

The high cost of reward in task productivity

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In an examination of social exchange propositions, rewards and costs were manipulated in a 2 by 2 factorial design. Twenty-four groups of three boys (ages 9-11) played a game under conditions of high or low cost and high or low reward. Reward interacted with cost in affecting productive behavior, a finding inconsistent with social exchange theory. The concept of equivalence is proposed as a theoretical modification where equivalence describes behavioral outcomes as a function of the interaction of rewards and costs.

Among the several theories postulated to account for behavior in the social system, one of the most interesting and influential is social exchange theory. There have been several forms of social exchange theory developed in recent years (Thibaut & Kelley, 1959; Homans, 1961; Blau, 1964), all with certain propositions in common. The basic metaphor for exchange theory is economic, with the outcomes or consequences of behavior considered as profit and loss, and the elements of this interaction being rewards and costs.

Reward refers to all the aspects or consequences of an activity that have value for the person. The greater the value or the more units of value, the greater the reward. The cost involved in any activity is the value of potential rewards obtainable through some alternative activity forgone (Homans, 1961). Punishment, fatigue, and effort all have more attractive alternatives and are, therefore, part of the total cost incurred in an activity.

The relationship between behavior and reward/cost factors is expressed by the definition of profit expressed as the algebraic sum of reward and cost: reward - cost = profit. If the reward value outweighs the cost value, the outcome is termed profit. If cost outweighs reward, the outcome is termed a loss. The outcome of any voluntary interaction must be profitable to all concerned for the activity to continue. As profit increases or decreases, the probability and rate of continued behavior increases or decreases correspondingly. Exchange theory thus stated involves several assumptions that warrant closer examination: (1) Man behaves to maximize profit. (2) Rewards and costs are independent factors. (3) Cost is always a negative factor that inhibits behavior.

UTILITY

The economic model of man in exchange theory involves an important assumption; man always behaves to maximize utility where utility is defined as the choice of behavioral alternative with greatest rewards and least cost. In Homans's terms, man behaves to maximize profit.

The simple view of utility has not been clearly substantiated, however. In experiments on information seeking, for example, individuals did not always seek information, even when it involved no cost and would clearly lead to greater payoff (Lanzetta, 1963). Baron (1966, 1968) has offered a model and some data supporting the contention that the value and consequent utility of rewards be considered within a relative framework rather than in terms of absolute value. The most preferred rewards (and thus most effective reinforcers) are those that are relatively consistent with past rewards for a given behavior. This social reinforcement standard (SRS) implies that both very high and very low rewards may be less reinforcing than rewards consistent with expectations. Furthermore, rewards not consistent with past reinforcement history may even be inhibiting factors.

Thus, from the viewpoint of the observer, man does not always behave to maximize utility or in the most profitable manner.

REWARD AND COST

Since profit is the algebraic sum of rewards and costs, exchange theory assumes that rewards and costs are independent cognitive judgments where one can vary without influencing the other. While rewards and costs have often been manipulated separately, there has been some empirical work that questions the generality of this assumption.

Lewis (1965) reports several studies which indicate that effort can affect the value or valence of a reward. Similarly, the concern of cognitive dissonance researchers with insufficient reward has yielded results both consistent and inconsistent with this assumption. In some instances insufficient reward will lead to the discontinuation of the effortful activity, but, in other cases, additional value will be attributed to the activity or its goal (Festinger & Aronson, 1960). These factors are therefore not independent because increasing the cost relative to the reward may change the reinforcing nature of the situation (e.g., by demanding greater effort). This problem has two implications; cost may not always

inhibit behavior, and the concept of reward cannot be considered independently of the concept of cost.

Thus, the relationship between reward, cost, and profit is probably more complex than generally assumed in an exchange framework. A simple task situation was designed to test the following hypotheses: (1) The behavioral consequences of reward are dependent on the relative level of cost; (2) cost does not necessarily inhibit behavior rate but will inhibit or facilitate behavior rate, depending on the relative level of reward; (3) the behavioral consequence (productivity) is not a linear function of profit.

METHOD

The experiment was a 2 by 2 factorial design with two levels of reward and two levels of cost. The dependent variable was the amount of time required to complete the task. The levels of the independent variable (reward and cost) were: (1) High cost (HC)—A valuable alternative forgone. HC groups had volunteered to give up their recess or part of their lunch hour in order to take part in the experiment. (2) Low cost (LC)—No valuable alternative forgone. The LC groups were assigned by their teacher and tested during class time. No boys were assigned during special activities, such as art or free reading time, to minimize the possibility of taking a boy away from a highly valued classroom activity. (3) High reward (HR)—The choice of a dime, 15 marbles, or a comic book given at the completion of a task. HR groups were told at the onset of the task what their reward would be. (4) Low reward (LR)—LR groups were told only that they had completed the task correctly. No praise or material reward was given.

All four experimental conditions, HR-RC, HR-LC, LR-HC, and LR-LC, consisted of six groups of three boys. Each condition consisted of the completion of three tasks; the mean time required to finish the task was the dependent measure for each group.

SUBJECTS

Ss were 96 boys, aged 9-11 years, from an elementary school in New Hampshire. The boys participated in groups of three, six groups for each experimental condition.

PROCEDURE

The task was a simple table game that required the cooperation of three Ss to complete each game or task. One colored

Table 1
Mean Time (Seconds Per Trial)
to Task Completion

Cost	Reward	
	High	Low
High	132.82	154.42
Low	140.28	146.47

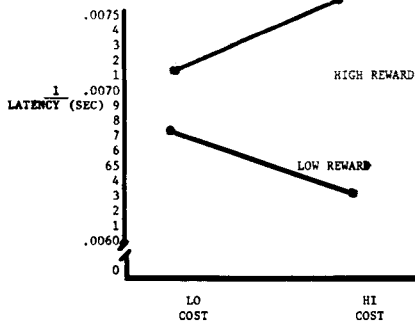


Figure 1
REWARD-COST INTERACTION: SIMPLE MAIN EFFECTS

ball at a time was ejected from an automatic dispenser at the head of a table. Each S was assigned a color (red, white, or green), and the task required that each S grab the ball of his color, place it in a slot in front of him, and pull a lever. The lever operated the mechanism that dropped the previous ball down into a collecting basket and released a new ball at random from the dispenser. Each task was completed when all 18 balls (6 of each color) had been caught and dropped into the collecting basket.

After each trial was finished, the boys were given a reward appropriate for that condition.

RESULTS

Data analysis by analysis of variance indicated a significant main effect for reward ($F = 17.62, p < .01$). The high reward conditions yielded a faster rate of task completion than low reward conditions. Table 1 shows the mean time to completion for the reward and cost conditions.

More importantly, there was a significant interaction between reward and cost levels ($F = 4.77, p < .05$). Time to completion was dependent on the relative levels of rewards and costs. An examination of the simple main effects indicated that the rate of task completion was faster under conditions of low reward/low cost than under low reward/high cost. This is consistent with general social exchange predictions. Under conditions of high reward, however, performance was faster when coupled with high cost than with low cost. These effects are plotted in Fig. 1.

These results indicate that the relationship of reward and cost to behavior is more complex than is assumed by social exchange propositions.

DISCUSSION

The results supported the hypothesis that the behavioral consequences of reward are dependent on the relative level of cost and that cost does not necessarily inhibit

behavior but will inhibit or facilitate behavior rate, dependent on the relative level of reward.

Reinforcement is a construct to describe the circumstances that increase the probability or rate of specific behavior. Reinforcement, as used in this analysis, is not a specific thing or event but a construct that describes the behavioral consequences of an entire set of stimuli upon response rate. Reward is an object or event that has value for the person; the reinforcement level is the degree or direction of change in response rate of the rewarded behavior. Rewards do maintain and shape behavior under most conditions, and this phenomenon is described as reinforcement. Our results indicated that the behavioral consequences (i.e., reinforcement) of reward and cost factors are more complex than expressed by the profit concept.

Other lines of research have also demonstrated complex relationships between rewards, costs, and behavior. These fall into personalistic and situational groupings.

Baron (1966) introduces a personalistic consideration by demonstrating the relevance of the past history of rewards. The person established reward expectancies that determine preferred levels of reward, and behavior may be orientated toward maintaining this preferred level. Gergen (1969) wrote of the necessity for social approval to be personalistic (i.e., be contingent on the person's own behavior) in order to operate as an effective reinforcer of behavior. The cognitive dissonance work indicates the relevance of personal effort and commitment in establishing both satisfaction and behavior patterns.

Situational factors have also been related to the behavioral consequences of rewards and cost. Aronson & Linder (1965) and Sigall & Aronson (1969) varied the sequence of rewards and punishment and found that a negative-to-positive sequence elicited more attraction and behavior change than an all-positive sequence. The positive-to-negative sequence elicited less attraction and behavior change than did the all-negative sequence. The order of presentation was behaviorally more significant than the total amount of rewards or punishments. Gergen (1969) referred to a possible "optimal state" for reward level that is set by cultural values. Thus, the "value" of a given reward could be dependent on cultural or subcultural norms.

Both personalistic and situational factors demonstrate the complex relationship between rewards, costs, and the behavioral consequences; to be adequate, exchange

theory must account for these.

Equivalence

The following model is a descriptive modification exchange theory, altering the assumptions that the behavioral consequences of cost and reward are independent or that cost is a necessarily inhibiting factor.

The reinforcement level (i.e., the degree to which it shapes and maintains behavior) for any reward object or event is assumed to be on a continuum. Thus, any specific reward would have different behavioral consequences, depending on circumstances. In exchange theory the next most critical input factor is cost. This model is an attempt to describe a hypothetical relationship between reward and cost levels and the resulting reinforcement level.

For any specific reward or level of reward, a relative level of cost that results in the maximum reinforcement level. As cost is raised or lowered from this point, the given reward level has fewer behavioral consequences. This ideal cost/reward ratio is termed equivalence.

Equivalence is the point where the relationship of cost and reward are such that the individual gets the reward level that he has learned to expect under similar cost circumstances. Thus, the higher the value of the expected reward, the higher the cost or input necessary for the reward object to have maximum reinforcement properties. Reward and cost are postulated as equivalent in a subjective sense—the expected or deserved amount of reward for a given input or cost. This is an empirical question, and cost/reward relationships to behavior can be tested.

As the reward/cost complex deviates from equivalence, the reinforcement level of the reward object decreases (see Fig. 2). As cost becomes disproportionately high, reinforcement properties drop off quickly and finally reach a point where the activity

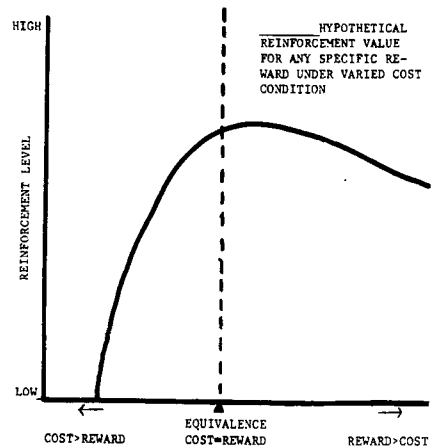


FIGURE 2

EQUIVALENCE RELATIONSHIPS

is too costly and the individual ceases the behavior. As the cost becomes disproportionately low for the reward, reinforcement properties fall off, but we assume more gradually than with an increase in cost. The reinforcement level might never go to zero on the $R > C$ side. An empirical study of two or three reward objects or events under a range of cost conditions would generate representative curves of the population of potential reinforcement levels around each reward under specific cost conditions.

If the relationship between reward-cost levels and behavior is more complex than a simple algebraic summation, as our results suggest, the basic propositions of exchange are not adequate to account for ongoing behavior. The concept of equivalence is proposed as a construct relating the relative, as well as the absolute, levels of reward and cost and their interaction.

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1960; Jaffee & Furr, 1968; McNair, 1957; Oakes, 1962; Oakes et al, 1960, 1961; Sidowski, 1954; Zdep & Oakes, 1967), while at the same time punishing specific responses results in a decrease in their subsequent occurrence (Bachrach et al, 1961; Cieutat, 1959; Oakes et al, 1960).

It would seem then that the consistencies noted concerning the verbal conditioning of individuals apply equally as well for the small-group situation. The relationship between verbal conditioning and leadership was evident in studies by Aiken (1965), Bales (1950), Bass (1954), Bavelas et al (1965), Jaffee & Lucas (1969), Riecken (1958), and Zdep & Oakes (1967), in which group members rated those who spoke the most as the leaders of the group. Duration of speech in a group situation, then, has been shown to be an important aspect of leadership, at least, with regard to other group members' impressions.

One of the factors that has been ignored in the literature to date is the number of group members reinforced or punished within one group. Until now, in all of the experiments reported, only one member per group has been conditioned.

The question that is explored by the present study is: What is the effect of an increase in the number of leaders in a group-interaction situation?

METHOD

One hundred and twenty experimentally naive male students enrolled in the introductory psychology classes at the University of Tennessee were divided into 30 groups of four students per group. Three treatments were used: one with one reinforced S (1TP), one with two reinforced Ss (2TP), and one with all reinforced Ss (4TP), with 10 groups in each.

Each group was seated around a table in a room separated from a control room by a one-way mirror. A signal box (through which the E was able to reinforce) was placed in front of each S. The signal boxes contained two lights, one green and one red, visible only to the one particular individual seated before it. Only the green light was used for reinforcing group members for verbal participation. A microphone was placed on the table through which the Ss' discussions were monitored by the Es in the adjoining room. For a more detailed description of the experimental setting, see Jaffee & Lucas (1969).

The experiment consisted of three different sessions given successively. The Ss were instructed that the E was interested in assessing group behavior and interaction when they were faced with discussion problems of varying complexity. The first

The effects of varying the number of conditioned leaders on group problem solving

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One hundred and twenty student Ss were divided into 30 four-man groups. The independent variable was the number of persons reinforced for verbal output in a group problem-solving situation. In 10 groups, only one person was reinforced; in 10 others two persons were reinforced; and in another 10 groups, all four persons were rewarded for their verbal participation. The dependent variables investigated were the amount of time necessary for solution of the problems and the total number of conflict remarks generated during those sessions. The results indicate that the 2TP groups took significantly longer to come to solution of the problem than either of the other two conditions. The number of conflict remarks, however, did not discriminate among treatments. The evidence suggests that the probable cause of the 2TP groups' poor performance is due to the significantly greater number of conflict statements generated by the initial high talker than were in the other two treatments.

Systematic observation of group behavior and the leader's place in the group have been widespread, but the variables altered have been, for the most part, group factors such as size, degree of homogeneity, task, etc. Little had been done with experimentally manipulating the overt verbal behavior of a person until Greenspan (1955) reported his now-classic experiment in verbal conditioning, in which he was able to

verbally reinforce Ss for particular speech categories. His experiment led to a good deal more research in the area of verbal conditioning and seems to have been the major impetus for an even more recent area of investigation concerning the conditioning of individuals within groups. Several authors have found that upon reinforcing the verbal output of a S in a group, an overall increase results (Bavelas et al, 1965; Cohen et al, 1954; Dinoff et al,