consistent with the framework set by contagion theory. When B was a noninstigator, his opinions would have served to evoke a rewarding response by the O in the absence of an aggressive model. Aggression by a model to a noninstigated opinion caused Ss to reward the opinion-giver less than would be expected in a no-model condition. It was evident that Ss' reinforcement of the opinion-giver was approximately half-way between the aggressive model's mean reinforcement (-2) and the probable reinforcement given by the naive S. In terms of approach-avoidance gradients conceived by Wheeler's theory of contagion (1966), these results became reconcilable within the definition of conformity. Because the avowed purpose of the study was to reach group accord, it seemed reasonable to assume a tendency toward group cohesion on the part of the Ss. Consistent with Wheeler's definition of conformity, aggression by a model to a noninstigating opinion served to introduce conflict *after* the model's response rather than having the model reconcile a conflict as in the contagion situation. The resultant reinforcement by the Ss was a reinforcement half-way between that expected of a naive S and the aggressive model.

In the condition C reward and B noninstigate, it seemed unlikely that any conflict resulted and the mean reinforcement score would have changed little in the absence of the model.

In the condition B instigate and C reward, the resultant response by S would seem to be some combination of inhibitions to aggression, upheld by a rewarding model, and the height of the approach gradient to aggression. Further research is necessary to determine the extent of model influence.

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NOTES

1. This research was supported by the Undergraduate Research Participation Program of the National Science Foundation, Grant GY-2712. The author is indebted to Sidney J. Arenson, Charles F. Schmidt, and Irwin P. Levin for their aid in completing the present study.

2. Author is now at the University of Wisconsin.

Fig. 1. Mean reinforcement scores for model aggressing or model rewarding with one or four reinforcements.

Reward schedule, response measure, and attentional deficiency: A reanalysis¹

PETER WATSON, Trent University, Peterborough, Ontario, Canada

Part of the data of a previously published experiment were reanalyzed in order to determine whether an attentional deficiency, defined in terms of mental age (MA), would influence the superiority of partial reward relative to continuous reward. It was hypothesized that low-MA retardates, if they are deficient in an attentional process as postulated by some theorists, would not demonstrate a difference between 50% and 100% reward schedules in performance of a starting speed response, which presumably involves a large attentional component. Differences in favor of 50% reward were predicted for the low-MA Ss on a movement speed response, which does not involve attention, and for the high-MA Ss on both starting and movement speeds. Results of the reanalysis confirmed these predictions, and supported the theoretical assumptions underlying them.

Several studies with young children (see Ryan & Watson, 1968) have shown that partial reward for a discrete-trial lever-pulling response leads to faster performance than is the case for continuous reward. The superiority of partial relative to continuous reward has been attributed to the operation of frustration-produced motivation (see Amsel, 1958; Spence, 1960, Chap. 6). One difficulty with this body of evidence is that the partial-continuous difference has generally been obtained on only one of the two response measures usually employed. The author has recently in this journal presented evidence (Watson, 1968) suggesting that the type of reward employed may determine in part which response measure will show the partial-continuous difference, and indicated the need for more information concerning the various psychological processes involved in the two response measures. The present paper represents an attempt to clarify the nature of these measures, by means of a reanalysis of data presented previously in

this journal (Watson, Ryan, & McEwan, 1967).

The response measures used in the studies cited above have been: (a) "starting speed," the reciprocal of the time from onset of a "start" signal (usually a light) to the initial movement of a lever; and (b) "movement speed," the reciprocal of the duration of the lever movement itself. The starting speed response may be conceived as involving both perceptual, or attentional, and motor components, while the movement speed response consists mainly of a large motor component. It is broadly hypothesized that differences in sensitivity of the two response measures to different reward schedules are a function of the different processes involved in the measures. It follows from this hypothesis that Ss who are deficient in an attentional process should not demonstrate a difference in performance between partial and continuous reward on starting speed, which has a large attentional component; conversely, Ss who are relatively less deficient should demonstrate partial-reward superiority on this measure. On movement speed, which does not involve an attentional component, both deficient and nondeficient Ss should respond faster under partial reward than they do under continuous reward.

Two problems are involved in a test of these predictions. The first is that of identifying or defining Ss who are or are not deficient in the attentional process. Zeaman & House (1963), in a series of experiments on retardates' discrimination learning, found that the learning process was essentially two-phased: (a) an initial period of chance-level responding during which, they assumed, Ss were learning to attend to relevant cues, and (b) a second period characterized by an increase in the number of correct responses from the chance level to near-perfect responding. High- and low-MA Ss did not differ in the second phase, i.e., in the rate at which they approached asymptote; they did differ in the length of the initial phase. Low-MA Ss took considerably longer than the high-MA Ss to learn to attend to the relevant cues; Zeaman and House postulated that low-MA Ss suffered from a deficiency of an attentional process, relative to the high-MA Ss. On this basis, MA was selected in the present paper as defining relatively deficient and nondeficient Ss.

The second problem involves the need for statistical comparison of the two response measures. Starting speed and movement speed are not, *per se*, comparable. The method used in the present study to compare the two measures was that of transforming all starting speeds and all movement speeds to standard scores with a common mean and standard deviation; starting speed and movement speed were

then employed as two levels of a within-Ss variable response measure.

Data from the Watson et al (1967) study were selected for reanalysis because MAs were available on all Ss. In this experiment, mentally retarded Ss were assigned randomly to six experimental groups. Ss were then given a series of 60 lever-pulling trials during which they received either continuous nonreward (0%), partial reward (10%, 30%, 50%, or 70%), or continuous reward (100%). Rewards were marbles which were later exchanged for candy; response measures were starting and movement speed as described above. The results indicated that for both response measures the performance of the partial-reward groups improved as training progressed, while the 0% and 100% groups showed no change as a function of training. The authors suggested that non-attainment of expected rewards in the partial-reward groups produced frustration and thus increased motivation. Motivation, and hence performance, in the 0% and 100% groups, which, respectively, had no expectancy of reward and no nonreward, was lower than in the partial-reward groups.

The data of the 50% and 100% groups of the Watson et al (1967) study were selected to test the general hypothesis advanced in the present paper. The specific predictions were: (1) For high-MA Ss, 50% reward would lead to increasingly faster starting and movement speeds relative to 100% reward. (2) For low-MA Ss, 50% reward would lead to increasingly faster performance relative to 100% reward, for movement speed but not for starting speed.

SUBJECTS AND DATA TREATMENT

The 50% and 100% groups of the Watson et al (1967) experiment consisted of 18 and 19 Ss, respectively. One S in the 100% group was randomly discarded in order to equate the number of Ss per group. The groups were then divided into high- and low-MA subgroups using a cutting point of MA = 80 months. The subgroups were as follows: (a) 50%-High MA (N = 9, mean MA = 99.5 months, range = 80-124 months); (b) 100%-High MA (N = 9, mean MA = 101.9 months, range = 83-129 months); (c) 50%-Low MA (N = 9, mean MA = 62.6 months, range = 36-79 months); and (d) 100%-Low MA (N = 9, mean MA = 58.9 months, range = 39-78 months).

For each of the 36 Ss, six blocks of 10 starting-speed trials and six blocks of 10 movement-speed trials were available. The starting-speed and movement-speed distributions were converted to standard scores based on their respective means and standard deviations; these two standard score distributions were then transformed into comparable sets of scores with means of 10.0 and standard deviations of 2.0. The

Fig. 1. Mean response speed as a function of MA, reward schedule, response measure, and blocks of 10 trials.

resulting transformed scores were then submitted to a 2 by 2 by 2 by 6 analysis of variance, with MA (Low MA vs High MA) and reward schedule (50% vs 100%) as between-Ss variables, and response measure (starting speed vs movement speed) and blocks of 10 trials as within-Ss variables.

RESULTS

The only significant main effect obtained in the initial analysis was that for trial blocks ($F = 12.33$; $df = 5, 160$; $p < .01$), which was attributable to a general increase in response speed as training progressed. Two of the two-way interactions were significant: (a) Blocks by MA ($F = 3.40$; $df = 5, 160$; $p < .01$), due to an initial difference in performance, in favor of the high-MA Ss, which decreased until about the middle of training and then increased again; and (b) Blocks by Reward Schedule ($F = 7.96$; $df = 5, 160$; $p < .01$), due to the initial inferiority but later superiority of the 50% groups relative to the 100% groups. Finally and, from the point of view of the present hypotheses, most importantly, the four-way interaction between MA, reward schedule, measure, and trial blocks was significant ($F = 4.69$; $df = 5, 160$; $p < .01$). Figure 1 presents the data involved in this interaction. For all but the starting speeds of the low-MA Ss, 50% reward appeared to produce faster responding than 100% reward.

In order to clarify this four-way interaction, the data for the high- and low-MA Ss were analyzed separately, in terms of reward schedule, measure, and blocks. For high-MA Ss, both the blocks

main effect ($F = 7.82$; $df = 5,80$; $p < .01$) and the Blocks by Schedule interaction ($F = 3.11$; $df = 5,80$; $p < .05$) were significant; none of the effects involving measure attained significance. For the low-MA Ss, in addition to the blocks main effect ($F = 7.92$; $df = 5,80$; $p < .01$) and the Blocks by Schedule interaction ($F = 5.31$; $df = 5,80$; $p < .01$), the Blocks by Measure by Schedule interaction attained significance ($F = 3.94$; $df = 5,80$; $p < .01$). Subsequent analyses in terms of blocks and reward schedule, performed separately for the starting speeds and movement speeds of the low-MA Ss, indicated a significant Blocks by Schedule interaction ($F = 8.02$; $df = 5,80$; $p < .01$) for the movement speed data only; the corresponding interaction for starting speed was not significant ($F = 1.53$; $df = 5,80$; $p > .10$).

DISCUSSION

The major results of the reanalyses of the Watson et al (1967) data may be summarized briefly as follows: (a) for high-MA Ss, asymptotic partial-reward superiority was evident on both starting speed and movement speed; (b) for low-MA Ss, asymptotic partial-reward superiority was evident on movement speed but not on starting speed.

These results confirm in full the predictions detailed earlier in this paper, and support the notion that an attentional factor is operative in the starting response but not the movement response. They further suggest that an attentional deficiency eliminates the performance increment resulting from nonreward, when the response in question has a large attentional component. The present data do not permit determination of whether the attentional deficiency results in (a) decreased reactivity to frustrative nonreward, (b) a relative failure to establish the reward expectancy which is assumed to underlie frustrative nonreward, or (c) both. Further research should be directed toward this question.

A second implication of these findings is that frustration can be specific to one of several contiguous responses (see Watson, 1968). The difference in performance between partial and continuous reward may be thought of as due either to primary frustration, which persists from a preceding trial to a subsequent trial, or to conditioned frustration, which is elicited at the beginning of a trial. In the case of the low-MA Ss of the present paper, who demonstrated the 50%-100% difference on movement but not starting speed, it is evident that conditioned rather than primary frustration was responsible, since primary frustration would have elevated both the starting and movement speeds of the 50% group.

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NOTE

1. Preparation of this report was facilitated by National Research Council of Canada Grant No. APA-250. The author is grateful to D. R. Pederson who provided computer facilities.

The effects of cognitive processes on skin conductance reactivity to an aversive film¹

DAVID C. GLASS, *Russell Sage Foundation and The Rockefeller University, New York, N.Y. 10017*, and PATRICIA MAYHEW, *Columbia University, New York, N.Y. 10027*

Two experiments tested the proposition derived from the theory of cognitive dissonance that attenuation in skin conductance response to a stressor film would be greatest where the individual voluntarily commits himself to watching the film, and makes the discrepant commitment under conditions of low rather than high justification. Experiment 1 showed that skin conductance was indeed less in the dissonance conditions than in a no-dissonance control condition, and Experiment 2 provided partial replication of these results. In both studies, however, the justification manipulation failed to exert a differential impact on skin conductance.

Recent experiments (e.g., Lazarus & Opton, 1966) suggest that under certain conditions cognitive processes may substantially reduce autonomic reactivity to an aversive motion-picture film. In an experiment testing predictions from the theory of cognitive dissonance, Zimbardo and his colleagues (1966) have also shown that experimentally induced cognitions alter physiological response to stressful stimuli. They report that when Ss are given minimal justification for voluntarily agreeing to experience electric shock during a serial learning task, marked decrements in phasic skin resistance occur from before commitment to after it.

The present research represents a further test of the general proposition that cognitive dissonance can limit autonomic reactivity. It examines the physiological effects of inducing a person to commit himself voluntarily to watching a stress-arousing

film. If the person makes such a choice, dissonance theory predicts lower skin conductance than in a control condition where he is given no choice about seeing the film. The theory also predicts lower reactivity where the S is given few as compared with many justifications for his voluntary commitment.

EXPERIMENT 1

Subjects and Method

Subjects were 47 paid male undergraduates from Columbia University, New York University, and the City College of New York.

Subjects were tested individually in a two-phase experimental session. After the recording of base-level skin conductance, Ss watched a 6-min film clip of a movie called "Subincision," which depicts crude surgical operations used in the puberty rites of an Australian aboriginal tribe (Lazarus & Opton, 1966). When the clip was over, Ss rated the film's unpleasantness on a 51-point scale ranging from 1 ("Not at all unpleasant") to 51 ("Extremely unpleasant").

Subjects in the dissonance conditions were led to believe that the experiment ended with the rating scales. However, as they were preparing to leave, they were asked to volunteer for a second study which involved "viewing a longer, 17-min version of the Subincision film." Half of these Ss (low dissonance condition) were given a variety of reasons for staying; for example, their participation would "make substantial contributions to behavioral science and government programs in biomedical research." The high dissonance Ss were given only minimal justifications before making their choice. Next, Ss were explicitly asked if they would remain for the second study. Only five Ss refused, leaving 10 cases in each of the two dissonance conditions. After the 17-min film was shown, Ss rated its