The Behavior of the Listener, Generic Extensions, and the Communicative Adequacy of Verbal Behavior

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Except for a few words, children first become listeners of a word before becoming speakers of the word. The analysis of listener behavior is therefore of fundamental importance for the complete analysis of verbal behavior. In this paper, some basic aspects of listener behavior are examined: in particular, the events that give origin to the behavior, the generic effects of these events, and intraspecific uniformities between these effects. By relying on the generic effects, the notion of extension is defined. This notion is then used for characterizing correct listener behavior. Finally, the uniformities between the generic effects are shown to play a crucial role in ensuring the communicative adequacy of verbal behavior.

Children learn most words first as listeners. Even more, with respect to the vast majority of words, becoming a listener will be shown to be almost a necessary condition for becoming a speaker. The analysis of listener behavior is therefore of great importance for the correct analysis of verbal behavior. In this paper, I intend to contribute to this analysis by examining various aspects of listener behavior.

THE BEHAVIOR OF THE LISTENER

Ostensive Events

One of the most basic procedures by which listener behavior is established is by exposure to the pairing of a verbal with a nonverbal stimulus. For example, a child can become a listener of the word *Jones-plug*

by watching someone working with electrical apparatus while describing his own behavior as he does so....The effect upon the listener is not only to establish *Jones-plug* as an appropriate tact but to set up nonverbal behavior in response to similar stimuli, for example, behaving correctly when asked *Please hand me a Jones-plug*. (Skinner, 1957, p. 360)

This child has been exposed to the pairing of two stimuli: the verbal stimulus *Jones-*

plug (within a verbal context) and the concrete Jones-plug. The exposure has two important effects. First, it establishes the verbal stimulus as an appropriate tact. That is, the child becomes a speaker of the verbal stimulus. (Skinner is assuming here that the child has already undergone the "long process of verbal conditioning" [1957, p. 360] which enables listeners of a word to generally become speakers of the word.) Second, it sets up appropriate nonverbal behavior in response to the verbal stimulus, for example, to further utterances of the word *Jones-plug* (perhaps within an appropriate verbal context such as in *Give me a Jones-plug*).

It is not easy to give a general characterization of listener behavior. Skinner speaks of behavior that is "appropriate to a given state of affairs" that may be evoked by a verbal stimulus (1957, p. 357). This, by itself, is rather vague, but Skinner's discussion of various examples gives more precision to his characterization. It calls our attention to two basic types of appropriate listener behavior. One is exemplified by pointing to a correct stimulus when requested *Point to w*; the other by the emission of a correct word when shown a stimulus while being asked *What is this?* (cf. the behavioral effects of learning the word *amphora*, Skinner, 1957, p. 360).

These types have different kinds of

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instances. For example, to give the correct object when asked *Please give me a w* belongs to the first type. Instead of pointing to the object the listener gives it. Or consider Ali Baba who, after being exposed to the pairing of the thief's response *Open, Sesame* and the opening of a door, later alone before the door, repeats the expression (cf. Skinner, 1957, p. 359). Here Ali Baba's listener response occurs without verbal prompting. The stimulus situation is sufficient to evoke the response. Still, the response can be considered as an instance of the second type of listener behavior; to emit *Open, Sesame* is correct relative to the stimulus situation.

There is, however, a problem with this characterization of the two types of listener behavior: it makes an essential use of the term *correct*. In the first case, the listener must point to (or give, eat, etc.) a stimulus that is correct relative to the word *w*; in the second case, the word evoked by the stimulus must be correct. Yet, in the present context, the term *correct* has no clear meaning, which of course affects the clarity of the characterization. In the next section, I will try to give more precision to this use of the term *correct*, in order to improve the characterization.

But first let me introduce the technical term *ostensive event*. This term will be used for referring to events that consist of the pairing of a verbal stimulus with a nonverbal stimulus, and give origin to listener behavior. (The notion of ostension is widely used in this sense by philosophers, e.g., Quine, 1953; see also Skinner's related use of the term *ostensive definition*, 1957, p. 360.)

GENERIC EXTENSIONS

Generalization Classes

Exposure to ostensive events normally has generic effects. Just as in operant or respondent conditioning, the relevant behavior is evoked not only by identical but also by similar stimuli, stimuli that share certain properties with the original ones (cf. Skinner, 1953, pp. 132-134; 1957, pp. 91-92). Thus, if the child in Skinner's

example is asked *Please hand me a Jones-plug*, and she does not see the original Jones-plug but only a similar one, then she will probably give the speaker the similar instrument.

The similarity that is intended here is a specific one. Since it plays an important role in verbal behavior, I will give it a more precise characterization. To this effect, I first define the notion of generalization class by relying on the phenomenon of stimulus generalization. (Stimulus generalization is examined in, e.g., Honig & Urcioli, 1981; Jenkins & Harrison, 1960; Kalish, 1969; Kirby & Bickel, 1988; Mostofski, 1965; Siegel, Hearst, George, & O'Neal, 1968.) Suppose an organism's response is reinforced m times in the presence of m entities $a_1...a_m$ ($m > 1$). The m entities can be instances of different stimuli, such as m pictures of different triangles, or instances of the same stimulus such as m utterances of *apple*. (As there may be minor differences between the m utterances of *apple*, I treat them as different entities.) After the training period, the response is evoked by n entities $b_1...b_n$ ($n > 1$), for example, by n pictures of different geometrical figures or n utterances of *apple*. The class containing the entities $b_1...b_n$ will be called the organism's *generalization class*, relative to the original entities $a_1...a_m$. (The term *stimulus class* is frequently used instead of *generalization class*, but I prefer the latter name because it stresses the generic effects of the relevant learning processes. The present definition is adapted from Stemmer, 1980.)

Since stimulus generalization is a matter of degree — it is reflected in a gradient — generalization classes have *boundary regions*. These regions contain the objects that evoke a weaker response or a less frequent one. For simplicity, I assume that the boundary regions are divided in inner and outer regions, and I consider the inner regions as a part of the generalization classes. This simplification is frequently assumed, especially in verbal behavior. For example, we speak of chairs, by which we mean the class of objects that strongly evoke the response *chair* in normal speak-

ers of English (cf. Skinner, 1957, p. 91). There are, of course, many problems behind this simplification, but for the purpose of this paper we can ignore them.

The notion of generalization class allows us to give an operational definition to an intuitive notion of similarity. If, for organism o , the class containing $b_1...b_n$ is a generalization class relative to the original stimuli $a_1...a_m$, then I say that, for o , $b_1...b_n$ are *similar* to $a_1...a_m$.

When people intuitively use the notion of similarity, they often seem to have in mind this notion. In the following, when speaking of similarity, I generally mean this notion. Sometimes, I will add the qualification *subjective* in order to stress its origin: the behavioral phenomenon of stimulus generalization. (Since the notion is based on the notion of generalization class, it ignores the gradual character of stimulus generalization. If we acknowledged this character, we would obtain a comparative notion such as a is more similar to b than to c , for organism o . For more details, see Quine, 1974, pp. 16-20.)

The notion of (subjective) similarity is derived from the notion of generalization class and not the other way around. Therefore, stimulus generalization cannot be explained by attributing it to this similarity. Rather, the similarity is explained in terms of stimulus generalization which is the fundamental phenomenon here. (Stimulus generalization is sometimes attributed to physical similarity, but I will not discuss this issue here. For the relation between physical and subjective similarity, see, Quine, 1969, 1974; Stemmer, 1981b, 1983.)

Returning to the generic effects of ostensive events, we notice that each of the stimuli that occur in the events can show such effects. Suppose two-year-old Mary has learned the word *apple*, by being exposed to the ostensive event of hearing *This is an apple* while the speaker pointed (or otherwise called her attention) to apple a . Then, as an instance of generic effects, the request *Bring me an apple* may evoke consistent behavior even if the original apple is no longer there. Seeing objects that are

merely similar to a will often be sufficient to evoke the behavior. Analogous conclusions hold for the verbal stimulus *apple*. The sound *apple* that occurs in the request does not have to be identical with the sound that was emitted in the ostensive event. Subjective similarity — more exactly, the fact that the sounds belong to a class that is a generalization class for the person — will usually be sufficient to evoke consistent behavior.

The notion of extension can now be introduced. If a listener has learned the word w by exposure to the pairing of w with the nonverbal stimuli $a_1...a_m$, and if G is the listener's generalization class from $a_1...a_m$, then G will be called the *extension* of w for the listener. (For simplicity, I will generally assume that $m=1$.)

A distinction can be made between becoming a listener of a word, and becoming a *competent* listener of the word, relative to a verbal community. The former is characterized by consistent behavior while the latter also assumes a significant agreement with a verbal community. Suppose that when Mary heard *This is an apple*, she was not paying attention to apple a but to the plate under a .¹ Afterwards, her behavior with respect to *apple* concerns similar plates; for example, she consistently brings plates when being requested *Bring me an apple*. In this case, one might still say that, relative to the object that was for Mary the nonverbal stimulus of the ostensive event, she has become a listener of *apple*. Mary's behavior I call *consistent*.

When Skinner speaks of a listener's *appropriate* behavior, he presumably

¹Although the notion of salience and derived notions such as to pay attention, or parallel notions such as effectiveness of stimuli, are closely linked to the behavioral effects of learning processes, we often can independently determine degrees of salience or effectiveness "by examining the effect of different values" of stimuli dimensions (Skinner, 1953, p. 133). Such investigations suggest, for example, that color is more salient or more effective for pigeons (in Skinner terms, more important) than shape or position; in colloquial terms, pigeons normally pay more attention to color than to shape or position. In addition, orienting responses may also give us an independent method for assigning degrees of salience or effectiveness. (For more details, including on conditions that modify these degrees, see, e.g., Mackintosh, 1975; Pearce & Hall, 1980.)

expects an additional condition to be fulfilled. Not only should the behavior be consistent with respect to the nonverbal stimulus of the ostensive event, but there should also be at least some similarity between the listener's behavior and the behavior of "standard" members of the person's verbal community, relative to the relevant word. In particular, the extension of the word for the listener should be close to the extensions of the word for these members.² If this condition is satisfied, I call the listener a *competent* listener of the word, relative to the community.

Although the difference between being a listener and being a competent listener of a word is important, I will frequently follow the normal usage and just speak of listeners, meaning by this competent listeners. Similarly, speakers will usually meant to be competent speakers.

I now return to the two types of appropriate listener behavior. We recall that one is exemplified by pointing to (or giving, or eating, etc.) the correct stimulus when requested *Point to w*; the other by emitting a correct word when shown a stimulus while being asked *What is this?* The present conclusions suggest the following clarification of these uses of the term *correct*, with respect to *ostensive* words (i.e., words that have been learned in ostensive events). In the former case, the stimulus is correct if it belongs to the extension of *w* for standard members of the community; in the latter case, the word *w* is correct if the shown stimulus belongs to the extension of *w* for standards members of the community. And listener behavior will be said to be appropriate (or correct or competent) with respect to ostensive words, if it agrees with these conditions.

This characterization of appropriate listener behavior (with respect to ostensive words) is not supposed to be exhaustive. There probably are instances of listener behavior that do not fit into the two basic

types but that could be classified as appropriate listener behavior. These instances are not covered by the characterization. What is important, however, is that with respect to most ostensive words one can frequently create an environment that generates listener behavior of one of the two types. This may then allow us to "test" the correctness of the behavior. Notice, moreover, that the method adopted by monolingual dictionaries often agrees with the characterization. When explaining a word *w*, they generally try to use expressions that specify (for standard members of the community) an extension that is close to the extension of *w*; more exactly, they try to use expressions that, under certain circumstances, are evoked by the elements of an identical, sometimes only a similar, extension.

The above stated conditions for correct listener behavior do not absolutely restrict the range of the responses. If, for example, the behavior is to emit the correct word and the shown stimulus is a poodle, then the responses *poodle*, *dog*, *mammal*, *animal*, and *three-dimensional-object* are all correct. The poodle belongs to the extensions of all the words. A parallel latitude holds for the other type of listener behavior. Pointing to a poodle is correct, if the *w* that occurs in *Point to a w* is any of the above expressions. But I will not enter into the problem of further restricting the range of possible responses.³

Physical and Functional Properties

The properties that determine the extensions of words such as *blue*, *apple*, or *thun-*

²I do not formally define the notion of a standard member of a verbal community. For the purposes of the present paper, an intuitive notion is sufficient. This intuitive notion admits of course individual differences between the members of the community (see also below).

³There usually are preferred responses. For example, if speakers of English are shown a poodle and asked *What is this?*, the preferred response is generally *dog*. Because of such preferences, many psychologists have assumed the psychological validity of so-called basic level, subordinate, and superordinate categories (e.g., Rosch, 1978; Rosch, Mervis, Gray, Johnson, & Boyes-Braem, 1976). The analysis in Stemmer (1981a, 1983) suggests that the preference is a consequence of the specific nature of generic effects. In verbal learning, for example, this specific nature determines that, under favorable circumstances, *dog* can be learned (relatively correctly) by a single exposure to a correct ostensive event, *poodle* requires in addition discriminative shaping (i.e., its extension is a so-called restricted generalization class), while *mammal* requires several ostensive events (i.e., its extension is a so-called critical or expanded generalization class).

der are largely physical properties. The extensions of words such as *toy* or *familiar* are in addition determined by so-called functional (or criterial) properties (for *familiar*, see Skinner, 1957, p. 136). Functional properties receive controlling efficacy in specific circumstances. These circumstances, however, will not be analyzed here. The reader is referred to the literature on functional generalization (e.g., Goldiamond, 1966; Stemmer, 1980, 1983).

UNIFORMITIES AND SUCCESSFUL VERBAL BEHAVIOR

Although people must individually learn the words of their language, members of the same verbal community communicate quite efficiently. What makes this efficient communication possible? More exactly, and restricting ourselves to ostensive words, what ensures that the extensions of ostensive words are significantly uniform for normal members of the community? An obvious factor are the shaping contingencies provided for by the community; they push towards uniformity. There is, however, a further factor that plays a crucial role.

Let a be a stimulus, say, a red triangle. According to an elementary theorem of set theory, a is an element of an infinite number of classes. Consider now the adult members of a relatively well developed species, for example, adult pigeons. They have been exposed to different contingencies. Therefore, if one of their responses is reinforced in the presence of a , the pigeons' generalization classes from a will probably be different (cf. the above mentioned references on stimulus generalization). Nevertheless, unless the previous contingencies include some highly specialized ones, their generalization classes from a will belong to an extremely small subset of the infinite number of classes of which a is an element. For example, none of the pigeons will generalize from a red triangle to windows and chairs or to clouds and poodles even though it is easy to define a class that contains the red triangle and, say, all windows and chairs.⁴ This shows that generic effects are biased: they deter-

mine specific rather than arbitrary generalization classes. Moreover, as is shown by the shapes of the gradients obtained in generalization experiments, the nature of the specificity, the bias, is significantly uniform for the adult members of a species. Their generalization classes with respect to an original stimulus a are very similar; in particular, none of the classes contains the countless stimuli that only share arbitrary similarities with a . I will express these conclusions by saying that generic effects have a high degree of intraspecies uniformity.⁵

Experiments on stimulus generalization show that this also holds for humans. Two-year-old children, who have not been exposed to specialized contingencies, do not generalize from a red triangle to windows and chairs or clouds and poodles. Rather, their generalization classes from a set of identical or similar stimuli are of a specific type and normally highly uniform.

This uniformity plays a crucial role in listener behavior. Consider children who learn word w by exposure to ostensive events. If the (salient) nonverbal stimuli of these events are similar, then, because of the uniformity, the children's initial extensions for w — the generalization classes that originate in the nonverbal stimuli — will frequently have a high degree of uniformity. Now, in most cases, the nonverbal stimuli of the ostensive events in which children of a verbal community learn the same words indeed are very similar (e.g.,

⁴Instead of saying that a is an element of an infinite number of classes one can also say that a is similar to an infinite number of objects, because, as Peirce (1878/1957) says, "When we take all the characters into account, any pair of objects resemble one another in just as many particulars as any other pair" (p. 116). When using this notion of similarity, which of course is not the notion of subjective similarity introduced above, then a red triangle is just as similar to a window or a cloud as to another red triangle. Sidman (1979) expresses the fact that stimuli always belong to an infinite number of classes by attributing to them an "inherent complexity" (p. 123).

⁵The intraspecies uniformity of generic effects suggests that the specific character of these effects derives from phylogenetic contingencies. (Cf. MacCorquodale: "Stimulus generalization and response induction are genetically determined characteristics," 1970, p. 93.) For a discussion of the adaptive value of the specific character of generic effects, see, Quine (1969, 1974), Quine & Ullian (1970), and Stemmer (1978, 1981b, 1983).

Ninio, 1980; Ninio & Bruner, 1978). For example, when English speaking parents provide ostensive events for the word *apple*, the nonverbal (salient) stimuli normally are apples rather than other objects such as windows or chairs. Therefore, the initial extensions of ostensive words for children of a verbal community will often be highly uniform. They will contain stimuli that are subjectively rather than arbitrarily similar to the nonverbal stimuli.

To be sure, in many cases there will also be significant differences between a child's initial extensions and those of other members of the verbal community. If this occurs, then the community will generally provide shaping contingencies. In most cases, however, the number of shaping contingencies needed for achieving a close agreement will be remarkably low, because, and this is the crucial point, the shaping does not begin from scratch. Rather, it operates on the child's initial extensions, and because of the intraspecies uniformity of generic effects, these extensions usually show a significant overlap with those of standard members of the community. In particular, they do not contain the countless stimuli that only share arbitrary similarities with the nonverbal stimuli. Consequently, the shaping contingencies need not eliminate all these incorrect stimuli. The uniformity therefore gives children (and adults learning new words) an excellent starting point: a significant agreement of their initial extensions with standard extensions. It follows that the intraspecies uniformity of generic effects plays a decisive role in ensuring the communicative success of verbal behavior.

Various qualifications must be made. First, there normally are differences between the extensions of an ostensive word for different members of a verbal community. There are therefore no real standard members of a community. Second, even with respect to a particular person, differences between tasks — as between pointing to an object, giving an object, or saying the correct word while seeing an object — may determine differences in the extensions. But what is deci-

sive is that, with respect to most members of a community and most tasks, the extensions of the same ostensive word usually have a significant common core: the core that contains clear-cut referents of the word. Because of this core, talk of standard members of a verbal community and of standard extensions of ostensive words is generally meaningful.

Respondent Conditioning

What kind of learning process is learning by exposure to an ostensive event? This is an important but also very difficult issue, and I will not enter into it here. Still, I would like to point to two similarities between this process and learning by exposure to respondent contingencies. First, in both cases, the learning event is basically an exposure (or several exposures) to the pairing of two stimuli. In respondent contingencies a conditioned stimulus (CS) is paired with an unconditioned stimulus (US), and in ostensive events a verbal stimulus *w* is paired with a nonverbal stimulus *a*. Second, in both cases, a stimulus that previously did not elicit or evoke a particular response now does so, and this response is strongly determined by the other stimulus. Thus, in respondent conditioning, the CS afterwards elicits a response, and this response is determined by the US; it is its typical, often unconditioned response. In ostensive learning, the verbal stimulus *w* afterwards evokes listener responses, and these responses are strongly determined by the nonverbal stimulus *a*; they are "typical" relative to the generalization class generated by *a*. For example, if the listener response is the giving of something, the given object will be an element of the generalization class generated by (i.e., determined by) the nonverbal stimulus *a*; or if the response is verbal, the stimulus that evokes the response will again be an element of the generalization class generated by *a*.

The processes also differ, however. Whereas in respondent contingencies the CS generally precedes the US, in ostensive events the verbal and the nonverbal stimulus may occur at about the same time, and

if one precedes the other, it does not matter which precedes which. Moreover, in ostensive learning none of the stimuli must have the status of a US, in the sense of previously eliciting a typical response, at least not one which the community can observe.

There are further similarities between respondent and ostensive learning processes. As was mentioned previously, both processes usually show generic effects. In respondent conditioning, the typical response is afterwards elicited not only by the original CS but also by similar stimuli, and in ostensive learning, the correct or appropriate behavior is evoked not only by the original stimuli but also by similar ones. Moreover, the classes that contain the similar stimuli in both processes — the generalization classes from the original stimuli are normally very uniform; they belong to the extremely small subset of the infinite number of classes of which the stimuli are elements.

The similarities between the two learning processes suggest that selected experiments on respondent conditioning, such as those on stimulus generalization (which may enable us to determine the ranges of generalization classes, relative to a set of original stimuli) or on the degree of salience or effectiveness that the stimuli should have for ensuring rapid results, may throw light on the processes by which listeners learn ostensive words.

Further Ostensive Expressions

So far, I have only analyzed the ostensive learning of words that refer to objects. But children can also ostensively learn other types of expressions, such as *holds*, *is behind*, or *receives*. Suppose Mary has already learned the words *Mommy* and *the-ball*, but has never heard the word *holds* (or other variants of the verb *to hold*). The girl is now looking for her ball (e.g., she emits *Ball?*), and her father responds *Mommy holds the ball*. Hearing this utterance may direct the girl's attention to the objects named by *Mommy* and *the-ball* — the mother and the ball — and consequently to the specific relationship in which the two objects stand: the holding relation. If this

gives sufficient salience to the relation, the ostensive event — the pairing of *Mommy holds the ball* with the holding event — may change the girl into a competent listener of the structure *x holds y*. Future utterances of such structures may evoke behavior that is correct with respect to the holding relation observed by Mary, and, by generic extension, with respect to those holding relations that, for Mary, are subjectively similar to the original relation. (The notion of *structure* corresponds to what Skinner calls *functional unity*, 1957, pp. 119-120, or *partial frame*, 1957, p. 336.)

Among the behavioral effects of the ostensive learning of relational words is also grammatical behavior. For example, the learning of *x holds y* also determines a particular word order: the expression that refers to the holder precedes the word *holds* while the one that refers to the held object follows this word. Therefore, if the learning of *holds* generates correct listener behavior, it will agree with this word order. Notice that the word order for ostensive relational words is individually learned—it is learned in the events in which the words are learned.

This result is important because the main non-Chomskyan explanation of this grammatical behavior is to attribute it to a process of generalization according to so-called case categories such as agent, action, or located object (e.g., Bowerman, 1976; Braine & Hardy, 1982; Brown, 1973; Schlesinger, 1971, 1982; see also Reese, 1991, pp. 158-159). It is not difficult to see, however, that this approach is incorrect (Stemmer, 1973, 1987, 1990). For instance, according to usual case grammar theories, the expression that refers to the agent of an action is supposed to precede the action word. Since in *John receives the book from Bill*, *John* precedes *receives*, *John* must be the agent of the relevant action. But the same action is also described by *Bill gives the book to John*. Since *John* is supposed to be the agent of the action, *John* should precede *gives*. A similar discrepancy occurs, for example, with *The book is behind the cup* and *The cup is in front of the book*. Here the expression referring to the located item is

supposed to precede the expression referring to the location (Braine & Hardy, 1982, p. 227). But both sentences describe the same event. Therefore, if *the book* refers to the located item of the event — it precedes the location-expression in the first sentence — it should also precede the location-expression in the second sentence.

The precise analysis of the events by which ostensive relational words are learned makes it thus possible to give a behavior analytic account of their behavioral effects, including the word-order feature. There is no need to introduce Chomskyan considerations. (For more details on the acquisition of grammatical behavior, see Stemmer, 1973, 1987, 1990.)

Many words are learned (as listeners) by exposure to ostensive events. Others are learned in other circumstances, especially by exposure to intraverbal events. However, I will not analyze here the further learning processes. Much material can be found in Skinner (1957). See also Stemmer (1973, pp. 87-110; 1983, pp. 138-144), where, in agreement with Osgood (1953), it is suggested that intraverbal processes have affinities with second-order conditioning processes.

Specification and Reference

Behavior analysts often speak of stimuli that *specify* something. For example, Skinner (1969) characterizes rule governed behavior as behavior controlled by a contingency-specifying stimulus. It seems, however, that no formal definition of the notion *x specifies y* has been given. The present conclusions suggest the following clarification of the notion with respect to ostensive terms, and relative to a verbal community. The ostensive word *w* specifies *a* (or refers to *a*) in community *C*, if *a* belongs to the extension of *w* for standard members of community *C*. For example, the word *apple* specifies (or refers to) an element of the standard extension of this word, relative to an English speaking community. This is only a clarification and not a definition since further conditions must be added: for example, which element of the extension is specified in case there are

several elements present or no element at all, differences between singular and plural instances of the word, fictional and deceptive uses of the word, and so forth.

The clarification also applies to complex ostensive expressions. For instance, *Mommy holds the ball* specifies a stimulus-situation aspect, often called an event, and this aspect belongs to the standard extension of the expression in the relevant community. (The analysis in Stemmer [1983] suggests that the clarification also holds for intraverbally learned expressions.)

Hayes & Hayes (1989) give the following clarification of the notion of specification: "Events are 'specified' in the sense that events are organized into a relational network" (p. 180). However, they do not formally define the notion 'events $x_1 \dots x_n$ are organized in the relational network *y* for a standard speaker of *C*.' (See also Schoneberger's remark that organizing verbal stimuli into relational networks is not an observable phenomenon, 1990.) Still, if we rely on the examples they give of relational networks — for example, *bread* and *bread* are supposed to be in a relational frame of coordination for (standard) speakers of English — then their clarification possibly corresponds to the present clarification, provided it is acknowledged that a word does not relate to a stimulus but to the elements of a particular generalization class; in the case of *bread*, for example, to the elements of the generalization classes generated by the breads the speakers saw when they learned this word, or, more exactly, to the elements of the common core of these classes.

LISTENERS AND SPEAKERS

The Preeminence of Listener Behavior

I mentioned above that, except for a few words, becoming a listener of a word is almost a necessary condition for becoming a speaker of the word. Let me now substantiate this claim. (The claim assumes that *becoming a (competent) speaker* is meant to be the result of a process in which a verbal response is reinforced on correct occasions. We will later see that if another defi-

nition of becoming a speaker is adopted, then the claim must be formulated differently, but its basic argument is still valid.)

Consider the word *thunder*. The probability that a child who has never heard the word will spontaneously emit *thunder* on correct occasions is practically zero. Even if the child has previously overheard the word but not on appropriate occasions and she is now repeating (or echoing) it, the probability that, by random repeating, the child will emit *thunder* precisely when a thunder occurs, is again practically zero. Yet, such *pairing* events — the child emitting the word *thunder* while hearing a thunder — must occur if the child is supposed to learn the word as a competent speaker, since, normally, only in these cases will the community's reinforcement of *thunder* establish the control of this vocal response by thunders. But if the probability of such pairing events to occur is practically zero, how do children learn to emit *thunder* on correct occasions?

The answer is well known: the community supplies a correct example. When a thunder occurs, someone emits expressions in which the word *thunder* appears, for example, *Did you hear the thunder?* or *That was a thunder*. Afterwards, or perhaps only after several of such examples, the child may then show a tendency to emit the word on the right occasion; similar thunders may now evoke the verbal response. Once this has occurred, the community can start with *correct* reinforcement — that is, reinforcement on correct occasions. (For a detailed investigation of such correct examples, see, e.g., Chapman, Leonard, & Mervis, 1986; Ninio, 1980; Ninio & Bruner, 1978.)

Since before the correct example being given the probability of the child emitting *thunder* on correct occasions is practically zero, and since only such examples can raise this probability, the example is crucial for producing this change. It practically is a necessary condition. But what is the nature of the example? It is easy to see that it is a typical ostensive event. Just as in the case of *Jones-plug*, the child is exposed to the pairing of two stimuli: the verbal stimulus

thunder (within a verbal context) and the nonverbal thunder.

For the community to become able to reinforce the child's response *thunder* on correct occasions, the child must thus first be exposed to an ostensive event in which *thunder* is paired with a nonverbal stimulus. This exposure transforms the child into a (competent) listener of *thunder*, and one of the behavioral effects of this process is the child now having the ability to emit *thunder* on correct occasions; more exactly, the probability of the child emitting *thunder* in the presence of correct stimuli is now significantly higher than zero. Once a correct response has been made by the child, the community can start reinforcing it on appropriate occasions.

The process is illustrated by the Ali Baba example. Before the exposure to the ostensive event, the probability of Ali Baba saying *Open Sesame* on correct occasions is practically zero. But the exposure transforms him into a listener of the expression, and one of the behavioral effects is his posterior emission of the expression on a correct occasion. The response is then reinforced by the environment: the door opens.

This analysis shows that, in general, in order to become a (competent) speaker of an ostensive word *w*, a child must first become a (competent) listener of *w*, where becoming a listener is based on exposure to an ostensive event. This exposure has typical listener effects, such as pointing to the correct stimulus when hearing *Point to w*, or showing a tendency to emit *w* on correct occasions. In the latter case, the first (relatively) correct emission of *w* occurs without previous reinforcement on correct occasions. Only after at least one correct response has been emitted can the community start with correct reinforcement. (These conditions also hold for the explicit training events described in Sundberg, San Juan, Dawdy, & Arguelles, 1990, p. 88. A subject is asked *What is this?* in the presence of a stimulus *a*, and if the correct word is not emitted within a few seconds, an echoic prompt of the word is given. These training events are ostensive events. They consist of the pairing of a verbal stim-

ulus — the prompted word within a verbal context — with the nonverbal stimulus *a*. The events may then have typical listener effects, among them, the emission of the verbal response on correct occasions. If correct responses do occur, correct reinforcement can begin. See also the label-training events described in the section *Baseline Condition* in Lee, 1981.)

There are exceptions. Sometimes, a child's random babbling or random repeating will occur at appropriate occasions and then be reinforced. In these cases, the child may become a speaker of *w* before becoming a listener of *w*. Similarly, the learning of general mands such as *Please*, *Give me*, or *I want* does not seem to require exposure to the pairing of the expressions with specific stimuli (although the paired events probably have certain specific features). But such words are the minority; most words are indeed first learned as listeners.

This also holds for intraverbally learned expressions. The probability that a child, who has never heard the word *amphora* or who is randomly repeating the word, will emit the word on correct occasions is practically zero. But, as pointed out by Skinner (1957, p. 360), the child can become a listener of this word by exposure to an intraverbal event in which she hears *An amphora is a Greek vase with two handles*. Afterwards, she may show listener behavior such as correctly pointing to an amphora or correctly emitting *amphora* without previous reinforcement. Only after the latter event occurs can the community start reinforcing the response on correct occasions.

The following argument could be raised against the claim that becoming a listener generally precedes becoming a speaker. In those cases where the first evidence for a child having become a listener of word *w* is the child emitting *w* on a correct occasion, one could say that the learning event transformed the child not only into a listener but also into a speaker of *w*. In these cases, therefore, becoming a listener would not precede becoming a speaker.

This argument can indeed be defended. It implies, however, that the expression *to*

become a (competent) speaker of w would now also apply to cases where the learning event that generates the correct speech is not a typical speaker-learning event — that is, an event in which the emission of a vocal response on a correct occasion is gradually shaped by reinforcement on correct occasions. A person could now become a speaker of a word by exposure to a typical listener-learning event — an event that generates correct listener behavior but does not include correct reinforcement of vocal responses.

If the notion *to become a speaker of w* is indeed widened, then the statements at the beginning of this paper must be changed. Instead of saying that, for most words, becoming a listener precedes (or is practically a necessary condition) for becoming a speaker, one should now say that most words are first learned by exposure to typical listener-learning events, events that generate listener behavior including sometimes correct speech, but do not require correct reinforcement of the vocal responses.

But whatever the semantics, the facts and the conclusions to be drawn remain the same, at least with respect to ostensive words. The vast majority of these words are first learned by exposure to ostensive events. The analysis of these processes and of their behavioral effects is therefore likely to be of great importance for the analysis of verbal behavior.

Even if the notion *to become a speaker of w* is widened, there are at least two reasons for using *listener learning events* for referring to events that, in addition to listener behavior, may generate speaker behavior, yet, do not require previous reinforcement of the vocal response on correct occasions. First, there have been cases of people who after exposure to such events showed typical listener behavior but, because of certain impairments, never learned to speak (see, e.g., Lenneberg, 1962). We would not want to call these learning events *speaker learning events*. Second, in many cases, and especially with young children, correct listener behavior (with respect to a word) occurs much earlier than correct speaker behavior.

Until the correct speech occurs, the person's behavior is therefore exclusively listener behavior.

Although exposure to listener learning events is practically a necessary condition for becoming a competent speaker of a word, it is not a sufficient condition, at least not for naive children. Children must previously undergo a long process of verbal conditioning (Skinner, 1957). What this process consists of is not yet clear. It has been argued that it requires exposure to the contingencies that underlie stimulus equivalence (e.g., Hayes & Hayes, 1989), but I will not deal with this issue here. Let me only point out that, at least with respect to becoming a listener, no stimulus equivalence is necessary. Functional generalization is sufficient, even for the learning of syntax (Stemmer, 1973, 1987, 1990).

CONCLUSIONS

Since most words are first learned in listener learning processes, the analysis of these processes is likely to contribute significantly to the analysis of verbal behavior. In this paper, I have examined various aspects of the processes, while restricting myself mainly to the learning of ostensive words.

The initial listener-learning events mostly are ostensive events. They have different types of behavioral effects, among them generic effects. On the basis of the generic effects, I introduced the notion of generalization class (relative to a set of original stimuli) and the related notion of the extension of a word. By using the notion of extension, and by concentrating on two basic types of listener behavior, I then gave a partial characterization of appropriate listener behavior.

An important characteristic of verbal behavior, perhaps even a defining characteristic, is its communicative success. A crucial part of this successful character of verbal behavior derives from intraspecies uniformities of generic effects. They determine that for normal members of a species, the generalization classes (relative to a set of stimuli) are very similar; they belong to a highly restricted subclass of the infinite

number of classes of which the stimuli are elements. Since in verbal behavior these classes become the initial extensions of ostensive words, the intraspecies uniformities make an essential contribution to ensuring the similarity between the extensions, and consequently to the adequacy of verbal behavior.

Listener behavior includes grammatical behavior. By examining the learning processes of ostensive relational terms, it is seen that these processes also determine a grammatical feature: the word order for the terms.

Finally, several common features of ostensive learning and respondent conditioning have been noted. They suggest that the investigation of selected aspects of respondent conditioning may contribute to the analysis of listener behavior and therefore of verbal behavior in general.

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