Contributions of *Verbal Behavior* to Instructional Technology

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The work in verbal behavior would please B. F. Skinner, were he alive today. He considered *Verbal Behavior* (1957) to be his most important book. And no wonder. Readers of this journal will probably remember the paper in which Skinner talked of three kinds of selection: (a) natural selection, from which we inherit our genetic makeup; (b) operant selection, by which our behavior evolves over our lifetime; and (c) cultural selection, through which we take advantage of the repertoires of generations before us (Skinner, 1981). Verbal behavior contributes much to the second, but underpins all of the third as well as the entire field of education. Thus he would have seen the growth of research and discussion in verbal behavior in this journal and in others as a very healthy sign for the future.

We are not yet out of the woods, however. Many errors are common even among behavioral writers. It is easy to slip with the basics, and talk about reinforcing people (even Skinner does it in *Verbal Behavior*, 1957), but it is even easier to slip when using Skinner's verbal behavior categories. For example, the tact is often misconstrued as a kind of reference or as a category to describe talking about something observed in the past. Skinner countered the equating of tact and reference with an example of a person saying he will "fish" in his briefcase (instead of "look" or "search"), under the control of a large fish prominently displayed within his view in the room (Skinner, 1986). No one would say that uttering "fish" in those

circumstances "refers" to the fish. To try to dispel the idea that tacting refers to something not currently present, when I teach *Verbal Behavior*, I ask students to describe, without looking at it, something they have recently seen (such as a bulletin board I point out in the back of the classroom). When they look again, they discover that what they described differs from what they saw. Obviously when they wrote, they were not under control of those objects or events or properties of the objects or events. Listing something you have seen, even just a few seconds before, does not qualify as a tact. Some kind of intraverbal control determines the form of the response.

In spite of common misconceptions, many positive trends can be seen. To me, the most exciting development is that behaviorologists and behavior analysts are beginning to develop teaching technologies based upon the functional analysis presented in the book. Of course, Skinner saw the connection. In the spring of 1955, when he was on sabbatical completing the book, he also developed his first fill-in-the-blank programmed instruction applying the prompting and fading discussed in chapter 10 of *Verbal Behavior* (1957, p. 255). Later, in his own course, he put the programmed material onto mechanical teaching machines. Today, with computers, more sophisticated work has been done.

Recently, Kritch and Bostow (in press) confirmed the importance of active responding. Students who typed critical words in computer-presented frames scored better on tests than those who simply read the same frames with the critical words highlighted. This study extended similar prior research

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in two ways. Kritch and Bostow added a problem-solving test to make sure that it was not just sequels that the students were learning, and they yoked the pacing of the readers to the typers. For every reader, each frame was present on the screen for the same amount of time it took his or her yoked typer to complete that same frame.

In another study, Clingan and Vargas (in press) showed that students tend to use self-prompting only when needed. Spanish words were shown on the screen, and students were instructed to type the English equivalents. A special key provided hints in the form of letters of the response. At first, students asked for many letters and made many mistakes. As they came more under stimulus control of the Spanish words, however, they stopped using the prompts. This research continues earlier research on prompting, but instead of the prompts arriving automatically after a time delay, student action was needed for them to appear.

A clearer example of Skinner's (1957) analysis of verbal behavior leading to a teaching technology lies in the field of autism. Before Hall and Sundberg's (1987) study, most language training consisted of presenting pictures and then asking children to repeat the name pronounced by the trainer (Hall & Sundberg, 1987). Echoics and some tacts were easily learned, but the children were not able to "use" the words they "knew" to "ask for things." Hall and Sundberg showed that mands and tacts are under separate controls, as Skinner had asserted in *Verbal Behavior*. They proposed methods of teaching mands, and found that mands were much easier to train than tacts. This was not surprising, because the mand is under control of deprivation of the speaker, and the tact is usually established by social controls which, with autistic persons, are less effective than usual. Further research investigated the way in which mand control spreads to tacting and vice versa in order to develop a program to help young special education students gain the transfer from form to form that most regular students seem to exhibit without special training (Twyman, 1996). As an additional benefit to a functional analysis, trainers began to realize that many inappropriate actions (e.g.,

throwing tantrums) were mands. By teaching more appropriate manding, parents and trainers found they could reduce or eliminate many of these inappropriate behaviors. I am not claiming that these research studies revolutionized special education (see Shafer, 1994-1995, for a broader view), but they did have an impact within the behavioral community. Many of my students have worked with children with autism and their families in homes throughout the state of West Virginia. They tell me that, in West Virginia at least, not only has the sequence of training changed (first mands, then tacts) but that parents talk of manding and tacting by their children, and they use the terms correctly.

For Skinner, the technology deriving from a science provided the final test of that science's merit. A technology of teaching is emerging from *Verbal Behavior* (1957). In applying a verbal behavior analysis to practical problems, we demonstrate the power of Skinner's scientific approach to address areas that others call *cognitive*. (One can change the word *cognitive* to *verbal* nine times out of 10, without changing the gist of a sentence.) But much still remains to be done. In particular, we have not yet solved one central problem.

The most critical problem in education is a lack of a unit of responding. In the traditional operant conditioning chamber, a lever press or key press was defined by operating an electronic switch, and every recorded response was thus functionally equivalent with every other response. In education, we have no equivalent unit for sequelic verbal behavior (see Vargas, 1986, for a discussion of the term *sequelic*). Even when problems are similar, as in one-digit addition problems, responses are not equivalent. The problem $1 + 1$ is easier than $8 + 7$. Rates on timed sets of similar problems, as in precision teaching, give an average rate over the set. They show changes from set to set, but not the fine-grained analysis of a cumulative record. I am not criticizing those who use this approach. I use precision teaching in my own classes, and know of nothing better for increasing speed and accuracy of a skill already acquired at minimal strength. I am only pointing out

that even with formally similar problems, we do not have the equivalent response measures of the operant chamber.

Measuring in equal units becomes harder still when shaping new behavior. Like key pecking or bar pressing, completing practice problems occurs *after* the initial shaping of behavior. Students must have been taught how to solve the problems first. The three-term contingency in discrete-trials training does not give equivalent units, because one response may be a single utterance, and another solving an entire problem. Many years ago, when developing a programmed instruction reading series, I took a measure of the rate of responding of the children trying out the lessons. Their rates actually went down from Lesson 1 through Lesson 10. It became clear to me why. The first lessons had very short sentences. As lessons progressed, the sentences got longer, so the students had to read more words in order to fill in each blank. When I graphed the words read per correct response, I found a steady increase from lesson to lesson. But number of words is a formal unit, not a functional one. It did not solve the problem of a unit for rate of responding. In any science, finding a universal unit precedes major breakthroughs. We have come close with mands and perhaps tacts in identifying functionally equivalent units, but we have not begun to solve the problem when shaping sequelic verbal behavior.

We have the kind of verbal community of professionals that is needed to continue analyzing verbal behavior within the framework that Skinner (1957) proposed. We have just begun to use that framework to improve teaching technologies. Continuing the work in applying *Verbal Behavior* to improve instructional techniques and finding a standard unit for sequelic verbal behavior, then, I propose as the challenge as we enter the 21st century.

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