Effect of monetary rewards on an insight learning task

CARL R. VIESTI, JR.
University of Victoria, Victoria, B.C., Canada

On an insightful learning task, Ss did not perform significantly different in pay and no-pay situations. Increasing the amount of money did not affect the results. Performance was significantly affected only by prior experience with materials involved in the task. These results indicated that insightful performance by humans can be facilitated by increasing familiarity with the task but not by presentation of external rewards.

A variety of sources (e.g., Edwards, 1954; Edwards, Lindman, & Phillips, 1965; Kogan & Wallach, 1967; Rapaport, 1966) indicate that there is need for more information about the psychological aspects of human performance for money.

In general, monetary payoffs may be involved in two classes of decision situations. The first is a riskless situation in which the S may win, but not lose, money. The second is a risk situation in which the S may both win and lose money. In formal game theory, when payoffs conform to an interval scale, they are designated as "utilities" (Rapaport, 1966). According to this theory, there is an assumption that, regardless of the qualitative and quantitative aspects of the payoff, Ss will always strive to maximize their earnings. Naturally, this mathematical model ignores such variables as motivation and personality factors. Introducing such variables leads to a modification of the meaning of utility, which now may be defined as "subjective value" or "value in use" (Edwards et al, 1965).

Kogan & Wallach (1966) examined studies which involved monetary payoffs. On the basis of their efforts, they found that it was difficult to draw conclusions, since most of the studies were not directly comparable. However, they did state that increasing the magnitude of incentives seemed to increase the conservatism of Ss in decision making. Among the characteristics of these studies were: no feedback regarding outcomes until all choices were made; employment of relatively small monetary utilities; and the use of more or less familiar stimulus materials in the experiments.

The present study attempted to examine the effect of monetary utilities in a riskless situation on an insight learning task. Thus, the study was similar to those above, inasmuch as the no-feedback situation prevailed. It differed from them insofar as the task was an insightful task, the stimulus material was novel and unfamiliar, and relatively large payoffs were employed.

An insightful task was chosen because, as in human performance for money, little empirical information exists about this important psychological concept. Insight was considered to be an apparently "sudden" learning of the relationships underlying the task (Guilford, 1967). For this study, insight was operationally defined as a rather consistent initial performance at chance level, followed by a rapid rise to a high level of performance (Edmonds, Mueller, & Evans, 1966; Edmonds & Mueller, 1967a, b). In agreement with the prevailing view of investigators, it has held that Ss can acquire a working concept of these relationships without awareness of what they are (Guilford, 1967). Finally, it was decided to distinguish insightful processes from perceptual processes. Perception was viewed as an important aspect of insight but not necessarily equated with it. It was somewhat difficult to deal with the subject of perception because of the variety of possible views about its basic nature (O'Neil, 1958). In this study, perception was regarded as involving the input or extraction of environmental information and insight as the processing of this intput (Forgus, 1966; von Fieandt, 1966).

It was hypothesized that man may be viewed as an information processing system, with some self-regulation possible, especially with regard to attaining goals. Furthermore, it was hypothesized that the presence of sufficient utilities should tend to facilitate insightful learning within the constraints imposed by the nature of the task and the parameters of that information processing system. Thus, is was expected that, if the utilities were sufficiently attractive to make performance on the task important enough and if insightful learning is amenable to empirical manipulation, it should then be possible to shift the point of insight so that fewer trials would be necessary to achieve it.

Based on these considerations, two experiments were devised to deal with the following questions. First, would monetary utilities facilitate insightful performance? Second, would a relatively large amount of money facilitate performance proportionately more than a lesser amount? Finally, how would practice in conjunction with utilities or no utilities affect insightful performance?

MATERIALS

Stimulus items were sets of patterns printed in a 15-page booklet. The patterns were produced by a computer program, VARGUS 7 (Evans, 1964; Edmonds & Evans, 1966), which produces histoform patterns at random from a defined population and permits independent manipulation of information content and schema (i.e., family of related patterns). This schema is composed of the most probable sequence (MPS) of elements governed by the transitional probabilities of a seven-element Markov matrix. In the present experiment, each histoform pattern was 67% redundant. Three patterns were printed on each page of the booklet. All three patterns on a page were visually different. However, two patterns on each page were chosen randomly from one of four MPSs, whereas the third pattern on that page was chosen randomly from one of the three remaining MPSs. The positions of the three patterns on each page were assigned randomly. Although the booklet of patterns was the same as those employed by Edmonds et al (1966), some of the pages were rearranged to increase the reliability of the insight curve. Comparison of performance on this booklet with the performance on the identical one in which the pages were randomly distributed revealed no significant differences between them ($F = 3.49$, $df = 65$, $p > .06$).

EXPERIMENT 1

Subjects

The Ss were 32 undergraduates (22 males and 10 females) enrolled in education courses at the University of Victoria. The Ss were naive with respect to the patterns.

Task and Procedure

First, the entire group (B) of Ss was assembled. Each S was given a 15-page booklet, described above, and instructed to select the pattern on each page that was least like the other two patterns on that page. The Ss were allowed 45 sec to select the appropriate pattern and record their response. This was a nonreward situation.

After a 4-month period, the B group was reassembled and divided randomly into two groups which were separated. One subgroup (1-b) was a control and followed the same procedures as above. The second subgroup (2-b) was

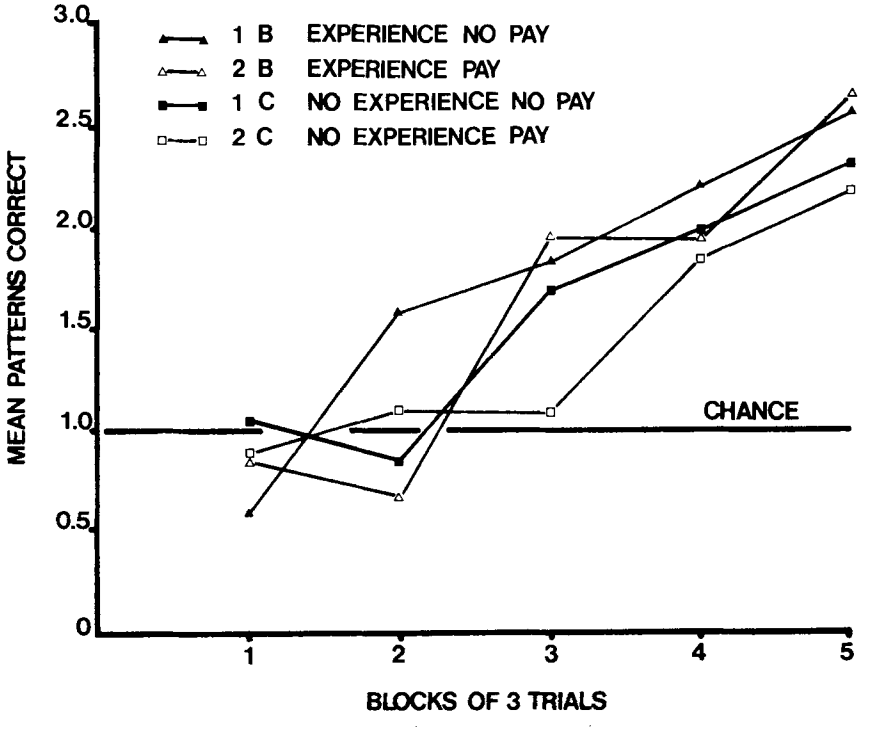

Fig. 1. Block means for experience with pay and no-pay Ss and for no experience with pay and no-pay Ss.

advised that each member could earn $.50 for every correct selection. The same booklets were used for all Ss. It was not believed that memory would be a relevant variable because of the long interval between testing and because of the complexity of the stimulus items. Information solicited from Ss confirmed this position. On a 4-point scale, each 2-b S was asked to indicate the perceived value of the maximum amount that could be earned (i.e., $7.50). The points of the scale were: no value, low value, high value, very high value.

EXPERIMENT 2

Subjects

The Ss were 61 undergraduates (15 males and 46 females) enrolled in education courses at the University of Victoria. The Ss were naive with regard to the patterns.

Task and Procedure

The group (C) was divided randomly into two subgroups which were separated. Each S was given the same materials and the same preliminary instructions as B Ss in Experiment 1. One subgroup (1-c) was a control. In the other subgroup (2-c), each S was told that he could earn $1.00 for every correct selection. On the same 4-point scale used in Experiment 1, each 2-c S was asked to indicate the perceived value of the maximum amount that could be earned (i.e., $15.00).

RESULTS AND DISCUSSION

In Fig. 1, the mean number of correct pattern selections for subgroups are plotted as a function of blocks of three trials. In order to simplify Fig. 1, the group performance of B Ss is not shown, since it was essentially the same as that of its subgroup, 2-b ($F = 0.32$, $df = 42$, $p > .50$).

In general, the data indicated that there was a significant difference between the two subgroups (1-b and 2-b), which had prior exposure to the patterns but no pay ($F = 4.66$, $df = 30$, $p < .05$). However, the difference was not in the expected direction. Those Ss who were not offered money performed significantly better than those who were paid. That is, the 2-b Ss (pay subgroup) did not differ essentially from their performance in the original (B) group; however, the 1-b Ss (no-pay subgroup) performed significantly *better* than their performance in the original (B) group. Several possibilities for these results suggested themselves. It was possible that the utilities were not large enough, that the presence of utilities interfered somehow with maximum performance, or that prior exposure might have interfered with performance.

Consequently, Experiment 2 was devised and executed. In this instance, the utilities were doubled for the pay subgroup (2-c) and neither group was preexposed to the patterns. The performances of 1-c and 2-c subgroups helped to clarify the above questions. According to the data, there was no significant difference in performance between either subgroup ($F = 1.55$, $df = 59$, $p > .20$). Hence, doubling the size of the reward did not improve insightful performance. Apparently, the lack of preexposure and not the amount of money was the crucial variable.

The amounts of money employed were selected on the basis of pilot studies and experiments cited in the literature. It was realized that doubling the size of the reward from $.50 to $1.00 per correct selection would not reveal anything about the subjectively perceived value of these amounts. Consequently, the 4-point scale was utilized. However, some Ss experienced difficulties in interpreting and using the scale; therefore, only rounded means are presented in order to indicate the trend of perceived value. Thus, caution must be exercised in interpreting the degree of motivation the utilities represented. In general, the 2-b Ss viewed $7.50 (maximum amount they could earn) as possessing high value (a rating of 3.00 on the scale). The 2-c Ss generally viewed $15.00 as possessing a very high value (a mean of 4.00 on the scale).

These results would appear to have implications regarding several important questions: the need for experience in order to gain insight, the amenability of insight to manipulation, and the specific effect of monetary rewards on insightful learning. The results would seem to indicate that, regardless of their size, monetary utilities do not appreciably increase performance on insight learning tasks; rather, their presence may interfere with such performance. In addition, it seems that performance on insight tasks may not be facilitated, except by preexposing Ss to similar kinds of tasks. In other words, it is probable that insight may not be manipulated by external contingencies. Instead, the best way to facilitate an earlier appearance of insight would be to increase an S's experience with that kind of task.

It would appear that the above evidence has considerable implications for areas such as education, counseling, and psychotherapy, where insightful performance in important. If extrinsic motivators have little or no effect on such performance, then many activities in those areas might have to be reexamined. On the basis of the results and implications of this study, it would seem that further research in this area is warranted.

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Number as a stimulus in a card-sorting task

ROBERT M. ADAMS*
University of Tennessee, Knoxville, Tenn. 37916

Human Ss performed a card-sorting task and were asked afterward to report the number of responses they had made in a sequence. Ability to give the correct number was found to vary as a function of the size of the number and as a function of the dissimilarity of the sequence-ending card. Ss who did not count the sequence length overestimated the length. The results are discussed in terms of the concept of number as a stimulus in psychophysical investigation.

Psychophysical studies have been carried out to establish the values of many types of stimuli which govern responses of the nature of, "Yes, I see it." The present study sought information about the stimulus "number." While there is a literature on estimates of numbers of things presented simultaneously (e.g., Kaufman, Lord, Reese, & Volkmann, 1949), this study investigated estimates of numbers of things presented sequentially, without instructing Ss to look for the number. The procedure was essentially that of the "no instructions to learn" group in incidental learning studies (e.g., McLaughlin, 1965) but with a task S would not fail to learn if instructed to do so.

SUBJECTS

The Ss were 90 male and 30 female students in the introductory psychology course at the University of Tennessee who were required to participate in one experiment per quarter. Ss were assigned to groups without regard to sex by their order of signing a list.

APPARATUS

The stimulus materials for the study were the backs of ordinary playing cards, including a great variety of animals, birds, outdoor scenes, houses, geometric patterns, and flowers. Duplication of cards seldom exceeded four of the same picture. No two identical cards were adjacent, and all pictures were presented rightside up.

PROCEDURE

Upon arrival, S was taken into a 2 x 2½ m room and seated at a 1 x 1 m table. Temperature in the room was approximately 75° F, and an overhead fan both ventilated the room and masked outside noise. The E seated himself across from S with notebook and pencil. In front of S was a row of stacks of playing cards, faces down, with each stack containing about 60 cards.

The S was then given the following instructions: "I'd like you to pick up each deck of cards, and looking at the backs, sort them one at a time into two stacks according to whether the picture contains a ship or a boat [the target card] or does not, like this. [The E then picks up a deck of cards and places two of them in a stack, one at a time, and then a third beside them.] So when you are finished you will have two stacks of cards, one with ships and boats, and one with everything else." The E then answered any questions, and S began sorting the cards. Questions usually served to confirm that the task was indeed as simple as it appeared.

The Ss were assigned randomly to one of nine groups. Seven groups were designated with the numbers 2-8, according to the placement of the target cards throughout the decks. For Group 2, the target card was every second card, for Group 3, every third card, and so on, through to every eighth card. There were 10 Ss in each of Groups 2, 3, 7, and 8 and 20 Ss in each of Groups 4, 5, and 6. Two groups of 10 Ss were tested on a variation of Group 6 and designated Group 6-S and Group 6-F. Each S was tested for only one session, lasting approximately 10 min.

For each S, there were 80 target cards picturing boats with sails. For each S, the total number of cards to be sorted was equal to 80 (the number of target cards) times the group number (2-8). At the end of the last deck, there was a run of cards without a target card. Ss in Group 4, for example, were required to sort 4 times 80 cards, plus an additional five nontarget cards at the end, for a total of 325 cards. The run at the end (equal to the group number plus one) was intended to yield a nonverbal indication of whether or not S had counted placement of target cards. Would the S pause at the card that normally would be the target card?

At the end of the task, S was asked the following: (1) "Do you have any comments or observations?" If S did not reply with a statement about the placement of the cards, he was asked: (2) "Did you notice any regularity in the placement of the boats?" Again, if S did not specify the placement, he was asked: (3) "How many cards do you think were between the boats?" If S indicated that he had counted the number between the boats, he was asked in what deck he first noticed the systematic placement.

For Group 6-S, the five cards between target cards were grouped according to the subject of the pictures. The target card might follow five dogs, five Indians, five geometric figures, five flowers, etc. The second added group, 6-F, was given random cards in the interval between target cards, but the target cards were placed in the deck face up. The face-up cards were random in regard to card value (number). All other details of the procedure were identical to Group 6.

RESULTS

Sixty-three Ss indicated they had counted the number of cards between target cards, and the percentage of each group counting was found to be a function of this number. All but one S, who had counted target card

*Now at Fort Hays Kansas State College, Hays, Kans. 67601.