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BEHAVIORAL ECONOMICS: AREAS OF COOPERATIVE RESEARCH BETWEEN ECONOMICS AND APPLIED BEHAVIORAL ANALYSIS[1]

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The current research methods of behavioral economics are characterized by inadequate empirical foundations. Psychologists involved in the experimental analysis of behavior with their research strategies and their experimental technology, particularly that of the Token Economy, can assist in providing empirical foundations for behavioral economics. Cooperative research between economists and psychologists to this end should be immediately fruitful and mutually beneficial.

The purpose of this paper is to explain how cooperative research between psychologists and economists in planned environments, in particular token systems, may be used for the advancement of knowledge in both disciplines. A token system for ward populations, whatever else it might happen to be, closely approximates the economist's concept of a closed economic system where tokens are money, deliveries of tokens as conditioned reinforcers are wage payments, and exchange rates of tokens for primary reinforcers are prices of consumption goods. As such, cooperative research in token systems would provide economists with unique opportunities for controlled observation and experimental analysis of economic behavior. In addition, this research promises to aid the practitioners of behavior modification in the management and control of token economies, as well as extending behavioral research into the study of economic behavior, a direction Skinner has often stressed (Skinner, 1953). However, in the discussion that follows the emphasis is on how cooperative research in planned environments provides one practical means of advancing the current state of economic science.

The field of economics is large and encompasses numerous diverse areas of study. In some areas, notably the field of production economics, proferred laws can be stated and predictions made without mentioning human behavior. In these areas—agricultural production economics and optimization procedures for production and inventory control problems of business and government—economists have made substantial contributions to the solution of practical empirical problems. The success of economists in each of these areas has been characterized by the systematic collection of controlled observations and substantial testing and analysis of the economic laws and relations in question. Research efforts in production economics have also been characterized by, indeed have required, the establishment of cooperative relationships between economists and engineering scientists.

In many other areas of economics, however, the proferred laws and relations formulated by economists are about human behavior. As such, theories and explanations in these areas of economics, which we call *behavioral economics,* incorporate hypotheses about human behavior. In sharp contrast to the success economists have achieved in problem solving in production economics, massive and sophisticated efforts aimed

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at the solution of practical empirical problems in behavioral economics have met with, in the words of Professor Leontief's 1970 Presidential address to the American Economic Association, "indifferent results" (Leontief, 1971, p. 3). A leading example of this is to be found in the large scale mathematical-statistical representations of aggregate economic activity in the United States, which have been constructed and fitted to numerical data over a period of years. The results, to quote *Business Week,* "have not been demonstrably better in the forecasting race than skilled business analysts flying by the seat of their pants" (*Business Week,* 1971, p. 125). Furthermore, it is generally recognized that the large computer representations could not perform as well as they do if the econometricians were excluded from making subjective *ad hoc* adjustments to the forecasts produced by the model itself (see Juster, 1970). Examples can be readily drawn from other areas of behavioral economics where extensive mathematical-statistical analysis of behavioral problems have added little to our understanding of economic behavior.

Leontief accounts for this indifferent performance in solving empirical problems of behavioral economics by the "palpable *inadequacy* of the scientific means with which they (economists) try to solve them" (Leontief, 1971, p. 1). First, many economists specialize in the formation of theoretical concepts of scientific economic theories, *e.g.,* the concept of preference in a theory of choice as presented by May, (1954). In the best work of this kind, theoretical economic concepts are characterized by presentations of deductively explored axiomatic systems (in the modern sense). Formalization, or the deliberate effort to preclude the attachment of spurious meanings to the theoretical concepts, is the hallmark of this work, and serves the practical purpose of facilitating the construction of scientifically adequate observational interpretations of the system of theoretical economic concepts. Transparently, theoretical economic concept formation does not, cannot, and is not intended to provide the observational economic concepts that are essential to the construction and testing of empirical economic theories. Most current theoretical and empirical economic research is, however, cast in a traditional mold that leaves little scope, if any at all, for scientific observation and observational concept formation in the construction and testing of economic theories. This mold is the traditional conception of a scientific theory as an "axiom system", in which it is supposed that the "axioms" are *a priori* propositions, *i.e.,* absolutely nondemonstrable, yet known to be true by their self-evidence to all thinking minds. Notable examples of the use of this traditional conception are found in Keynes, where he refers to a "fundamental psychological law, upon which we are entitled to depend with great confidence both *a priori* from our knowledge of human nature and from the detailed facts of experience" (Keynes, 1938, p. 96) to explain the relation between changes in consumption and changes in income, and in Samuelson when he claims that it is usual to make "assumptions" about the signs of partial derivatives in consumption, investment, liquidity preference, and supply of money functions "on a basis of *a priori,* intuitive, empirical experience" (Samuelson, 1948, p. 277). The necessity for some economic observation (by somebody) to take place as a condition for the economic theorists' acquisition of *a priori* economic knowledge is widely recognized, as in the above quotations. But this is a far cry from the modern conception of the role of systematic, critical observation, and observational concept formation in science, *e.g.,* as in experimental psychology. In particular, the traditional conception of *a priori* justification of axioms leaves no room for the systematic development of empirical interpretations of these "axiom systems" or for testing the *a priori* propositions against economic observations. (See Basmann, [*unpublished*] for further clarification.) In spite of this, much journal space is devoted to the systematic derivation of the "implications", especially the "public policy implications", of these "axiom systems".

Quantitative economic research in the traditional mold consists of the development, analysis, and application of complicated arithmetic computational methods and techniques to quantitative economic problems. The techniques and methods are almost invariably applied to highly processed numerical data generated as by-products of results of business and government activity. These numerical data are collected and processed primarily for government administrative purposes and can be fairly appraised only against administrative criteria. However, for purposes of scientific economic research, these numerical data are deficient in one critical respect. Namely, it is exceedingly difficult, and frequently impossible, to determine exactly what, if anything, the numbers designate even when prepared by the finest economic-statistical institutions (Morgenstern, 1963). The cause of this state of affairs is directly attributable to the economists who use these numerical data, for although these economists are not generally involved in the production of these data, the tradition has not established itself for them to insist on being fully informed about all steps of gathering and computing the numerical data clear back to its observational basis. In spite of this, only the smallest amount of the research time of academic economists is devoted to the generation of either controlled or uncontrolled economic observations. Instead, more and more arithmetic computational techniques are devised to adjust one more parameter to the existing set of data with the warning that the reader not take the material conclusions of the entire "exercise" too seriously (Leontief, 1971).

The result of following these research strategies is that there is a fundamental imbalance in behavioral economics between work on a slowly growing but still weak observational foundation and a proliferating super-structure of observationally uninterpreted theories and tedious arithmetic computational techniques. One need not look very far for the reinforcement contingencies sustaining this research behavior. According to the valuation scale used to assess and to rank academic economists' performance, empirical analysis gets a lower ranking than formal mathematical reasoning (Leontief, 1971). Put more concretely, suppose a dissertation student in economics is faced with the following choice of data to use in testing an hypothesis. One choice is to use numerical data that are already available but for which, as usual, the exact observational procedures followed and numerical processing procedures used are not known. The alternative choice is to collect and to analyze original observations that closely correspond to the hypothesis formulated but which would involve considerable extra time and expense. Since it is safe to say that the students expected income and professional reputation would probably be unaffected by the choice made, the thesis advisor cannot, in fairness or in fact, recommend the investment of an extra couple of years in generating observations (Juster, 1970).

PROPOSED AREAS OF SCIENTIFIC COOPERATION

These critical remarks on the current state of behavioral economics are shared by a number of economists, as evidenced by the references and quotations above (also see Brunner, 1967; 1969). An uneasy feeling about the present state of behavioral economics had been growing among economists. The question becomes, what practical research strategies are available for establishing a sound empirical basis with which to develop a theory of economic behavior.

Cooperative research between economists and psychologists in experimental and applied behavioral analysis can be one practical method for accomplishing this task.[2] The concepts and

[2]The possibilities for direct experimental analysis of economic behavior are, of course, greater than those proposed in this paper. For a discussion of additional possibilities as well as a brief review of experimental studies in economics see Morgenstern, 1954, pp. 511-520. Also see Juster's (1970) suggestions for experi-

theories of operant research are built around quantitative hedonism, as is much of economics. The field is empirically based, has well-developed observational concepts, and has developed an experimental technology that can be readily adapted to study economic behavior. Of the specific areas within experimental and applied behavior analysis, the area devoted to the investigation of token economies seems the most appropriate point where cooperative research might begin. There are other areas also, two of which will briefly be mentioned following the discussion of token economics.

As already noted, a token system for ward populations, whatever else it might happen to be, closely approximates the concept of a closed economic system. From this perspective, token economies present economists with a number of simple, but concrete, economic relations to observe and manipulate under laboratory conditions. Given the current status of the numerical data generated for the natural economy, the singular advantage for economists studying economic behavior in token systems, as compared with "studying" behavior in the natural economy, is that they would know, in fact would help determine, the precise observational basis and data-processing procedures underlying the quantitative measures of economic behavior analyzed. In helping to determine which data to collect, economists could experiment with alternative practical measures for theoretical economic concepts, rather than forfeiting this task to some government data-gathering agency. In addition, token systems allow for the deliberate manipulation, within a wide range of values, of variables in an economic system. Such manipulation, although possible, is generally extremely difficult and expensive to do in the natural economy. Finally, the relative simplicity of economic relations and of the characteristics of consumption goods and job categories in token systems, as compared with the natural economy, provide the built-in control of variables so essential to the experimental analysis of behavior.

A relevant question to ask at this point is: what does Applied Behavior Analysis have to gain from cooperative research with economists? The answer to this question is based on the fact that token systems may be profitably viewed as economic systems. Many of the independent variables used to predict and to control behavior in token systems correspond to concepts used by economists in studying economic behavior. In addition, the responses observed to changes in these variables have been, in general, consistent with economic theory and uncontrolled observations drawn from the natural economy. For example, the experiments Ayllon and Azrin (1965) conducted to determine the effectiveness of the token reinforcement system in maintaining desired behavior provide dramatic confirmation of the economic hypothesis that wage rates affect the supply of labor. More recently, Phillips, Phillips, Fixsen, and Wolf (1971) found that in order to encourage saving money it was necessary to pay interest on savings deposits. Viewing token systems as economic systems suggests studying the effects on behavior of a wide variety of simple and complex economic variables that psychologists have, quite naturally, not investigated. The results of these studies promise to increase the psychologist's understanding of patients' behavior. An example of this is found in Winkler's research (Winkler, 1971*b*) where, drawing on economic concepts and principles, he decided to investigate the relationship between an operational

mental controls in economic research. In addition, efforts aimed at the improvement of the quality of economic observations of the natural economy are essential to establishing a sound empirical basis for economic science. At the very least, improved economic observations of the natural economy are essential to the technological implementation of economic theories in the natural economy. Suggestions on how to improve these data are found in Morgenstern, 1963; Leontief, 1971, and the papers and discussion of the session on Basic Data for Policy and Public Decisions: Technical Aspects held at the Eighty Second Annual Meeting of the American Economic Association (*American Economic Review*, 50, no. 2, May 1970).

counterpart to the economists' concept of the stock of savings and the amount of work patients performed, finding a strong inverse relationship between these variables (Winkler, 1971*b*). Findings such as this are of more than academic interest to behavior modifiers. The economic relationships demonstrated can provide a rational basis for decisions concerning the management of prices, wages, interest rates, and so on in token systems, thereby replacing the intuitive decision making that is now the norm. For example, the relationship between stock of savings and work performance tells the token system planner that if patients' work performance improves, thereby increasing income, or if wages are increased, that the range of consumption goods available should also increase or the prices of the available goods be increased in order to forestall a high amount of savings and resultant deterioration in the patients' performance (Winkler, 1971a). In addition to contributing to a functional analysis of patients' behavior, economists can help structure token economic systems that may have more therapeutic effects in given areas than the economic structure typically found in most token economies. First, the introduction of economic institutions to be found in the natural economy but not now present in most token systems—*e.g.,* Phillips, *et. al.,* (1971) introduction of a savings institution—may make it easier for patients to remain in the natural economy once they have left the institutional environment. Second, exploration in the token economy of the effects on behavior of alternative kinds of economic systems not only has potential benefit for patients in token economies, but empirical evaluations of the differential effects of alternative token economic systems can provide observations with which to answer some of the empirical issues raised in discussions of alternative economic systems (Winkler and Krasner, *unpublished*).

Economic experimentation in token systems is, however, not without some of the same problems psychologists face when conducting research in these systems. One problem is that the optimal research design is frequently constrained by the therapeutic goals of the token system. For example, in the study of consumer behavior, the optimal research design for investigating several important questions posed by economists would involve fixing patients' income. One possible method for doing this would be to put patients on paid vacations for several weeks, but this would result in a decrease in the frequency of responses the system was designed to increase in the first place. The solutions available to problems such as this are the same as those available to psychologists: study those aspects of behavior first that can most readily be analyzed in token systems, such that only transitory, short-run therapeutic costs need be paid for substantial long-run research benefits, and study other aspects of behavior in a different experimental framework. Problems in implementing a given experimental design may also arise from uncontrolled exogenous factors; *e.g.,* the administrative withdrawal of honor cards in the middle of an experiment designed to see the effect of increased prices on the use of honor cards. However, all of these problems can be treated in a forthright manner and are clearly more tractable than the problems encountered in working with standard economic data.

In concluding this section, we briefly discuss two other areas where cooperative research between economists and psychologists in the experimental analysis of economic behavior might begin. These are "Findley-type" programmed environments, and laboratory studies of the behavior of animals below the human level. Both these areas of research are complementary to the experimental work in token systems in terms of establishing a sound empirical basis with which to develop economic theory.

Findley (1966) reported the design and establishment of continuous laboratory environments for the study and support of a full range of individual human behavior. The environment reported allows for extensive objective

measurement and manipulation of experimental conditions for volunteer subjects who live in the environment continuously for extended periods of time. Such environments are ideally suited to the experimental analysis of individual choice behavior, which underlies most of behavioral economics. The problems of control and conflict of interest encountered in studying behavior in token systems are largely overcome in programmed environments such as Findley's. Theories of economic exchange and group behavior could be readily studied in planned environments designed for two or more people. However, given the almost total lack of experience of economists in the experimental analysis of economic behavior, it is questionable whether, at this point in time, empirical economists are ready to make efficient use of such relatively expensive, time-consuming research designs.

Laboratory studies of the behavior of animals below the human level are long overdue in economics. Recently, an appeal for such experimentation was made in the economics literature (Castro and Weingarten, 1970). However, substantive research by economists with subhuman animals has yet to appear. Many of the results of operant conditioning studies are of direct relevance to the analysis of economic behavior. For example, schedules of reinforcement and the associated frequency of response data are readily interpreted as practical measures for schedules of wage payments and the associated labor output (see Skinner, 1953). From this perspective, certain aspects of frequently studied operant behaviors that have received little attention by psychologists are of prime interest to economists; *e.g.,* the effects of changes in quantity and quality of reinforcers on rates of responding. Still other behavioral questions of fundamental interest to economists have simply, and quite naturally, not been raised by psychologists, although the technical means are available to study them. For example, economists are primarily interested in choice behavior that involves distributing a fixed number or quantity of reinforcers over a discrete time interval, whereas subhuman animal research has generally concentrated on choices between discrete alternatives at a point in time. Although, as Castro and Weingarten note, operant conditioning procedures that allow for distinction between work and purchase by the introduction of conditioned reinforcers are ideally suited to the study of these economic problems, economic experimentation need not be limited to such research designs. The entire theory of consumer choice, which underlies the theory of consumer demand, can be stated and tested without the introduction of prices and income. Thus, a research design in which subjects are given alternatives to choose from, an opportunity to make a single choice and then have the alternatives withdrawn for the duration of the intertrial interval can be used to study consumer choice behavior and other choice problems that underlie so much of behavioral economics. The experimental analysis of economic behavior using animals below the human level is an untapped and immediately accessible source of information about economic behavior.

Each of the three research situations that have been discussed can be viewed as a laboratory, where economic theory can be tested under controlled conditions. These economic laboratories have all of the advantages and disadvantages of any laboratory situation where increased control of observational procedures and of independent variables is achieved, while questions inevitably arise as to the generality of the experimental results obtained, given the obvious differences between laboratory populations and conditions and their natural counterparts. As in any laboratory, the question of the generality of the experimental results obtained is an empirical one that can not be prejudged. It would seem, however, that the generality of results obtained in subhuman animal research can be judged initially by conducting appropriate experiments in token economies and in Findley-type environments. In turn, the generality of results obtained in the last two situations can be judged, at least

partly, by attempting to reproduce the same behavior in token economies with radically different subject characteristics and with more, or less, sophisticated economic systems, and by attempting to reproduce in these laboratory situations what little is known empirically for natural economies. So far, attempts of the latter sort have been successful (Wrinkler, 1971*a*), thereby suggesting that data from the token economy do have implications for the natural economy. Ultimately, however, questions pertaining to the generality of the results obtained in these laboratory situations must be settled by reliable field tests (see the comments in footnote 2 in this respect).

SUMMARY AND CONCLUSIONS

What has been said here can be summarized quite simply. The current research methods of behavioral economics are characterized by the palpable inadequacy of their scientific foundations. Psychologists have developed successful scientific techniques for the experimental analysis of behavior. These techniques can be used to study problems in behavioral economics and it is therefore incumbent on economists to apply these techniques to the study of economic behavior.

The developments of an experimental analysis of economic behavior are of importance to a broad number of psychologists whether they take part in such an analysis or not. First, this research promises to provide a satisfactory account of the individual behavior that is responsible for the data of economics in general, an essential requirement, as Skinner (1953) noted, of an adequate science of behavior. Second, in the process of extending a functional analysis of behavior to economic behavior, an entire network of variables and relations will come under experimental investigation for the first time. As an initial hypothesis, we may suppose that the economic processes and relations studied are definable or explainable in terms of processes and relations of operant conditioning. That is, that the behavior observed will be consistent with reinforcement principles as currently understood. However, there is no assurance that this will be the case; rather, the behavior observed may be found to be inconsistent with or simply be outside the current scope of reinforcement theory. Thus, the attempt to extend the experimental analysis of behavior to the study of economic behavior is of vital interest to both economists and psychologists.

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REVIEWER'S COMMENT

The manuscript by Kagel and Winkler is a proposal that Economics and Reinforcement Theory might usefully integrate their activities. The best argument for this coordination would be the existence and value of examples of past efforts to do so. Fortunately, Winkler has provided just such examples himself. It would have been useful for the authors to say just a bit more about the advantages they foresee by alluding to these examples. But even had these examples not existed, the authors have made a convincing argument for integrative efforts.

The style is quite evangelistic and preachy at points, but considering the objective of the paper as a call to strangers to form a trial friendship, this style is appropriate. I personally have held the position advocated by this paper for some time but without the basis in economic knowledge elaborated by the authors. I hope that their "call for action" is successful.