performances without recourse to naming and subsumes the animal as well as the human data. It is also grounded in current neuroscience. The functions of such networks have been modeled by Barnes and Hampson (1993). A connectionist network that contained one hidden layer produced the emergent performances that were analogous to those obtained by Wulfert and Hayes (1988). These data then support a neurologically based interpretation of equivalence class formation.

Thus, the proposal that naming accounts for equivalence class formation is based on the assessment of correlated occurrences of naming performances and performances indicative of equivalence class formation. There are four possible combinations of these performances. A particular set of outcomes is needed to support the view that naming produces equivalence. Given the correlational nature of the data, however, a causal relation

could not be proven. Support requires unequivocal demonstrations that (a) classes emerge when naming is present, and (b) classes do not emerge when naming is absent. Evidence that would not support the naming hypothesis include (c) failures of class formation when naming is present, and (d) the emergence of classes in the absence of naming. When viewed within these decision-making constraints, the data cited by Horne and Lowe do not provide unequivocal demonstrations of (a) and (b). Indeed, data cited by them and other evidence are characterized by the correlations mentioned in (c) and (d). Thus, it does not appear that a compelling case cannot be made to account for the emergence of equivalence classes by naming. A further clarification of the issue will depend on the gathering of additional experimental data, addressing issues mentioned above, and further clarifications in the interpretation of existing data.

LISTENING WITH UNDERSTANDING AND SPEAKING WITH MEANING

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Parrott (1984) has argued that Skinner's (1957) analysis of verbal behavior as nonverbal acts of reinforcement mediation for a speaker's behavior is imprecise, in that cases in which reinforcement mediation does not occur cannot be differentiated as to their sources. For instance, reinforcement mediation for a speaker's mand may not occur because the listener did not hear the request due to ambient noise, or it may not occur because the listener does not understand the request (e.g., when it is made in an unfamiliar lan-

guage), or it may not occur because the mand does not establish circumstances that result in the speaker's compliance as a reinforcer for the listener. That is to say, in this last case, reinforcement mediation may not occur because the listener is not motivated to comply with the speaker's mand. To rectify this situation, Parrott (1984) provided an account of listening and understanding *per se* in which listening was taken to be differentiated and evolving activity with respect to auditory stimulation; understanding was taken to be implicit responding with respect to things and events historically associated with aural interactions, occurring by way of acquired or substitutional functions of auditory stimuli.

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Horne and Lowe's account of these phenomena, although similar as to the end reached, follows a different path and, in my view, a less precise one. For example, listening as aural activity is not clearly differentiated from listening with understanding. Listening is not assumed to be merely discriminated activity but also as involving implicit action with respect to things and events historically related to auditory interactions. Horne and Lowe state that "If listener behavior to the speech of others is to become fully established . . . it is necessary not just for speech to be discriminated (i.e., controlling different responding of some sort) but when a particular verbal stimulus is heard (e.g., /where's mama?/) it should be discriminative for conventional object- or event-related behavior (e.g., looking at mama)" (p. 193). These kinds of conventional behavior with respect to mama as an object are what are taken to be understanding, not listening, in Parrott's (1984) account. Horne and Lowe do not recognize the occurrence of such behavior in a verbal episode as understanding, however. (Although in one case an implicit recognition is suggested in a parenthetical explanation of listening skills as comprehension, p. 202.) Instead, it is only when the listener becomes a speaker that the concept of comprehension is invoked. In their words, "As we have shown, the child begins as a listener to the utterances of others, but the critical development occurs with the advent of naming when she produces her own utterances and responds to them as she has done to those of her caregivers, that is, in a socially shared manner . . . In this sense the child now *understands* her own words" (p. 213, italics in original).

There seems to be a confusion here. Is naming an act of speaking or an act of listening? I believe that the general thrust of Horne and Lowe's argument is that naming, although dependent on listening, is itself an act of speaking. Second, does listening involve understanding, or is understanding invoked only when the listener becomes a speaker? It seems that the authors reserve un-

derstanding only for acts of naming. They state, "That is, when humans become speaker-listeners and name, they *mean*" (p. 214, italics in original). Clarity on these issues is warranted, because in its absence, we have no means of distinguishing among cases in which reinforcement for a speaker's mand is not mediated, as discussed by Parrott (1984). It is further not possible to differentiate that which is verbal from that which is not.

In coming to terms with this clarity, I believe that the authors will find themselves agreeing that both listening and speaking can occur without comprehension. Listening without understanding is what we ordinarily describe as hearing. Speaking without understanding encompasses a variety of different events, among which must be included Skinner's (1957) conception of echoic behavior. These events are not conventional acts, and I would argue that this implies that they are also not verbal acts. It is only when listening with understanding and speaking with meaning occur that we can call these actions verbal.

I predict that if Horne and Lowe clarify their account of these issues they will conclude that speaking with meaning is no more verbal than is listening with understanding. Both are conventional in nature, and both involve the same sorts of implicit actions with respect to things and events historically related either to stimulation provided by another (listening) or to stimulation produced by one's own responding (speaking). These activities differ only in the response mode involved and in the source of stimulation for implicit activity, neither of which is relevant to their categorization as verbal or nonverbal.

Horne and Lowe make a substantial and welcome contribution to our understanding of the complexities of speaking and listening. More explicit discussion as to the distinction between listening and speaking with and without comprehension, and the implications of this analysis for the definition of that which is verbal, would constitute a refinement of their analysis.