

WHY DO CHILDREN SAY WHAT THEY SAY WHEN THEY SAY IT?: AN EXPERIMENTAL APPROACH TO THE PSYCHOGENESIS OF PRESUPPOSITION*

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Given a child at the one-word stage who is encoding a complex event but is limited to uttering but a single word, can we characterize which element of the referential event will be selected for verbal expression? This is the basic problem we set for ourselves in this chapter. A basic assumption, demonstrated in an earlier work (Greenfield and Smith, 1976), is that the message of the one-word child is more complex than his linguistic means; the child often combines the single word with at least one nonverbal element in the situation to form a semantic relation. For instance, when the child says *down* while coming down the stairs, he is expressing an action or change of state of himself as agent. The awareness of self as agent completes the implied semantic relation, but agent is not expressed verbally. If, however, the child is at a point in his or her cognitive and linguistic development where he or she is able to express either of the component functions (e.g., agent or action), and where he or she also possesses the specific vocabulary appropriate to express those functions in this particular situation (e.g.,

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me, down), what factors determine the choice of one of these elements for linguistic expression?

In our earlier work (Greenfield, Smith, and Laufer, 1972; Greenfield and Smith, 1976; Greenfield, in press), we have argued that the principle of informativeness can generally explain which element is selected. Informativeness is used in the information theory sense of uncertainty. Uncertainty exists where there are possible alternatives; that element among possible alternatives which reduces uncertainty most is considered to be the most informative. But uncertainty must be defined from the child-speaker's point of view. Information in this sense, then, is relative to the child. In order to validate the nature of the child's point of view, we must construct hypotheses about how the child structures situations in terms of the distribution of information and certainty and see if these hypotheses are borne out by the facts of semantic choice in these different sorts of situations.

Up to now, we have formulated hypotheses *ex post facto* which are validated by regularities in naturally-occurring speech samples. For example, in positive volitional utterances, i.e., where the child wants something, uncertainty lies with the volitional object, and this is the element generally expressed. In negative volitional utterances, on the other hand, the child is generally being offered something which he does not want. In such cases, the identity of the volitional object is taken for granted and volition itself (i.e., rejection) is expressed verbally (Greenfield and Smith, 1976). Thus, a child would say *banana* (expression of volitional object) while reaching for a banana which she wanted to eat, but would say *no* (expression of negative volition) pushing away a banana, offered by an adult, which she did not want to eat. Conversely, expression of the volitional element in a positive demand is uncommon (e.g., saying *want* while reaching for a banana), while expression of a rejected object in a negative volitional utterance is also unusual (e.g., saying *banana* while pushing it away). Another manifestation of the principle of informativeness was the rarity with which agents were expressed and the nature of the unusual circumstances in which they were. Agents seem to receive verbal expression only when (a) there is conflict over agency, a question in the child's mind as to who should perform some action; or (b) an agent is not visibly present, as when the child hears someone making noise in the next room. These two types of situations constitute circumstances under which agent uncertainty is maximized. In other types of situations involving intransitive action performed by an agent, it is often clear *who* is acting, and uncertainty lies with the nature of the action. This

is, of course, particularly true when the agent is the child-speaker; in this case the agent is maximally certain to the point of being totally taken for granted. Another application of the concept of informativeness to our naturally-occurring longitudinal data related to transitive action. *Objects* are expressed when the object is undergoing a change of state out of hand, while *change of state* is verbalized when the child is talking about an object in hand which he is acting upon (an idea put forth originally by Veneziano, 1973). Finally, we posited that when, in a sequence of events, all elements remain constant but one, the variable element has the highest information value and will be expressed. In this type of situation, alternatives are made available through change over time, and permutations of the event are created by substituting one element for another. For instance, a child who has just taken off a shoe and is now taking off a sock should prefer to say *sock* rather than *off*, thus focusing linguistically on the variable element. Although our original study did not include the proper sort of data to test this prediction, we did find some confirmation of this idea in a reanalysis of Bloom's (1973) data (Greenfield and Smith, 1976).

The purposes of the major study to be reported were: (1) to formulate before the data were collected an expanded set of explicit hypotheses that would predict the elements which children would select to express, and (2) to produce the predicted semantic choices through experimental manipulation of the referential situation.

THEORETICAL BACKGROUND

In an earlier paper (Greenfield, in press), we proposed that the distinction between *information* and *certainty* is the psychological basis for the distinction between *assertion* and *presupposition* in language. At this point, we should like to present an expanded theoretical formulation to delineate different types of presupposition and their threads of connection with certainty and information. Let us begin by defining presupposition and assertion in terms of relations between propositions, following Bates (1976), where proposition is defined as "a state or change predicated of one argument" (entity), "or a relationship predicated of two or more arguments" (Bates, 1976, p. 12). One proposition presupposes another where the truth of the second is a necessary precondition for judging the truth or falsity of the first. That proposition which *must* be true is the presupposition. That which may be either true or false is the assertion. In order for such a definition to be useful

for psychological analyses, it is necessary to expand the concept of truth beyond its logical meaning. We therefore propose to assess the truth of a proposition in terms of its acceptance by speaker and/or hearer.

Our view is that the state of certainty or the process of taking for granted is the cognitive basis for presupposition, while perception of uncertainty or change is the cognitive basis for assertion. In the one-word stage, what is taken for granted goes unstated by the child, while uncertain, informative, or changing elements are given verbal expression in the single-word utterance.

A number of typologies of presupposition have been proposed by philosophers and linguists (e.g., Edward Keenan, 1971). In terms of the ontogenesis and psychology of communication, however, we propose a typology based on two dimensions: (1) the degree of linguistic (or, more generally, symbolic) representation, and (2) the form of the linguistic representation.

Degree of Linguistic Representation

Following Bates' (1976) terminology, in single-word utterances, the presupposition exists on the sensorimotor level, while the assertion is represented on the symbolic, verbal level. (Sensorimotor is being used here in a broad sense to denote all nonsymbolic forms of encoding experience: perceptual, motor, and affective.) For instance, in the example of *down* discussed above, the child recognizes himself as agent on the sensorimotor but not on the linguistic level. The informative element in contrast, his *change* of state, not only exists on the sensorimotor level but is also represented on the symbolic level. At the two-word stage, both presupposition and assertion of this message could be represented symbolically, as in the sentence *me down*. At this point, both presupposition and assertion are represented linguistically, but there is no linguistic differentiation (marking) of the two types of proposition. As Bates (1976) points out, a new level of symbolic representation is reached when the distinction between presupposition and assertion is linguistically represented as such. Thus, pronouns in English can be used to mark presupposed entities. For example, a dinner guest walks out the door and the host says to his wife, *She's crazy*. In the asserted proposition, craziness is predicated of a female. The presupposed information is the existence of a particular female. This presupposed proposition is *encoded* through perception of the event but is *linguistically marked* as presupposed information by the pronoun *she*. In terms of the sensorimotor (perceptual) basis, the person is taken for granted by virtue of the situation; the predication of craziness, in contrast, signals

the presence of uncertainty or alternative characterizations. It therefore constitutes information in the information theory sense of the term.

Form of Linguistic Representation

Given a degree of symbolic representation in which both assertion and presupposition are given some linguistic representation, there are two major forms in which presuppositional relations between propositions are expressed linguistically: within and across utterances (Elinor Keenan, Schieffelin, and Platt, 1976). The first way in which both presupposition and assertion are linguistically represented by the developing child is across utterances (Greenfield, Smith, and Laufer, 1972; Greenfield and Smith, 1976; Elinor Keenan, Schieffelin, and Platt, 1976; Scollon, 1976). Thus, at some point in the one-word stage, a child might encode the act of taking his shoes off, using a sequence of one-word utterances: *shoe; off*. (Such a sequence is distinguished from a single sentence by pause length and intonation contours; e.g., Greenfield and Smith, 1976.) Here the first proposition, *shoe*, can be considered as the presupposition of the assertion, *off*. Another equally early way of representing presupposition and assertion across utterances is in dialogue (Greenfield, Smith, and Laufer, 1972; Greenfield and Smith, 1976; Greenfield, in press; Elinor Keenan, Schieffelin, and Platt, in press). For example:

Adult: *What are you doing with your shoe?*

Child: *Off*.

Here, *off* has meaning as an assertion only in relation to the implicit proposition contained in the adult's question: 'You are doing something with your shoe.' From the point of view of the child, his or her single-word utterance again expresses the *informative* element, that which is in question. Later, the child becomes capable of expressing both presupposition and assertion within a single utterance, *shoe off*. Note that in terms of propositional content all of the above examples represent an object (*shoe*) undergoing a change of state (*off*).

Logical Presupposition and Dialogue

Logical presupposition, as defined by linguists and philosophers, involves a relation between sentences. One sentence presupposes another just in case (as we noted above) the truth of the second sentence is a necessary condition for the truth or falsity of the first. An assertion,

on the other hand, can be either true or false. The standard test for presupposition is negation (Langendoen, 1971): presupposed meaning will not be affected by the negation of the sentence; asserted meaning will be. Take, for example, the sentence *Our olive tree is dying*. Negating it, we get *Our olive tree is not dying*. The part whose meaning is unaffected by the negation operation is *Our olive tree*. Hence, this is the presupposed element. The meaning of *is dying*, in contrast, is affected by the negation and, therefore, constitutes asserted meaning. In the context of logical presupposition, one could say that *Our olive tree is dying* presupposes the sentence *We have an olive tree* because the truth of the latter is a necessary precondition for judging the truth or falsity of the second.

The cognitive basis for logical presupposition as a relationship between utterances lies in early dialogue. In logical presupposition, the judgment of whether a sentence is true or false depends on the truth of another sentence. Similarly, we have seen that in early dialogue the communicativeness of the child's response depends on the existence of the adult's sentence and assumes the proposition contained in it. Thus, we are giving logical presupposition psychological meaning in terms of propositional knowledge carried by preceding utterances in a discourse.

Philosophers of language, in contrast, seem to talk about logical presupposition in terms of possible rather than actual sentences. In logical presupposition, again, one sentence is presupposed by another when the truth of the first sentence is a necessary condition for the truth of the second. But the presupposed sentence is not necessarily produced. Take a classic example in philosophy, *The King of France is bald*. This sentence presupposes the sentence *There is a King of France*, or *There exists a King of France*, or any of a number of variants having the same basic propositional content. In the philosophical approach, it appears that none of these need actually be produced. What matters is that each would be true if it were (hypothetically) to be produced. What we are attempting to do is to give logical presupposition a psychological or behavioral meaning by defining it in terms of relations between the propositional content of sentences that actually are expressed in discourse.

Presupposition and Shared Knowledge

For successful communication to take place, speaker and hearer must share presupposed knowledge. In some treatments (e.g., Keenan and Klein, 1975), the speaker's concept that this knowledge is shared

is part of the definition of presupposition. We propose to separate the speaker's ideas concerning the listener's knowledge from the basic concept of presupposition. Thus, in the above example, having an olive tree is presupposed, even if the speaker does not take into account whether the listener is also in possession of this knowledge before the sentence is uttered. The speaker's knowledge of and assumptions about the hearer are, of course, important and worthy of study in their own right, but they add confusion if not distinguished analytically from the way in which the speaker's knowledge of the referential situation relates to his or her linguistic messages, independent of assumptions about the listener. There is probably a developmental change such that linguistic form is increasingly affected by the speaker's concepts of the listener's knowledge. In addition, as we have said before (Greenfield and Smith, 1976; Greenfield, in press), because the very young child just beginning to speak is almost always referring to the here-and-now, the necessary presuppositional background required for successful communication is automatically available to the listener. Awareness of such shared knowledge no doubt develops with age, but successful adult communication also makes use of what might be called unintentionally shared information.

Because logical presuppositions are made available in the linguistic context, they constitute explicitly shared knowledge between speaker and hearer. Thus, one can think of early dialogue in which the adult frames a question and the child gives a one-word answer as providing the child with experience in the use of explicitly shared presuppositional information.

In the work to be reported our concern is with the sensorimotor structuring of assertion and presupposition. Our aim is to show relations between the structure of a referential situation and what the child selects to express linguistically. We hope to demonstrate that the observed regularities can best be explained in terms of an inference about the child's perception of information and certainty. In this way, our work also bears on the question of how children structure nonverbal events. What is certain for the child, what he or she takes for granted at the one-word stage, becomes the linguistically represented presupposition of mature speech. What is uncertain, informative, becomes the adult assertion. But this is not to say that the level of sensorimotor presupposition disappears from adult speech. Besides being the basis for the other levels, it continues to function in its own right. In parallel fashion, the reliance on presuppositional information in a preceding utterance plays an important role in adult conversation.

Ontogenetically Primitive Forms of Presupposition in Adult Communication: Vygotsky

Vygotsky (1962), in a work originally published in 1934, presents an interesting discussion of psychological presupposition, although he does not use this term. He speaks of the psychological subject and psychological predicate of a sentence. The psychological subject is what is already known; the psychological predicate is what is said about the subject. Psychological subject and predicate, thus, correspond to presupposition (certainty) and assertion, respectively. Vygotsky notes that pure predication occurs in speech in two cases:

... either as an answer or when the subject of the sentence is known beforehand to all concerned. The answer to "Would you like a cup of tea?" is never "No, I don't want a cup of tea" but a simple "No." Obviously, such a sentence is possible only because its subject is tacitly understood by both parties. . . . Now let us imagine that several people are waiting for a bus. No one will say, on seeing the bus approach, "The bus for which we are waiting is coming." The sentence is likely to be an abbreviated "Coming," or some such expression, because the subject is plain from the situation. (p. 139)

Vygotsky goes on to discuss Tolstoy's observation that, between people who live in close psychological contact, communication by means of abbreviated speech is the rule rather than the exception. Thus, Vygotsky showed how the operation of cognitive certainty affects the forms of adult communication.

Olson's Cognitive Theory of Semantics

Olson (1970) posits "that words designate, signal or specify an intended referent relative to the set of alternatives from which it must be differentiated" (p. 264). In the language of information theory, we would say that statements "reduce alternatives or uncertainty." Olson cites Brown's (1958) earlier idea that objects are usually named at the level of generality which allows us to differentiate them from other objects of contrasting function. Thus, the fact that we use the term *ball* more than *baseball* or *sphere* reflects the nature of potential alternative referents, not usually golf balls or cubes but, rather, bats, rackets, kites, skateboards. Thus, the very choice of a label reflects the set of alternatives psychologically present in a given context.

Olson's analysis moves from word to message, which is defined as "any utterance that specifies the event relative to the set of alternatives." A single-word utterance, then, is one "in which all the other sentence constituents are assumed or agreed upon" (p. 269). Thus, Vygotsky's psychological predicate (that which is expressed) becomes, in Olson's analysis, that constituent of the message where alternative referents are a distinct psychological possibility.

The present work seeks to present new evidence that children at the one-word stage function like adults in this respect: children also select for verbal expression that aspect of an event where alternative possibilities are perceived.

The Structure of Referential Events

Isomorphic forms of presupposition on two levels, the sensorimotor and the linguistic, imply that the sensorimotor structuring of events is isomorphic with linguistic structuring. This was the claim of our earlier work (Greenfield and Smith, 1976), which tried to show that children fit their early words into a preexisting cognitive framework. This framework structures events in terms of roles like agent, object, location, and the relations among them. Thus, single words function to fulfill such roles through their combination with elements in the nonverbal situation. For example, when a child says *outside* as she goes outside, she is expressing the change of state of an agent. While the agent is not expressed verbally, it is through its existence in the event that *outside* can be produced and understood. Greenfield and Smith (1976) observed semantic functions like action or state of agent, object, and dative develop gradually in the period of single-word utterances. The later linguistic expression of relations among these semantic roles constitutes grammar. In addition to evidence from early word use, Greenfield and Smith (1976) summarized studies indicating that concepts like agent and location develop on a perceptual level during the first year of life, before the onset of language. Such an argument, supported by behavioral evidence from the prelinguistic period, has also been made by Bruner (1975) and Bates (1976).

The question of semantic selection, the concern of this paper, becomes relevant when the child is capable of expressing more than one semantic role with regard to a given referential event. For instance, at a certain point in time, the child is capable of expressing both change of state and agent and also has the vocabulary to do so linguistically in a number of different situations. With respect to the referential event

just described—the child going outside—the child may, at this juncture, express either her change of state (*outside*) or the agent (e.g., *me*). The question of semantic choice then arises: in the above event, for example, we can ask why the child expresses her change of state rather than the agent. The existence of alternative semantic functions in the child's speech and thought becomes a fact toward the end of the one-word period; this is the stage of development that has been the focus of our present study.

While the existence of action roles in cognition and language will be assumed in the present study, their ordering will not be. Linguistic selection, the focus of our study, could be a function of the way in which events are ordered on the sensorimotor level; for instance, there could be a selection rule to express the first element perceived in an event. Because of the possible interaction between the sensorimotor and linguistic levels, it is necessary to present a view of the underlying cognitive ordering of events before discussing how an element in this structure is selected and/or ordered in linguistic expression.

Cognitive Ordering

The child's sensorimotor structuring of an event has, we are claiming, a topic-comment order. Topic is basically defined in relation to comment, what is commented upon. While the syntactic process of topicalization can turn actions and other relations into topics (e.g., the gerund turns a verb into a noun), we are claiming that the most basic and ontogenetically earliest form of topic is an entity. A corollary claim is that the most basic sort of comment is a change of state. Clearly, the latter cannot be perceived without first establishing the former: *something* must undergo a change of state. For example, we know that the newborn is aware of movement (a change of state), because he or she visually follows an object (entity) which is moving; this fact lends support to our claims. Thus, if an entity constitutes a primitive topic and a change of state a primitive comment, then the perceptual precedence of the entity implies a topic-comment ordering on the sensorimotor level.

When there is more than one possible entity in a given referential event, the child will attend to that entity whose state is in question. Thus, informativeness influences choice of topic. Ordinarily, the topic will be the first element to be expressed linguistically when a particular event is being described to a listener. Although this order is conceived of as invariant at the sensorimotor level, the topic may not be initially (or ever) realized at the level of linguistic expression. Thus, in addition to principles of *sensorimotor* ordering, it is also necessary to develop

rules for the selection and ordering of *linguistic* elements, the main topic of our study.

Linguistic Selection and Ordering: The Single Event

Our central hypothesis is that linguistic selection and ordering is a function of the informativeness of the elements. Informativeness derives from the perception of alternatives, change, uncertainty. Its opposite, certainty, is a process of taking for granted and is linked to the absence of alternatives.

Our conceptualization of the interaction between the sensorimotor and linguistic levels at a point in the one-word stage where semantic choice lies within the child's competence asserts that the child processes different aspects of a referential event, according to the perceptual order described above. That is, topic is followed by comment; entity is followed by change of state. Given that the child is competent to express either aspect of the event, he or she will verbally express the first one to reach a certain level of informativeness. Because the topic is the first element to be processed, a single-word utterance will express the topic where it is sufficiently informative, that is, where it cannot be taken for granted. But the topic is taken for granted and will not be expressed first, when the topic is closely identified with the self. Included are situations in which the topic is the self, something possessed by the self (e.g., in hand), or something about to be possessed by the self. In such cases, single-word utterances will comment on the topic rather than express the topic itself.

Taking for granted can be specified in terms of attentional shifts. If attention is already on the topic before the referential event takes place, it will be taken for granted and go unexpressed in a single-word utterance. For instance, attentional focus is generally on the self when one is undertaking to act. Similarly, it would generally be on an object when that object is in hand. In these situations, therefore, the topic will not usually be expressed. The analysis is more subtle when an animate being other than the speaker is acting. At any moment, there is a greater chance of attention being focused on an animate being with whom interaction is occurring than on a particular inanimate object not in the speaker's possession. Hence, animate agents should rarely be expressed, whereas objects undergoing changes of state at a distance from the speaker would be. In contrast, when the event *shifts* the attentional focus to its topic, it will not be taken for granted and will be the first element expressed on a linguistic level. For instance, imagine a situation where the child is focused on playing with a car, when a rolling

ball catches her attention. This attentional shift provides psychologically real alternative objects of attention (the car or the ball). It is posited that such an attentional shift occurs, in general, when objects undergo changes of state at a distance from the child. Since the object, ball, is not in hand, it cannot be taken for granted. Therefore, if the child verbalizes in this instance, the child begins by saying *ball*. We are thus providing a perceptual-cognitive explanation of why and how distance from the child-speaker affects the informativeness of objects, a notion suggested originally by Veneziano (1973).

Where an object undergoes a change of state at a distance from the child, we are hypothesizing that the topic is expressed first because it has not been established. (See Keenan and Schieffelin, concerning the establishment of a topic as the first requirement in conversational discourse.) We are not claiming that it is necessarily more informative than the change of state, the other element in the situation. The claim is, rather, that where topic is sufficiently uncertain, it will be stated first. Where it is not sufficiently informative because the child is *a priori* aware of it (our cognitive definition of taking-for-granted), it will be skipped over," and the comment will be the first linguistically expressed element. In such a case, we would claim that the comment (change of state) is more informative than the topic (object). In other words, there is an asymmetry in the following respect: where topic is expressed first, topic and comment are informative or uncertain to roughly the same extent; but where comment is expressed first, the comment is more informative than the topic. Once one element is communicated successfully, the alternative element will be expressed if the child continues to talk about the original event. When the child goes on to encode a second aspect of the event in a single-word utterance, a sequence is formed. Quite often, however, children repeat themselves.

Sometimes children persist in talking about the same event. To understand this phenomenon, we must first consider what constitutes a successful communicative act. According to Searle (1969), a speech act is not successful unless various conditions are met. In particular, the essential rule must hold if a speech act is to be considered successful. The essential rule is a constitutive rule; that is, in a particular situation, an utterance must be counted by both participants as an attempt to be a member of the class of illocutionary acts (e.g., requests) to which it belongs. Searle discusses only speech acts, communications that are expressed linguistically. As described elsewhere (Greenfield and Smith, 1976; Elinor Keenan, Schieffelin, and Platt, 1976), the child at the

single-word level combines a nonverbal cue (a facet of the referential event) with his or her single-word utterance to construct a proposition. Extrapolating from Searle, we suggest that, for the child's communicative act to be successful, it must count as a request, assertion, question, offer, greeting, command, etc. (see Dore, Gearhart, and Newman, Chapter 8 below).

We are concerned here with the child/speaker's immediate judgment that the communicative act is or is not successful. A communicative act might not count if it were too garbled to be received or were not received by the intended hearer. The utterances of children at the one-word stage are characterized by great phonetic instability. Thus, if the phonetic realization does not approximate some acceptable standard, the child may repeat the utterance until he or she is satisfied with the outcome (Scollon, 1976). A speaker may also consider an utterance unsuccessful if the coparticipant in a conversation does not acknowledge the utterance. The child may repeat and repeat and repeat the same utterance until the coconversationalist responds (Elinor Keenan, 1975) or the referential event changes. Single-word children/speakers use the device of repetition to correct their own unsuccessful communicative acts within the same turn (see Elinor Keenan, 1975, for other uses of repetition). Once the communicative act is deemed successful, repetition stops.

In the course of an earlier study of language development in the period of one-word speech (Greenfield, Smith, and Laufer, 1972; Greenfield and Smith, 1976), we observed a stage, relatively late in the period, in which the children uttered a series of two (or more) single-word utterances to communicate linguistically a single referential event. This phenomenon has been noted by many other observers, as early as Guillaume (1927) and as recently as Bloom (1973) and Scollon (1976). In such a sequence, the child encodes two aspects of a single event: for example, the sequence, *ball; down*, uttered when the child saw someone throw a ball to the ground, would sequentially express an object and its change of state.

Conversational sequences are similar to this basic sequence, except that the second element is elicited through the verbal questioning or comment of a mature speaker. Thus, if in the sequence just described, an adult had interjected *What happened to the ball?* after the child said *ball*, and the child had responded with *down*, then this example would constitute a conversational sequence.

Because of the asymmetry noted above, we would expect that the

child would more often form a sequence by adding comment to topic than by adding topic to comment. The reason for this is that we have theorized that initial comments signal that the topic has been "skipped over" because of its uninformativeness. Hence, on the basis of this conceptualization, we would expect topic-comment sequences to be more frequent than comment-topic sequences, while comment-only utterances should be more frequent than topics alone.

Predictions and Prior Data for Objects Changing State

In the sort of referential situation where an object is the topic and a change of state the comment, we would predict (1) that object-action sequences will exceed action-object sequences and (2) that the expression of action in isolated single-word utterances will exceed the expression of object in this form. This prediction was tested with data from one of the children, Matthew, from our earlier study (Greenfield and Smith, 1976). We selected the particular observation session, Period VII, in which sequence construction was at its height; at this time Matthew's age was 19 months, 21 days. During the 3-hour-and-15-minute observation period, Matthew produced a total of 253 utterances. The analysis to be reported focused on dynamic events involving objects, objects undergoing a change of state. Thus, objects were the sole type of topic considered. Excluded were events in which an object was being indicated or demanded. Our prediction was borne out by the data. Considering object as topic and change of state as comment, we found 7 topic-comment sequences in contrast with no comment-topic ones, and 18 comment-only utterances in contrast with 9 topic-only utterances. The stability of this pattern is confirmed by a one-tailed chi-square test ($\chi^2=5.11$, $p<.025$).

Data collected by Bloom (1973) on her daughter, Allison, were used to confirm this pattern with an independently collected corpus of material. The sample from Allison at 19 months, 2 days, was subjected to the same analysis as Matthew's data. The results showed the same pattern. Considering speech events relating to an object undergoing some change of state, we find topic-comment sequences outnumbering comment-topic 8 to 2 and comment-only outnumbering topic-only 10 to 5. A Fisher Test (one-tailed) indicated the stability of this pattern at the .05 level of significance.

While the data were collected before the prediction was formulated, the prediction antedated this particular analysis. This hypothesis did not,

furthermore, influence the collection of either set of original data in any way, as it had not yet been formulated. Hence, our test does not fall neatly into the categories of either "postdiction" or prediction.

Linguistic Selection and Ordering: A Series of Related Events

In a series of referential events in which all elements remain constant but one, the variable element will be selected for linguistic encoding from the second member of the series on. This selection would reflect attentional shift to the variable element. In the situation just discussed, where there is but a single event, information derives from the spatial patterning of objects and actions. In a sequence of related events, it is the temporal pattern that is critical.

Temporal patterning also comes into play when conversational discourse creates certainty and information. Attentional focus may be created by previous utterances, as well as by attention to nonverbal elements. Consequently, elements which are "old" by virtue of previous linguistic expression do not get expressed. When one speaker expresses the topic of the next speaker's message, the second speaker will verbally express only the comment.

In the following sections of this paper, we will provide much more detail on theoretical expectations derived from uncertainty or informativeness, expectations concerning linguistic ordering and selection for both single events and related series of events. To assess these hypotheses, we rely partly on previously collected data of our own and of other investigators, but the primary data are from new work with new methods.

SPECIFIC PREDICTIVE RULES

Our study attempts to demonstrate that there are regular relations between the structure of nonverbal events and the process of semantic choice at the linguistic level and that these regularities can best be explained in terms of the principle of informativeness, even at the one-word stage. The theoretical concepts discussed above generate a series of specific predictions for the referential events used in our study. In the predictions that follow, an event is conceptualized as what is occurring: in this study we are confining ourselves to events consisting of some entity undergoing a change produced by an agent. In a sequence of events, one or more new elements is substituted for the

original element(s). For instance, an animate being continues to perform the same action but interacts with a series of different objects or continues to place the same object in a succession of new locations.

Transitive Events

(1) When an agent is making an object¹ undergo a change of state at a distance from the speaker, perception of that event is likely to involve a shift of focus to the object in question. The identity of the object is uncertain. Hence, the object becomes a topic that is not taken for granted and will, therefore, be expressed.

(2) When an object is in the speaker's possession or is being acted upon by the speaker, it is generally taken for granted through its connection with the self. Its identity is not in question, and it will, therefore, go unexpressed. When the object is being acted on, uncertainty will inhere in the change of state, which will be expressed.

(3) If an object belonging to another person is given or is in the process of being given to the child/speaker, the object is taken for granted and the possessor is expressed verbally.²

(4) When the child is showing an object to another person, there is no change of state to express (Rule 2), and so the object is named.³

Intransitive Events

(5) When another animate being is acting, the speaker's attention is likely already to be focused on the actor, who, therefore, represents a constant in the situation. The actor as topic goes unexpressed, and the action, representing a change in the situation, receives verbal expression.

(6) When the speaker is acting, the self as agent is taken for granted, and the action receives verbal expression. Another way of looking at this situation is to say that the agent is a constant while the action represents a change in the situation.

All Events

(7) If the most uncertain and informative element within a single referential event is unsuccessfully expressed, it remains uncertain and informative. Therefore, if the child continues to encode the situation verbally, he will persist in encoding that element until successful or the situation changes.⁴

(8) If the referential event is immediately repeated, there is no change in the relative certainty and informativeness of the different

elements. Therefore, if the child continues to encode the situation verbally the child will express the same element again.⁵

(9) Once the most uncertain or informative element in a single referential event involving two elements has been given verbal expression, it becomes more certain and less informative. At this point, then, if the child continues to encode the situation verbally, he will now express the other aspect, heretofore unstated.

Subsequent events in an event sequence

(10) If, in a sequence of events, the action (including locative action) remains constant while the object⁶ varies, the object will be given verbal expression.

(11) If, in a sequence of events, the object remains constant while the action varies, the action will be given verbal expression.

(12) If, in a sequence of events, the object remains constant while the location changes, the location will be given verbal expression.

(13) If, in a sequence of events, the possessor remains constant and the object varies, the object will be given verbal expression.⁷

(14) If, in a sequence of events, the object remains constant and the possessor varies, the possessor will be given verbal expression. (In the rare case where two rules could apply to the same situation, Rules 10 through 14 override all others.)

According to our earlier findings (Greenfield and Smith, 1976), agents are informative only when (1) they are absent or (2) there is a conflict over agency. Because such situations were not included in our scripts, none of the rules predict the expression of agent.

A METHOD OF INDIVIDUALIZED EXPERIMENTS

Before discussing our tests of these predictive rules, we would like to introduce and discuss a new methodological concept—the individualized experiment—which we developed in the context of the present study. It is currently recognized (e.g., Mischel, 1977) that the same physical stimuli are not functionally equivalent for all participants in a given experiment. Yet the assumption behind standard experimental approaches is that all subjects are, in fact, being exposed and reacting to a common set of conditions. Usually, the ability to draw general conclusions from one's results depends on the validity of this assumption. The recognition that this assumption is often not valid has led to various attempts to modify methods of study. One common practice is to ques-

tion participants afterwards about their interpretations of the experimental procedure. Relationships between the participants' view of the experiment and their behavior in response to the experimental stimuli are used to confirm or disprove the assumption of stimulus equivalence. At best, this method is indirect. This practice substitutes knowledge of a failure to equate stimuli across subjects for actual experimental control. In this way, such procedures represent a deviation from the experimental method. This method is, of course, useless with children too young to be able to verbalize an interpretation of the experiment.

The individualized experiment deals with the problem of stimulus equivalence in a direct fashion. The basic concept is that what is held constant across subjects is not the *physical characteristics of the stimuli* but the *functional relations between subject and stimuli*. In the present study, the important functional relationships between child-participants and stimuli are the following: (1) the items relevant to a particular procedure must be in the participant's lexicon; (2) the participant must have used a particular lexical item in reference to the physical stimuli actually used in the experiment; (3) the participant must have shown evidence of the ability to express, in single-word utterances, all the semantic functions assumed by the procedure; and (4) the experimenter and surroundings must be maximally familiar to the participant (to achieve this aim, the mother served as experimenter, and the experiment was carried out in the child's home). Each of the children in our sample had, in fact, a different lexicon, used lexical items in reference to different people, actions, and things, had a slightly different set of semantic functions available, and lived in different physical and social environments. Maintenance of uniform functional relations across children required a different experimental procedure for each child: the individualized experiment.

The individualized experiment solves a number of methodological problems. An important one is that of ecological validity. Often, standardized experimental procedures have a tenuous or unknown relationship to real life circumstances. Yet, the effects of such circumstances on behavior are precisely those which one would like to understand. In the individualized experiment, the procedures can be designed to have a determinate relationship with each subject's real-life circumstances, as these vary from person to person. For example, the experimenter's choice of a toy canary might not be recognized as a bird by any of the children. Further, the children might not use "bird" productively in reference to an unfamiliar object. Therefore, each child's

procedure is based upon diary evidence or caretaker report that lexical items were uttered in reference to the particular person, object, or action/state used as stimulus material in the experimental procedure.

A second problem is addressed by the individualized experiment. Current concepts of method in psychology still assume a one-way relationship between stimulus and response, although important current theories—structuralism, a systems approach—are quite explicit in positing two-way interaction between person and environment. That is, our theoretical formulations recognize that a person does not merely passively react to sets of stimuli. Instead, he or she actively imposes an order upon them through processes of selection and interpretation; these processes reflect such factors as cognitive level, past experience, and motivational state. The classical Stimulus—>Response has become Stimulus<—>Response; but experiments are still designed as though the researchers believed in the old one-way model. The individualized experiment represents a start toward actualizing the theoretical assumptions of a two-way interaction between stimulus and response in an experimental technique. That is, the specific characteristics of the participating child influence the creation of the stimuli to which he or she will later be required to respond in the experiment proper. Since each child constructs his or her own lexicon based upon different life experiences interacting with variations in cognitive level and motivational state, it is unlikely that any two lexicons will be identical. Therefore, each child's experimental procedure utilizes different surface manifestations to test the same functional relationships.

A third problem addressed by the individualized experiment is that of individual prediction. The standard types of experimental design attempt to predict only group averages. No attempt has been made to predict the behavior of any single individual. Yet the ability to predict behavior for every individual participant represents a much more precise level of behavioral understanding. Once the notion of individualizing an experimental procedure is put into practice, it is no longer possible to pool data derived from different individuals and do group analyses. The responses from each subject are treated as a sample in itself. A statistical analysis is performed on each sample individually. The question asked of the statistic, then, is, "Can one generalize about the behavior of this particular subject?" The individualized experiment, thus, leads to predictions on the individual level. Ironically enough, this notion of understanding the behavior of every individual participating in an experiment is one shared by Skinner's operant conditioning methodology, in which general principles are demonstrated by learning curves

of a few individual animals. But the main point here is that the ability to predict on the individual level, when repeated for a reasonable number of individuals, is a much more stringent test of theoretical concepts than is prediction on the group level.

Some researchers have been moving towards individualized experiments without ever formally stating the principles behind these attempts. For this reason, these moves toward individualization have often been incomplete, although each represents a valuable methodological advance. While attempts of this nature could probably be cited in many areas of psychology, we will limit ourselves to mentioning some that have been used in the investigation of child language.

Greenfield (1973) devised tests to investigate the precise referential meaning and phonological categories of her child's first words. These tests involved familiar people as stimuli and were given in the child's natural surroundings. The generality of the results was limited by the fact that the experiments, while individualized, were limited to an N of 1.

A good example of the recent development of individualized experimentation where several subjects are studied is Huttenlocher's (1974) study of the development of comprehension. For each of the subjects in her longitudinal study, she devised systematic tests of comprehension based on the mother's report of the nature and use of the child's lexicon in comprehension and production. In this way, Huttenlocher was able to get much more precise information about the comprehension competence of each child than if she had made up a set of standardized tests. At the same time, she was also able to describe underlying competence more completely than if she had based her conclusions on the unsystematic tests of comprehension that would occur naturally.

Recently researchers have begun to individualize experiments in a systematic fashion. In a study designed to test the hypothesis that selectively directed adult verbal intervention facilitates syntax acquisition in children, Nelson (1977) analyzed each child's transcripts for presence or absence of various sentence structures. Intervention sessions were tailored to the individual child by introducing syntactic forms not found in the samples of speech examined prior to intervention by reworking or recasting the child's own utterances. It is doubtful that the effects of this treatment would have been significant if the intervention had been standardized for all the children. The fact that Nelson's intervention sessions clearly facilitated acquisition of new syntactic forms can be attributed, in part, to the precise assessment made of each child and the individualization of treatment.

For a study of children's lexical overgeneralization in comprehension and production, Thomson and Chapman (in press) photographed stimulus objects from the child's own environment. These photographs constituted one end of a stimulus continuum that went from familiar to unfamiliar. Thus, the functional relationships between child and stimuli (degree of familiarity) were held constant by varying the particular stimuli for each child. For instance, each child was shown a picture of his or her own father as part of the test for the child's comprehension of the word "daddy."

The notion that the specific experiment will have to vary to achieve functional equivalence has been recognized in the field of cross-cultural psychology in recent years (e.g., Cole, 1973; Cole and Bruner, 1971; Cole, *et al.*, 1971; Greenfield, 1976; Childs and Greenfield, in press; Price-Williams, 1975). In this view, cultural variability must be reflected in procedural variability: an experimental procedure must be derived from particular cultures. This is an application, on the cross-cultural level, of the view being presented here, that is, that individual variability (within a given culture) must be reflected in individualized procedures. The general principle that true experimental "control" requires constancy in functional relations rather than physical characteristics is identical in both cases.

As was pointed out in an earlier paper (Greenfield, 1976), Piaget's concept of the clinical method also has a concept of adjusting experimental procedures for individual subjects. We have extended this concept to generate more radical differences in experimental procedure from participant to participant. Unlike the clinical method, the concept of the individualized experiment is tied to, rather than separated from, experimental methodology and statistical treatment of data. In this way, the concept of individualized experiments represents a methodological rapprochement between American experimental psychology and European structuralism.

DESIGN OF THE STUDY

Sample

The four children whose results are reported here are part of a larger longitudinal sample of babies recruited through a private pediatric practice in Los Angeles. Parents of each baby were shown how to keep a diary of the child's language development and were given diary forms to help them in doing so. The diary focused on lexical develop-

ment, stressing development of the semantic functions (Greenfield and Smith, 1976) served by each word. The diaries were started either before or after the child's first meaningful word. To fill out the forms, parents had to record situational and verbal context for each new usage of a word. Participating families were each given a small honorarium.

The particular children whose results are reported here are those who had reached an appropriate stage of linguistic development at the time of these experiments. An appropriate level involved productive use of the requisite semantic functions, as well as a set of lexical items from which to make a particular semantic choice. We did make the assumption that semantic functions were generative. For instance, if Jason (pseudonym of one of the children) had been observed to say *Daddy* when selecting daddy's shoe from others in a closet, it was considered to be within his scope to utter *Daddy* when handling daddy's socks or jacket in a similar situation. Level of linguistic development was determined by a combination of diary information and questioning of the mother immediately before the design of each child's individualized procedure. The caretakers were interviewed a week prior to the videotaping to ascertain whether there was evidence for the use of at least two alternative semantic functions in particular situations proposed for the script. At that time, possible lexical realizations for each semantic category were collected. For the unscripted utterances, the data were analyzed only if the caretaker provided information that the child had alternative semantic functions and lexicon available in that situation. An example of these requirements and how they relate to the design of an experimental procedure will be presented below.

The four children whose results will be presented were from middle-class white families. All of the mothers except one and all of the fathers were college educated. The children's ages at the time of the experiment were as follows: Martha and Jim, 1 year, 9 months; Alice and Jason, 1 year, 11 months. (Names throughout are pseudonyms.) Martha's longest utterance was 1 word in length, Jason's 2 words, Jim's 3 words, and Alice's 4 words. In terms of the linguistic requirements for the present study, the children were ordered as follows from least to most advanced: Martha, Jim and Jason, Alice. The procedure for each child was designed for the level of that child. Alice's script had the potential to assess the operation of Rules 1 through 3 and 9 through 14. Jason and Jim were tested for Rules 1-3, 9-11, and 14. Martha's script assessed Rules 1, 2, 9, 10, and 11. Evidence for Rules 4-8 lies in unscripted behavior for all four children.

Procedure

Our procedure was based on the notion of an individualized script. Each script was tailored to the child-participant. The scripts contained situations designed to test Rules 1-3 and 9-14, as described in the section on specific predictions. These situations were, in each case, constructed from the child's current vocabulary, semantic functions, and past history (real-life experiences), as determined by a combination of diary information and questioning of the mother. The mother assembled the necessary props, composed of familiar objects, in advance.

A Latin square design was employed to control for main effects due to all order effects of presentation of the units which tested rules and for the ordinal position of the units within the sequence. To counterbalance the lexical items that tested a particular rules or rules, a Latin square design was also used within units. However, application of the Latin square design had to be modified in order to adapt to individual differences among children. For example, although all the children had the semantic functions action/state and object, they did not share the same realization lexically. That is, one child might have *bye-bye*, *night-night*, and *eat*, while another could express action/state by means of *all gone*, *up/down*, and *night-night*. Further, all the children had not acquired the same semantic functions. In such cases, the sequence was collapsed or an appropriate substitution was made.

The basic method was selective imitation. That is, the mother, as experimenter, would follow the script, carrying out certain actions and describing them verbally or asking the child to do various things. The child's verbal expression would consist of selectively imitating some aspect of the mother's utterance. The use of imitation as an experimental technique is based on Piaget's (1951) basic discovery that imitation, far from being a mechanical procedure, reflects as much about the cognitive structure of the imitator as it does about the characteristics of the model. In language acquisition research in particular, imitation seems to reflect what the child knows about grammar (Slobin and Welsh, 1973), vocabulary (Bloom, Hood and Lightbown, 1974) and discourse (Elinor Keenan, 1975). In general, it has been found that imitation tends to be more frequent when the potential model embodies principles or content that the child is currently in the process of learning to master (Bloom et al., 1974).

Alice's script is now presented to illustrate how these notions were actualized in practice. The scripted action appears in Roman type; the

speech in italics. Next to the scripted action and speech are listed the applicable rule (from the section on specific predictions), the resultant prediction in that instance, and the alternative semantic possibilities available in the child's vocabulary. The requisite semantic functions for a given item type are listed above the predicted and alternative semantic choices.

	Scripted Action Speech	Applicable Rule	Semantic Prediction	Semantic Alternative
(1)	Constant action, variable object (When Alice comes in from outside) <i>Can you take your hat off?</i>	Rule 2	Action/State <i>off</i>	Object <i>hat</i>
	<i>Can you take your jacket off?</i>	Rule 10	Object <i>jacket</i>	Action/State <i>off</i>
	<i>Can you take your shoes off?</i>	Rule 10	Object <i>shoes</i>	Action/State <i>off</i>
	<i>Can you take your socks off?</i>	Rule 10	Object <i>socks</i>	Action/State <i>off</i>
(2)	Constant object, variable possessor Handing Alice mother's shoe. <i>Here is Mommy's shoe.</i>	Rule 3	Possessor <i>Mommy</i>	Object <i>shoe</i>
	Handing Alice Cathy's shoe. <i>Here is Cathy's shoe.</i>	Rule 14	Possessor <i>Cathy</i>	Object <i>shoe</i>
	Handing Alice her own shoe. <i>Here is Alice's shoe.</i>	Rule 14	Possessor <i>Alice</i>	Object <i>shoe</i>
	Handing Alice father's shoe. <i>Here is Daddy's shoe.</i>	Rule 14	Possessor <i>Daddy</i>	Object <i>shoe</i>
(3)	Constant object and agent, variable action/state Putting hat on, <i>Look, Mommy is putting the hat on.</i>	Rule 1	Object <i>hat</i>	Action/State <i>on</i> Agent <i>Mommy</i>
	Taking hat off. <i>Now Mommy is taking the hat off.</i>	Rule 11	Action/State <i>off</i>	Object <i>hat</i> Agent <i>Mommy</i>
(4a)	Patient and object at a variable distance from the child. Mother gives Alice a doll; mother gives Alice a cookie.	Rule 2	Action/State <i>eat</i>	Patient <i>doll</i> Agent <i>Alice</i>

	Scripted Action Speech	Applicable Rule	Semantic Prediction	Semantic Alternative
	<i>Alice makes the doll eat the cookie.</i>			Object <i>cookie</i> Agent <i>Alice</i>
	Mother gives doll a cookie. <i>Now Mommy is making the doll eat the cookie.</i>	Rule 1	Patient <i>doll</i> or Object <i>cookie</i>	Action/State <i>eat</i> Agent <i>Mommy</i>
(4b)	Mother rolls ball into tube. <i>Mommy makes the ball all gone.</i>	Rule 1	Object <i>ball</i>	Action/State <i>all gone</i> Agent <i>Mommy</i>
	Mother gives the ball to Alice. <i>Can Alice make the ball all gone?</i>	Rule 2	Action/State <i>all gone</i>	Object <i>ball</i> Agent <i>Alice</i>
(4c)	Mother gives bear to Alice; mother gives blanket to Alice. <i>Can Alice make the bear go night-night?</i>	Rule 2	Action/State <i>night-night</i>	Patient <i>bear</i> Agent <i>Alice</i>
	Mother lays bear down and covers it. <i>Now Mommy is making the bear go night-night</i>	Rule 1	Patient <i>bear</i>	Action/State <i>night-night</i> Agent <i>Mommy</i>
(4d)	Mother pushes bunny in stroller. <i>Mommy is making the bunny go bye-bye.</i>	Rule 1	Patient <i>bunny</i>	Action/State <i>bye-bye</i> Agent <i>Mommy</i>
	Mother gives Alice stroller; mother gives Alice bunny. <i>Now Alice makes the bunny go bye-bye.</i>	Rule 2	Action/State <i>bye-bye</i>	Patient <i>bunny</i> Agent <i>Alice</i>

Scripted Action Speech	Applicable Rule	Semantic Prediction	Semantic Alternative
(5) Constant object, variable location			
Mother places stroller, chair, high chair, and box near Alice; mother hands Alice the bird. <i>Sit the bird in the stroller.</i>	Rule 2	Action/State <i>sit</i>	Location <i>chair</i> Object <i>bird</i>
Mother hands Alice the bird again. <i>Sit the bird in the chair.</i>	Rule 12	Location <i>chair</i>	Object <i>bird</i> Action/State <i>sit</i>
Mother hands Alice the bird again. <i>Sit the bird in the high chair.</i>	Rule 12	Location <i>high chair</i>	Object <i>bird</i> Action/State <i>sit</i>
Mother hands Alice the bird again. <i>Sit the bird in the box</i>	Rule 12	Location <i>box</i>	Object <i>bird</i> Action/State <i>sit</i>
(6) Constant possessor, variable object			
Mother hands her own shirt to Alice. <i>Would you like to dress up?</i> <i>Here is Mommy's shirt.</i>	Rule 3	Possessor <i>Mommy</i>	Object <i>shirt</i>
Mother hands her own shoe to Alice. <i>Here is Mommy's shoe.</i>	Rule 13	Object <i>shoe</i>	Possessor <i>Mommy</i>
Mother hands her own jacket to Alice. <i>Here is Mommy's jacket.</i>	Rule 13	Object <i>jacket</i>	Possessor <i>Mommy</i>
Mother hands her own hat to Alice. <i>Here is Mommy's hat.</i>	Rule 13	Object <i>hat</i>	Possessor <i>Mommy</i>

THE INDIVIDUALIZED SCRIPT STUDY: RESULTS

Is it possible to predict what a child will say and when? Our answer is a qualified yes. There are two major qualifications. The first is that we have made no attempt to predict silence. Our predictions are, therefore,

of the type, "If the child speaks now, she will say X." The second is that most children did not accept and respond to our script most of the time. It is possible that failure of the children to verbalize at various junctures in the script may be accounted for by our overestimating the generality of the children's semantic functions. The specific predictions were, however, based on principles that can be applied to a wide variety of situations. When these situations occurred, it was possible to apply these principles postdictively. For most children, it was necessary to combine utterances relating to spontaneously created events with those produced in response to the script in order to have a statistically analyzable sample for each child. In addition, as mentioned earlier, four of the rules were *ex post facto* in the sense that they were formulated to cover unanticipated phenomena noticed after the data had been collected.

Quantitative Results

Informativeness

The principles of informativeness were able to account for the actual semantic choices of all four children in the great majority of cases. Table I presents a summary of these data. Only the first verbal response to a referential event or adult utterance was counted for the purpose of these statistics, since the probability of expressing an alternative aspect of an event rises once a given aspect has already been expressed. Later responses to a given event (examples of Rules 7 and 9) were included in the qualitative examples to be described later, but they do not enter into the statistical analysis presented in this section. The following types of utterances were also excluded from our analysis: (1) wholly unintelligible utterances, (2) partly unintelligible utterances such that one possible interpretation would lead to confirmation of a prediction from informativeness, while the other would lead to disconfirmation, (3) utterances preceded by a "biasing" question, e.g., *Whose shoe is this?* as a follow-up to *Here's Cathy's shoe* biases the response toward expressing the possessor, and (4) utterances of two words or more in which both the possible semantic choices are included, unless they contrast with an earlier one-word utterance in a series of related events. An example of an excluded utterance would be *allgone ball* as a response to *Can you make the ball allgone?* The number of exclusions varied among the children, possibly depending on their level of linguistic sophistication and/or production. For Martha, there were no utterances of more than one word to eliminate; for Jason, 7 utterances of more than one word were not included; for Jim, 5 were left

Table I
Frequency of Scripted and Unscripted Confirmations and Disconfirmations
of Specific Predictive Rules of Informativeness

Child:	Alice				Jim				Jason				Martha			
Frequency	Scripted		Unscripted		Scripted		Unscripted		Scripted		Unscripted		Scripted		Unscripted	
	confirmation	disconfirmation	confirmation	disconfirmation	confirmation	disconfirmation	confirmation	disconfirmation	confirmation	disconfirmation	confirmation	disconfirmation	confirmation	disconfirmation	confirmation	disconfirmation
	2	2	0	0	5	0	3	0	13*	0	9	3	1	0	7	2
	1, rule 10	1, rule 2	4, rule 2	1, rule 2	3, rule 2	1, rule 2	1, rule 2	1, rule 2	1, rule 1	1, rule 1	5, rule 2	2, rule 2	1, rule 2	1, rule 2	1, rule 2	1, rule 1
	1, rule 12	1, rule 3*	2, rule 4*	1, rule 3*	1, rule 8*	1, rule 8*	2, rule 11	1, rule 10	2, rule 2	2, rule 2	3, rule 4*	1, rule 10	1, rule 4*	1, rule 4*	1, rule 1	1, rule 2
			2, rule 11		1, rule 11						1, rule 10				1, rule 5	
															4, rule 6	
Total	10	2	8	0	8	0	22	3	22	3	22	3	8	2	8	2
p value	p = .0.19		p = .004		p = .001		p = .055									

*Ex post facto rule.

out; and for Alice, 8. An example of a two-word utterance contrasting with a prior single-word utterance would be as follows:

Mother	Child
Here Jason/	Here are Arthur's pants/
Here's Arthur's shoe/	Arthur's shoe/

The child's final utterance in this sequence expresses a new element, the object, not present in the earlier one-word utterance. Because this corresponds to the variable aspect of the referential situation (Rule 13), this two-word utterance was classified as confirming a prediction.

Each child's data were subjected to a binomial test to see if the proportion of overall rule confirmations was greater than what would be expected by chance. These statistics test the validity of the rules as a body. Indeed, our study was not designed in such a way as to permit the testing of individual rules. However, inspection of Table I indicates that, with the exception of Rule 1, of which there was only one instance, all rules were confirmed more frequently than they were disconfirmed.

The chance probability of a particular choice was considered to be .5 for purposes of the tests. This assumption leads to very conservative tests as the actual choice is often one of three alternative types of semantic possibility for each type of referential situation (e.g., a choice from among three elements: agent, action, or object). This can be seen in the sample script.

The binomial test yielded clearly statistically significant results for three of the children and borderline results for the fourth (Table I). Results for all four children were in the predicted direction. Exact probability levels are presented in the table. As Table I shows, most children did not follow the script frequently enough to permit separate analysis of the scripted behavior. In addition, several rules were formulated after the data had been collected. If we eliminate unscripted behavior and ex post facto rules, only Jason provides a body of data large enough to test the purely *predictive* power of the rules. There are ten examples where (1) Jason followed the script and (2) the script tested rules formulated in advance. In all such cases, the predictions were confirmed by Jason's actual semantic choices. According to the binomial test, the probability of these results for Jason occurring by chance is less than .001. In the case of this one child, rules generated by the principle of informativeness enabled us to *predict* quite exactly what he would say and when. In the case of the other three children, we must limit ourselves to concluding that these same rules allow us to *understand* their semantic choices in the great majority of instances.

Stress

If the caretaker stresses a certain lexical item in the utterance prior to the child's turn, does this emphasis influence what the child will say? In order to investigate this potential explanation, both scripted and unscripted confirmations and disconfirmations of the predictions were tallied with respect to stress in the caretaker's prior utterance. Transcripts of the audio portion of each videotape carefully recorded all occurrences of stress, including syllable stretches, changes in pitch or loudness, and pauses. The caretakers of Jim, Jason, and Martha used stress in nearly every utterance; Alice's caretaker spoke with little emphasis. The child can imitate stressed or unstressed elements from the prior utterance. Eighty-four percent of the time either there were in the caretaker's prior utterance several stressed elements, no stressed elements, a single stressed element which was not repeated by the child, or there was no immediately prior caretaker utterance. Obviously, in the latter three cases, emphasis does not account for the child's utterance. Further, if more than one element is stressed then stress cannot account for what the child says. Only 16% of the children's utterances reflected the single stressed element in the caretaker's prior turn. There was, therefore, virtually no evidence to support the notion that stress in the caretaker's prior utterance accounted for the child's selection of an element to express.

Qualitative Results

Here we shall present examples of the operation of informativeness for different types of referential situations. All of the following examples represent responses to the script, except (7) and (8). The scripts did not include intransitive action; this type of event is necessary to illustrate Rules 5 and 6. Spontaneous instances (7) and (8) were used to illustrate the operation of these two rules. Similarly, the script did not include "showing" events necessary for Rule 4 or repetitions (Rules 7, 8). Therefore, spontaneous occurrences have been included as they naturally happened to illustrate Rules 4-8.

In the examples that follow, Roman type indicates the referential event; italics show what is said. Individual words are placed under the particular aspect of the event to which they refer. The mother's utterances are in standard English orthography. The child's utterances are written phonetically, according to the transcription conventions of Ladefoged (1975) and enclosed in brackets. Underneath the phonetic transcription, the child's utterances have been translated into standard

English orthography. For the most part, we follow the conventions of Sacks, Schegloff, and Jefferson (1974) for the verbal transcription. Underlining (*shoe*) indicates emphasis (stress, intensity). Punctuation marks (,!?) are used for intonation, not as grammatical symbols. The end of an utterance is represented by an oblique (/). Contextual notes are enclosed in double parentheses; uncertain transcriptions in single parentheses. Colons (:or::) indicate syllable lengthening.

(1) Constant object, variable possessor

Mother	Child	Applicable Rule
Handin Jason, here's Here's	her Mommy's Mommy's	shoe <i>shoe:/</i> <i>shoe/</i>
	to Jason.	
	Looking at	mommy's [mami m] Mommy Mom/
		shoe. [fu] <i>shoe/</i>
		Rule 3 Rule 9
There ((Grunt)) There's	Mommy's <i>shoe/</i>	
	((intervening play and uninterpretable sounds))	
Handin Jason, here's	father's shoe Da:d'dy's <i>shoe/</i>	
	to Jason.	
	Looking up at	father's [dæ ^h (d)] Dad/
		shoe. [fu] <i>shoe/</i>
		Rule 14 Rule 9

In the above example the object, shoe, is initially taken for granted, because the child knows that it will soon be in his possession. Therefore, he starts by imitating the predicate, a possessive (Rule 3), and then continues to encode the situation by expressing the more certain aspect (Rule 9). In the second referential event, the object type (shoe) remains constant, while the possessor changes (to father). Jason responds by expressing the variable or informative element, naming the possessor, *Dad* (Rule 14) and then encodes the constant, less informative element, saying *shoe* (Rule 9).

(2) Constant patient and action, variable location

Mother has given Alice instructions to put a toy bird into a succession of locations—stroller, box, and chair. Alice has followed the instructions but has not imitated any part of them. During this sequence of events, Alice does produce some unintelligible sounds. The following excerpt from the transcript occurred when a fourth location was suggested.

Mother	Child	Applicable Rule
And now the bird wants to sit in the high chair/		
The bi:rd wants to sit in the hi:gh chair		
	Alice puts the bird in the high chair. [ɪna haɪ tʃeə] in the high chair/	Rule 12
	((barely audible)) [ɪna haɪ tʃeə] in the high chair/	Rule 7
In the high chair/		

In this example the child again expresses the changing or informative element (the bird's location), while leaving the constant element (the bird) unexpressed (Rule 12). Because the utterance is a four-word phrase, it is clear that the operation of informativeness guides semantic choice at varying levels of syntactic complexity, not just in single-word utterances. Alice's first utterance is not clearly audible and, therefore, not successful. Alice repeats herself (Rule 7). Her mother's response, an exact repetition, provides clear evidence the message was received (Elinor Keenan, Schieffelin, Platt, in press). At this point, Alice ceases to repeat herself.

(3) Constant patient and action, variable object

Jason has just been asked to make his doll, named Fonzie, eat a cookie. In a prior item in this series, Jason was asked by his mother to feed Fonzie a banana. Jason gave the unpeeled banana to the first author, PMG, and did not feed Fonzie.

Mother	Child	Applicable Rule
	Jason makes Fonzie eat a cookie [e: tʃ] eat/	Rule 2
	Jason fumbles with the cookie. Jason makes Fonzie eat the cookie again. [e: tʃ] eat/	Rule 8
Jason/ Here's some bread/ You wanna (.) make Fonzie eat bread/ ((Talk between researcher, PMG, and mother.))	((Jason hands Fonzie to PMG, who then takes over the mother's role as experimenter.))	

PMG makes Here	Fonzie Fonzie	eat wan	a cracker. a cracker/		
				[kaki] cracker/	Unanalyzable biasing statement from adult
PMG makes Hm?	Fonzie Fonzie's	eat ea:ting eating	bread. the brea::d/ the bread?/	[ai] [bred] bread/	unintelligible Rule 10
Bun?/ Mother: Bread/ Oh, bread/ PGZ: Bread,O:h/					
PMG makes	Fonzie Fonzie	eat eating	a cookie. the coo:kie/	[koo:ɪ] cookie/	Rule 10

In this example Jason first expresses the action (eat), while the patient and object (Fonzie, cracker) are taken for granted and go unexpressed (Rule 2). Jason repeats *eat* because he repeats the referential event. Later, when the researcher makes the doll eat a series of foods, the child expresses the changing or informative elements (bread, cookie) and leaves unexpressed the constant elements (eat, Fonzie) within that situation (Rule 10).

(4) Constant object, variable action

Mother	Jason	Applicable Rule
Mother putting jacket on. Look Mommy's putting jacket on/	Jason is looking at and approaching his mother. [dʒæk tʃ] jacket/	Rule 1
	[dʒæk tʃ] jacket/	Rule 7
	[dʒæk tʃ] jacket/	Rule 7
	[(Barely audible)) Mm hm/	
	[dʒæk tʃ] jacket/	Rule 7
Here the jacket's on/	[an] on/	Rule 9
Mother taking Now Mommy's taking	jacket off. the jacket off/	
	[s:f] off/	Rule 11

In this exchange, the child starts by naming the object undergoing a change of state at a distance (Rule 1). Unsuccessful utterances are

repeated until the utterance is acknowledged (Rule 7). *Mm hm* does not acknowledge "what" was said, only that "something" was said. When the mother expands the child's prior utterance, thereby acknowledging that utterance, Jason goes on to encode the next most uncertain element (Rule 9). In the next referential event, the object remains constant, while a further change of state occurs. This change is expressed (*off*, Rule 11).

(5) Child causing object to undergo change of state

(5) Child causing object to undergo change of state.

Mother	Jim	Applicable Rule
Can you make the <u>ball</u> go all go:ne?/	Jim has made the ball go in a tube. [a(1)ga:n] allgone/	Rule 2

This interaction illustrates how an object is taken for granted and goes unexpressed when the child is causing it to undergo some change of state. In such cases, only the change of state is expressed (Rule 2). Contrast this instance with what is said when another person causes some object to undergo a change of state, as in Jason's first utterance in Example 4 above. In such a case, it is the object that is first expressed (Rule 1).

(6) Showing an object

(6) Showing an object.

Martha	Applicable Rule
Martha showing mother the monkey. [m (k) i] monkey/	Rule 4

There are a number of factors which may contribute to such a semantic choice. Perhaps the most important in terms of the actual communicative purpose is that, because the child's point is to draw the mother's attention to the object, it is not taken for granted and is therefore expressed, even though it is in hand (Rule 4). Another factor is that the object is not undergoing any change of state, and it is, therefore, not possible to choose to express change of state verbally. The only other elements of this referential situation involve the child herself, as agent carrying out the action of showing. These elements are likely to be taken for granted, as we have noted before.

(7) Child carrying out an action

(7) Child carrying out an action.

Mother	Martha	Applicable Rule
	Martha in process of lying down. [nal nal t] night-night/	Rule 6
	As Martha lies down looking toward mother. [na/ na/ t] night-night/	Rule 7
Mother looks toward Martha.		

The significance of this example is that it shows how self as agent is taken for granted and, therefore, goes unexpressed (Rule 6). Martha repeats until she gets her mother's attention (Rule 7).

(8) Another agent carrying out an action

(8) Another agent carrying out an action.

Mother	Martha	Applicable Rule
	Martha has her arms almost around the walking cat. [wak] walk/	Rule 5
	Martha is holding onto the walking cat. [wak] walk/	Rule 7
Mother does not acknowledge that the cat is walking.	Martha follows the cat out of the room, repeating herself 7 times more. She stops when the cat is out of sight.	

Here we have an illustration of the general principle that agents tend to be taken for granted and go unexpressed (Rule 5), unless there is uncertainty about who the agent is or conflict over who should carry on a particular action. This interaction further shows that utterances are repeated until acknowledged or until the referential situation changes (Rule 7).

These examples show how the predictive rules derived from the principle of informativeness operate in specific concrete situations. The reader should now have a better idea of the nature of the behavior which produced the statistical results presented earlier. Because our conceptualization of the structure of referential events leads to correct predictions and postdictions concerning children's semantic choice, we have some internal validation of this conceptualization. Future analyses of the children's patterns of visual attention will be able to provide even more direct evidence on this matter.

EXTENSION OF THE PRINCIPLE OF INFORMATIVENESS TO NONVERBAL COMMUNICATION AND LANGUAGE-DISABLED CHILDREN

Snyder (1975) sought to compare the role of informativeness in language disabled and "normal" children. The latter ranged from 11 through 18 months, while the language-disabled group went from 20 through 30 months of age. She involved each child in a series of events in which the object varied, while the action pattern remained constant. For example, the experimenter models the action of throwing blocks into a pail. The examiner then hands the child each block while holding the pail. After the child repeats the modeled action three times, the examiner hands the child a doll figure instead of the anticipated block. For each item, both verbal and nonverbal responses were noted from the second stimulus object on. Snyder found that, on a nonverbal level, both language-disabled and normal children encoded the new or changing item about 95% of the time and a less informative element only about 5% of the time (for example, by pointing). While the "normal" children performed similarly on the verbal level, the language-disabled children showed a much less distinct preference for the most informative element: they encoded a less informative element 32% of the time. The tendency to express the most informative element in the situation did not attain statistical significance for the language disabled children.

Snyder's results extend our hypothesis about the role of informativeness to nonverbal communication in both normal and language-disabled children. Her data also support our hypothesis on the verbal level for normal children. They show, in addition, that language-disabled children are comparatively lacking in the ability to coordinate sensorimotor presupposition and verbal expression.

SEMANTIC CHOICE IN RESPONSE TO PICTURES

Our first experimental attempt to study semantic choice as a function of the principle of informativeness used photographs as stimuli. The children were observers of still photographs of a sequence of related events, rather than participants in scripted action sequences. Objects representative of particular semantic functions were selected from the child's environment to be photographed on the basis of the caretaker's judgment that the items were familiar to the child and were members of the child's productive lexicon. A child would be presented with a

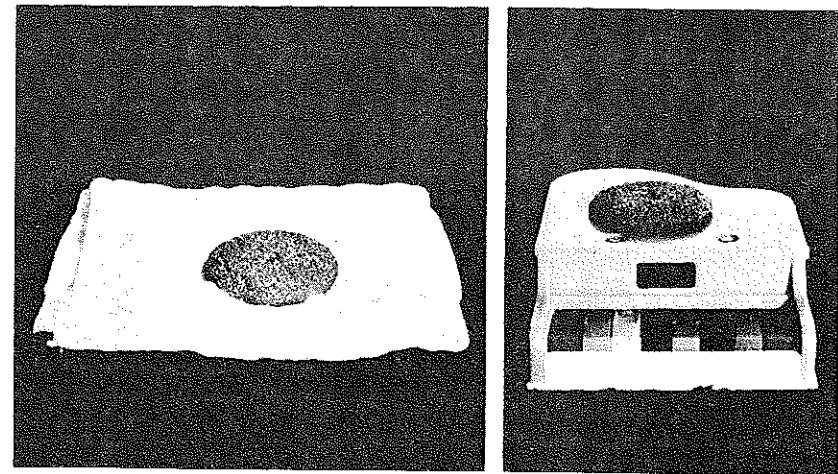


Figure 7-1. Two of the pictures from the series with cookie as constant object and with location varied.

series of color photographs in which one aspect varied, while one aspect remained the same. For example, photos of three shoes belonging to three different people comprised one series; in this series, the possessor varies, while the object remains constant. Predicting from the principle of informativeness, the child should encode the possessor after the first picture. The mother would "read" the photo album with the child in the normal way. She was instructed not to say anything after turning to a particular page. If the child did not give a verbal response, the mother was to say "What's that?" without pointing (in order not to bias the child's response towards a particular aspect of the picture).

Our first participant was a girl named Andrea, aged 22 months. The stimuli were designed to investigate the process of semantic choice in expressing the relation between an object and location. Initially, the location, a cup, appeared in each photograph while the object varied from photo to photo. This relation was reversed in a second series, in which locations varied from photo to photo while the object (a cookie) stayed constant, as Figure 1 depicts. A third, control series, consisted of photos in which both object and location varied from picture to picture. A detailed description of the stimuli is presented in Table II. This table also shows the predicted response for each picture. For the initial item in each series as well as the entire control series, where both object and location vary simultaneously, it was thought that the object (as topic) would be verbally expressed. Andrea's

Table II
Semantic Choice in Response to Photographs Depicting Object and Location

Series			Prediction
Location Constant, Object Varied			
cup containing	keys		keys
	cheerios		cheerio
	flowers		flower
	beads		bead
	water		water
	a cookie		cookie
	a fork		fork
	a brush		brush
Object Constant, Location Varied			
cookie on top of a	radio		cookie
	toy boat		boat
	diaper		diaper
	cup		cup
	toy truck		truck
	Andrea's shoe		shoe
	blanket		blanket
	toy piano		piano
Object Varied, Location Varied			
keys	on top of	the blanket	keys
cheerios	on top of	the radio	cheerio
fork	on top of	the diaper	fork
brush	in	the toy truck	brush
cookie	on top of	the piano	cookie
flowers	in	the boat	flower
beads	on top of	Andrea's shoe	bead
water	in	the cup	water

lexicon included lexical items for each of these familiar locations and objects. In addition, Andrea had been observed to express indicative object and location of an object.

The results were entirely different from these expectations. In 17 out of 19 pictures responded to, Andrea verbally expressed the object, regardless of which element varied. A two-tailed binomial test shows this pattern significant at the .001 level. Thus, in the second series, Andrea repeatedly responded with *cookie*, even though cookie was the constant element.

At this point, we decided to present the same stimuli to another child who displayed productive use of the requisite semantic functions

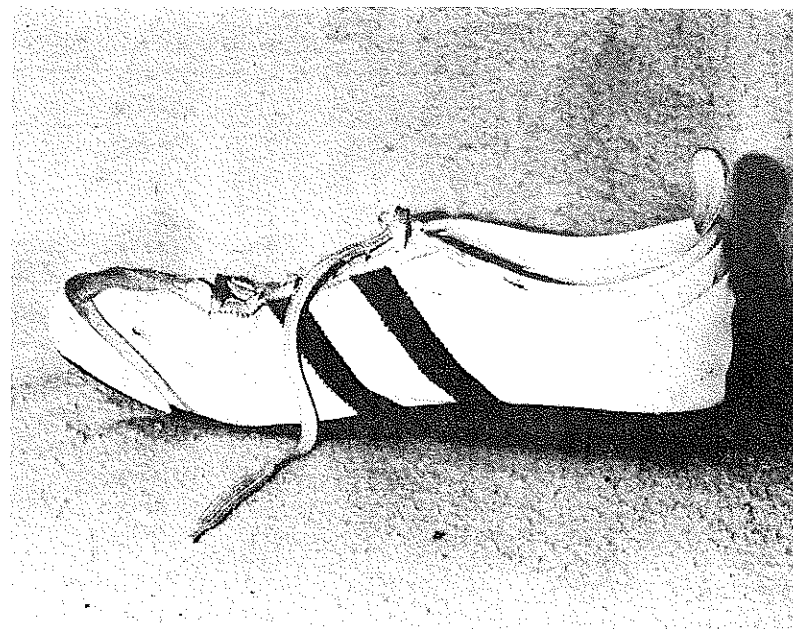


Figure 7-2. A photograph of "Daddy's shoe," used in the series with shoe as constant object and in the series with daddy as constant possessor.

(object and location) to see whether we would obtain the same pattern of results. The exemplars of object and location in Andrea's photo album were similar but not identical to items found in Jason's home. For instance, the cookie in the photographs was not the same type of cookie available in Jason's home. Jason (1 year, 11 months; longest utterance: 2 words) responded to 18 out of the 24 photographs. In 16 out of 18 pictures Jason named the object. This result is significant at the .002 level, according to a two-tailed binomial test.

Next, a second set of photographic stimuli was produced involving the relation between possessor and possessed. There were more series in this set, but the principles of construction were exactly the same as for the first set. In the first series, the object (shoe) was held constant, while the possessor (Mommy, Daddy, Andrea) varied. In the second series, the possessor (Andrea) remained constant, while the object (sock, shoe, jacket) varied. Four more series continued to alternate between possessor and object as the variable element. In a final control series, both elements varied simultaneously. An exact description of the stimuli is presented in Table III, along with the predictions. As before, the child was familiar with all the requisite vocabulary. Figure 2 shows one of

Table III

Semantic Choice in Response to Photographs Depicting Object and Possessor

Series	Prediction
Object Constant, Possessor Varied	
Mommy's shoe	shoe
Daddy's	Daddy
Andrea's	Andrea
Possessor Constant, Object Varied	
Andrea's sock	sock
shoe	shoe
jacket	jacket
Object Constant, Possessor Varied	
Daddy's jacket	jacket
Andrea's	Andrea
Mommy's	Mommy
Possessor Constant, Object Varied	
Mommy's shoe	shoe
jacket	jacket
socks	sock
Object Constant, Possessor Varied	
Andrea's socks	sock
Mommy's	Mommy
Daddy's	Daddy
Possessor Constant, Object Varied	
Daddy's jacket	jacket
shoe	shoe
sock	sock
Object Varied, Possessor Varied	
Andrea's pacifier	pacifier
Mommy's brassiere	brassiere
Daddy's shaver	shaver

the photographs, Daddy's shoe, which served in two of these series.

Again the results were different from expectations. In 13 cases, Andrea simply named the object. In 4 others, she produced two-word utterances consisting of both possessor and possessed. Not counting these two-word utterances, we find that this tendency to name the object is significant at the .004 level according to a two-tailed binomial test.

What is the explanation for these results? Whereas we developed the distinction between information and certainty to deal with the cognitive structuring of dynamic events, Bates (1976) points out that the figure-ground distinction may play a similar role in a static situation. In terms of information, a figure represents a change from its background and is, in this sense, the most informative part of a display. In the displays pictured, the object can be considered figure, its location ground. According to this analysis of the informational structure of pictures, these children were, therefore, expressing the most informative element. The thinking on which our original predictions were based seems to have erred in assuming that, when an element appeared in two successive photos (e.g., the cookie), it could be treated as a single constant element. In a sense, then, we erred in thinking that a child would treat successive pictures as representing successive (but related) events.

In order to test this post hoc explanation of the picture results, we used the first set of stimuli (in which objects and locations were varied) with one of the children, Jason, who had responded in the predicted manner in the scripted procedure described earlier using objects and actions (see description of scripted actions in the Procedure section). Jason was not shown Andrea's possessor-possessioned series, since he was unfamiliar with the owners of the objects and, therefore, could not be expected to attribute ownership to particular persons. Jason responded differently to the pictures than he had to the script, although the distinction between foreground and background was not the major response factor. He named very few pictures and concentrated particularly on two items which interested him, the truck and boat. Not only did he name them when they appeared (as locations), but he also requested them when they were absent. Although truck and boat were named when they appeared as (variable) locations, in line with our original hypothesis, these were the only instances of this tendency. The motivational value of these objects, as shown by the recurring requests for them, indicates that this, rather than variability, was the important factor. Thus, Jason's results indicate that a series of pictures will not be interpreted as a series of dynamic, interrelated events, but as a series of static, unrelated events.

Motivational value may endow an object with saliency. Similarly, a figure is salient against a background. It would, thus, be a correct summary of the picture results to say that salience is the main determinant of semantic choice.

In the case of pictures, information and salience appear to be one and the same. Since pictures are static situations, the main source of

information is the figure-ground contrast, the basic factor in the usual concept of salienc . In dynamic events, by contrast, there are many other sources of information. For instance the salient object (in the figure-ground sense discussed above) may remain constant, while its state changes. In this situation, the "salient" object will attract less attention than its change of state. Since the eyes are primarily detectors of movement (Gregory, 1966), action is a powerful determinant of attention (French, 1975). In parallel fashion, it seems possible that in static displays involving *several* "figures," attention may be directed away from perceptually salient features like color by other features which differentiate a particular object from its contextual alternatives. Thus, when a child chooses something to play with from among a red ball and a red book, he may not notice the otherwise "salient" color. In contrast, when having decided to buy a ball, a child chooses a particular ball from among a batch of different colored balls, color is sure to influence his choice. It seems likely that this type of process also influences linguistic selection with complex picture displays involving arrays of depicted objects (for example, see Press, 1974). In its usual meaning, salienc  is a more absolute concept (in the sense that there is only one alternative, e.g., Dent, 1977) than information. Salienc  in this sense does not take into account the spatial or temporal context of the stimulus, whereas spatial and temporal variability present alternatives that alter the distribution of attention. The viewing of a single item remaining constant over time—i.e., a picture of something—removes these elements and, thus, exaggerates the psychological predictiveness of an absolute concept of salienc . For young children, the most informative aspect of a single static display is the figure, embodying change from its ground.

In any event, the results for the dynamic events and for the picture series are easily summarized. The rules derived from our notion of informativeness account for a large percentage of the utterances of young children participating in dynamic events. On the other end of the continuum, where children are observers of static displays, information and salienc  appear to be one and the same. Between static displays and dynamic events are opportunities to broaden our understanding of the notion of informativeness.

The Contribution of Saliency to the Distribution of Information in Pictorial Stimuli

Horgan (1976) used pictures to investigate ordering of successive single-word utterances. She also has presented data on isolated single-

word utterances produced in response to her pictures. These data come from a larger study, but we shall not consider the other aspects of the study, as they go beyond the scope of this paper. We shall, however, utilize a reanalysis of Horgan's data, which she very kindly made available to us.

Her major finding was that successive single-word utterances tend to conform to English word order. The five children in her study whose MLU ranged from 1.08 to 1.59 produced 29 sequences which conformed to English word order and 11 which violated it, a difference in favor of conformity significant at the .05 level. Do these findings contradict our hypotheses and results?

If we take into account that Horgan was using pictures, it seems as though they do not. A major finding in Horgan's study was that children tended to mention agents before objects in sequences of single-word utterances. Looking through her actual pictures (she supplied us with a subset of the ones actually used), we found that, where agents were not in the foreground of the picture or clearly visually dominant, they were not mentioned at all. In addition, Horgan reports that, when children name only one aspect of a picture in an isolated single-word utterance, it is generally the result of a saliency strategy, rather than a linguistic strategy. For example, one child always noted a ball, whenever it appeared in a picture. Another boy always used his own name (*Tim*) first, whenever the picture included a boy. In addition, Horgan tested perceptual saliency directly by including a few drawings in which one item was colored. The two children who did not use one of the saliency strategies already mentioned consistently named the colored item first. From these facts, it seems that the agent-object ordering could well be an artifact of perceptual saliency, rather than a syntactic ordering strategy. It would be necessary to examine all the stimulus pictures and rate them for relative saliency in order to know whether this explanation could better account for the data. In the light of the large number of discrepant word orders produced, this seems a distinct possibility.

In conclusion, Horgan's data, derived from children at the one-word stage in response to pictures, confirms our observation that figure-ground relations or other determinants of perceptual saliency contribute to the distribution of information in static displays. In this way, pictures differ informationally from dynamic events. For all the reasons given above, we feel that it remains to be established that Horgan's data on the ordering of successive single-word utterances reflects the syntactic realization of action roles inferred from static pictorial displays.

THE ROLE OF INFORMATIVENESS IN LATER SPEECH

Max Miller (1975) has investigated the speech of a child using one- and two-word utterances from this point of view. He reports that Simone, a child acquiring German as her first language, "actually uses in spontaneous utterances only those surface structures which, from her communicative perspective, express non-redundant semantic information explicitly" (p. 97). For example, Miller contrasts Simone's two-word utterance *karre rein* (into stroller) with her one-word utterance *raus* (out). In the former case, she is outside the stroller, wanting to get in. In the latter, she is in, wanting to get out. According to Miller's analysis, the location (*karre*) is not realized in the surface structure of the second utterance because it refers to a place where the child is already situated and is therefore egocentrically taken for granted. Where this is not the case, in the first utterance, location is, in contrast, linguistically expressed. Miller sees the child of this stage as expressing only what, from her point of view, is nonredundant information.

Weisenberger (1976), using a different technique of analysis, identifies a similar phenomenon in slightly more complex speech. She looks at what elements a child maintains across two consecutive versions of a sentence, shortened and self-expanded. Her conclusion is the same as that of Miller. "The lexical constituents that are situationally the least redundant are most likely to be lexicalized" (p. 281). An example is the contrast between the circumstances surrounding the following two pieces of discourse:

- (1) *A banana. I wa see a banana.*
- (2) *I wa see. I wa see baby.*

In the first example, where *banana*, a volitional object, is maintained in both versions, the banana was inside a bag and not visible. In the second example, by contrast, where the object disappears from the shortened version, the object was visible and clear from the situation. (The child is trying to climb into someone's lap where a baby is being held.) Implicit in Weisenberger's analysis is the fact that, in this situation, there exist alternative action possibilities for the child in relation to the baby. Hence the verb (*see*) is relatively informative or nonredundant.

The analyses of Miller (1975) and Weisenberger (1976) illuminate the circumstances under which children continue to produce utterances containing but a single constituent even after they have acquired more complex syntactic forms. This notion fits nicely with the idea that adults continue to produce single constituents under circumstances where

all elements of a message but one are known to both parties (Greenfield, in press; Olson, 1970; Vygotsky, 1962).

MacWhinney and Bates (personal communication from Bates, 1977) have evidence from 3-, 4-, and 5-year-olds and adults that redundant elements in a series of pictures denoting events tend to be omitted, while changing elements tend to be expressed. An example of one of their series is the following set of three pictures:

Boy running.

Boy swimming.

Boy skiing.

Descriptions of this series tend to omit mention of the redundant (constant) agent as the series progresses.

Apparently, by age 3, children can perceive a series of related pictures as depicting a series of related events. The tendency to name the figure in a picture did, however, appear to affect the MacWhinney and Bates results: agents were mentioned much more frequently than actions in response to the initial picture when both elements were new. Apparently, pictures represent actions more indirectly than entities, requiring the perceiver to infer dynamism from a static display. This fact is reflected in the low base rate reported by MacWhinney and Bates for linguistic expression of action.

Gordon (1977) used a different sort of picture technique with children 2 through 6 to get at the same sort of question. Her pictures represented different stages of a continuous event, rather than a series of discrete events. For example, a child would be shown a series of two pictures of a boy and a third picture in which the boy (old element) catches the ball (new element). The task is to describe this final picture. This series contrasts with another one, which starts by showing a ball and ends with the same final picture. What is different is the distribution of old and new information. Now the boy (agent) is new, while the ball (object) is old. Gordon found that there was a tendency to omit or pronominalize the old information, whether agent or object. When a pronoun is used, it means that the noun is omitted. This is a way of "omitting" a redundant element that does not necessarily involve a reduction in sentence length. Thus, repeated or constant elements are signaled by omission at the one-word stage and by pronominalization at more advanced stages of language development. Gordon also found evidence that other syntactic devices mark the distinction between old and new, constant and changing elements. For example, indefinite articles are more often used for new elements than old ones. Hence, the perception of information and certainty is manifest in surface linguistic forms at such later stages of language development. That is

to say, the presupposed element is now not only expressed but is linguistically marked, as, for example, through pronominalization. Thus, the operation of the principle of informativeness remains constant throughout development as the cognitive basis for the presupposition at all levels of linguistic symbolization.

SUMMARY

Why do children say what they say when they say it? The purpose of this chapter was to begin to answer that question. We have attempted to predict which elements of a referential event will be selected for verbalization by a child who has the ability to express more than one facet of a situation but is limited to uttering one word at a time. The factors hypothesized to determine that choice have been the focus of this study.

Our intention was to show the relations between the structure of a referential event and what the child selects to express linguistically. From inferences made about the child's point of view we were able to account for a large proportion of the children's utterances. Central to our argument was the notion that the distinction between information and certainty is the psychological basis for the distinction between assertion and presupposition in language. That which is presupposed or taken for granted is more certain and less informative and, therefore, left unexpressed or expressed later. The uncertain, changing, informative elements are expressed first. For the young child, what is taken for granted is presupposed by virtue of being situated in the "here and now." In adult communication, presuppositions are often hypothetical and complex. However, the cognitive basis for presupposition remains the same: the certainties that must exist as a background for the present assertion.

The specific rules devised to predict the children's utterances accounted for a large portion of the children's spontaneous and scripted speech. In order to test our hypotheses concerning certainty and information, we developed a new methodology of individualized experiments in which stimuli were functionally equivalent across children but particularized for the individual child. Although we have extended Piaget's concept of clinical method radically, we have retained experimental methodology and statistical analysis of data. The outcome is a reconciliation between American experimental psychology and European structuralism.

The notion of informativeness has extended our ability to predict

what children say when they speak and appears to hold promise for increasing our knowledge of the relationship between cognition and communication.

NOTES

¹Our basic definition of object as an inanimate entity involved in a change of state has remained from our earlier work (Greenfield and Smith, 1976). We have, however, included as examples of objects inanimate representations of animate beings who are being made to undergo a change of state; for example, when a child lays a doll down (makes the doll lie down), the doll is considered to have the role of an object. When, however, an agent causes such a representation to act on an inanimate object (e.g., the child makes a doll eat a cookie) doll is considered a patient (Chafe's [1970] term), cookie an object.

²Rule 3 is *ex post facto*. Rule 2 was originally applied to predict what the child would say when the object was in hand and Rule 1 when the object was not in hand. However, these rules did not account for the observed behavior. Rule 4 is also *ex post facto* in the sense that it was formulated to apply to unscripted behavior.

³Camaioni (personal communication, 1977) noted, in response to an early draft of this chapter, that children sometimes begin with the name of the listener when indicating objects. We would expect this phenomenon to occur where the listener's attention could not be taken for granted. Because this hypothesis was not tested in the present study, the question of semantic choice in situations of object deixis clearly requires further investigation.

⁴Rule 7 is *ex post facto*. The rationale is discussed at length in the section entitled *Linguistic Selection and Ordering: The Single Event*.

⁵Rule 8 is *ex post facto*. In the case of a repetition of an immediately prior event, the relative certainty of the elements remains unaltered.

⁶See Note 1 above.

⁷Volterra (personal communication, 1977) responded to a prior version of this chapter with the comment that there is a general tendency to express the possessor in a possessive type of situation. Our hypothesis, in contrast, was that where object varied while possessor remained constant, object, not possessor, would be expressed. Our only successful elicitation in this kind of situation is presented on page 36. In the first event in the series, presentation of Arthur's pants, Jason selectively imitates *Arthur*, following Rule 3. When presented with Arthur's shoe, Jason imitates the whole phrase, *Arthur's shoe*. Thus he adds the variable object, *shoe*, without dropping the expression of the possessor, *Arthur*, now a constant element. We did not, however, find examples where possessor alone was expressed, even though it was the constant element, as Volterra might predict. Thus, there is limited evidence for both a general tendency to express possessors and a tendency to express the variable object in a series where possessor remains constant. Our hypothesis is that the maintenance of the constant possessor in the above example stems from a second source of uncertainty in the situation, the absence of the possessor, *Arthur*, an older brother who had gone to school. Further work is, of course, needed to clarify these questions.

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