

U-SHAPED CURVES IN THE ACQUISITION OF SPATIAL  
ADJECTIVES: THEIR EXPLANATION AND IMPLICATIONS\*

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0.0. Introduction

In recent years, a considerable amount of research on child language development has focused on the acquisition of relative polar opposites, such as big-little, tall-short, long-short, and high-low (Lumsden and Poteat 1968, Donaldson and Wales 1970, H. Clark 1970, E. Clark 1972, 1973, Klatzky, Clark, and Macken 1973, Nelson and Benedict 1973, Maratsos 1973, 1974, Eilers, Oller, and Ellington 1974, Brewer and Stone 1975, Ehri 1976, Bartlett 1976, Townsend 1976, Carey 1978b). This set of adjectives has been of interest because it constitutes a well-defined set of semantically related words that can provide a basis for testing theories of the acquisition of word meaning. The process by which the child learns the various semantic elements associated with this group of adjectives has played a major role in E. Clark's Semantic Feature Hypothesis (1973), in subsequent studies testing that hypothesis (Klatzky, Clark, and Macken 1973, Eilers, Oller, and Ellington 1974, Brewer and Stone 1975, Ehri 1976, Bartlett 1976), and, more recently, in Carey's (1978b) "Missing Features Plus Haphazard Examples" hypothesis.

Although much of the research to date has focused on the upward progression in a child's command of this set of adjectives and of the semantic features common to them, some important work has also been conducted that reveals decrements in children's understandings of at least two of these adjectives. In particular, Maratsos (1973, 1974) has reported a decline with age in children's ability to accurately respond to big and tall. Although 3-year-olds generally respond accurately to these adjectives in experimental settings, 4- and 5-year-olds show an increasing tendency to make errors. Children aged four and five have a much stronger predilection than 3-year-olds to respond to big as if it means "tall" (Maratsos 1973) and to big and tall as if they mean "high" (Maratsos 1974).

Maratsos (1973, 1974) suggests several complex factors that might contribute to these apparent decrements in children's understanding of big and tall, yet the ultimate reasons for these changes remain unclear. Discovering why a child's understanding of big and tall change in the ways described by Maratsos may prove to

be a critical key to understanding how the child learns the meanings of all spatial adjectives and, ultimately, how the child learns word meanings in general. The purpose of this paper is to reexamine closely the potential causes of the decrements in children's understanding of big and tall and to explore means of determining which of those potential causes is actually operative in the acquisition of these adjectives.

After first reviewing the evidence for the decrements in children's responses to big and tall, I will present four hypotheses that might explain those decrements. It is at times difficult to tease apart the potential causes of the decrease in accuracy, but it is important to attempt to do so because each explanation ultimately leads to a different view of the acquisition of word meaning. The first two hypotheses are based on comparatively minor changes in the child's knowledge -- that is, based on modifications of the non-linguistic strategies the child uses in experimental settings or on the child's recognition that big, tall, and high are semantically related. The remaining two hypotheses are based on major changes in the child's knowledge -- that is, based on changes that represent major new insights, or a reorganization, either in the child's knowledge of the world or in his knowledge of the semantic structure of words. As each hypothesis is discussed, the extent to which it can or cannot explain the response patterns in Maratsos (1973, 1974) will be explored. Although each of the first two hypotheses will be shown to be unsatisfactory in some way, the last two hypotheses appear to be equally plausible explanations for the evidenced decrements in children's understanding of big and tall; the evidence presently available is consistent with either hypothesis. However, I will argue that cross-linguistic evidence might prove instrumental in determining which of these possible causes is operative in the developmental changes in children's responses to big and tall, and I will discuss how such evidence might bear on our understanding of the meanings of words for children. In particular, I will discuss how evidence in favor of a strong semantic explanation would lend substantial support to Carey's (1978b) "Missing Features Plus Haphazard Examples" hypothesis, and how evidence in favor of a strong cognitive explanation should lead us to seriously reflect on the criteria we use in describing the semantic representation of a word in the child's lexicon. Finally, I will present data on the acquisition of Arabic kabiir ("big") that appear to support a strong semantic explanation for the decrements in children's understanding of the English spatial adjectives.

### 1.0. The Evidence I

In a study of children's understanding of big, Maratsos (1973) found that when children were shown two objects and were asked "Which one is the big one?" 3-year-olds correctly responded by choosing the stimulus that had the greater overall mass; however, older children, especially from 4;6 on, responded by choosing the object that had the greater height, rather than the greater overall mass. Lumsden and Poteat (1968) obtained similar greater-height responses to bigger from children aged 5;5 to 6;6. The older child incorrectly responds to big as if it means "tall" even when the area of the shorter object is as much as four times that of the taller object (Lumsden and Poteat 1968). When two stimuli are of the same height, but of different widths, children aged 4;6 and older usually assert that the two objects are the same size or that they are both big (Maratsos 1973: 749).

There is a comparable change in children's developing understanding of tall, and to a lesser extent, of big, towards interpreting the adjective as if it means "high." Maratsos (1974) conducted seven experiments in which children were shown pairs of stimuli of unequal heights and sizes. The stimuli were presented under two conditions, a static condition and a movement condition. In the static condition, the two objects were placed either at the same base level or with one at a higher base level than the other. In the movement condition, one object that had first been placed at the same base level as another was raised or lowered. The child was asked "Which one is the big (tall, high) one?" (High was only tested in the static condition, however.) The younger children generally performed well in all their responses to big. The older children, however, performed well only in the static condition; in the movement condition, they responded to big by choosing the higher object. When the questions contained the word tall, children aged 3;0 to 4;5 responded correctly in the static condition but chose the higher object in the movement condition. Children aged 4;6 to 5;11 chose the higher object, regardless of its size, in both the static and movement conditions.

Maratsos interprets the results of this second study as indicating that the subjects showed an increasing tendency with age to interpret tall and big as referring to the object with a higher top point. However, the data are also consistent with an interpretation under which the child shows an increasing tendency with age to respond to tall and big as if they refer to a higher base point or a higher position in general. The critical contexts for revealing a change in response patterns from correct

responses to "higher top point" responses were those in which the smaller, shorter object of a pair of stimuli was located on a higher level than the larger, taller object. In those critical cases, the object with the higher top point also always had the higher base point, or the higher position in general. Thus it is impossible to determine whether the important cue for the child was higher top point, higher base point, or higher position in general. Nevertheless, with the understanding that the response patterns evidenced by the older children in the study could have been based on higher top point, base level, or position in general, we can refer to the type of response uncovered in this study as one in which the child responds to tall or big as if it means "high."<sup>1</sup>

## 2.0. Explaining the Changes in Response Patterns

Maratsos suggests that perhaps one contributing factor in the older children's misunderstanding of big and tall is the fact that in the adult's application of big, tall, and high to objects in the real world, bigness, tallness, and highness are often correlated with each other. Big can be and often is applied appropriately to extension along the vertical dimension; big and tall can be and often are applied appropriately to objects that reach high levels. Maratsos (1973) points out that a "socially important usage" of big in adult speech to children occurs when measuring children's relative sizes by their heights. Similarly, Maratsos (1974) notes, "children often hear tall and big used of things with higher top points; in particular, they are used of adults as opposed to children" (1974: 372).

However, this environmental correlation of big, tall, and high can be seen only as an indirect or secondary cause for the decrements found in these studies. It alone is not sufficient for explaining older children's incorrect responses to big and tall. As Maratsos (1974) carefully points out, these environmental correlations between big, tall, and high are always present in the environment. If this were the only factor influencing children's uses of big and tall, highness and verticality should be as influential early in development as they are later in development -- as, e.g., in the case of the influence of the vertical dimension on children's understanding of older and younger (Kuczaj and Lederberg 1977). Therefore, there must be some change in the child's knowledge that is ultimately responsible for the changes in responses to big and tall.

That change might occur in any one of several different realms. In the following sections, I will consider four possibilities under four distinct hypotheses. As mentioned above, the first two hypotheses will be shown to be inadequate in accounting for all the data, but each of the two alternative hypotheses offers a plausible explanation for the evidenced decrements.

### 2.1. The Non-linguistic Strategy Hypothesis

The first hypothesis, the non-linguistic strategy hypothesis, holds that the changes in response patterns evidenced in these studies are due to changes in children's strategies for responding to experimental stimuli. That is, there is a change with age either in the child's preference for choosing one type of object over another, regardless of instruction, or in his adeptness at guessing from the context how the experimenter wants him to respond. An older child may show a strong tendency, in any setting, to choose the taller of two objects. Or he may have learned that when a person effects some change on objects in the environment, it is probable that the effects of that change will be relevant to and significant in any subsequent question or discourse. His own responses to a subsequent question, then, should refer to that change.

The former strategy would lead children to respond to big as if it means "tall," and it would be consistent with other non-linguistic strategies that children have been shown to use in experimental settings. In studies of the acquisition of more and less, children have demonstrated a non-linguistic response bias for choosing the greater of two amounts even when simply instructed to "choose one." (Trehub and Abramovitch 1978, Weiner 1974. See Gathercole 1979 for relevant discussion.) Similarly, the latter strategy could lead the children who had witnessed the movement of one object in Maratsos (1974) to guess that the experimenter's next question would have something to do with the effects of that movement. Since the effect of movement was always a change from objects standing at the same level to objects standing at different levels, the child might readily respond to the experimenter's questions containing big and tall by focusing on the difference in levels and guessing that the appropriate response would be to choose the higher object. The higher object might be chosen over the lower object simply because it respected the positive polarity of big and tall.

There are several strong arguments against the non-linguistic strategy hypothesis, however. First, the subjects in these studies appear to have responded with great confidence. With regard to the possibility that children were "distracted" by the movement in the movement conditions in his study, Maratsos (1974: 374, fn 4) reports that some children in pilot work and after completion of the study were interviewed about their incorrect responses to big. The children always kept to their contention that a small but high object was the big one and sometimes became annoyed at the repeated questioning.<sup>2</sup>

Secondly, even if non-linguistic strategies might play some role in the children's responses, there are several aspects of the data that a non-linguistic strategy hypothesis cannot explain. In particular, if we hypothesized that a child's responses to big as if it means "tall" are an artifact of his non-linguistic preference for choosing the taller object of a pair, this does not explain children's responses to big in conditions in which stimuli were of equal heights, but different widths. On the assumption that the older children retain some of the linguistic knowledge of big that the three-year-olds apparently have, they should be able to draw on this knowledge in the equal-height conditions, for which the hypothesized non-linguistic strategy of choosing the taller object would not serve. In the equal-height condition, then, the older children should have been able to easily choose the correct object in response to big questions. However, in these contexts, Maratsos (1973) found that the older children still responded incorrectly to big by asserting, e.g., that both objects were big. Similarly, if we hypothesized that children's responses to big and tall as if they mean "high" were a result of a strategy of choosing an object according to the effects of a witnessed change, we could not explain the fact that even in the static condition, the older children responded to tall as if it means "high."

In addition, there is independent evidence in the literature that the use of non-linguistic strategies in experimental settings is most useful for the child and most prominent at stages that occur before he can respond correctly to a form or construction. In their study of the acquisition of more and less, Trehub and Abramovitch (1978) found that the non-linguistic strategy of choosing the greater of two amounts was only significantly present in those subjects who made errors on less; for those subjects who responded correctly to less, this response bias was non-significant. In relation to children's understanding of complex sentences, Cromer (1976) and Bowerman (1979) point out that children use strategies to interpret complex sentences whose

structure is not yet understood. Bowerman adds, "Once they can process these sentences, they no longer need the strategies and begin instead to interpret them on the basis of structural knowledge" (1979: 304). According to the non-linguistic strategy hypothesis, the hypothesized sequence in children's responses to big and tall would be counter to this general trend. The child first would respond to a word correctly and only later would he rely heavily on non-linguistic strategies to respond.

Since it would be difficult to explain why the use of a response strategy would become prominent after the child can already respond appropriately to big and tall, and since the non-linguistic strategy hypothesis appears inadequate in accounting for all the data, we must search for alternative explanations for the decrements in children's responses to big and tall.

## 2.2. The Weak Semantic Hypothesis

One hypothesis that attributes the decrements to a change in the child's semantic knowledge is the weak semantic hypothesis. This hypothesis holds that the child has come to the realization that there is a semantic relationship between big and tall, and between big, tall, and high, and that it is because of this discovery that he has begun to confuse these words. The discovery might consist of learning that the words are environmentally correlated -- i.e., overlap in their applications in the real world, or it might consist of learning that these words are related on a more abstract level -- e.g., realizing that they all belong to a semantic field of [+Pol, +Spatial] adjectives. In either case, there are several difficulties with the weak semantic hypothesis.

The first difficulty, whether the semantic relationship discovered was of the first or the second type above, has to do with the prevalence of the incorrect responses over correct responses to big and tall. Under the weak semantic hypothesis, the decrements in the child's understanding of big and tall would be analogous to some of the late-emerging errors reported by Bowerman (1978a, 1978b, in press). Bowerman discusses several types of substitution errors that, like the errors in the comprehension of big and tall, occur only after the words in question have been used appropriately. And Bowerman hypothesizes, as does the weak semantic hypothesis, that the errors arise as a result of the child's realization that the words in question are semantically related.

Some of these errors seem to arise from an increased awareness of the overlapping applications of words (e.g., errors

in the use of bring, take, put, and give (Bowerman 1978b), to be discussed below), and others from a perhaps more abstract association of words (e.g., errors in which spatial words are substituted for time words (Bowerman, in press.)). In both cases, Bowerman stresses that the overall number of incorrect uses were infrequent relative to the number of correct uses in her children's speech (Bowerman 1978a: 982, in press: 51ms). In the case of the spatial adjectives we are concerned with here, in contrast, the errors in the older children's responses to big and tall greatly outweigh their correct interpretations.

A second problem with the weak semantic hypothesis becomes apparent if it is assumed that the late errors with big and tall grow out of an increase in the children's knowledge of the overlapping applications of these words. In this case, the errors should be comparable to errors in Bowerman's subjects' use of bring, take, put, and give. Bowerman (1978a, 1978b) reports that after an initial period of correct use, her daughters began producing errors in the choice of bring, take, put, and give, whereby they used put for "take," "give," and "bring"; take for "bring" and "put"; give for "put"; and so forth. These errors, she hypothesizes, arise when the children become more aware of the semantic relationships among these words and, therefore, "the words begin to bump up against each others' territories and to compete for selection in particular speech contexts" (1978b: 391).

However, there is a critical difference between these errors discussed by Bowerman and those with big and tall. The initial ranges of application of the verbs studied by Bowerman were quite independent, while those of the spatial adjectives show some degree of overlap. A progression from correct to incorrect usage of a set of words on the basis of a growth in the child's command of their intersecting applications might, of necessity, start from a point at which the uses of the words are independent and only later begin to intersect. Bowerman hypothesizes that her daughters were initially able to use the verbs above correctly because they used them in relatively specific, and different, contexts:

the semantic ranges across which the words  
are initially applied are not nearly so  
broad nor so closely related as in adult  
speech....  
(1978b: 390-391).

It is clear, however, that children's initially correct uses of big and tall, unlike the initially correct uses of the verbs studied by Bowerman, are not independent. The early knowledge of big and tall evidenced by three-year-olds in Maratsos (1973, 1974) includes uses of big and tall in contexts in which these words do overlap environmentally. Specifically, their correct responses to big and tall indicate that, when it is appropriate, they can use both adjectives in reference to greater extension along the vertical dimension. When the clearly correct uses of two words already include uses in overlapping contexts, it is difficult to predict whether a simple growth in the child's familiarity with the uses of the two words would lead to confusion or increased accuracy in the child's uses of the words.

Of course, it is difficult to determine if the three-year-old child is aware of the similarity of his overlapping uses of big and tall. Perhaps increased awareness of this overlap could result in confusion. Even then, however, it is not clear whether a confusion that arose from an increased awareness of overlapping uses would affect children's comprehension in contexts where the applications of the words do not overlap. Suppose, for example, big and tall became confused by a child because he realized that both could be applied to greater extension along the vertical dimension. In contexts in which two stimuli of equal heights, but different widths, were present, would the child find it easy to respond appropriately to "Which one is big?" or would the confusion caused by awareness of the overlapping applications of big and tall overflow into this non-overlapping context?

To answer this question, we might draw on Kuczaj and Lederberg's (1977) work on the acquisition of younger and older. Kuczaj and Lederberg hypothesize that a child's first guess about the meaning of older and younger is based on the environmental relationship between age and height, so he equates older with "taller" and younger with "shorter." Later, the child learns that chronological age is important to the meanings of these terms, but he is still influenced by relative size. At this stage, he is able to correctly respond to older and younger on the basis of age when he is presented with two dolls of the same height, but when the stimuli are of unequal heights, he will still treat the taller one as the older one and the shorter one as the younger one. Kuczaj and Lederberg remark:

This finding suggests that when children learn something additional about the meaning of a word, this additional component will not necessarily re-

place or override previously learned aspects of the word's meaning... (1977: 413).

Thus, the child will use that component in some restricted contexts, but he will rely on previously accumulated information to use the word in other contexts.

Although Kuczaj and Lederberg were dealing with the acquisition of knowledge that allows the child to correct a misapplication of words, and here we are concerned with the child's acquiring knowledge that leads him to use a word incorrectly, we can speculate that the child's new awareness of the overlapping uses of big and tall might similarly affect his use of big in only some contexts. A confusion caused by an increased awareness of the intersecting applications of big and tall would probably lead to inconsistency in response patterns, whereby the child would have difficulties in the overlapping contexts but would still be able to respond correctly in the non-intersecting contexts.

Additional problems with the weak semantic hypothesis come to light if the errors with big and tall are assumed to occur as a result of a discovery of a more abstract relationship between the words -- e.g., a discovery that the words in question are all positive-pole spatial adjectives. One of these is that the errors should go in both directions -- e.g., not only should big be understood as "tall" and "high," but high and tall should be sometimes understood as "big." But the older children in Maratsos (1974) responded perfectly to questions containing high; they never treated it as if it meant "big."

Another problem is that the weak semantic hypothesis should also predict that big will similarly be confused with, e.g., long, deep, and thick. Although these adjectives do not bear as strong an environmental correlation with big as tall and high do, long is of particular interest, since bigness does sometimes correlate with length (as in a "big car"), and long appears to be learned at about the same time as tall (Clark 1972, Brewer and Stone 1975, Bartlett 1976). But there is no indication that big is ever taken to mean "long" by children learning English.

It appears, then, that the weak semantic hypothesis is incapable of explaining the decrements in children's responses to big and tall. The primary difficulties are that under this hypothesis errors should be less frequent than correct uses, young children's earliest uses of these words should be non-intersecting, and

older children's errors should not be unidirectional nor restricted to big, tall, and high.

There are two alternative hypotheses that can more adequately explain the decrements in children's understanding of big and tall. These two hypotheses, which I shall refer to as the "strong cognitive hypothesis" and the "strong semantic hypothesis," are both based on hypothesized new insights, or a reorganization, in the child's knowledge, either of the world or of the semantic makeup of words.

### 2.3. The Strong Cognitive Hypothesis

The strong cognitive hypothesis theorizes that the decrements in children's responses to big and tall are a result of changes in the child's categorization of the world. This is basically the position taken by Maratsos. Thus, he asserts that the "most parsimonious explanation" for the changes in children's understanding of big and tall is that as children grow older, the vertical dimension and top point acquire greater salience as perceptual categorizations. As the vertical dimension and top point gain perceptual salience for the child, they affect the child's use of the words that are environmentally correlated with these spatial categories.

The cognitive changes could affect the child's use of a given word in one of at least two ways. First, the salience of a spatial category may allow the child to notice the fact that a given word is used in reference to that spatial category. Because of this he might add a reference to that spatial category to his definition of the word. This is essentially the stance taken by Maratsos. With respect to his finding that big is understood by older children as if it means "tall," Maratsos states:

there is indeed an age progression from a more general definition of "big" toward a definition which employs extension along the vertical dimension as the critical defining characteristic of "big"... (1973:748).  
[Emphasis mine.]

In reference to the finding that big and tall are treated by older children as if they mean "high," Maratsos asserts:

Because of a growing tendency to notice top point in situations including those of lexical usage, the child would increasingly notice the respective correlations of top point with uses of the words high, tall, and big. Since greater top point is in fact correlated most strongly to uses of high (perfect correlation), next most strongly to uses of tall, and least strongly to uses of big, it would come to acquire influence on the definitions of those terms in just that order of degree -- greatest influence on high, next on tall, and least on big. (1974: 373). [Emphasis mine.]

Alternatively, the young child's early definitions of big, tall and high may already include elements (either in systematic features, in unanalyzed form in haphazard examples, or in components of a prototypical concept) that refer to the vertical dimension and top point. The growth in the salience of these spatial categories may simply cause the child to focus on those elements, which are already present, in the semantic representation of these words and lead him to favor them in his application of the words. Maratsos (1974) allows for the possibility that different semantic components take on distinct weights in different experimental contexts, but I am suggesting that the components could take on distinct weights at different ages, such that a given component could be present even before it takes on any importance in the child's responses.<sup>3</sup>

To explain why there should be a developmental increase in the perceptual salience of certain spatial categories, Maratsos makes reference to the relative cognitive complexity of these categories and the theory that a more complex category should be learned after a less complex one. With reference to the increase with age in the salience of top point as a conceptual category, Maratsos (1974) states that top point is

a more complex perceptual category than bigness and tallness. Top point consists of a relation (distance) between the highest point of the vertical axis of an object and the common baseline for all objects, the ground. Tallness and bigness, in contrast, can be defined by extensional properties of the object itself: bigness by general spatial extension and tallness by extension along the object's normal vertical axis.

So top point refers criterially to extensional relations between part of the object and its general frame of reference in a way that tallness and bigness do not, which may make it perceptually more complex. (1974: 373).

A succinct summary of this strong cognitive view of the causes of the developmental changes in children's responses to big and tall can be found in Maratsos (1974):

It seems likely that the semantic developments uncovered in these studies can best find their explanation in the interaction of word usage around the child with underlying changes in his perceptual categorizations of the environment. (1974: 373).  
[Emphasis mine.]

#### 2.4. The Strong Semantic Hypothesis

The cognitive explanation outlined above can be contrasted with an explanation that is based on hypothesized semantic changes in the child's lexicon. The manner in which semantic changes might affect a child's use of big and tall is hinted at in Maratsos (1973). Maratsos suggests that the increasing tendency to understand big as if it applies to a single dimension is consistent with improvement with age on more specific adjectives like tall and wide, which are specified in terms of a fixed single dimension. He says,

In the case of "big" the procedure of semantic analysis in terms of a fixed single dimension is apparently actively overextended, producing an incorrect definition. (1973: 751).

Although Maratsos does not expand on this idea, the possibility that the child's increasing knowledge of other spatial adjectives might affect his use of big (and tall) is a very real one. In this section, I will develop this idea further and indicate how the decrements in children's use of big and tall might arise as a result of semantic developments in relative adjectives.

Recently, Carey (1978b) has proposed a new model for the acquisition of word meanings that distinguishes between knowledge of the appropriate application of a given word in particular con-

texts and more abstract knowledge of the systematic semantic content of a word. She hypothesizes that in acquiring the meaning of a word, children initially accumulate and store "haphazard examples" of privileges of occurrence that arise from their experience with that word. From these haphazard examples, the child abstracts out features of meaning common to those examples. The features act as "lexical organizers," or semantic features that become available for use as components of meaning in that and other words in the language. For example, Carey suggests that at an immature stage of development, one child's lexical entry for tall might contain the haphazard examples shown in (1) and the systematic semantic information shown in the lexical organizers in (2).

1. [ \_\_\_ building, ground up; \_\_\_ person, head to toe ]
2. [ Adj. ] [ comparative ] [ +pole ]      (Carey 1978b: 286)

Three aspects of this model are relevant to our discussion here. First, at immature stages of development, although the child is not able to apply a given word appropriately in all contexts, he is able to use it appropriately in some contexts. (Keil and Carroll (1980) have presented data on the acquisition of tall that are consistent with such an immature stage of development.) Secondly, systematic semantic features are abstracted out by the child after he has learned to use the word appropriately in some contexts. And, thirdly, the features the child has posited for one word are available for use in the definitions of other words.

The data on the decrements in children's understandings of big and tall can be seen as highly consistent with this model. The 3-year-olds are in general able to respond appropriately to big and tall, which would be predicted by Carey's model if the experimental stimuli are similar to the stored haphazard examples the children have accumulated for these adjectives. The subsequent decrements in children's responses to big and tall might well arise from the child's discovery of the semantic features [ +Vertical ] and [ +Positional ] (or [ +Top Point ] ). One feature common to all examples he has stored for tall will be reference to the vertical dimension, and one feature common to all examples for high will be reference to the position of an object relative to a ground level. The discovery of these features for tall and high, respectively, may lead the child to overextend these "lexical organizers" to environmentally related words, thus leading to the incorrect responses to big and tall reflected in Maratsos (1973, 1974) and Lumsden and Poteat (1968).

This strong semantic hypothesis offers a plausible explanation for the decrements in children's responses to big and tall that is markedly distinct from the strong cognitive hypothesis outlined above. According to this semantic explanation, the change that is ultimately responsible for changes in children's response patterns occurs in the child's knowledge of the semantics of words related to the word in question, not in his knowledge of and processing of the outside world.

### 3.0. Choosing Between Hypotheses

From the data in Maratsos (1973, 1974) and Lumsden and Potat (1968), it is impossible to determine whether it is the strong cognitive hypothesis or the strong semantic hypothesis that more adequately captures the process that actually occurs in the acquisition of big, tall, and high. However, there is at least one kind of data that could prove instrumental in choosing between the two hypotheses: data on the acquisition of spatial adjectives in other languages.

The strong cognitive hypothesis bases the changes in children's understanding of big and tall on changes in the child's cognitive processing of the world. Apart from the fact that the cognitive categories to which the child attends will affect only those adjectives that are environmentally correlated with that category, the strong cognitive hypothesis claims that the changes in children's responses to big and tall are not at all related to the child's knowledge of the semantic makeup of those words. The strong semantic hypothesis, on the other hand, claims that changes in children's responses to big and tall are directly based on the child's knowledge of the meanings of words and his discovery of the features that are common to the haphazard examples he has stored for words. Given that many languages have spatial adjectives whose systematic semantic contents are not directly parallel to those of the spatial adjectives in English, the two hypotheses will make markedly different predictions about whether children learning one of those languages will demonstrate the same decrements in their understandings of spatial adjectives, particularly of the word for "big" in their language, as English-speaking children do.

In English, both the vertical dimension and reference to position off the ground enjoy the status of systematic semantic components that serve to define and contrast spatial adjectives.

The adjective tall can be specified with the semantic feature [+Vertical] because it always refers to extension along the vertical dimension. It always refers to extension along the vertical dimension because there is a contrasting adjective, long, that is used in reference to extension along the non-vertical, or horizontal, dimension.<sup>4</sup> Similarly, the adjective high can be specified with the semantic feature [+Positional] (or, perhaps, [+TopPoint]) because it always refers to the position of an object off the ground. It always refers to position off the ground because there is a contrasting adjective, tall, that is used in reference to the extension of an object off the ground.

In a language in which there is only a single adjective corresponding to both English tall and long, such as in Arabic, tawil, or in Turkish, uzun, the vertical dimension does not enjoy the semantic status that it has in English. These adjectives refer not only to extension along the vertical dimension, but also to extension along the horizontal dimension. Likewise, in a language in which there is only a single adjective corresponding to both English tall and high, such as in Spanish, alto, position off the ground is not an important semantic component, since there is no contrast between the extension and the position of an object off the ground. The adjective can refer to either.

According to Carey's model for the acquisition of word meaning, children learning Arabic and Turkish should not posit a feature [+Vertical], and children learning Spanish should not posit a feature [+Positional] for spatial adjectives. The strong semantic hypothesis outlined above, then, predicts that children learning Arabic or Turkish will not pass through a stage in which kabir and büyük ("big" in Arabic and Turkish, respectively) appear to mean "tall," and children learning Spanish will not pass through a stage during which grande ("big" in Spanish) appears to mean "high."<sup>5</sup> The strong cognitive hypothesis, in contrast, will predict that children learning these languages will pass through exactly the same stages as the English-speaking children do.

#### 4.0. Implications of Cross-Linguistic Evidence

Such cross-linguistic evidence on whether children learning languages such as Arabic, Turkish, and Spanish show response patterns to the words for "big" in their languages comparable to those shown by English-speaking children would have important implications for the acquisition of word meaning. If the evidence came down in favor of the strong semantic hypothesis -- i.e., if

children learning these languages do not demonstrate response decrements similar to those demonstrated by English-speaking children -- such data would lend very strong support to Carey's theory of the acquisition of word meaning. In particular, it would corroborate her theory that children abstract out semantic components for a word at a stage subsequent to a period during which the meaning of that word is contained in unanalyzed hap-hazard examples.

In addition, if the evidence comes down in favor of the strong semantic hypothesis, we can make important inferences about the process of feature acquisition on the basis of the data from English-speaking children. In the acquisition of systematic features, one might hypothesize that features are discovered and abstracted out by the child on the basis of contrasts. For example, one might hypothesize that the feature [+Pole] becomes a feature for the child at the point at which he understands that words such as big and little, and tall and short, form contrasting pairs, one member marked [+Pole], the other [-Pole]. Alternatively, features might be originally postulated by the child on the basis of the meaning of a single word, rather than on the basis of what that word contrasts with. That is, the child might posit [+Pole] for big on the basis of its individual application, and independent of his abstraction of [-Pole] for little. (See Barrett 1978, in press, and Nelson 1979 for a recent debate on this issue.)

If the strong semantic hypothesis proved to be the correct hypothesis, the data on the acquisition of English tall and high would indicate that the second of these possibilities more aptly describes the process of feature acquisition. Recall that the feature [+Positional] is a component of high because high contrasts with tall, which is [-Positional] (or [+Extensional]). If [+Positional] were discovered for high by the child on the basis of the contrast between high and tall, the child would at the time of his discovery realize also that tall is semantically [-Positional]. The data on the acquisition of tall in Maratsos (1974) indicate that this is certainly not the case. According to the strong semantic hypothesis, the data in Maratsos (1974), in which children respond to big and tall as if they mean "high," are explained in terms of the child having discovered the feature [+Positional] for high and overextending this feature to the environmentally correlated words big and tall. Contrary to what one would expect if the feature [+Positional] was discovered for high because it contrasts with tall, this overextension occurs to a greater extent for tall than it does for big. The implication

of this is that the child posits the feature [+Positional] for high entirely on the basis of the common aspects of the haphazard examples he has stored for high. Thus, if the strong semantic hypothesis proves to be valid, children, at least sometimes, posit semantic features for words as isolated elements, not in terms of their relationships to other words.

If the evidence favors the strong cognitive hypothesis -- i.e., if children learning languages like Arabic, Turkish, and Spanish do pass through the same decrements in their understandings of spatial adjectives in their languages -- the implications are just as important to consider. It should be made clear that this result would not necessarily contradict Carey's theory of the acquisition of word meanings. First, it is possible that the non-English-speaking children could posit the semantic feature [+Vertical] or [+Positional] on the basis of words in another semantic domain and overgeneralize it to big. The timing of the resulting decrements might be quite different from those found for English, however. Secondly, even if the decrements are due to cognitive changes, the abstraction of features from haphazard examples need not necessarily result in the type of error discussed here.

The most important thing to consider, however, if cross-linguistic data favored the strong cognitive hypothesis, is our criteria in determining what "counts" when describing a child's semantic representation of a form. We must ask if a cognitive change that affects a child's responses to a word automatically means that there is a concomitant semantic change in the child's representation of that word.

As discussed above, Maratsos' position in this regard appears to be that the hypothesized cognitive changes do effect semantic changes. Maratsos often refers to the "semantic developments" uncovered in his studies and changes in the definitions of the words. However, as also noted above, it is possible that there is no semantic change at all. It may be, instead, that the child's early definitions of big, tall, and high include references to the vertical dimension and highness, and the later cognitive developments simply cause the child to pay more attention to these elements in his applications of big, tall, and high.

## 5.0 The Evidence II

In order to test the strong cognitive hypothesis and the

strong semantic hypothesis, an experiment was designed to test Arabic-speaking children's understanding of *kabir* ("big"). Arabic was chosen because of the availability of Arabic-speaking children who do not speak English in the vicinity of the university.

## 5.1. Method.<sup>6</sup>

### 5.1.1. Materials.

Pairs of stimuli were designed to replicate as closely as possible the stimuli used by Maratsos (1973) in his Experiment 1. As in that study, three sets of stimuli were prepared. Each of the first two sets consisted of four pairs of two-dimensional rectangles that had the same dimensions as those used by Maratsos (1973). Set A consisted of pairs of unequal heights. For each pair, the taller rectangle was the smaller of the two in overall size. Set B consisted of equal-height rectangles of different overall sizes. The third set of stimuli (C) contained four pairs of toy animals in which the taller animal was always smaller in overall size. (Maratsos used only three pairs of animals, but it was deemed desirable to have the same number of stimuli in Set C as in sets A and B.) For two of the pairs in Set C, the larger toy animal represented a class of animals that is typically larger than the class represented by the smaller toy animal; for the other two pairs, the larger toy animal belonged to a class that is typically smaller. The twelve pairs of stimuli and their precise dimensions are shown in Table 1. (See Table 1 next page.)

### 5.1.2. Procedure

Each subject was seen separately on a single occasion. Before testing began, there was a warm-up session in which the children were shown toy animals different from those used in the experiment and were asked the names of those toys in Arabic. This was used primarily to familiarize the children with the experimenter. Subsequent to this warm-up, a pretest was given. In the pretest, the child was shown two pairs of rectangles in which the larger of each pair exceeded the smaller in both height and width, and he was instructed in Arabic to choose the "big" one. (The dimensions of the pretest pairs were 7" x 5" and 9" x 7½", and 5" x 9" and 7" x 15".) Each subject was then shown the twelve test pairs of stimuli in a randomized order. Each pair was presented in an upright position, with the correct rectangle

TABLE 1  
Stimuli and their Dimensions

<u>Stimuli</u>	<u>Sizes</u> height x width (x depth) (in inches)	
	<u>smaller</u>	<u>larger</u>
A. unequal-height rectangles	1. 10 x 5 2. 10 x 5 3. 10 x 5 4. 10 x 5	9 x 10 9 x 7 1/2 9 x 9 3/4 9 x 12 1/2
B. equal-height rectangles	5. 9 x 5 6. 9 x 5 7. 7 x 5 8. 7 x 5	9 x 10 9 x 7 1/2 7 x 10 7 x 15
C. unequal-height animals <sup>1</sup>	9. deer: 3 x 3/8 (x 1 5/8)  10. swan: 2 7/8 x 3/4 (x 1 7/8)  11. gorilla: 2 1/8 x 7/8 (x 5/8) (or 2 1/2 x 7/8 (x 5/8), including raised arm)  12. rhinoceros: 3 x 3/8 (x 2 1/8)	elephant: 2 1/2 x 1 3/8 (x 2 5/8)  whale: 2 1/4 x 2 (x 4) (or 2 1/2 x 3 1/4 (x 5), including fins)  frog: 1 3/8 x 2 3/8 (x 3 1/8)  crab: 2 x 3 1/2 (x 1 7/8)

<sup>1</sup>Sizes of animals refer to most extended portion of the body along the relevant dimension.