gun in *Verbal Behavior*. Should Horne and Lowe succeed in their efforts to inspire new interest by behavior analysts in the scientific

study of early child development, their contribution will be great even if these specific theories do not survive the test of time.

NAMING, STIMULUS EQUIVALENCE, AND CONDITIONED HEARING

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Horne and Lowe suggest, in keeping with earlier formulations of the naming hypothesis (Dugdale & Lowe, 1990), that naming is necessary for passing standard tests of stimulus equivalence (i.e., for forming emergent stimulus-stimulus relations). They suggest a developmental sequence by which the naming relation is learned. First, listener behavior is established with respect to classes of stimuli. Next the child learns a generalized echoic repertoire that is said to supply a critical link in the formation of a naming (or speaker-listener) relation. Upon hearing someone else say "shoe," the child now has two types of behavior evoked concurrently (i.e., listener behavior of selecting and seeing shoes and, via the echoic, speaker behavior of saying "shoe"). Because this pairing incidentally enables the child's seeing shoes to be an antecedent to his saying "shoe" (which is consequently reinforced by the caregiver), the shoe-"shoe" relation is learned. This interlocks with the previously established listener relation to create, say Horne and Lowe, a "qualitatively new bidirectional relation" (p. 200). Moreover, they claim that "it is at this stage that we can say the child has learned to name the shoe" (p. 199). I have three observations regarding this: First, I do not see why the interlocking of two relations that have both been directly trained produces a *quali-*

tatively new relation. Second, because both relations have been directly trained, there is nothing emergent in the episode. Thus, the behavior of the monkeys in the equivalence study by McIntire, Cleary, and Thompson (1987) satisfies this definition of naming; their contingencies allowed precisely this kind of interlocking to occur, and their monkeys went on to pass the test. If so, we have an example of the same behavioral principles (three-term contingency) governing the success of nonhumans and humans on equivalence tests. Third, naming as defined here does not require an echoic repertoire. All that is required is to train the respective listener and speaker relations somehow. Speaker relations can be trained in subjects with little or no echoic repertoire. For example, tacting can be established (albeit slowly) by shaping successive approximations (see Manabe, Kawashima, & Staddon, 1995, for an example with budgerigars).

Later, a change occurs in the definition of naming when Horne and Lowe claim that "naming is a higher order bidirectional behavioral relation" (p. 207). They attempt to specify how it comes about, arguing that "with repetitions of the interactions [between the listener, echoic, and tact components] shown in Figure 9 the cues of the caregiver's naming of and pointing at a new object come to be sufficient *on their own* to evoke the full sequence of behavior that makes up the name relation" (p. 202, my italics). The point to note here is that direct reinforcement is

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no longer required to bring about the speaker and listener components of any naming relation. Thus naming now has emergent or derived properties. But it seems to me that Horne and Lowe have not specified the behavioral principles that are involved in the emergence of the higher order relation, despite criticizing Hayes and Hayes (1989, 1992) for the same shortcoming with respect to their account of the emergence of framing from a history of exemplars. Are *higher order responding* and *framing* merely different terms for essentially the same phenomenon? Whatever the answer, one can ask why it is that some emergent performances (higher order naming) can be brought about through essentially contingency-shaped repetitions, whereas others (those demonstrated on standard equivalence tests) cannot (cf. Boelens, 1994). I do not think that this question has been answered by Horne and Lowe or by any of the earlier formulations of the naming hypothesis (e.g., Dugdale & Lowe, 1990).

A central assumption underlying the naming hypothesis is that subjects cannot hear names (or see them if the verbal response is a manual sign) unless they are preceded by an articulated (or signed) response, that is, a topographically distinct response (see Michael, 1985), produced either by the subject or somebody else (see p. 232). Thus if a subject is taught, via matching to sample, the auditory-visual baseline relations hear X-select A and hear X-select B, then, according to the naming hypothesis, the only way they could go on to match A to B (and thereby pass the equivalence test) is by the following route: see A-say "X"-hear X; hear X-select B. However, what if the subject could somehow come to hear the dictated words conditional upon the test samples without actually *naming* the latter? Then the naming hypothesis would be challenged. Is there any rationale or evidence to support the notion that we can hear things in the absence of a thing to be heard (e.g., a speaker)? Horne and Lowe suggest that there is. They refer (p. 194) to Skinner's analysis of respondent and operant conditioned seeing. Although Skinner (1953, pp. 266-278, 1988) uses the term *conditioned seeing*, he notes that the phenomenon extends to other forms of sensory responding such as hearing; thus in what follows the term *hearing* can substitute for *seeing*. Skinner (1988, p. 287) states that,

"Seeing does not imply something seen. We acquire the behaviour of seeing under stimulation from actual objects, but it may occur in the absence of these objects *under the control of other variables*" (my italics). The other variables are any events that have frequently accompanied the objects in a contingency, and they can be classically conditioned stimuli (CSs) or operant discriminative stimuli.

Let us now apply a conditioned hearing and seeing account to the prespeech listener-behavioral sequences described by Horne and Lowe (p. 193). The following two sequences occur: (a) The child hears the name the caregiver gives to an object before coming into visual contact with it (e.g., hear /*shoe*/, see shoe). The actual shoe could function as an unconditioned stimulus (US) that elicits the child's unconditioned response (UR) of seeing the shoe. Thus, because the auditory stimulus /*shoe*/ reliably precedes the US shoe, it alone may eventually become a CS for the conditioned response (CR) of seeing the shoe. This is a form of listener behavior that, as Horne and Lowe recognize, can supplement other forms established through operant contingencies. (b) The child sees the object, and the caregiver, noting the child's orienting response, names that object (e.g., see shoe, hear /*shoe*/). This may therefore establish the object shoe as a CS for conditioned hearing of /*shoe*/ *in the absence of the caregiver*. Note that this is neither listener behavior nor speaker behavior. It is hearer behavior. (c) Once conditioned hearing and conditioned seeing are established in this way with respect to some shoes, both kinds of covert behavior can participate in operant contingencies that involve those shoes or the auditory stimulus /*shoe*/ produced by the caregiver. For example, in an identity matching contingency that involves matching a familiar shoe (which the caregiver has previously labeled) to a novel shoe, the sequence see old shoe-hear /*shoe*/ (CR)-select new shoe-reinforcer will enable conditioned hearing of /*shoe*/ to gain operant discriminative control over the new shoe while extending the listener class. (d) The corresponding listener relations (hear-see) and hearer relations (see-hear) can interlock, thus achieving closure of the circles depicted in Horne and Lowe's illustrations, but without requiring the child to speak. Presumably, this nonspeech bi-

directional relation can later become "higher order." Now any test that was previously deemed to require higher order naming for successful completion, including the various tests described on pages 205–208 and, most importantly, tests of stimulus equivalence, can be passed in its absence.

Evidence that subjects can covertly hear words without speaking, and that such responses can be functional, comes from the literature on remembering. Bishop and Robson (1989) tested 12 congenitally anarthric cerebral-palsied individuals on their ability to recall the order in which up to eight simple line drawings were presented per trial (a "memory-span" task). These subjects had never been able to speak because of a complete lack of control of the muscles involved in articulation, and their hand control was too poor for manual signing. Their memory span was much poorer for sequences of pictures with short but phonologically similar names (e.g., man, van, pan) or long names (e.g., elephant, airplane, kangaroo) than for those with short and phonologically dissimilar names (e.g., bath, pig, leaf). It seems, then, that when these subjects looked at the

pictures they "heard" the corresponding words, and these covert responses mediated their recall performances. How would such individuals perform on standard equivalence tasks? Note that the only kind of verbal behavior we could attempt to teach them to produce is stimulus-selection (i.e., matching-to-sample) based (see Michael, 1985). Is it really the case that, as Horne and Lowe's account demands, these people could never be capable of naming, verbal thinking, verbal consciousness, verbal meaning, and verbal understanding (see pp. 213–215)?

Despite the comments made above, I should end by making it clear that I am not about to abandon studying the very verbal processes that Horne and Lowe so elegantly bring to our attention in their extraordinarily ambitious and thought-provoking paper. Even if naming as they define it is not necessary for the emergent behavior we study via the equivalence paradigm, it is likely to be, by far, the most predominant means by which most humans accumulate such repertoires. I am therefore confident that their paper will guide my research efforts for many years to come.

NAMING, MEANING, AND VERBAL OPERANTS

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Horne and Lowe present a theory of the development of symbolic behavior in which naming is featured as the basic unit. Although their position has many points of contact with that of Skinner (1957), it contradicts central aspects of Skinner's analysis.

A central feature of Skinner's approach is the rejection of descriptions or explanations

based on meaning. Other major points of Skinner's formulation follow from this. First, for Skinner, verbal behavior is not in principle different from nonverbal behavior; it is operant behavior, shaped and maintained by reinforcers mediated by other organisms. Second, the role of the listener is central to Skinner's approach, because the listener mediates reinforcement for verbal behavior. The listener does so because of explicit conditioning by the verbal community; in this sense, the listener understands (i.e., reacts appropriately).

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