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Avoidant Control Difficulty and Aversive Incentive Appraisals: Additional Evidence of an Energization Effect[1]

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There is evidence that certain physiological and subjective indices of stress are relatively great when control over aversive outcomes is moderately difficult and relatively reduced when control over such outcomes is either easy or impossible. A possible explanation is suggested by Brehm's recent theory of motivation, which asserts that energy mobilization and the perceived unpleasantness of an aversive event will (a) increase with the difficulty of avoidant behavior so long as avoidance is believed to be possible and worthwhile, and (b) be low when avoidant behavior is impossible, not worthwhile, or simply unavailable. This article reports two experiments that examined appraisals of an aversive incentive under conditions where avoidance was expected to be easy, difficult, and impossible. The first demonstrated the complete nonmonotonic pattern of appraisals predicted by the energization theory, something that has proved elusive in previous investigations. The second study demonstrated this as well and, in addition, showed a correspondence between subjects' incentive appraisals and their cardiovascular responses immediately before and during an avoidance task period. Implications and alternative interpretations are discussed.

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In the past 20 years, attempts to understand affective and physiological responses to threat have focused to a considerable degree on control as a mediating variable (Averill, 1973; Miller, 1980; Thompson, 1981). With but a few exceptions (e.g., Burger, 1989; Folkman, 1984; Hobfoll, 1989), investigators have asserted or assumed an inverse relation between control and reactions believed to be indicative of stress. That is, it commonly has been believed that stress responses are attenuated to the extent that individuals perceive themselves as having the ability to affect the occurrence or impact of an aversive outcome (Bandura, 1989; Cox, 1978; Glass & Singer, 1972; Lazarus, 1966; Pittman & Heller, 1987).

Despite the pervasive confidence in the ameliorative effects of control, the research literature actually is inconclusive in this regard. While some studies do seem to show reduced physiological activity and/or negative affect (e.g., anxiety) under conditions of control relative to conditions of no control (Corah & Boffa, 1970; Hokanson, DeGood, Forrest, & Brittain, 1971), others do not (Staub, Tursky, & Schwartz, 1971, Experiment 1). The most recent evidence suggests that the impact of control depends, at least in part, upon the ease with which it can be exercised. Where avoidant behavior has been made moderately difficult, cardiovascular reactivity and negative affect have been found to be higher than where avoidant behavior has been made easy (Elliott, 1969; Light & Obrist, 1980; Obrist et al., 1978; Solomon, Holmes, & McCaul, 1980; Svebak, 1982; Wright, 1984; Wright, Brehm, & Bushman, 1989). On the other hand, where avoidant behavior has been made *impossibly* difficult or simply unavailable, physiologic and affective responses have been found to be comparable to those observed where control required little effort (Contrada et al., 1982; Elliott, 1969; Houston, 1972; Obrist et al., 1978; Smith, Houston, & Stucky, 1985; Wright, 1984; Wright et al., 1989).

A Motivational Analysis

A theory of motivation by Brehm (Brehm & Self, 1989; Brehm, Wright, Solomon, Silka, & Greenberg, 1983; Ford & Brehm, 1987; Wright & Brehm, 1989) would seem highly relevant to these issues and data. The model assumes that the direct function of motivation is not need satisfaction or goal attainment, but rather the energization of relevant instrumental behavior. Thus, it asserts that motivational arousal (energization) is determined by what can, will, and must be done to satisfy a motive. If approach or avoidant behavior is easy, little effort and energy are needed and therefore little should be mobilized. If approach or avoidant behavior is difficult, more effort and energy are needed and therefore more should tend to be mobilized. However, a positive relation between task difficulty, on the one hand, and effort and energization, on the other, should be in evidence only so long as success is possible and the benefits of task performance exceed the costs of task performance. Where task demands are insurmountable or require more effort than an incentive is worth, effort and energization should be low. Energization also should be low where approach or avoidant behavior simply is unavailable, since in this situation, too, there is nothing to be done.

A further assertion is that the perceived attractiveness or aversiveness of an incentive varies directly with the level of energy mobilized to carry out behavior. In conjunction with the reasoning above, this leads to the prediction that the subjective desirability of a positive goal should be nonmonotonically related to the difficulty of imminent or ongoing instrumental activity, being greatest where such behavior is difficult, but possible and worthwhile. More relevant to the present discussion, it suggests that an unpleasant outcome should be experienced as more aversive when imminent or ongoing coping activity is difficult, possible, and worthwhile than when such activity is easy, too difficult to be worthwhile, impossible, or unavailable.

The notion that energization will be a function of what can, will, and must be done to cope provides an explanation for the aforementioned evidence suggesting that cardiovascular responsivity is greater when avoidant task demands are moderate rather than low or very high. Likewise, the hypothesis that aversive incentive appraisals vary with energization could account for data indicating more negative affect under moderately difficult avoidance conditions than under easy and impossible avoidance conditions.

Do Aversive Outcome Appraisals Vary with Avoidant Task Difficulty?

Recently, investigations have been carried out to evaluate directly the prediction that the perceived aversiveness of a potential unpleasant outcome will be relatively low when avoidant behavior is easy and impossible, and relatively high when avoidant behavior is difficult, possible, and warranted. The most successful experiment to date was one in which subjects were told they could avoid going to an aversive shock session by performing a preliminary memory task that was easy, moderately difficult, or impossible (Brehm et al., 1983, Experiment 4). In half of the cases the task was to be performed right away, whereas in the other cases the task was to be performed approximately half an hour later. It was expected that differences in energization and therefore incentive appraisals as a function of task difficulty would be found only when task performance was imminent. When performance was not imminent, energy levels and incentive appraisals were expected to be constant regardless of the task assigned. Results were congruent with this expectation. For subjects expecting to perform the task immediately, shock unpleasantness ratings were higher in the moderately difficult condition than in the easy and impossible conditions. For subjects expecting to perform the task later, on the other hand, unpleasantness ratings were moderate and did not differ across difficulty conditions.

Although data from the foregoing study were consistent with theoretical predictions, they are to some degree called into question by results of the other experiments of this type. In the earliest (Brehm et al., 1983, Experiment 3), subjects were given the opportunity to avoid an aversive shock session by memorizing two, four, six, or twenty nonsense trigrams. As expected, anticipatory appraisals of the potential shock were more negative in the four- and six-trigram conditions than in the two-trigram condition. They also were somewhat more negative in the four- and six-trigram conditions than in the twenty-trigram condition; however, pair-wise comparisons involving the twenty-trigram condition did not approach significance. Another experiment (Wright & Brehm, 1984) used a different incentive and a different experimental task. Subjects first listened to an unpleasant noise over headphones and then were led to believe they could avoid a second presentation of it by making an easy, difficult, or impossible dynamometer grip. As in the previous study, subjects who expected avoidance to be difficult had aversive incentive (i.e., noise) ratings that were more negative ($p < .08$) than those of subjects who expected avoidance to be easy. When the task was impossible, though, incentive ratings were no different than when the task was difficult. The final experiment (Wright, 1984) was one in which subjects learned either that they could avoid a shock session by flipping a toggle switch (easy motor task) or making an effortful dynamometer grip (difficult motor task) within 10 seconds of hearing a signal tone, or that they had been assigned to a group that could not avoid the session. Measures of heart rate and finger pulse volume indicated greater anticipatory physiologic activity in the difficult avoidance condition than in the easy avoidance and no avoidance conditions. Shock unpleasantness ratings tended to mirror the cardiovascular responses, but comparisons between the difficult avoidance and no avoidance conditions did not attain significance.

The inconsistency between the fourth experiment by Brehm et al. (1983) and the other avoidance experiments, obviously, lies in the cells in which avoidance was intended to be impossible. Whereas the former investigation showed a pronounced reduction in negative appraisals in the (immediate) impossible avoidance condition relative to the (immediate) difficult avoidance condition, the latter experiments showed, at best, only trends in that direction. It is needless to say that there are a number of possible explanations for the failures to strongly replicate. For example, it could be that paper-and-pencil ratings are simply unstable measures of psychological states and thus subject to fluctuation from study to study. This interpretation would seem to apply most readily to the Wright (1984) investigation, in which unpleasantness effects were weak but psychophysiological effects were quite powerful. Alternatively, it could be that there was something in the operations of the experiments which was responsible for the different effects. Perhaps the most glaring possibility is that the studies by Brehm et al. (1983, Experiment 3), Wright (1984), and Wright and Brehm (1984) were not entirely successful in creating circumstances in which subjects truly believed there was nothing to be done. This seems particularly plausible in the Wright and Brehm (1984) investigation, where a few "impossible avoidance" subjects reported in debriefing that they were prepared to forcibly remove the headphones if the noise became unbearable. A similar process could have occurred in the shock avoidance experiments because some impossible avoidance subjects may have experienced considerable conflict in deciding whether or not to remain in the experiment. As discussed by Brehm et al. (1983), if these individuals mobilized energy for the potentially embarrassing task of telling the experimenter that they wanted to drop out, effects congruent with predictions would have been masked.

Whatever the most appropriate explanation for discrepancies in the appraisal studies published thus far, it is apparent that the investigations do not answer conclusively the question they were designed to address. For this reason, we report here two experiments that examined the issue further.

EXPERIMENT 1

In the first study, subjects were assigned a memorization task and told that if they succeeded they could leave the session early and thereby avoid having to perform an aversive reading task. The memorization task for some was easy, for others was difficult, and for still others was impossible. Considering the results of certain of the previous avoidance studies, it is significant that the aversive (reading task) incentive was relatively low in threat value and therefore not likely to cause subjects to entertain thoughts of quitting. It also is of note that this incentive provided subjects with no extra-experimental means of avoidance. Together, these features should have allowed for a reasonable test of the hypothesis that negative appraisals of an aversive event will be reduced when the event is impossible to avoid relative to when the event is difficult, but possible and worthwhile, to avoid.

Method

Subjects

Thirty-seven student volunteers (27 females, 10 males) served as subjects. For participating, they received research credit in introductory psychology. Data from two subjects were lost because the subjects misunderstood the written experimental materials. Final analyses were performed on data from 35 subjects, 11 in the easy avoidance condition, 10 in the difficult avoidance condition, and 14 in the impossible avoidance condition.

Procedure

Subjects were met individually by a male experimenter who introduced them to the laboratory facility, seated them at a table in an experimental chamber, and described the purpose of the study: to examine psychological responses in people exerting different amounts of effort on different kinds of tasks. The experimenter left the room while subjects read an informed consent agreement.

Once the consent statement was signed, the experimenter re-entered the experimental chamber and instructed subjects to simply relax and read magazines for approximately 5 min while he occupied himself in an adjacent control room. When 5 min were up, the experimenter returned, removed the magazines, and placed directly in front of subjects a set of written experimental instructions. The experimenter also placed in the upper left-hand corner of the table two folders (one marked *MEMORY TASK FOLDER* and the other marked *QUESTIONNAIRE 1*) and in the upper right-hand corner of the table a pair of complicated-looking research articles (Formelli, Carsana, & Pollini, 1987; Germana, 1968). After directing subjects to read and follow the experimental instructions, the experimenter went back to the control room.

Information provided on the first page of instructions was general and not much different from that in the informed consent agreement. Initially, subjects were to be randomly assigned a memory task that could range in difficulty from very easy to very difficult. Following that, they might perform a reading comprehension task, which would involve their reading and being tested over the research articles on display.

Information on the second page was more specific and differed according to the condition to which subjects were assigned. Easy avoidance subjects were told that their first task would be to memorize *two* nonsense trigrams within 2 min. Difficult avoidance subjects were informed that their task would be to memorize *six* nonsense trigrams in 2 min. Finally, impossible avoidance subjects learned that their task would be to memorize *twenty-five* nonsense trigrams in 2 min. An example of each type of task was provided (e.g., RGT YHG).

In addition to describing the task, instructions on the second page introduced a "reason" for subjects to perform well on the memory task. Specifically, subjects were told that, if they succeeded on the memory task that they had been randomly assigned, they could leave the experiment early and thereby avoid having to stay and perform the reading comprehension task later in the session. If they did not succeed, they would have to stay and perform the reading comprehension task to receive full credit.

Once instructions were clear, subjects pressed the *CALL* button on an intercom in front of them to indicate to the experimenter that they were ready to begin. They expected a brief pause and then a signal from the experimenter to open the *MEMORY TASK FOLDER* and start work. Instead of giving the signal, however, the experimenter interrupted and instructed subjects over a PA system to complete the questionnaire in the folder marked *QUESTIONNAIRE 1.* When subjects finished, they notified the experimenter by pressing the *CALL* button again. At this point the experimenter returned to the experimental chamber and conducted a thorough debriefing.

Results

The primary manipulation check was a question asking subjects how difficult they thought the memory task was that they had been assigned (1 = *not at all,* 15 = *extremely*). An ANOVA on responses to this measure revealed a reliable groups effect, $F(2, 32) = 40.12, p < .001$. Consistent with expectations, difficulty ratings increased from the easy avoidance condition ($M = 2.27$) to the difficult avoidance condition ($M = 6.80$), $t(32) = 3.92, p < .01$, and from there to the impossible avoidance condition ($M = 11.79$), $t(32) = 4.56, p < .01$. A secondary manipulation check asked subjects to indicate how likely they believed it was that they would be able to perform their memory task and thereby avoid the reading comprehension task (1 = *not at all,* 15 = *extremely*). An ANOVA on those data also yielded

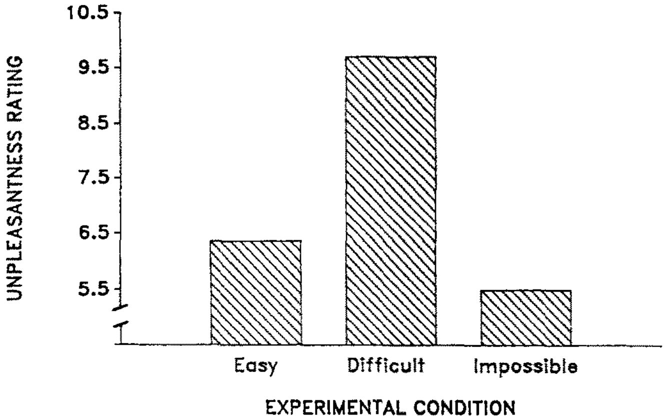

Fig. 1. Experiment 1: Unpleasantness ratings as a function of experimental condition.

a significant groups effect, $F(2, 32) = 23.53$, $p < .001$. As might be expected, likelihood of success estimates were higher in the easy avoidance condition ($M = 12.82$) than in the difficult avoidance condition ($M = 8.70$), $t(32) = 3.13$, $p < .01$, and higher in the difficult avoidance condition than in the impossible avoidance condition ($M = 4.50$), $t(32) = 3.36$, $p < .01$.[3]

Appraisals of the aversive incentive were assessed by asking: "Sometimes people find certain kinds of tasks more unpleasant than others. If you have to stay for the full session, how unpleasant do you think the reading comprehension task will be?" Once again, responses were made on a 15-point scale with endpoints of 1 (*not at all unpleasant*) and 15 (*extremely unpleasant*). Given that the difficulty manipulation was effective, the appropriate test of the experimental predictions is the quadratic trend across difficulty conditions. This proved to be highly significant, $F(1, 32) = 8.06$, $p < .01$. Figure 1 shows that, as expected, unpleasantness ratings were higher in the difficult avoidance condition than in the easy avoidance condition, $t(32) = 2.08$, $p < .05$, and the impossible avoidance condition, $t(32) = 2.75$, $p < .01$.

In the context of this procedure, there is second motive that could be operating – the motive to leave early. Conceptually, this and the motive

[3]The MSe from an overall ANOVA is a better estimate of population variance than are variance estimates based on data from individual cells. Consequently, t-test comparisons here and throughout the paper were performed using a pooled error term.

to avoid the reading comprehension task are not independent. That is, part of the unpleasantness of having the stay and read is the further time required in the experimental situation. Similarly, the appeal of getting to leave derives in part from the avoidance of the effortful and possibly onerous reading assignment. Consequently, our expectation was that the difficulty manipulation would affect the perceived attractiveness of leaving in the same manner as it affected the perceived aversiveness of performing the reading task. To assess the magnitude of motivation to leave, we simply asked subjects to indicate how attractive to them was the incentive of leaving early (1 = *not at all,* 15 = *extremely*). Analysis of those data revealed a reliable groups effect, $F(2, 32) = 5.65$, $p < .01$. As expected, ratings in the difficult avoidance condition ($M = 13.00$) were higher than those in the impossible avoidance condition ($M = 10.21$), $t(32) = 2.13$, $p < .05$. Unexpectedly, though, ratings by difficult subjects did not differ from those by easy subjects ($M = 14.36$), $t(32) = .99$, ns.

The General Activation (G Act) subscale from the Activation–Deactivation Adjective Check-List by Thayer (1967) was designed to measure the effects of physical exercise on feelings of energy. Despite the fact that this investigation did not involve physical exercise, we administered the subscale on an exploratory basis to see if self-reports of energy would be higher under difficult conditions than under easy and impossible conditions. An ANOVA on G Act scores indicated that the experimental groups did not differ in this respect. ANOVAs on subjects' responses to questions asking how helpless, depressed, and angry they felt (1 = *not at all*; 15 = *extremely*) also revealed no experimental effects.

Discussion

Results on the unpleasantness measure indicated that the aversive incentive was appraised differently depending on how difficult it was expected to be to avoid. As predicted, appraisals were less negative when avoidance was to be easy than when avoidance was to be difficult, but possible, to avoid. This finding replicates similar results in previous avoidance studies and provides still more evidence of the easy–difficult effect that has been hypothesized on the basis of energization theory. More significantly, appraisals also were found to be less negative when avoidance was to be impossible than when avoidance was to be difficult, but possible. This, of course, is the difficult–impossible effect that has been predicted, but clearly demonstrated in only one previous experiment (Brehm et al., 1983, Experiment 4).

Although the unpleasantness ratings accorded perfectly with predictions, ratings of the attractiveness of the incentive of leaving early did so only in part. Attractiveness ratings were lower for impossible subjects than for difficult subjects. However, ratings for the easy group did not differ from those for the difficult group. The unexpectedly high attractiveness ratings in the easy condition necessarily qualify the suggestion that avoidance motivation was lower when avoidance was easy than when avoidance was difficult. That is, because the motives to avoid staying and to leave early appear inextricably linked, it would seem that reduced avoidance motivation under easy task conditions should have been reflected in relatively low attractiveness ratings as well as in relatively low unpleasantness ratings.

There is the possibility that the failure to observe an easy–difficult effect on the attractiveness measure was due to a ceiling effect in the easy and difficult conditions. Note that the attractiveness ratings were higher overall than were the unpleasantness ratings and that in the analysis of the unpleasantness ratings the easy–difficult comparison was slightly weaker than the difficult–impossible comparison. If (a) energization effects were superimposed on higher initial values in the case of the attractiveness measure, and (b) energy levels were somewhat greater for easy subjects than for impossible subjects, then a weak or null effect between the easy and difficult conditions might be expected. On the other hand, the tendency was for ratings to be slightly higher for easy subjects than for difficult subjects, which does not fit well with this view.

EXPERIMENT 2

One purpose for the second experiment was to replicate the aversive incentive appraisal effects observed in the preceding investigation using the more conventional threat of aversive auditory stimulation. A further purpose was to obtain evidence relevant to the assumption that a moderately difficult trigram memorization task produces greater energization in an avoidance context than does an easy or impossibly difficult trigram memorization task. To these ends, we led subjects to believe they could avoid a noxious noise by memorizing in 3 min two, eight, or twenty nonsense trigrams. As in Experiment 1, subjective measures were obtained just before subjects expected to perform their task. In addition, assessments of systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HR) were made immediately before and then during the task period.

Cardiovascular Predictions

Research on the psychophysiological effects of effortful, or active, coping (Obrist, 1976, 1981) led us to expect that sympathetic (beta-adrenergic) influences upon the heart would be greater among subjects assigned the moderately difficult task than among subjects assigned the easy and impossibly difficult tasks. We believed that task engagement would increase once work began relative to when work was only imminent, and therefore predicted that group differences in cardiovascular reactivity would be more pronounced during the performance phase of the study than during the anticipatory phase of the study. Evidence that HR and SBP are more sensitive than DBP to sympathetic influences (Obrist, 1976; Obrist et al., 1978; Obrist, Light, McCubbin, Hutcheson, & Hoffer, 1979), led to the expectation that HR and SBP would be most likely to reflect the impact of the experimental manipulation. However, because (a) the effect of low levels of sympathetic activity upon HR can be overriden by countervailing parasympathetic influences (Light & Obrist, 1983; Obrist, 1981), and (b) a number of studies from our laboratories have suggested that, during an anticipatory interval, HR is less affected by a difficulty manipulation than is SBP (e.g., Contrada, Wright, & Glass, 1984; Wright, Contrada, & Patane, 1986; Wright & Gregorich, 1989; Wright, Shaw, & Jones, 1990, Experiment 2), predictions regarding HR responses during the anticipation phase were considered tentative.

Method

Subjects

Subjects were 51 female and 33 male undergraduate volunteers. They participated in order to receive research credit in the general psychology course at the University of Alabama at Birmingham. Data from two (female) subjects were lost: One subject misunderstood the experimental instructions and the other was suspicious about the cover story because she had been in a similar study previously. Final analyses were performed on data from 82 subjects, 30 (12 male, 18 female) in the easy avoidance condition, 30 (10 male, 20 female) in the difficult avoidance condition, and 22 (11 male, 11 female) in the impossible avoidance condition.

Measurement of Blood Pressure and Heart Rate

Cardiovascular measurements were obtained with an automatic noninvasive heart rate and blood pressure monitor (Spacelabs, Model 2600). This device attempts initially to determine blood pressure via the auscultatory method, utilizing a standard blood pressure cuff and Korotkoff sound microphone. If sound detection fails, it switches from the auscultatory mode to an oscillometric mode. In the oscillometric mode SBP and DBP estimates are calculated from mean arterial pressure [mean arterial pressure = DBP + 1/3 (SBP–DBP)], which is inferred on the basis of the intensity of pulsations in the occluding cuff. Blood pressure readings obtained with this type of monitor have been found to correlate highly with those obtained stethoscopically (Light, Obrist, & Cubeddu, 1988). Heart rate is derived via detections of K sounds (auscultatory mode) or oscillometric pressure surges (oscillometric mode) within the cuff bladder.

The compressing cuff and mounted sensor were placed over the brachial artery of the subject's nonpreferred arm. Determinations took approximately 20 seconds to make and were displayed numerically on a monitor in an observation room adjacent to the experimental chamber. Visual observation of the subjects was maintained via closed-circuit TV.

Procedure

Subjects were greeted individually by a male or female experimenter who introduced them to the facility and asked them to be seated at a table in the experimental chamber. On the table was an informed consent agreement and an intercom. Directly in front of the table, mounted on the wall, were two 3-in. × 6-in. speakers (Realistic, Minimus-3.5). The experimenter left the room for a brief period of time so that subjects could read and then sign the consent statement in private. The form indicated that the study was concerned with psychophysiological correlates of decision making. It further stated that over a series of trials subjects would be presented with different tasks and given the opportunity to obtain something attractive or avoid something aversive by performing them. Heart rate and blood pressure were to be measured at various intervals and, periodically, subjects would be asked to indicate their feelings and impressions of the situation.

Once the informed consent statement was signed and collected by the experimenter, there was a 6- to 10-min baseline period, during which time subjects were to sit quietly and relax. Several popular magazines were made available for perusal. In the majority of cases, measurements of SBP, DBP, and HR were taken every minute until two successive SBP values were relatively constant (±5 mmHg) and a minimum of 6 min had passed (Contrada et al., 1982; Glass et al., 1980). Where this was done, the average of the final two readings on each measure constituted baselines. Two subjects had successive SBP values between the 6th and 10th minutes that fell just outside the ±5-mmHg range. For them, baselines were calculated by taking the average of the final five readings on each measure.

After the baseline period, the experimenter re-entered the experimental chamber and gave subjects a set of written instructions. In addition, the experimenter (a) placed in the upper left-hand corner of the table two large envelopes, one marked *INSTRUCTIONS FOR TASK 1* and the other marked *TASK 1*, and (b) placed in the upper right-hand corner of the table an envelope marked *QUESTIONNAIRE 1*. Immediately thereafter, the experimenter left the room, explaining that any further communication would take place over the intercom and PA systems.

The general instructions reiterated the purpose of the study and went into some detail about what would be taking place. They stated that the session would involve a series of trials, or work periods, in which subjects would be presented with a task and offered the chance to gain an attractive incentive or avoid an aversive incentive by performing up to a certain standard. Presumably, the nature and difficulty of the task could differ from trial to trial as could the nature of the incentive. The role of the subjects was to decide how much effort they wanted to exert, given the "payoff" involved, and then behave accordingly. So that subjects would not work hard just to please the experimenter, it was emphasized that the investigators did not care how much effort was exerted in any given trial, or for that matter in the session as a whole. Ostensibly, the research would be benefited regardless.

Once they read and understood the general instructions, subjects opened the envelope marked *INSTRUCTIONS FOR TRIAL 1*. Inside was a page describing the specific task that would be performed in the first trial and the outcome that was contingent upon good performance. If subjects were in the easy avoidance condition, instructions stated that the first task would be to memorize two nonsense trigrams within 3 min. If subjects were in the difficult avoidance condition, instructions stated that the task would be to memorize eight trigrams in 3 min. And if subjects were in the impossible avoidance condition, instructions stated that the task would be to memorize twenty trigrams in 3 min. In all conditions, subjects were told that a noise would come over the speakers on the wall if all of the assigned trigrams were not memorized at the end of the

3-min performance period. To limit the degree of threat and minimize "steeling" (physical bracing) toward the end of the performance period, the noise was described as moderate and gradual in building to a peak intensity.

> The noise [in this trial] will not occur suddenly and therefore startle you. Instead, it begins at a very low volume and builds gradually to its peak. On the other hand, at its peak the noise is fairly loud and unpleasant. A good comparison would be the noise created by an average stereo turned up to one-half its maximum volume.

When subjects understood the instructions, they indicated their readiness to begin by pressing the *CALL* button on the intercom, which sounded a tone in the observation room. They expected a 30-second pause after this and then a signal from the experimenter (over the PA system) to open the *TASK 1* envelope and begin work. After hearing the tone, the experimenter waited approximately 15 seconds and then took an anticipatory sample of blood pressure and heart rate. Immediately thereafter, the experimenter interrupted and, rather than directing attention to the *TASK 1* envelope, asked subjects to open the envelope marked *QUESTIONNAIRE 1*. Inside, subjects found a questionnaire asking them to report on 11-point scales (0 = *not at all*; 10 = *extremely*) (a) how difficult the task was that they had been assigned, (b) how likely they thought it was that they would succeed on the task if they tried, (c) how unpleasant it would be to them personally to have to be exposed to the noise at the end of the trial, (d) how much they wanted to avoid the noise at the end of the trial, and (e) how much effort they intended to exert during the work period.

Following completion of the questionnaire, subjects pressed the *CALL* button once again. At that point, the experimenter directed them to open the *TASK 1* envelope and begin work on their memorization task. Blood pressure and heart rate samples were taken at the end of each minute in the (3-min) performance period. After the final assessment was made, the experimenter told subjects to stop working and then returned to the experimental chamber for the debriefing. All subjects were asked not to discuss the study with anyone who might later be in it or in one like it. No subjects were actually exposed to noise.

Results

Questionnaire Responses

An ANOVA on the difficulty data revealed a groups effect, $F(2, 79) = 46.81$, $p < .001$. Ratings were higher in the difficult avoidance

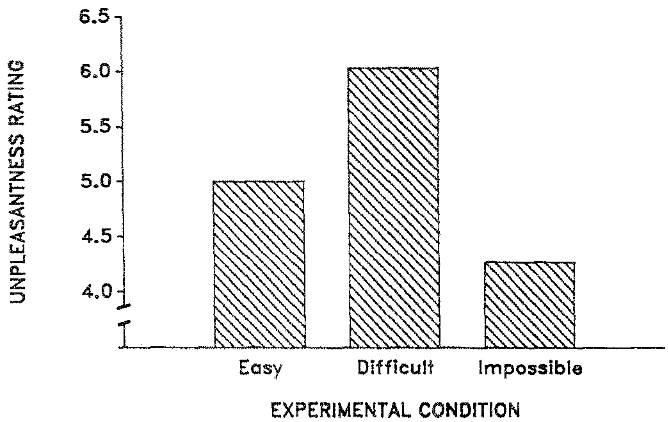

Fig. 2. Experiment 2: Unpleasantness ratings as a function of experimental condition.

condition (M = 6.00, SD = 2.03) than in the easy avoidance condition (M = 2.37, SD = 2.03), $t(79) = 7.07$, $p < .001$, and higher in the impossible avoidance condition (M = 7.46, SD = 1.87) than in the difficult avoidance condition, $t(79) = 2.43$, $p < .02$. There also was a groups effect in the analysis of likelihood of success ratings, $F(2, 79) = 23.13$, $p < .001$, due to a decrease in perceived likelihood of success from the easy avoidance condition (M = 8.13, SD = 1.70) to the difficult avoidance condition (M = 5.37, SD = 2.09), $t(79) = 4.97$, $p < .01$, and a near-significant decrease in perceived likelihood of success from the difficult avoidance condition to the impossible avoidance condition (M = 4.27, SD = 2.71), $t(79) = 1.82$, $p < .08$.

Subjects' ratings of how unpleasant it would be to be exposed to the noise are presented in Fig. 2. Analysis indicated that the quadratic trend across difficulty conditions was reliable, $F(1, 79) = 6.83$, $p < .01$. As expected, unpleasantness ratings were relatively higher in the difficult avoidance condition than in the easy avoidance condition than in the impossible avoidance condition. Pair-wise comparisons revealed that the difference between the difficult avoidance and impossible avoidance groups was significant, $t(79) = 2.75$, $p < .01$, and that the difference between the easy avoidance and difficult avoidance groups approached significance, $t(79) = 1.75$, $p < .09$. Contrary to expectations, the quadratic equations did not attain significance in the analyses of subjects' ratings of desire to avoid the noise and intended effort (all $ps < .16$), although the means for those measures were in the expected order (want-to-avoid: easy M = 6.90,

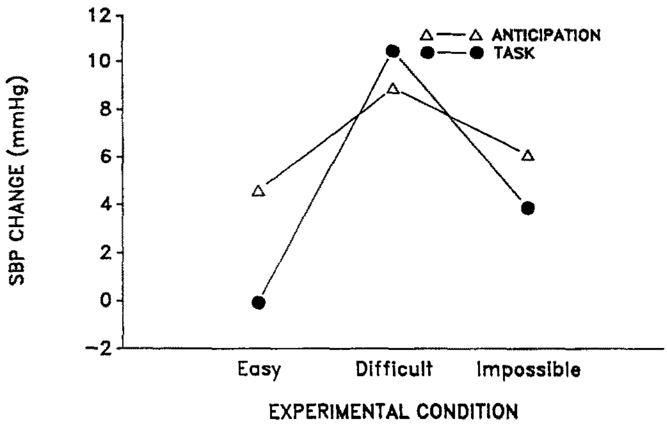

Fig. 3. Experiment 2: Systolic change-scores as a function of period and experimental condition.

difficult $M = 7.07$, impossible $M = 5.82$; effort: easy $M = 7.37$, difficult $M = 7.77$, impossible $M = 6.36$).

Basal Blood Pressure and Heart Rate

ANOVAs were performed on the baseline cardiovascular data to determine whether there were group differences prior to the experimental treatment. These yielded no main effects or interactions.

Cardiovascular Reactivity

Cardiovascular change-scores were calculated by subtracting baseline values from values obtained during the anticipation period and mean values obtained during the task period. These change-scores were then submitted to 3 (Easy Avoidance, Difficult Avoidance, Impossible Avoidance) × 2 (Pretask, Task) repeated-measures analyses of variance or covariance (baseline as the covariate), depending on whether there was a significant relation between change-scores and baseline values.[4]

Systolic Blood Pressure. In the case of SBP, the regression of change-scores onto baseline values was not reliable, and consequently an ANOVA

[4]Cardiovascular data were lost for two subjects due to equipment failure and for one subject due to experimenter error.

Table I. Experiment 2: Anticipatory SBP Change-Scores Above and Below the Group Median (+7.25 mmHg)[a]

Experimental condition	Easy	Difficult	Impossible
Above the median	13	19	8
Below the median	16	11	13
Proportion above the median	.45	.63	.38

[a]*Note:* There were no change-scores on the median. Due to equipment failure, anticipatory SBP data were not available for one subject in the easy avoidance condition and one subject in the impossible avoidance condition.

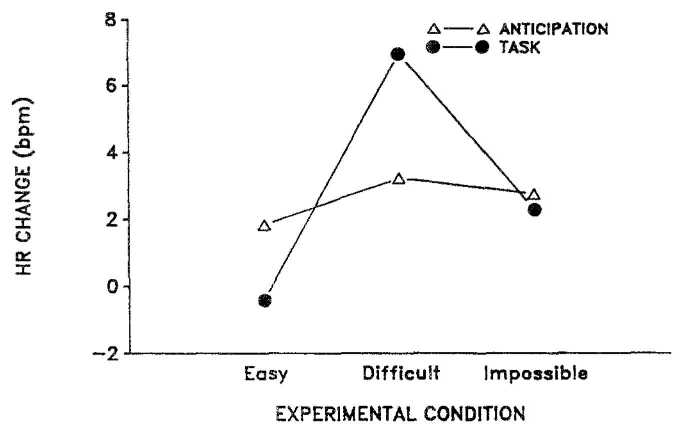

Fig. 4. Experiment 2: Heart rate change-scores as a function of period and experimental condition.

was conducted. This produced a difficulty main effect, $F(2, 76) = 6.09$, $p < .01$, a marginally reliable period main effect, $F(1, 76) = 3.57$, $p < .06$, and a Difficulty × Period interaction, $F(2, 76) = 4.20$, $p < .02$. Figure 3 shows that systolic elevations were relatively greater overall when the task was difficult than when the task was easy and impossible, although only the easy–difficult comparison was significant, $t(76) = 2.44$, $p < .02$. In addition, change-scores tended to be larger overall in the pretask period than in the task period. The interaction reflects primarily a less pronounced difficulty effect in the pretask period than in the task period. This is highlighted by planned tests of the quadratic trend across difficulty conditions in the pretask and task periods separately. Whereas the quadratic equation only approached significance during the pretask interval, $F(1, 152) = 2.60$, $p = .11$, it was highly reliable during the task interval, $F(1, 152) = 15.38$, $p < .01$.

An inspection of the SBP chance-scores indicated that the relative flattening of means in the pretask period was due in part to the presence of a few extreme values in some conditions. Therefore, the anticipatory SBP data also were analyzed by calculating in each condition the proportion of scores above the median (+7.25 mmHg) (see Table I) and submitting the arc sine-transformed proportions to a trend analysis (Langer & Abelson, 1972). This yielded a quadratic trend that fell just short of significance, $Z = 1.87$, $p = .062$.[5]

Heart Rate. Because the relation between HR change-scores and baseline HR values was not reliable, the HR changes were analyzed using the ANOVA. This yielded a marginally reliable difficulty effect, $F(1, 77) = 2.63$, $p < .08$, and a Difficulty × Period interaction, $F(2, 77) = 4.77$, $p < .01$. As seen in Fig. 4, HR elevations were somewhat higher overall under difficult task conditions than under easy and impossible task conditions. However, whereas the quadratic trend was reliable when applied to performance scores, $F(1, 154) = 9.29$, $p < .01$, it did not approach significance when applied to anticipation scores ($F < 1.0$).

Diastolic Blood Pressure. The regression of DBP change-scores onto DBP baseline values was reliable ($p < .005$); therefore DBP change-scores were analyzed with the ANCOVA. This revealed no significant effects (all $p > .20$). Covariance-adjusted pretask means in the easy avoidance, difficult avoidance, and impossible avoidance conditions were +6.25, +6.34, and +4.44, respectively. Covariance-adjusted task means in the easy avoidance, difficult avoidance, and impossible avoidance conditions were +3.56, +8.39, and +3.40, respectively.[6]

Mean Arterial Pressure. In addition to analyzing the conventional cardiovascular measures of SBP, DBP, and HR, we also calculated and analyzed change-scores for mean arterial pressure (MAP), which is thought to be an index of overall tissue perfusion. The relation between MAP

[5]This analysis includes an anticipatory SBP change-score from a subject for whom easy task instructions were mistakenly paired with a difficult task (see experimenter error in footnote 4). If the change-score is excluded, as it had to be in the conventional repeated-measures analysis, the quadratic effect is strengthened slightly.

[6]As a guard against noise/movement artifact, we omitted a single DBP change-score in the impossible avoidance condition which exceeded the group mean by more than 3 standard deviations.

change-scores and baseline MAP values was not reliable; consequently, the data were analyzed in the context of an ANOVA. This yielded only a main effect for task difficulty, $F(1, 75) = 4.30, p < .02$. Mean arterial reactivity was greater overall in the difficult avoidance condition than in the easy and impossible avoidance conditions. Although the Difficulty × Period interaction was not significant ($p > .10$), an inspection of the means indicates that the magnitude of the difficulty effect was somewhat greater during the performance period (easy avoidance $M = +2.06$, difficult avoidance $M = +8.83$, impossible avoidance $M = +3.08$) than during the anticipation period (easy avoidance $M = +5.87$, difficult avoidance $M = +7.35$, impossible avoidance $M = +4.49$).

Relations Between Pretask Change-Scores and Incentive Appraisals

To examine further the relationships between anticipatory physiologic responses and incentive appraisals, we computed product-moment correlations between the pretask change-scores and the unpleasantness ratings within and across the experimental conditions. As expected, anticipatory SBP elevations were positively correlated with unpleasantness ratings in the total sample ($r = .28$, $N = 80$, $p < .02$). This relation held within the impossible avoidance condition ($r = .43$, $n = 21$, $p < .05$). Coefficients in the easy avoidance condition ($r = .26$, $n = 29$, $p < .13$) and difficult condition ($r = .12$) were positive but not significant. Heart rate elevations were related to unpleasantness ratings only when avoidance was to be easy, and then the coefficient only approached significance ($r = .31$, $n = 29$, $p < .10$). Correlations involving (covariance-adjusted) DBP change-scores and MAP change-scores did not approach significance.

Differences as a Function of Gender

Questionnaire Responses. Three (Difficulty) × 2 (Gender) ANOVAs on the questionnaire data revealed two reliable effects involving gender: a gender main effect on the measure of how much subjects wanted to avoid the noise ($p < .01$) and a Difficulty × Gender interaction on the likelihood of success measure ($p < .02$). The main effect was due to lower want-to-avoid ratings among males ($M = 5.69$) than among females ($M = 7.29$). The interaction was the result of lower likelihood ratings for males ($M = 3.27$) than for females ($M = 5.27$) when avoidance was impossible, but not when avoidance was easy (male $M = 8.75$, female $M = 7.72$) and difficult (male $M = 6.00$, female $M = 5.05$). The MSe terms for the want-to-avoid and likelihood measures were 7.02 and 4.33, respectively.

Cardiovascular Data. Analyses on the cardiovascular data revealed three effects involving gender: a gender main effect on baseline SBP ($p < .04$), a gender main effect on baseline HR ($p < .005$), and a gender main effect on SBP change ($p < .03$). The main effects in the analyses of baseline data were due to a higher resting SBP among males ($M = 115.79$ mmHg) than among females ($M = 110.58$ mmHg) and a *lower* resting HR among males ($M = 75.47$ beats/min) than among females ($M = 81.92$ beats/min). The main effect in the analysis of SBP change-scores reflected greater change overall among males (+8.54) than among females (+4.30). The MSe terms for baseline SBP, baseline HR, and SBP change were 119.07, 94.63, and 122.44, respectively.

Discussion

The unpleasantness data, again, were congruent with the experimental predictions. When the memory task was moderately difficult, negative appraisals of the noise were relatively great in magnitude. When the task was easy or impossible, on the other hand, negative appraisals were relatively low in magnitude. These findings argue against the possibility that the effects observed in Experiment 1 were peculiar to the unusual incentive that was utilized. More importantly, they would seem to leave little doubt about the replicability of the full appraisal pattern observed in the immediate performance conditions of the fourth experiment by Brehm et al. (1983).

As expected, the cardiovascular results indicated relatively greater SBP reactivity among difficult avoidance subjects than among easy avoidance and impossible avoidance subjects. Group differences were quite pronounced in the task period, where the quadratic equation was reliable. Means were in the same order during the pretask period, but the predicted quadratic effect there only approached significance. The performance data provide more evidence that energy mobilization in an avoidant context is not simply related to perceived control, but rather to what can, will, and must be done to cope. The anticipatory data provided somewhat equivocal evidence of this and tentative support for our assumption that energization was greater among difficult avoidance subjects than among easy and impossible avoidance subjects during the interval in which incentive appraisals were assessed.

In view of the weakness of the pretask SBP results, it is of some note that the pattern of responses does have precedent in a previous investigation that differed from the present one in only minor respects (Wright, Brehm, & Bushman, 1989). Subjects were led to believe either that they could avoid an aversive noise by performing an easy or difficult memory task, or that they were in a control group that would not be able to avoid the noise. Analysis of anticipatory SBP change-scores revealed a quadratic trend ($p < .05$) reflecting a higher proportion of change-scores above the median in the difficult avoidance condition than in the easy avoidance and impossible avoidance conditions. Since the experiment did not provide impossible avoidance subjects with a task and did not measure incentive appraisals, it should not be considered redundant to the present investigation. Still, it was similar conceptually and in terms of procedure; therefore, the SBP findings may increase confidence in the reliability of the pattern of anticipatory SBP responses observed here, which did not quite reach customarily accepted levels of reliability. The extent to which they increase confidence is suggested by a summary of the obtained significance levels. Using the method of adding probabilities, described by Edgington (1972) and Rosenthal (1978), we obtain a $p < .008$.

Analyses indicated no group differences in DBP change, and greater HR reactivity among difficult avoidance subjects than among easy avoidance and impossible avoidance subjects only in the performance period. The null result for DBP, of course, was not surprising in view of data indicating that DBP is a poor index of sympathetic influence on the heart (Obrist, 1976). Although not predicted, the null effect for anticipatory HR also was not entirely unanticipated in view of the other evidence discussed earlier. If the present procedure induced a relatively modest beta-adrenergic response during the pretask period, then the effect of such a response upon HR may well have been neutralized by parasympathetic influences. Particularly in conjunction with the strong effects for performance SBP, the powerful effects for performance HR suggest substantial group differences in sympathetic activity once the work period began.

Results on the want-to-avoid and effort measures yielded weak support for the predictions. While means for each measure were patterned in the expected quadratic form, only the difference between the difficult and impossible avoidance conditions approached reliability (all $ps < .10$). In the case of the effort ratings, this may have been due to there having been a demand for all subjects to indicate that they intended to work hard (Orne, 1962). If there were such a demand, it could account for the lack of a significant quadratic trend and the tendency for estimates to be in the upper portion of the response scale. There also may have been a demand for subjects to indicate that they wanted to avoid the aversive incentive they were presented with. However, we suspect that another factor was at least as important in determining responses in this instance. That is, when faced with this question, some subjects may fail to distinguish the state with which we are concerned – that of active desire – from a more hypothetical wishing state, or what Feather (1959) has referred to as "attainment attractiveness." Since hypothetical wishing probably does not always correspond with active wanting, any confusion in this regard would be expected to dilute the sensitivity of the want-to-avoid measure to the effect of interest.

The correlational analyses indicated that anticipatory SBP change-scores were correlated with unpleasantness ratings in the full sample and at least marginally related to unpleasantness ratings within two of the three experimental conditions. These findings fit well with the experimental results and provide some additional support for the notion that aversive outcome appraisals vary with energization, as indexed by changes in SBP. At the same time, the findings suggest that subjects' responses on the unpleasantness measure were not solely a function of their SBP reactivity levels. Although correlations were observed, the amount of variance accounted for was small. Indeed, if an ANCOVA is performed on the unpleasantness ratings, using anticipatory SBP change as the covariate, the quadratic relation across difficulty conditions is weakened slightly, but not eliminated ($F = 6.39$). It would seem, then, either that SBP as it was assessed here was a highly imperfect measure of the energization construct, or that there were factors in this study other than energization which were associated with task demand and involved in the determination of incentive appraisals.

GENERAL DISCUSSION

The present studies strengthen the case for the argument that aversive incentive appraisals vary nonmonotonically with the difficulty of avoidant behavior. Moreover, the second study provides some evidence that variations in incentive appraisals are accompanied by corresponding variations in energy levels. To review, Experiment 1 indicated that ratings of the aversive reading task were more negative when the reading task was to be difficult to avoid than when the task was to be easy and impossible to avoid. Experiment 2 conceptually replicated this effect in a procedure that used noise as the aversive incentive. In addition, it showed (a) a limited correspondence between the pattern of incentive appraisals obtained in the pretask period and the pattern of SBP reactivity in the pretask period, and (b) reliable quadratic patterns for SBP and HR change during the task period.

While evidence was obtained that aversive incentive appraisals and certain cardiovascular responses are a function of avoidant task demand, it is noteworthy that in the first study there were no group differences on the G Act scale, which would be expected to reflect *feelings* of energy. This could be viewed as contrary to an energization interpretation of the main unpleasantness results. It should not be, though, because the energization model makes no assumption about whether alterations in subjective arousal are necessary for appraisal effects to occur (for discussions, see Brehm et al., 1983, and Wright & Brehm, 1989). In relation to this, it is interesting that of the four avoidance experiments described earlier, only one showed a consistent correspondence between outcome appraisals and ratings on measures of self-perceived energy (Wright, 1984). Thus, the data from Experiment 1 fit with the bulk of available evidence which suggests that in avoidance contexts such as these appraisal effects are not mediated by perceptions of arousal.

To the degree that they bear out predictions from the energization model, these experiments lend credence to the suggestion that the formulation has potential as an integrative framework within which a variety of results in the stress literature may be understood. The findings to which they appear most relevant are those, described earlier, that indicate greater physiological and subjective "stress" where avoidant control has been made difficult as compared to easy and impossible. These effects are not easily explained in terms of conventional theories of stress because most of the theories assume that stress increases as control decreases. However, they would seem quite interpretable in terms of energization theory. That is, since energy mobilization and the perceived aversiveness of a stressor should be a function of the intention to try, it would be expected that certain physiological responses and measures of negative affect would be relatively great when task demands were moderate and relatively reduced when task demands were easy or impossible to meet.

Of course, this is not to say that no stress and coping models can be applied to data such as these. One notable case to the contrary is a model offered by Folkman (1984), which distinguishes between coping that is oriented toward averting or ameliorating the impact of a stressor (problem-focused coping) and coping that is oriented toward managing one's affective response to something unpleasant (emotion-focused coping). It is proposed that so long as something can be done to affect the occurrence or impact of the stressor, coping will be of the former type and that stress will be inversely proportional to the degree of behavioral control an individual has over the stressor. On the other hand, when a negative outcome is unavoidable, coping is expected to be of the latter type and stress a function of the effectiveness of intrapsychic processes such as reappraisal. The notion that stress increases as control decreases when individuals are engaged in problem-focused coping could be used to explain the subjective and physiological effects that have been observed under easy and difficult avoidance conditions. Similarly, the suggestion that subjects may actively reinterpret inevitable unpleasant outcomes as relatively benign could be offered as an explanation for the subjective and physiological results obtained where avoidance has been made impossible.

Somewhat less plausible is the model resulting from Wortman and Brehm's (1975) integration of learned helplessness theory (Seligman, 1975) and reactance theory (Brehm, 1966). This suggests that, if individuals start out expecting to be able avoid an unpleasant outcome, then experience with failure should initially lead to reactance and an increase in avoidance motivation. With repeated failure, though, there should be helplessness and reduced avoidance motivation. In the present instances, it could be argued that the difficult tasks induced reactance, whereas the impossible tasks produced helplessness. The problem with this suggestion is that the procedures in these studies did not establish in advance subjects' freedom to avoid the potential unpleasant outcomes. From the beginning, instructions made clear that (a) the difficulty of the task assigned could range from very low to very high, and (b) the outcomes could be avoided only if subjects' succeeded on their task. Therefore, reactance should not have been aroused.

It also is worth noting, in this regard, that whereas the helplessness model implies that avoidance motivation should be reduced only when avoidant control is impossible, energization theory suggests that avoidance motivation will be reduced when avoidant control is either impossible or *not worthwhile.* The experiments reported here do not provide evidence relevant to this distinction; however, recent studies by Biner, Hua, Kidd, and Spencer (in press, Experiment 1) and Wright et al. (1990, Experiment 1) do. Biner et al. found that negative appraisals of a noise stimulus increased from an easy avoidance condition to a difficult avoidance condition when the noise was expected to be highly aversive (presumably aversive enough to justify the effort required by the more difficult task), but were low irrespective of avoidant task demand when the noise was to be mildly aversive. Wright et al. obtained the same pattern of results on an appraisal measure and on measures of SBP and HR reactivity taken just prior to and during task performance.

In addition to the above perspectives, there are a number of theories outside of the stress and coping area that might be applied to the appraisal results (for discussions, see Brehm et al., 1983; Wright & Gregorich, 1991). Two of the most familiar are dissonance theory (Cooper & Fazio, 1984; Festinger, 1957) and achievement motivation theory (Atkinson & Feather, 1966; Heckhausen, 1977). Dissonance could be offered as an explanation insofar as it predicts that people will sometimes (a) maximize the aversive quality of unpleasant outcomes they have freely chosen to avoid, and (b) minimize the aversive quality of unpleasant outcomes they have freely chosen not to avoid. However, in the current studies choice was not emphasized. Moreover, subjects in the difficult conditions did not know whether they would succeed and therefore avoid the aversive incentive. This is crucial because work by Jecker (1964) indicates that, in a dissonance paradigm, re-evaluation of potential outcomes does not occur until the results of one's efforts are known. In view of these considerations, it is not surprising that Brehm et al. (1983, Experiment 2) found that ratings of the attractiveness of a potential positive outcome were higher under difficult task conditions than under easy task conditions when they were made immediately prior to a performance period, but not when they were made 5 min after the performance period. Such a result conflicts with a dissonance interpretation, because dissonance effects should be at least as strong after work as before. It supports an energization interpretation, though, because energy levels would be expected to return to baseline once work has been completed.

Achievement theory, of course, predicts a nonmonotonic relation between the motivation to achieve and task difficulty, with achievement motivation increasing with task demand up to the point at which success probability is perceived as close to .5 and then decreasing systematically. If one assumes that the motivation to achieve could affect perceptions of achievement-relevant outcomes, then it seems reasonable that this could account for data indicating more negative evaluations of an aversive incentive under difficult avoidance conditions than under easy and impossible avoidance conditions.

Although an interpretation in terms of achievement theory cannot be ruled out, that view also is not without difficulty. For one thing, it would appear to assume that subjects in these studies are more concerned about achievement than they are about avoiding the negative outcome contingent upon good performance, which seems unlikely. For another, it cannot easily account for the full interactive pattern of appraisals obtained in studies which have crossed difficulty manipulations with manipulations of variables that ought to affect how much effort is warranted in the experimental situation. In the study by Biner et al. (in press, Experiment 1), for instance, achievement theory might explain results in the highly aversive noise conditions, but it cannot explain results in the mildly aversive noise conditions. Still another problem is that, in the third experiment reported by Brehm et al. (1983), perceived difficulty was successfully manipulated between the two-trigram and four-trigram conditions without affecting subjects' perceptions of the likelihood that they would succeed. Despite the fact that success likelihood was held constant, four-trigram subjects appraised the potential shock as more aversive than did two-trigram subjects.

A final perspective that should be mentioned is Seta and Seta's (1982; Seta, Seta, & Martin, 1987) personal equity analysis, which proposes that individuals adjust their perceptions of outcomes to make them equitable with the costs incurred in attaining the outcomes. Typically, this has been discussed in relation to circumstances in which individuals have actually exerted different degrees of effort. However, it might be suggested that, in appraisal experiments such as those presented here, subjects adjust their perceptions of relevant outcomes on the basis of costs they *expect* to incur, in terms of energy expenditure. Since subjects in the difficult condition, presumably, intend to exert relatively great effort, they would be expected to enhance the value of attractive or aversive incentives. Because subjects in the easy and impossible conditions, presumably, do not intend to exert much effort, they would be expected to minimize the value of attractive or aversive incentives.

Like the analysis by Folkman (1984), the personal equity model would seem to present a plausible alternative to the energization interpretation of the appraisal findings. And so far as we can tell, there are only two sets of data with which the analysis might have difficulty. The first is from the fourth experiment by Brehm et al. (1983), which indicated a nonmonotonic relation between avoidant task demand and shock unpleasantness ratings when performance was imminent, but not when performance was to occur some time later. The other is from the second experiment by Brehm et al. (1983), which showed a positive correspondence between task demand and goal attractiveness immediately prior to, but not 5 min after, performance. Clearly, interesting aims for future research would be to specify areas in which this and other plausible formulations make predictions that conflict with those from the energization model and then determine empirically the relative viability of the opposing views.

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