The Analysis of Verbal Behavior 2004, **20,** 77-97

Meaning: A Verbal Behavior Account

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Although the verbal operants that comprise Skinner's account of verbal behavior provide a seemingly complete description of the behavior of the speaker with respect to what is ordinarily called the expression of meanings, it may be shown that the account is intrinsically deficient in describing the receptive behavior of listeners with regard to their comprehension of the meanings of novel words, sentences and propositions. In response to this perceived deficiency, the notion of *joint control* is presented here. Joint control occurs when a verbal-operant topography, currently evoked by one stimulus, is additionally (i.e., jointly) evoked by a second stimulus. This event of joint stimulus control then sets the occasion for a response. This simple mechanism is shown here to have exceedingly broad explanatory properties: providing a coherent and rigorously behavioral account of various aspects of language ranging from meaning, reference and comprehension, to the development of abstraction in children's speech.

Certainly one of the most significant impediments to a comprehensive account of human function is the problem of explaining the nature of *meaning* as it occurs in words, phrases, and sentences. What follows is an attempt to surmount this impediment by providing a behavioral account of meaning. It is an account of how words are tied to the objects, events and relations that are ordinarily said to be the meanings of words. The account is rigorous and parsimonious; derived from, and phrased solely in terms of, the verbal operants described by Skinner (1957) in his book *Verbal Behavior.*

The account is thus not an extension of the Pavlovian-based approaches proposed by S-R mediation theorists such as Osgood (1963), Mowrer (1960), and Hull (1943). Neither does this account invoke any of the non-behavioral mechanisms (i.e., mental activities or brain functions), that figure so prominently in traditional accounts of meaning. But despite this limitation, this account still satisfies a principle requirement of any approach (cognitive or behavioral), namely a consideration, if not a demonstration, of the mechanism that mediates connections, both trained and untrained, between words and their referents.

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I would like to thank Hank Schlinger for his helpful comments on an earlier draft of this article.

In essence, this account reconciles operant and cognitive accounts of meaning by analyzing a putatively cognitive phenomenon strictly within the terms of a rigorously behavioral system (Skinner, 1957).

Current Status of the Term Meaning: Cognitive and Behavioral Accounts

There could be no greater difference than the current status of the term meaning in cognitive and behavioral accounts. Nor is this surprising given the vast differences in the history of the concept in the two accounts.

The Traditional Approach to Meaning

Looking first at the cognitive account, meaning is traditionally viewed as a cognitive commodity: something sent and received as a thought, idea or semantic dictionary entry (Pinker, 2000, p. 94), or as a quantified string of bits of information (Garner, 1962). In each of these a meaning corresponds to events occurring somewhere in the mind or the nervous system.

Expressive Meaning

In the traditional account of expressive meaning, speech (spoken, written, or signed) is said to have its immediate origin in the psychological events that occur within the speaker. Speech is the medium by which some features of these psychological events are expressed to others. The actual characteristics of the behav-

ior of speaking, writing or signing are traditionally seen to be secondary to the role they play in expressing some features of the speaker's thoughts (i.e., transmitting meaning or information) to the listener.

Receptive Meaning

The traditional account of expressing meaning is mirrored by the traditional account of the listener receiving meaning: whereas the former refers to the transmission of ideas and meanings to others via speech, receptive meaning involves decoding this speech so that the ideas and meanings it carries may be received and comprehended. Together these two actions effect the transfer of meaning from the speaker to the listener.

Skinners Approach to Meaning

Skinner's approach (Skinner, 1957) puts things differently. Expression and reception are not symmetrical. For him the actual behavior of speaking, writing or signing, and the environmental events that control this behavior, are of primary concern. A speaker in the act of speaking, writing or signing, is not *expressing* meaning, but rather is emitting operant behavior that has an effect on the behavior of others. Likewise, the listener, in responding to the speaking, writing or signing of another, is not engaged in the *reception* of information or meaning, rather, the listener's behavior is being affected by stimuli generated in the verbal behavior of the speaker. There is thus no surplus cognitive function here, (no central agency of *meaning*): there is only the behavior emitted by the speaker and by the listener and the related environmental events (the contingencies of reinforcement) that control this behavior.

On this account the notions of meaning, and the transmission of meaning from speaker to listener, are superfluous fictions that may be replaced with an account phrased solely in terms of the interaction of the operant responses of two or more people. And it is toward the exposition of such an account that this paper is dedicated. We begin by considering some of the relevant relations between behavior and the controlling environment put forth in Skinner's account.

The Verbal Operant

In general, the relations between behavior and the environment described by Skinner (1957) are all operants. More particularly, Skinner qualifies these operants as *verbal* operants because the consequences are provided by other people—the verbal community.

But the definition of a verbal operant, though simple, is not arbitrary. In a highly complex terrain the definition simply serves to demarcate the border between the relatively simple operant behavior demanded by interactions with the natural environment, and the far more complex behavior demanded by interactions with other people: all the while appreciating the fact that there is continuity: Operants, both verbal and nonverbal, obey the same laws despite the fact that particular instances may be hard to classify as verbal or nonverbal operants.

The Behavior of the Speaker

Skinner's account (1957) concerns itself almost exclusively with the verbal behavior of the speaker; leaving the behavior of the listener to be derived from these and other behavioral principles. And so we begin our account with an overview of Skinner's verbal operants and the behavior of the speaker. Because the issues at hand here, regarding meaning, do not involve all of the verbal operants identified by Skinner, some, for the sake of readability, are left out of this account entirely, and others are just described briefly. Such is the case with the *mand.*

The mand. Traditionally, mands are what are referred to as requests, orders, commands, demands or questions. The defining characteristic of the mand is that it specifies to the listener the particular consequence the listener is to bring about. Thus the mands *What time is it?, Give me water,* and *Please be quiet* all specify what the listener must provide or remove.

The tact. Colloquially, tacts are what are commonly called names, labels and descriptions of objects and events. The defining characteristic of a tact is that its topography (spoken, written or signed) is under stimulus control of the properties of a nonverbal stimulus such as a picture, an object, or an event, or one or more characteristic of a picture, object or event. Thus, emissions of the topography *water* controlled by the sight of water, or the topography *red square* controlled by the color and shape of such an object, or an emission of

the phrase *ten o'clock* when controlled by the locations of the hands of a clock, are all tacts.

The echoic. An echoic is a vocal (i.e., spoken) verbal response that generally conforms to what is called an imitation (e.g., saying "ten o'clock" in response to hearing someone else say "ten o'clock"). The precise features of an echoic are under stimulus control of the features of a prior vocal stimulus so as to reproduce these features within the limits of accuracy required by the current environment. For any such level of control to exist, appropriate phonemes must exist in the repertoire of the imitator so that accurate imitations may be emitted under the control of a spoken example. Where the behavior imitated is not vocal, as for example in the imitation of hand signs, this kind of imitative response is called a mimetic.

The self-echoic. In a *self*-echoic the speaker imitates his own behavior—as in rehearsal. The amount of time that may elapse between the repetitions of the self-echoic is a function of the characteristics of stimulus control exerted by the prior pronunciation. The phrase red square need only be rehearsed occasionally for the speaker to be able to continue to repeat it, while a newly learned phone number must be repeated rapidly as a self-echoic in order to preserved the response.

The autoclitic. This operant is actually a special kind of tact and certainly the most controversial notion in Skinner's menagerie of verbal operants. Put simply, for present purposes an autoclitic is a tact that describes (i.e., is under the stimulus control of) those specific aspects of the environment that control *other* verbal responding. Thus, in the phrase "It is raining," the word *rain* is a tact under the control of events outdoors. The assertion *it is,* is an autoclitic indicating (tacting the condition) that the speaker has had direct contact with the rain. On the other hand saying "I think it's raining" indicates that the phrase *it's raining* did not arise under stimulus control of the rain itself. Perhaps the speaker has just seen people coming in with wet shoes. The phrase "I think" is thus an autoclitic serving to indicate to the listener that the speaker's behavior, saying "it's raining," is under a form of stimulus control weaker than direct contact with the rain.

The Behavior of the Listener

Turning now to the behavior of the listener, we must first appreciate that for Skinner there is no *receptive* verbal behavior. The listener is not a receiver: not of meaning, nor of information. This is because verbal behavior, as we have seen, is operant behavior under the control of stimuli emitted by a *speaker* and reinforced by others; which is to say, verbal behavior is always what is commonly called *expressive* behavior. Nevertheless, despite the fact that, technically, receptive behavior is not verbal behavior as Skinner defined it, there still remains the need to account for the behavior of the listener in response to external stimuli (e.g., pressing a bar when a tone sounds, behaving according to instructions, or responding to an inquiry).

As we shall see next, it is in providing for a complete account of the behavior of the listener, that Skinner's approach needs a minor supplementation: the appreciation of a previously unrecognized interaction of stimulus control between tacts and self-echoics henceforth referred to as *joint control.* Once so supplemented, it may easily be shown that Skinner's approach provides a coherent account of what is ordinarily referred to as the expression and reception of meaning. That is, an account phrased solely in terms of the verbal operants enumerated above, and one that ultimately treats the listener as a behaving speaker and thus brings the listener again within the legitimate purview of behavior analysis.

A Behavioral Account of Meaning

To pursue a behavioral account of meaning, we shall begin by examining various types of behavior in order of their increasing abstraction until we arrive at the current limits of Skinner's account. We shall then add to his account the notion of joint control, and then examine the advance this provides to the account by allowing us to now describe behaviorally those forms of listener behavior hitherto deemed behaviorally inexplicable, and hence necessarily attributed to cognitive notions of transmission, clarification and the seeking of meaning.

The Simple Discrimination

We may begin with the simplest form of op-

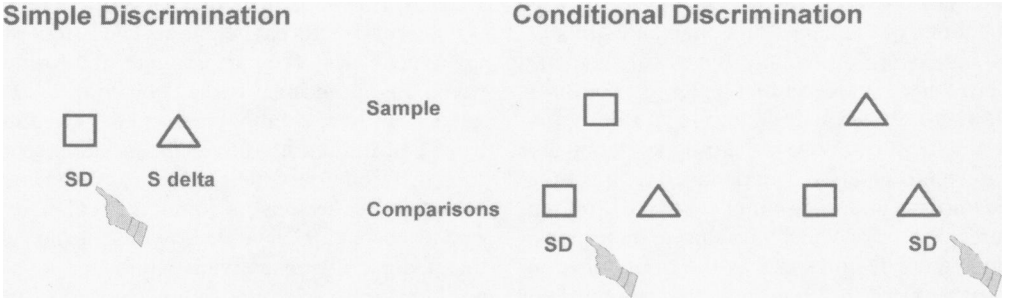

Figure 1. Behavior in a simple, and in a conditional discrimination. In a simple discrimination the S^D evokes the selection response. In a conditional discrimination the sample determines which comparison stimulus functions as an S^D.

erant responding to a stimulus, the discriminated operant. As illustrated in Figure 1, in a simple discriminated operant, two or more stimuli are presented—here, a square and a triangle—with reinforcement contingent upon the selection of one of them; here, the square. On the usual account of this behavior, henceforth called the *unmediated selection account,* one stimulus serves as a discriminative stimulus, (S^D) for a selection response, such as pointing, due to a history of differentially reinforced practice for such responding. Thus, here, due to a history of reinforced selections, the square functions as an S^D to produce a direct, unmediated increase in the momentary rate of the pointing response thereby causing the square comparison to be selected.

The Conditional Discrimination

Bringing in a second source of stimulus control makes for a different kind of behavior: selecting stimuli in response to other stimuli (the conditional discrimination). In this task an array of comparison objects is presented—here a triangle and a square—with reinforcement for a selection conditional upon the state of the sample. As illustrated in Figure 1, if the sample is a square, then selection of the square comparison is reinforced, and if the sample is a triangle, then selection of the triangle comparison is reinforced. On the usual account of this behavior, the sample stimulus, due to a history of reinforced practice, is said to serve as a *conditional* stimulus. That is to say the sample serves to make one of the comparisons function as a S^D that evokes a selection response such as pointing.

Thus, here, the sample square, as a conditional stimulus, functions to make the comparison square act as an S^D for a selection response just as the sample triangle functions to make the comparison triangle act as an S^D for a selection response. In both cases a comparison is selected only because the current sample produces a direct unmediated increase in the momentary rate of the selection response (e.g., pointing) in the presence of that comparison and not because the sample specifies or otherwise transmits information or meaning to the subject indicating which comparison is correct.

Where one or more of the stimuli is a word, the unmediated selection account applies unchanged. Thus, as we see in Figure 2, in Panel A, we may explain the selection of a square in response to the heard word */square/*, the selection of the printed word *square* in response to the actual object, (Panel B) and the selection of the printed word *square* in response to the heard word (*/square/*) (Panel C) all in exactly the same terms: As a result of a history of reinforced training, the sample, as a conditional stimulus, makes one of the comparisons function as an S^D that evokes a pointing response thereby causing that comparison to be selected.

Relations between Objects

Ultimately, however, the preceding is insufficient. Put simply, the problem with the unmediated selection account is that it explains neither the emergence of generalized (novel, untrained) responding to constant relations, nor the emergence of word-object symmetry (Horne & Lowe 1996). And in failing to do so, this approach fails to account for two funda-

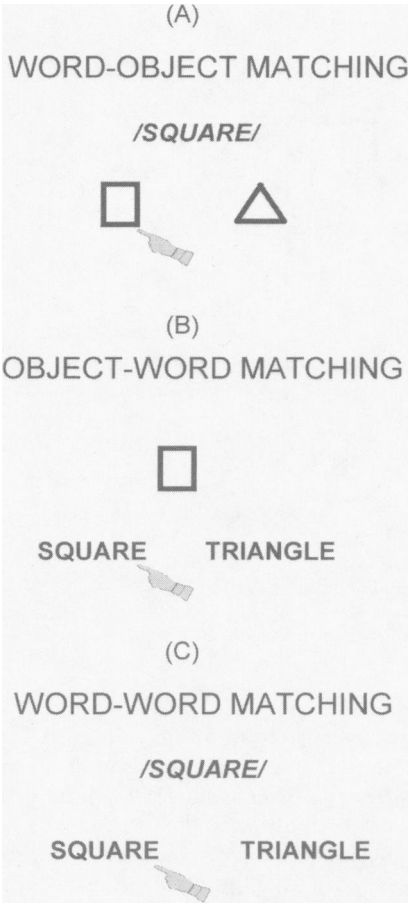

Figure 2. Responding in three conditional discriminations. In all cases the words and objects affect each others' selection simply as a function of the selection-response probabilities each control and not because of any linguistic or S-R associations between the printed and spoken words and the objects. Quotes denote spoken words; slashes denote heard words; and words with neither denote printed words. Boldface indicates words spoken or heard by an initial speaker (e.g., the parent) , non-boldface indicates words spoken or heard by listener (e.g., the child).

mentally important linguistic processes. As we see next, this is because the same mechanism operates for both relational and arbitrary matching.

And so, as shown in Figure 3, given the proper reinforcement history, just as the sample square may cause the comparison square to function as an S^D for the pointing response, so may the sample square also cause a blue stimulus to function as an S^D for the pointing response. The unmediated selection account does

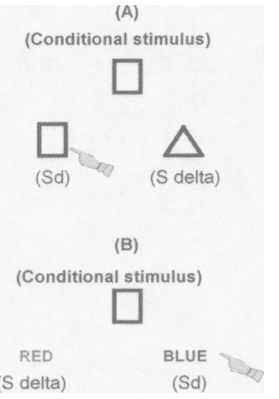

Figure 3. Selection in two condition discriminations. In Panel A the square, and in Panel B a blue stimulus, is selected in response to the square sample because these stimuli, as a result of their respective histories of reinforcement in conditional discrimination training, increase the rate of the selection response. Thus, accurate matching in Panel A does not require control by the identity relation between the sample and the correct comparison. Indeed, the identity relation is not mentioned in this account.

not appreciate that a special relation, identity, exists in the first case but not the second. And of course if this account cannot even recognize the identity relation, it can hardly be expected to explain generalized responding based on that relation.

Relations between Words and Objects

We find similar problems in describing relations between words and objects. Thus, if the only association between a word and an object is based on the unmediated selection just described, then in word-object matching, the listener can respond to no other relation between the stimuli except that which was explicitly trained (Figure 4). And so, after a subject is trained to select the appropriate shapes in response to the phrases *square over circle* and also to the phrase *triangle over line,* unmediated selection cannot account for untrained generalization to novel combinations of these words so that listeners, with no additional training, now select appropriate stimulus in response to the phrases *square over line* and *triangle over circle.*

Finally, there is the problem of the actual selection response itself. Though the unmediated selection account explains how the heightened rate of a selection response, such as point-

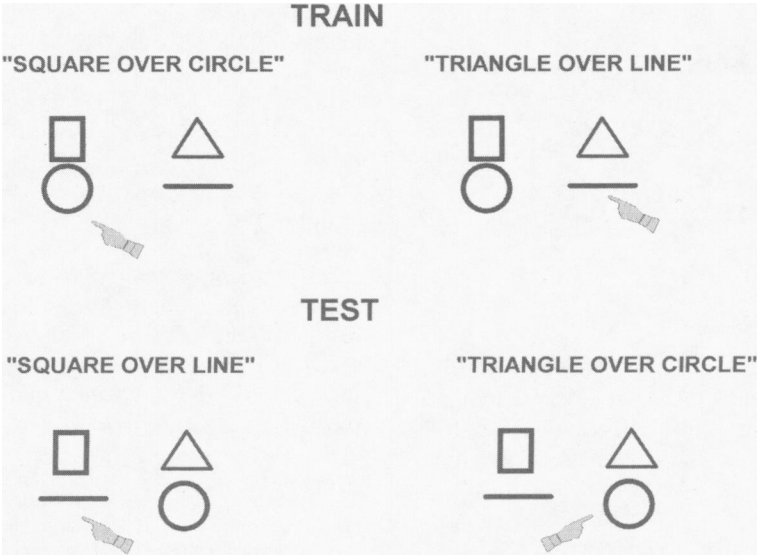

Figure 4. Responding to combinations of words and shapes in a condition discrimination. Based solely on the known properties of primary stimulus generalization, learning to select in response to some combinations of nouns (square, circle) and prepositions (over, under) cannot produce accurate generalized responding to novel combinations because all of the stimuli are mixtures of the same words and shapes.

ing to a shape (or pecking a colored disc), may arise through the process of differential reinforcement, such an account is utterly deficient in explaining how it is that we may locate and *recognize* a specified stimulus without actually emitting any selection (e.g., pointing) response at all, as when we notice ourselves, or report to others, that we have found a specified stimulus without actually pointing to it.

In summary here, having traced through a series of increasingly abstract performances, we find that the concept of unmediated selection does not seem suited to serve as the mechanism for much more than directly-trained conditional discriminations. In terms of levels of abstraction, the limits of Skinner's behavioral account appear to have been reached.

In what follows, a simple, additional mechanism is proposed. It is a mechanism that remedies these shortcomings in a way that provides a complete, yet parsimonious account of the nature of those behaviors we typically ascribe to meaning, and it does so while fully preserving the ordinary notion of stimulus control as developed by Skinner (1938).

The Nature of Joint Control

The mechanism to be proposed here is based on the concept of joint stimulus control (henceforth joint control). As discussed in recent articles (e.g., Lowenkron, 1998), joint control involves nothing more than the usual kind of operant stimulus control, except that under joint control two stimuli jointly exert control over a single, common, verbal topography. Now while this may sound trivial, this simple modification has exceedingly powerful and important effects. Its triviality is perhaps better viewed as parsimony.

What Is Joint Control?

As a demonstration of joint control, consider the task illustrated in Figure 5 in which the reader is now asked to locate a particular 6-digit number from the array of numbers in response to the instruction *Find nine three nine one seven three*.

An Intuitive Account

How now did you, the reader, locate the correct 6-digit number? Almost certainly after reading the printed-word sample (nine three nine ...) you began to rehearse this string of numbers as a series of spoken words while searching among the 6-digit numbers. During

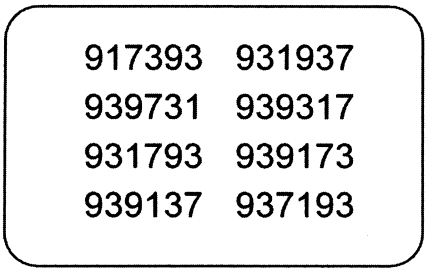

Figure 5. Find the 6-digit number *nine three nine one seven three* from among these eight sequences.

this search each rehearsal of the search string was under the control of stimuli generated by prior rehearsals. Thus, had someone loudly read off random strings of numbers during the search, your rehearsal of the search string, and thus the whole search process, would likely have been disrupted. And so one source of stimulus control over rehearsal of the search string was vocal, response-produced self-stimulation.

But at some point, there occurred a second source of stimulus control. That is, while searching among the alternatives in Figure 5, the reader encountered the correct six-digit number. At that point, and *only at that point,* something unique happened: rehearsal of the search string now came under a second source of stimulus control: it was now also being said in response to the digits on the page. And so, at this moment, the single search string 9-3-9-1-7-3 was said *both* as a repetition under the control of stimuli arising from the prior vocal repetitions, and also, that is, *jointly,* as a sequence of numbers being read from the printed page. That is, at that moment the reader was emitting a single vocal topography, the names of the digits, but was emitting them both as rehearsals under the control of what had been said before, and jointly as responses to what was printed on the page.

This particular joint control event, of course, is unique in that it could only happen with a particular 6-digit number. But like any other stimulus event, the onset of joint control may itself control a response. In the current case, depending on the exigencies of the task, that response might be a vocal report to others that the sought-after number had been located, or the reader might actually point to the sought-after number (e.g., in response to a request), or more likely here, the reader might just have an "ah-ha" experience—responding by noting silently that the specified number had been located.

In any event, *the only means* by which the specified 6-digit number could be identified from among the printed alternatives was by the onset of joint control. Since the sample was a string of printed words, and the comparisons were printed digits, there was no other way (e.g., physical similarity) to determine when the specified number has been found except to respond to the fact that, at some point. a single series of vocal response topographies was being emitted both as reading and as rehearsal responses.

An Operant Explanation

The language of Skinner's verbal operants readily provides a formal description of joint control. Thus, in Skinner's terms, as illustrated along the top of Figure 6, the listener's first emission of the initially spoken phrase, having point-to-point correspondence with that phrase, would be an echoic. Any subsequent rehearsals would be *self*-echoics because they have point-to-point correspondence with the prior repetitions emitted by the listener himself.

Next, as illustrated lower in Figure 6, the names of the digits emitted in response to the array of comparison numbers, were *tacts*. This tacting continued until, as illustrated here, a particular six-digit number was encountered whose topography could be emitted *both* as a tact, and simultaneously as a self-echoic of the prior rehearsals of the sample.

That is, at some point the response topography *nine three nine one seven three* was emitted both as a tact of the printed digits, and jointly as a self-echoic rehearsal of the spoken numbers. That is, under *joint tact/echoic control.* Finally, as shown on the right side of Figure 6, any pointing response, or any vocal report that the sought-after sequence had been found, would be an autoclitic (Lowenkron, 1991).

It is important to note here that the autoclitic response is optional. Thus, as illustrated in Figure 6, one may emit an autoclitic by vocally reporting to others that the specified stimulus has been located, or by pointing to the specified stimulus, (a selection based autoclitic) (Lowenkron, 1991, p. 124) or alternately, one may respond solely by noting it to one's self

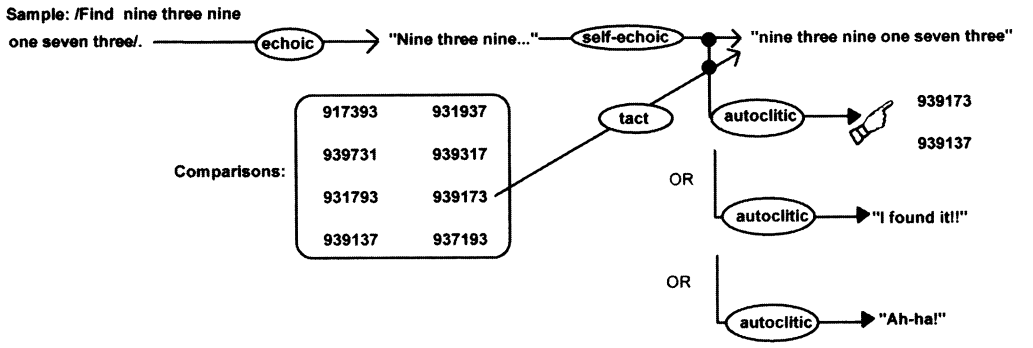

Figure 6. The operants of joint control. Rehearsing the sample phrase in response to the heard sample is an echoic: saying it in response to ones own prior production is a self-echoic. Responding to the printed numbers is a tact. Joint control occurs when a single emission of the response occurs both as a self-echoic and a tact. For simplicity of presentation, as indicated by the slashes, this episode begins with the listener hearing the sample.

(ah-ha!) while emitting no overt response. (For the sake of clarity, autoclitics will be omitted from most of the figures that follow.) In contrast, the models of unmediated stimulus selection described earlier do not allow the latter option. Under unmediated selection, the response to the correct stimulus is always the initially trained overt response: be it saying a word, pecking a key, or pressing a bar.

Thus, though joint control is constructed from unmediated verbal operants, its own function, ultimately, is to mediate emission of the autoclitic. And likewise, though the tact and echoic, and indeed all the verbal operants, involve nothing beyond the simple notion of discriminative stimulus control Skinner first formulated in 1938, the effect of their interaction is to provide for something quite different: a form of stimulus control in which characteristics of the response do indeed recognize the characteristics of the stimulus and thus relations between the stimuli.

The Generic Nature of Joint Control

Some idea of the vast generality of function possessed by joint control may be garnered by noting how directly the notion may be applied even where the sample phrase requires a selection based on both concrete dimensions such as color (black) and shape (dot, pentagon) as well as on abstract dimensions such as relative size (larger/smaller) and location (in/out). Thus, in Figure 7, we see that these differences are in fact immaterial. As long as subjects can respond to these features with appropriate tacts, generalized abstract relations between features can easily be responded to under joint control.

From this we see that joint control is indeed a *generic event* because it requires nothing new of subjects across situations and stimuli. The echoic and self-echoic components of joint control only require that previously learned topographies (phonemes) be emitted in the particular combination specified by the speaker's first emission of the word or phrase. Likewise, the tact component only requires an emission of the very same topography. As for the autoclitic component, it is controlled by the onset of the joint control event itself—not by the particular stimuli involved—so there is nothing new there either.

Taken together, these examples illustrate that the event of joint-control, while specific to the currently specified stimulus, is itself a *generic event,* and thus independent of any particular stimulus features. As we shall see shortly, this generic feature of joint control makes it surprisingly ubiquitous in our verbal behavior: producing a variety of behavioral phenomena typically attributed to the semantic notion of word meaning.

A Joint Control Account of Meaning

In the following sections we analyze various performances, ordinarily attributed to word meaning, in order to demonstrate how these performances may be described entirely by the terms of Skinner's verbal operants. The intention here is to show that a coherent, complete, and strictly behavioral account of meaning, one

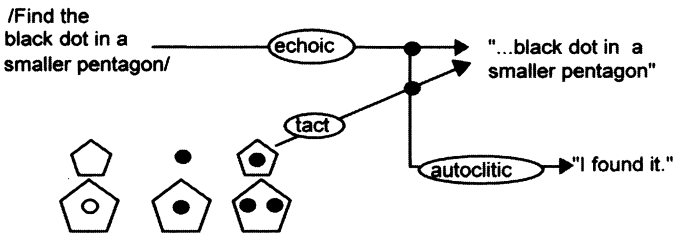

Figure 7. The generic nature of joint control. Under joint control finding the stimulus with the specified color and number of dots, in the specified location and of the correct relative size only requires that the subject be able to tact each of these features. Each of the specified features are identified by a common generic event, the onset of joint control.

not appealing to non-behavioral elements such as ideas, information, communication, and so forth, is not only possible, but easily accomplished. This first section looks at the fundamental characteristic of meaning, *reference:* the connection between word and referent, and shows this fundamental connection to be the product of joint control. This analysis is then followed by an examination of other linguistic phenomena in which meaning is ordinarily said to play a role.

Reference, Naming, and Symmetry

The notion of reference, variously called the *symbolic* or *semantic function,* is concerned with the nature of the connection that exists between a word or phrase and the object, event or relation the word or phrase is said to refer to. This connection is said to play a role both when a word is spoken, and its meaning is transmitted, and also when a word is heard and its meaning is received.

But what is the nature of that connection we call reference? How exactly is a word or phrase connected to what the word refers to (i.e., how does a word or phrase specify an object)? And conversely, how is an object or event associated with its *name,* or description (i.e., how does the object evoke the word)? And finally, what is the basis of the symmetry between these two cases that seems to make word and object equivalent and interchangeable so that learning one of these relations (i.e., the word–object referential relation) seems to imply, with no additional training, the presence of the symmetrical alternative (i.e., the object–word naming relation) in the subject's behavioral repertoire?

It is not enough to assert *a priori* that none of this is behavioral, but rather a product of processes of association, usage, semantics and/or rule governance, for such an assertion simply defers the problem; leaving us with all the same questions, but in a less accessible domain: the mind rather than behavior. Thus, the first problem is one of locating a feasible and explicit behavioral mechanism, exploring its identifying characteristics, and then demonstrating, as fully as possible, the role this mechanism plays in situations typically ascribed to meaning. If this can be done, accounts referring to other domains then become superfluous.

The Problem of Reference: How Words Specify Objects and Events

To begin to explore the nature of reference, let us first consider the case of self-reference: that is, identity matching. Seeing how joint control operates in this situation makes for an easy jump to the case where one event (object, symbol or word) refers to a *different* object, symbol or event (Lowenkron, 1998).

A demonstration of self-reference (identity). The mechanism of self-reference may be clearly seen in an experiment reported by Lowenkron, 1988) in which severely retarded children, with neither vocal speech nor sign language, were first trained to name each of the shapes shown in Panel A of Figure 8 with the corresponding handsigns. The children were then trained in the sequence of performances shown in Panel B. Thus, as each of the 4 shapes was presented alone on the display screen as a sample, the subject was trained to emit the handsign appropriate to the shape, and then rehearse the handsign over a delay interval (roughly 10 seconds) until all four shapes

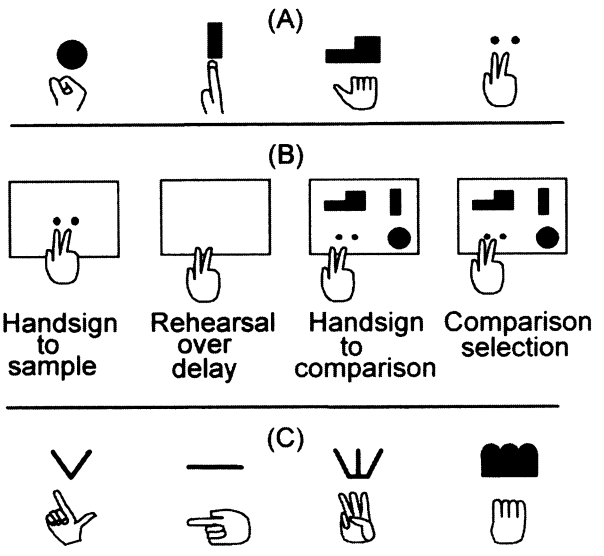

Figure 8. Generalized self-reference mediated by handsigns. (A) The training-set stimuli and their associated handsigns. (B) The four component responses of the performance: Subjects must make an appropriate handsign to the sample when it appears, rehearse the handsign over the delay interval, and then, while rehearsing it, attempt to make the handsign, unchanged, to one of the comparisons. Finally, they select the comparison to which they make the rehearsed handsign. (C) The transfer-set stimuli and their associated handsigns.

appeared on the screen as comparisons. At this point, the child was trained to continue rehearsing the handsign, that is, maintain the original handsign unchanged, but was also trained to place the handsign over the comparison for which that handsign had previously been trained.

Finally, as shown in the last picture of Panel B, the subject selected a shape by making the unchanged handsign while touching the shape. Thus, here, the subject has made the handsign to the two dots, has rehearsed the handsign over the delay interval, has maintained the handsign at the appropriate comparison, and finally has selected a comparison by touching it with the unchanged handsign. This training continued until all 4 shapes evoked appropriate selections (i.e., identity matching).

Subsequently, when first tested in this same task with the novel shapes illustrated in Panel C, performance dropped to chance levels of selection. Thus, practicing the initial identity matching task did not, by itself, lead to generalized identity matching with the novel shapes. But after the subjects were trained to make appropriate handsigns (to tact) each of the novel shapes, as shown in Panel C, high levels of accurate identity matching were immediately observed with these shapes.

How stimuli specify themselves: the joint control account of self-reference. These findings, and the training procedures that produced them, reveal directly how a stimulus may specify itself. First off, it is apparent that the mechanism of stimulus specification need not involve directly reinforced, unmediated selection; for subjects here were never trained to select the novel shapes shown in Panel C, but only to name them with the handsigns. Rather, stimulus specification appears to be based on response mediation and joint control. Thus, here the sample stimulus specified the comparison stimulus with the identical shape because the sample stimulus evoked a particular mediating handsign, and that handsign could only enter into joint control with one comparison: the one that evoked the same handsign.

And so, as illustrated in Figure 9, Panel A, the two-dot sample evokes the particular handsign shown here, and that handsign can occur under joint control, *only* with the two-dot comparison. Likewise, in Panel B, the line sample specifies the line comparison, but none of the other three shapes, because the line sample evokes the illustrated handsign, and that handsign *only* enters into joint control with the line comparison. Thus where the basis of selection is the onset of joint control, one instance

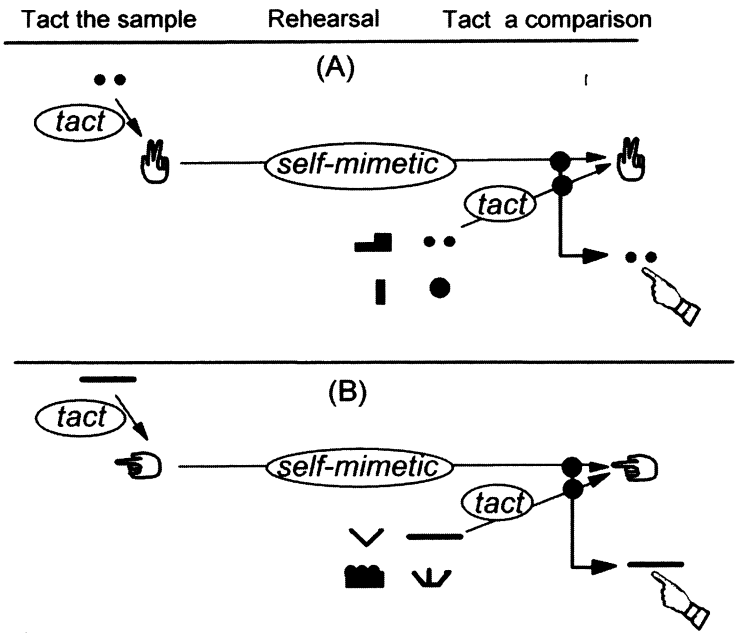

Figure 9. Self reference mediated by joint control. The two-dot sample specifies the two-dot comparison because the two-dot sample evokes a particular handsign topography which in turn, can only be emitted at the two-dot comparison. Thus one stimulus specifies a second stimulus because they both evoke a common response topography under joint control.

of a stimulus specifies another instance of the same stimulus because both instances *jointly evoke a common response topography.*

Behavioralizing reference: the joint control account of the semantic function. Now with but a single modification, this account provides a simple explanation of how names and descriptions function to *refer* to objects and events; that is, the semantic function. Consider a hypothetical modification of the previously described experiment: Suppose the shapes to be selected had been *named* by the experimenter providing the handsigns directly. Thus, as we see in Figure 10, Panel A, by providing a handsign, the experimenter is *telling* the subject which shape to select. That is, to select the shape that enters into joint control with the given handsign. And so again, just as we saw in the identity matching task, under joint control the sample stimulus specifies a particular comparison stimulus because only that comparison stimulus enters into joint control with the topography evoked by the sample. But here, where the specifying stimulus (the handsign), and the specified stimulus (the shape), are not identical, the relation between stimuli is typically described as one of reference. Thus, the handsign illustrated in Figure 10 may be said to *refer* to the two dots.

And of course the jump to vocal language is obvious. As we see in Panel B the subject is still selecting the comparison whose tact enters into joint control with the rehearsed phrase "two dots." The only difference here is that the speaker's response is vocal rather than a handsign. Thus we see how a word heard by the listener *refers* to an object. That is, the heard word evokes the topography to be rehearsed by the listener, and that *topography,* in turn, acts to specify one particular comparison stimulus: namely the stimulus that evokes the same topography; thereby bringing that topography under joint control.

And of course none of this is restricted to single words. As we saw in Figure 7, by saying the phrase *black dot in the smaller pentagon,* the speaker specified to the listener that topography for rehearsal and thus that object, and no other, for selection. The complex object is thus the *referent* of the phrase *black dot in the smaller pentagon* because both object and phrase evoke a common topography.

The mechanism of reference. From all of the above it is apparent that the connection between

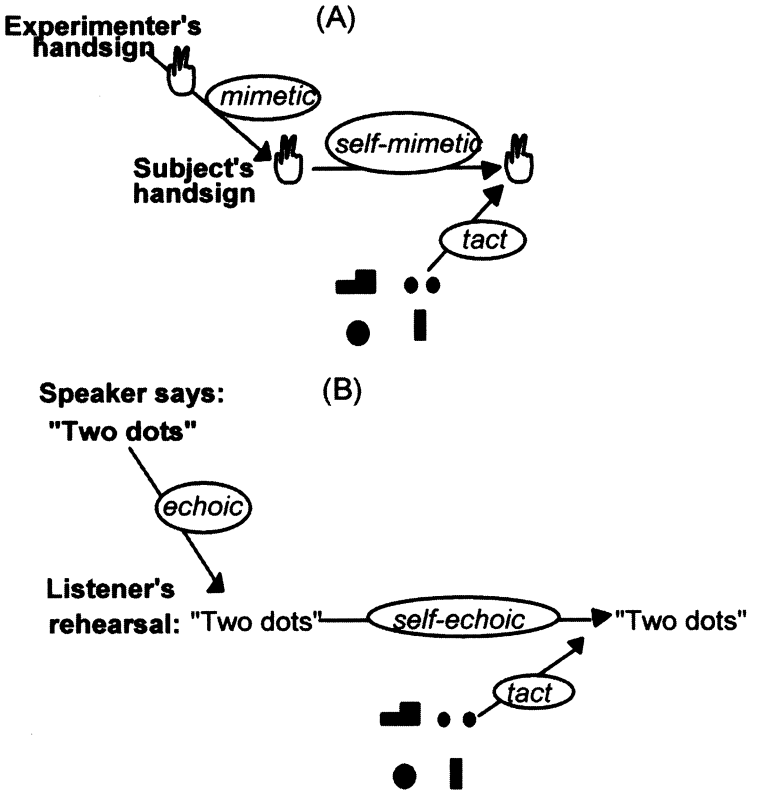

Figure 10. Though the topography may differ, selection controlled by a sample object (A) or by a sample spoken phrase (B) involves the same pattern of stimulus control; namely joint control.

a heard word and its referent (the word-object relation) is not a single simple association between the word and the referent as earlier, Pavlovian-based formulations proposed (e.g., Kendler & Kendler, 1962; Osgood,1952; Noble, 1952). Rather, as we see here, a word specifies a referent by the congruity of the response topographies both evoke. Thus, in Figure 10, the signer's handsign *specifies* the two-dot comparison stimulus in the sense that the signer's handsign determines the handsign the subject is to emit as a mimetic (i.e., a copy), but that handsign, in turn, can only be emitted in response to a particular comparison shape (namely, the two dots). Thus, by specifying the response the listener is to copy (the handsign), the signer also specifies the stimulus the listener is to select (the two dots) because only that stimulus evokes the currently rehearsed topography under joint control. Likewise, as illustrated in Panel B, when the sample is a spoken word or phrase (e.g., "two dots"), the speaker, in emitting the phrase "two dots," controls the topography of the self-echoic response the listener is to rehearse, and thereby specifies the comparison shape the listener must select; namely the particular comparison whose tact enters into joint control with the rehearsed self-echoic.

In essence then, the nature of reference is as follows: a word or phrase, as a response topography, specifies a referent by specifying the topography the referent must evoke. Or put simply, a topography specifies a referent because the referent evokes that topography.

Negation. But what happens when the specified referent is not found, and the listener is left rehearsing as for example, if the listener were asked to find *four* small dots in Figure 10. Appropriate behavior here would simply require a history of reinforced practice for saying phrases such as "it isn't here" or "I can't find it" in cases of extended search where a specified object was sought but not found. That is, the presence of the rehearsed (echoic) component, but the absence of the actual object that

is being sought (and thus the *absence of joint control*) may itself evoke such a report in the listener. That the generic properties of stimuli associated with prolonged searching due to the *absence* of joint control can themselves be stimuli for other behavior, has been illustrated by Lowenkron and Colvin (1992).

The Nature of Naming as the Basis of Reference

Having described how words may specify an object or event (the word–object relation), we turn now to an account of the alternate relation: how an object evokes a word (the object–word relation). This is, in fact, the performance commonly called naming, labeling or describing, and it was discussed in the previous description of the tact. There is no complexity here. Naming, labeling, and describing are unmediated performances, and as tacts they are simple, verbal, operant responses with topographies evoked under the direct, discriminative-stimulus control of physical events or series of events in the environment.

The fact that object–word responding is the tact performance presents a fascinating situation because the tact, as we have seen, is one of the two constituents of joint control (the other of course being self-echoic rehearsal), and it is joint control that mediates the word–object relation. Thus, the *object–word relation* (tacting) is actually a constituent of the *word–object relation (selection)*. For example, in Figure 10 we see that the word–object relation (wherein the phrase "two dots" evokes a selection of the two dots under joint control), actually contains within it the object–word relation (the tact). Thus it is that *tacting (naming) is the basis for reference* (Fodor, Bever & Garrett, 1974, p. 146). And so, a word or phrase refers to an object or event (word–object responding) because that word or phrase topography is also (jointly) evoked by that object or event (object–word responding.)

Symmetry: A Behavioral Account of the Semantic Relation

The semantic relation is generally characterized as a fundamental equivalence between objects or events and the word(s) that name, specify, describe or mean those objects or events. This equivalence is seen to manifest itself in the *symmetry* of word-object and object-word relations such that training either one of these relations regularly causes the other to appear with no additional training. But as we see next, this symmetry need not be ascribed to inaccessible linguistic processes or meanings stored within the speaker. Rather, symmetry is a mechanical product of responding under joint control (Lowenkron, 1996).

How training object–word naming produces word–object selection. Let us first consider the symmetry that exists between object-word training, (naming), and the untrained appearance of word-object responding, (i.e., selection). How is it that training subjects, who are already responding under joint control, to name novel stimuli engenders, with no additional training, the accurate selection of these stimuli in response to these names when spoken by others? The answer is not difficult to find.

At the top of Figure 11 are four novel shapes and four words. And as we have seen, training subjects to emit words in response to novel shapes is to make these words function as tacts: the object–word relation. But, as illustrated here, such training also produces the alternate relation: word–object selection. This is because, as noted previously, joint control over selection involves only two operant relations: the tact and the echoic, both of which consist of the same response topography (e.g. "hill"). And so, once a new topography is acquired as a tact (the object–word relation illustrated in Fig 11, Panel A), nothing else need be acquired for word–object selection to emerge because all of the components, both of historical origin and contemporary, are now present.

And so, in Figure 11, after learning to tact the novel shapes in Panel A, given the word / *hill*/, the reader can find the shape called *hill* in Panel B by rehearsing that topography as a self-echoic while perusing the shapes in Panel B until one is encountered that causes the topography *hill* to be emitted under joint control. As illustrated, this shape is then selected by an autoclitic pointing response. Of course, in subjects such as young children, the severely developmentally disabled and animals, where responding is based on unmediated selection rather than joint control, this symmetry does not exist: training such subjects to name stimuli does not reciprocally engender their accurate selection. Several examples of the dependence of this particular symmetry on a history of responding under joint control have been dem-

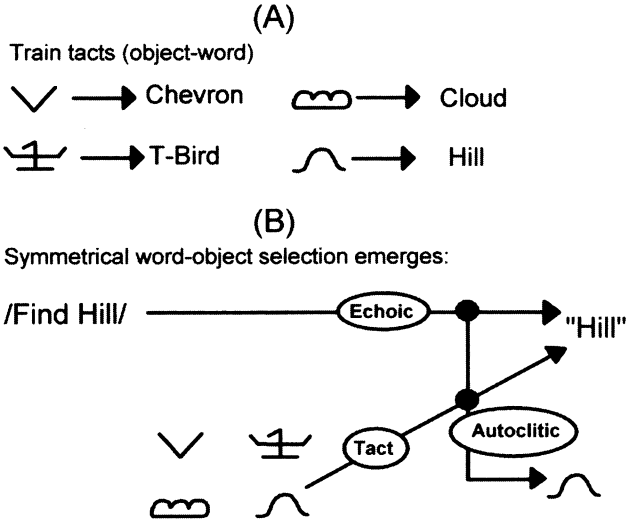

Figure 11. How training object-word naming produces word-object selection. Once the subject is responding under joint control, subsequently training names for novel stimuli (A) then allows those stimuli to function under joint control in word-object selection (B).

onstrated across a variety of behaviors (Lowenkron, 1984, 1988, 1989).

How training word–object selection produces object–word naming. As to the alternate relation, wherein reinforced training in word-object selection produces accurate object-word tacting, we again consider a subject who is already selecting under joint control, and who is already able to repeat, as echoics, words and phrases that are heard. The subject is then trained in word–object selection with a new set of words and objects. That is, the subject hears the word and is reinforced for selecting the appropriate object. Since, as we have seen, the word–object selection performance includes the object–word tact, we would expect that reinforcing the first would naturally produce the second. Let us look at this a little more analytically.

To begin with, let us assume, for reasons to be given shortly, that, upon hearing a name, the subject rehearses it as an echoic while perusing the available comparison objects. Because there has been no prior training with this word, the subject must select a comparison object at random in response to the heard word. When the subject happens to select the correct object for that word, reinforcement is provided. As a result, not only is the selection of that object in the presence of the word reinforced, but the trial also functions as an object–word training trial because in the presence of the object the subject emitted an echoic production of the currently rehearsed word, and this behavior was reinforced. Thus, where a correct word–object selection is made, even accidentally, the object–word (tact) relation is reinforced. Thus, as the subject learns to select particular objects in response to their names, he also learns to name the objects. An accurate word–object selection thus necessarily engenders the symmetric relation, object–word naming. (Readers who mimic this behavior will quickly recognize it as a part of their own repertoire).

The Development of Joint Control

We are left, finally, with the question of where joint control originates: for all of the phenomena described above is premised on a listener already responding under joint control. The answer to this question does not reside in theory: for unlike a psychological account, in which novel psychological processes may be postulated and defined operationally, a conceptual behavior analysis, as described earlier, does not permit the postulation of non-empirical constructs; but rather, in deference to the principle of parsimony, requires a derivation in its

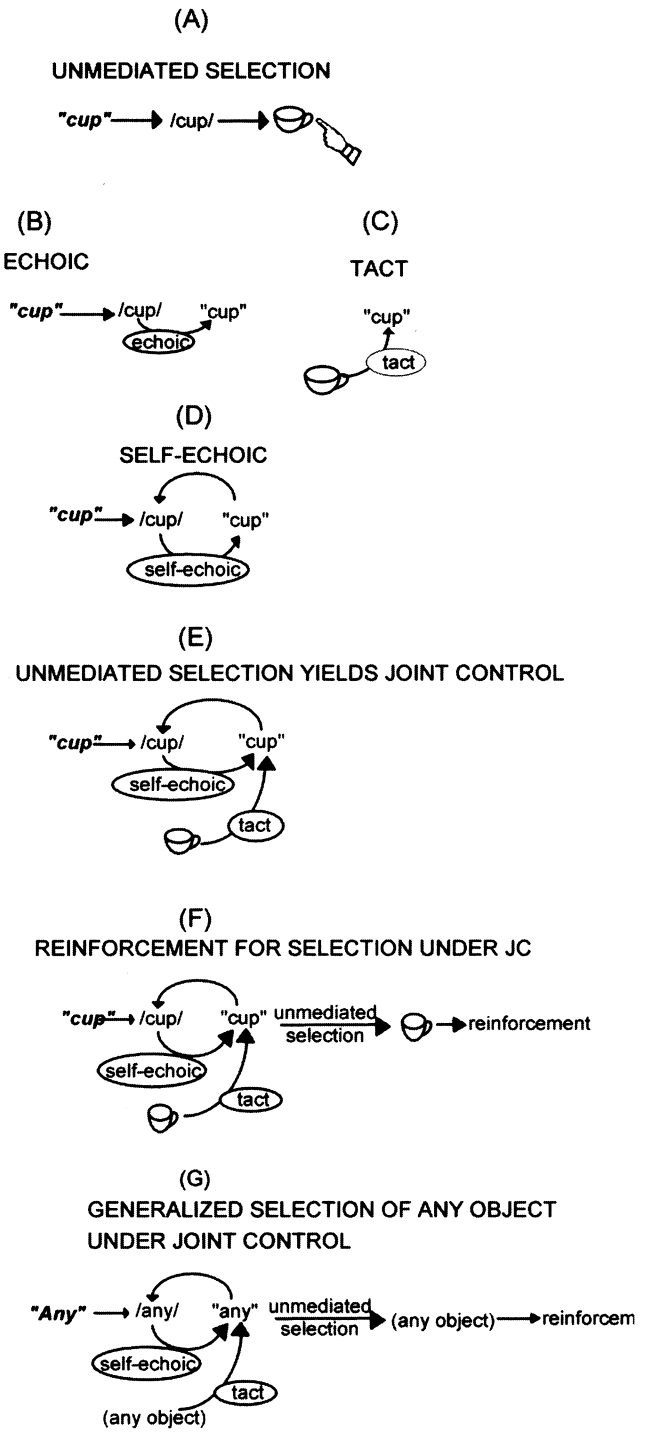

Figure 12. The development of joint control. Development of joint control only requires the development of interactions between the three simple operants acquired in Panels A, B, and C. No hypothetical mechanisms are required. Bold italics indicate words spoken by others; /slashes/ indicate words heard by subject; non-bold, non-italic type indicates words spoken by subject.

own (behavioral) terms. And so we are left with the task of providing a behavioral account of how, in the course of a child's development, unmediated responding, comprised of the three operants illustrated in Figure 12, Panels A, B, and C, eventually turns into responding mediated under joint control.

In devising such an account, it is important to recognize at the outset that phrasing the account in terms of the activity of verbal operants means phrasing the account in terms of a mechanism with well known and widely studied properties. There is nothing new and ad hoc here. There is only the question of whether the particular stimulus-control relations and reinforcers proposed by the account are accurate. The account thus stands on its own internal consistency and on its congruence with well known principles of, and findings about, behavior. And as a matter of fact, as illustrated in Figure 12, such an account is quite straightforward.

As documented by Benedict (1979) and by Horne and Lowe (1996) and as illustrated by Lowenkron (1997), before complex responding develops, children acquire three simple operants; though not necessarily in the order illustrated here: One such behavior (Figure 12, Panel A), as described earlier, is the unmediated selection in a conditional discrimination. Here, in the presence of the spoken word / ***cup***/, the child first learning English hears the word /cup/, and in response to parental prompts with this word is reinforced for selecting that object. As a result of this history of differential reinforcement in this simple contingency, in the presence of the heard word /*cup*/, a pointing response to it becomes more likely than a pointing response to any other object.

A second behavior that children acquire (Panel B) is the simple echoic. Here, in the presence of the spoken word "cup," the child hears the word /cup/ and as a result of reinforcement from others, repeats the word. The third behavior, shown in Panel C, is the tact: In the presence of the cup and appropriate prompts (e.g., What is this?), emitting the spoken word "cup" is reinforced. Subsequently, on this account, these three simple operants interact so that the child's basis of responding changes from unmediated selecting and saying, engendered by direct reinforcement, to generalized responding under joint control. The contingencies of reinforcement that cause this change to occur, as illustrated in Figure 12, presumably, though not exclusively, affect the child in the following order.

First, (Panel D) in an environment more complex than the one in which this conditional discrimination was originally trained (i.e., with more alternatives available, or with delays until the named objects appear), the sample name is spoken ("cup") and the child hears it as / *cup*/. To preserve the name in this complex environment, while seeking to locate and select the cup as originally trained in unmediated selection (Panel A), the child now rehearses the name as an echoic: saying "*cup*" and hearing (/*cup*/) which then acts as a stimulus for further (self-echoic) repetitions while seeking the object so named (Michael, 1996). The heightened rate of reinforced selections such rehearsing produces then increases the likelihood of self-echoic behavior in these kinds of tasks.

Eventually (Panel E), as this rehearsal is practiced, the sought-after object is encountered, and so the joint control event occurs. That is, at this point the topography of the currently rehearsed self-echoic (Panel D) also serves as a tact (Panel C) for the sought-after object. Thus, when the cup is actually encountered, the word "cup" is now said both as a tact and as a self-echoic and is thus under joint self-echoic/tact control.

And as we see in Panel F, as a result of prior training in *unmediated* selections of this object in response to its name (as illustrated in Panel A), the child selects the object here, and this selection response is reinforced. Selecting an object that evokes a tact that enters into joint control with the currently rehearsed self-echoic is thus adventitiously reinforced.

Finally, as illustrated in Panel G, as the sequence illustrated in Panel F happens across many different name-object combinations, selections of objects that enter into joint control are differentially reinforced because the joint-control event itself is the only stimulus event that consistently precedes all reinforced selections. Joint control thus becomes a *generic stimulus event* for selecting stimuli; thereby providing the basis for the many generalized performances described here. For as we have seen, once a child has learned to respond under joint control, further learning to name objects (object–word responding) produces *untrained* word–object selections of those objects

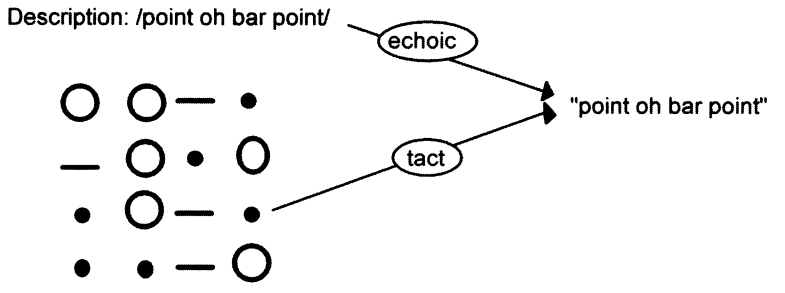

Figure 13. Recognizing an object or event from its description. At the moment the phrase, rehearsed as an echoic, comes under joint control with a tact of one of the comparisons, that comparison is said to be recognized from its description.

in response to their name (symmetrical responding). And surely this 2-for-1 bargain—coming at the time it does in children's development must—at least in part—account for the spurt of growth in children's vocabularies commonly reported around age 2 (Nelson & Bonvillian, 1973). Thus it is that both the development and function of many performances traditionally attributed to linguistic processes can be accounted for in terms of the interaction of simple operants.

Implications of the Notion of Joint Control for Other Phenomena of Meaning

Certainly, reference and symmetry are the most important of the many functions commonly ascribed to meaning, but there are others. This next section applies the same analysis to several other linguistic phenomena typically attributed to meaning—however defined. It is an analysis that is not only enlightening, but also one that provides the basis of a coherent scientific usage for the term *meaning*. For it turns out that these analyses, seemingly of disparate phenomena, actually all focus on subtly different aspects of a single phenomenon: joint control.

As evidence of the conceptually unifying function of joint control, we first look at those phenomenon commonly ascribed to psychological processes of comprehension and recognition. Interestingly enough, it turns out that the act of comprehending a description of an object or event and the act of recognizing an object or an event from its description, are two aspects of the same joint-control event.

Comprehension. Suppose a listener is shown Figure 13 and instructed to find the row of shapes that may be described with the ambiguous phrase *point oh bar point*. Initially, the listener reports *not comprehending* this phrase, and so repeats the phrase only as a self-echoic: that is, as a *meaningless* list of words. Later, after perusing the various rows of shapes, the listener finds one series that may be described with exactly these words. That is, he finds one series of shapes for which each of the words in the spoken phrase can enter into joint control with a corresponding feature of that series. It is at this point that the phrase may be said to become comprehended, as the listener reports (perhaps somewhat tentatively), that the once meaningless phrase has suddenly gained meaning.

But what has really happened? Actually, nothing but a change of stimulus control from self-echoic responding alone, to joint control. That is, rather than just rehearsing the descriptive phrase solely as a self-echoic, it is now emitted as both a self-echoic and also (as a result of earlier incidental training with these shapes) as a series of tacts of the shapes in one of the series. A subsequent reinforcement for this repetition further strengthens joint control, by strengthening the tact: an event which the listener may report (an autoclitic) as an increase in his *certainty* that the phrase is correctly comprehended. And so, if asked again, the subject may now report that he does indeed comprehend the description "point oh bar point." Thus, a novel series of words is comprehended as a description, that is, it gains meaning, as stimulus control over the phrase transfers from self-echoic to joint self-echoic/tact control. The *ah-ha* event of comprehension may then be identified as the moment that the entire phrase is emitted under joint control.

Finally, it appears that the notion of joint control gives precision to the common obser-

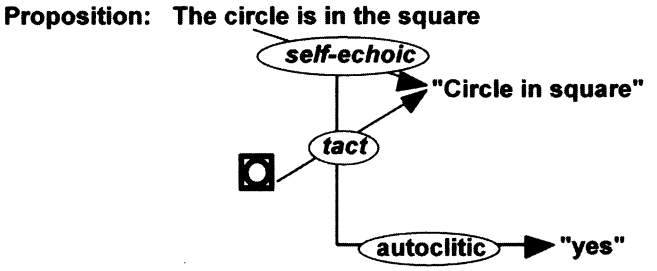

Figure 14. Verification of a proposition. Here rather than which comparison enters into joint control with the sample, the issue is whether or not a particular comparison enters into joint control.

vation that comprehending a description implies a capacity to *apply* the description. And so, as we see here, when the listener just repeats the phrase under self-echoic control alone, and does not apply the terms of the phrase as tacts, it may be said that he does not comprehend the phrase. But when the listener also emits the terms of the phrase as tacts of the shapes in the series, he applies the description to the series, and also reports that he comprehends the description.

Recognition. There is more. Symmetrical to the process of *comprehending* a description is the process of *recognizing* the object so described. Thus, at the moment the terms of the description are comprehended in the sense just described, so is the particular object whose properties are evoking those tacts typically said to be recognized. Thus, in Figure 13, as the echoic topography comes under joint self-echoic/tact control, and the description is thereby said to be comprehended, so too is the object that is described being recognized. Apparently, the putatively cognitive events of comprehension and of recognition both come from a single behavioral event, the onset of joint control.

We should note however, that this recognition event only happens the first time the listener selects in response to a description. If subsequently asked to point to that stimulus again, the listener no longer need repeat the description and respond under joint control. Rather, given the immediate history of reinforcement for having pointed to that stimulus in the presence of the description, subsequent selections of the stimulus may be directly reinforced: thereby simplifying responding by changing it from mediated responding under joint control to unmediated selection.

The Comprehension of a Proposition.

As we see in Figure 14, with no additional complexity, the joint-control account easily extends from responding to simple names to the comprehension of multi-term propositions. Comprehending these propositions brings about yet another advance in the abstraction of the behavior, for now, rather than merely selecting stimuli in response to complex statements, comprehension allows for an evaluation of the truth status of a proposition. In such a case, as illustrated in Figure 14, a proposition is presented, and its truth status is adjudged relative to a single alternative. *Yes, no, true,* and *false* are all autoclitic reports of joint control or its absence. Thus, generally speaking (depending on how the proposition is phrased) if a self-echoic of the proposition enters into joint control with (a tact of) the situation described, this joint control event evokes the autoclitic response *true*: otherwise, the lack of joint control evokes the autoclitic *false*. Thus, here, where a simple behavioral account suffices, judgements about the truth and falsity of a proposition need not be cast as mental events.

Assessing the Equivalence of Propositions

Finally, joint control also plays an important role in evaluating the equivalence of different propositions. Thus, a listener is able to identify the propositions *The box is on the circle* and *The circle is under the box* with one environmental event, and the propositions *The box is under the circle* and *The circle is on the box* with another environmental event because of the manner in which each proposition enters, as a self-echoic, into joint control with tacts evoked by the shapes (box/circle), and by the

relations (over/under) between them. Different statements that enter into joint control with a common environmental event may be said to have *equivalent meanings* in the sense that they have common referents as that term was described previously.

The Clarification of Ambiguous Propositions and the Behavior of Seeking Meaning

Sometimes a proposition is presented whose meaning is ambiguous with respect to a particular situation, and the proposition must be clarified. But what might the terms *ambiguous* and *clarify* mean in this context? In the current case, simply this: a proposition (or its meaning) is ambiguous when one emits self-echoic rehearsals of the heard proposition, but, given the opportunity, one cannot completely emit these same topographies as tacts of the current situation. Thus, the proposition "Most of the circles in Figure 13 are on the diagonals" would be reported by a listener as *ambiguous* if that proposition, while it was rehearsed as a self-echoic, could not also be emitted as a tact of any feature of Figure 13. An instruction such as "look at the open circles only" would disambiguate the task; allowing for the original proposition to be stated now as a self-echoic that would fall under joint control with a tact of the actual situation.

Clarifying Propositions by Changing the Self-echoic. Moving to more difficult situations, in those cases of ambiguity where a search of the comparisons does not bring about joint control, stimuli arising from the extended search (Lowenkron, 1989) may, through prior learning, evoke ancillary behavior that serves to modify the task so that joint control over the subject's emission of the phrase is achieved. In essence, the listener emits a problem-solving behavior.

Thus, as shown in Figure 15, given the spoken proposition "The line is bigger than the circle," a listener, upon finding no tact of the figure available to enter into joint control with his self-echoic of this proposition, may engage in some ancillary behavior to clarify the proposition. He may do this by asking the speaker "What do you mean the line is bigger? I don't understand" (i.e., "Given these stimuli I can't find a way to emit the phrase 'The line is bigger than the circle' as a tact.") If the speaker then gives the listener a new phrase, (e.g., "No

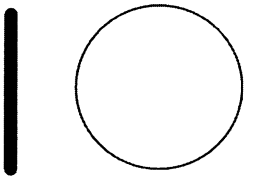

Figure 15. Clarifying a proposition. The proposition "The line is bigger than the circle" does not seem to enter into joint control with any obvious tacts of the stimulus and thus is said to be not understood. Changing the word bigger to thicker yields a self-echoic that does enter into joint control, and so the statement is said to be understood.

I meant the line is *thicker* than the circle") this allows the listener to emit the new phrase as a self-echoic, and jointly as a tact of the figure, thereby *clarifying* the phrase and allowing the listener to *comprehend* it in the sense described previously and thereby report "OK, I understand your meaning."

Seeking Meaning: A Goal-Oriented Behavior

The preceding exemplifies an interesting property in that it emulates the activity of *seeking* meaning. Presumably, if the clarifications offered had not been enough to bring about joint control, the listener could have returned saying, "I still don't understand what you mean by that statement," and then taken any further clarifications offered and attempted to emit them under joint control.

This pattern of emitting responses to seek changes in the stimuli that enter into joint control gives us a behavioral account of what might be referred to colloquially as a goal-oriented behavior: namely, seeking the clarification of a meaning. Several detailed behavioral analyses of this kind of goal-oriented behavior in young children have been studied using overt operants to permit direct observations of the behavior (Lowenkron, 1984, 1989; Lowenkron & Colvin, 1995).

How a situation gains meaning. There is another possibility. Rather than causing the self-echoic to change over time by asking for additional information, it is also possible to seek joint control by waiting for the situation, (and thus the tact it controls) to change. This is the situation in which a stated proposition is not understood, while changes in the environment proceed apace, until a particular change

arises which evokes a tact that *can* enter into joint control with the original self-echoic.

For example: a naïve player, told that a certain slot machine was "hot," might initially comment, upon touching the machine, that the machine felt to be the same temperature as the rest of the room. But as the player started to win repeatedly, this event might then evoke a comment (such as "I see what you mean") indicating sudden comprehension of the meaning of the phrase, as a gradually evolving history of repeatedly winning comes to evoke the tact "hot" with respect to the machine and this tact topography then enters into joint control with the rehearsed self-echoic "hot machine."

Summary

There are other phenomena ordinarily ascribed to meaning that might be discussed, as for example, with respect to the *synonymy* of meanings, but the preceding illustrates the coherence of a behavioral analysis of phenomena commonly ascribed to the transmission and reception of meaning.

Given the foregoing it is clear that two important benefits arise from the fact that this analysis does not require the use of any terms other than those described by Skinner in his original work on language *Verbal Behavior.* First off, the account is parsimonious: it provides for a simple and consistent analysis of important linguistic phenomena using relatively few concepts. And indeed, the fact that these concepts, developed by Skinner to analyze the behavior of the speaker, apply directly the behavior of the listener, testifies greatly as to the validity of Skinner's original analysis for we might expect that it is only when the terms of an analysis contact some basic truth that they may be applied as widely, as consistently, and as effortlessly as we see here.

The second benefit is the fact that this account is based upon a well-understood unit of behavior, the operant. Thus, the many variables (e.g., deprivation, stimulus generalization) that have been shown to effect to affect operant performances, may be reasonably assumed to affect, in like fashion, the operants described here as verbal operants. The account presented here is thus not a theory in the common sense of the term, but rather may be more accurately described as an increasingly broad empirical generalization based on well-established facts.

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