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HARVARD MEDICAL SCHOOL  
Department of Psychiatry  
BEHAVIOR RESEARCH LABORATORY  
Metropolitan State Hospital, Waltham, Massachusetts

FINAL REPORT

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Project Title:

An Experimental Analysis of Cooperation and Competition.

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## 1. GOAL OF RESEARCH --

To develop and standardize a single experimental method for comparing both individual and social cooperative and competitive behavior in the same team of human subjects.

Unless individual behavior and social behavior are measured by variants of the same basic method, it is extremely difficult to separate the contribution of individual performance variables, such as discrimination ability or motivation, from emergent social variables. Furthermore, even though an experimental situation is arranged so that social variables can emerge, subjects may not be responding to the social aspects of the situation. Unless the behavior of each individual can be shown to change when a machine is substituted for and performs the function of the other person, behavioral transactions with the other person cannot be functionally defined as social.

Free-operant techniques have been widely applied in studying the behavior of individual organisms. Because the method utilizes relatively complete environmental control and automatic, continuous, direct recording of responses, subtle moment-to-moment changes in the behavior of single individuals can be objectively analyzed. The applicability of these techniques to social behavior was demonstrated in exploratory studies of cooperative responding in pigeons<sup>1</sup> and children<sup>2</sup>. We therefore believed that the free-operant method was the best single method available for comparing individual and social behavior. In addition to the high control and objectivity provided by the method, a variety of social variables could be introduced and removed without otherwise changing the experimental situation.

In developing and standardizing the method for experimentally analyzing social behavior, we planned to:

- 1) Design apparatus to measure a wide variety of social behaviors as well as individual behavior simply by adding social stimuli and rearranging reinforcement contingencies.
- 2) Automatically record and experimentally control leader-follower relationships in both cooperation and competition.
- 3) Measure and manipulate both cooperation and competition with only minimal stimulus changes and no apparatus changes which would confound variables.

## 2. APPARATUS DEVELOPED FOR SOCIAL RESEARCH

Briefly, the apparatus consists of two adjacent rooms, each equipped with an operant conditioning panel on one wall. The rooms are the same as those used in our laboratory since 1953 in studying the individual behavior of normal and psychotic persons. On each operant panel is a plunger that can be pulled and an opening into which reinforcers (pennies or other small objects) can be dispensed.

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<sup>1</sup> Skinner, B. F. Science and human behavior. New York: Macmillan, 1953, p. 306.

<sup>2</sup> Azrin, N. H., & Lindsley, O. R. The reinforcement of cooperation between children. J. abnorm. soc. Psychol., 1956, 52, 100-102.

Between the two rooms is a sliding panel. On each side of the panel are two mechanical stimuli ( a red light and a white light ) which can signal the responding and reinforcement of the person in the other room. The panel can be opened to permit subjects to view each other through a plexiglass window.

Automatic controlling and recording apparatus is located in an adjoining area. From this area, the rooms can be observed through hidden periscopes.

Speakers in each room deliver white noise for masking the sound of the apparatus and preventing conversation.

The apparatus is described in detail in the enclosed articles:

- 1) Lindsley, O. R. Experimental analysis of cooperation and competition.
- 2) Cohen, D. J. Justin and his peers: An experimental analysis of a child's social world.

Methodologically, the apparatus contains two important innovations.

First, the social responses are defined temporally (both subjects must respond at almost the same instant) rather than topographically (both subjects must respond at the same of several alternate locations). This permits using a single manipulandum which greatly simplifies apparatus design by eliminating the many variables involved in multiple response interaction.

Second, the individual behavior is made as complex as the social behavior by using humanly programmed mechanical stimuli. Essentially we produce a machine that behaves as complexly as a person by putting a person inside a machine, or (said another way) by putting a machine face on a person. In this way, the effects of social variables beyond mere complication of performance can be directly recorded and experimentally manipulated.

### 3. SUMMARY OF RESULTS

Free-operant analysis of social behavior has yielded interesting and important data. Although our findings must be followed up in some cases with more data and in others with further methodological refinements, we have demonstrated:

- 1) Leadership in both cooperation and competition can be directly recorded and experimentally manipulated in the laboratory by differential reinforcement.
- 2) Since initially emergent cooperative leadership is highly correlated with leadership in home and school situations, it may be used to measure and predict extra-laboratory leadership.

- 3) Human discriminative stimulation or communication between teammates markedly alters the degree to which cooperative leadership is manipulable by differential reinforcement. For example, when a team is composed of strangers, the follower tends to make fewer erroneous attempts to lead when he must follow mechanical indicators of the leader's response than when he can actually see the leader.
- 4) Social connotation sharply reduces the acquisition time of the complicated discriminations involved in humanly programmed cooperation and competition.
- 5) Teams with a history of cooperation convert the programmed competitive situation to a complicated cooperative situation by alternating leadership.
- 6) Overly aggressive individuals learn to distract their teammates in the competitive situation in order to "catch him asleep."

We have learned, moreover, how to conduct social experiments efficiently and with full environmental control. We have found, for example, that social connotation cannot be experimentally controlled unless teammates are brought to the laboratory separately. We have also found that the use of strong reinforcement, although seemingly costly, actually minimizes the cost of experimental sessions by producing maximally reliable and sensitive data, reducing acquisition time, insuring prompt and frequent subject attendance, reducing intersubject and intrasubject variability, and eliminating low motivation as a possible interpretation of differential results.

#### 4. PLANS FOR FURTHER EXPERIMENTATION

We plan to do more parametric analyses to determine the extent to which experimentally measured leadership predicts leadership in extra-experimental social interactions.

We will explore social deficits in cooperation and competition among neurotic, retarded, and psychotic individuals.

We plan further development and refinement of the method by:

- 1) Developing a one-way communication system, so that we can determine if it is the follower's observation of the leader or the leader's observation of the follower that produces erroneous attempts at leadership and so that we can produce experimentally reversible social connotation.
- 2) Adding electrical equipment for recording alternation of leadership and for controlling it experimentally by differential reinforcement.
- 3) Adding a manipulandum which produces a mechanical distracting stimulus in the other teammate's room, so that the distraction behavior of aggressive individuals in competition can be directly measured and experimentally manipulated.

## 5. SUGGESTED APPLICATIONS OF THE METHOD

Basic Research: Using this method, a social psychologist can study directly in the laboratory the effects of socially emergent variables without fear that they will be confounded with complexities of individual performance. For example, the effects of a teammate's current performance can be separated from the anticipations of his performance based upon past extra-laboratory experience by comparing the responses of his teammate with and without immediate social connotation and human stimulation. A wife's reactions to her husband's behavior can be separated from her reactions to her husband behaving. A wife's reactions to her husband's behavior when she thinks it is a stranger's behavior can be compared to her reactions when she knows it is her husband behaving.

Relationship between Cooperation and Competition: Since the method permits the generation and recording of either cooperation or competition by merely rearranging reinforcement contingencies, these two social behaviors can be compared in the same team in a single experimental session without confounding variables.

Teaching Cooperation: With very long experimental contact, an uncooperative maladjusted individual might gradually be taught to cooperate with another disturbed individual, a therapist, his parent, wife, or any other person.

Developmental Psychology: The method can be used to study longitudinally the growth of a child's social repertoire and the changes that occur in his interactions with family and friends. The effects of such major events as the birth of another child, a summer away from home, or divorce of parents could be evaluated.

Clinical Psychology: Areas of social deficit or disturbance can be objectively determined and their severity estimated in the laboratory as an aid to a psychotherapist in planning a program of therapy. Experimental analysis of the social profile of a patient at various stages of therapy would serve as an indicator of therapeutic progress.

## 6. TEACHING FUNCTIONS PERFORMED

Donald J. Cohan used the method and our laboratory facilities to produce data for his Honors Thesis, submitted to the Department of Psychology, Brandeis University, June 1961.

The laboratory always welcomes scientific researchers and students who wish to learn about our research. During 1960 and 1961 there were 190 professional visitors to the laboratory. Lectures and tours of our facilities were given to 451 students in 23 separate groups.

## 7. ORAL PRESENTATION OF RESULTS

During 1960 and 1961, Dr. Lindsley gave 36 lectures at professional societies, universities, and hospitals. Most of these presentations included description and discussion of experimental analysis of cooperation and competition, and one was specifically based on research supported by this grant:

Experimental Analysis of Cooperation and Competition, presented at Eastern Psychological Association, Philadelphia, April 1961.

Donald J. Cohen described his research at the Department of Psychology, Brandeis University, and at the Department of Psychology, Harvard University.

## 8. PUBLICATIONS\*

Cohen, Donald J. Justin and his peers: An experimental analysis of a child's social world. Child Development, 1962, 33, 697-717.

Lindsley, Ogden R. Experimental analysis of cooperation and competition.

## 9. PROFESSIONAL PERSONNEL

Ogden R. Lindsley, Ph.D., Principal Investigator. Associate in Psychology and Director of Behavior Research Laboratory, Department of Psychiatry, Harvard Medical School.

Donald J. Cohen, Undergraduate Research Fellow, Behavior Research Laboratory and Brandeis University.

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\*Four copies of each are enclosed.