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Effect of perceived cost on judgments regarding the efficacy of investment

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Abstract

Three experiments examined the effect of costs associated with investments on the judgments of the causal effectiveness of those investments, and on the type of information utilised when making those judgements. Using operant conditioning technology, in an experimental analogue of making economic investments, it was found that greater costs associated with an investment reduced the judgement about the effectiveness of the response (Experiment 1). Greater investment costs tended to bias the subject toward using information integrated over a longer period of time; whereas low costs tended to produce judgements made on the basis of the conditions prevailing immediately prior to the return being acquired (Experiments 1–3). The effect of cost was modulated by the subjects' own financial background. The same absolute cost being treated as "greater" by those from less wealthy backgrounds compared to those from more affluent backgrounds (Experiments 2 and 3). These results suggest that as well as the nature of the schedule relating investment to return, the perceived cost of the investment determines the manner in which it is judged with respect to its efficacy.

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1. Introduction

The present report investigated the effect of the cost of an investment on judgements regarding the efficacy of those investments. It asks whether the cost of an investment modulates the manner in which the investment–return relationship influences judgements regarding the effectiveness of that investment. Although, cost in itself may affect judgments about investments, cost also could produce different approaches to the judgment of the efficacy of investments: for example, when the cost of investments is high, people may look for different kinds of indicators about the relationship between investments and return than they do when investment cost is low. For example, either a long-term view of the relationship between investment and return, or a short-term view about that relationship, could be adopted when making a judgment about the efficacy of the investment. If a long-term view is taken, then the relationship between rates of investment and return rates over an extended period of time could be taken into account when making a judgement. In contrast, if a short-term view is taken, then only those factors prevailing at the time a return is acquired might influence the judgement. A tendency to take a longer term view with increased cost has been noted in some of the literature on economic decision making (Corfman & Lehmann, 1994; Gregory & Lichtenstein, 1994).

In addition to the putative cost-modulated effects, there is reason to believe that the subjects' perception of the cost may guide judgments regarding the effectiveness of an investment. There are lines of evidence to suggest that the perceived cost, rather than (or in addition to) the absolute level of cost, could be a determinant of the efficacy judgment given to an investment. Some studies show individuals adopt a variety of postures with regard to investment based on the prevailing situation (Sullivan & Miller, 1996). The economic climate, for example, appears to influence judgements regarding the size or value of coinage and events. Inflation leads to a reduction in the perceived size of currency (Furnham, 1983; Lea, 1981). Similarly, scarcity leads to an increase in the value of an event (Allison, 1979). Moreover, the personal circumstances of the individual also appear to affect assessment of value. For example, Bruner and Goodman (1947), Dawson (1975) noted that subjects from less wealthy backgrounds overestimated the size of coinage.

Dittmar (1994) noted that the perceived value of possessions altered due to the personal circumstances of an individual. Such findings receive converging support from the literature derived from the study of conditioning. In the operant conditioning literature, alterations in motivation levels through satiation (Bradshaw & Szabadi, 1992) or the addition of punishment contingencies (Farley, 1980) have increased sensitivity to reward. Thus, there appears reason to suggest that the perceived as opposed to the absolute cost of a response may affect judgments regarding the effectiveness of responding.

The technology associated with the investigation of operant conditioning has been used to investigate economic behaviour (e.g., Lea, 1981; Lea, Tarpy & Webley, 1987). In particular, schedules of reinforcement, that is, the operative relationship between responding and its outcome, have been employed in the study of choice behaviour (Davison & McCarthy, 1988), and also in the investigation of the manner in which performance varies as a function of the outcomes available (Rachlin, 1989). In fact, models based on instrumental conditioning have been developed for many aspects of economic behaviour (e.g., Foxall, 1999). The relationship between economic psychology and instrumental conditioning is, in fact, a mutually beneficial one (Nevin, 1995). Concepts from economics, such as: elasticity of demand (Lea, 1978); open and closed economies (Cohen, Furman, Crouse & Kroner, 1990; Hursh, 1980); and, the substitutability of 'leisure time' and reward (Rachlin, Kagel, Battalio & Green, 1983), have all been used to illuminate the processes which control free-operant behaviour. The present report sought to extend the investigation of economic behaviour through the technology of operant conditioning, and to extend the above findings relating to the costs of investments, by investigating the extent to which varying the cost of an investment would affect judgments about its efficacy under various schedules of reinforcement. This procedure is employed, because a large amount of research has already established the properties arranged by various schedules at the molar (long-term) and molecular (short-term) levels. From this work it is relatively easy to establish which of these properties are controlling behaviour under any given circumstance.

This investigation involves integrating the literature, not only concerning economic and instrumentally conditioned behaviour, but also from the field of causal attribution. It views making an investment as a response that can be controlled by its outcome (the return on the investment), and toward which people can produce some form of judgment regarding its efficacy. Many of the factors that influence the course of conditioning in nonhuman subjects also have been observed to influence causal attributions in human subjects

(Allan, 1993; Shanks, 1995; Wasserman, 1990). Evidence for this functional equivalence has been provided from a variety of sources. Notably this evidence concerns the effect of both: contiguity between response and outcome (e.g., Reed, 1992; Shanks, Pearson & Dickinson, 1989; Wasserman & Neunaber, 1986); and, the contingency between response and outcome. Investigations of contingency between response and outcome have generally varied the probability of an outcome in the presence and absence of a response (see Allan, 1980). This form of contingency manipulation, a probabilistic schedule, has been used extensively in the study of human behaviour. However, the schedules of reinforcement often used in the study of operant conditioning are somewhat different in nature, and could be claimed to generate much more orderly relationships in behaviour (Ferster & Skinner, 1957). It has been suggested that the schedule which relates a response to its consequence is a fundamental determinant of the behaviour observed during exposure to that schedule (e.g., Morse & Kelleher, 1970; Nevin, 1979). Given this, it may be that schedules are important in affecting judgments concerning economic responses such as investments.

In an investigation of the effect that different schedules have on judgments of causality (outside the economic sphere), subjects pressed a key on a computer keyboard and assessed its effectiveness in illuminating a triangle displayed on the monitor (Reed, 1992,1993). The effect of scheduling outcomes on two schedules was studied in this article. One of the schedules, a variable ratio (VR) schedule, involved scheduling an outcome to be presented following the emission of a predetermined number of responses. The number of responses required for an outcome varied, from outcome to outcome, around a main value. The other schedule, a variable interval (VI) schedule, involved presenting an outcome following the first response to be emitted after a prespecified period of time had elapsed. Any responding prior to this specified time had no effect on the delivery of the outcome. As with the VR schedule, the interval before which the outcome was not available varied, from outcome to outcome, around a mean value. Reed (1993) used a yoking procedure to match the probability of receiving an outcome for any particular response on the two schedules. The number of responses made prior to each successive outcome being delivered on the VI schedule were recorded. This number of responses became the number of responses required to fulfill the ratio requirement for each successive outcome on the subsequently experienced VR schedule. The level of causal effectiveness attributed to a response emitted during exposure to a VR schedule, which was matched to a VI schedule in terms of responses required per

outcome in this manner, was low. Other studies appear to have isolated the reason for this as being connected with the manner in which responses are followed by outcomes on VI schedules and the size of the temporal window over which subjects integrate information (Reed, 1992). On VI schedules (but not VR schedules) the longer the time elapsed since the last response, the greater the probability that an outcome will follow the next response. Thus, temporally isolated responses are more often followed by an outcome. If subjects integrate information about responses and outcomes only over a short temporal period prior to the outcome, then responses on VI schedules may be rated as particularly effective, since only one response will be perceived to be needed for an outcome. In contrast, on a VR schedule a number of responses may be perceived as being required to produce the outcome. This perception would, consequently, reduce the rating of response effectiveness.

Although comparable with procedures previously used to study causal attribution (e.g., Alloy & Abramson, 1979), it is not clear how the outcome (i.e. a triangle flash) used by Reed (1992) could be equated either to a reinforcer in studies of free-operant conditioning or to economic outcomes such as financial returns taken to control investment: a schedule that relates a response to an outcome is not necessarily a reinforcement schedule since there may be no reinforcement involved. Further, there were no obvious costs involved in the subject making a response. Cost has been implicated as influencing nonhuman performance on free-operant schedules of reinforcement (Lea, 1978), and, as discussed above, in influencing decisions on investments in economic spheres (Hursh, 1980).

Given the above considerations, Reed (1994) extended the investigation of schedule dependency to examine the effect of the 'cost' of a response on the perception of causal efficacy. In these experiments, subjects' responded on the computer keyboard to 'invest' a certain amount of money in the economy of a fictitious country. They judged the efficacy of the investment response against the likelihood of obtaining a return on their investment. Under these conditions, with 'costs' for responding and 'gains' for obtaining an outcome, the relative rating of causal effectiveness on VI and VR schedules was reversed from that noted in the study by Reed (1993). With the introduction of costs and gains, higher ratings of causal efficacy were given to responses emitted during exposure to a VR schedule compared to those given to responses emitted on a VI schedule. This result was obtained despite there being equal probabilities of an outcome following a response on the two schedules.

This latter result implies that different processes are involved in generating judgments about causal effectiveness in different situations. With greater costs associated with a response, a longer term view may be taken of the relation between response and outcome: subjects may start to integrate information about investments and returns over a longer temporal period. If this were the case, then the subjects may have perceived the strong correlation between responding and outcome on the VR schedule. As response rate increases, so does the rate of reinforcement. This relationship is not present in the VI schedule. As a consequence of the covariation in the rates of response and reinforcement, subjects may have rated responses as more effective in the VR compared to the VI schedule. The present series of experiments, therefore, sought to examine if cost (actual and perceived) does modulate the information used in making judgments regarding the effectiveness of an investment.

2. Experiment 1

The first experiment examined the effect on causal attributions about investments made during exposure to either a VI or a VR schedule when the probability of a return for an investment was equated across the two schedules. To date, comparisons of different costs have been largely cross-experimental, with not only cost, but also task (triangle flash versus investment return as outcome) varying between conditions. It may be that there is something in the nature of the task other than the cost of a response that produces the different results observed. Only one experiment has provided a direct comparison of the effect of low and high cost conditions on efficacy judgments (Reed, 1994; Experiment 3). In this study, subjects first experienced a VI schedule, the number of responses emitted for each successive outcome being the number required for each successive outcome in a subsequent VR condition. When investment responses cost only a nominal amount (£1), those in the VI condition were rated as more effective than those in the VR condition. However, when responses cost a larger amount (£100), investments in the VR condition were rated as more effective than those in the VI condition. The present experiment sought to replicate this finding, and extend it to study whether attributions of efficacy could be further manipulated by a greater range of costs. To this end, three levels of cost were studied; £1 and £100, as in the previous study, and, additionally, a cost condition of £200 was used.

2.1. Method

Subjects. Sixteen subjects were recruited. All subjects were volunteers, and none was paid for their participation. The subjects had an age range of 24–57. They were all students participating in an Open University Summer School, held at The University of Sussex, from whence they where recruited.

Apparatus. The experiment was conducted with the subject sitting at a table, on which was placed a BBC computer, which controlled the video display screen (screen size 24 cm wide and 17 cm high). The screen was placed approximately 50 cm in front of the subject. All tasks were conducted via this apparatus. The subjects could respond to the instructions given to them on the video screen via the computer keyboard in front of them.

Procedure. The subjects were presented with the following instructions.

> You have been given the job of testing the effectiveness of investments made in a number of countries. You must test how well your investments in these countries do and report back to the company that hired you. (Return).
> Your managing director has given you a sum of £20,000 to invest as you see fit. After a certain time the board will want a report on how well your investments have gone. They will want to know how effective an investment was in that country. (Return).
> You can make an investment by pressing the Space Bar of the computer. Each press will subtract some money from your investment fund. You may, or may not, receive income from your investment. Should you receive income, £1000 will be added to your fund. (Return).
> You are free to make an investment at any time. However, due to the nature of the economies it is to your advantage to invest some of the time and not to invest some of the time. (Return).
> You will be involved in testing two different economies. The relationship between investment and returns will be constant within a particular country, but may well differ from country to country. (Return).
> After a period of time, you will be asked to report to the board on your activities. They will want to see a good return on your investment. The board will also want you to give an estimate of how effective an investment was in the country your are investigating. (Return).
> You will be required to give a rating on a scale of 0–100 on the success of your investments. Zero means that investments never made money, and 100 means that investments always produced a return – made money. (Return).

After presentation of these instructions, the subjects were exposed to six conditions. Each condition was clearly labelled by the words "Country 1", "Country 2", etc., which appeared at the bottom of the screen during exposure to that condition.

The six conditions consisted of three pairs of yoked schedules; a VI and a VR schedule constituting a pair in each case. In each of the three pairs of schedules, subjects responded first on a VI 20-second schedule (range 1–39 seconds), and in the second schedule condition they responded on a yoked VR schedule. The value of the VR component was yoked to the number of responses emitted by the subject in completion of the VI condition. Thus, if a subject emitted 10 responses during the first interval and 5 responses during the second interval set up by the VI condition, then the first ratio in the VR condition would be 10 responses and the second would be 5 responses. Thus, the probability of a response being followed by an outcome was equated across the two conditions. The VI component lasted for 4 minutes, the VR component lasted until the subject had obtained all the investment returns available as a result of the yoking procedure (i.e. the number of outcomes were the same in the two conditions).

Each of the pairs of conditions had a different cost associated with making an investment. For one pair of yoked schedules, the cost was £1; for the second VI–VR pair the cost was £100, and for the third pair it was £200. The order in which the subjects experienced these conditions was randomised with the exception that the master VI schedule for each of the pairs of schedules was experienced prior to the yoked VR (the yoked VR schedule from each pair did not necessarily follow the master VI schedule from that pair directly).

2.2. Results and discussion

Fig. 1 displays the judgments of causal effectiveness for investments made during exposure to each condition in Experiment 1. Inspection of these data reveals that the effectiveness rating for an investment declined as the cost of that investment increased; ratings for the £1 condition were higher than those for the £100 condition. Ratings for the £100 condition were higher than those for the £200 condition. The relative ratings of the efficacy of investments for each yoked pair of schedules changed as a function of the cost of an investment. In the £1 condition, investments made during exposure to the VI condition were rated as more effective than those emitted in the VR condition. There was little difference in ratings of effectiveness in the £100 cost

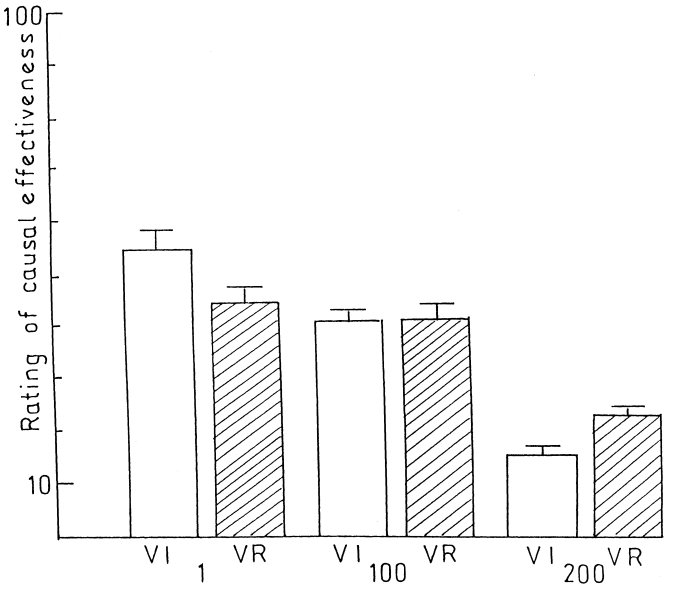

Fig. 1. Results from Experiment 1. Mean ratings of the causal effectiveness. VI = variable interval; VR = variable ratio. 1 = responses cost \$£1; £100 = responses cost £100; 200 = responses cost £200.

condition. However, the relative rating for the VR condition was higher than that for the VI condition in the £200 cost condition.

These impressions were confirmed by a two-factor analysis of variance (ANOVA) with cost (£1 versus £100 versus £200) and schedule (VR versus VI) as within-subject factors. A rejection criterion of $p < 0.05$ was adopted for this and all subsequent analyses. This analysis revealed a significant main effect of cost, $F(2, 30) = 55.01$, a significant interaction between schedule and cost, $F(2, 30) = 7.45$, but no significant main effect of schedule, $F < 1$. Planned comparisons were conducted between the schedules at each cost. For the £1 cost condition, this analysis revealed that there was a significant effect of schedule, $t(15) = 2.64$, with the VI schedule being rated as more effective. There was no difference for the £100 condition, $t < 1$. However, there was a significantly greater efficacy rating for the VR schedule for the £200 cost condition, $t(15) = 2.66$.

These data confirm, in some regards, those previously reported by Reed (1994; Experiment 3). As the cost of the investment became higher, investments made on a VR schedule were rated as more effective than those made on a VI schedule. In contrast, the opposite effect of the schedules on efficacy

ratings was noted when the cost of an investment was low. This finding was obtained despite equal probabilities of a return on the investment on both the VR and VI schedules. To this extent the present data are consistent with the view put forward by Reed (1994).

These data are consistent with the view that larger costs provoke integration of information about rates of investment and their covariance with rates of return. High rates of investment would lead to greater numbers of returns on a VR schedule, but would not do so on a VI schedule. If such a long-term view is taken, the overall investment–return relationship may make attributions regarding the effectiveness of investment greater on the VR compared to the VI schedule (see also Dickinson, 1985). With low costs for investment, however, subjects may only integrate information about investment responding and returns over a short temporal window preceding the return. This would allow little differentiation between VR and VI schedules in terms of the probability of an investment producing a return. If anything, it may promote attributions on the VI schedule (Reed, 1992).

One aspect of these present data failed to replicate those reported by Reed (1994). In the earlier report, a cost of £100 was sufficient to promote greater attributions of effectiveness on the VR compared to the VI schedules. This was not the case in the present study. Given that the overall pattern of data was consistent with that reported by Reed (1994); that is, greater ratings of efficacy on VR schedules when costs are higher, and greater ratings on VI schedules when costs are lower, this anomaly may not be viewed as too problematic. However, consideration of a difference in the subject sample on which the two experiments were conducted suggests that another factor may be influencing judgments about investment efficacy. The present experiment was conducted on students from the Open University. These students were typically older than those used in the earlier experiments (undergraduates at conventional universities), and they are more likely to be employed in occupations receiving higher remuneration than the sample used by Reed (1994). It may be that the cost of an investment was regarded differently by these two subject samples, leading to differences in the pattern of data produced.

3. Experiment 2

The social psychological literature has many reports of people's financial circumstances altering their perception of economic events. For example,

Bruner and Goodman (1947) noted that people who were less wealthy perceived the physical size of coins to be larger than those who were more wealthy. In a similar vein, Dittmar (1994) noted that wealth produces differences in the importance given to various possessions. It may be that perception of the cost of an investment in wealthier subjects is different to the perception of cost for a person with fewer financial means. If this were the case, then it would be expected that those with larger incomes may perceive £100 not to be as great an investment as those people with smaller incomes. This may lead to the same absolute cost of a response triggering quite different mechanisms in terms of the integration of information. Certainly, in the literature on operant conditioning, different levels of motivation can change the manner in which animals respond in various choice situations (Bradshaw & Szabadi, 1992; Farley, 1980).

The second experiment investigated the possibility that a persons' income would affect their perception of the cost of a response, and that this would produce different attributions of the effectiveness of investments under otherwise similar conditions. To this end, two groups of subjects were studied on the task described in Experiment 1. Both groups had a similar age range, and both groups were studying for a first degree. However, one group had an income of greater that £10,000 a year, the other had an income of less than £5000 a year. If differences in income effect perceptions regarding cost, then differences in the manner in which schedules effect attributions of causality for these two groups should emerge. The more wealthy group should judge investments made on a VR schedule as more effective than those made on a VI schedule only at the highest investment costs. In contrast, this VR/VI difference should emerge at a lower investment cost level for the subjects who were not so wealthy.

3.1. Method

Twenty-four subjects were used in this experiment. They were divided into two groups of 12. The first group (Poor) had an annual income of £5000 or less. They had an age range of 23–52, and were all mature students at The University of Sussex. The second group (Wealth) had an annual income of more than £10,000, had an age range of 25–43, and were mostly students of The Open University, attending a summer school at The University of Sussex. All other details of the procedure were as described in Experiment 1.

3.2. Results and discussion

Fig. 2 displays the judgments made by both groups regarding the causal effectiveness of an investment made during exposure to each condition in Experiment 2. Inspection of these data reveals that the efficacy rating for an investment declined as the cost of that investment increased; ratings for the £1 condition were higher than those for the £100 condition. Ratings for the £100 conditions were higher than those for the £200 condition. The relative ratings of efficacy between schedules changed as a function of the cost of an investment. However, the precise nature of this change depended upon the group from which the subjects were drawn. For Group Wealth, investments

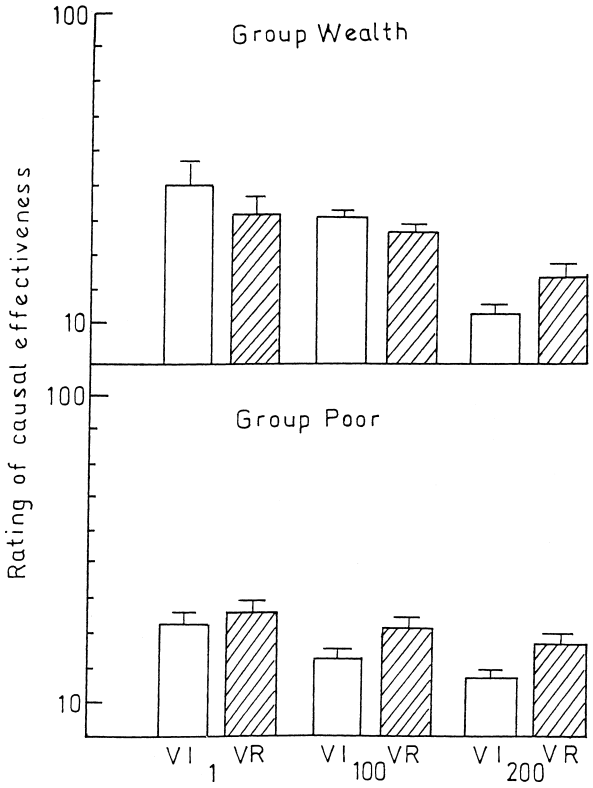

Fig. 2. Results from Experiment 2. Mean ratings of the causal effectiveness for both groups. (Top panel) Subjects with high earnings (Group Wealth). (Bottom panel) Subjects with low earnings (Group Poor). VI = variable interval; VR = variable ratio. 1 = responses cost \$£1; £100 = responses cost £100; 200 = responses cost £200.

in the £1 condition made during exposure to the VI schedule were rated as more effective than those made during the VR condition. There was little difference between the schedules at the £100 cost condition. However, the rating for the VR condition was higher than that for the VI condition in the £200 cost condition. In contrast, for Group Poor there was little difference between the schedules in the £1 cost condition, but in both the £100 and the £200 cost conditions, investments in the VR schedule were rated as more effective than those in the VI condition.

A 3-factor ANOVA (group × cost × schedule) was conducted on these data and revealed significant main effects of group, $F(1,22) = 9.85$, and cost, $F(2,44) = 16.09$. There were significant interactions between group and cost, $F(2,44) = 3.98$, group and schedule, $F(1,22) = 9.57$, and cost and schedule, $F(2,44) = 6.48$. No other main effect or interaction proved to be significant. Planned comparisons between the two schedules at the £1 cost condition, revealed a significantly higher rating for the VI condition for Group Wealth, $t(11) = 2.64$, but not for Group Poor, $t < 1$. Planned comparisons between the two schedules at the £100 cost condition, revealed no difference for Group Wealth, $t < 1$, but a significantly higher rating for the VR condition in Group Poor, $t(11) = 3.03$. Planned comparisons between the two schedules at the £200 cost condition, revealed a significantly higher rating for the VR schedule in Group Wealth, $t(11) = 4.34$, and Group Poor, $t(11) = 2.04$.

These data for the wealthier subjects replicate those reported in the present Experiment 1. That is, the relative attributions of effectiveness of investments made under a VI or a VR schedule reversed as the cost of an investment increased; VI investments were rated as more effective when the cost was low, but VR investments were rated as more effective when the cost was high. Although the trend toward greater judgments of effectiveness for responses on a VR schedule as the cost increased was also apparent for the less wealthy subjects, the point at which VR investments were judged as more effective was different to that noted for the wealthy subjects. A lower cost was enough to generate VR superiority in the less wealthy subjects. These data support the contention that the subjects' financial background can influence their judgments (Bruner & Goodman, 1947; Dawson, 1975). Of course, the subjects in the two groups may have differed in ways other than their financial background. The characteristics of students at the Open University may be somewhat different from those at a conventional university. However, an attempt was made to match the students so far as was possible. It should be noted also that some of the subjects from Group Wealth were drawn from students not attending the Open University.

4. Experiment 3

To test further the notion that the background financial circumstances of the subject may alter the rating of efficacy given to investments, the final experiment attempted to control this factor directly. To this end, subjects were divided into two groups who were both presented with the task outlined above. However, one group were given a relatively small amount of money in their investment fund, while the other group received a relatively high amount of money in their initial investment fund. There were no differences between the subjects other than this manipulation since they were all drawn from the same subject population. If the results from the present Experiment 2 were supported, then subjects with a relatively small investment fund should perceive the same actual cost of responses as being higher than those with the greater investment fund. As a consequence, they should rate investments made on a VR schedule as more effective than those made on a VI schedule at a lower cost of investment than subjects with a larger fund.

4.1. Method

Twenty-four subjects were used in this experiment. They had an age range of 21 to 40, and were all post-graduate students at University College London (their income ranged between £5000 and £7000). They were divided into two groups of 12. The first group (Poor) were given an investment fund of £2000, the second group (Wealth) were given an investment fund of £20000. Both groups experienced four conditions comprising two yoked VI–VR pairs as described in Experiment 1. For one VI–VR pair of conditions investment cost £1. For the other pair of VI–VR schedules, investments cost £100. All other details of the procedure were as described in Experiment 1.

4.2. Results and discussion

Fig. 3 displays the judgments made by both groups regarding the causal effectiveness of an investment made during exposure to each condition in Experiment 3. Inspection of these data reveals that ratings for the £1 condition were higher than those for the £100 condition. For Group Wealth, investments in the £1 condition made during exposure to the VI schedule were rated as slightly more effective than those made in the VR condition, whereas this difference was in the opposite direction for the £100 cost condition. In contrast, for Group Poor, investments on the VR schedule were

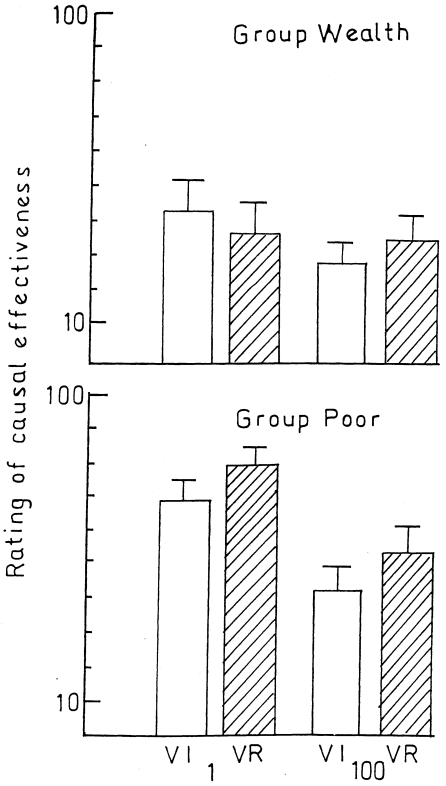

Fig. 3. Results from Experiment 3. Mean ratings of the causal effectiveness for both groups. (Top panel) Subjects with £20,000 to invest (Group Wealth). (Bottom panel) Subjects with £2000 to invest (Group Poor). VI = variable interval; VR = variable ratio. 1 = responses cost $£1; £100 = responses cost £100; 200 = responses cost £200.

rated as more effective than those in the VI condition for both cost conditions.

A 3-factor ANOVA (group × cost × schedule) was conducted on these data and revealed significant main effects of group, $F(1,22) = 6.54$, schedule, $F(1,22) = 7.21$, and cost, $F(1,22) = 15.95$. There were significant interactions between group and schedule, $F(1,22) = 6.95$, group and cost, $F(1,22) = 3.96$, and schedule and cost, $F(1,22) = 5.44$. The three-way interaction was not significant, $F < 1$. Planned comparisons between the two schedules at the £1 cost condition, revealed no difference between the schedules for Group Wealth, $t(11) = 1.39$, $p > 0.10$, but a significantly higher rating for the VR condition for Group Poor, $t(11) = 2.62$. Planned

comparisons between the two schedules at the £100 cost condition, revealed a higher rating for the VR schedule for Group Wealth, $t(11) = 2.39$, and for Group Poor, $t(11) = 2.70$.

These data for the subjects with greater initial resources are very similar to those reported in the present Experiment 1. That is, attributions of the effectiveness of investments altered as the cost of an investment increased; VI investments being rated, numerically, as more effective when the cost was low, but investments were rated as more effective on a VR schedule when the cost was high. For subjects with fewer initial resources, higher effectiveness ratings for investments made on a VR schedule were also apparent, but the point at which VR investments became judged as more effective than the VI investments was different to that of the subjects with greater initial resources. A lower cost was enough to generate higher VR ratings in subjects with fewer initial resources. These data support the contention that the subjects financial background can influence their judgments. In this case, no difference other than this factor separates the subjects, since they were all drawn from the same subject population (post-graduate students).

5. General discussion

In all the present experiments, the perceived efficacy of an investment response was dependent upon the nature of the schedule that related the investment to a return. The nature of the schedule-dependency was altered by the cost of an investment. When the cost was low, investments were rated as more effective in producing a return than when the cost was high. Low cost investments were rated as more effective when emitted on a VI schedule of return than on a VR schedule. Conversely, when the cost of an investment was high, then investments made under a VR schedule were perceived to be more effective. However, the cost of an investment that would produce this reversal in the schedule-dependency altered according to the financial circumstances of the individual. In Experiment 2, it was demonstrated that subjects with low incomes rated investments as more effective on a VR schedule than on a VI schedule at a much lower cost of investment than subjects with higher incomes. In Experiment 3, it was shown that those with fewer initial resources rated investments made according to a VR schedule as more effective than those made according to a VI schedule at lower investment costs than subjects with greater initial resources. These results demonstrate that the perceived, as well as the absolute value of an investment

may influence the manner in which investment–return schedules affect judgments about the efficacy of investment responses.

Taken together with previous reports on the nature of schedule influence, the present experiments help to build a picture of the factors that are responsible for ratings of causal efficacy of responses. It has long been established that the overall probability that a response will produce an outcome affects judgment of causal efficacy (Allan, 1980). However, over and above this, the schedule which relates the response to the outcome can also be seen to affect attributions of causality (Reed, 1993,1994). How the schedule exerts an influence on subjects' judgments about the effectiveness of a response appears to depend upon the cost of a response (Reed, 1994).

There are a number of alternate mechanisms that may produce these schedule-induced effects. Which processes are in operation at any given time may depend upon the nature of the information relating response to outcome that the subject is utilising. In turn, this may depend upon both actual and perceived cost of the response. One set of theories, termed "molar theories", stress the relationship between response rate and reinforcement rate as critical in determining levels of performance (Baum, 1973). Such views are built on the observation that on VR schedules, the faster a subject responds the faster reinforcement will be delivered. There is a perfect correlation between response rate and reinforcement rate. In contrast, on VI schedules, once the subjects emits over a minimum response rate, further increases in responding will not affect the obtained rate of reinforcement. There is a poor correlation between response and outcome on a VI schedule, suggesting that responses on VR schedules should be perceived as more effective. This view requires that subjects integrate information about response and reinforcement rates over relatively long temporal periods. Based on the results from studies of causal attribution, this view is consistent with data from subjects when costs of responses are high.

An alternate set of theories (molecular theories) stress the importance of events that occur immediately prior to the outcome in determining performance. On a VI schedule, as the pause from the last response becomes longer, the probability of an outcome being delivered for the next response increases. Thus, this schedule differentially favors long inter-response times (IRTs). On VR schedules, on the other hand, there is no such favoring of long IRTs. If anything, due to the manner in which subjects respond in bursts and pauses, short IRTs may be favored (Pear, 1985). When subjects are asked to make attributions about the efficacy of responses, then on VI schedules they may perceive that only a single, temporally isolated response is sufficient to produce the outcome. This may lead to high ratings of effectiveness for the response.

When they are responding on VR schedules, they may perceive that a number of responses are required, and so reduce the efficacy rating for a single response. When costs are low, causal attributions appear consistent with the operation of such molecular processes (Reed, 1992,1993). There is little incentive to make long-term judgments when immediate costs for responding are low.

That different strategies can be adopted under different conditions is not a novel suggestion, and has been demonstrated in many areas of both cognitive and economic psychology. However, what the present results show is that perceived cost may determine when these various influences are more or less dominant. The present results also show linkage to phenomena in economic psychology. Perception of the size and value of currency is affected by personal circumstances (Bruner & Goodman, 1947; Dawson, 1975; Lea, 1981). Poorer people judge the same sized coinage as larger or more valuable than richer people. Indeed, personal wealth has been shown to exert a large influence over the importance attached to personal possessions (Dittmar, 1994). Thus, it may be that the financial background of an individual causes differences in the assessment of the absolute cost of an investment and, thus, provokes the operation of a different set of mechanisms regarding causal attribution.

The present research obviously has its roots in operant conditioning, and from this literature too comes a range of evidence which appears consistent with the findings and interpretation of the current report. The degree of effort associated with a response can make a difference to the sensitivity of the organism to the schedule in operation. Making a response require more force or changing the nature of a response from more effortful (e.g., treadle pressing) to less effortful (e.g., keypecking) also appears to exert a similar influence over the nature of the cues which guide an organisms performance (Bradshaw, Szabadi & Ruddle, 1983; McSweeney & Melville, 1988; but see Chelonis & Logue, 1996). Likewise, sensitivity to reinforcer rate can be enhanced by superimposition of punishment (Farley, 1980) or by altering the motivation of the subject by prefeeding (Bradshaw & Szabadi, 1992).

Personal wealth may be regarded as acting in much the same way as motivation to alter the perception of cost of responding, and alter the processes engaged for judgments of efficacy of investment. This may have a number of implications for economic policy and regulation. For example, in terms of the regulation of investments, it may be wise to limit the fund from which any individual draws in order to make investments so as to maximize the likelihood that the relationship between investments and returns over a longer period would be included in the assessment of the benefits from that

investment. Similarly in terms of personal savings, building a large amount of savings may tend to reduce the perception of cost of an investment, and lead to more short-term decisions being taken. In both cases, the decision may be more influenced by moment-to-moment variations in the relationship between investment and return than may be prudent.

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