentence ou *vent les oiseaux?* ("where are the birds?"), which she had learned at school. To cite another example, Peters (1980) reports that at 1;8 Satoshi Hayasaka learned the sentence *what a nice bicycle you have* and soon after produced *what a nice elbow you have* and *what a nice daddy you have.* Similarly, Clark (1977, p. 354) and MacWhinney (1974, p. 584) report sequences such as the adult's *are you?* followed by the child's I *are* in which the child produces a sentence on analogy to the sentence of the adult but in which the pronoun is converted. Further examples of this type of analogy were given previously. An analogic mechanism of this type can also be used to explain certain types of strings containing errors. For example, you *pick up it* (Menyuk, 1969, p. 94) could be formed on analogy with *you pick up John,* and *did l caught it* could be based on analogy with *did I take it.* Furthermore, sentences with nonce words such as *this is my wug* could be produced by analogy with rote items such as *this is my bear.*

In general, one can argue that analogy has occurred when there is reason to believe that a model sentence is available in either short- or long-term memory. It is also necessary to specify how the child uses the information in this stored rote chunk to produce the current utterance. In the case of build-ups, the chunk is used as a whole and one cannot speak of the result as an analogy. Analogy requires replacement rather than build-up. At least one element in the rote string must be analyzed out and replaced by some other semantically similar element.

In the area of morphophonology, it is often possible to get positive evidence for the use of analogy in the production of at least some forms. This is done by "priming" the child with the basis of an analogy. A child is asked first for the plural of *scarf* and then for the plural of *narf* . The production of *scarves* would serve as a prime for the plural *narves.* The evidence suggests that, in systems where the structure of the patterns to be learned is complex and irregular, it will take a long time to perfect the full set of combinatorial rules. In such systems, there is evidence that analogy continues for a long time to play a major role in producing new forms. One example of a system

that encourages the use of analogy is the complex and arbitrary system of gender, case, and number in German (MacWhinney, 1978). In other systems, in which rules are less subject to exceptions and idiosyncrasies, we would expect that analogy should quickly give way to combination. For example, many of the basic rules that govern both the order of morphemes in words and the ordering of words in strings are fairly consistent. Therefore, we should expect analogy to play a fairly minor role in the control of word order. To see why this is true, consider this example: A child learns the item *my book* by rote and uses it frequently. Later, the child wants to say that a certain toy is his, or hers. Taking *my book* as the basis of the analogy, the child then produces *my toy*. However, having done this once, the child immediately sets up the sequence *my + X* as a combinatorial pattern. Because *my* always appears before the noun it possesses, the pattern rapidly grows in strength and becomes a full-fledged rule (MacWhinney, 1978). Analogy was important only at first and later it was overtaken by the rule itself. Because of this, we do not expect to find much evidence for analogy in early syntax.

In fact, there is good evidence that analogy alone cannot explain a variety of error types both in morphophonology (MacWhinney, 1978) and syntax. Some sentential error types for which it is difficult to imagine correct analogues are: *allgone sticky, why not me sleeping, shoes on off, where's the a truck, it's have two, saw it ball, put on some rouge on, some lots of flour, does it rolls?, I'm go,* and many others. However, if we assume that these errors are produced by analogic operation upon rote chunks, they can be explained fairly easily. For example, *shoes on off is* based on analogy with *pants off,* and *shoes on is* considered to be a rote item meaning something like "shoes." Similarly *some lots of flour* could be an analogy with *some bread,* and *lots of flour* could be taken to be a rote unit.

Thus, although both analogy and rote are fairly weak accounts when taken alone, when they are taken together, they are much more powerful. Although this combined model is quite powerful, there are still three major objections that can be raised against such a simple rote-plus-analogy model. First, the number of rote sentence types to be memorized would still be fairly large. However, by combining rote with analogy, it is possible to limit this total number to some finite set. Second, there is no way of knowing in a given case just what the basis of a purported analogy might have been. Thus, the rote-plus-analogy model is really highly unconstrained. Third, and most important, we have very little evidence that either children or adults spend much time memorizing sentence length sentence patterns. Nor do we have any evidence that such long rote forms have any impact on either the production or the comprehension of word strings. Until such evidence becomes available, we must assume that rote and analogy, by themselves, cannot explain word-string production in either children or adults. This does not mean that rote and analogy have no role in word-string formation. In fact, there is evidence that many short strings are learned by rote and that analogy can work on strings held in short-term memory. However, until evidence for long rote units becomes available, we must attempt to explain the production and comprehension of long strings of novel combinations by some more complex mechanism.2

COMBINATION

The third mechanism that we consider is *combination.* Combination is defined as the set of principles that serves to transform an unordered string of lexical items into an ordered string. When defined this way, combination presupposes that lexical items are initially unordered, because a preordered string of items would be governed by rote and, when rote operates, combination is precluded.

Combination must begin, then, with a search for a series of lexical items or morphemes. When this search yields more than one item, combination is called into play. Combination itself involves two major subsystems. One is the system of morphophonological rules that alter the phonological shapes of morphemes; this system was discussed in MacWhinney (1978). The second major subsystem of lexical combination is linearization. This system comprises the set of principles that govern the ordering of morphemes into strings, and it is the major focus of the present section. The four principles or strategies that we consider here are: (1) predispositions; (2) bound rules; (3) free rules; and (4) class- bound rules. In this section, we examine the evidence for and against each of these four strategies.

Predispositions

In order to formulate the notion of combinatorial predispositions in a maximally simple way, we must make two assumptions. The first is that, for a given item, the process of lexicalization precedes the process of linearization. This assumption is accepted by some linguists (Chafe, 1971) and psycholinguists (Clark & Clark, 1977), and rejected by others (N. Chomsky, 1965; Schlesinger, 1977). However, for our present purposes, it is useful to make this assumption, because it permits a simple formulation of the notion of predispositions.

Assuming, then, that lexicalization precedes linearization, we must also make a second simplifying assumption: When linearization rules do not apply, the order of lexical items in a sentence is a function of the order in which those items are lexicalized. This could be referred to as the "first come-first served" principle. In fact, some of the child's earliest utterances seem to provide good evidence for this hypothesized principle. In particular, a number of writers (Bloom, 1973, p. 53, Brown, 1973, p. 148, Greenfield & Zukow, 1978; Guillaume, 1927; Shipley, Smith, & Gleitman, 1969; Smith, 1970; Weisenburger, 1976) have argued that the order of items in successive single-word utterances is not governed by principles of semantic relation. Rather, the child seems to say words, one by one, as they come to his or her mind.

Given the assumption that lexicalization precedes linearization and that linearization orders items on a first come-first served basis, we must consider what principles might be involved in predicting the order in which items will be lexicalized. If we can discover such principles, and if they hold uniformly, we will have succeeded in accounting for syntax. Of course, this solution will not exclude rote and analogy as alternative strategies. However, it would provide us with a combinatorial mechanism that would be so powerful that we would have no need to consider any additional combinatorial strategies.

The notion of a predisposition is being used here in a very nonspecific way to refer to any strategy whose origin has not yet been traced and whose consequences appear to be universal. It may be that some predispositions rest upon a set of epigenetically canalized abilities (Waddington, 1957). What is important for the present analysis is not the source of the predispositions, but the fact that they govern operations on the information-processing level that constrains the level being examined. In the case of word order, predispositions work on lexicalization, because the order of lexicalization can constrain the order of linearization. In the case of morphophonology, predispositions operate on the phonological level, constraining the shape of morphological productions.

There are at least seven predispositional principles that have been suggested at various points by various writers. These items tend to be lexicalized and/or ordered in terms of decreasing: (1) informativeness (Greenfield & Zukow, 1978; MacWhinney, 1977; Sgall, Hajicova, & Benesova, 1973); (2) grammatical complexity or size (Bloom, Miller, & Hood, 1975, p. 45, Dik, 1978); (3) agency (Osgood & Bock, 1977, p. 93); (4) salience (Horgan, 1976); (5) perspective (MacWhinney, 1977, Osgood & Bock, 1977, p. 94); (6) order of occurrence (E. Clark, 1971); and (7) relatedness (Clark & Clark, 1977; Slobin, 1973). Let us briefly examine evidence for each of these seven principles.

Informativeness

The predisposition that has received the most attention is the informativeness. Studies by Braine (1973, p. 425), deLaguna (1927, 1963), Greenfield and Zukow (1978), Sechehaye (1926), Snyder (1976), and Vygotsky (1934/1962) have suggested that, in early one-word utterances, the child vocalizes the most informative or newest item and suppresses less-informative or given items. Similarly, in early two-word utterances, children seem to place the most- informative word first (Guillaume, 1927; Leonard & Schwartz, 1977; Lindner, 1898; Menyuk, 1969; O'Shea, 1907; also see MacWhinney & Bates, 1978, p. 546 for additional references).

It is probably impossible to distinguish between informativeness and newness (MacWhinney, 1977) as determinants of early word order. However, whether we speak of informativeness or newness, the tendency to order the new before the given runs exactly counter to the tendency in many adult languages to order the given before the new (Bock, 1977; also see MacWhinney, 1977, pp. 159-161 for details). In this regard, it is important to realize that no one has ever claimed that this particular predisposition is a rule. Eventually, the child will have to learn to overcome this hypothesized predisposition in order to produce grammatical utterances. Moreover, even in the early periods, the child begins to order the given before the new (Gruber, 1967; MacWhinney, 1975a; Menyuk, 1969, p. 49). However, we do not know whether the child actually has to try to overcome the predisposition in order to do this or whether she or he relies on

some opposing predisposition towards saying the given first. Nor do we know what it would mean to have two predispositions working in opposite directions.

Complexity

Dik (1978, pp. 189-211) has suggested that there is a universal tendency to order constituents by size. According to this principle, short, simple phrases or words come early and long, complex strings come late. In other words, we prefer to say it *amazed me that he arrived late* rather than *that he arrived late amazed me* because the latter begins with the relatively complex phrase *that he arrived late* whereas the former begins simply with *it.* Similarly, other things being equal, pronouns occur earlier than nouns. Dik's proposed ordering by complexity seems to be closely related to the idea of an ordering by degrees of givenness suggested by Prague School functionalism (Sgall et al., 1973). In any case, there are no investigations of complexity as a determinant of early child word orderings.

The next three predispositions we consider were proposed in slightly different formats by MacWhinney (1977) and Osgood and Bock (1977). In the terms of Osgood and Bock, the predispositions are: naturalness, vividness, and motivation of speaker. In the terms of MacWhinney (1977), the choice of the starting point for English is influenced by agency, salience, perspective, and givenness. In MacWhinney's account, agency expresses one aspect of Osgood and Bock's naturalness. However, Osgood and Bock make the broader claim that our cognitions utilize agent-action-recipient order and that our language reflects this underlying natural cognitive order. MacWhinney's salience corresponds to Osgood and Bock's vividness and MacWhinney's perspective corresponds to Osgood and Bock's motivation of speaker. Thus, the overall fit between these proposals is fairly close (see also Ertel, 1977).

Osgood and Sridhar (1979) have assembled a variety of experimental data supporting a role for perspective, salience, and agency in the speech of adults from 14 language communities. However, as Osgood himself admits (1971), claims regarding predispositions must eventually be tested on young children. Although Osgood has not yet conducted such tests, a variety of other studies do suggest that agency, salience, and perspective may in fact function as predispositions for young children.

Agency

First let us consider agency. The strategy of choosing the first noun phrase (NP) as the agent was proposed by Bever in 1970. Studies of the comprehension of alternative word orders by children in Japanese (Hakuta, 1979; Hayashibe, 1975) and Tagalog (Segalowitz & Galang, 1976) have provided evidence for a fairly weak tendency to take the first NP as the agent, although no such rule is present in the adult language. Unfortunately, the exact status of word-order variations in Tagalog is a matter of controversy. Moreover, in Hungarian (MacWhinney, 1976) and Turkish (Slobin, and Aksu, in press), which also allow object-agent ordering, no such tendency emerges. Of course, in English, which heavily disfavors object-agent ordering, children tend to take the first noun as the agent (see the section *Free Rules* later in this chapter) and to initialize agents even in the period of successive single-word utterances (Horgan, 1976, p. 120). However, English is hardly a useful test case. Rather, what we need is further data on both comprehension and production in Verb-Object-Subject (VOS) languages like Tagalog.

Salience

The fourth of the six predispositions we are considering is salience or vividness. Although there are a variety of studies of the effects of perceptual salience on adult production and comprehension (see MacWhinney, 1977), there are no clear-cut experimental demonstrations of its effects on word ordering in children. Horgan (1976) reports that some of her child subjects began their picture descriptions by mentioning what first "caught their eye [p. 122]." However, it is not clear how this definition of salience serves to distinguish it from informativeness and newness.

Perspective

The fifth predisposition that has been suggested is that children might tend to initialize the element with which they most closely identify. This is what MacWhinney (1977) calls the perspective. Of course, in many cases, the perspective is also the agent. However, in the passive or

in nontransitive sentences, the perspective is not the agent. Here, again, English provides a very poor test of the hypothesized predisposition, because the initialization of the perspective is a central rule of English grammar. The kinds of tests we need could be made, say, in Navajo, where the order of nouns is governed by animacy and not perspective. If children were to initialize a perspective that was low in animacy, there would be evidence for the hypothesized predisposition, because they would be running directly counter to a basic word-order rule of the language.

Order of Occurrence

The five predispositions already mentioned all serve to constrain the order of constituents in a clause. However, there may also be predispositions that constrain the order of clauses in a sentence. One such predisposition would be the tendency to mention events in the order of their actual occurrence. Clark and Clark (1968), E. Clark (1971), and Ferreiro and Sinclair (1971) have shown that subjects tend to assume that the first clause mentioned in a complex temporal sentence (i.e., a sentence with either "before" or "after") also occurred first. However, studies by Amidon and Carey (1972), Amidon (1976), and Johnson (1975) have failed to detect an effect for order of mention. Amidon (1976) attributes these differences in results to task variables.

This hypothesized preference for the first action as the first clause is not necessarily supported by linguistic analysis. For example, Talmy (1978, p. 638) argues that the main predisposition in complex sentences is to place the figure before the ground. In temporal sentences, the earlier event is usually the reference point. Thus, as the reference point, it is the conceptual ground and should occur in a second (subordinate) clause, whereas the later event, which functions as the figure, will appear first in a main (asserted) clause.

A somewhat different, but closely related, predisposition for interclausal ordering might be the putative universal tendency to order the cause before the result. In fact, Bebout, Segalowitz, and White (1980) have found that children prefer to interpret causal conjunctions such as "because" and "so" in terms of a cause followed by a result. Here again, the hypothesized universal order is opposite to that suggested by Talmy (1978) on the basis of his linguistic analysis. According to Talmy, the result functions as the figure and the cause functions as the ground. Thus, the basic order in causal conjunctions should be result before cause.

Relatedness

In general, it seems that words that are most closely related in the sense of semantic constituency are ordered closest to each other. This tendency has been called Behaghel's Law (Clark & Clark, 1977, pp. 80-84) and it seems to have surprisingly universal results both for word order (Bolinger, 1952) and affix order (Chafe, 1974). To some degree, we can say that this law functions as a predisposition regarding the order in which items may be lexicalized.

In order to comply with Behaghel's Law? speakers must optimize the relatedness of neighboring items. Thus, both Bever (1970) and Slobin (1973, pp. 199-201) have cited evidence indicating that both speakers and listeners tend to avoid interruption of related items. Although this principle seems generally quite reasonable, its exact importance in specific cases has been the subject of some dispute (Sheldon, 1974). Later, we examine this dispute in regard to the impact of relatedness and interruption on the processing of relative clauses.

It should be clear from the preceding discussion that the evidence for these seven predispositions in early combinations is far from overwhelming. This does not mean that predispositions are not there. Rather, it means that if we want to demonstrate their existence, we need to devise more convincing experiments that can be used with younger children. However, there is no need for us to suspend other lines of inquiry until such experiments are conducted, for it is likely, in any case, that predispositions are not the only mechanism underlying combinations. As evidence for this, consider that there is no universally valid rule of surface syntactic order. In some languages, the adjective follows the noun. In others it precedes the noun. If the first come-first served principle were operative, we would have to argue that in some cultures, adjectives are more important than nouns, whereas in other cultures, nouns are more important than adjectives. Such extreme linguistic relativism seems fairly unlikely. Therefore, we are left with the fact that surface syntax exists and must be explained. Moreover, even those who support the importance of predispositions (Bates & MacWhinney, in press; Dik, 1978) recognize that language-specific fixed word orders constitute the bulk of syntactic structure even in so-called "free word-order" languages. And, it is clear that any theory of syntactic acquisition must include mechanisms that can account for these language-specific fixed word orders. Such mechanisms must also be able to

account for the basic phenomenon mentioned earlier—that we have no evidence for widespread rote encoding of long strings of words and that, therefore, rote and analogy are insufficient as accounts of the production and comprehension of long strings of words.

Bound Rules

We now turn to the consideration of a simple, rule-governed way for combining lexical items. This strategy makes use of a set of lexically bound rules, which we call item-based patterns.3 These patterns are designed to place two strings into a linear order when one of these strings is a single item. However, as we note later, such simple binary patterns can be combined to produce large structures. We see that such patterns are able to overcome the chief inadequacies of rote, analogy, and predispositions—that is, they can produce long strings of words without relying on rote templates and they can account for the systematic control of patterns that are language specific rather than universal.

Each item-based pattern is an ordering procedure that is bound to (i.e., stored on) a single lexical item. The item on which the procedure is stored is called the operator. The procedure allows an operator to either precede or follow some other string, which is called the nucleus. Whereas, by definition, an item-based pattern specifies a single, unique lexical item as the operator, it may specify either a single item or some set of items as the nucleus. Thus, one can imagine two types of item-based patterns: (1) item-item patterns; and (2) item-set patterns. However, the first type of pattern is uninteresting, because it is equivalent to a rote item. For example, we might know about the item *shrift* that it follows the item *short* in the sequence *short shrift.* However, this is equivalent to saying that we have *short shrift* as a rote item (Becker, 1975).4 It is clear, then, that item- item patterns are of little explanatory value, although they may be of importance in talking about the emergence of item-set patterns from rote items (see Braine, 1976, p. 9, Maratsos & Chalkley, 1980). Therefore, we use the term "item based pattern" to refer to item-set patterns rather than to item-item patterns.

The shape of the nucleus of an item-based pattern could be defined in a variety of ways. In the present section, we consider a characterization of the nucleus in terms of a single semantic feature. Thus, we talk about item-based patterns like *my + entity* and *action + -ed.* In the *Nonsemantic Class-Bound Positional Patterns* section later in this chapter, we see why this characterization is inappropriate. However, for the moment, we explore the potential applicability of this initial simple formulation of the item-based pattern.

Evidence for Item-Based Patterns

The notion of an item-based pattern just given is so simple that one immediately wonders whether such a mechanism could really be of any value in analyzing even the most primitive utterances of young children. Thus, in order to lend credibility to the notion, we would need to see that it actually worked to explain some important phenomena. In this section, we first examine the kinds of data that seem to be satisfactorily explained by item-based patterns and then consider the kinds of data that are not well explained by this account. We can distinguish at least seven lines of evidence that argue for the usefulness of item- based patterns. These include their ability to explain: (1) ordering in short strings; (2) children's failure to generalize; (3) the control of discontinuous morphemes; (4) item-phrase orderings; (5) competitive orderings; (6) strings not attributable to analogy; and (7) the nonoccurrence of certain types of errors. Let us consider each of these seven lines of evidence in sequence.

Ordering in Short Strings. Item-based patterns have received the widest attention in regard to their ability to account for early multiword utterances. Braine (1976) proposed two criteria for full positional patterns in early grammars. The first is that such patterns should be consistent and the second is that they should be productive. For example, if we find that the word *too* occurs after the nucleus nine times out of 10, then by calculating binomial probabilities, we have evidence for a positional pattern (Braine, 1976) for the item *too.* This pattern can be represented as: X + *too.* Productivity for the X + *too* patter' would be indicated if *too* occurred with more than just two or three words. Using these criteria, MacWhinney (1975a) examined the word order of 11,077 utterances produced by two Hungarian children during the ages of 1;5,2 to 2;2,3 and 1;11,18 to 2;5,23. He found that between 85 and 100% of the utterances in these large samples could be generated by a set of 42 item-based patterns. Some examples of these patterns in English

translation are: X + *too, no + X, where + X, dirty +X,* and *see +X.* For the full list of patterns, see MacWhinney (1975a, pp. 155- 158**).**

More recently, Ingram (1979) presented an analytic framework that extended that of Braine (1976) and MacWhinney (1975a) in certain ways. Ingram first attempted to determine whether or not a given lexical item was syntactically free or bound by examining the extent to which it combined with other words. Once it was determined that an item was free, Ingram examined the words with which it cooccurred to determine if it was placed in a consistent position. In fact, most of the sentences in his two corpora seemed to utilize some form of item-based pattern. Thus, his two l-year-olds used the words *here, my, hi, a, that, want, its,* and *what* as operators before object words. The words *this* and *it* were used after action words and the word I was used before action words.

It is important to recognize that a fair test of the power of the item-based pattern concept requires a sample density that at least approaches that of Ingram (1979) and MacWhinney (1975a). There is a very simple reason for this: If an observer records only a small set of sentences, the less frequent item-set patterns may occur only once or twice. For example, in a sample of 100 sentences, the pattern X + *walk* may occur twice. However, in a sample of 1000 sentences, the same pattern may occur 20 times. On the basis of the first sample, one would not conclude that an item-based pattern was operative. However, in a larger sample, it will be clear that the X + *walk* pattern is consistent and productive.

In fact, many of the most widely cited and influential corpora in the literature (Blount, 1969; Bowerman, 1976; Braine, 1963, 1976; Gruber, 1967; Kernan, 1969; Lange & Larsson, 1973; Miller & Ervin, 1964) contain less than 300 multiword utterances per child grammar. Bloom (1970) and Brown (1973) have somewhat larger corpora, but they remain unpublished and have not been analyzed in terms of item-based patterns. Given this, it is quite remarkable that there is, in fact, much evidence at all for item-based patterns. Much of this evidence is displayed in Braine (1976) and the interested reader may wish to examine the data published there. Additional support for the importance of item- based patterns can also be found in Francis (1969) and Smoczynska (1976). However, it should be remembered that a full appraisal of the explanatory power of the item-based pattern requires very large corpora, and that in the only large corpora that have been analyzed this way, item-based patterns can account for from 85 to 100% of the multiword utterances.

Failure to Generalize. It has often been noted that, when a child acquires a new combinatorial pattern, that pattern fails to generalize immediately to all elements of a given type. Kuczaj and Brannick (1979) note that auxiliary attachment applies to *what* before it applies to *how long;* children say *what are you doing?* at a time when they also say *how long you (are) staying?* Similarly, Bowerman (1976, p. 157) noted that at 171/2 months, her daughter Eva used the patterns *want + X* and *more + X* fairly productively. However, these patterns did not generalize to other words like "open," "close," "bite," "no more," or "all gone." That is, she did not form sentences according to the pattern *open* + X. Eva's failure to produce combinations for words for which she had not yet formulated item-based patterns can be understood by viewing the item-based pattern as a way of bringing words together. Item-based patterns can facilitate not only the concatenation of morphemes, but also their integration into an overall intonational contour (Bloom, 1970; Branigan, 1979; Fonagy, 1972; Scollon, 1976).

Discontinuous Morphemes. Item-based patterns can also be used to explain the child's control of so-called discontinuous morphemes. Such "morphemes" seem to be better understood as two separate lexical items each with its own item- based positional pattern. During the process of lexicalization, which precedes linearization, these two items each facilitate the lexicalization of the other. Having been lexicalized, each is ordered in terms of its own positional patterns. For instance, in the French negative *ne pas, ne* would be placed according to the pattern *ne + verb* and *pas* would be placed according to the pattern *verb + pas.* Francis (1969, p. 298) suggests that children may have learned forms such as *look what NP Ving* (as in look what John is eating) as discontinuous units. Similarly, Bellugi (1965, pp. 128-130) and Klima and Bellugi (1966, p. 200) report a number of sentences in which these discontinuous frames appear: where go?, where going?, what doing?, and what name? Of course, these frames need not be analyzed as discontinuous morphemes. One could simply argue that they are morphemes that happen to cooccur because of natural aspects of the things children talk about.

It is important to remember that many idioms can be controlled as discontinuous morphemes; the idiom *give five* (i.e., give a slapping handshake) can be realized as *give me five,*

give your little brother five, and so on. Similarly, the combination of *think* and *over is* best treated as a discontinuous morpheme, because it has the frozen meaning of "consider," but can appear in frames like *think it over* and *think all my problems over once again. A* large array of adult items of this type is discussed by Becker (1975).

Item-Phrase Orderings. The fourth major class of phenomena that can be explained by item-bound patterns are item-phrase orderings. As Block, Moulton, and Robinson (1975), Braine (1976), and Schlesinger (1977) have noted, the concept of an item-based pattern is in no way limited to explanations of two- word utterances, because the nucleus for an item-based pattern may be a phrase. For example, in the string *my big chair,* we can say that *my is* being ordered vis a vis the phrase *big chair.* In this way, we can account not only for the generation of noun phrases and verb phrases, but also for certain interesting aspects of the ordering of interrogatives, negatives, and auxiliaries. Klima and Bellugi (1966, pp. 192, 201) and Brown, Cazden, and Bellugi (1968, p. 58) argue that in one fairly early period in the acquisition of English, all the child knows is that certain interrogatives and negatives are often ordered as operators in front of some nucleus. This nucleus may be a noun phrase, a verb phrase, or a whole clause. To relate this ordering to the notion of item-based patterns, an NP nucleus may be characterized as having the semantic feature (+ entity) (see Miller & Johnson-Laird, 1976); a VP nucleus may be said to have the feature (+ state/process/action) (Chafe, 1971); and a clause may be said to have the feature (+ predication) (MacWhinney, 1980). Abbreviating these features as *ent, spa,* and *pred,* we can formulate these item-based patterns quite simply. For the word *where,* we would have *where + ent, where + spa,* and *where + pred.* In fact, there is evidence that children use each of these patterns. Bellugi (1965, pp. 128-130) cites these examples of the *where + ent* patterns from Adam, Eve, and Sarah: *where Ann pencil?, where Mama boot?, where kitty?, where string?, where boot?, where Donna?, where my mitten?, where crayons?, where Fraser elbow?, where you coffee?, where Baby Sarah rattle?, where Mommy?, where Fraser and Cromer?,* and *where big round clock?* As these examples show, the *ent* in these cases may be either an item or a phrase. Similar patterns for *who + ent, what + ent, what color + ent, where's + ent,* and *what's + ent* from Bellugi (1965, pp. 128-130) are *who that?, what that?, what train?, what dat needle?, what color dis?, where's the wheel?,* and *what's this thing?* The reported combinations of *no* with NP's are *no cowboy* (Menyuk, 1969, p. 73), *there no squirrels, no Rusty hat, that no fish school, no money, no mitten, no a boy bed,* and *that no Mommy* (Klima & Bellugi, 1966, pp. 192, 194). The reported combinations of *not* with NP's are *not a Teddy bear* (Klima & Bellugi, 1966, p. 192), *that not "O" that blue* (Klima & Bellugi, 1966, p. 194), and *that not cowboy* (Menyuk, 1969, p. 73). Of course, formulas such as *where's + ent, there's + ent,* and *not + ent* do not necessarily lead to errors, and wherever the use of a pattern leads mostly to correct productions, we tend to see it mentioned less frequently in the literature.

There is also evidence that children formulate at least some of these interrogative and negative item-based patterns so that the nucleus is a verb phrase. In the case of *not* and contractions with *not (can't, don't, didn't, won't,* etc.), this formulation is correct. Klima and Bellugi (1966, pp. 193- 194) report correct use of *can't* and *don't* even before *can* and *do* are learned. As we noted earlier, this suggests that *can't* and *don't* are single rote items and not productive combinations. Thus, it is possible to speak of *can't + spa* and *don't + spa* as item-based patterns. Errors such as I *not touch* (Menyuk, 1969, p. 73), I *not hurt him, I not see you anymore,* and *ask me if I not made mistake* (Klima & Bellugi, 1966, p. 196) show that the positioning of *not is* not controlled simply by rote.

Children also seem to extend the permissible *not + spa* pattern to create an incorrect *no + spa* pattern. Some errors illustrating this incorrect overextension are: *no do this, I no do this, no touch,* and *no write dis* (Menyuk, 1969, pp. 71, 73); *no wipe finger, no fall, no singing song, no sit there, no play that, he no bite you, I no want envelope, I no taste them,* and *no pinch me* (Klima & Bellugi, 1966, pp. 192, 194); and *no fall* and *no put* (Brown, Cazden & Bellugi, 1968, p. 41).

There is no similarly confusing model for interrogatives that would lead to *where + spa, what + spa,* and *why + spa.* Because of this, errors of this type are quite rare, although Bellugi (1965, pp. 128-129) reports *where go?, what happen?, where put him on a chair?, what happen me?,* and *why need them more?* Some of these errors may be reduced imitations. For example, *what happen?* may come from *what's happening?* and *where go?* may come from *wherezit go?* Of course, *who + spa is* a perfectly correct pattern and forms like *who bought that?* are correctly produced at an early age (Klima & Bellugi, 1966). Eventually, the positioning of all the *wh* words may be correctly controlled by patterns such as *what + tense* and *why + tense,* because the word that follows the interrogative is always the main tense marker for the sentence.

Perhaps the most widespread error in the positioning of interrogatives is their use in patterns such as *where + pred, why + pred, why + pred, why not + pred, how + pred,* and *what + pred* without auxiliary attachment. Such patterns lead to errors such as *what they are doing?* and *where he's going?* (Menyuk, 1969, p. 76), in which the auxiliary follows the subject rather than the interrogative. There are so many reports of this type of error that a full listing would be prohibitively lengthy. Menyuk (1969, pp. 71-76) cites nine such errors; R. Brown (1968) cites about two dozen such errors throughout his article; Bellugi (1971) cites 15 errors of the *why + pred* variety; Klima and Bellugi (1966, p. 205) cite about 18 interrogative plus predication errors; Bellugi (1965, p. 129- 130) cites several dozen; Brown, Cazden, and Bellugi (1968, pp. 57-60) cite 17 errors; Gruber (1967) cites four and Hatch et al. (1979, p. 273) cite one.

As Brown (1968) notes, there are at least three possible sources for these errors. One is the adult subordinate clause. Another is a reduction of full adult questions. For example, *what you do?* (Menyuk, 1969, p. 76) could be a reduction of *what are you doing?* Finally, as illustrated by examples 3, 4, and 10- 19 the section *Evidence for Short-Term Syntactic Rote,* the nucleus of these combinations could be a rote item in short-term memory, with a pronoun or auxiliary possibly altered by what Clark (1977) calls conversion (see the section *Analogy).* The examples cited by Brown (1968) suggest that this last influence may be the most important source of this error type. However, a fuller account of this phenomenon will need to be based on the use of discourse data such as that cited by Brown (1968).

Although there are many errors involving interrogatives and misplaced auxiliaries, there are no reports of incorrect placement of interrogatives. Labov and Labov (1978) report that, in the huge collection of questions produced by their daughter, there are no errors such as *he can't do it why*. Although such errors would seem to be predicted by transformational-generative grammar, their nonoccurrence is correctly predicted by the notion of the item-based pattern.

Of course, the use of item-based patterns with whole predicates as nuclei such as *does + pred* or *can't + pred* in yes-no questions is perfectly correct. In fact, Brown, Cazden, and Bellugi (1968) report early correct positioning of these forms. Erroneous use of *no + pred is* fairly rare. The reported errors are *no picture in there* (Brown, Cazden, & Bellugi, 1968, p. 41), *no the sun shining, no square is clown* (Klima & Bellugi, 1966, pp. 192, 194) and *no books in* (Menyuk, 1969, p. 71 and 73).

Competitive Orderings. The fifth major class of phenomena that can be explained by item-based patterns are competitive orderings. So far, we have treated item-based patterns as if they were never in competition. Such a restriction is not at all necessary and there is no reason that any number of item-based patterns cannot be operative in a single utterance. However, when more than one item-based pattern is operating on a string of lexical items, there must be a way of resolving potential conflicts between patterns. Two types of conflicts can arise: reversal conflicts and precedence conflicts. Reversal conflicts occur when one pattern or group of patterns leads to the order A + B and the other produces the order *B + A.* An example of an ordering in which a reversal conflict must be resolved is the ordering of the set of items *why, did,* and *she.* Here, the item *why* has the positional pattern *why + tense* that places it before the subject of the sentence—in this case *she.* However, *did* has one pattern that places it after interrogatives *(int + did)* and another that places it after the sentence subject.

The most primitive way of improving performance is to give the *int + did* pattern a stronger vectorial weight (MacWhinney 1978, 1981b) than the *ent + did* pattern. If this is done, then *why did she?* will be the maximally satisfactory ordering and *why she did?* will be avoided. This type of solution to competition in word order is parallel developmentally to the use of allomorph strength to govern morphophonological variation (MacWhinney, 1978). A more advanced solution to this type of competition involves the formation of specific lexical links. When an interrogative occurs, the *ent + dud* pattern is specifically inhibited. Such specific inhibitions and facilitations are particularly important in the area of lexicalization (MacWhinney, in press (a)). Evidently, there is a time during the development of English when patterns of the type just discussed have either not yet been acquired or are insufficiently strong. Apart from the huge number of errors like *where he's going?* that were previously noted, there are also errors in which the auxiliary is misplaced within the nucleus. Reported errors of this type, include *what you did eat?* (Kuczaj, 1976, p. 427) and *where the wheel do go?* (Menyuk, 1969, p. 90). It is clear, however, that at some later time, patterns like *where + tense* become productive. Overgeneralization errors attesting this productivity are: *where goes the wheel?* (Menyuk, 1969, p. 73), *where could be the shopping place?,* and *where's going to be the school?* (Menyuk, 1969, p. 76); *what do wheel?, what does the truck?,* and *where went the wheel?* (Gruber, 1967, p. 41). Kuczaj and Brannick (1979) show that, in fact,

the interrogatives *what* and *where* show stronger attraction of the auxiliary than do interrogatives like *how long* or *when*. Thus, it may well be that the child eventually learns to rely on patterns like *where + tense* rather than patterns like *int + did.* However, the details of this competition still need to be worked out. In any case, it is important to realize that the acquisition of auxiliary ordering can be explained in terms of item-based patterns and that it is not necessary to invoke a transformational account (Hurford, 1975; W. R. Miller, 1973) for this ordering.

The second type of conflict that may arise between item-based patterns, or any set of independent patterns, is a precedence conflict. This occurs when one pattern specifies the order *A + B* and the other specifies the order *A + C.* If the first takes precedence, then the result will be *ABC*. If the second takes precedence, then the result will be *ACB*. For example, if the words *big, ball,* and *rubber* are lexicalized, the pattern *rubber + ent* will take precedence over the pattern *big + ent* and the result will be *big rubber ball.* In fact, as we see later, control of modifier ordering takes many years to learn. The problem is that modifier ordering is variable and the number of different modifiers is very large.

When item-based patterns are strong and simple, their precedence can be controlled without much error. One area in which item-based patterns would be particularly useful is affix ordering. In fact, affix ordering is so consistent that the morphology of the word can be reasonably well described in terms of a series of fixed positions or plots, each of which contains certain affixes (Pike, 1967). Evidently, children find this very easy to learn. We know that in English (Braine, 1963), Garo (Burling, 1959), Hungarian (MacWhinney, 1974, 1977, 1978), Japanese (Hakuta, 1979, p. 18), and Turkish (Slobin, 1973, p. 197) the ordering of affixes vis a vis the base is almost always correct, even at the youngest ages. A series of item-based patterns with affixes as operators and the base as the nucleus might well be controlling this ordering.

The control of precedence between words seems to be a far more difficult matter. It seems that for young children, the relative position of words in the sentence cannot always be determined at a single pass. Often, children need to determine the order of a nucleus of two or more words and then add on words to this nucleus. Evidence for this type of analysis comes from word-string repetition phenomena. Thus, at age 1; 11,3, my child Ross said *hot water # nice hot water,* whereas at 1; 11,5, he said simply *nice hot water* without joining *hot water* as a separate element. At the earlier date, it is almost as if he had spent so much energy saying *hot water* that he decided to say it aloud and then try to use it as a short-term memory rote basis for his next production.

As the child continues to work with these patterns, their use becomes more automatic (Shiffrin & Schneider, 1977) and unitized (Hayes-Roth, 1977). As a result, longer strings can be produced before there is any need for emptying the contents of the processor. However, studies by Jarvella (1971) and Rubin (1976) indicate that adult production and comprehension are still influenced by the clustering of operators about a nucleus. Thus, a noun with its operators constitutes a noun phrase, a verb with its auxiliaries constitutes a verb phrase, and the verb serves as a center about which the various phrases constellate (C. Fillmore, 1968). Although adult processing is fairly smooth and automatic, it still appears that precedence decisions must be made in a sequential fashion.

Strings not Attributable to Analogy. A sixth line of support for item-based patterns involves their ability to account for strings that cannot be attributed to rote or analogy. For example, an error like *no down* can be understood as an application of the pattern *no + X.* Of course, *no* cannot be combined indiscriminately and the child must learn to prune the nucleus (X) into something more like (+ entity). Similarly, *where Tim go* can be viewed as a combination of *where* and a phrasal nucleus. Note that neither *no down* nor *where Tim go* could be based on either rote or analogy. We have noted that productive use of a nonce word cannot be based on rote, although it can be based on analogy. For instance, the string *this my wug* could be based on analogy with *this my shoe*. But, then, it would be difficult to specify how *this my shoe* could be an analogy. On the other hand, both *this my shoe* and *this my wug* could be based on use of *this + ent* and *my + ent.*

Nonoccurrences. A seventh line of evidence for item-based patterns involves their ability to account for the absence of certain error types. For example, Kuczaj and Maratsos (1979) note that the errors like *gonna he go?* have never been reported, although children say *he's gonna go, he will go* and *will he go?* If analogy were an important process in syntax, we would expect to find *gonna he go* on analogy with *will he go?* However, if we attribute the placement of *will* before *he go* to an item-based pattern with *will* as its operator, it is not surprising to see that the pattern does not generalize to *gonna,* because by definition item-based patterns do not generalize to new operators. A further example of this type is cited by Bellugi (1971, p. 99). She notes that errors

like I *should put it where* do not occur, although they could be produced by analogy with I *should put it here.* However, the availability of the *where + pred* pattern serves to block this possible error type.

Evidence Limiting the Generality of the Item-Based

Pattern Concept

There are at least five major problems with the item-based pattern concept. These are that it fails to deal with (1) productive use of nonce operators; (2) pattern overgeneralization; (3) the semantics of the nucleus; (4) synchrony in development; and (5) the ability to operate on structures. Let us consider each of these five limitations in order.

Productive Use of Nonce Operators. This phenomenon has not yet been demonstrated empirically. But, for the sake of our analysis, we assume that it could be demonstrated. For example, given a new nonce item such as *narf* with the meaning "smelly and ugly," presented in the frame of the sentence *this is really narf,* we assume that the child will be able to produce the utterance *that's a narf apple?* If this were possible (and it seems reasonable to imagine that it could be), then we would have to say that the child had formed an item-based pattern for *narf + ent.* But note that, in order to formulate such a pattern, the child would have to know that positional patterns could be related to each other in terms of a system of implications (MacWhinney, 1978; Maratsos & Chalkley, 1980). Moreover, control of such a system goes far beyond the simple combinatorial strategy of the item-based pattern.

However, there is at least one other way to generate *that's a narf apple* without use of the pattern *narf + ent.* This is to use an analogy with a pattern such as *smelly + ent.* If item-based patterns are supplemented by analogy in this way, they become an extremely powerful explanatory device. Of course, such an account still begs the basic question of how the child decides what other item to choose as the basis for the analogy.

Pattern Overgeneralization. If syntax were entirely governed by item-based patterns, the acquisition of a given pattern would not be influenced by the variety or frequency of patterns of a similar structure. However, there is a variety of evidence indicating that there are item-based patterns that are in competition with certain more general patterns. For example, up to about age eight, children have trouble with the interpretation of sentences with *easy* (Cambon & Sinclair, 1974; p. 135; C. Chomsky, 1969; Cromer, 1970; pp. 401-402; Kessel, 1970, pp. 38, 49 but see Morsbach & Steel, 1976, p. 445). *Easy* requires that the patient be initialized. This goes against the prevailing *actor + action* pattern in English that is discussed in the next section. Similarly, the verb *promise* specifies that the actor of the main clause will also be the actor in the complement clause (Maratsos, 1974b). However, most verbs that take complements stipulate that the patient of the main clause will be the actor in the complement clause. In this case, the generality of the primary pattern delays full control of *promise* until adolescence (see C. Chomsky, 1969; Goldman, 1976; Kramer, Kopf, & Luria, 1972, p. 126 and compare with C. Chomsky, 1972, and Kelleher, 1973).

Synchrony in Development. A third problem with the item-based pattern is its inability to account for across-the-board changes in uses of a group of lexical items. Bellugi (1971), Klima and Bellugi (1966), and Miller and Ervin (1964) report that movement of the auxiliary to sentence initial position in yes-no questions comes in at about the same time for all auxiliaries. If initialization were learned item by item, we would not expect such simultaneity. To the degree that simultaneity occurs, we must imagine that some principle stronger than the item-based pattern is at work.

The Semantics of the Nucleus. The fourth major problem with the item based pattern as formulated in this section is that it relies on the use of a single semantic feature to characterize the nucleus. For example, the pattern *my + entity* relies on the feature "entity" as a characterization of the nucleus. In nonsemantic terms, this nucleus would be called a noun or a noun phrase. In many cases, it is clear that nouns are in fact entities. However, if the nucleus is one like *arriving late on Saturday night,* then the "entity" quality of the nucleus is far less transparent (Ross, 1972). In the next section, we see how the notion of meaning as a set of vectors can be used to increase the

explanatory power of the feature-based pattern. We see then how the expanded semantic account can also be applied to the item-based pattern.

The Ability to Operate on Structures. Perhaps the most interesting but elusive of our grammatical abilities is that of forming paraphrases (Gleitman & Gleitman, 1970). Closely related to this are the abilities to rewrite passages (Hunt, 1969), reinterpret sentences (Lashley, 1951), detect grammaticality (Gleitman, Gleitman, & Shipley, 1972), and monitor contradiction (Markman, 1979). All of these abilities seem to depend on use of a representation of the structure of the sentence that far transcends the level of the item-based pattern. Later, we discuss these abilities in greater detail.

One further type of objection that may be raised against the notion of an item- based pattern is that it requires excessive learning of individual lexical frames, and that it therefore fails to capture a series of "significant generalizations" regarding syntactic classes. However, if such generalizations are real, we should be able to detect their influence, and establish these influences as separate limitations on the power of item-based patterns.

Free Rules

The next level of complexity that must be added to our theory is the level of the free rule or feature-based pattern. The feature-based pattern differs from the item- based pattern in that both the operator and the nucleus are characterized in terms of a set of semantic features or vectors. As a result, the feature-based pattern does not depend on lexical information; rather it is lexically free.

Our discussion of feature-based patterns is in five sections. First, we consider data on the general role of an *actor + action* pattern in early English child language. Second, we consider data on a variety of other feature-based patterns in several languages. Third, we consider in detail the internal structure of the *actor + action* pattern and then the internal structures of other feature-based patterns. On the basis of this discussion, we propose a more complex account for the semantics of both item-based and feature-based patterns. Fourth, we compare the revised notions of item-based and feature-based patterns in terms of explanatory power. Finally, we consider certain problems with all semantically based positional patterns in English.

Evidence for the Actor + Action Pattern

In English, it is usually the case that, if a noun plays the role of the actor, then it usually appears before the verb. Of course, this pattern is reversed in the passive. However, the correlation seems to be good enough to induce children to formulate an *actor + action* feature-based pattern. Evidence for the reality of this pattern can be found in (1) early spontaneous productions; (2) elicited production; (3) comprehension as measured by enactment; and (4) comprehension as measured by verification. In early spontaneous productions in English (Bloom, 1970; Bowerman, 1973; Braine, 1976; Brown, Cazden, & Bellugi, 1968; Greenfield & Smith, 1976; Leonard, 1976), many children exhibit a consistent placement of the agent/actor before the action. Similar results have been reported for Finnish (Bowerman, 1973) and Swedish (Lange & Larsson, 1973). In Samoan, which has VSO order, Kernan (1969) found evidence for consistent use of an *action + agent* pattern. Throughout the preschool years, children continue to rely on this pattern and, as a result, spontaneous use of the passive is a fairly late development (Harwood, 1959; Leopold, 1953; Slobin, 1966). When called upon to describe pictures in which the object is focused and salient, even older children resist use of the passive (Turner & Rommetveit, 1967) and use the *actor + action* order. When asked to enact reversible passive sentences, children tend to choose the noun before the verb as the actor (Beilin, 1975; Bever, 1970; Braine & Wells, 1978; Chapman & Miller, 1975, p. 365; de Villiers & de Villiers, 1974; Dewart, 1972, Huttenlocher, Eisenberg, & Strauss, 1968; Maratsos, 1974a; p. 570, Sinclair & Bronckart, 1972, p. 337, Strohner & Nelson, 1974). When asked to enact NNV sentences, children choose the noun before the verb as the actor (Bates, McNew, MacWhinney, & Smith, 1980; Lempert & Kinsbourne, 1980). And, when children are asked to judge whether sentences are true or false, they seem to assume that the noun preceding the verb is the actor (Beilin, 1975; Gaer, 1969; Slobin, 1966; Suci & Hamacher, 1972, p. 44; and Turner & Rommetveit, 1967, p. 657).

A variety of evidence suggests that this pattern is not fully stable in comprehension until after the third year. Thus, for nonreversible sentences like *the door pushes the cat*, it has been found that 2 year olds fail to take the first noun as actor. This has been demonstrated both by the use of enactment (Chapman & Kohn, 1977, p. 27, Chapman & Miller, 1975, p. 365; Strohner &

Nelson, 1974, p. 570) and by various acceptability response measures (de Villiers & de Villiers, 1972, p. 307; Kramer, 1977; Petretic & Tweney, 1976, p. 205; Shipley et al., 1969; Wetstone & Friedlander, 1973, p. 738). Using the enactment technique, de Villiers and de Villiers (1972, p. 335) and Sinclair and Bronckart (1972, p. 339) have shown that 2 year olds also fail to uniformly apply the *actor + action* pattern to reversible sentences. Thus, it appears that use of the *actor + action* pattern in comprehension is fairly unstable in 2 year olds. Moreover, cross-sectional data suggest that young children rely very little on word order as a cue to the actor role, depending instead on relative potency and activity. As a result, they often enact passives correctly. However, around age 3;8, many children start to apply the *actor + action* pattern more strictly. As a result, their comprehension of passive sentences actually declines in accuracy (Bever, 1970; de Villiers & de Villiers, 1974, p. 336; Maratsos, 1974a; Sinclair & Bronckart, 1972, p. 335; and Strohner & Nelson, 1974, p. 570). Eventually the child learns to rely on both word order and semantic cues such as potency as cues to the actor role. Word order is overridden only when the morphemes associated with the passive are also present.

Evidence for Early Use of Other Feature-Based Patterns

Braine (1976) reviews much of the diary evidence for early use of feature based patterns. In English, he reviews data for six children. We have already noted that many of these children use an *actor + action* pattern. In addition, there is evidence for several other feature-based patterns. Thus, Kendall I (Bowerman, 1973) seems to have acquired a *possessor + possessed* pattern and a *located + location* pattern; Kendall II seems to have these patterns together with an *action + location* pattern and an *identified + identification* pattern; and Jonathan II (Braine, 1976, p. 34) seems to use the *possessor + possessed, modifier + modif ed,* and *located + location* patterns productively. Braine notes that the *modifier + modified* pattern is not fully congealed in Jonathan II and that Jonathan may have more specific patterns such as *size + entity*. David II (Braine, 1976, p. 44) has some evidence for use of an *action + object* pattern. In Samoan, Tofi (Kernan, 1969) uses both an *action + object* pattern and an *action + location* pattern and Sipili uses a *possessed + possessor* pattern. In English, Bates et al. (1980) have shown that children interpret VNN strings as VOS sentences, thus evidencing use of an *action* and *object* pattern.

The Internal Structure of Grammatical Concepts

Up to this point, we have treated the notion of the actor as a single unified concept. In this section, we see why this simple formulation is untenable. We examine an alternative formulation that treats grammatical categories in terms of clusters of vectors rather than single semantic features. For our present purposes, all we need to assume is that the decision to place an item into a given semantic role is influenced by a variety of converging data sources rather than some single criteria! attribute. Following MacWhinney (in press b), each of these data sources is called a "vector." There are many consequences of this analysis for language history and linguistic analysis (Bates & MacWhinney, in press). However, in this section and the next we confine our attention to the internal structure of grammatical concepts as they are reflected in positional patterns

There is evidence that the decision to treat an item as an actor in English is influenced by at least four semantic vectors: potency, mobility, causation, and perspective. Of course, there are a variety of syntactic vectors promoting the choice of a noun as an actor. These include preverbal positioning (i.e., *actor + action* patterning), placement in an agential by-clause, and postcopula placement in clefts when no other noun occurs in preverbal position. The control of these vectors is discussed later. For the present, however, we focus on the four semantic vectors. Tests of these vectors usually require manipulation of the positional pattern so that the actor does not always appear in preverbal position.

Potency. There is a fair amount of evidence that potency and/or animacy is a major attribute of the actor in English. In tests of comprehension with nonreversible sentences, it is possible to obtain evidence for use of potency as an evidential vector (MacWhinney, in press b) for the actor role. For example, given a sentence like *the ball bit the dog,* children will assume that it was the dog who did the biting. We refer to this as the "potency strategy." Very young children seem to be quite dependent on this strategy. Strohner and Nelson (1974) and Chapman and Miller (1975, p. 365) found a high reliance on the potency strategy in their 1- to 3-year-old subjects. Although Strohner and Nelson found this strategy to be strong for both 2 and 3 year olds, Chapman and Miller found some decrease in use of potency from 1;11 to 2;8.

There then follows a slow but continual decline in the use of the potency strategy from 1; 11 to 12;0. During the period from 3 to 5 years, Grimm, Scholer, and Wintermantel (1975, p. 88) working in German and Strohner and Nelson (1974, p. 569) working in English found that there was a decrease in use of the strategy for both actives and passives. However, Strohner and Nelson (1974) found that this decrease was faster for actives than for passives. Throughout the period from 6 to 12 years, children show a minimal use of the potency strategy for actives. For passives, however, the strategy has some importance at age 6, but declines in importance throughout the period (Beilin, 1975, p. 48; Grimm et al., 1975, p. 88; Powers & Gowie, 1977; and Slobin, 1966, p. 226).

The role of the potency strategy in production is more difficult to assess. In early productions, the first of two nouns is usually the most potent. Of course, it is also most often the mover, the causer, the topic, and so forth. Because these roles are confounded in spontaneous production, researchers have relied on preference judgments and sentence completion tasks as indices of possible production biases. Sentence completion studies by H. Clark (1965), Jarvella and Sinnott (1972), and Kail and Segui (1978) show that older children and adults prefer sentences that begin with potent nouns. Dewart (1975) asked children to choose referents for nonsense words in NVN sentences. She found that 3 year olds had a very strong bias towards choice of an animate referent for the first noun but that this preference was somewhat less in 5 year olds. This decline in reliance on the dimension of animacy or potency parallels the decline found in the studies of sentence comprehension.

Mobility. In a series of studies, Huttenlocher and her associates (Huttenlocher et al., 1968; Huttenlocher & Strauss, 1968; Huttenlocher & Weiner, 1971) have shown that 9- and 10-year-old children comprehend sentences most readily when the noun that is placed in the role of actor by the syntax is also mobile. Dewart (1972, p. 201) replicated the results of Huttenlocher et al (1968) and found that 5 and 6 year olds made more errors in understanding sentences when the actor was immobile than when no context was given.

The importance of motion as an aspect of the actor role can also be assessed by comparing treatment of moving and nonmoving participants. Braine and Wells (1978) have shown that children's judgments regarding semantic roles are more consistent for actors than for experiencers. And Leonard (1976) has shown that very young children assimilate new teens to the actor role before they assimilate them to the experiencer role.

Causation. Anderson (1976) has argued that the prototypical actor is the causal agent of the transitive clause—that is, the ergative. In fact, Schieffelin (1979) reports that children learning Kaluli, an ergative language, almost never overgeneralize the ergative to the noncausal actor—that is, the absolutive in intransitive clauses. This suggests that the notion of causality is particularly clear to at least some very young children, and that they find it easy to relate this concept to specific surface devices.

Perspective. Dewart (1975, cited in Cromer, 1976, p. 307) found that 3 and 4 year olds who did not know the passive could be induced into a correct interpretation of passive sentences by setting up a prior perspective. For example, given the sequence *bad duck # the cat was bitten by the duck,* children would choose the "duck" as the ator in the enactment task. Alternatively, given the sequence *poor cat # the cat was bitten by the duck,* children would still choose the duck as the actor. However, these same children were unable to correctly enact passive sentences without this perspective cue.

In the Dewart experiment, the preamble serves to establish either an active perspective *(bad duck)* or a passive perspective *(poor cat).* This perspective is then maintained into the next clause. MacWhinney (1977) suggested that the starting point of a sentence establishes a perspective that is then maintained until it is overtly canceled by some new perspective. At each juncture, the perspective will be assumed to be the actor unless otherwise marked. In a sentence like *Bill was told by Tom that his picture was hanging in the Post Office,* neither "Bill" nor "he" are actors. However, the perspective of "Bill" seems to be maintained enough for most speakers to establish its identity with "he." As we note later, perspective maintenance is one aspect of a general parallel-function strategy (Sheldon, 1974). This effect of perspective maintenance seems to be of particular importance between clauses within a sentence. In particular, perspective maintenance seems to be involved in the interpretation and production of relatives, complements, and conjoined clauses. Of course, perspective maintenance is not the only factor involved in the processing of complex sentences. However, as we see later, there is reason to believe that English- speaking

children often attempt to process complex sentences by assuming the perspective of the first preverbal noun.

The first major area where perspective maintenance has been studied is in the interpretation of relative clauses. In a variety of experiments, children have been asked to enact sentences like these:

21. SS: The dog that chased the cat kicked the horse.
22. SO: The dog that the cat chased kicked the horse.
23. 00: The dog chased the cat that the horse kicked.
24. OS: The dog chased the cat that kicked the horse.

The perspective maintenance hypothesis holds that, in terms of ease of enactment, the sentences should be ordered in this way: SS > 00~0S > SO. The explanation for this ordering is as follows: Sentences of the SS type can be correctly interpreted without conducting any perspective shift. Both 00 and OS sentences require a single perspective shift. Thus, in the 00 type, the shift occurs once the NN sequence is encountered. In the OS type, the shift occurs when the object noun (i.e., "the cat") is followed by a relative pronoun. In both cases, there is a surface syntactic cue signaling a perspective shift. Both 00 and OS are, therefore, predicted to be harder to understand than SS. However, SO sentences should be the hardest of all because they require a double perspective shift. The first shift, from "the dog" to "the cat," occurs upon detection of an NN sequence. Then, following "chased," the child must return perspective to the dog. Because of this double perspective shift, SO is predicted to be harder than OO, OS, or SS. Thus, the five specific predictions are: SS > 0S, SS > 00, SS > SO, OS > SO, and OO > SO. Some of these predictions are also generated by alternative hypotheses such as the parallel-function hypothesis (Sheldon, 1974), the adjacency principle (Sheldon, 1977b), the "bird-in-the-hand" approach (Legum, 1975), the avoid-interruptions principle (Slobin, 1973), the first-NPas- agent strategy (Bever, 1970), the conjoined-clause hypothesis (Tavakolian, 1978), and others. However, the particular set of five predictions just given is unique to the perspective-shift hypothesis.

The data from the various enactment studies support these predictions quite strongly: (1) the superiority of SS over OS is supported by Aller, Aller, and Trover (1979), H. Brown (1971), Ferreiro, Othenin-Girard, Chipman, and Sinclair (1976, p. 237), Fluck (1977, p. 62; 1978, p. 195), Lahey (1974, p. 665), Legum (1975, cited by Sheldon, 1977 9 p. 54), Sheldon (1974a), and Tavakolian (1978); (2) the superiority of SS over OO is supported by Brown (1971), Ferreiro et al. (1976, p. 237), Grimm et al. (1975, p. 124), Legum (1975), and Tavakolian (1978); (3) the superiority of SS over SO is supported by Aller et al. (1979), Brown (1971), de Villiers, Tager-Flusberg, and Hakuta (1977), Ferreiro et al. (1976), Grimm et al. (1975, p. 124), Legum (1975), Sheldon (1974, 1977a), and Tavakolian (1978); (4) the superiority of OS over SO is supported by Brown (1971), de Villiers et al. (1977), Ferreiro et al. (1976), Legum (1975), Sheldon (1974, 1977a), and Tavakolian (1978); and (5) the superiority of OO over SO is supported by Aller et al. (1979), Brown (1971), de Villiers et al. (1977), Ferreiro et al. (1976), Legum (1975), Sheldon (1974, 1977a), and Tavakolian (1978).

The only exceptions to the five predictions of the perspective-maintenance hypothesis are failures to find sign)ficant differences. There are no sign)ficant reversals. Aller et al. failed to find SS superior to OS or OS superior to SO; de Villiers et al. failed to find SS superior to OS or SS superior to OO; and Sheldon failed to find SS superior to OO. In each case, the failure to find the predicted relations could be interpreted as the result of a ceiling effect. Therefore, no true counterinstance to the perspective-maintenance hypothesis for the enactment of sentences with relative clauses has yet been detected.

However, using a task that measured latency to comprehension, Foss, Bias, and Starkey (1977) were able to show that OO sentences could be processed faster and with fewer mistakes than SS sentences. Given sentences like examples 21 or 24, children were asked "Who kicked the horse?" Latency to response was taken as a direct measure of comprehension. Foss et al. interpreted their results as supporting Slobin's (1973) proposal regarding the listener's tendency to avoid interruptions. The longer latency in SS sentences is then attributed to the separation of the subject of the main clause from its verb. One way of reconciling the results of Foss et al. with the results of the enactment studies is to view relatedness as previously discussed as of greater importance during the initial processing of a sentence and perspective (another predisposition) as of greatest importance during the imitation and/or subsequent reenactment of the sentence.

By way of an aside, it is important to recognize that these results regarding perspective maintenance are limited to the comprehension of sentences when no context is provided. Ferreiro et

al. (1976, p. 250) have found that comprehension can be greatly facilitated by providing a motivation for use of the relative clause. For example, if the child is shown two people, one who paints self-portraits and one who is chased by a dog, it is reasonable to ask the child to act out the sentence *the person the dog chased climbs a ladder.* In such a framework, comprehension is greatly facilitated. This distinguishing or specifying function of the relative clause is also evident in production. There, Limber (1976, p. 315) and Menyuk (1969, p. 16) find that OO and OS relatives emerge before SO and SS types. Limber argues that this is because the object of the matrix sentence is more foregrounded than the subject and more in need of specification. Thus, although SS seems to be easily processed, sentences of the OS type seem to fit in more closely with overall discourse patterns.

The second area in which perspective maintenance seems to be important is in the interpretation of the actor in complement clauses. Some of the structures involved are as follows:

25. The lion wanted to go.
26. The lion wanted the pig to bump into the horse.
27. John promised Bill to go.
28. John criticized Bill for leaving too soon.
29. John apologized to Bill for leaving too soon.
30. John hit Bill standing on the platform.
31. John saw Bill standing on the platform.
32. Standing on the platform, John hit Bill.
33. The lion jumped over the pig to stand on the horse.

As a number of writers have discovered (C. Chomsky, 1969; Garvey, Caramazza, & Yates, 1975; Goodluck & Roeper, 1978; Grober, Beardsley, & Caramazza, 1978), the choice of an actor for the complement clause in these sentences is largely dependent on the identity of the main verb. As we noted earlier, it is reasonable to imagine that each verb has associated with it a set of expectations for various roles—for example, *promise* has a frame for a person who received the promise. This role follows the verb according to the positional pattern *promise + promissee*. The verb also determines whether or not the actor of the main clause will be maintained into the complement clause. The verb *criticize,* on the other hand, works to shift perspective to the person being criticized. The verb *want* shifts perspective, but only if another perspective is available. Verbs like *jump* and hit, as in examples 31 and 32, do not seem to have any such frames.

The perspective-maintenance hypothesis suggests that, in English, children assume that the perspective of the main clause is also the perspective and actor of the subordinate clause unless the perspective is expressly shifted to another noun. In fact, Tavakolian (1978, pp. 77,80) has found that 3 year olds interpret sentences like numbers 26 and 33 according to the perspective-maintenance principle. However, after this early period, children begin to learn that perspective maintenance is violated for the complements of many verbs. Goodluck and Roeper (1978) argue that this learning occurs verb by verb even when general semantic principles are available. Of course, perspective maintenance is never challenged in structures like numbers 25 and 32 and errors seldom arise for these forms. In the adult grammar, perspective maintenance is only challenged in the cases of sentences like numbers 26, 28, and 31. However, because number 27 is like 26, and because number 29 is like 28, and because number 30 is like 31, the weight of syntactic analogy seems to draw the perspective-maintenance principle into doubt in all but numbers 25 and 33. In any case, the child must eventually come to rely on word-by-word learning of complement restrictions, except for structures like numbers 25 and 33.

The third major area in which perspective maintenance seems important is the processing of gaps in conjoined clauses. Conjoined clauses have been studied in terms of imitation, production, and comprehension. There is evidence (Lust, 1977) that children find sentences like numbers 34 and 35 easier to imitate than sentences like numbers 36 and 37:

34. Kittens hop and * run.
35. Mary cooked the meal and * ate the bread.
36. The kittens * and the dogs hide.
37. John baked *, and Mary ate the bread.

In these sentences, the phi symbol indicates where there is missing information. In numbers 34 and 35, this missing information can be filled in by looking back in the sentence; these are anaphoric gaps. In numbers 36 and 37, the gaps must be filled by looking forward in the

sentences; these are cataphoric gaps. In particular, the gaps in sentences 34 and 35 can be filled by maintaining the initial perspective without any shift. The perspective-maintenance hypothesis holds that sentences 34 and 35 should be easier to imitate than 36 and 37. Moreover, children should simplify the dual perspectives in 36 and 37 by expanding them to 38 and 39, respectively:

38. The kittens hide and the dogs hide.
39. John baked the bread and Mary ate the bread.

No such expansion is predicted for sentence 40, because there is no split in perspective. In fact, sentence 41 will likely be reduced to 40:

40. Give me the oranges and * the apples.
41. Give me the oranges and give me the apples.

These predictions of the perspective-maintenance hypothesis have been supported in studies of elicited imitation by Beilin (1975), Lust (1977), and Slobin and Welsh (1973). A study by de Villiers et al. (1977) also examines imitations of coordinate structures. However, the data are not reported by individual sentence type and the relative ease of sentences like numbers 34 to 41 cannot be directly determined.

In the area of the production of conjoined clauses, there are three recent studies. Lust and Mervis (1978) analyzed a corpus of 435 spontaneously produced coordinate structures. They found that 84% of the phrasal coordinations reflected the anaphoric reduction pattern. In a study of elicited production, Ardery (1979) found that children's coordinations were mostly of the types found in sentences 34, 35, and 40. In another elicited production study, Greenfield and Dent (1979) found that children used virtually no cataphoric gapping at all. Greenfield and Dent interpret this finding in terms of the fact that only anaphoric deletion serves to decrease redundancy. This account seems quite reasonable. Thus, it seems necessary to view redundancy elimination as complementary to the role of perspective maintenance in the processing of coordination. In general, the data gathered by these three studies of production seem to be congruent with the data gathered by studies of elicited imitation.

In the area of comprehension, coordinate structures have been examined principally in terms of the choice of a referent for the pronoun in the second clause of sentences like numbers 42 to 47:

42. The camel hit the lion, and then he hit the elephant.
43. The camel hit the lion, and then HE hit the elephant.
44. The camel hit the lion, and then the elephant hit him.
45. The camel hit the lion, and then the elephant hit HIM.
46. The camel hit the lion, and then he kicked him.
47. The camel hit the lion, and then HE kicked HIM.

The interpretation of sentences 42, 44, and 46 by adults is governed by the parallel-function principle, which can be stated as a generalization of the perspective-maintenance principle. The perspective-maintenance principle holds that the perspective of the main or first clause will also be the perspective of the subordinate or conjoined clause, unless perspective is expressly shifted. The parallel-function hypothesis (Akmajian, 1979; Grober et al., 1978, Sheldon, 1974) holds that the pronominal or missing referent in a second or subordinate clause will be identified with the noun that serves a parallel function in the main clause. This principle works to establish referents in sentences 42, 44, and 46. Tavakolian (1978) has shown that children do not care whether the second referent in a sentence like number 42 is pronominalized or ellipsed. In both cases, they interpret the sentence through perspective maintenance. N. Chomsky (1971) and Maratsos (1973) have shown that the parallel-function strategy is widely used by 3 and 4 year olds for sentences 42 to 47. By age 5, Maratsos (1973) found that some children could use contrastive stress, as in 43 and 45, to correctly shift reference. However, these children did better with sentences like numbers 45 than 43. This suggests that perspective maintenance as a particular type of parallel- function strategy may be a stronger than parallel function in general. Recently, Solan (1979) has examined the comprehension of sentences like 42 to 47 in 5 to 7 year olds. In this age group, parallel function seems to have lost its clear force and children actually do better on stressed sentences like numbers 43, 45, and 47 than on unstressed sentences like 42, 44, and 46. These surprising findings suggest that children may be engaged in the acquisition of some general sentence-

processing strategies during this period that operate on the structure of the sentence as a whole. One possibility is that children develop a means of representing the sentence as a formal object in working memory. Having done this, they can then acquire transformations that operate on the sentence as a whole.

Interaction of Vectors. To summarize this section, up to this point, we can say that there is evidence that children's use of the actor concept involves a vectorial convergence of syntactic and semantic data sources. Prototypically, the element chosen as the actor is supported by a strong combination of the vectors for potency, mobility, causation, and perspective. In production, such an element will be placed before the verb. Conversely, in comprehension, the children generally assume that the element before the verb is the one that has potency, mobility, causation, and perspective. Eventually, children also learn to counterbalance the word-order vector by a vector for the passive morphemes when those morphemes occur.

Other Grammatical Categories. Bates and MacWhinney (in press) have suggested that this type of analysis can be extended to grammatical concepts in general. Thus, one could speak of the vectors present for a prototypical verb (Bloom, Lightbown, & Hood, 1975; Bowerman, 1973, p. 210; Leonard, 1976); those for a prototypical direct object (Bowerman, 1973, p. 208, 1978; Braine & Wells, 1978); a prototypical instrument (Duchan & Lund, 1979, p. 243); a prototypical locative (Braine & Wells, 1978); a prototypical past tense (Antinucci & Miller, 1976; Bronckart & Sinclair, 1963); and a prototypical modifier (Richards, 1979, p. 225).

However, in English, for these particular concepts, only the *action + object* and *modifier + modified* patterns are conventionalized word-order patterns. The acquisition of modifier ordering before the noun in English is particularly interesting, because nouns may be preceded by long strings of adjectives. Several writers have noted that adjectives seem to be ordered along some general semantic dimension. Sweet (1898) called this "denotativeness"; Martin (1969) called it "definiteness"; Bever (1970) called it "nouniness"; and Danks and Glucksberg (1972) called it "intrinsicalness." These dimensions are clearly related to the tendency for some modifiers to be placed closer to the noun. However, it is doubtful that full adult control of adjective ordering can rely on this predisposition. Quirk, Greenbaum, Leech, and Svartvik (1972, p. 267) have suggested that adjective ordering could be controlled by something like a set of feature-based patterns that place adjectives in this order: (1) intensification; (2) number; (3) subjective measure; (4) size or shape; (5) age; (6) color; (7) material; and (8) provenance, or material. For example, ordering of *big, rubber,* and *ball* would rely on use of the pattern *size + material,* as well as the general *modifier + modified* pattern. In fact, Richards (1979) presents data suggesting that 4 and 5 year olds may not yet be in control of the full set of particular patterns like *size + material* and *numeral + age.* Both Richards (1979) and Scheffelin (1971) show that the most basic patterns begin to emerge after age 5, but Martin and Molfese (1972) show that even by age 14 adolescents had not mastered the full adult system. The general pattern that seems to emerge from these studies is one of the slow acquisition of a series of particular feature-based patterns for the different types of adjectives.

However, some of the data presented by Bever (1970) and Richards (1979) seem, at first, to contradict this interpretation. Bever (1970) found that 3 year olds had essentially adult-like preferences for adjective-order retention in imitation. However, Bever's methodology has been strongly criticized by Martin and Molfese (1972) and Richards (1979), both of whom also present data contradicting Bever's findings. At the same time, Richards (1979) reports that 3 year olds are more like adults in their production of adjective strings than are 4 and 5 year olds. Although Richards presents few examples of 3-year-old adjective strings, it may well be that they include many rote orderings such as *big fat, little round,* and *nice clean.* By using rote, 3 year olds could appear to have adult- like rules, whereas 5 year olds might be attempting to string adjectives together without knowing the various feature-based rules that govern their combination.

Reformulation of the Notion of a "Feature." In the preceding section, we examined in detail the internal structure of the actor category and considered briefly several other categories that figure in free rules. These facts suggest that a fundamental revision be made in the way that both item-based and feature-based patterns were previously defined. For the item-based pattern, the revision is that the semantics of the nucleus should be represented by a set of semantic vectors. For the feature-based pattern, both the operator and the nucleus are defined as a set of semantic features that interact in a vectorial fashion.

Item-Based Patterns Versus Feature-Based Patterns

We are now in a position to compare the relative generative power of item based and feature-based patterns. The main point to observe is that, if we allow analogy to operate on item-based patterns, they start to resemble feature-based patterns. Thus, a child could produce *narf apple* on analogy with *red apple.* But, as King (1969), MacWhinney (1975b), and many others have argued, the problem with analogy is that it fails to tell us how the speaker selects the form to serve as the basis of the analogy. The power of the feature-based pattern is that it can account for productivity and error without ad hoc recourse to analogy.

However, in the case of certain pseudopassive verbs like *receive* and *belong,* there is some reason to prefer an item-based account of word ordering to a feature- based account. For example in sentences like numbers 48 and 49, the word before the verb is not as much an actor as the word following the verb:

48. Mary received a letter from lane.
49. The tree belongs to Tim.

For such verbs, item-based patterns like *recipient + receive* and *object owned + belong* could successfully control word ordering. Because fairly young children are able to successfully control the syntax of *please, like, own, belong, take,* and *receive* (Maratsos & Chalkley, 1980), it is likely that at least some item-based patterns are being used.

Inadequacies of All Semantically Based Positional

Patterns

Both the item-based pattern and the feature-based pattern involve the prediction and control of word order on the basis of the semantic properties of the words being ordered. Item-based patterns are bound to specific lexical items, whereas feature-based patterns are lexically free. It is also possible to imagine a type of rule that is bound not to a single lexical item, but to a whole network or class of lexical items. Such a rule type is involved in the control of systems such as the marking of gender (i.e., declension) on the German article (MacWhinney, 1978). In fact, many morphophonological systems make extensive use of rules with different degrees of binding to lexical structures. However, it remains to be seen whether syntax also shows nonsemantic lexical classes of this type. If there exist word classes that have no consistent or usable semantic bases, then it is clear that no combination of predispositions, item-based patterns, and featurebased patterns can be fully sufficient as an account of syntactic combination. Rather, we need to consider a way in which arbitrary cooccurrence classes can be acquired and utilized. What evidence is there, then, for the reality of nonsemantic classes in syntax?

Nonsemantic Class-Bound Positional Patterns

There seem to be at least four types of evidence that can be cited in support of the inadequacy of semantic classes and the need for nonsemantic classes. These four are: (1) category interpenetration; (2) lack of privileges for the prototype; (3) deduction of class membership; and (4) the ability to operate on surface structure. Let us examine each of these four types of evidence.

Category Interpenetration

Maratsos and Chalkley (1980) argue that there is a class of "process" adjectives like *variable, fond, nice, noisy,* and *aware* that are semantically indistinguishable from process verbs like *vary, like, treat well, make noise,* and *know*. Given this extreme overlap of categories, one would expect to find errors like *he fonds the dog* and I *am like of him.* Maratsos and Chalkley argue that, because such errors are vanishingly rare, there must be a firmer basis for the separation of adjectives from verbs than the semantic features (+ state) and (+ process). Following Braine (1963, 1971), they suggest that this firmer basis is a reliance on the network of semantic-distributional patterns that constitutes a class. Adjectives can occur in the frames: be , is , NP, and so on, whereas verbs can occur in the frames: ed, am ing, and will . According to Maratsos and Chalkley, the basis for the separation between classes is not some semantic feature or set of features, but the facts of correlated distributional uses.

Before considering Maratsos and Chalkley's basic argument regarding category interpenetration, we should note some facts about the behavior of these borderline "process" adjectives. When words like *fond, nice,* and *aware* stand alone as prenominal modifiers or predicate adjectives, they act as states. However, when they are combined with particles, they act more nearly like processes. For example, we can say that *Mary is a fond mother* or we can say *Mary is fond of Mark.* In the former case, the stative qualities of *fond* are emphasized, whereas in the latter case, the processual qualities are focused. Formally and semantically, these adjectives seem to form a third class at the border between states (adjectives) and processes (verbs). In general, adjectives of this type indicate a state that arises from and gives rise to a process—for instance, a noisy door often makes noises and nice parents often' treat their children well. Furthermore, note that verbs like *consist (of)* and *compare (with)* also require particles and also have a similar process/state ambiguity.

This ambiguity in the stative quality of certain adjectives is important to the interpretation of a further supporting argument offerred by Maratsos and Chalkley. They note that one can say *be obnoxious* and *be nice to Bill.* They reason that the use of *be* in such phrases cannot be governed by the feature (+ process), because that would mean that a process was being treated as a state by the copula. However, a somewhat different semantic analysis of the adjectives suggests a different interpretation of these phrases. According to this account, adjectives like obnoxious and nice involve a process that characteristically places the actor into a state. Thus, by committing certain disagreeable acts, a person enters into the state of being obnoxious. If we say to someone *be obnoxious,* we mean for that person to commence those actions that will lead towards entry into the state of obnoxiousness. Thus, the copula is in fact referring to a process, even though the adjective itself refers, at least in part, to a state.

Returning now to the basic argument regarding category interpenetration, it is important to recognize that, on some level, the semantics *of fond* and *like* show a real overlap. However, speakers seem to be able to deal with this problem by "stativizing" *fond* and "processualizing " *like.* In the next section, we discuss how this might be achieved.

Deduction of C/ass Membership

There is reason to believe that acquisition of the semantics of lexical items depends heavily on their appearance in specific syntactic contexts. When adults hear the sentence *this is narf,* they know that *narf* must be a modifier. That is, they know that *narf* describes some characteristic of certain entities. Thus, it is clear that adults can use semantic-distributional frames such as *this is* + X to infer aspects of the semantics of lexical items. Moreover, there is good evidence that young children can make similar inferences. For example, at age 1;11, my son Ross referred to his sleeper as a *warm;* he would say *no warm, want warm,* and *my warm.* In these utterances, the word *warm* occurs in an item-based pattern that requires an entity as a nucleus. It seems, then, that Ross assumed that *warm* was the name for a sleeper. This is not surprising, because he learned the word at 1;10,16 from my utterance *this is warm.* Although an adult would recognize that the absence of an article meant that the word was an adjective or a mass noun, Ross failed to detect the missing article and ended up treating *warm* as a count noun. Errors of this type are quite frequent (MacWhinney, 1974) for very young children, because the exact shape of the major syntactic frames has not yet been fully determined. These errors underscore the importance of this deductive process at even the youngest ages. However, it is important to distinguish the deduction of semantic features from the deduction of arbitrary formal class. MacWhinney (1978, p. 48) found that the ability to deduce arbitrary formal class may not emerge until age 5. The ability to deduce semantic content, on the other hand, is evidenced even before 2;0.

Lack of Privileges for the Prototyp

Prototype theory, according to Maratsos and Chalkley (1980), predicts that central instances of a category will enjoy more privileges of occurrence than noncentral instances. However, in English, peripheral adjectives like *obnoxious* can occur in even more frames than core adjectives like *red.* Thus, according to Maratsos and Chalkley, prototype theory seems to be violated. The problem with this argument is that prototype theory is not committed to this particular identification of the operative prototypes with the traditional parts of speech. Rather, it is necessary to talk about prototypes as they relate to specific positional patterns in specific languages. Thus, as previously noted, English syntax tends to distinguish process-initiating statives like *noisy* from pure statives like *red.* Moreover, in the case of modifiers, syntax makes fine distinctions between

provenance shape, quality, etc. (Quirk et al., 1972). In general, then, one must know what syntactic rules are involved with what semantic structures in order to state how prototypes should operate for a given language.

A somewhat different version of this same argument has been advanced by Kuczaj, Maratsos, Fox & Chalkley (1979) in regard to the acquisition of the English past tense. If the past suffix had the frame *verb + ed,* Kuczaj argues, then we should expect that this rule should apply earlier to verbs that are more prototypically "verbal" than to verbs that are less prototypically verbal. Following this line of reasoning, we would expect errors like *breaked* and *hitted* to appear earlier than *thoughted* or *knowed.* However, no such difference between action verbs and mental-process verbs actually appears in Kuczaj's data. Thus, this version of prototype theory fails to receive support.

The problem with this line of analysis is the same as the problem with Maratsos and Chalkley's analysis of adjectives" privileges of occurrence. In both cases, prototype theory is assumed to relate only to the traditional parts of speech. However, the version of prototype theory that was presented in the section *Free Rules* assumes no such relation. Rather, each item-based or feature- based pattern stipulates its own set of semantic vectors. The past-tense positional pattern stipulates a feature set like (+ process, + mental activity), whereas the present progressive *be + ing* stipulates (+ action) and excludes (+ mental activity). For example, we can say I *wanted,* but not I *am wanting.*

The arguments presented by Maratsos and Chalkley and Kuczaj on this issue are of real importance. They show that one very simple version of prototype theory will fail to account for certain aspects of even the earliest stages of language acquisition. However, these arguments seem to be reasonably well addressed by the notions of item-based and feature-based patterns, as they have been presented in this chapter. Moreover, syntactic devices that operate on standard categories should be sensitive to the prototype structure of those categories. For example, Sinclair, Sinclair, and deMarcellus (1971), and Turner and Rommetveit (1968) have found that passives are first acquired for active verbs and causal subjects.

The Ability to Operate upon Surface Structure

Eventually, all school children learn to perform operations upon sentences. They learn to parse sentences into phrases and clauses, to rewrite according to specifications, to perform specific transformations, and to make judgments regarding synonymity, ambiguity, and acceptability. These skills could conceivably operate on semantic classes. However, it seems likely that, at some point, the child uses his or her knowledge of formal classes to achieve a full structural representation of the sentence. The control of contrastively stressed pronouns (Solan, 1978), clefts, dislocations, adjective reorderings (Schwenk & Danks, 1974), passives (Olson & Nickerson, 1977), and raising transformations may require the child to represent the sentence as a whole and then to operate on this representation. It seems likely that this representation would make use of information about formal classes. However, an examination of this possibility lies outside of the scope of the present chapter.

SYNTAX AND MORPHOPHONOLOGY: AN ANALOGY

Application

In MacWhinney (1978), the language-acquisition device was interpreted in terms of three types of processing: application, monitoring, and acquisition. The present chapter has focused on the system of application. We have examined a set of six strategies in string formation and have found that none is sufficient to account for syntactic development, but that each is necessary. The six strategies are rote, analogy, predispositions, simple bound rules, free rules, and class-bound rules. Each of these six strategies corresponds to one of the six strategies in morphophonological application that were proposed in MacWhinney (1978).

In both systems, rote involves the use of a multimorphemic string as a single unit. Morphophonological rote involves single complex words whereas syntactic rote involves word strings. However, from the child's point of view, this distinction is moot. In morphophonology, analogy uses the sound structure of some rote form as a guide to the sound structure of some new form. In syntax, analogy uses the morpheme order in some rote unit as a guide to the placement of some new material into a similar string.

In combination, both morphophonology and syntax are subject to predispositions. In morphophonology, predispositions derive from phonology. They include both phonotactic rules (i.e., morpheme-structure conditions) and segment-structure conditions. In syntax, predispositions relate to the sequencing of lexicalization decisions. Both morphophonology and syntax also make use of free rules. In morphophonology, these rules change segments or features without regard to lexical information. MacWhinney (1978) speaks of these free rules as "modifications." In syntax, free rules are the feature-based positional patterns previously discussed. Both morphophonology and syntax also make use of bound patterns. In syntax, the item-based pattern is bound to a lexical item. It specifies a choice between prepositioning and postpositioning in a given context. In morphophonology, selections are bound to specific lexical items. They specify a choice between allomorphs of a morph in a given context. The fourth class of combinatorial pattern, the class-bound rule, corresponds to the paradigmatic selection in morphophonology. In syntax, class-bound rules are governed by the classes traditionally known as the "parts of speech." In morphophonology, class- bound rules are governed by membership in declensional and conjugational classes. Table 3.1 summarizes the analogy between morphophonology and syntax. For a fuller characterization of rule types in morphophonology, the reader should consult MacWhinney (1978). For additional discussion of the consequences of the analogy, consult MacWhinney (in press a).

TABLE 3.1
Levels of Application in Morphophonology and Linearization

	Morphophonology		*Linearization*	
Process	*Level-Specifc Term*	*Example*	*Level-Specific Term*	*Example*
Rote	Amalgam	*jumped*	Amalgam, idiom, phrase	*short shrift*
Analogy	Analogy	*narves* (on *scarves)*	Replacement, analogy	*gonna he go*
Predisposition	Phonotactic constraints	voicing assimilation	Lexicalization order	"infommativeness"
Free rule	Modification	vowel harmony	Feature-based pattern	*actor + action*
Bound rule	Selection	*wife, wives*	Item-set pattern	my
Class-bound rule	Paradigmatic selection	*den Mann*	Formal phrase structure	"part of speech"

We see, then, that each of the six basic strategies in syntax corresponds to a basic strategy in morphophonology. On the basis of this analogy, we might risk the following speculations: In any given problem domain (at least in language and related domains), solutions can be formulated by rote, analogy, or combination. Within combination, predispositions will operate between structural/ information-processing levels. They will force more abstract levels to adapt to the constraints of processing more concrete levels. All domains will also make use of free rules and bound rules. Finally, in many domains, we should expect to encounter class-bound rules that operate on formally defined classes of items. These six levels and their interactions should be operative in a wide variety of domains, including spelling, phonology, composition, drawing, semantics, and mathematics.

If we were to extend the analogy given in Table 3.1 to phonology and lexical semantics (what MacWhinney, in press a, calls "lexology"), we might expect to find something like the analysis that is presented in Table 3.2. In the case of phonology, rote would lead to the use of phonological idioms, such as those first reported by Leopold (1949). Analogy would rely on some well-learned word or canonical form to serve as the basis for other productions. Predispositions would impose articulatory constraints on segmental structures. The various levels of

TABLE 3.2

Levels of Application in Phonology and Lexology

	Phonology		*Lexology*	
Process	*Level-Specific c Term*	*ExampleLevel-Specific c Term*		*Example*
Rote	Phonologieal idions	pretty	Amalgams, portmanteaus	"dogs"

Analogy	Extension by canonical forms	spoon -> pu based analogy	Semantically	deer, fish
Predispositions	Phonetic constraints	segment structure	Natural construal	under -> in
Free rules	Target modifications	VOT agreement, conflation	General construal, agreement	subject-verb
Bound rules	Feature assimilations, allophony	nasal assimilation	Selections, homonymy	red -> Communist

combinatorial rules would affect either segments, features, or the target values of the motor movements underlying features.

In lexology (i.e., the semantics of lexical combinations), rote would select a lexical amalgam to refer to an exactly matching referent (Carey, 1978, p. 289). Analogy would produce a combination on the basis of a complex amalgam with a similar meaning. Predispositions would be natural tendencies towards specific construals (E. Clark, 1973; G. Miller, 1978). On the various levels of combinatorial rules, construal patterns would select between alternative readings of specific lexes. Further ideas regarding the application of rote, analogy, and combination in lexical semantics can be found in MacWhinney (in press a).

Acquisition

This section outlines the central processes in form acquisition and sketches out informally the major predictions that arise from the hypothesized analogy between morphophonology and syntax. These processes and predictions are discussed in relation to the three major strategies in application: rote, analogy, and combination. For details regarding the specific predictions, see MacWhinney (in press, a).

In syntax, as in morphology, the child will acquire items that: (1) are intonationally salient; (2) comprise entire intonation units; (3) refer to aspects of activities or perceptions that are important to the child; (4) are produced in the context of a clear referent within the situation; (5) are not too long; and (6) do not involve too many phonological structures outside of the child's control. Once a rote phrasal unit is acquired, the child may begin to subject it to semantic analysis. If this analysis is successful, an attempt at lexical/morphemic analysis may soon follow. In particular, children will attempt to analyze rote strings when they contain embedded semantic clusters that they want to use.

The continued use of an unanalyzed rote string will be promoted by several factors. If the item is semantically unanalyzable or opaque (i.e., *short shrift),* there will be a tendency to preserve the unit as a whole. If it is used frequently, it will be maintained and its latency to lexicalization will decrease to a certain floor value. In general, rote items will be able to preserve all sorts of phonological, semantic, and syntactic irregularities against the pressures of analysis and regularization.

Children may also acquire rote forms out of their own combinatorial productions. This will occur when a given combination is used so frequently that its unitization facilitates processing in both comprehension and production.

Analogy

When children do not have rote forms to express certain meanings, they may produce word strings by analogy. However, in English syntax, most analogies will lead directly to the emergence of new combinatorial rules. In a few areas of irregular syntax, such as the use of archaisms and idioms, analogy may continue to be important. In general, analogies that rely on long-term storage will involve only a few words. However, analogies that work on items in short-term memory may be somewhat longer.

Combination

Combinatorial patterns will be acquired both receptively and expressively. The basic data for expressive acquisition will be the use of order information in parsing. Patterns that are initially

formulated for reception will soon be transferred to expression. However, this transfer is not automatic. Frequent, highly consistent patterns that are central to parsing will transfer most quickly. Thus, the ordering of high-frequency affixes and closed-class operators *(the, to)* will seldom be incorrect. A secondary source of acquisitional data will be the order errors produced by the child (Type I correction, MacWhinney, 1978). Errors such as *bottle Mark's* will be useful if the child also has stored rote forms such as *Mark's bottle* that indicate the nature of the error in the combination. Finally, some learning may occur when the child attempts to match the input by generating his or her own alternative productions (Type 4 correction, MacWhinney, 1978).

Rules will be either free, bound, or class-bound. Free rules are the most applicable and also the most easily disconfirmed. The least general rules are those that are bound to lexical classes. For a given piece of data, the child will formulate alternative patterns on each of these three levels. As long as a free rule remains correct, it will dominate over the other rules because its greater applicability leads to rapid growth in its strength. However, once a free rule starts to falter, bound rules will move to the fore. In general, the pattern that wins out in the end is the one that maximizes applicability without sacrificing correctness.

This final section has been sketchy and speculative. However, it may serve to suggest to the reader useful tests of the model underlying this approach. These tests are crucial to further elaboration of this type of account. If the analogy between morphophonology and linearization that was presented in this chapter is to be of any use, it must serve not only to account for existing data but also to predict the shape of new data. If this goal can be achieved, then it may be possible to go beyond the analogy and begin to think about the fundamental patterns that govern the acquisition of cognitive systems. However, in any such extension, we must be eventually willing to abandon applicability for correctness.

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End Notes

1) Other multiword frames that have been suggested include: *where NP go?* and *what NP doing?* from Bellugi (1965, p. *128); that's mine NP* and *wait for S* from R. Clark (1977, pp. 344-345); and *look what NP Ving* and *see what NP Ving* from Francis (1969, p. *298)*

2) Maratsos and Chalkley (1980) argue that analogy also fails to deal with the fact that the use of certain grammatical markers, like tense in the third person singular, is obligatory. Although this observation is entirely true, it is not necessarily the case that all obligatory elements must be inserted by the syntactic component. In fact, it is quite reasonable to argue that obligatory intentions are inserted, in certain cases, by the semantic component. For example, in English, the child would learn that he or she would always have to specify the tense of any action or process in semantic structure. Once this decision is made, the lexicalization of the semantic intention can proceed by either rote, analogy, or combination. This solution to the problem raised by Maratsos and Chalkley does not negate the importance of the issue. Rather, it suggests that the child will attempt to solve this problem not by setting up word-order rules, but by coordinating semantic intentions.

3) This analysis relies heavily on Braine (1976). However, it differs from Braine's analysis in that it distinguishes more sharply between item-based patterns and feature-based patterns. Also, it attempts to locate semantic relations within the lexical specifications of the operator and the nucleus.

4) As explained in MacWhinney (in press (a)), items like *short shrift*, *cranberry*, and *phone up* can be viewed as lexical entries with one lex and two morphs.