In Response

A Reply to Graf's Review of Hardy's Behavior Analysis: A Computer-based Tutorial

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After concluding "overall, accuracy and educational value seemed acceptable" (p. 78), Graf's review of Hardy's courseware (1988) contained several incorrect criticisms which may have unintentionally reduced readers' desire to use the program. In the paragraphs below, the author of the software offers explanations for how such inaccuracies could reasonably have slipped into Graf's review, and attempts to correct/explain the most salient of them.

In the second paragraph of his introduction Dr. Graf says, "Spurned by several software publishers, Hardy has offered the program to the behavioral community as "shareware." (p. 77) This statement is needlessly and inaccurately derogatory. In fact, only one software publisher (Pergamon) rejected the program, asserting that they had decided not to publish any computer-based training software. The program was accepted for publication by another company, but the publisher's marketing strategy would have set the price at around \$500, well beyond the reach of the majority of its target audience.

Requests for copies of *Behavior Analysis: A Computer-based Tutorial* (Version 3.3, a 3 disk set) should be addressed to Reed Hardy, Ph.D., Psychology Department, St. Norbert College, De Pere, WI 54115. Older versions of the program are available for downloading via Compuserve's Education Forum, OERI's TEACHER BBS, EXEC-PC, Capital-PC and most branches of the Learning Tree International Electronic Bulletin Board Network. A donation of \$20.00 U.S. (Canada add \$1.00, Europe add \$2.00, Australia/Asia add \$4.00) is greatly appreciated, but smaller donations and unpaid requests will be honored as long as costs do not become prohibitive. P/O's and custom invoicing delay processing.

Instructional Design

Individualization. This section of Graf's review presents one with a sense that the program has few or no individualization features; yet individualization is one of the program's most salient characteristics. Branching at many points in the program is based upon the student's personal interests stated during the initial logon interview. Students advance at their own pace based upon their differing interest in further explanations and differing abilities to answer content questions. Each student's progress is recorded so that upon return to the tutorial the student is greeted by name and starts where she/he left off. In fact, the program is so highly individualized that one of the great difficulties encountered during debugging has been that every student takes a different path through it, making it almost impossible to catch all of the bugs that can occur!

Perhaps Dr. Graf did not notice the program's individualization features because they are so transparent (so well integrated into the program that they are invisible to any single user). For example, the program not only uses the student's name, or special "nickname," as do many similar programs, but it also uses the name of a close friend or spouse of the student, yielding enhanced social reinforcement and an occasional humorous twist. When a student answers a content question incorrectly he/she is always branched to appropriate remedial material which is often several frames long, but this does not occur unless the question is answered incorrectly. Even in the selection of test items the student's special interests are used in determining

which items may be selected. All of this is relatively invisible to the student/user. Several of Graf's students indicated appreciation for one or more of these features, but Graf's minimal mention of this makes both the appreciation and the features themselves seem trivial.

For the record, a utilities disk, which allows teacher/supervisors to read students' records so that they can keep track of student progress and help students with concepts with which they are having difficulty, was sent in June 1988 to all registered users (and many nonregistered folks who have been helpful in the development of the program).

Presentation. Here Graf states, "Review was provided but much of the time as an option with restrictive alternatives." (p. 78) In fact, students could elect to review at any point in the tutorial except during tests and/or during simulations. Students could also "page back" at any time during the program except during special presentations, simulations, and testing. Graf states that a student cannot skip the shaping simulation during his/her review of the operant conditioning unit, but students are *allowed* to bypass the simulation during review even though the program asserts that they *should not* do so. Even if the student had been "forced" into the simulation, merely pressing "R" at the beginning of the simulation would have quickly (R)eturned the student to the lesson, so the inconvenience caused would have been minimal (about 60 seconds total delay of progress on the most typical IBM/compatible computer).

Concepts. Graf complains in this section that the program lacks non-examples and range variations through examples. He indicates that "minimally different non-examples sequenced to demonstrate differences would have been useful." (p. 78) Graf does not mention in this context that each concept is introduced via examples and that many of the embedded content questions require students to deal with "real world" examples. He also fails to mention that students may get more examples via the "Definitions," "Explanations," or "Special In-

terest Examples" options on the student "Question" menu. However, a wider range of examples, including sequenced non-examples, would be useful and will be incorporated into future versions of the software as time and hardware enhancements permit.

Under the same heading Graf indicates that "preskills required as entry competencies could have served to select users ready to succeed in the program from users who needed other skills before attempting the program." (p. 78) Because the program is designed for people who have no background in behavior analysis (i.e., it is introductory in nature), the only preskills needed are the ability to read and use a computer keyboard. Since folks who either cannot read or who do not know how to use a computer are not likely to try to use the program without supervision, it would be superfluous to design reading and computer literacy pretests into the program itself! On the other end of the spectrum, relatively sophisticated students who may wish to use the program as a review, or for entertainment, will find that they can usually complete the current version (SW 3.3) in less than three hours. While a pretest that branches students around material they already know is under development, it will not be implemented until version 5.0. There is not much that could be constructively skipped in the current version of the program. Spending 40 minutes pre-testing in order to skip 30 minutes of tutorial makes little sense.

Strategies. Graf says, "The program doesn't contain sufficient independent practice with a range of appropriate tasks." (p. 78) On what basis does Dr. Graf make such judgments? Can he point to an example in which "sufficient independent practice" has occurred? Why are we given no hint of what a "range of appropriate tasks" would be? The fact is that students are repeatedly asked to practice their newly acquired discriminative verbal behavior via many examples and to practice actual applied skills via two simulations. More could certainly be done (and will be), but undiluted criticism without corrective feedback

seems antithetical to the basic tenets of the behavioral approach.

Simulations. Graf indicates that there is only one simulation included in the program, but there are actually two (both of which deal with shaping). The first one occurs in the middle of the History and Ethics unit, and the other occurs near the middle of the Operant Conditioning unit.

Feedback. Graf states that "errors on the embedded questions are done again until corrected, with the prompt to read more carefully if several errors occur." What actually happens is that the student is given a hint after the first error and asked to answer again. The "read more carefully" admonition occurs in only one or two instances in the "System Introduction" unit where the branching remediation following repeated incorrect answers eventually ends.

Graf states, "So informative feedback does not occur to any quiz items." (p. 78) But, in almost all cases feedback is answer/error-specific and remedial for embedded quiz items, and content-specific feedback *always* occurs after a unit test when the student's answer pattern allows the program to single out a particular content area for review. The student's complaint, "You didn't know what you didn't know," could only have been appropriate following a test on which the student made errors in all of the content areas in equal proportion, in which case the program appropriately suggested that the student restudy the entire unit. Most teachers would suggest that a student study an entire unit if the student had answered fewer than 65% of a given test's items correctly with no noticeable loading of errors in a particular content area.

What Dr. Graf is getting at here, I think, is the fact that students would rather have had item-by-item feedback following unit tests. Neither the earlier version (version 2.3) of the software that Dr. Graf reviewed, nor the current version allows students to receive item-by-item feedback. This is a regrettable, but necessary feature of the program. While such feedback would be beneficial and relatively easy to program, it would allow students to quickly learn the specific question-an-

swer pairings for all of the questions in the very limited pool of items from which questions are "randomly" selected during testing. On any given retest, approximately 50% of the items presented on the second testing will be the same as those used during the first testing. I promise Dr. Graf and the other users of this software that future updates of the program, designed with larger high-density, hard disk or optical disk data storage capacity in mind, will allow item-by-item feedback immediately following testing.

Review. Graf is again globally critical in saying "the quizzes detract from the program rather than enhance it." (p. 78) I see tests as producing data that prepares instructors to make discriminations concerning who will, and who will not, receive academic reinforcers. Tests are barriers between students and the academic reinforcers they are temporarily (in most cases) deprived of. As such, they almost always produce at least some deprivation/schedule-induced frustration. Those who obtain the reinforcers tend to accept tests as a "necessary evil," while those who do not obtain those reinforcers tend to revile the tests and the entire situation.

If the preponderance of missed items, even on a test that is "passed," is within a given subarea within the unit, then the program advises the student to give careful attention to that content area, and branches the student to it or to the next unit depending upon the situation and the student's reply to options like "Would you like to (R)evuew, (L)ogoff or go (F)orward to the next unit?" This feature of the program, individualized test interpretation and remediation, would not be visible to a student who appropriately only passed through the program on one path, but it is available if test performance indicates a need for review. Note that the new "Teacher/Supervisor Utilities" disk gives teachers item-by-item feedback which should allow them to help their students with the concepts they find most difficult.

Motivation. "Motivation" seems an obsolete concept that has long been replaced by more behavioral measures like deprivation level, history of reinforce-

ment, and schedule of reinforcement. Thus, the "motivational" characteristics of the program have to do with the fact that students who do what is necessary to answer content questions correctly progress rapidly through the program, saving themselves more than half of the time it takes students who have more difficulty answering the content questions. These time savings are an important reinforcer for busy students, but they are not the only "motivators" present in the program. One of the most important characteristics of the program is that it uses the student's name and other social stimuli as conditioned social reinforcers immediately after appropriate behavior.

The reviewer indicated that three of the ten students who used the program under his supervision complained about the use of time restrictions on unit examinations. One of the reasons students are not told how much time they have to answer quiz items is that, because items differ in length and difficulty, the allotted completion time changes for item to item. I may include a count-down time-available indicator in future versions of the program, but such an indicator may distract students even more than not knowing how much time is left.

Program Utility

This section of the review could be given in two statements: 1) the program could be easier to operate, and 2) two program "glitches" were found, one in the software itself (the password input routine of version 2.3 contained an error), and one in the hardware (printer sharing network) configuration on which Graf attempted to run the software. Dr. Graf also stated that the program does not function properly on a system without a color graphics adapter (CGA). The hardware specifications call for a CGA. He could just as appropriately have tried the program in an Apple II or Commodore 64 and reported that it did not function at all!

Promoting Behaviorism in Non-Academic Settings

Dr. Graf commented on the mentalistic terms used in portions of the tuto-

rial, but one must start where the student is and shape behavior toward the target responses. In his recent article "Promoting Behaviorism in Non-Academic Settings," in *The ABA Newsletter*, Crist (1987) suggests that we take into account the point of view of others outside the discipline in our attempts to promote behavior analysis. This is the value of introducing behavioral concepts in a verbal context familiar to the students. *Behavior Analysis: A Computer-based Tutorial* was designed to serve as the student's first introduction to behavioral concepts. The task of strengthening the students' repertoire following their use of the program must be left to human teacher/mentors and to more advanced training materials.

Conclusion

Dr. Graf's review cited several ways in which the program does not meet formal, technical, and/or theoretical expectations. Several of his criticisms were inaccurate because of the transparency of individualization features or misinterpretation by the students who used the program. Such difficulties could be minimized in the future if those who review software look to the computer industry for review methods and standard evaluation formats which emphasize creativity and practical utility rather than preconceived notions of proper form.

Readers of the review might have found useful some indication of the behavioral rather than formal success of the program as a training medium. How did those students who used the program perform on independent measures of their behavior analytic skills? In developing and releasing this new tool for the dissemination of the behavioral approach, cosmetic perfection and adherence to others' ideas of how a computer-based tutorial should look were not even on my list of priorities. Knowing I had only one arrow to shoot, I aimed directly at what I considered to be the primary target, educational effectiveness.¹ I will certainly take all of

¹ For an empirical assessment of the effectiveness of the software discussed here, the reader is referred to Hardy (1988).

Dr. Graf's constructive criticisms into account in planning future revisions of the program. I hope that anyone who has access to an IBM/compatible (PC/XT/AT) with a CGA/EGA/VGA card or emulator and at least 256K of RAM will try the program with a group of students prior to judging its usefulness.

Final Note

In Disney's "Fantasia" (1941) Mickey Mouse is the sorcerer's apprentice. He has been given the task of filling a large hot-tub-like container using only a small bucket to carry water the considerable distance from pump to tub. Mickey, after attempting to do the work himself (while the Sorcerer sleeps), with little demonstrable progress, finally peeks into his master's sorcery book and finds a spell that turns a common broom into a two-fisted water carrier. Mickey successfully invokes the spell using his trusty broom, but as the large container approaches the full mark he finds he cannot stop his magic "helper." When, in desperation, he tries to stop the broom by chopping it up with an ax, each splinter springs up and becomes a whole water carrier madly filling the basement of the castle.

Mickey and the entire castle are about to drown when the master sorcerer enters the scene with glowing eyes. With one quick utterance and several powerful gestures the Sorcerer stops all of the havoc and sets all in order. After the Sorcerer's

brief scowl at Mickey, who stands meekly kicking at a nonexistent object on the floor, the viewer gets the impression that all is forgiven.

Dr. Graf has cast me as the sorcerer in his review, with *Behavior Analysis: A Computer-based Tutorial* cast as the apprentice. Anyone who has seen the movie must agree that a more apt casting would have Skinner as the sorcerer, me as the apprentice, the computer as the broom, and the program as the spell. Given this, I would cast Graf's review as the ax. Will the fragments thus created spring up and carry on?

Regardless of how we feel about using computer technology to help train a "flood" of new behavioral technicians, this program is here to stay. There is no doubt that future developments will obsolete the program, but in the meantime, in the famous words of Kenneth MacCorquodale, "Like it or not, the camel's nose is in the tent." (1969, p. 841)

REFERENCES

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