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THE EXPERIMENTAL ANALYSIS OF HUMAN BEHAVIOR

The increasing number of articles involving human subjects that have appeared in this journal in recent years should serve to underscore what many would regard as the fundamental aim of operant research. Although most studies published in *JEAB* have employed nonhuman subjects, the classic rationale for conducting nonhuman research, as enunciated by B. F. Skinner, is to provide the foundation for a better understanding of human behavior. "The importance of a science of behavior," wrote Skinner in *The Behavior of Organisms* (1938), "derives largely from the possibility of an eventual extension to human affairs" (p. 441). This was an ironic assertion, considering that all of the research he reported was based on the lever-pressing behavior of rats. Nevertheless, it was a point worth making because some readers might easily have presumed that they were being called upon to cultivate an intrinsic interest in the sort of behavior that Skinner had examined so intensively. The potential for human application envisioned in the earliest days of operant research has been partially realized. The introduction of the *Journal of Applied Behavior Analysis* in 1968, and its continuing strength, have confirmed the practical relevance of behavior analysis to human affairs. What has been missing until recently has been an ongoing, systematic effort to develop a data base pertaining to human behavior under the rigorously controlled conditions of the laboratory. Occupying a niche between the nonhuman laboratory and the natural settings of applied research, specialists in human operant behavior are in an optimal position to benefit from, and to contribute to, advances in both fields. The present special issue reaffirms *JEAB*'s commitment to fostering this unique research enterprise. The distinguished articles appearing herein testify to its vitality and sophistication.

The articles we have selected provide a sample of the controversies and concerns that characterize a variety of areas of investigation. One general concern has involved assessment of the extent to which behavioral principles, well established in the pigeon and rat laboratories, are helpful in accounting for human behavior in relatively naturalistic settings. Our first three articles address this general concern. In an ingenious study, Mace, Lalli, Shea, Lalli, West, Roberts, and Nevin assess principles of behavioral momentum in describing the everyday behavior of mentally retarded adults in a group home setting. In the pigeon laboratory, resistance to behavior change depends on stimulus–reinforcer relations but not on response–reinforcer contingencies or baseline response rates. Does the same outcome apply in this group home setting?

Bernstein and Michael had their human subjects live in a laboratory apartment for 30 days, engaging in a set of ordinary activities that were sometimes restricted. Their research, which has its roots in response-deprivation studies with nonhumans, measures how other activities are redistributed when one is restricted and looks at the correspondence between verbal and behavioral assessments of value.

Advances in the experimental analysis of human behavior depend on innovations and refinements in methodology. Studies on stimulus equivalence and rule governance, discussed below, illustrate the close relationship between theory and procedural considerations. Researchers' efforts to enhance experimental control generally have been directed toward the stimulus antecedents of responding (e.g., the design of test trials in equivalence research) or the contingencies that define a schedule of reinforcement (e.g., the contingencies used to study verbal control of responding). Relatively little attention has been given to the nature of the reinforcer delivered by a schedule, especially in research with adults in which the reinforcer is commonly points that may or may not be exchangeable for money. The use of secondary reinforcers combined with temporally distant primary (backup) reinforcers potentially limits direct comparisons with nonhuman research, in which behavior is maintained by powerful primary reinforcers administered within the experimental session. The article by Case, Ploog, and Fantino on observing behavior describes a promising ap-

proach for enhancing the power and realism of reinforcers in human operant research. The contingencies and reinforcers are embedded within the context of a highly motivating computer game. The study shows that meaningful, systematic data are obtainable from complex computer games when appropriate technical adjustments are made in game characteristics. The findings thus have significance extending well beyond the immediate issues related to observing behavior and conditioned reinforcement.

Human operant research seems vulnerable to a criticism sometimes directed at nonhuman research—a limited variety of subject populations, which may cast doubt on the generality of some findings. Pigeons and rats are the predominant subjects in nonhuman research. In the human operant laboratory, researchers seem to favor college students, presumably for reasons of convenience. Nevertheless, progress has been made in extending the domain of behavior analysis to other populations, especially children and the developmentally delayed. The article by Baron and Surdy focuses on a population that has received relatively little attention on the pages of this journal—older adults—and demonstrates what behavior analysis can contribute in one major area of investigation that has both theoretical and practical significance—memory. Baron and Surdy apply a signal detection analysis to data obtained from older and younger men in a continuous recognition procedure. While replicating previous findings showing lower "sensitivity" in older subjects (although the deficit decreased with practice), the authors report a surprising finding related to "bias" under changing patterns of consequences for correct and incorrect responses. We hope that this impressive study will encourage further research with the continuous recognition procedure across age groups and will generate greater interest in older adults as subjects for behavior analysis.

Perhaps the area that has generated the most intense research activity, resulting in the most elaborately developed data base, is the study of conditional discrimination, especially as related to stimulus equivalence. In addition to providing a potentially useful framework for the analysis of language, the matching-to-sample procedures commonly used in equivalence research have revealed effects that some argue have no counterpart in nonhuman behavior. Such claims naturally have provoked heated controversy, an excellent illustration of which can be found in a set of special articles that appeared in the May 1989 issue of *JEAB*. It is possible, however, that debates over the implications of equivalence phenomena for the understanding of language and the relationship between human and nonhuman behavior are premature. Important questions remain unresolved concerning the interpretation of data from equivalence procedures; in particular, from the tests that probe the emergence of untrained conditional relations following matching-to-sample training. The test data are used to make inferences about the properties of the originally established conditional relations. If it can be ascertained that the original relations possess the properties of reflexivity, symmetry, and transitivity, then the criteria are met for concluding that the original relations are equivalence relations and that the stimuli involved comprise an equivalence class. Everything hinges on the presumption that the emergent relations revealed during testing are a product of original training and not trained by the test procedure itself. In addition, there is an implication that the properties of reflexivity, symmetry, and transitivity are functionally related, reflecting a unitary phenomenon, and are not merely arbitrarily selected performance criteria.

Both premises of equivalence research are challenged by articles appearing in the present issue. Pilgrim and Galizio report evidence that symmetry and transitivity are functionally independent in the sense that the conditional relations defining these properties do not change in similar ways when changes are made in the original baseline relations. Symmetry conforms to the newly trained relations, but transitivity remains consistent with the conditional relations from which it was originally derived. Although several explanations of the findings are possible and are discussed in the article, it is evident that performance in equivalence tests is complexly determined and must be interpreted cautiously. Further complications attendant to equivalence testing are illustrated in the article by Harrison and Green. Although subjects did not receive differential consequences for responding in probes for emergent relations, data are presented

showing that various stimulus arrangements under such conditions can result in acquisition of conditional relations specified in advance. Acquisition occurred with repeated presentation of the "test" trials, a common practice in equivalence research because the conditional relations being assessed often do not appear on the initial presentation. The hazards of repeated testing are now clear, and, as the authors state, care must be taken in the design of test procedures to prevent the kind of acquisition process they have demonstrated. Continued exploration of the conditions necessary for the development of equivalence is represented by the work of Saunders and Spradlin. Following up on work previously reported in *JEAB,* the present data demonstrate the effects of clustering trials and encouraging naming of stimuli; this research also extends the tradition of studying basic processes with developmentally delayed participants.

Another major area of research is the study of rule-governed behavior. Behavior that is influenced by rules, either self-produced or externally provided, usually exhibits reduced sensitivity to schedule contingencies. Key issues concern the means by which schedule sensitivity should be measured and the nature of the processes responsible for the attenuation of schedule control. One approach to the measurement of sensitivity is to compare patterns of responding of humans with those of nonhumans on simple schedules of reinforcement, such as fixed interval. Another approach is to assess the degree of differential responding in humans on multiple schedules that alternate components imposing different requirements for reinforcement. Using the latter approach, Baxter and Schlinger, in a novel longitudinal study, demonstrate a higher degree of schedule sensitivity in young children than has previously been found using the single-schedule procedure. The implication is that the degree of schedule control one observes in individuals with the capacity for verbalization depends critically on characteristics of the schedule arrangements. The importance of schedule design is underscored by the study of Torgrud and Holborn, who employed an innovative multiple-schedule procedure with adults to assess relative control by schedule contingencies and by shaped verbal representations of the contingencies. An exceptionally high degree of schedule control was found despite conflicting verbalizations. That schedule factors can apparently override competing verbal influences has implications for current theoretical debates over the processes responsible for rule governance. Torgrud and Holborn explore these implications in a manner that readers should find informative and provocative. Sensitivity may also vary with the pattern of behavior under schedules, as is demonstrated by Joyce and Chase. In an extension of work previously reported in *JEAB,* the present data demonstrate that variability in performance is crucial to identification of changes in environmental contingencies. These results suggest that only those schedule histories that create tightly patterned performance will be prone to insensitivity, and a conceptual understanding of the phenomenon may not be tied uniquely to language.

Another emerging trend in human behavior analysis is a resurgence of interest in verbal behavior. The present issue offers two examples of interdisciplinary work that provide behavior analysts with conceptual tools for continuing operant work on this important topic. Moerk summarizes his previous work on interactions between an adult speaker and a language learner and provides some new linguistic analyses that speak to crucial differences in cognitive and behavioral accounts of language acquisition. In addition to the present data analysis, Moerk's article provides a valuable guide to his extensive empirical work on Brown's important data set and also presents an empirical strategy for analysis of naturally occurring interactions that can reveal contingency patterns. From a different intellectual tradition, Stemmer adopts a nonempirical, purely analytic stance characteristic of philosophy in addressing the arguments in Chomsky's review of Skinner's *Verbal Behavior.* This piece goes beyond the normal behavioral rejoinders to offer criticism of Chomsky in terms of the original argument. Stemmer and Moerk together offer behavior analysts a rich resource for grappling with the subtleties of the debate about language acquisition waged by cognitive linguists and operant psychologists.

Finally, we feature two book reviews: One, stimulated by Rachlin's interesting book on judgment and decision, assesses the relation

between behavior analysis and cognition; the second takes a behavioral look at Deci and Ryan's review of intrinsic motivation.

In reviewing this collection of human operant research, it becomes clear that there is no consensus on an appropriate set of methodological guidelines or criteria. To some extent this state of affairs is appropriate, for the field is emerging from the experimental analysis of nonhuman behavior, and much of the work is exploratory. We should not necessarily limit ourselves with research conventions that evolved in the analysis of behavior that could be studied in laboratory settings. Human behavior often must be studied under conditions that cannot be perfectly controlled and with populations that cannot be manipulated exclusively at the discretion of our research agendas. Recognition of this change will be critical to the continued development of interesting and creative lines of human operant research.

At the same time, the need for exploration of new directions should not obscure the value of traditional forms of research design and data interpretation. There are many sources of research plans that take natural settings into account, as demonstrated regularly by applied behavior analysts and by some of the articles in this special issue. Laboratory researchers should not assume that dealing with human participants or with verbal data means behavior analysis will progress with anecdotal accounts or with data from haphazard procedures. Ideally, we will continue to be intrigued by studies that identify new and interesting phenomena, but we will also follow up on those early discoveries with more mature research to identify clearly the sources of behavior. Our knowledge of contemporary research methods and standards should keep pace with our interest in the experimental analysis of more complex and interesting forms of human behavior.

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