BRIEF REPORT

ON REINFORCING HUMAN BEHAVIOR IN THE LABORATORY: A BRIEF REVIEW AND SOME RECOMMENDATIONS

Brian D. Kangas and Timothy D. Hackenberg

UNIVERSITY OF FLORIDA

> The importance of a science of behavior derives largely from the possibility of an eventual extension to human affairs. (Skinner, 1938, p. 441)

This passage, embedded in the final pages of *The Behavior of Organisms*, suggests that even in its incipient stages, the experimental analysis of behavior was concerned with the behavior of humans. Indeed, research with human subjects has been featured in the pages of the *Journal of the Experimental Analysis of Behavior* (*JEAB*) since its inception in 1958.

Figure 1 presents the percentage of empirical publications per year using human subjects during the first 50 years of *JEAB* (1958-2007), revealing an upward trend over the last 30 years. When presented in absolute terms, however, a somewhat different picture emerges. Figure 2 shows the frequency of publications using human (dashed line) and nonhuman animal subjects (solid line) over the same time period as Figure 1. Unlike the increasing trend of Figure 1, the absolute frequency of articles using human subjects has remained fairly constant. Moreover, examining the history of *JEAB* in its entirety, articles using human subjects accounts for only 15% of the total number of empirical publications.

Such data on research trends have occasioned a range of different opinions and interpretations over the years. The relative dearth of published research with human subjects during the first 20 years of *JEAB* has been described as dismal (e.g., Buskist & Miller, 1982; Nevin, 1982). A somewhat different conclusion was drawn by Hyten and Reilly (1992) in their publication analysis at the end of that decade. They concluded that the experimental analysis of human behavior (EAHB) in the 1980s staged a renaissance of both interest and increased publication trends in the pages of *JEAB* (but see Dougherty, 1994). The

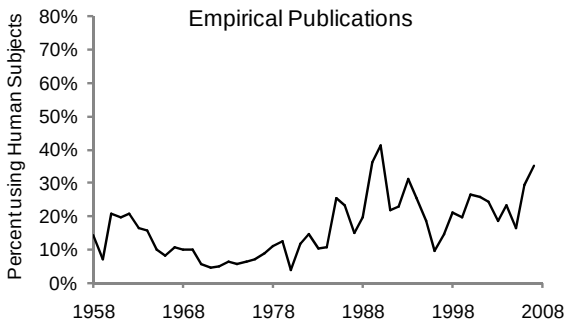

Figure 1

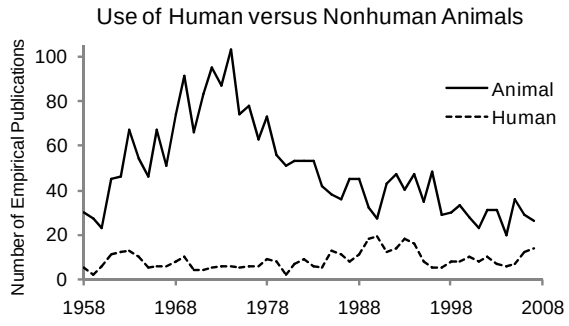

Figure 2

Correspondence concerning this article can be directed to Brian D. Kangas at the Department of Psychology, University of Florida, P.O. Box 112250, Gainesville, FL 32611 (e-mail: kangas@ufl.edu).

most recent update of publication trends (1980-1999) by Dymond & Critchfield (2001) suggested that the 20th century ended in a mixed state of affairs - a fairly steady rate of activity, but dominated by a small handful of research topics by veteran authors.

All of these interpretations can be described as accurate depending on how the data are analyzed. What does seem clear, however, is that EAHB has not yet lived up to its potential as an equal partner with nonhuman research in the experimental analysis of behavior more generally. One important factor impeding the widespread growth of EAHB may be the lack of standard research methods. As Galizio and Buskist (1988) noted some 20 years ago:

> First, unlike nonhuman subjects who are conveniently maintained in the controlled laboratory environment and are thus always available for research, humans are ranging about the natural environment and special contingencies must be arranged to induce their participation in research. Second, once human subjects arrive in the laboratory, the researcher must arrange contingencies that are effective in controlling the behavior under study. In both cases, the choice of reinforcers has methodological and theoretical implications that remain largely unexamined. (Galizio & Buskist, 1988, p. 65)

Unfortunately, in the ensuing two decades little progress has been made in the standardization of reinforcement procedures employed in laboratory research with human subjects. The purpose of the present paper is twofold: (1) to characterize briefly the frequency and trends in the use of various reinforcement methods, and (2) to describe some infrequently used but potentially effective methods we believe may be of general use to EAHB researchers.

REINFORCEMENT METHODS

Figure 3 presents cumulative records of the number of EAHB articles using various reinforcement methods during the first 50 years of *JEAB* (1958-2007). The methods that are included in this analysis are those that were each used in at least 5% of total EAHB

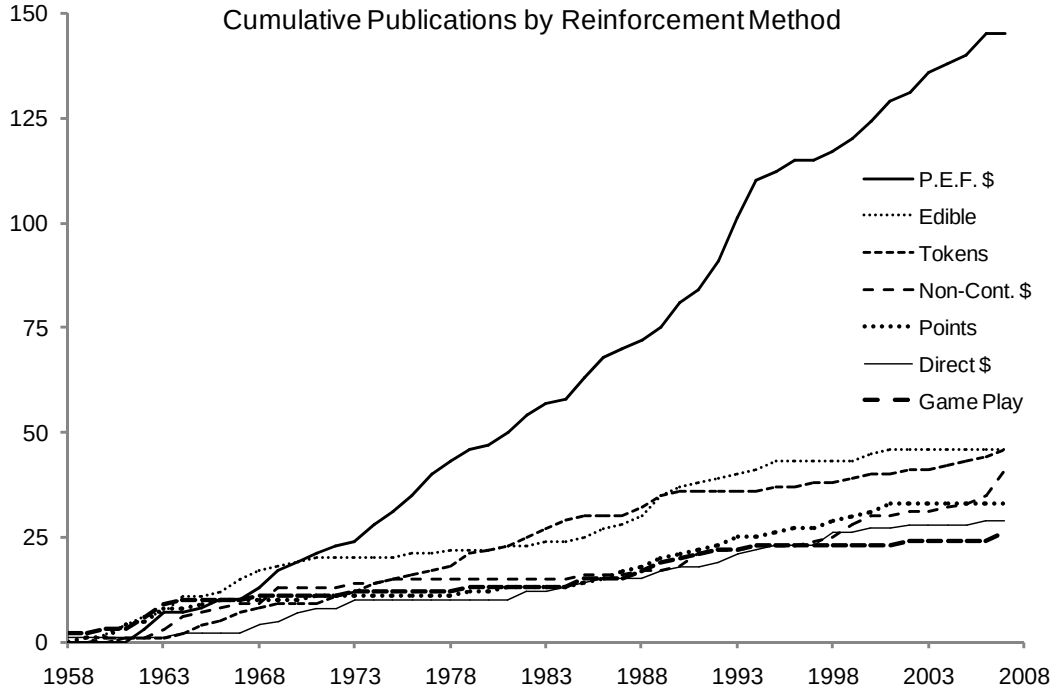

Figure 3

Table 1

Category descriptions used in the analysis of reinforcement methods.

Points Exchangeable for Money: The use of an analog or digital counter that is related to later monetary payment; for example, each point will yield one penny at the end of the experiment.

Edible: The use of immediately consumable goods such as food and liquids as a primary reinforcer.

Tokens: The use of a conditioned reinforcer such as a plastic disc that can be accumulated and later exchanged for food, money, privileges, etc. These are often part of a larger system, or token economy.

Non-Contingent Money: The use of money as a generalized reinforcer accumulated in some predetermined non-response based fashion; for example, dollars per session or dollars per hour of participation.

Points: The use of an analog or digital counter that advances in relation to some operant response but is not related to later monetary payment.

Direct Money: The use of money as a generalized reinforcer delivered immediately following an operant response typically via an electromechanical device.

Game Play: The use of access to games and leisure activities as a reinforcer, typically with children or developmentally-disabled subjects.

Other: The methods above are not an exhaustive list of reinforcement techniques with human subjects. Other less frequently employed methods that do not easily fit into one of the categories above include attention, escape from aversive stimuli, hypothetical rewards, competitive-performance contingencies, and descriptive feedback about experimental performance. These methods individually accounted for less than 5% of the total number of EAHB articles in JEAB and do not appear in Figure 3.

publications during *JEAB's* history. Although several classes of reinforcers have been successfully employed, including edibles, tokens, non-contingent money, points, direct money, and game play (see Table 1 for details), by far the most prevalent class of reinforcers is points exchangeable for money.

There are many good reasons monetary reinforcers have been used frequently and with success in human behavioral research. To begin with, money is a potent generalized reinforcer that retains its efficacy across a range of individuals, situations and motivational conditions (Skinner, 1953). The generalized nature of the reinforcer helps dampen individual differences that may contribute to between-subject variability in reinforcer efficacy. And because most people have extensive pre-experimental histories with money, there is no special training needed to establish monetary consequences as reinforcers. Despite these considerable advantages, the use of monetary

reinforcers has some limitations. A principal limitation is the financial cost to the researcher. Given the methodological practices that characterize EAHB research (steady-state analyses, within-subject experimental designs), the financial costs of monetary reinforcement can add up quickly. Lacking stable sources of research funding, research programs that rely on monetary reinforcement face formidable challenges.

A less expensive but commonly used incentive in research with human subjects is course credit - a common feature of introductory psychology course syllabi where hours of participation in psychological research serve as a required component of the student's final grade. Figure 4 presents a cumulative record of the use of course credit in articles during the first 50 years of *JEAB*. The use of course credit was first reported in *JEAB* by Greene and Sutor (1971). Following a period of moderate use in

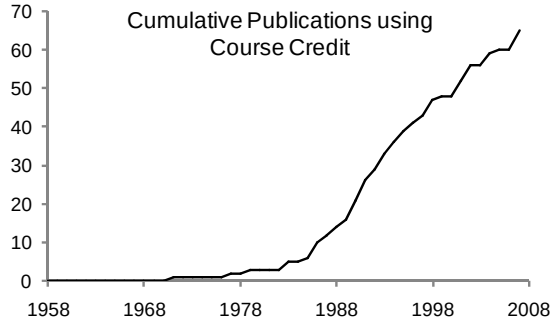

Figure 4

the late-1970s and early-1980s, the use of course credit accelerated greatly in the mid-1980s and remains high today. We treated these data separately from those shown in Figure 3 because course credit is typically a variable that induces participation in the experiment but is used in concert with another reinforcement method designed to maintain responding.

A major advantage of course credit is the financial cost. Because subjects are compensated in non-monetary ways, many data can be collected at relatively low costs. A chief problem with the use of course credit, however, is that by itself it may not serve as an effective reinforcer. That is, in all studies that used course credit, an additional (typically response-dependent) reinforcer was also programmed. Thus, while course credit may be used to encourage subject participation and attendance, it may require an effective reinforcement system to maintain responding within the session (although see Critchfield, Schlund, & Ecott [2000] for a novel method to make course credit response-based).

COMPETITIVE-PERFORMANCE CONTINGENCIES

Procedures that allow subjects to accumulate points exchangeable for money can lead to high costs and therefore limit the amount of data that can be collected with fixed monetary resources. One way to circumvent this problem is to combine course credit contingencies with reinforcement procedures that hold participant payouts constant across the experiment. One such procedure is the competitive-performance contingency, which can be used to establish points used during experimental sessions as reinforcers by placing a monetary contingency on net earnings; for example, providing a monetary bonus to only one participant who earns the most points during the experiment.

Although not used frequently, several variants of competitive-performance contingencies have been successfully employed in laboratory research with human subjects. For example, in a study on the transfer of function in stimulus equivalence classes by Dougher, Augustson, Markham, Greenway, and Wulfert (1994), subjects received course credit and a flat $10 for participation, with the subject scoring the most (response-dependent) points in the study earning an extra $20. Similarly, in a study on symbolic matching-to-sample with human subjects, Alsop, Rowley, and Fon (1995) instructed their subjects recruited from an introductory psychology pool that whoever scored the most points would receive a $25 cash prize. In a study by Madden, Peden, and Yamaguchi (2002) on group choice, all subjects received extra credit and a small ($3-5) bonus; in addition, the two subjects receiving the highest and second-highest number of points received

$30 and $10, respectively. In a pair of studies on rule-governed behavior, Hayes and colleagues gave introductory psychology students course credit, with the highest point earners receiving monetary payments ranging from $5-20 (Hayes, Brownstein, Haas, & Greenway, 1986; Hayes, Brownstein, Zettle, Rosenfarb, & Korn, 1986).

We have recently developed a similar set of procedures in our laboratory that combines the reinforcing efficacy of monetary reinforcers with the cost-effectiveness of course credit. Human subjects are recruited from an introductory psychology course requiring research participation, a common practice in many psychology departments. In several of our current experiments on choice and decision-making, subjects play various video games against a computer opponent that we are able to program with an assortment of contingencies with point earnings (e.g., Kangas et al., in press). Subjects are informed that whoever earns the most points in the study will receive a $50 gift certificate to the store of their choice. As in the studies reviewed above, this extra monetary incentive is designed to imbue the otherwise potentially meaningless points with reinforcing functions. While we have no direct evidence that the monetary bonus functions in this way—that is, we have not compared these conditions to those without a monetary bonus—the procedures do generate systematic performances in the relatively brief periods of data collection allowed by the course-credit contingency. And because the definition of a study can be left somewhat open-ended, the method has proven to be quite economical, generating copious amounts of data at relatively low cost. Insofar as the amount of the bonus is a constant, each additional subject in the protocol reduces the "unit price" of the research as a whole. An additional advantage of a fixed payout is that the costs of a project can be anticipated in advance - an important consideration when conducting research on a limited budget.

In spite of these benefits, competitive-performance contingencies are necessarily limited to studies of relatively brief duration. Most competitive-performance contingencies, including those reviewed above, usually entail approximately 2-6 hr of research participation. The effectiveness of the competitive-performance methods for longer-term studies is unknown. Such contingencies would likely need to be supplemented with additional monetary-based incentives to sustain long-term participation. This may reduce somewhat the advantages of the competitive-performance contingency as an effective experimental control technique. Even so, however, the use of competitive-performance contingencies, especially when used in conjunction with tasks of some intrinsic value (e.g., videos, games), may reduce the rate of pay needed to maintain long-term attendance and participation. Thus, while competitive-performance contingencies should not be considered a replacement for monetary reinforcers, they do seem to provide a useful method for short-term EAHB studies on a budget. And as the brief review of the studies above suggests, even relatively short-term studies can address conceptually important topics (e.g., relational stimulus control, social behavior, choice, rule-governed behavior, to name a few).

The complexity of competitive-performance contingencies must also be considered. The behavior of subjects may be under the control of several variables acting simultaneously: (a) the course-credit contingency that brings the subject to the laboratory in the first place; (b) the point-earning contingency arising from the task; (c) the global monetary contingency that confers reinforcing functions to the points; and (d) the competitive social contingencies that determine the allocation of bonus earnings. Together, these variables comprise an interlocking set of contingencies not unlike many encountered in everyday human circumstances. And while the complexity of such contingencies may seem daunting, we believe an analysis of behavior under such contingencies would be an important topic of research in its own right - not only for what it may reveal about the necessary and sufficient conditions of competitive-

performance contingencies, but also for human behavior more generally.

REFERENCES

Alsop, B., Rowley, R., & Fon, C. (1995). Human symbolic matching-to-sample performance: Effects of reinforcer and sample-stimulus probabilities. *Journal of the Experimental Analysis of Behavior, 63*, 53-70.

Buskist, W. F., & Miller, H. L. (1982). The analysis of human operant behavior: A brief census of the literature: 1958-1981. *The Behavior Analyst, 5*, 137-141.

Critchfield, T. S., Schlund, M., & Ecott, C. (2000). A procedure for using bonus course credit to establish points as reinforcers for human subjects. *Experimental Analysis of Human Behavior Bulletin, 18*, 15-18.

Dougher, M. J., Augustson, E., Markham, M. R., Greenway, D. E., & Wulfert, E. (1994). The transfer of respondent eliciting and extinction functions through stimulus equivalence classes. *Journal of the Experimental Analysis of Behavior, 62*, 331-351.

Dougherty, D. M. (1994). The selective renaissance of the experimental analysis of human behavior. *The Behavior Analyst, 17*, 169-174.

Dymond, S., & Critchfield, T. S. (2001). Neither Dark Age nor renaissance: Research and authorship trends in the experimental analysis of human behavior (1980-1999). *The Behavior Analyst, 24*, 241-253.

Galizio, M., & Buskist, W. F. (1988). Laboratory lore and research practices in the experimental analysis of human behavior: Selecting reinforcers and arranging contingencies. *The Behavior Analyst, 11*, 65-69.

Greene, W. A., & Sutor, L. T. (1971). Stimulus control of skin resistance responses on an escape-avoidance schedule. *Journal of the Experimental Analysis of Behavior, 16*, 269-274.

Hayes, S. C., Brownstein, A. J., Haas, J. R., & Greenway, D. E. (1986). Instructions, multiple schedules, and extinction: Distinguishing rule-governed from schedule-controlled behavior. *Journal of the Experimental Analysis of Behavior, 46*, 137-147.

Hayes, S. C., Brownstein, A. J., Zettle, R. D., Rosenfarb, I., & Korn, Z. (1986). Rule-governed behavior and sensitivity to changing consequences of responding. *Journal of the Experimental Analysis of Behavior, 45*, 237-256.

Hyten, C., & Reilly, M. P. (1992). The renaissance of the experimental analysis of human behavior. *The Behavior Analyst, 15*, 109-114.

Kangas, B. D., Berry, M. S., Cassidy, R. N., Dallery, J., Vaidya, M., & Hackenberg, T. D. (in press). Concurrent performance in a three-alternative choice situation: Response allocation in a Rock/Paper/Scissors game. *Behavioural Processes*.

Madden, G. J., Peden, B. F., & Yamaguchi, T. (2002). Human group choice: discrete-trial and free-operant tests of the ideal free distribution. *Journal of the Experimental Analysis of Behavior, 78*, 1-15.

Nevin, J. A. (1982). Editorial. *Journal of the Experimental Analysis of Behavior, 37*, 1-2.

Skinner, B. F. (1938). *The behavior of organisms: An experimental analysis.* New York: Appleton-Century.

Skinner, B. F. (1953). *Science and human behavior*. New York: Macmillan.