An Experimental Analysis of Human Social Behavior in a Competitive Situation with the Opportunity for Aggression[1]

William A. Michael

Western Michigan University

The compilation of this article was funded by the Office of Naval Research, Group Psychology Branch, under Contract Number N00014-67-A-0421-0001, NR 171-807.

INTRODUCTION

Recent applications of the techniques of the experimental analysis of individual behavior as described by Skinner (1953) and Keller and Schoenfeld (1950) have shown promise as instruments for providing order and precision to the analysis and control of human social interactions. In a study which was originally used for classroom purposes, and later published, Skinner (1962) demonstrated free-operant conditioning techniques to be effective in developing and maintaining social behaviors in lower organisms by manipulating only the reinforcement contingencies in the environment. Azrin and Lindsley (1956) later used operant techniques requiring no verbal instructions to develop, maintain, and eliminate social (cooperative) behavior in children. They also found that the rate of social responses changed in much the same way as to individual response rates as a function of the reinforcing stimuli.

Operant conditioning techniques employed in relation to these findings have been found effective in controlling social behavior in applied settings. Only minimal verbal shaping was necessary in getting adult schizophrenics to respond cooperatively when meal coins were made contingent on such a response (Ayllon and Haughton, 1962). Hingtgen, Sanders, and DeMeyer (1963) and Hingtgen and Trost (1964) used a non-verbal shaping procedure to increase social interactions of early childhood schizophrenics by differentially reinforcing mutual physical contact, cooperation, and vocalizations.

Further use of these techniques has been made in the study of social interactions between two people (Lindsley, 1961). Cooperation and competition in two person teams were experimentally analyzed. Social variables in the experimental environment were introduced and removed without changing other aspects of the situation. Social and individual behaviors were therefore clearly differentiated. Ongoing social and nonsocial responses were automatically and continuously measured, and thus allowed a functional analysis of the effects of environmental changes. Cohen (1962) later found this method to be sensitive to important extra-experimental social variables in a laboratory analysis of a child's social behavior. Experimental measures were found to be highly valid when compared to non-experimental social interactions.

Cohen and Lindsley (1964) used this method to generate controlled leadership during cooperation both with and without social connotation (human stimulation). Results indicated two new socially emergent phenomena which were not predictable from individual data. Human stimulation in this situation catalyzed acquisition of responses but in some cases suppressed performance. These findings were used to emphasize the need for methods to analyze both individual and social behavior without confounding variables.

Lindsley (1961) suggests that the study of individual behavior and the study of cooperation and competition should be possible by changing reinforcement contingencies in otherwise equivalent conditions. Three methodological requirements must be met in such a study. (1) The physical properties of the apparatus must be no

different from the measurement of individual behavior than they would be for the measurement of a wide variety of social behavior. (2) The procedure must include direct recording and experimental control of the social relationships. (3) The method must permit measurement and control of both cooperation and competition without any apparatus change that would confound variables.

The present study examined human social behavior in a competitive situation with afforded variability in the selection of strategies (McDavid and Harari, 1968). The methodological approach described above, with only necessary variations, was employed. Free-operant conditioning techniques have proven to be useful when social response acquisition was of experimental interest (Lindsley, 1961; Cohen, 1962, and Cohen and Lindsley, 1964). Prime interest in the present investigation was in actual performance under competitive conditions. For purposes of expedience, instructions to the subjects were therefore employed (Baron, Kaufman, and Staubner, 1969). The objectives of this investigation were twofold: (1) An attempt was made to determine the social and nonsocial properties of competitive behavior and to separate the contribution of individual performance variables from emergent social variables. (2) An attempt was made to analyze the occurrence of aggressive behavior in relation to and as a function of the properties of the competitive situation. Competitive interactions are said to produce negative or aversive consequences for the nonreinforced participants (Skinner, 1953). Studies using both animals and humans as subjects have indicated that aversive circumstances produce aggression (Ulrich and Azrin,

1962; Azrin, Hake and Hutchinson, 1965; Ulrich, 1965; and Ulrich and Favell, 1968). Aggression occurring under competitive conditions has often been attributed to either the frustrative effects of the situation on the thwarted competitor or to the effects such a response had on achieving reinforcement (Berkowitz, 1962). The present study therefore analyzed aggressive behavior in terms of the experimental conditions under which it did or did not occur and in terms of its specific controlling variables.

METHOD

Subjects

Six male college students between 20 and 26 years of age participated concurrently in pairs in 20 minute sessions, five days per week. Notices advertising for their services were placed around the campus. These indicated an opportunity to earn $4.50 per session. Subjects contacted the experimenter who explained the nature of their participation, including the fact that non-harmful electric shock would be involved. Subjects were told that if they decided to participate, they would be expected to serve for approximately eight weeks.

Apparatus

The study was conducted in a small room divided into two chambers. The dimensions of each chamber were 6' 8" deep, 4' 6" wide and 8' high. The chambers were separated by a sound attenuated

wall, constructed of insulated sheet rock panels and separated by a 4" air space. Fresh air was drawn through the chamber rooms by exhaust fans housed in sound attenuated boxes. A plexiglass window, 30" by 23" and approximately 35" from the floor, was situated in the wall between the two chambers. A shutter was positioned in this window to deny visual access to the adjoining chamber. Vacant areas on each end of the chamber rooms served to buffer noises from outside. Rooms were equipped with carpeting and overhead light.

Response consoles (Figure 1)[1] were located against the back walls of each of the chamber rooms. The consoles consisted of sheet metal and measured approximately two feet in width and depth and seven feet in height. The front sides consisted of seven interchangeable metal panels that were 19" wide and varied in height. One of these panels on each console served as a response panel. These panels were 21" high and approximately 22" from the floor at their base. The response panels contained three response buttons 1" in diameter and one button of the same size that served as a "shock" button. The response buttons were aligned horizontally near the center of the panel. The "shock" button was located near the bottom of the panel in an area that insured significantly different response topography than responses on the task response buttons.

Subjects each wore shock cuffs applied to their preferred ankle. Cuffs consisted of a 2" by 12" strip of elastic, self adhering material (Velcro) to which two metal buttons, 1" in diameter, were attached. Wires leading to the shock source were soldered to

---

[1] Figures and Tables are located in the Appendix of this paper.

the buttons. After application, shock cuffs were taped to discourage manipulation. Shock was generated by a 0 to 1500-v ac transformer. Thus, up to 1500 volts in series with a 50,000 ohm resister could be applied to the subjects ankle. High voltage was used with high resistance to provide a relatively constant current with changes in the subject's resistance. Shock intensities are expressed in this paper at the short-circuit current (0-22ma) at the various voltage settings. Shock duration was approximately .05 seconds.

The response panel also contained a feedback light 1" in diameter, centered near the top of the panel. This light indicated correct task responses. A digital counter centered above the feedback light on each panel accumulated correct responses made in that chamber.

A panel 14" high was located above the response panels on each of the consoles. These panels contained viewing screens, 11 1/2" square and 3' 6" from the floor, upon which a series of visual stimuli were back projected. The stimuli were presented automatically using a technique described by Lubow and Stevens (1964). Eye level viewing of the screens was maintained through the use of adjustable chairs in each chamber.

Automatic programming and recording equipment were located in a nearby room. An event recorder and impulse counters continuously recorded responses made on both consoles. A temporal printout counter recorded individual response latencies to .5 seconds.

Procedure

Before the first experimental session each subject was told the following: (a) that no information could be given him concerning the nature of the research and, while the study was not secret, he should not discuss his participation with anyone; (b) that he would be able to earn up to $4.50 per session. The ability to earn $4.00 of this amount was dependent upon his responses during the session and $.50 would be paid for each day he participated; (c) that a daily record of his earnings would be kept and that he would be paid the total amount on the Monday following each week he participated. Also, if he never missed a session throughout the study, he would be given a $10.00 bonus when the study was completed. If he missed a session without proper notification or excuse, he would be fined $1.00 for the first session missed, and so on (Scobie and Kaufman, 1969); (d) that he would not be allowed to take anything with him into the experimental chambers.

Description of the task

Slides containing 71, 75, or 79 black dots scattered randomly on a white background were back projected onto the viewing screens with a limited hold of 30 seconds. Forty such slides were presented per session. The task required the subject's to make discriminations as to the total number of dots contained on each slide. Subjects indicated their choice by responding on one of the three buttons labeled to correspond to one of the three possible dot totals. Responses had to be made within the 30 second presentation interval

had elapsed and a new slide was presented.

Individual task performance

At the start of the first session, the subjects were given a written copy of the instructions, which were also read to them in the experimental chamber. Any questions were responded to by referring the subject back to the written instructions. They were as follows:

> You are here to work and how much money you earn depends on how well you do.
>
> We have a series of black and white slides which will be presented individually on the screen in front of you every 30 seconds. Each of these slides shows a random scattering of black dots, which if counted will total either 71, 75, or 79. Your job will be to determine the number of dots on each slide and to indicate that number by pressing the button in the horizontal row of buttons in front of you that is labeled to correspond to your total. This must be done before the presentation of the next slide. If your count doesn't agree with one of the three possible totals, you have miscounted.
>
> Correct responses will light the red light on the panel briefly and cause a count to be recorded on the counter, each of which will be worth $.10 to you.
>
> The button on the bottom of the panel will, when pressed, delivers an electric shock to a shock cuff in the adjacent chamber, which will be worn by another individual. You will be required to wear this cuff thoughout each of the sessions. Tampering with or removal of this cuff at any time during the session will disqualify you from any compensation you might earn in that session. One of our staff will apply and remove the cuff before and after each session.
>
> Do not come out of the chamber until someone comes and lets you out.

Subjects performed concurrently in pairs - Subject 701 with 702, Subject 703 with 704, and Subject 705 with 706. Slide presentations were identical and simultaneous in each chamber. Extra-experimental interactions between subjects were avoided by having subjects come in and wait on different floors of the laboratory. Each was placed in and removed from the experiment chambers at slightly different times. Sessions were begun once both subjects were situated in front of the consoles. Subjects were not told the results of the other individual's performance.

Subjects had the opportunity to aggress throughout the study. Both subjects wore shock cuffs. An aggressive response was operationally defined in this study as a response on the shock button which directed a shock to the shock cuff worn by the individual in the adjacent chamber. Shock intensity was 14 ma with a .05 duration. Intensity was later manipulated with Subjects 703 and 704. Otherwise, these parameters remained the same in all phases for Subjects 701, 702, 704 and 705.

The subjects were reinforced with money on a fixed interval schedule (FI) of one week. Other reinforcers were conditioned and presented on a continuous schedule (CRF). These consisted of counts on the digital counter (each worth $.10) and flashes on the feedback light, each of which occurred immediately following the emission of a correct response.

These experimental conditions were maintained for each subject pair until both participants had attained relative stability on the following dependent measures: (1) Efficiency, defined by the formula,

% E = $\frac{\text{correct responses}}{40}$; (2) Accuracy, defined by the formula,

% A = $\frac{\text{number of correct responses}}{\text{number of responses emitted}}$; (3) Mean response speed, defined as the average speed of responding following stimulus presentations; and (4) Number of shock responses. It might be noted that efficiency and accuracy measures should have been identical under the conditions of this phase.

Competitive task performance

Once individual performance measures stabilized, the reinforcement contingency was altered to produce a competitive situation between subject pairs. The following instructions were given the subjects in the manner previously used:

> Beginning today, you must make a correct response before the subject in the next chamber makes one in order to receive pay for it.
>
> Slides will be removed in both chambers when a correct response is made by either of you or at the end of the 30 second interval. Slides will be removed in your chamber only after you have made an incorrect response. This light will now also flash when the other individual makes his response.
>
> Everything else will remain the same, including the fact that the bottom button, when pressed, will direct a shock to the individual in the next chamber.

Only the first subject to respond correctly on each slide was reinforced. Thus, the criterion for reinforcement was established by the non-reinforced subject in terms of the quality and latency of his responses. Light flashes produced in one chamber by responses made in the other, and the presence or removal of the slide following

those responses, provided feedback as to the quality of the other subject's response.

Subject pairs performed under these conditions until each subject's data stabilized.

Individual task performance II

To determine whether behavior changes produced in the previous phase were due to the competitive conditions, reinforcement contingencies were reversed. Thus, nonsocial individual performance conditions were reinstated. Subjects were instructed as follows:

> Beginning today you will once again have the full 30 seconds in which to make your choice as to the correct number of dots presented on each slide.

Dependent measures were again allowed to stabilize for each subject before further manipulations were made.

Competition II

The experimental phases which followed were specifically concerned with the variables controlling aggressive behavior under competitive conditions. Subjects were considered separately. Manipulation differed in all cases, except with Subjects 702 and 706. A summary of procedural changes is provided in Table 1.

Competitive conditions were reinstated for all subjects. Instructions were identical to those given before the previous competitive phase. An experimenter's confederate competed with Subjects 701, 702, 705 and 706 throughout all phases and manipulated the variables examined in each. This individual wore the shock cuff

in his chamber and received feedback on subject shock responses in the form of 7 ma shocks. The confederate was aware of the correct response for each slide presented. By studing the typical response patterns of each subject, he was able to approximate when necessary the conditions in the previous competitive phase for each subject.

An attempt was made to alter experimental conditions in a manner which would not cause undue suspicion on the part of the subjects. Therefore, systematic manipulation of variables was limited to the extent necessary in meeting this objective. For instance, Table 2 shows total incidence of shocks to the subjects in those phases where the effects of competitor initiated correct-response-contingent shock were examined. For the purpose of this investigation, contingent competitor initiated shock was operationally defined as the confederate's emitting 90% or more of his initial shock responses following a correct response by the subject(s). This was not to be confused with shocking the subject 90% of the time correct responses were emitted. Correct-response-contingent shocks were initiated randomly with frequency being somewhat dependent on the number of correct responses made by the subjects throughout these phases. This tactic, and that of emitting non-correct-response-contingent shocks, was employed in these phases in order to maintain the established experimental facade. However, data concerning both correct-response-contingent and non-correct-response-contingent shocks were examined.

In phases where the effects of increased losses by the subject were examined, the confederate attempted to win as often as possible

by responding with prior knowledge on the correct button immediately after each slide was in view. In Phase IX for Subject 703 and in Phases IX and X for Subject 704, competitor initiated non-contingent shocks were presented approximately once every six seconds.

Employment of the confederate was made possible by having Subjects 701 and 705 select an alternative running time "necessitated by unforeseen circumstances." They choose from times which were supposedly designated as convenient by their usual experimental mate when he was asked. Subjects 702 and 706 continued to particiate at their usual times.

Through a coincidental meeting outside the laboratory following Session 6 of Individual Task Performance, a "friendly" relationship was established between Subjects 703 and 704. This was brought to the experimenter's attention by a member of the laboratory staff who knew Subject 703. Subject 703 was not aware of the informant's laboratory connections. This social variable was considered in the analysis of the resultant data from these subjects. It was also necessary to proceed differently with this subject pair in the final phases of the study. These subjects interacted experimentally with one another for two sessions once competitive conditions were reinstated. Then Subject 703 was paired with the confederate for the third session. Subject 704 was detained "because of problems with the apparatus." The confederate then participated with Subject 704 once Subject 703 had left the laboratory. Before the next session each was informed that they were not interacting with different individuals than they had previously. Arrangements were then made

for Subject 704 to participate an hour later than usual. In all subsequent sessions the confederate was employed. He controlled experimental variables in the manner previously described.

RESULTS

Individual and competitive task performance

Results from individual and competitive conditions for all subject pairs are shown in Figure 2-A through 4-B. Acquisition of the required task discriminations during individual performance was characterized in all cases by gradual increases in coincident efficiency and accuracy measures. Increases occurred as a function of experimental sessions. Performance stabilized at approximately 80% for all subjects. Since each subject had three alternative responses, chance responding would have produced 33% proficiency on these measures. Mean response speeds showed varying rates of increase as a function of experimental sessions for all but one subject. Subject 701 showed a slight decrease in speed following Session 4. The broken lines which intersect portions of the data in Figures 2-A through 4-B under both individual performance conditions represent the mean of each performance measure for those sessions included. In the initial phase, these lines are representative of performance level following acquisition.

Few or no shock responses were emitted under the initial conditions. Subjects 702, 703, 704, and 706 initiated single shock responses only once under these conditions. Subjects 703 and 706

also made single shock responses after receiving single shocks.

At the onset of the competitive condition, data from all subjects generally showed immediate decreases in accuracy and efficiency along with increased speeds of responding. Subject 703's accuracy, however, did not appear to be significantly effected. Response characteristics thereafter differed. Therefore, further analysis considered each subject separately in relation to this and the following experimental conditions for his subject pair.

Figures 2-A and 2-B show the results from the Subject-Pair 701 and 702. Initial competitive sessions were characterized by response speeds which were less than one second and approximately equal. Only random exchanges of correct and incorrect responses were observed. Individual response patterns were not established. Subject 701's mean response latency for Sessions 14-16 (.86 seconds) was nearly identical to that of Subject 702 (.88 seconds). Accuracy and efficiency measures of Subject 701 exceeded those of his competitor in these sessions. It should be noted that under non-competitive conditions following acquisition, Subject 702 exceeded Subject 701 on all performance measures.

Data for Subject 701 following Session 16 show a gradual increase in response speed for four sessions. This was accompanied by a decrease in accuracy which became coincident with efficiency. An analysis of individual response data indicated that the subject was not always responding to visual task stimuli. Mean latencies below .50 seconds required responding prior to stimulus presentations since the apparatus only recorded latencies to the half second. Such

a response could be made on the apparatus by holding one of the response buttons down before each slide came into view. Emission of such a response reduced correct response probability to chance and respond latencies to zero.

This trend was then reversed and response speeds stabilized at an average of about .60 seconds for all subsequent sessions. Following Session 22, Subject 701's accuracy and efficiency appeared to vary inversely with slight changes in mean response speeds which to some extent were effected by the percentage of responses made prior to slide presentations.

Data from Subject 702 following Session 16 show an inverse relationship to those of Subject 701. In sessions where accuracy and efficiency coincided for Subject 701, accuracy increased up to 100% in Session 21 for Subject 702. Response speeds decreased to a level similar to that seen in the individual performance phase. Mean efficiency measures were also higher in Sessions 18-22 than in previous competitive sessions. After Session 22, a gradual decline in this trend was shown and data appeared stable in the final three sessions. Subject 701 emitted the only shock response occurring under these conditions.

Upon reinstatement of the individual performance conditions, the mean performance measures of both Subject 701 and Subject 702 immediately returned to levels approximating those attained previously under these conditions. Results of Subject 701's performance indicate improvement on all measures. This is indicated in Figures 2-A and 2-B by the relative position of the broken lines. Similar effects

were not apparent in Subject 702's data. Two shock responses emitted by Subject 701 in Session 30 were not returned by Subject 702. No other shock responses were recorded.

The results from Subject-Pair 703 and 704 are presented in Figures 3-A and 3-B. From the onset of the competitive conditions, both subjects established and maintained high response speeds. Mean performance measures showed Subject 704 to be less accurate and efficient but faster than Subject 703. Under non-competitive conditions, accuracy and efficiency measures were nearly equal, with Subject 703.

Examination of individual responses emitted by each subject within competitive sessions revealed distinct patterns of responding that varied from session to session. These patterns were characterized by highly accurate and rapid responding in the initial portions of a session until approximately 15 correct responses had been emitted. At this point, the subjects' rate of responding decreased sharply. Figure 5 shows cumulative graphs of the subjects' correct responses in Session 19 and Session 22. Also, responses emitted in later portions of a session often followed the emission of incorrect responses by the other subject. No shock responses were emitted by either subject during this phase of the study.

Data for both subjects recovered the characteristics existing in the initial phase once those conditions were reinstated. Subject 703 showed a slight decrease in accuracy and efficiency measured and an increased speed of responding in comparison to performance levels attained previously under these conditions. Subject 704 showed very

little change in individual performance. Again, no shock responses were emitted by either subject.

Additional data from this subject-pair was obtained from the Competition II portion of this study. The subjects interacted after being returned to the competitive conditions for two additional sessions. Results showed identical efficiency measures (47.5%) for both subjects. Subject 703 attained a mean accuracy level of 72% in these sessions while Subject 704 attained a mean level of 76%. The subjects displayed an interesting pattern of responding which differed from that seen previously. This pattern is represented in Figure 6, which shows a graph of cumulative correct responses for each subject in Session 30.

Correct responses were shown to be emitted in groups of five followed by non-responding, while the other subject responded. The exception to this occurred when the subject responding emitted an incorrect response.

Figures 4-A and 4-B show the results from Subject-Pair 705 and 706. Initial changes in the performance measures of Subject 705 were generally maintained throughout this condition. Accuracy and efficiency measures for this subject differed only slightly in all sessions. Speed of responding was maintained at approximately 1 second and was consistently higher than that of Subject 706. This was not the case in the previous phase. Data for Subject 706 showed a high degree of variance in response speeds and accuracy. Variations did not appear to be a function of changes in the performance measures of Subject 705.

Within-session response analysis showed that Subject 706 seldom responded prior to the emission of a response by Subject 705. In these cases, responses followed relatively long latencies. When Subject 706 responded prior to Subject 705, latencies were seldom longer than .5 seconds. Efficiency measures were approximately the same for both subjects. No shock responses were emitted by either subject under these conditions.

When returned to individual performance conditions, performance measures of both subjects appeared similar to those attained prior to the competitive phase. In Session 34, Subject 705 showed a sharp increase in response speed along with a decrease in coincident accuracy and efficiency measures. This variation in the data corrected itself in the following session. It should be noted, however, that the data from Session 34 were included in determining the mean performance level for the subject in this phase. If this data were excluded, his performance level would have more nearly approximated that in the initial phase.

Subject 706 showed slight increases in coincident accuracy and efficiency measures in comparison to his previous individual performance level. He also showed a slight decrease in response speed. These conditions resulted in no shock responses from either subject.

Competition II

Results from this portion of the study indicated that three of the six subjects examined responded aggressively when they received competitor initiated shocks. With the exception of one shock

response, non-aggressive subjects remained non-aggressive under all conditions examined.

Subject 701 emitted no shock responses in Phase IV. It was noticed in the first session of this phase that the subject would laugh after being shocked each time. Following that session he told the experimenter that he thought it was funny that the other individual got mad every time he lost and shocked him. He went on to say that he did not mind being shocked as long as he still won the money.

Manipulation of the subject's wins in Phase V also failed to produce shock responses from Subject 701. The subject, did, however, continue to laugh following shocks. He told the experimenter that he thought it was funny that the other subject was trying to get him mad. He said that he had been a prisoner of war for seven months and that little things like being shocked no longer bothered him. It should be noted that this subject emitted more shock response than any other in the first portion of the study.

Subject 702 became aggressive following competitor initiated shock. Table 3 shows the incidence of shock for this and other subjects that were found to aggress. In the first session of Phase IV the subject emitted only four shock responses. After that session, he appeared very angry and made the following comment, "I don't like this stuff. Everytime I'd get a correct answer after the first three, he would shock me. That's kiddy games. It will be different tomorrow." He also said, "I shocked him but at different times." Shocks were seen to occur at times other than following competitor shock. In Session 34, all shocks emitted were immediately

prior to slide presentations and did not follow shocks from the confederate.

In Session 35 of Phase V, no shocks and only 10 correct responses were emitted by Subject 702. In Session 36 of the "no shock" condition, the subject emitted 22 shocks. All of these occurred immediately prior to slide presentations. This pattern was identical to that occurring in Session 34 of the previous phase. Figure 7 shows portions of the response event records from each of these sessions. It should be noted that six of the final seven task responses made by the subject were correct in Session 34. In total, 84% of the shock responses emitted by this subject occurred in relation to events other than receiving a shock from the confederate.

Subject 703 emitted no shock responses as a result of any of the manipulations made. He made few if any comments pertaining to the study following sessions.

Subject 704 emitted no shock responses in Phase V. In the first session of Phase VI the subject responded on the shock button immediately following the second competitor initiated shock. After the session he asked, "What kind of sick person is in the other chamber." He went on to say that he shocked the "new opponent" only once so he would know what the shocks felt like. No other shock responses occurred as a result of subsequent manipulations. The effect of conditions described in Phase IX and X were not ascertained since the subject admitted pulling his sock under the electrodes of the shock cuffs in those four sessions.

Subject 705 responded aggressively as a result of competitor

initiated shock in Phase V. Eighty-four percent of the shocks emitted by this subject directly followed shocks initiated by the confederate (Table 3). The remaining shock responses were initiated by the subject. The first shock occurring in Session 38 was initiated by him. This subject did not comment on shock following these sessions.

In the "no shock" session the subject did not respond on the shock button.

Subject 706 also responded on the shock button as a result of receiving shocks from his competitor. In Session 36 of this phase, the subject reciprocated all shocks received. The first shock received was followed by about a 10 second latency before the subject reciprocated. All other shocks received were returned immediately. This shock pattern is illustrated in Figure 8 which shows portions of the response event record from that session.

Shock responses in Session 38 decreased to 6 even though shocks received increased to 16. The subject made the comment that he would "take the money and leave the shocking to the other guy." In the final session under these conditions, the subject received 23 shocks and reciprocated 17. When observed, shock responses immediately followed shocks received.

The subject did not respond on the shock button under the "no shock" conditions of Phase V.

Table 4 shows the percentage of "shock induced" and "other induced" shock responses from the total shocks received by Subjects

702, 705 and 706. It should be noted that the ratio of shock responses made by these subjects to those received is approximately two-thirds in each case.

DISCUSSION

A variation of the method described by Lindsley (1961), Cohen (1962) and Cohen and Lindsley (1964) was employed successfully in an analysis of human social behavior in a competitive situation with the opportunity for aggression. Since the competitive conditions allowed the subjects variability in their selection of task response "strategies", various types of social interaction patterns were observed and identified. Individual performance measures obtained prior to and following competitive performance were employed in identifying the social emergents of the competitive situation. Response speed and accuracy measures provided the basis for interpreting individual data attained as a result of this social condition. Data showed speed of responding to be extremely sensitive to the differential reinforcement provided in social interactions. Accuracy was indicative of the ratio of reinforced responses.

Results from Subjects 701 and 702 indicated mutual competition in the first four sessions. Following these sessions, Subject 701 resorted to what has been termed a "conflict of interest" strategy (Thibaut and Faucheux, 1965). This was characterized by responses made in a manner not specified by the task. Responses on the correct button prior to slide presentations served to maximize Subject 701's gain. Such responses also prevented Subject 702 from competing

effectively. However, incorrect responses made in this manner had an opposite effect. When Subject 701 responded incorrectly prior to a slide presentation, he removed himself from the competitive situation. Thus, Subject 702 was given a more promising alternative. This strategy is shown in Subject 701's data by increased response speeds and decreased accuracy (Sessions 18-21). Subject 702's data showed an inverse effect to that of Subject 701.

Resolution of this pattern appeared gradually following Session 21. This was interpreted as a function of differencial reinforcement of decreased response speeds for Subject 701. Sessions 22-28 were characteristic of mutual competition. This finding proved that the experimental procedure employed could generate and measure competitive performance. Lindsley (1961) found that special contingencies had to be employed to establish competitive responding using a free-operant design. This might be indicative of the value of instructions in studies where acquisition of social behavior is not of special interest. The relatively close response speed levels attained by these subjects during individual performance suggests that relative skill in terms of the response characteristic chosen as the basis of competition is a necessary requirement if actual competition is to occur.

Results from Subjects 703 and 704 showed patterns of social responding which were previously described by both Lindsley (1961) and Cohen (1962). Data showed that these subjects gradually resolved the competitive contingencies by cooperatively alternating leadership and reinforcement. Subject 703's individual performance

data characterized him as the potential leader in the social interaction. This was confirmed in the initial sessions by social response data. Subsequent sessions showed a progression from unbalanced to highly balanced leadership (Session 30). These findings when examined in terms of the extra-experimental social interactions known to occur between this subject pair were indicative of the validity of the present experimental approach in analyzing social relationships.

As expected, no aggressive behavior was observed between Subject 703 and 704. Their "avoidance" of competitive social responding might be considered as an indication of the general aversive characteristics of such interactions described by Berkowitz (1962).

An analysis of Subject 706's social response data indicated an altruistic approach to the competitive situation. This subject was shown to provide Subject 705 with opportunities for reinforcement. He did this by withholding most of his responses until the other subject emitted his choice. This interpretation of the data was later confirmed by the subject in post experimental questioning. These results served to further emphasize the sensitivity of the approach employed in analyzing varying social interactions.

The results of the final phases of the present investigation analyzed the effects of shock and increased losses on aggressive behavior. Three of the subjects were shown to aggress once "attacked" by their competitor. Subject 702 displayed what Berkowitz (1962) calls strategic aggression. This was characterized by shock responses which immediately preceeded stimulus presentations.

Responses of this nature were interpreted as attempts to disrupt his competitor's performance and, thus, increase his own chances for reinforcement. In Session 34 it was noticed that six of the seven times this occurred the subject also responded correctly. This may have led to "superstitious" reinforcement of this form of aggression. Indications of this were seen when the subject resorted to this strategy in Session 36 of the "no shock" phase. This came after the session in which he had emitted no shock responses and responded correctly only ten times.

Subject 705 and 706 aggressed following shocks in a manner similar to what has been described in animals as "pain-elicited" aggression (Ulrich and Azrin, 1962; Azrin, et al., 1965; Ulrich, 1965). The immediacy of the aggressive responses following painful stimulation made them appear reflexive in nature. All of Subject 706's responses were of this nature following his first. The first shock "attack" produced a pause and then aggression. This might be looked upon as the breaking down of social constraints usually associated with aggressive behavior. Subject 706 reported later that his initial reaction to this shock was, in his words, to "turn the other cheek." He obviously then decided otherwise and returned all subsequent shocks in that session immediately.

The results from Subject 701 showed him to be non-aggressive following confederate "attacks" and increase losses. Although it appeared insignificant, it was noted that this subject "playfully" emitted the only three shock responses observed in any of the subjects following the individual performance phase of the study. These

data suggest a conditioning history which differentially punished aggressing when provoked or angered. The fact that this subject had been a prisoner of war for seven months may have provided him with such a conditioning history.

The absence of aggression between Subjects 703 and 704 was predicted from their earlier social response patterns. The fact that they did not aggress against "new opponents" was not predicted. The only interpretation offered is that of strong social conditioning against such behavior. Comments from Subject 703 indicated that he saw an aggressive person as being "sick". Therefore, aggressive behavior on his part would have placed him in this same category. Subject 704 indicated that he saw the shock response as irrational and unnecessary and that it would have served no purpose.

In summary, the following conclusions could be drawn from the present investigation: First, that further evidence was shown for the relevance of methods which provide objective ongoing control and measurement of human social behavior in the experimental setting. The methods employed served to eliminate confounding variables and simplify the experimental analysis of social behavior in the laboratory. Lindsley (1961) suggests that methods of this nature are necessary in qualifying sociology as a natural science. Secondly, it was shown that the examination of a variety of social interactions was possible. Also, the interactions observed and defined experimentally were largely validated when compared to extra-experimental findings. These results were attributed to the sensitivity of the method employed. Finally, this study showed that it is possible to

further refine the types of behaviors engaged in for experimental analysis by making responses available which are typically considered manifestations of certain social interactions.

TABLE LEGEND

Table 1 - Procedural changes made for all subjects during Competition II portion of the experiment.

Table 2 - Incidence of contingent shock from the confederate to all subjects in phases where correct-response-contingent shock was examined.

Table 3 - Incidence of aggressive responses by those subjects responding on the shock button in phases where correct-response-contingent shock from the confederate was examined.

Table 4 - Ratios of shocks returned by Subjects 702, 705 and 706 to the total shocks received by each. Ratios are shown as a function of the events to which shocks appeared related and as a function of the total shocks received.

TABLE I

COMPETITION II: SUMMARY OF PROCEDURAL CHANGES

SUBJECT	PHASE	EXPERIMENTAL CONDITION
701	IV	Competitor initiated shock - correct response contingent (Sessions 32-34)
	V	Increased losses Competitor initiated shock - correct response contingent (Sessions 35-36)
702	IV	Competitor initiated shock - correct response contingent (Sessions 32-34)
	V	No shock (Sessions 35 and 36)
703	IV	Competition with S 704 (Session 29 and 30)*
	V	Competitor initiated shock - correct response contingent "S 704" (Session 31)
	VI	Competitor initiated shock - correct response contingent "New competitor" (Sessions 32 and 35)
	VII	Increased losses No shock (Sessions 34 and 35)
	VIII	Increased losses Competitor initiated shock - correct response contingent (Sessions 36 and 37)
	IX	Competitor initiated shock - non-contingent (22 ma)** Normal losses (Sessions 38 and 39)

* The experimenter's confederate was not employed in this phase.

** Shock intensity was held constant at 14 ma through all other phases of the study.

TABLE I - Continued

COMPETITION II: SUMMARY OF PROCEDURAL CHANGES

SUBJECT	PHASE	EXPERIMENTAL CONDITION
704	IV	Competition with S 703 (Sessions 29 and 30)
	V	Competitor initiated shock - correct response contingent "S 703" (Session 31)
	VI	Competitor initiated shock - correct response contingent "New competitor" (Sessions 32 and 33)
	VII	Increased losses No shock (Sessions 34 and 35)
	VIII	Increased losses Competitor initiated shock - correct response contingent (Sessions 36 and 37)
	IX	Competitor initiated shock - non-contingent Normal losses (Sessions 38 and 39)
	X	Competitor initiated shock - non-contingent (22 ma) ** Normal losses (Sessions 40 and 41)
705	IV	Competition (Session 36)
	V	Competitor initiated shock - correct response contingent (Sessions 37 and 38)
	VI	No shock (Session 39)
706	IV	Competitor initiated shock - correct response contingent (Sessions 36-38)
	V	No shock (Sessions 39 and 40)

* The experimenter's confederate was not employed in this phase.

** Shock intensity was held constant at 14 ma through all other phases of the study.

TABLE 2

INCIDENCE OF CONTINGENT SHOCK

Subjects	Sessions	Confederate Initiated Shock							Confederate Reciprocated Shock		Total shock to subjects	
		Contingent on:										
	No.	Cor.* resp.		Before slide		Own Inc.** resp.		Total C.I.S.***	Subject shock response			
		No.	%	No.	%	No.	%	No.	No.	%	No.	% C.I.S.*** total shocks
S 701	5	80	91	8	9	0	0	88	0	0	88	100
S 702	3	57	100	0	0	0	0	57	4	6.5	61	93.5
S 703	5	110	97	0	0	4	3	114	0	0	114	100
S 704	5	116	97	4	3	0	0	120	0	0	120	100
S 705	2	29	100	0	0	0	0	29	15	34	44	66
S 706	3	40	91	3	7	1	2	44	7	14	51	86

* Cor. Resp. = correct response
** Own inc. resp. = own incorrect response
*** C.I.S. = competitor initiated shock

TABLE 3

INCIDENCE OF SUBJECT SHOCK RESPONSES

			"Shock induced"				"Other induced"						Total
			Contingent on:										
Subject	Phase	Session	C.I.S.*		C.R.S.*		Before Slide		Confed.* Cor. Resp.		Other		
			No.	%	No.	%	No.	%	No.	%	No.	%	No.
S 702	IV	32	0	0	0	0	3	75	1	25	0	0	4
		33	4	21	2	11	8	42	5	26	0	0	19
		34	0	0	0	0	14	100	0	0	0	0	14
		Total	4	11	2	5	25	68	6	16	0	0	37
	V	36	0	0	0	0	22	100	0	0	0	0	22
S 704	VII	37	1	100	0	0	0	0	0	0	0	0	1
S 705	V	37	8	67	2	17	0	0	2	17	0	0	12
		38	9	69	2	15	0	0	0	0	2**	15	13
		Total	17	68	4	16	0	0	2	8	2	8	25
S 706	IV	36	12	100	0	0	0	0	0	0	0	0	12
		37	6	100	0	0	0	0	0	0	0	0	6
		38	12	71	5	29	0	0	0	0	0	0	17
		Total	30	86	5	14	0	0	0	0	0	0	35

* C.I.S. = Competitor initiated shock
* C.R.S. = Confederate reciprocated shock
* Confed. Cor. Resp. = Confederate correct response

** One of these shocks occurred following an incorrect response by the subject and the other appeared non-contingent.

TABLE 4

RATIO OF SHOCK RETURN
FOR AGGRESSIVE SUBJECTS

	"Shock induced" shock / Total shocks received	"Other induced" shock / Total shocks received	Total shock responses / Total shocks received
S 702	10%	51%	61%
S 705	48%	9%	57%
S 706	69%	0%	69%
MEAN TOTAL	40%	22%	66%

FIGURE LEGEND

Figure 1 - Response console.

Figure 2-A - Comparison of accuracy and efficiency data and number of shock responses for Subject-pair 701 and 702 in individual and competitive task performance phases.

Figure 2-B - Comparison of mean response speeds for Subject-pair 701 and 702 in individual and competitive task performance phase.

Figure 3-A - Comparison of accuracy and efficiency data and number of shock responses for Subject-pair 703 and 704 in individual and competitive task performance phases.

Figure 3-B - Comparison of mean response speeds for Subject-pair 703 and 704 in individual and competitive task performance phase.

Figure 4-A - Comparison of accuracy and efficiency data and number of shock responses for Subject-pair 705 and 706 in individual and competitive task performance phases.

Figure 4-B - Comparison of mean response speeds for Subject-pair 705 and 706 in individual and competitive task performance phase.

Figure 5 - Cumulative correct responses in Session 19 and 22 where Subjects 703 and 704 alternated initial cooperative leadership between sessions.

Figure 6 - Cumulative correct responses in Session 30 where Subjects

703 and 704 alternated cooperative leadership equally within the session.

Figure 7 - Response event records from Subject 702 showing a "strategic" aggressive pattern of shocking the competition immediately prior to slide presentations in Sessions 34 and 36.

Figure 8 - Response event records showing Subject 706's initial reaction to shock and the "reflexive" manner in which he responded to subsequent shocks.

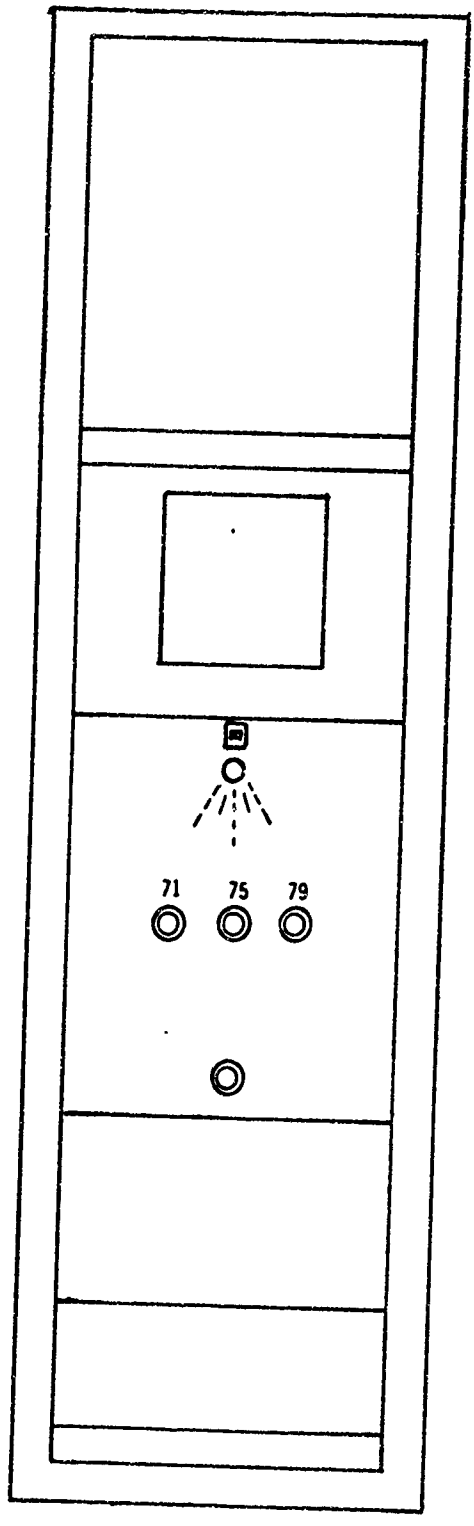


FIGURE 1

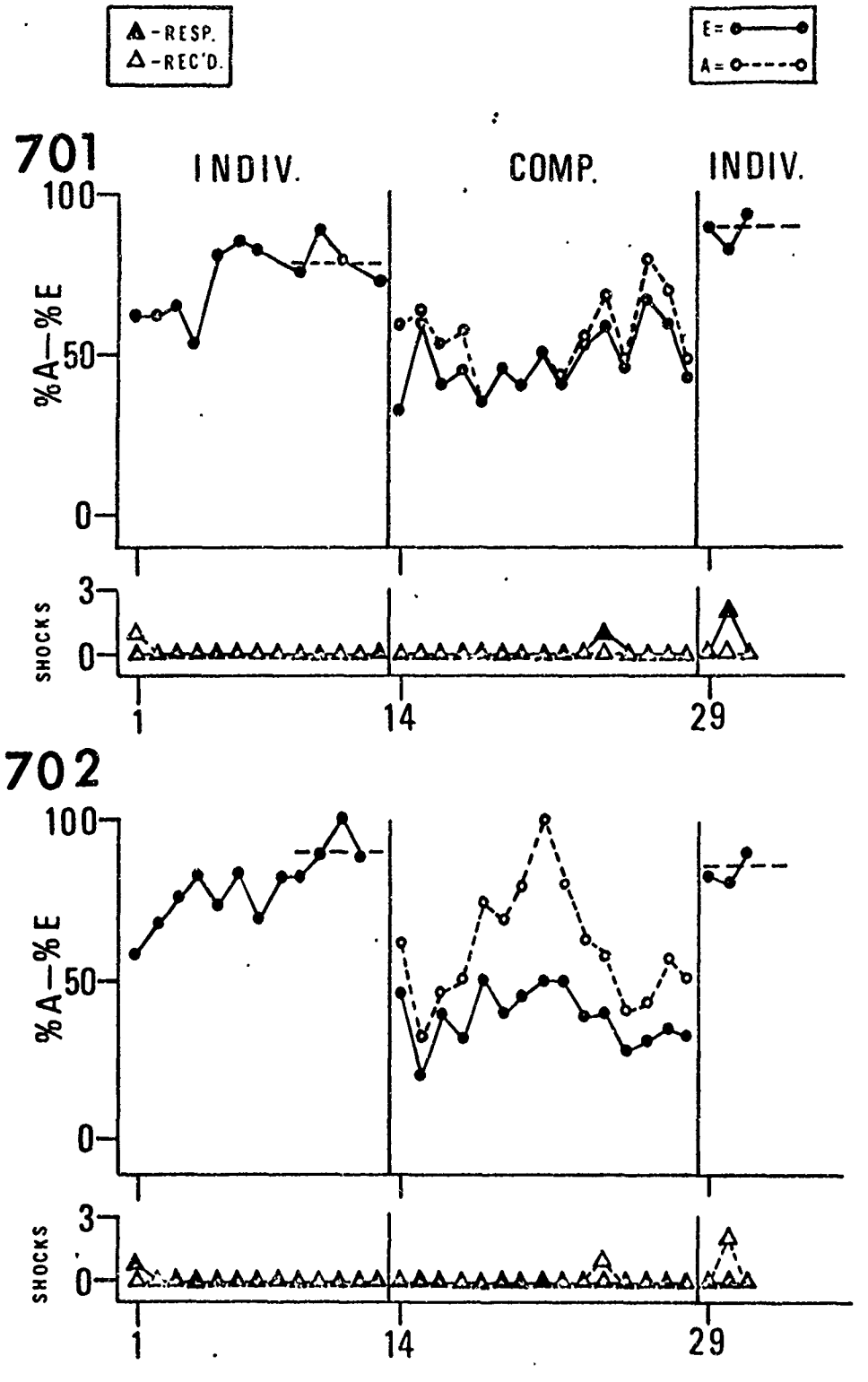

▲-RESP.
△-REC'D.
E=
A=
701
INDIV.
COMP.
INDIV.
100
%A—%E
50
0
SHOCKS
3
0
1
14
29
702
100
%A—%E
50
0
SHOCKS
3
0
1
14
29
SESSIONS

FIGURE 2-A

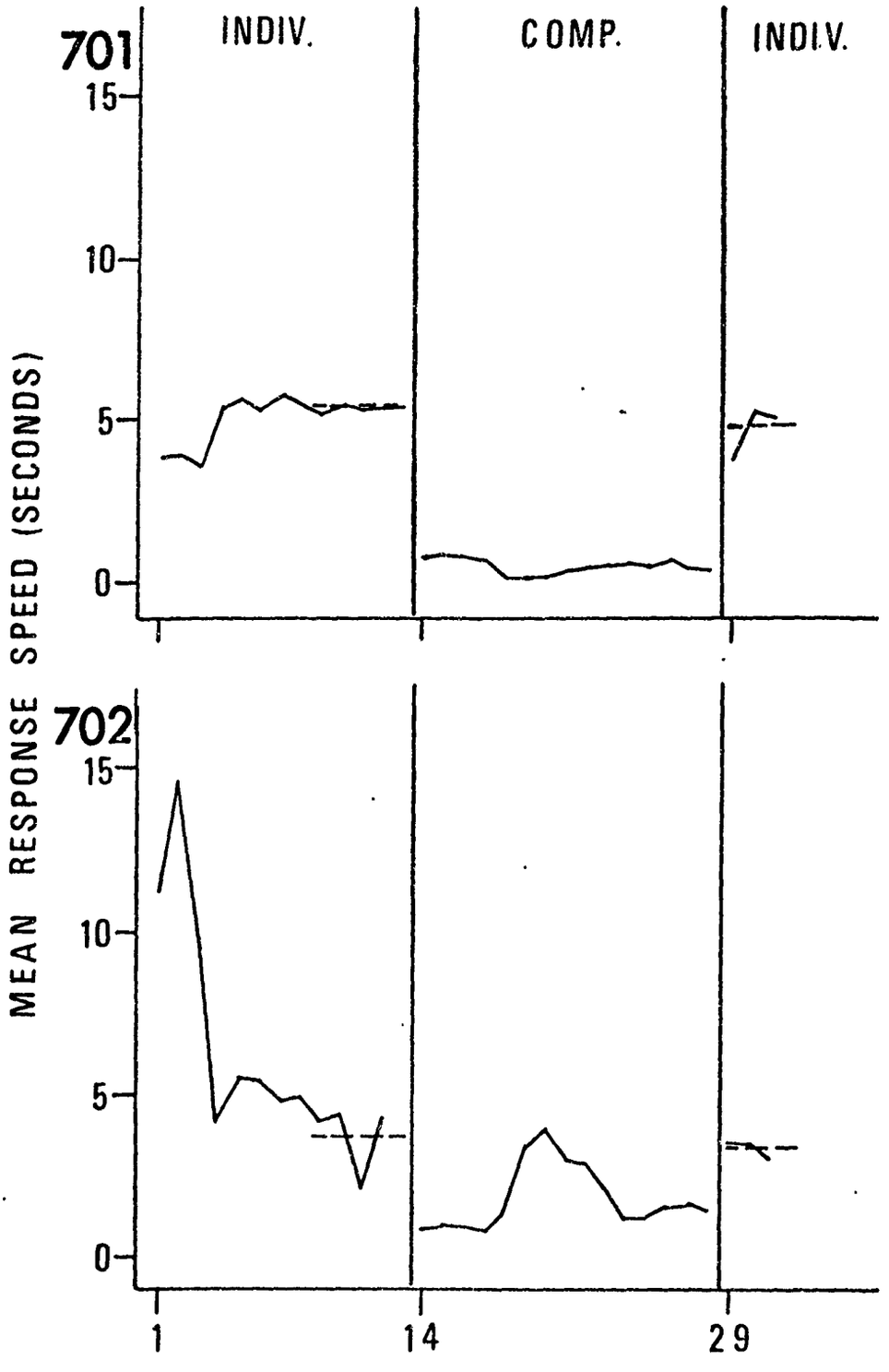

701
INDIV.
COMP.
INDIV.
15
10
5
0
MEAN RESPONSE SPEED (SECONDS)
702
15
10
5
0
1
14
29
SESSIONS

FIGURE 2-B

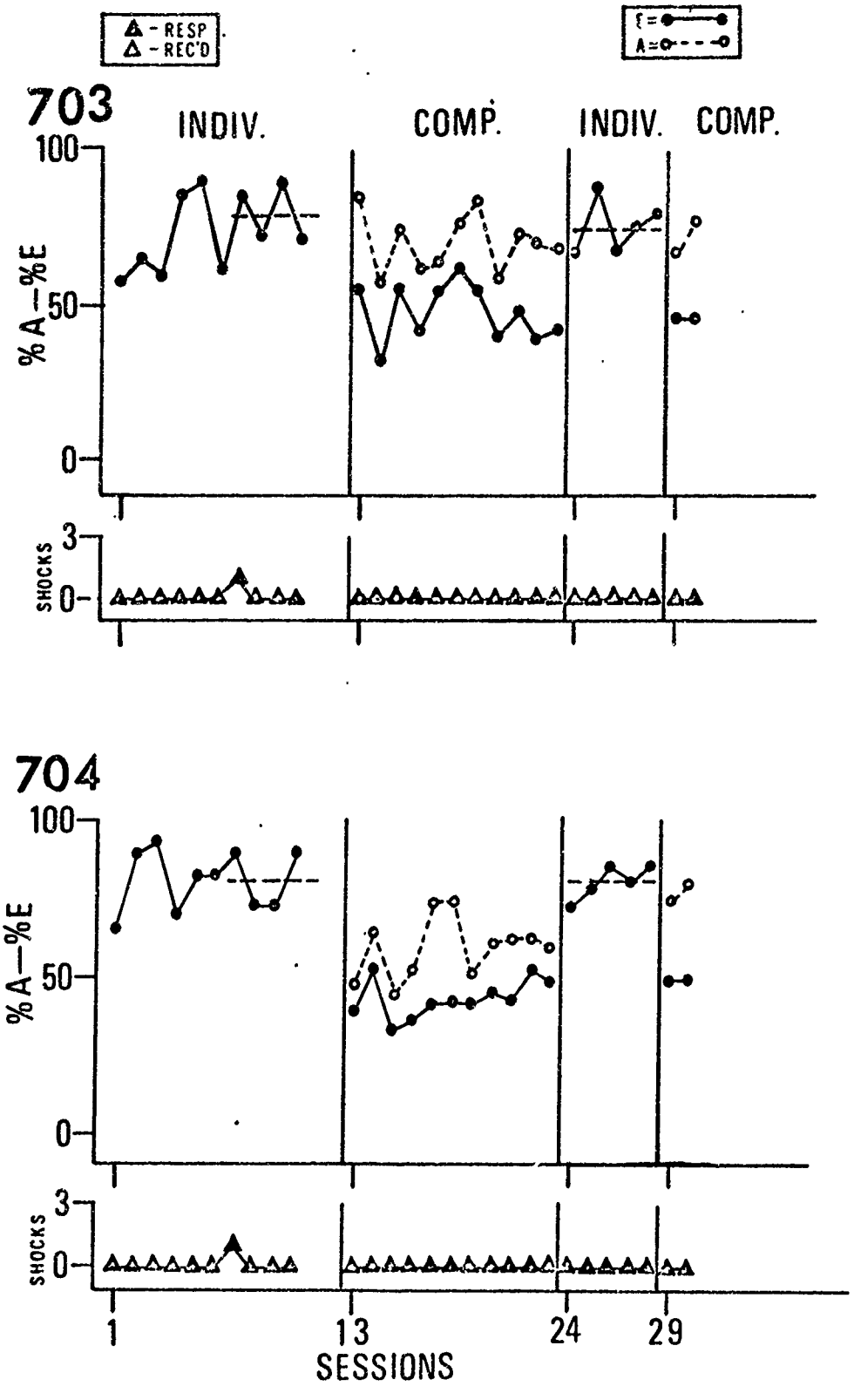

△ - RESP
△ - REC'D
E =
A =
703
INDIV.
COMP.
INDIV.
COMP.
100
50
0
%A—%E
SHOCKS
3
0
704
100
50
0
%A—%E
SHOCKS
3
0
1
13
24
29
SESSIONS

FIGURE 3-A

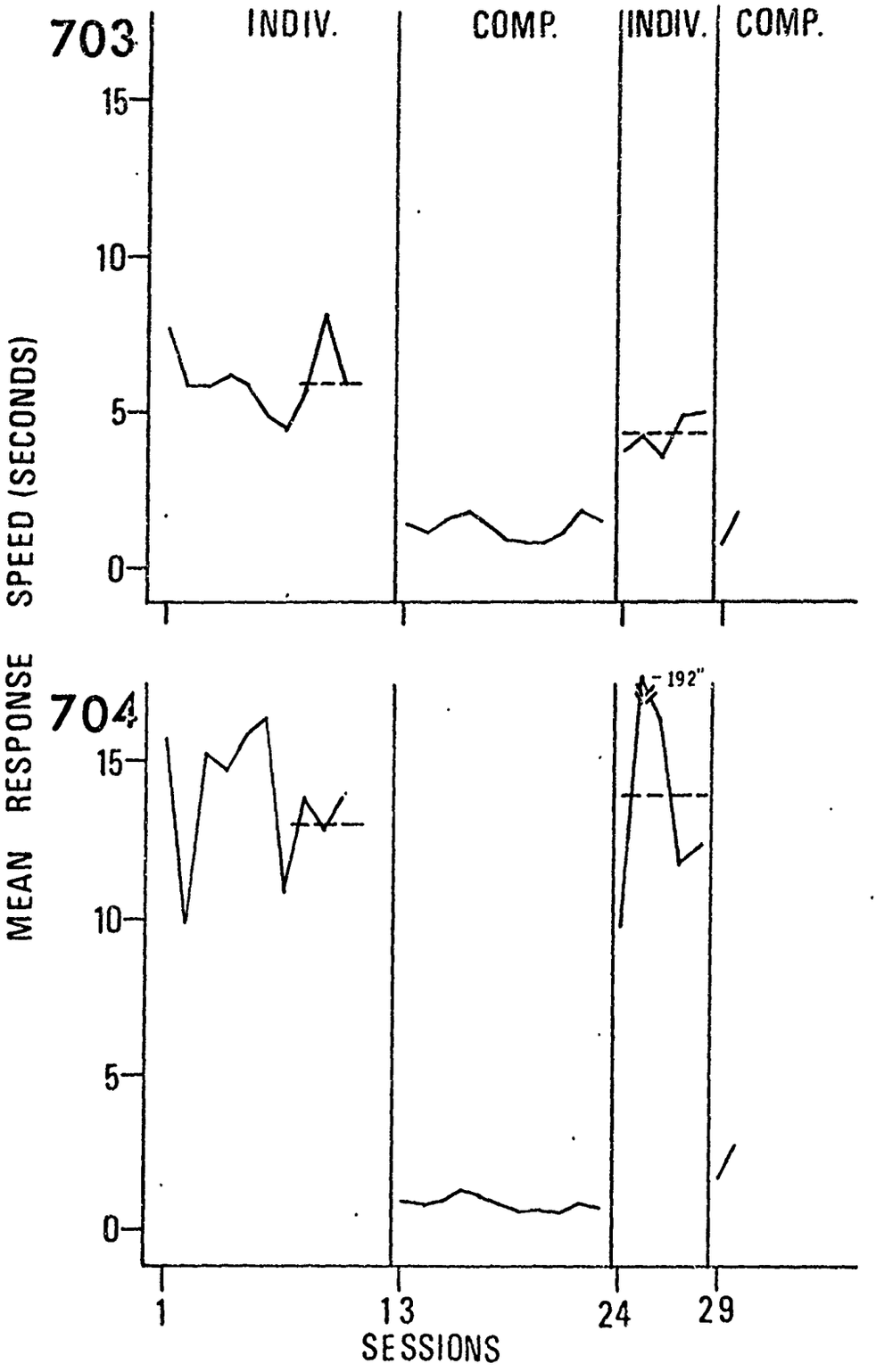

703
INDIV.
COMP.
INDIV.
COMP.
15
10
5
0
MEAN RESPONSE SPEED (SECONDS)
704
192"
15
10
5
0
1
13
24
29
SESSIONS

FIGURE 3-B

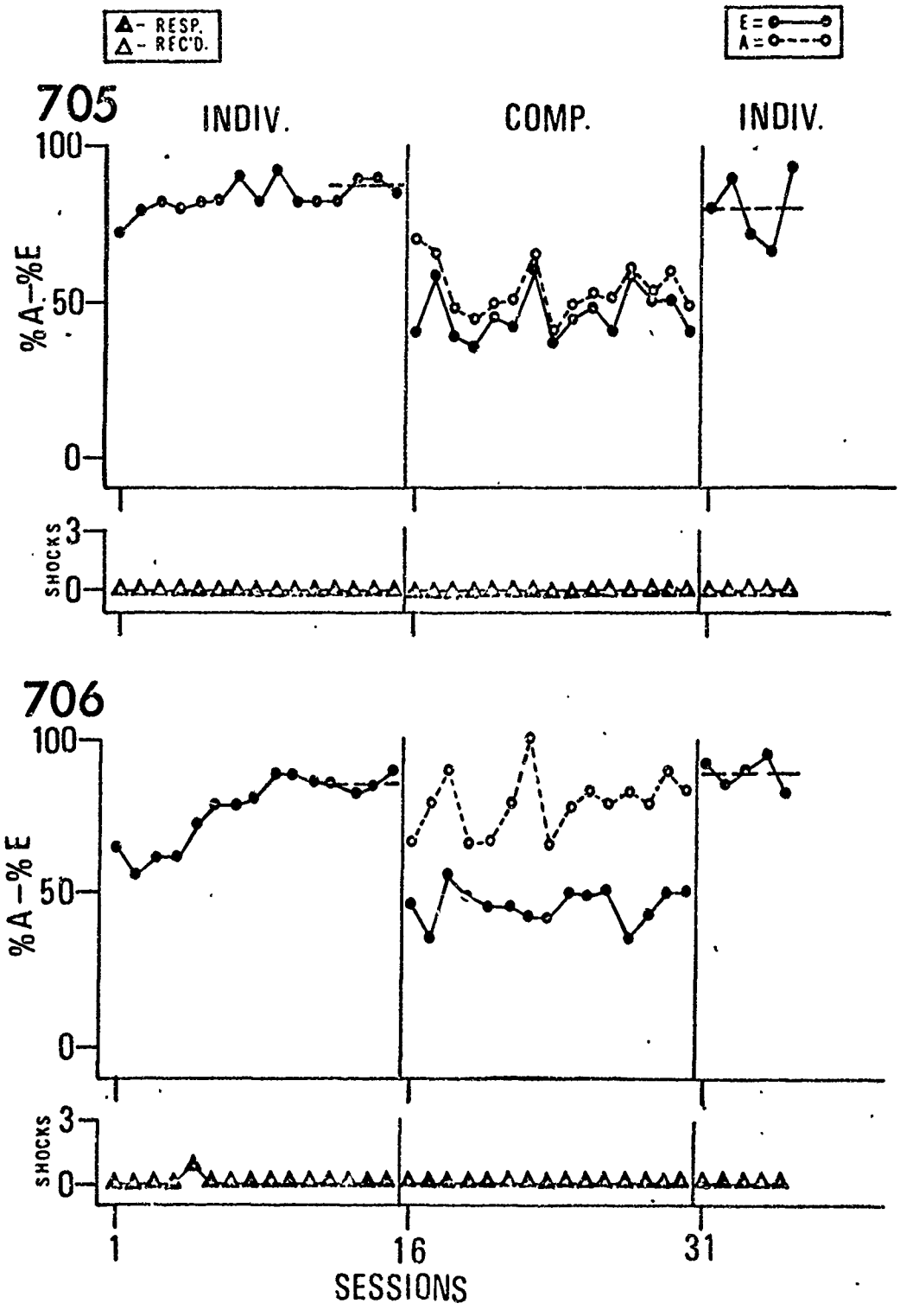

▲- RESP.
△- REC'D.
E =
A =
705
INDIV.
COMP.
INDIV.
100
50
0
%A-%E
SHOCKS
3
0
706
100
50
0
%A-%E
SHOCKS
3
0
1
16
31
SESSIONS

FIGURE 4-A

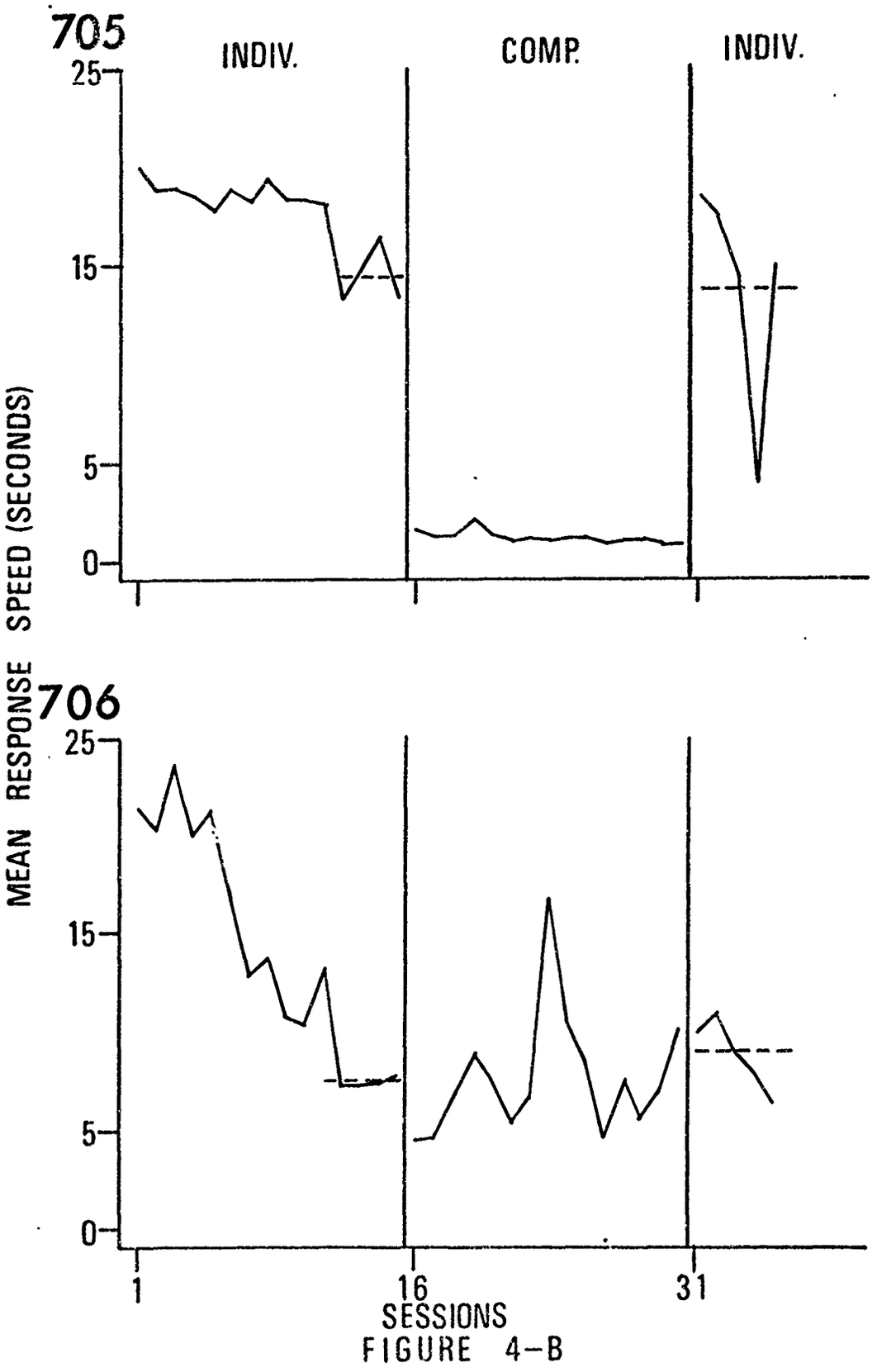

705
INDIV.
COMP.
INDIV.
25
15
5
0
MEAN RESPONSE SPEED (SECONDS)
706
25
15
5
0
1
16
31
SESSIONS

FIGURE 4-B

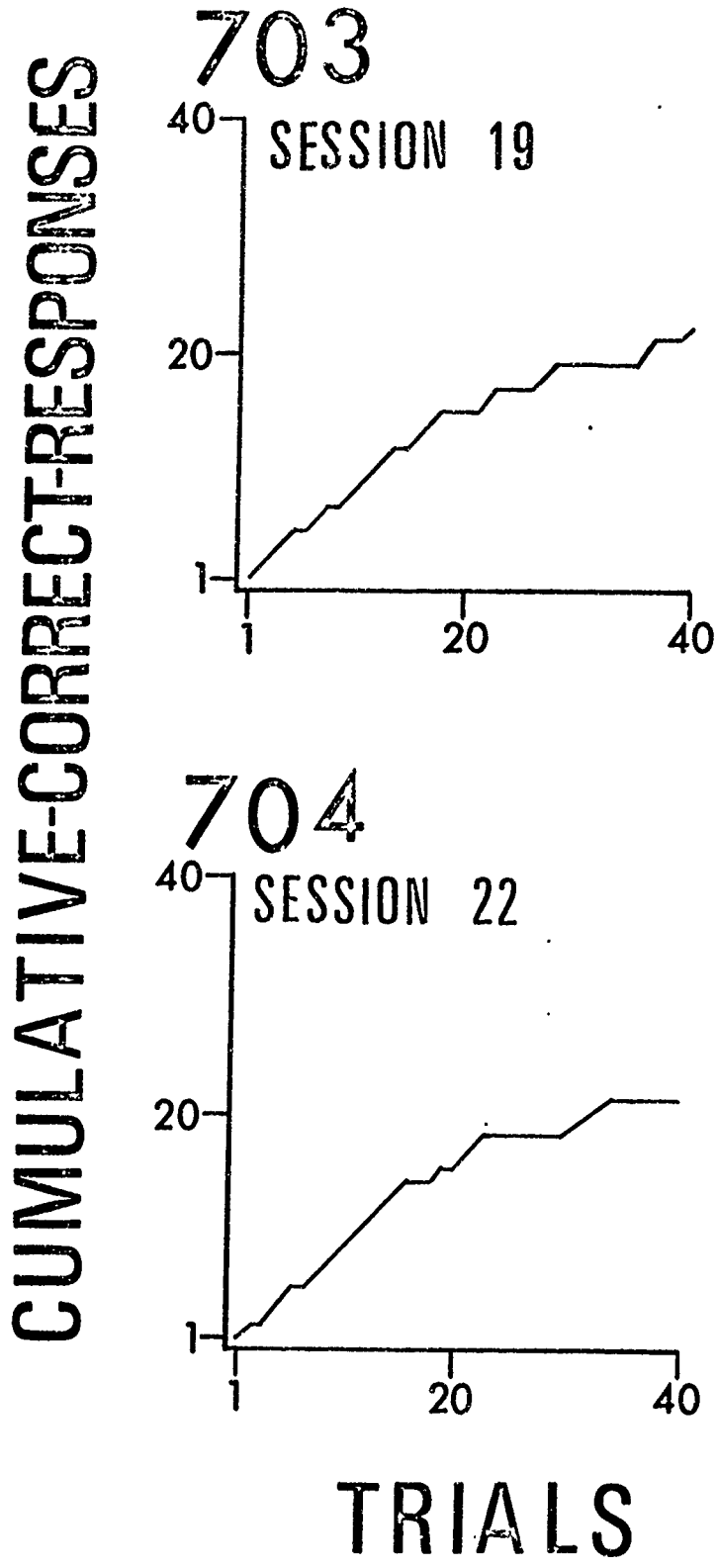

703
SESSION 19
40
20
1
1
20
40
704
SESSION 22
40
20
1
1
20
40
CUMULATIVE-CORRECT-RESPONSES
TRIALS

FIGURE 5

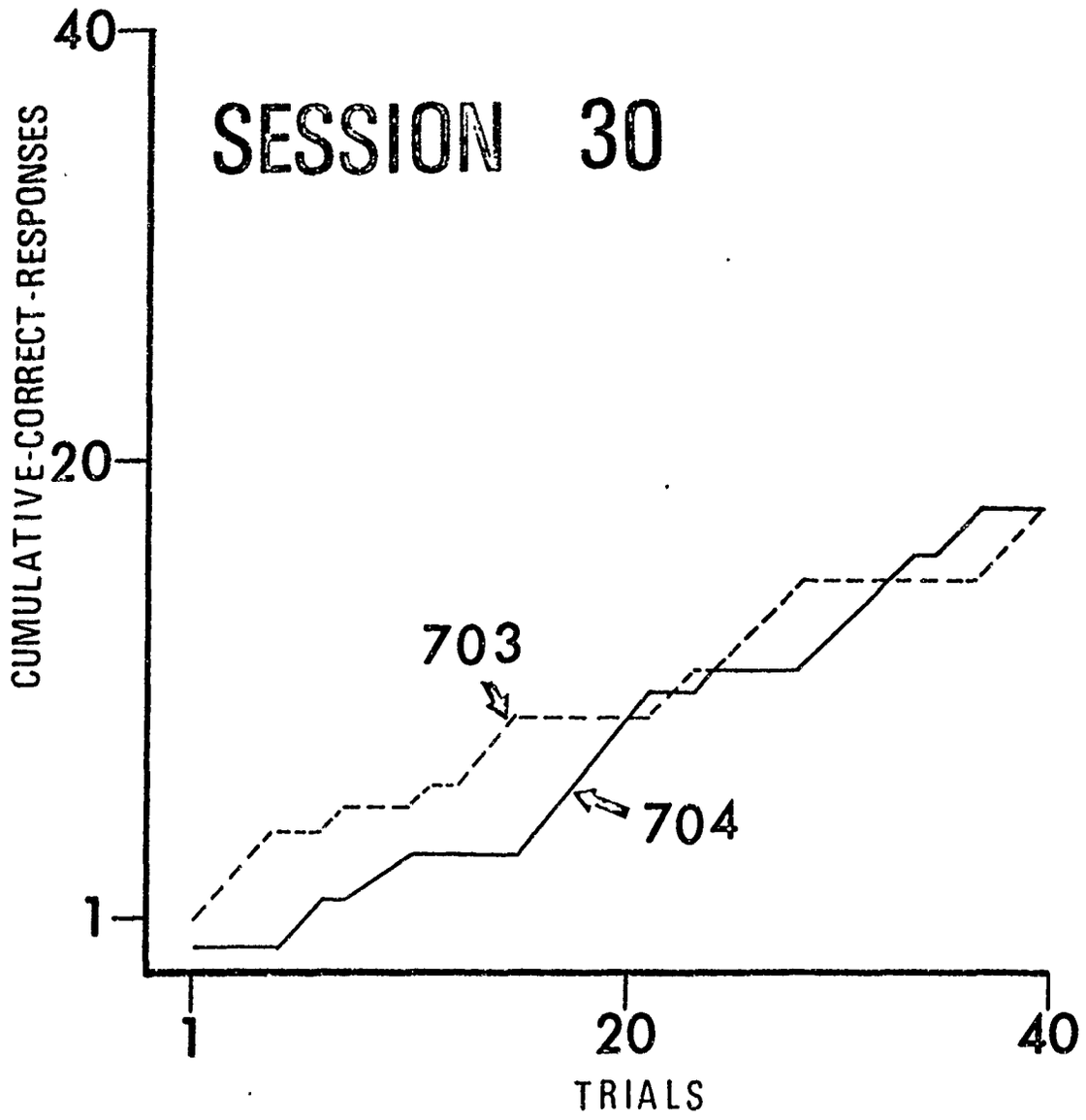
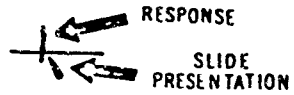
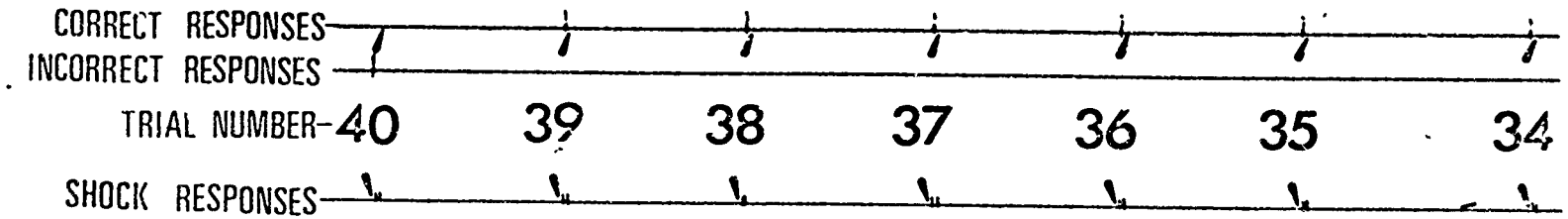

SESSION 30
CUMULATIVE-CORRECT-RESPONSES
40
20
1
703
704
1
20
40
TRIALS

FIGURE 6



S 702

SESSION 34



SESSION 36

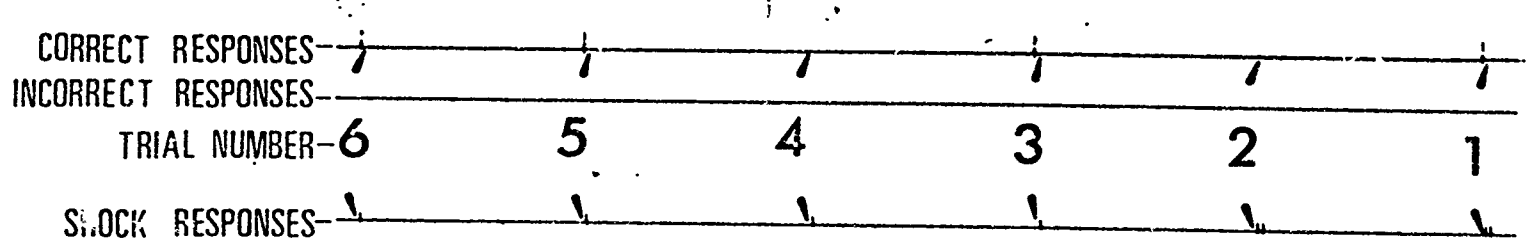
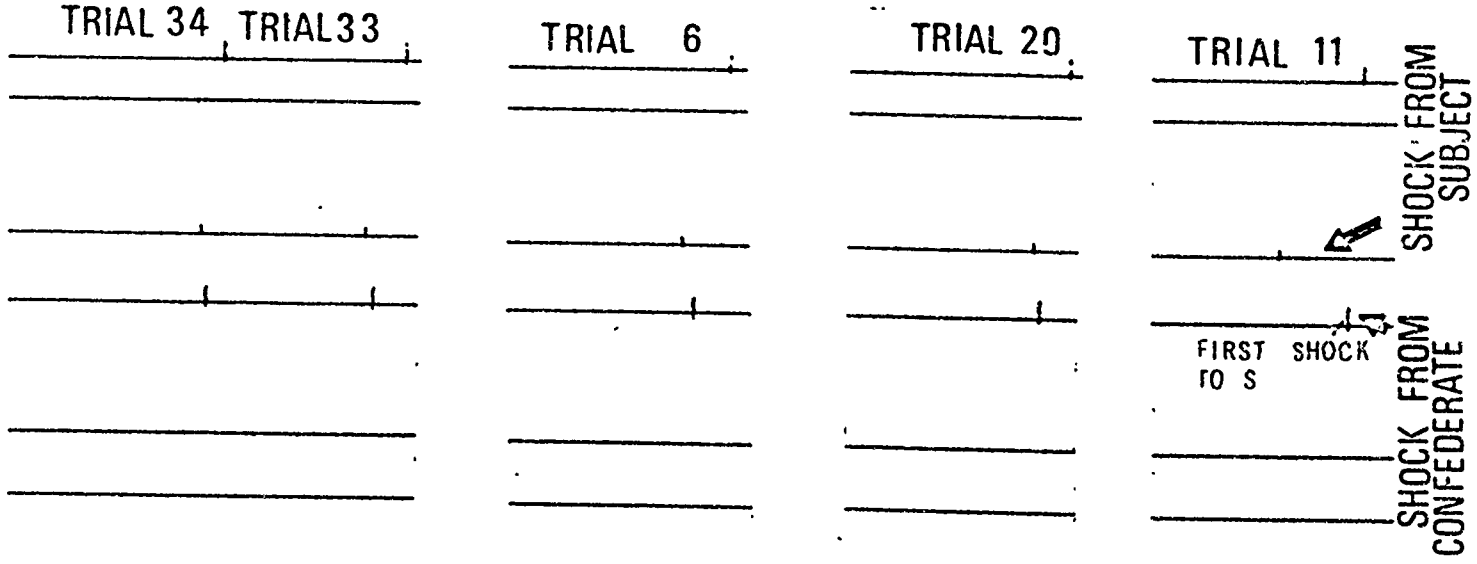


FIGURE 7

S 706



⟸ ORDER OF EVENTS

FIGURE 8

REFERENCES

Ayllon, T., and Haughton, E. (1962), Control of the behavior of schizophrenic patients by food. J. Exp. Anal. Behav., 5, 343-352.

Azrin, N.H., Hake, D.F., and Hutchinson, R.R. (1965) Elicitation of aggression by a physical blow. J. Exp. Anal. Behav., 8, 55-57.

Azrin, N.H., and Lindsley, O.R. (1965) The reinforcement of cooperation between children. J. Abnorm. Soc. Psych., 52, 100-102.

Baron, A., Kaufman, A., and Stauber, K.A. (1969) Effects of instructions and reinforcement feedback on human operant behavior maintained by fixed interval reinforcement. J. Exp. Anal. Behav., 112, 5, 701-712.

Berkowitz, L. (1962) Aggression: A Social Psychological Analysis: New York: McGraw Hill, 178-185.

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

Cohen, D.J. and Lindsley, O.R. (1964) Catalysis of controlled leadership in cooperation by human stimulation. J. Child. Psychol. Psychiat., 5, 119-137.

Hingtgen, J.N., and Trost, F.C., Jr. (1964) Shaping cooperative responses in early childhood schizophrenics: II. Reinforcement of mutual physical contact and verbal responses. In R.E. Ulrich, T. Stachnik, and J. Mabry, (Eds.) Control of Human Behavior. Glenview, Illinois: Scott, Foresman and Company, 1966, 110.

Hingtgen, J.N., Sanders, B.M., and DeMeyer, M.K. (1965) Shaping cooperative responses in early childhood schizophrenics. In L. Ullmann and L. Krasner, (Eds.) Case Studies in Behavior Modification. New York: Holt, 130-138.

Keller, F.S. and Schoenfeld, W.N. (1950) Principles of Psychology. New York: Appleton-Century-Crofts, 352-397.

Lindsley, O.R. (1961) Experimental analysis of cooperation and competition. Read in part in a symposium on S-R Modes of Social Interaction, Eastern Psychological Association, Philadelphia, April 8. In T. Verhave (Ed.) The Experimental Analysis of Behavior. New York: Appleton-Century-Crofts, 1966.

Lubow, R.E. and Stevens, E. (1964) A technique for automatic, recycled, serial presentation of up to 80 unique visual stimuli. J. Exp. Anal. Behav., 7, 1, 50.

McDavid, J W. and Harari, H. (1968) Social Psychology: Individuals, Group, Societies. New York: Harper, Row Publishers, Inc., 225.

Scobie, S.R. and Kaufman, A. Intermittent punishment of human responding maintained by intermittent reinforcement. J. Exp. Anal. Behav., 12, 1, 137-148.

Skinner, B.F. (1962) Two synthetic social relations. J. Exp. Anal. Behav., 5, 4, 531-533.

Skinner, B.F. (1953) Science and Human Behavior. New York: Macmillan, 311.

Thibaut, J.W., and Faucheux, C. (1965) The development of contractual norms in a bargaining situation under two types of stress. J. Exp. Soc. Psychol., 1, 89-102.

Ulrich, R.E. (1965) Disruptive effects of aggression. Paper read at American Psychological Association, Chicago.

Ulrich, R.E. and Azrin, N.H. (1962) Reflexive fighting in response to aversive stimulation. J. Exp. Anal. Behav., 5, 511.

Ulrich, R.E. and Favell, J. (1968) Human Aggression. In Neuringer and Michael's Behavior Modification in Clinical Psychology, New York: Appleton-Century-Crofts. In press.

FOOTNOTES

[1]The investigator wishes to express his sincere appreciation to Drs. Jack Michael and Frank Fatzinger for their cooperation, advice, and constructive criticism concerning the present study. I am particularly grateful to Dr. Roger E. Ulrich for his invaluable guidance and encouragement in the completion of this investigation. Without his efforts and support, the opportunity for this research would not have occurred.

Special thanks are owed to John Wolflin for his aid in conducting this study; and to the entire staff at the Behavior Research and Development Center at Western Michigan University.

Special mention is to be given my wife, Musette, whose support and encouragement were of great value in this endeavor.

This research was supported by a Naval Research Grant to Dr. Roger Ulrich, Contract Number N00014-67-A-0421-0001, NR 171-807.

UNCLASSIFIED
Security Classification

DOCUMENT CONTROL DATA - R & D

Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1 ORIGINATING ACTIVITY (Corporate author)	2a. REPORT SECURITY CLASSIFICATION
Western Michigan University Kalamazoo, Michigan 49001	Unclassified
	2b. GROUP

3 REPORT TITLE

An Experimental Analysis of Human Social Behavior in a Competitive Situation With the Opportunity for Aggression

4 DESCRIPTIVE NOTES (Type of report and, inclusive dates) An exploration of human social response patterns in a competitive situation with the opportunity for aggression.

5. AUTHOR(S) (First name, middle initial, last name)

William A. Michael

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
	51	20

8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)
N00014-67-A-0421-0001, NR 171-807	
b. PROJECT NO.	
c.	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)
d.	

10 DISTRIBUTION STATEMENT

Distribution of this document is unlimited

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
	Office of Naval Research Group Psychology Branch, Code 452 Washington, D. C. 20360

13. ABSTRACT

By manipulating only the reinforcement contingency, it was possible to examine the emergent social properties of the behavior of six college males performing on a discrimination task. All subjects were given the opportunity for aggression while they performed individually (nonsocially) and competitively (socially) in pairs. Social and nonsocial conditions, and the dependent measures of each, were compared. Results indicated that the competitive conditions provided differential reinforcement for quantitative response characteristics. Little or no aggressive behavior occurred under either condition. Competitive conditions failed to produce sustained mutual competitive strategies, but complex cooperation and conflicting strategies were exhibited.

The effects of being the target of competitor aggression were then examined by employing an experimental confederate as the competitor. Half of the subjects responded aggressively under this condition. Non-aggressive subjects remained non-aggressive under conditions of (1) significantly increased losses; (2) high frequency of non-contingent competitor aggression; and (3) increased intensity of non-contingent competitor aggression.

DD FORM 1 NOV 65 1473 (PAGE 1)

S/N 0101-807-6811

Security Classification

A-31408

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Competition Aversive Aggression Shock Cooperation Reinforcement						