THE RECOGNIZABILITY OF PREDICTION, CONTROL, AND SUCCESS INTRODUCED INTO AN AVERSIVE STIMULUS CONTEXT

BY

DEBORAH M. GURAL

A Thesis
Submitted to the Faculty of Graduate Studies
in Partial Fulfillment of the Requirements
for the Degree of

MASTER OF ARTS

Department of Psychology
University of Manitoba
Winnipeg, Manitoba

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Abstract

To assess effects of predictionless control, participants on each of 24 card-positioning trials blindly chose which of two positions (A or B) they wanted to count for that trial, each position resulting in either a "success" (which supposedly reduced a later duration of noise exposure) or a "failure" (which supposedly had no effect on this duration). Participants were told at the start of each trial whether their choice of card-position "makes a difference" (control) or "makes no difference" (no-control) on the noise duration, and on each trial they were either shown (prediction) or not shown (no-prediction) whether the noise duration had been reduced. Before and after exposure to the noise, participants completed a dependent measures questionnaire assessing perceptions of control, prediction, and success regarding the noise duration. Participants receiving 25% controllable trials gave higher ratings of perceived control than those receiving 0% controllable trials. Participants under 100%-prediction gave higher ratings of perceived confidence than those under 0%-prediction conditions. These and other findings support the researcher's conceptualization of control.

Introduction

Importance of the Control Concept

Numerous products, services, and self-help groups have been developed to assist individuals quit smoking, lose weight, cope with stress, and become more assertive (Goor & Goor, 1990; Leventhal & Cleary, 1980; Leventhal & Nerenz, 1982; Maltz, 1964; Peale, 1990; Stunkard, 1979). The majority of these resources appear to have the common goal of helping people maximize the control they have over themselves and their environment. The extensive development and use of such resources indicate that having some level of control in situations is important to people and implies that such control serves a significant function in everyday life. Control-associated concepts such as mastery and power (Adler, 1927), operant behavior (Skinner, 1953), and effectance (White, 1961) have even formed the basis of several theories of personality.

The large number of studies investigating various aspects of controllability demonstrates that psychological researchers also have an interest in this concept (Seligman, 1975; Miller, 1979). Such investigators have focused primarily on the control of aversive and/or stressful stimuli, where control is generally defined as the dependence of an outcome on a response (contingency). This research suggests that both humans (Miller, 1979) and animals (Seligman, 1975) generally prefer controllable events over uncontrollable events. Accordingly, definite benefits resulting from controllability (i.e., Hiroto, 1974; Miller & Seligman, 1975) have been observed. Specifically, perceptions of control appear to be important in reducing the aversiveness of an unpleasant situation (e.g., Glass & Singer, 1972), reducing participants' ratings of pain of aversive stimuli (Miller, 1979), and assisting one in adjusting to short term (Averill, 1973; Thompson, 1981) and long term stressors (Taylor, Lichtman, & Wood, 1984). For example, it has been observed that increased perceptions of control over the progression of one's illness (cancer) was related to increased psychological adjustment (Taylor, Lichtman, & Wood, 1984). The conclusions resulting from this research attest to the importance of control in a variety of situations (Averill, 1973; Seligman, 1975) and lend support to the notion that a sense of control has a "definite and positive role in sustaining life" (Lefcourt, 1973, p. 424).

From the reverse perspective, the debilitating consequences of exposure to uncontrollable stimuli have been observed across various species and experimental situations. For example, Sklar and Anisman (1981) found that tumors grow more quickly in mice given inescapable (uncontrollable) shock than in mice given escapable (controllable) or no shock. Similarly, rats exposed to uncontrollable shock were only half as likely to reject a tumor and twice as likely to die than rats exposed to uncontrollable or no shock (Visintainer, Volpicelli, & Seligman, 1982). The authors conclude that these results imply that "lack of control over stressors reduces tumor rejection and decreases survival" (p. 437). This increase in susceptibility to tumor growth and death has been explained as resulting from a suppression of the organisms' immune system that has been found to follow exposure to uncontrollable aversive events (Greenberg, Dyck, & Sandler, 1984). Additional uncontrollability deficits have been observed in studies using cats (Seward & Humphrey, 1967) and dogs (Seligman & Maier, 1967). Previous studies with human participants also demonstrate the adverse effects of uncontrollability. For example, exposure to uncontrollable stimuli has been observed to result in behavioral symptoms of depression in humans (Gatchel, Paulus, & Maples, 1975).

Importance of the Prediction Concept

The concept of prediction has also been investigated in numerous studies (Davis & Levine, 1982; Finkelman & Glass, 1970; Miller, 1981). As with control, the concept of prediction has also formed the basis of personality theories (e.g., Kelly, 1955).

Although it may not always be possible to control a specific aversive event, it may still be possible (and advantageous) to predict something about the situation. In such instances, prediction may decrease the aversiveness of a situation. Accordingly, research suggests that humans (Lanzetta & Driscoll, 1966) and animals (Badia, Harsh, & Abbott, 1979) prefer predictable events over unpredictable events. This research also finds behavioral deficits experienced by individuals who do not have prediction over aversive events (Glass & Singer, 1972, 1973; Seligman, 1975; Miller, 1980). It has even been suggested that it may be the prediction accompanying control that facilitates the reduction of stress (Averill, 1973).

Control versus Prediction

The emotional, physiological, cognitive, and motivational deficits that result when an organism is exposed to uncontrollable and/or unpredictable aversive stimuli have been studied extensively by numerous researchers (see Glass & Singer, 1973; Maier & Seligman, 1976; Seligman, 1975 for reviews). Given the apparent importance of both control and prediction in reducing the debilitating effects of aversive stimuli, the question immediately arises whether it is more beneficial to have some level of control over an aversive event or to be able to predict that event. Accordingly, researchers (Turnbull, 1982; Wortman, 1975) have attempted to determine the differential effects of controlling and predicting an aversive event.

Such efforts have run into a major obstacle, however. Although prediction without control has been examined (Finkelman & Glass, 1970; Mineka & Kihlstrom, 1978), control without prediction has been a difficult condition to arrange.

> These two variables are very hard to separate; for when control is present, prediction is as well...Ultimately, the problems of disentangling the effects of controllability from predictability may be next to logically impossible. (Seligman,

1975, p. 124).

It is, of course, logically impossible to manipulate the factors of controllability and predictability completely independently. (Mineka & Kihlstrom, 1978, p. 259).

Such statements imply that it has been difficult--if not impossible--to separate control and prediction not only because of the inability to experimentally arrange such conditions, but also because of problems encountered when trying to isolate control and prediction conceptually. Despite this difficulty, some researchers have still attempted to examine the separate effects of control and prediction (Burger & Arkin, 1980; Wortman, 1975).

Previous Attempts to Isolate Control and Prediction

Attempts to isolate the differential effects of control and prediction (Mineka & Hendersen, 1985) have occasionally resulted in findings which suggest that predictability alone may be sufficient to produce the benefits previously attributed to controllability. According to this view, the active mechanism in producing observed controllability benefits is the predictability that is inherent in the controlling response.

For example, Starr and Mineka (1977) examined rats that were trained to bar press for food. Following this training, the rats were randomly assigned to one of three groups for avoidance training/fear conditioning: (a) a master-control group which was presented with a tone (conditioned stimulus or CS) followed by a shock (unconditioned stimulus or US) and could escape the shock by jumping to the "safe" side of the shuttle-box; (b) a yoked/external-safety-signal group which could not escape the shock but received the same CS and US presentations as those in the master-control group as well as a brief "safety-signal" (houselight shut-off for three seconds) coincidental with shock/tone termination; and (c) a yoked-no-external-safety-signal group which was exposed to the same CS/US events as the previous two groups, but could not escape the shock and did not receive the safety-signal. Following this conditioning the rats were tested for fear of the CS, which was indexed by recording the degree to which bar pressing for food was suppressed following CS presentation. The researchers concluded that the fear level of the rats was the same for master-control animals able to escape the shock as for yoked/external-safety-signal animals presented the safety signal coincidental with shock offset. Both of these groups exhibited lower fear levels than the yoked/no-external-safety-signal group which did not receive the safety signal. This finding suggests that both (a) the predictive safety signal (external feedback) for the yoked-feedback group and (b) the proprioceptive feedback from responding (internal feedback) for the escape-avoidance group decreased fear of shock, and either is sufficient to reduce or eliminate the detrimental effects caused by a lack of control. Thus, internal feedback and external feedback may have served the same function (i.e., allowed prediction of shock termination). It should be noted that this design failed to include a group able to control the shock but not able to predict its termination (i.e., a master-control/no-predictive-safety-signal group).

Mineka, Cook, and Miller (1984) examined these findings further, yoking the same three groups together: (a) a master/no-external-safety-signal group which was presented with a tone (CS) followed by a shock (US) and could terminate an aversive shock by depressing a ledge; (b) a yoked/external-safety-signal group which could not terminate the shock but received the same CS/US presentations as well as a lights-off safety signal; and (c) a yoked/no-external-safety-signal group which received the same CS/US presentations as the master-no-external-safety-signal group. When the rats were later tested for fear of the CS (as indicated by freezing behavior or absence of skeletal movement), the authors observed that master subjects and the subjects in the yoked-signal group displayed comparable fear levels which were significantly lower than those displayed by subjects in the yoked-no-signal group. It was concluded by the researchers that these findings implicated predictability as the active mechanism that eliminated increased fear (Mineka et al., 1984). This predictability was provided by either (a) the external safety signal or (b) proprioceptive signals resulting from making the escape response. As in the previous study (Starr et al., 1977), this design failed to include a group able to control the shock but unable to predict its offset.

Some studies lend support to the idea that control and prediction have entirely different effects. Rosellini, Warren, and DeCola (1987) examined the same groups studied in Mineka et al. (1984) while experimentally manipulating: (a) number of shock training trials and (b) intertrial interval (ITI) length. When exposed to 80 trials, the observations replicated the earlier findings of Mineka et al. (1984). Specifically, animals able to escape the shock by barpressing (master-control animals) and animals exposed to inescapable shock with a lights-off safety stimulus exhibited similar, reduced levels of fear conditioned to the aversive stimulus as compared to those animals exposed to inescapable shock in the absence of a safety signal. When the number of training trials was decreased to 40, however, animals in both yoked groups exhibited comparable fear levels which were significantly higher than those displayed by the master-control animals. Similar findings were also observed when the ITI (inter-trial interval between shock presentations) was decreased from 60 seconds to 5 seconds. It was concluded that such findings suggest that controllability and predictability operate differently in affecting fear. Again, it should be noted that a group which could control the shock but not predict its offset was excluded from the study.

Independence of action for control and prediction was also observed using two measures to test the effect: (a) a shuttle box escape test and (b) an appetitive noncontingent test (DeCola, Rosellini, & Warren, 1988). As observed by Mineka et al. (1984), animals exposed to inescapable shock with an external safety signal (light-offset) and animals that were able to escape the shock by making two barpresses (and thus generated their own predictive proprioceptive signals) exhibited comparable levels of fear (as measured by the amount of time the animal spent on the grid floor versus a platform) conditioned to the shock. Animals in both of these groups exhibited lower levels of fear than animals unable to escape the shock and not presented a safety stimulus. These two groups also demonstrated comparable performance in a shuttle box test, exhibiting lower escape latencies (i.e., decreased shuttle-escape deficits) than subjects who had received uncontrollable shock exposure in absence of a safety signal. While the researchers (DeCola et al., 1988) acknowledged that these findings support the hypothesis that predictability is sufficient to produce controllability benefits, they also reported that the responding of the two yoked groups on an appetitive noncontingent test was comparable and significantly different from those animals exposed to the controllable shock condition. Specifically, animals in the yoked groups exhibited lower operant response rates (fewer lever presses for food pellets) when compared with animals in the controllable shock condition, suggesting that the yoked groups were more sensitive to response-reinforcer independence than animals able to control the shock. Previous research has demonstrated that animals exposed to inescapable shock are more sensitive to subsequent response-reinforcer independence than if they had never been exposed (Warren, Rosellini, Plonsky, & DeCola, 1985). Consequently, when the response-food contingency is set to zero (no relationship between bar press and food delivery), inescapably shocked animals make fewer operant responses for food as compared to animals previously exposed to escapable or no shock. Failure of the safety signal to alter the responses of animals in the yoked/safety-signal condition suggests that prediction is not able to duplicate this effect of controllability. Thus, some mechanism in addition to prediction may be involved in producing the previously observed benefits for animals in the master (control) condition and those in the yoked/safety-signal condition. As in the previous study (Rosellini et al., 1987), the authors conclude that this finding supports the notion of an independence of action for control and prediction (DeCola et al., 1988). Considering these results, it seems possible that one cannot attribute the observed controllability benefits to the influence of predictability alone. However, as was noted for the previous studies, this design failed to include a group which could control the shock but not predict its termination. It should be noted that attempts to isolate control and prediction using human participants have also failed to include such a condition (Turnbull, 1982; Wortman, 1975).

The Traditional View of Control and Prediction

Researchers (e.g., Starr et al., 1977; Mineka et al., 1984) who have previously focused on separating the effects of control and prediction have contributed to numerous experimental studies. Their viewpoint that control is always confounded with prediction (though not vice versa) can be termed the "traditional view." According to this view, control requires that someone restrain, regulate, or direct the occurrence of an event; whereas prediction requires that someone get information which foretells the liklihood of occurrence of an event. For example, one can terminate a shock

(Starr & Mineka, 1977) or one can <u>be informed</u> whether or when a shock will occur; one can <u>control</u> the intensity of a shock (Staub, Tursky, & Schwartz, 1971) or <u>be informed</u> how intense it will be (Miller & Grant, 1979); one can <u>self-administer</u> the shock (Ball & Vogler, 1971) or <u>be informed</u> where on the body it will occur (Mineka & Kihlstrom, 1978) or what type of shock it will be.

Despite these seemingly independent definitions for control and prediction, the traditional view assumes that prediction is inherent (both conceptually and methodologically) in any controlling response (e.g., Averill, 1973; Seligman, 1975). According to this view, the concepts of controllability and predictability cannot be effectively isolated from one another, since whenever one has control over an event one undoubtedly has prediction of that event as well.

> ... an organism that has control over the offset of an event **ipso facto** has predictability about when that event will terminate. Indeed some theorists...argue that it is this added predictability inherent in control that produces all of the beneficial consequences of having control, and conversely that it is the

> unpredictability inherent in not having control that produces all the negative consequences... (Mineka et al., 1985, p. 509)

Thus, the traditional view of control says that we can predict an event without controlling it, but we cannot control an event without predicting it. However, even if adherents to the traditional view were to agree that it is technically feasible to include a predictionless control condition in a research study, some have suggested that participants would not be able to recognize predictionless control as control.

> While it is relatively easy to arrange outcomes that are uncontrollable but predictable, it is not at all easy to arrange outcomes that are controllable yet unpredictable. And even if they could be arranged, it is hard to see how one could convince people that they were controlling outcomes they were unable to predict. (Tiggemann & Winefield, 1987, p. 255)

Problems With the Traditional View of Control and Prediction

The assumption that one cannot have control over an event without predicting something about that event implies that it is impossible to study the effects of control free from the contaminating effects of prediction. According to Nickels, Cramer, & Gural (1992), the traditional view, that predictionless control is impossible to recognize or obtain, has had a number of difficulties:

1. Prediction/control studies working under the traditional view (Burger & Arkin, 1980; Wortman, 1975) have been unable to isolate effectively these two variables. Since the traditional view of control maintains that one cannot have control without having prediction, researchers have been discouraged from trying to develop a predictionless control condition. Thus, the no-prediction/control condition has typically been omitted from previous research. Even those studies which have attempted to separate the effects of control and prediction have failed to include this group, examining only prediction/control, prediction/no control, and no-prediction/no-control groups (e.g., Mineka, Cook, & Miller, 1984). Failure to include the no-prediction/control group makes it impossible to clearly separate the effects of control and prediction.

2. Some researchers have tried to separate control and prediction, but perhaps because of their traditional leanings, have often had their participants

control and predict different outcomes (depending on which groups they were in). For example, in one study (Burger & Arkin, 1980), participants controlled noise by solving anagram problems and predicted noise by being given time cues. However, participants actually (a) controlled noise offset (but not onset) and predicted noise offset (and onset) on the current trial in the control/prediction condition; (b) controlled nothing but predicted noise offset (but not onset) on the current trial in the no-control/prediction condition; (c) reduced by one half an unknown duration of noise on the next trial in the control/no-prediction condition; and (d) controlled and predicted nothing in the no-control/no-prediction condition. Comparison of the differential effects of control and prediction (both within and across experimental conditions) requires that one control and predict the same outcome.

3. Under the traditional view, benefits of predictionless (blind) control are often attributed to chance rather than to personal control. For example, in one study (Turnbull, 1982) the blind selection of a poker chip determined whether participants would later engage in an interesting or boring task. Half of the participants chose the chip themselves, while the

experimenter chose the chip for the other half of the participants. The author referred to both of these outcomes as being chance-determined outcomes. Not surprisingly, any perceptions of control resulting from such predictionless control situations are typically explained as being an instance of illusory control, which is defined as personal control attributed erroneously to a chance situation (Langer, 1975). In a similar study by Wortman (1975), participants blindly chose between two differently colored marbles, the color deciding whether the participant received a more or a less attractive prize. Alloy & Abramson (1979) noted that since such participants were choosing their outcomes blindly, their outcomes were due to chance. This meant that participants rating themselves as having high control erroneously attributed the outcome to their own "random" efforts rather than to chance and thus were succumbing to the illusion of control. In other words, the traditional view does not and cannot distinguish between predictionless (blind) control and illusory (false) control.

4. Some studies reflecting the traditional approach apparently had predictionless control at some point; but because they did not appreciate it as being

control, they gave it up by providing outcome information before the dependent measures were taken. In the previously described studies (Turnbull, 1982; Wortman, 1975), predictionless control was seemingly achieved when participants blindly chose between the poker chips or the marbles and thus decided which outcome would occur. However, the participants in the no-prediction/control condition were informed about their outcome before control ratings and other dependent measures were taken. Thus, the effects of predictionless control were not actually measured because the participants were given predictive information before the dependent measures could assess the effects of predictionless control. What probably was measured, however, was a certain degree of hindsight bias (Hawkins & Hastie, 1990).

5. According to the traditional view, "when individuals have control, they do not allow bad outcomes to occur" (Alloy & Abramson, 1979, p. 468). Again, it is implied that when one has control, one also has prediction and knows the outcome that follows from such control. It is also implied that prediction means being informed about contingencies; that is, being provided information as to which controlling

actions will result in which outcomes prior to engaging in the controlling response. The traditional view not only disallows predictionless control but also seems to have the additional restriction of requiring a foreknowledge of contingencies before control can be exercised.

6. In an attempt to distinguish between different levels or degrees of actual control, a measure designed to index objective controllability has been formulated in accordance with the traditional view (Alloy & Abramson, 1979). Based on Jenkins & Ward (1965), Alloy and Abramson (1979) used a "difference metric" to measure participants' degree of control, defined as contingency or dependency between responses and outcomes across trials (Alloy & Abramson, 1979, p. 447). Specifically, participants were required to either press or not-press a button on each of 40 trials, each response resulting in either a green-light outcome (success) or a no-light outcome (failure). Participants then rated the degree of control they believed their responses exerted over the outcomes. The difference metric was defined as the percentage of trials on which a press resulted in the desired outcome (light) minus the percentage of trials on which a not-

press resulted in the desired outcome. (In practice, negative difference metric values are avoided because the researchers always subtract the lower percentage from the higher percentage.) For example, in one condition the green light (desired outcome) came on 75% of the time when the button was pressed and 50% of the time when the button was not pressed. According to the difference metric, the degree of actual control or contingency in this case would be 75%-50% or 25%.

Unfortunately, the difference metric does not measure pure control. The phrase "desired outcome" in the definition of the difference metric implies that control depends on the difference in likelihood of getting the successful or desired outcome by giving one response rather than another. For the above example, there is a 25% greater likelihood of getting the desired outcome (success) by button pressing versus not pressing. The difference metric fails to focus solely on the influence one has over whatever outcome occurs (desired or undesired) because it also focuses on the predictable advantage one has in trying to get the desired outcome by pressing versus not pressing. Thus, the difference metric confounds personal control with predicted success.

A Reconceptualization of Control and Prediction: Impact Theory

Nickels (1980, 1991) has proposed a reconceptualization called Impact Theory in which the two concepts of control and prediction can be defined without reference to one another. Contamination of one concept by the other is thus avoided.

Control. According to Impact Theory, control implies that an organism makes an impact upon an event regardless of whether or not the individual anticipates this event (Nickels, 1991). Control refers to someone exerting an influence over an event. Whenever one is given the opportunity to take one action rather than another and whenever this action makes a difference in which of several outcomes will occur, then to the extent of the influence exerted, one controls that outcome (Nickels, 1991). For example, one can choose between two secretly hidden prizes behind Door #1 and Door #2 in a television game show without knowing which prize is behind which door. (In fact, the contestant may not even know what the prizes are.) In such a situation, the individual exerts predictionless control by choosing to take the prize behind one door instead of the other, thus having an impact on the prize to be received (outcome). Such a person contributes to deciding the outcome and knows about this contribution but does not now know the actual prize soon to be obtained.

Prediction. According to Impact Theory, prediction implies that an organism anticipates an event through the availability of relevant information about this event regardless of whether the individual affects the event (Nickels, 1991). In other words, the focus has changed from information-giving to information-getting. Prediction is now defined from the actor's (participant's) perspective, rather than from the observer's (experimenter's) perspective. Thus, prediction refers to knowing something about an event which allows one to foretell that event. Additionally, Impact Theory discriminates among the following: (a) predicting which events will influence which other events in which ways before an outcome occurs (prediction of contingencies), (b) predicting which outcome will occur (prediction of outcome), and (c) predicting that one has already influenced whichever outcome will occur (prediction of personal control). In the last case, one can predict that whatever outcome occurs will be due (at least in part) to one's own optional actions; and one can predict this without also predicting to which possible outcome one has contributed. Thus, we can foretell (c) the extent of our impact on an outcome without predicting either (a) the contingencies involved or (b) the most likely outcome to occur. Predicting (or knowing) (c) that we control an outcome is not the same as predicting (a) which antecedent event affects which outcome or predicting (b) which of several outcomes will occur. Although one can have control over an outcome without prediction (as defined in a, b, or c above), the reconceptualization recognizes that having prediction in sense (c)--but lacking it in senses (a) and (b)--is still a case of predictionless control.

Avoiding the Difficulties of the Traditional View

According to the reconceptualization, the redefinition of control and prediction allows researchers to define each concept separately without recourse to the other concept. This enables researchers to disentangle control and prediction effects largely because it recognizes predictionless control to be a possible condition in research. The availability of such a predictionless control condition thereby resolves the previously outlined problems associated with the traditional view.

1. The reconceptualization does not assume that prediction is inherent in a controlling response. Thus, it allows for the inclusion of a no-prediction control group that has been excluded from previous research and enables one to assess the effects of control <u>without</u> the confounding effects of predictability.

2. According to Impact Theory, control is redefined as the <u>influence</u> of a behavior on an outcome without the necessity of predicting that outcome (even though one may have prediction of one's personal control over this outcome). Whenever the differential effects of control and prediction are studied, the reconceptualization emphasizes that each must have the same outcome.

3. According to the reconceptualization, whenever one's choice contributes to an outcome, to that extent it is controlled by the person. Thus, predictionless control is neither a chance event nor an example of illusory control. For example, although Turnbull (1982) refers to the outcome of a participant's blind selection of a poker chip as chance-determined, the reconceptualization would state that the person has

predictionless control over the outcome to be received. For example, assume that there are two different soft drinks (Coke and Pepsi) served in a drink machine. Two buttons labelled "Coke" and "Pepsi," respectively, allow one to select the drink to be received. When the machine functions correctly, pressing the "Coke" button will result in a Coke, while pressing the "Pepsi" button will result in a Pepsi. In such a case, the outcome is controlled by which button is pressed; and since the contingencies are known beforehand, one would thus have predictive control. However, suppose the machine malfunctions, and one will receive a Coke regardless of which button is pressed. In such a situation, the outcome is not controlled by which button is pressed; but following the first few trials one knows the outcome will always be a Coke and thus, would have predictive uncontrol. Suppose now that the machine is fixed, but the labels have peeled off the buttons so one does not know which drink is associated with which particular button. At least for the first (blind) button press, one would have predictionless control. In this case, although the person does not know ahead of time (cannot predict) which button press results in which drink, the person's selecting and pressing one button rather than the other button does make a difference in the outcome (drink) received. Therefore, the reconceptualization interprets this choice behavior as providing genuine cues underlying veridical control (rather than as false cues underlying illusory control).

4. As previously noted, the reconceptualization acknowledges that people can have control by influencing an event without knowing in which way they have affected this event. As a result, it is possible to measure the effects of controllability without providing one with predictive knowledge regarding how one has influenced a particular outcome. According to Impact Theory, both Wortman (1975) and Turnbull (1982) were examining predictionless control before they provided predictive information about the outcome to their participants. After that, participants may have been highly susceptible to a hindsight bias (Hawkins et al., 1990). Since Impact Theory recognizes that one does not need to know how one will influence an outcome in order to have control over this outcome, the theory suggests that these difficulties can be avoided merely by measuring how much control people think they have prior to providing them with predictive information.

5. Because Impact Theory conceptually and operationally defines control independently of prediction, it is possible to consider and measure a person's control without any predictive cues whatsoever. Thus, not only does the reconceptualization allow for the fact that people may not know at any one time which outcome they have brought about (i.e., prediction of outcome), but it also allows for the fact that people may not know before control is exerted which options result in which outcomes (i.e., prediction of contingencies).

6. In addition to redefining the concepts of control and prediction, Impact Theory also proposes a new index of control. While acknowledging the simplicity of the difference metric and its capability of discerning different levels of control, Nickels et al. (1991) states that in some cases this measure appears to be incapable of separating control from prediction and success. In the two-choice task of Alloy and Abramson (1979), each response (press or no-press) resulted in a preset outcome (light or no-light). Table 1 presents three possible option sequences in which a participant's press or no-press on each trial results in either a light or no-light outcome, the "light"

Table 1

Comparison of Two Metrics for Measuring Control

	Sequence 1		Sequence 2		Sequence 3	
	press	nopress	press	nopress	press	nopress
Trial 1	light	light	light	light	light	nolight
Trial 2	light	light	light	nolight	light	nolight
Trial 3	nolight	nolight	nolight	light	nolight	light
Trial 4	nolight	nolight	nolight	nolight	nolight	light

Difference Metric (DM):

50% - 50% = 0%   50% - 50% = 0%   50% - 50% = 0%

Make-a-Difference Metric (MAD):

0/4 X 100 = 0%   2/4 X 100 = 50%   4/4 X 100 = 100%

outcome representing the desired outcome. According to the difference metric (DM), each of the three sequences has 50%-50% = 0% control since both a press and a no-press result in a green light (desired outcome) 50% of the time. For example, a press response under Sequence 1 results in a light outcome for two of the four trials, or 50% of the time. Similarly, a no-press response under Sequence 1 also results in a light outcome for two of the four trials, or 50% of the time. This measurement of control confounds control and success, since such a measurement focuses on only one possible outcome, namely, the desired or successful one. Traditionally, control is based on how much more of an influence one has over getting the outcome of interest by giving one response rather than another. Since neither option (press or not-press) is more likely to result in the desired outcome (i.e., 75-75, 50-50, or 25-25), the response is not considered to be contingently related to the outcome.

For the reconceptualization, however, control is based on how much influence one has over getting different outcomes--not necessarily outcomes of interest--by giving different responses (Nickels, 1991). Thus, making a difference implies that, on any trial, choosing one option contributes to some outcome, whereas choosing another option contributes to some other outcome, regardless of the desirability of these outcomes. For example, on Trial 1 of Sequence 1 a participant's press results in a light and a participant's no-press also results in a light. Thus, a participant has the opportunity of producing either a press or a no-press, with each response giving the same outcome (i.e., light). This represents no-control because neither response makes a difference in outcomes. In contrast, on Trial 1 of Sequence 3 a participant's press results in a light whereas a participant's no-press results in a no-light. Thus, a participant has the opportunity of giving either a press or a no-press, with each response producing a different outcome. This represents control because each response makes a difference in outcomes. It should be noted that Trial 4 of Sequence 3 represents control just as Trial 1 represents control even though the outcomes are associated with different responses. (In other words, control is not a direct measure of contingency which measures the degree to which a particular response is associated with a particular outcome across trials. Even if the contingencies were determined by chance, one would still have control on those trials where one's selection of response made a difference in outcomes.)

According to the reconceptualization, making a difference in outcomes through one's actions is considered to be more relevant to the measurement of control than predicting a difference in success between these actions. Such a distinction allows us to separate control from both prediction and success and to examine the independent effects of control. According to Impact Theory, control may be better measured by a "make-a-difference metric" (MAD), which measures control in terms of the average amount of difference one makes in deciding outcomes across choice points (trials). Typically, this comes out to be the percentage of trials on which the participant's choice between options (e.g., press or nopress) makes a difference in outcomes (e.g., light or no-light). The make-a-difference metric is calculated by multiplying by 100 the number of trials on which a participant's selection makes a difference in outcome received and dividing the result by the total number of trials. For example, in Table 1, control is measured at 0% in all cases according to the difference metric, but at 0%, 50%, and 100%, respectively, according to the make-a-difference metric. Thus, the make-a-difference metric is more sensitive to different levels of control. It also eliminates the contaminating factors of success and prediction and allows one to independently measure objective control.

Refinement of the Experimental Procedure under the Reconceptualization

In accordance with Impact Theory (Nickels, 1980), several studies have attempted to create a predictionless control condition and test participants' recognizability of this predictionless control once achieved. These studies have demonstrated that it is possible to effectively separate control and prediction and to examine their independent effects (Echols, 1983; Evers, 1991; Guttormson, 1984; Nickels, Cramer, & Gural, 1992; Tan, 1981). The results of these investigations suggest that participants can discriminate predictionless control to be control; that is, participants under high control give higher ratings of control than participants under low control regardless of predictability. The results also suggest that control and prediction exert different effects. Although all of these studies were based on the original concepts of Impact Theory (Nickels, 1980), they differed in the way participants with control exercised their control. However, each of these investigations used choice of response to define the control condition and no-choice of response to define the no-control condition, and also included some form of physical manipulation under choice conditions, but not under no-choice conditions. These physical manipulations involved contact with an outcome-related object.

For example, three different studies examined outcomes determined by the participant's choice of response (control) and by some random event (no-control), where some participants knew the outcome (prediction) while others did not know the outcome (no-prediction). In one study (Echols, 1983), participants were led to believe that through the insertion of one of two plugs into a timer circuit they could predict and/or control whether they worked on math problems for a short or long period of time while listening to white noise. The session would supposedly end when an unrevealed but preset number was reached on the timer as it counted up from 0000. During a demonstration, participants would see one speed plug cycling the timer display slowly (indicating a long time period), the other plug cycling the timer display fast (indicating a short time period). During the experimental trials, participants with control blindly chose one of the two speed plugs, picked it up, and inserted it into the circuit. Participants with no control did not make a choice response and were not allowed to touch either plug at all; instead, the experimenter flipped a coin and inserted the indicated plug into the circuit. Following plug selection, participants with prediction would see whether the fast speed plug (colored yellow) or the slow speed plug (colored black) was in the circuit. Participants with no-prediction would see two speed plugs but both would be black. Results indicated that participants with predictability (regardless of control) gave higher ratings of confidence than those with predictionless control. Also, participants (a) with both predictability and controllability or (b) with either predictability or controllability alone gave higher ratings of control and responsibility than those with neither prediction nor control. These findings support the observation in the previous study that perceived control and perceived prediction are related to different variables.

In this study, control (as distinguished from no-control) required the participants' physical manipulation of an outcome-related object, whereas no-control required the experimenter's physical manipulation of an outcome-related object. This last point raises a question as to whether one needs some form of physical manipulation in order to convey the idea of control.

As demonstrated by Langer (1975) in a series of studies, factors such as choice, active (physical) involvement in a task, and passive (thinking) involvement in a task are sufficient to bring about an illusion of control. For example, in Experiments 2 and 3 (Langer, 1975), participants given choices on "chance-controlled" tasks gave higher ratings of control than participants not given choices, implying that the cues provided by the choice behavior were sufficient to convey the "erroneous" idea of control. In addition, in Experiment 4 (Langer, 1975), participants who physically carried out the chosen action had higher confidence ratings about the outcome than those who did not; and in Experiments 5 and 6 (Langer, 1975), the participants who thought about the choices they made for a length of time had higher confidence ratings about outcomes than those who did not. Therefore, studies attempting to avoid the introduction of an illusion of control must take account of the possible biases brought about (a) by making choices; (b) by having physical contact with outcome-related objects; and (c) by thinking about choices once made. The study reviewed above held passive involvement constant, but it did not hold active involvement constant.

In a second study described in Nickels, Cramer, & Gural (1992, Study 1), participants were told that they would listen to an aversive white noise for either a short or long period of time (the long period being twice as long as the short time period) depending on which of two speed plugs was inserted into a timer circuit. Participants with control blindly chose one of the two speed plugs, picked it up, and inserted it into the timer circuit. Participants with no-control exercised no-choice; instead, the experimenter flipped a coin to determine the plug to be inserted, but participants themselves inserted the plug into the circuit. Participants with prediction were shown the speed of the cycling numbers on the display immediately after plug insertion, thus receiving information leading them to believe they would listen to the noise for either the short or long time period, while those with no prediction were not shown the speed of the cycling numbers. Participants with control (as compared to those with nocontrol) reported higher ratings of influence over how long they would be listening to the aversive noise, regardless of predictability. (Ratings of control were not taken.) Participants with prediction (as compared to those with noprediction) reported higher ratings of confidence regarding the amount of time they would spend listening to the noise. It should also be noted that no interaction between the variables of control and prediction was observed. These findings not only support the idea that control and prediction can be isolated, but also demonstrate that predictionless control is possible and will be perceived as such. In this study, all participants touched the selected speed plug so physical contact was held constant. A question remains as to what would happen if all participants were prevented from touching outcome-related objects.

In a third study (Nickels et al., 1992, Study 2) outcomes were associated either with the participant's choice of response (control) or with some random process (no-control); but unlike the previous studies, control did not involve a participant's physical contact with any outcome-related object. Participants with control blindly chose an outcome-related card by pointing to it. Participants with no-control exercised no-choice; instead, the outcome-related card was selected (but not touched) by the participant's partner. Participants with prediction were shown the back of the card immediately after the card was selected, thus receiving information leading them to believe they would work on the task for either the short or long time period. Participants with control (as compared to those with no-control) gave higher ratings of control, influence, responsibility, and credit or blame, regardless of predictabilty. Participants with prediction (as compared to those with no-prediction) gave higher ratings of prediction and confidence, regardless of controllability. Thus, this study eliminated physical contact as an element of control, but the results still showed that choice increased perceptions of control. However, as in the previous studies, only two levels of control (no-control versus total control) were examined. Therefore, a more complete test of Impact Theory would be to examine the effects of several levels of control.

In a fourth study, Guttormson (1984) investigated the effects of different degrees of control and prediction (as defined by Impact Theory's make-a-difference metric); specifically, 25%-control, 50%-control, and 75%-control and comparable levels of prediction were examined. As in the previously mentioned study (Nickels et al., 1992, Study 2), outcomes were associated either with the participant's choice of response (control) or with some random process (no-control), and the exertion of control did not involve physical manipulation. For each of several trials, participants attempted to match a preset pattern of letters (written in invisible ink) to win a prize with the experimenter revealing the chosen letter (and thus the outcome) by using a special pen. Participants blindly chose the counting letter (outcome) on each control trial, but exercised no-choice on each no-control trial (on which the counting letter was determined by the experimenter's flip of a disk); participants were shown the outcome on predictable trials, but were not shown the outcome on unpredictable trials. Since the number of controllable trials for a participant defined that participant's level of control, Guttormson (1984) extended the measurement of control from a dichotomy of no-control versus total control to varying degrees of control along a continuum. For example, participants with 25%-control blindly chose the counting letter (outcome) for 4 of 16 trials; those with 50%-control and 75%-control blindly chose the outcome for 8 and 12 trials, respectively. It was observed that participants with higher levels of control gave higher ratings of influence, regardless of predictability. Participants with higher levels of prediction gave higher ratings of prediction and knowing, regardless of controllability.

In all four of the above studies, only participants with control could make a choice between outcome-related responses; participants with no-control were given no-choice. Under such circumstances, both the traditional view and the reconceptualization advance the same hypothesis, namely, that participants with control will give higher ratings of control than participants without control whether predictive or predictionless. The traditional view would argue that this increase in control ratings is an instance of illusory control (Langer, 1975) induced by the exercise of choice, whereas Impact Theory would suggest that this increase in control ratings is an instance of veridical control (i.e., the participants' perception of their actual influence over the outcome.)

On the other hand, whenever both control and no-control participants make choices throughout a study, these two theories would advance opposite hypotheses. According to Langer (1975), ratings of control would be comparable if both control and no-control participants exercised choice in the study, since the exercise of choice would be sufficient to induce illusory control (i.e., high control ratings) for both groups. According to Impact Theory, however, the level of ratings of control would be higher for participants whose choices make a difference in outcomes than for participants whose choices make no difference in outcomes, because only the former participants would recognize that they actually controlled the outcome. Therefore, a further refinement of the experimental procedure would be to have all participants make choices, but only those with control would have different outcomes resulting from their choices.

One or more of the four studies reviewed above (a) examined varying degrees of control and (b) asked participants to indicate their choices without physically touching any part of the experimental apparatus. However, in all four studies, participants with control were asked to make a choice while participants without control were given no choice. In other words, a factor which has never been held constant before is (c) giving all participants a choice, regardless of their level of control. Thus, a clearer and more refined assessment of the usefulness of Impact Theory would take each of these factors into consideration.

The Present Study

In contrast with traditionalists' research which has confounded control and prediction (e.g., Mineka et al., 1984), the present study separates their effects by including a predictionless control condition. The present study also: (a) minimizes physical actions for all participants; (b) examines degrees of control; and (c) introduces (for the first time) choices that make a difference in outcomes (control) and choices that make no difference in outcomes (no-control).

As previously discussed, traditional measures of control such as the difference metric (Alloy et al., 1979) have confounded control with success. Thus, the present study also examines the effects of control and prediction within a context of varying levels of success.

Although sex differences were not an integral part of the hypotheses, the present study examined the effects of sex as well as control and prediction on the dependent variables. Differences in responding for males and females to prediction and control manipulations have been observed in previous research (Echols, 1983). Thus, data in the present study were analyzed according to sex to assess the extent to which sex differences influenced the dependent variables.

Hypotheses

According to the reconceptualization of control and prediction by Nickels (1980, 1991), one can have prediction without having control as well as control without prediction. In accordance with the reconceptualization and the results of previous studies (Echols, 1983; Guttormson, 1984; Nickels, Cramer, & Gural, 1992), it is expected that participants will recognize the prediction of outcomes as prediction; consequently, participants with higher prediction than other participants will give higher ratings of "prediction" and "confidence." Accordingly, it is hypothesized that (1) participants under 100%-

prediction (whether they receive cues that they will succeed or fail) will give higher ratings of "prediction" and "confidence" than participants under 0%-prediction.

Based on the same reasoning and in accordance with the results of previous studies (Echols, 1983; Guttormson, 1984; Nickels et al., 1992), it is expected that participants will recognize predictionless control as control; consequently, participants with higher control than other participants will give higher ratings of "control" and "influence." A typical baseline in control research has been the 0%-control condition (e.g., Mineka et al., 1984); a comparison condition requiring the greatest amount of discrimination of control by participants would be a 25%-control condition (rather than 50%, 75%, or 100%). Accordingly, it is hypothesized that (2) participants under 25%-control will give higher ratings of control and influence than participants under 0%-control. Consistent with previous findings (Echols, 1983; Guttormson, 1984; Nickels et al., 1992), no interaction between the variables of control and prediction is expected on any dependent variables.

Research (Miller, 1979; Wortman, 1976) also indicates that both perceived control and perceived prediction are important factors in reducing perceptions of aversiveness of a noxious stimulus. Although Nickels et al. (Study 1, 1992) did not observe lower perceptions of aversiveness for participants with control and/or prediction, such effects might have been observed under more aversive conditions than those used in that study. Thus, although not specifically addressed by Impact Theory, it is hypothesized that (3) participants under 25%-control conditions and 100%-prediction conditions (whether they receive cues that they will succeed or fail) will give lower ratings of stimulus aversiveness for a highly aversive stimulus than those under any other conditions (i.e., 25%-control/0%-prediction, 0%-control/100%-prediction, 0%-control/0%-prediction). As in Hypotheses 1 and 2, no interaction between control and prediction is expected.

Method

Participants

Participants were 120 students (72 females and 48 males) from the Introductory Psychology course at the University of Manitoba. They were solicited for their participation via sign-up booklets that were circulated within a single, intact class. Participation in the study was voluntary with no ethnic or sex restrictions, except that each participant had English as a primary or co-primary language. Each participant received an experimental credit which contributed towards his/her final grade in the course. The data of eight participants were excluded from the final data analysis for one of four reasons: (a) obtaining an ambiguous number of successes (1 male/25%-control; one female/25%-control); (b) disclosing suspicions that they were being deceived (1 male/25%-control; 2 females: 1 from 0%-control, 1 from 25%-control); (c) disclosing uncertainty as to their understanding of the experimental procedure (1 male/0%-control; 1 female/0%-control); and (4) voluntary withdrawal from the experiment (1 female/0%-control).

Experimental Design

The design of the study was a 3 X 2 X 2 factorial. Three factors were manipulated across participants: (a) Prediction/success (0%-prediction, 100%-prediction of success, and 100%-prediction of failure); (b) Control (0%-control and 25%-control); and (c) Sex (male and female). Twenty participants (12 females, 8 males) were randomly assigned to each of the Prediction/success X Control conditions: (a) 0%-

control/0%-prediction; (b) 0%-control/100%-prediction/success; (c) 0%-control/100%-prediction/failure (d) 25%-control/0%-prediction; (e) 25%-control/100%-prediction/success; and (f) 25%-control/100%-prediction/failure. (Success and failure appear only under 100%-prediction because in the 0%-prediction condition, the effects of an unpredictable, thus unknown, success or failure were assumed to have no impact on participant ratings.) Although no hypotheses refer to the sex variable, it was included as a separate independent variable in order to investigate its possible effect on the dependent measures.

On each of 24 trials, participants were asked to position an experimental card in one of two ways (Position A or Position B). On some control trials, Position A reduced the time they spent listening to an aversive noise, but Position B did not reduce the time duration; whereas on other control trials, the reverse occurred. On no-control trials, both positions gave the same outcome (either a reduction or a no-reduction in noise duration.) Participants in 25%-control conditions had more trials (6 trials out of 24) on which they could influence whether or not the duration would be reduced by a specific amount than 0%-control participants (0 trials out of 24). Participants in 100%-prediction conditions had more trials (24 trials out of 24) on which they were given information about-- and therefore could predict-- whether or not the duration would be reduced than participants in 0%-prediction conditions (0 trials out of 24). There were two kinds of 100%-prediction conditions: success and failure. The success condition had more trials (at least 15 or 15/24 = 62.5% of the trials) on which participants knew (were given clear cues) that the duration would in fact be reduced than the failure condition (at most 9 or 9/24 = 37.5% of trials). In order to increase (or decrease) the likelihood that participants would receive 15 or more successes for the success condition (or 9 or less successes for the failure condition) the number of time reductions for no-control trials was increased for success conditions (or decreased for failure conditions). (The exact number of successes and failures on control trials depended on a participant's choices which could not be preset.)

The study examined the effects of the prediction/success, control, and participants' sex on:

(a) ratings of controllability and influence over the reduction in the duration of the noise; (b) ratings of predictability and confidence about the reduction in the duration of the noise; (c) ratings of helplessness under the noise; (d) ratings of success and failure in getting a reduction in the duration the noise; and (e) ratings of aversiveness of the noise. Although not dealt with specifically under the hypotheses, the variables under (c) were included because they may be associated with measures under (a); and the variables under (d) were included because they might be associated with measures under (b).

Experimental Task

Participants proceeded through the experiment individually. During the demonstration describing the experimental setup, participants were told that the experiment consisted of two parts: (a) a card-positioning task and (b) an aversive noise exposure period. During the card positioning task, participants completed 24 card-positioning trials. Prior to the trials, they were shown that the back of each card had either: (a) two white squares; (b) one white square; or (c) no white square. On each trial, the experimenter held up a card so that the back of the card was not visible to the participant, and the participant told the experimenter whether they wanted the card to be placed in Position A or Position B in a "card-reader." If (because of the positioning of the card on any trial) a white square was opposite a light-metering device in the card-reader, the amount of time remaining on a noise-duration-timer was reduced by a specific amount (a success); if a no-white square was opposite the light-metering device on any trial, the amount of time remaining was not reduced (a failure). On controllable trials, participants were informed by a message on the front of the card (prior to their selection of card-position) that their choice of card-position makes a difference whether they do or do not get a time reduction, while on uncontrollable trials participants were informed that their choice makes no difference as to which outcome was obtained. All participants were told that the greater the reduction in time during the card-positioning task, the less time they must listen to the noise during the noise exposure period. Participants with prediction viewed the timer and thus, the outcome of each trial, while those without prediction did not view the timer and thus did not know the outcomes of their choices until all of the trials had been completed and the dependent measures had been taken.

Apparatus and Materials

Experimental cards. The cards (each measuring 15.2 cm x 15.2 cm) were made of heavy black construction paper (Canson Mi-Teints, 25 lb weight paper). One side of the card (the front) had white labels containing specific messages, whereas the reverse side (the back) had one of three variations: (a) one had two 7.6 cm x 7.6 cm white squares, (b) one had a single 7.6 cm x 7.6 cm white square; and (c) one had no white squares. The phrase "YOUR CHOICE MAKES NO DIFFERENCE" was printed on the front of cards (a) and (c). The phrase "YOUR CHOICE MAKES A DIFFERENCE" was printed on the third type of card, (b). The words "POSITION A" and "POSITION B" were printed along two edges of the front of each card, perpendicular to the main message on the front of the card. (See Appendix A.)

Fifty-four demonstration cards were constructed: 15 with two white areas (no-control/success), 24 with one white area (control), and 15 with no white area (no-control/failure). (Twelve of the 24 control cards had the single white area on the left side of the card and the other twelve had it on the right side.) Twenty-four of these cards were used during the experimental trials and three were used for the demonstration trials. Three beige plastic trays held the cards.

Tape, taperecorder and headphones. Three types of noise were recorded onto a TDK SA-190 High Position Type II audio tape using a Marantz Superscope cassette tape-recorder (29 cm x 19.5 cm x 8 cm): (1) an alternating two-tone, repetitive noise (like that of a British police car); (2) an alternating two-tone siren (like that of a North American emergency vehicle); and (3) a tone continually cycling higher then lower in pitch. These three noises alternated in random order in their presentation and in their duration, thus creating numerous, unpredictable segments of each noise. In other words, participants did not know how long they would listen to any one particular type of noise before the next type of noise began, nor did they know which type of noise would be next on the tape. The three varying sounds were presented to participants through earphones (Realistic, model LV-10) which fit over (rather than in) the ears. The earphone cushions were cleaned between participants. The loudness level of the three varying sounds at the earphones ranged from 67 db(A) to 79 db(A) across all participants, as measured by a Bruel & Kjaer Precision Sound Level Meter 2203/1613.

Card-reader. The card-reader consisted of a plastic, black ribbed box (measuring 38 cm x 34.5 cm x 26.5 cm) containing a light, a tube, and a card slot opposite the tube. The slot in the top of the box allowed the cards to be inserted, one at a time, into the box. Once a card is properly inserted into the card slot, 2.5 cm of the card remains outside the top of the box, displaying either the message, "POSITION A" or "POSITION B."

A 15 watt incandescent light bulb provided light which reflects off the back of an inserted card. The small plastic tube (14.5 cm long with a 6.2 cm diameter and a 4.5 cm opening diameter) contained a SEN ISYS (Sensor Integrated Systems) Hawker-Siddeley CL603 Cadmium Selinide photocell, senses the light intensity reflecting off the surface directly in front of it (at a distance of 12 cm). This surface was either a white square or the black construction paper (no white square) on the back of each card. A white area placed in front of the photocell gives an output of approximately 300 K ohms from the photocell, whereas a black area gives approximately 30,000 K ohms output from the photocell. (Photometric brightness or luminence of the black and white card areas are 0.75 cd/m^2 and 164.75 cd/m^2, respectively, as measured by a photo Research Litemate/Spotmate Model 502.)

Count-down timer. A three digit LED display of a count-down timer (19 cm x 11 cm x 6 cm) was used to indicate to participants how close they were to the termination of the noise. The numbers on the display (1.8 cm x 5 cm) silently counted down from 99.9 to 00.0, where 00.0 terminated the noise. This timer was connected to the photocell of the card-reader. When a white area was placed directly in front of the photocell in the card-reader, the output from the photocell made the numbers on the count-down timer display count down rapidly for approximately five consecutive numbers (in approximately two seconds), indicating to participants that they had decreased the total time they would spend later listening to the noise (representing a success). When a black area was placed directly in front of the photocell, the low output from the photocell allowed the numbers on the count-down timer display to continue counting down at the normal rate (representing a failure). (The minimal output of the photocell required to accelerate the count-down timer was 770 K ohms, as measured by a Beckman Industrial RMS225 Digital Multimeter.)

It should be noted that, regardless of how the operation of the count-down timer appeared to work to participants, the timer counted from 99.9 to 00.0 after the same lapse of time (25 minutes) for all participants. Whenever the countdown of the numbers on the timer display was accelerated (for approximately two seconds), the subsequent speed at which the display counts down decreased automatically and unnoticeably so that the numbers counted down at a slower rate than the original cycling, thus compensating for the brief acceleration. Thus, the timer reached 00.0 after the same lapse of time for all participants, resulting in equal exposure time to the aversive stimulus for all participants.

Count-up counter. An Archer 277-302 five digit LCD electronic count-up counter (attached to the top of the count-down timer enclosure) silently increased by one digit each time the count-down timer indicated a success. The counter indicated to participants the cumulative number of successful trials they had obtained. A black cloth was used to cover both the timer and the counter during no-prediction trials.

Stopwatch. A Heuer Tag Model 200S stopwatch measured the duration of each phase of the experiment.

Preliminary information sheet. A preliminary information sheet requested participants to indicate their name, student number, date and place of birth, first language, and program of academic study. This sheet was filed separately from all other information collected from participants.

Experimental questionnaires. Two questionnaires consisting of items approximating those used in previous research (Nickels et al., 1992, Study 1) were used to measure the dependent variables. Specifically, Questionnaire #1 (see Appendix B) was given after the card-positioning task but before the aversive noise period began and included measures of perceived control and influence, perceived prediction and confidence, anticipated success and failure, perceived helplessness, and perceived aversiveness of the aversive noise presented in the demonstration. Several manipulation checks were included in the questionnaire to assess whether the information provided to participants was recognized and understood by them (see Questions 9, 11, and 12). Question 11 was also included in an accuracy measure labelled, "accuracy in estimating the number of control trials" (AccControl) and was calculated by subtracting the actual number of control trials from the estimate. A second accuracy measure labelled, "accuracy in estimating the number of total trials" (AccTotal), was calculated by subtracting 24 (the actual number of trials) from the participants' estimate.

Questionnaire #2 (see Appendix C) was given after the termination of the noise and included all items in Questionnaire #1 as well as estimates of how long the noise lasted (Duration) and how much longer the participant could have listened to the noise (Longer). A manipulation check in this questionnaire (question 10) asked if the participant saw the numbers on the count-down timer display after each trial. Questions 13-16 on Questionnaire #2 assessed participants' impressions and suspicions about various aspects of the experiment.

Procedure

The experiment consisted of five phases: (a) a 10 minute preparation and demonstration period; (b) a five minute card-positioning task period; (c) a 10 minute pretask questionnaire period; (d) a 10 minute noise exposure period; and (e) a 10 minute posttask questionnaire and debriefing period. The count-down timer began counting down at the start of (b) the card-positioning task period and stopped immediately when it reached 00.0, at which time (e) the posttask questionnaire and debriefing period began; thus, the count-down timer was on for 25 minutes for each participant. The stopwatch held by the experimenter timed each of the five phases of the experiment.

Preparation and demonstration. Participants were tested individually in a small, quiet room. Each participant was greeted and asked to sit in a chair at a right angle next to the experimenter and directly in front of the experimental materials which were on a 75 cm x 105 cm x 75 cm table. The tape recorder was on the table located next to the experimenter but visible to participants. Participants were told that the experiment consisted of two parts; during the first part of the experiment they will be asked to choose the positions of 24 cards to be placed by the experimenter into the card-reader; during the second part, they will be listening to an aversive noise for the length of time determined by the participant's success during the first part of the experiment. At this time, participants received a 10-second demonstration exposure to the aversive noise. Participants then received detailed instructions explaining the experimental apparatus and task. (See Appendix D for complete instructions.) Participants were told that they will obtain a success if their blind choice of the position of the card results in a white area (if indeed there was one) ending up directly in front of the photocell in the card-reader. Each success they obtained on a trial would (a) decrease, by a present amount, the time they would spend listening to the noise and (b) increase their success count by one digit. Thus, the participant's task was to obtain as many successes as possible. (All participants actually received comparable exposure times to the aversive stimulus; duration of noise was held constant across participants to control for the possible extraneous effects that may result from different exposure times to the aversive stimulus.) Participants under high-prediction conditions were able to see both the count-down timer and count-up counter displays throughout the experiment; those under low-prediction conditions did not see these displays. The count-up counter enabled participants with prediction to know their cumulative number of successes, while the cycling of the count-down timer allowed participants to view the actual reduction on the counter.

To ensure that participants had a complete understanding of the experimental apparatus and task, participants were able to examine (without touching) all 54 demonstration cards. Three demonstration trials were then completed using each of the three types of cards. For each of these trials, both the front and back of the card were shown to the participant, and the card was turned to Position A. The participant was asked to tell the experimenter whether the trial would be a success (the cycling speed of the timer to be increased) or a failure (the cycling speed of the timer to remain unchanged). The experimenter then inserted the card into the card-reader to confirm or deny the participant's expectations. At this time, the card was turned to Position B and the process repeated. The demonstration trials were continued until the participant states correct expectations for three consecutive cards.

Card-positioning task. Following the demonstration trials, the card-positioning task began. The experimenter rearranged the 54 cards into the appropriate preset order of 24 cards. Appendix E shows the order of the 24 cards used for each group and what was on the back of each card. For example, for Trial 1 for the low-success, 0%-control condition there were two white squares on the back of the card; a white area or a success results for both Position A and Position B. For Trial 2 for the low success, 25%-control condition there was one black area and one white area on the back of the card; a black area or a failure results for Position A and a white area or a success results for Position B. The experimenter then started both the count-down timer and count-up counter, and removed the first card from the card box. The experimenter held it up to the participant so that the message on the front side of the card was visible. The card was then inserted into the card-reader, in either Position A or Position B, as indicated by the participant's verbal instructions. If the card area opposite the photocell was white, the result of that trial was a success; if the card area opposite the photocell was black, the result of the trial was a failure.

All participants received control information on each trial (through statements presented on the front of each card) leading them to believe that their choice either made a difference in the outcome they obtained (controllability) or made no difference in the outcome they obtained (uncontrollability). They also received prediction information on each trial (through the count-down timer and count-up counter cover being on or off) leading them to believe that they either knew how much they had reduced the total time they would spend listening to the noise (predictability) or that they did not know this amount (unpredictability). Participants under prediction conditions also received success information on each trial (through the acceleration of the count-down timer and one-step increases in the count-up counter) leading them to believe that they either had reduced the total time they would spend listening to the noise (success) or that they had not reduced this duration (failure). Thus, participants received information on each trial leading them to believe that they had controllability and/or predictability over how long they would be listening to the noise and, for participants with predictability, that they were either successful or unsuccessful in reducing the amount of time they would spend listening to the noise.

All participants knew before each card positioning which trials were controllable and which trials were uncontrollable. If a trial was controllable the words "YOUR CHOICE MAKES A DIFFERENCE" was the message on the front of the card, indicating that the two areas on the back of the card were different (i.e., there is only one white square). On these trials, participants told the experimenter if they wanted the card to be inserted into the card-reader in Position A or in Position B. Participants were told that there was no consistent relation between which position was chosen and which area (white or black) would be opposite the photocell. This should have created the impression that they had the opportunity to influence how long they would spend listening to the noise.

If a trial was uncontrollable, the words "YOUR CHOICE MAKES NO DIFFERENCE" was the message on the front of the card, indicating that the two areas on the back of the card were the same (i.e., there are two white squares or no white squares). On these trials, the participants also indicated which position they wanted the card to be inserted into the card-reader, but because the two outcomes were identical, the participant's choice of position would have no effect on the outcome of the trial. This should have created the impression that they had no opportunity to influence how long they would spend listening to the noise. Participants in the 0%-control groups had 0 out of 24 controllable trials, and participants in the 25%-control groups had 6 out of 24 controllable trials.

Participants in conditions with predictability (100%-prediction) saw the result of each card placement. That is, they will saw (a) whether the count-down timer display accelerated and (b) whether the count-up counter display increased. Thus, participants were led to believe that they knew how long they would spend listening to the noise. Those under high-success conditions obtained more successes on the trials (at least 15 or 62.5% of the trials) than participants under low-success conditions (at most 9 or 62.5% of the trials). Specifically, those under the high-success condition were under a 75-75 difference metric and would obtain a success on 75% of the trials if their responding was constant across trials (i.e., if the same response/card position is always given). Thus, 18 successes and 6 failures would be obtained if one gave the same response for all trials. However, the possible range of success differed across control conditions: (a) a range of 62.5% to 87.5% success for the 25%-control condition and (b) 75% success for the 0%-control condition. Participants under low-success conditions were under a 25-25 difference metric and would obtain a success on 25% of the trials if the same response is always given. Thus, 6 successes and 18 failures would be obtained if one gave the same response for all 24 trials. However, the possible range of success differed across control conditions: (a) a range of 12.5% to 37.5% success for the 25%-control condition and (b) a 25% success for the 25%-control condition.

Participants under high-success conditions were led to believe that they had obtained enough successes during the 24 trials to end the experiment considerably early, and that they would listen to the noise for much less than the maximum amount of time. Participants under low-success conditions obtained fewer success trials than participants in the high-success conditions. Thus, they were led to believe that they had not obtained enough successes during the 24 trials to end the experiment considerably early, and that they listened to the noise for close to the maximum length of time. Both high-success and low-success conditions, however, actually received identical exposure times to the noise because of the compensation circuit in the count-down timer.

Participants in conditions with unpredictability (0%-prediction) were not shown the display of either the count-down timer or count-up counter and, thus, did not know whether a particular trial was a success or a failure or how many successes and failures they obtained across all trials. A black cloth covered both the counter and timer so that these participants were prevented from viewing their displays. (In this condition, the counter display was also turned away from the participant.)

Pretask questionnaire. Following completion of the 24 card trials, the participant was asked to complete Questionnaire #1 (see Appendix B). Although ten minutes was more than sufficient time to complete the questionnaire, all participants were required to wait the full ten minutes before proceeding to the next phase.

Aversive task. After completing Questionnaire #1, participants were instructed to remove their watches, put on the earphones, and remain relatively still while they listened to the prerecorded noise for

10 minutes. The experimenter then turned on the prerecorded noise. At the end of this 10 minutes, the count-down timer reached 00.0 and the noise was consequently shut-off. The participant then removed the earphones.

Posttask questionnaire. After completion of the aversive task, participants completed Questionnaire #2 (see Appendix C), and were then debriefed. (See Appendix F for debriefing procedure; also, see Appendix G for a photograph of all experimental equipment.)

Results

Manipulation Checks

Since the level of control in this study was manipulated by altering the number of trials on which choices made a difference in outcome, a manipulation check was introduced by comparing participants' estimates of how many such trials they had received. Results of a one-way analysis of variance, $F(1, 119) = 30.90$, $p < .0001$, showed that participants with 25%-control estimated the number of cards leading to different outcomes to be higher (mean = 8.12) than participants with 0%-control (mean = 2.73).

Since the level of prediction in this study was manipulated by either showing (100%-prediction) or not showing (0%-prediction) participants whether they received a time reduction on each trial, a manipulation check was introduced by asking participants whether or not they had been shown the count-down timer display during the card trials. Analysis of participants' responses showed that all participants correctly identified whether or not they had been shown the results of their choices.

Additional checks indicated that all participants accurately understood the experimental procedure (i.e., questions 9 and 12 on Questionnaire #1 and question 10 on Questionnaire #2).

Experimental Results

A factor analysis using four principal factors extraction with varimax rotation was performed using the SAS FACTOR program (Appendix H) on 23 items from Questionnaire #1 (Appendix B) and from Questionnaire #2 (Appendix C). With .30 as the criterion for inclusion of a variable within a factor, 20 of the 23 variables loaded on some factor. The resulting dependent variable packages (factors) were labelled: (1) Predictability; (2) Controllability; (3) Helplessness; and (4) Aversiveness. A fifth package containing the three "unloaded" variables was labelled (5)

Miscellaneous.

The experimental hypotheses were tested at the .05 level through multivariate analysis of variance (MANOVA) using Wilks' lambda. A separate 3 X 2 X 2 MANOVA analyzed the dependent measures for each of the five dependent variable packages, with Prediction/success (0%-prediction, 100%-prediction/success, and 100%-prediction/failure), Control (0%-control, 25%-control), and Sex (male, female) as the independent variables.

Predictability analysis. Results of the MANOVA for the Predictability package (Factor 1) showed a significant effect for Prediction/success, $F(18, 200) = 3.05$, $p < .0001$; and for Control, $F(9, 100) = 2.40$, $p = .017$; but not for Sex, $F(9, 100) = .86$, $p = .5632$; and not for any of the interactions (each $p > .05$). (Predictability package means and standard deviations are presented in Tables 2 and 3.)

Followup ANOVAs for significant MANOVA Prediction/success effects showed a difference for the three levels of prediction for ratings of Confidence on Questionnaire #1, $F(2, 108) = 15.18$, $p < .0001$, and on Questionnaire #2, $F(2, 108) = 5.98$, $p = .00034$; for ratings of Expectancy on Questionnaire #1,

Table 2

Means (Standard Deviations) for Variables in the Predictability Package for Male Participants

Dependent Measure	Prediction HighSuccess 0%-Control	Prediction HighSuccess 25%-Control	Prediction LowSuccess 0%-Control	Prediction LowSuccess 25%-Control	Noprediction 0%-Control	Noprediction 25%-Control
Questionnaire #1						
Predict	4.63 (1.19)	5.13 (0.99)	4.63 (1.51)	4.13 (0.99)	4.50 (1.31)	4.50 (0.93)
Expect	4.88 (0.99)	5.63 (0.99)	5.38 (1.41)	3.75 (1.04)	4.25 (1.04)	4.88 (1.25)
Conf1	5.13 (1.73)	5.25 (1.04)	5.38 (1.19)	5.25 (0.89)	3.00 (2.00)	4.38 (0.74)
Success1	4.25 (2.19)	5.50 (0.76)	4.00 (2.20)	4.13 (1.13)	3.75 (1.04)	4.50 (1.31)
Fail1	2.00 (1.41)	1.75 (0.46)	1.25 (0.71)	3.38 (1.41)	4.00 (1.07)	3.13 (1.46)
Questionnaire #2						
ReceivedTR	4.75 (1.73)	5.13 (1.36)	4.13 (2.53)	3.75 (1.28)	2.75 (1.49)	3.75 (1.38)
Conf2	5.38 (1.41)	4.88 (1.96)	6.38 (1.06)	4.88 (1.25)	4.38 (1.93)	3.75 (1.58)
Success2	3.89 (2.59)	4.50 (1.93)	3.88 (2.30)	3.88 (1.36)	3.00 (1.31)	3.63 (1.41)
Fail2	2.13 (1.81)	2.50 (1.20)	2.38 (1.93)	2.88 (0.99)	3.63 (1.93)	3.63 (1.85)

Note. Means are based on n=8.

Table 3

Means (Standard Deviations) for Variables in the Predictability Package for Female Participants

Dependent Measure	Prediction HighSuccess 0%-Control	Prediction HighSuccess 25%-Control	Prediction LowSuccess 0%-Control	Prediction LowSuccess 25%-Control	Noprediction 0%-Control	Noprediction 25%-Control
Questionnaire #1						
Predict	5.17 (1.11)	4.00 (1.21)	4.17 (1.59)	3.83 (1.27)	4.17 (1.27)	4.08 (1.00)
Expect	4.83 (1.40)	4.67 (0.98)	4.50 (1.68)	4.25 (1.14)	4.33 (1.15)	3.83 (0.94)
Conf1	5.50 (1.00)	5.17 (1.40)	5.00 (1.71)	4.25 (1.54)	4.00 (1.35)	3.33 (1.07)
Success1	4.50 (1.57)	5.17 (1.19)	3.42 (1.88)	3.75 (1.60)	4.00 (1.41)	3.67 (1.15)
Fail1	2.58 (1.24)	2.58 (1.08)	3.08 (1.83)	3.92 (1.38)	3.00 (1.48)	3.92 (1.24)
Questionnaire #2						
ReceivedTR	4.58 (1.88)	4.00 (1.21)	4.08 (2.15)	3.50 (1.78)	3.17 (1.85)	2.42 (1.38)
Conf2	5.58 (1.56)	4.33 (1.56)	5.50 (1.62)	4.00 (1.54)	4.08 (1.93)	3.67 (2.06)
Success2	4.25 (2.09)	4.00 (1.35)	3.67 (2.23)	3.08 (1.08)	3.00 (1.71)	2.17 (0.94)
Fail2	2.67 (1.67)	2.58 (0.90)	2.83 (1.90)	4.08 (1.38)	3.67 (2.31)	4.67 (1.97)

Note. Means are based on n=12.

$F(2, 108) = 3.52$, $p = .0329$; for ratings of Success on Questionnaire #1, $F(2, 108) = 5.83$, $p = .0039$, and on Questionnaire #2, $F(2, 108) = 5.40$, $p = .0058$; and for ratings of Received Time Reduction on Questionnaire #2, $F(2, 108) = 8.43$, $p = .0004$. Participants also showed a difference for ratings of Failure on Questionnaire #1, $F(2, 108) = 8.56$, $p = .0004$, and on Questionnaire #2, $F(2, 108) = 7.21$, $p = .0011$. No significant difference was found for ratings of prediction on Questionnnaire #1 ($p > .05$).

Post hoc pairwise comparisons of significant ANOVA effects using the Scheffé test showed that participants with 100%-prediction/success (as compared to those with 0%-prediction) gave higher ratings of Expectancy on Questionnaire #1 (mean = 4.95 versus 4.28, respectively); Success on Questionnaire #2 (mean = 4.15 versus 2.88, respectively); and Received Time Reduction on Questionnaire #2 (mean = 4.55 versus 2.98, respectively); but gave lower ratings of Failure on Questionnaire #1 (mean = 2.30 versus 3.50, respectively); and on Questionnaire #2 (mean = 2.50 versus 3.95, respectively). Additionally, participants with 100%-prediction/success and those with 100%-prediction/failure (as compared to those with 0%-

prediction) gave higher ratings of Confidence on Questionnaire #1 (means = 5.28 and 4.90 versus 3.68, respectively); and on Questionnaire #2 (means = 5.03 and 5.10 versus 3.95, respectively). Participants with 100%-prediction/success (as compared to those with 100%-prediction/failure and those with 0%-prediction) gave higher ratings of Success on Questionnaire #1 (means = 4.85 versus 3.78 and 3.95, respectively).

Followup ANOVAs for significant MANOVA Control effects showed that participants with 25%-control (as compared to those with 0%-control) gave higher ratings of Failure on Questionnaire #1, $F(1, 108) = 4.11$, $p = .0452$; but gave lower ratings of Confidence on Questionnaire #2, $F(1, 108) = 10.48$, $p = .0016$. No other significant Control differences were found within the Predictability package (each $p > .05$).

<u>Controllability analysis.</u> Results of the MANOVA for the Controllability package (Factor 2) showed a significant effect for Control, $F(4, 105) = 5.89$, $p < .0003$; but not for Prediction/success, $F(8, 210) = .44$, $p = .895$; or Sex, $F(4, 105) = 1.31$, $p = .273$; and not for any of the interactions (each $p > .05$). (Controllability package means and standard deviations are presented in Tables 4 and 5.)

Table 4

Means (Standard Deviations) for Variables in the Controllability Package for Male Participants

Dependent Measure	Prediction HighSuccess 0%-Control	Prediction HighSuccess 25%-Control	Prediction LowSuccess 0%-Control	Prediction LowSuccess 25%-Control	Noprediction 0%-Control	Noprediction 25%-Control
Questionnaire #1						
Control1	1.75 (1.39)	3.63 (1.51)	3.00 (2.20)	3.13 (1.13)	2.13 (1.64)	3.75 (1.75)
Influence1	2.00 (1.60)	4.00 (2.00)	2.75 (2.31)	3.25 (1.04)	2.13 (1.55)	3.38 (2.13)
Questionnaire #2						
Control2	1.38 (0.74)	3.13 (1.46)	2.38 (2.13)	3.13 (1.46)	2.25 (1.58)	3.25 (1.28)
Influence2	2.63 (2.33)	3.13 (1.73)	2.38 (2.00)	3.38 (1.30)	2.50 (1.60)	3.00 (1.51)

Note. Means are based on n=8.

Table 5

Means (Standard Deviations) for Variables in the Controllability Package for Female Participants

Dependent Measure	Prediction HighSuccess 0%-Control	Prediction HighSuccess 25%-Control	Prediction LowSuccess 0%-Control	Prediction LowSuccess 25%-Control	Noprediction 0%-Control	Noprediction 25%-Control
Questionnaire #1						
Control1	2.33 (1.50)	4.17 (1.11)	1.92 (1.16)	2.92 (1.31)	2.00 (1.41)	3.25 (1.48)
Influence1	2.58 (1.83)	4.17 (1.03)	2.92 (2.15)	3.33 (1.44)	2.42 (1.56)	3.58 (1.88)
Questionnaire #2						
Control2	2.08 (1.50)	3.50 (1.09)	3.08 (2.43)	2.03 (1.03)	2.33 (1.72)	2.42 (1.16)
Influence2	2.08 (1.50)	3.33 (1.44)	2.75 (2.34)	3.00 (1.21)	2.17 (1.70)	2.58 (1.31)

Note. Means are based on n=12.

Followup ANOVAs for significant MANOVA Control effects showed that participants with 25%-control (as compared to those with 0%-control) gave higher ratings of Control on Questionnaire #1, $F(1, 108) = 23.70$, $p < .0001$, and on Questionnaire #2, $F(1, 108) = 6.49$, $p = .0123$; and gave higher ratings of Influence on Questionnaire #1, $F(1, 108) = 12.70$, $p = .0005$, and on Questionnaire #2, $F(1, 108) = 4.46$, $p = .0370$.

Helplessness analysis. Results of the MANOVA for the Helplessness package (Factor 3) showed a significant effect for Control, $F(4, 105) = 6.17$, $p = .0002$; but not for Prediction/success, $F(8, 210) = .80$, $p = .6045$; Sex, $F(4, 105) = 2.12$, $p = .0833$; and not for any of the interactions (each $p > .05$). (Helplessness package means and standard deviations are presented in Tables 6 and 7.)

Followup ANOVAs for significant MANOVA Helplessness effects showed that participants with 25%-control (as compared to those with 0%-control) gave lower ratings of Helplessness in controlling the card task outcome for Questionnaire #1, $F(1, 108) = 15.00$, $p = .0002$, and for Questionnaire #2, $F(1, 108) = 4.13$, $p = .0446$.

Aversiveness analysis. Results of the MANOVA for

Table 6

Means (Standard Deviations) for Variables in the Aversiveness Package for Male Participants

Dependent Measure	Prediction				Noprediction	
	HighSuccess		LowSuccess			
	0%-Control	25%-Control	0%-Control	25%-Control	0%-Control	25%-Control
Questionnaire #1						
Annoy1	3.50 (2.33)	3.38 (1.30)	4.13 (1.89)	2.88 (0.99)	3.38 (1.51)	3.88 (1.64)
Questionnaire #2						
Annoy2	3.38 (2.45)	4.25 (2.05)	4.50 (1.85)	3.63 (1.69)	3.75 (2.25)	3.88 (1.36)
Longer	27.38 (35.37)	28.00 (34.65)	27.38 (8.75)	14.50 (15.09)	28.75 (31.14)	10.50 (9.83)

Note. Means are based on n=8.

Table 7

Means (Standard Deviations) for Variables in the Aversiveness Package for Female Participants

Dependent Measure	Prediction HighSuccess 0%-Control	Prediction HighSuccess 25%-Control	Prediction LowSuccess 0%-Control	Prediction LowSuccess 25%-Control	Noprediction 0%-Control	Noprediction 25%-Control
Questionnaire #1						
Annoy1	3.08 (1.31)	4.50 (1.57)	4.08 (0.99)	3.33 (1.67)	4.75 (1.54)	3.58 (1.38)
Questionnaire #2						
Annoy2	4.17 (1.40)	5.17 (1.90)	4.00 (1.48)	4.75 (1.36)	5.33 (1.61)	5.33 (1.37)
Longer	6.25 (5.36)	8.08 (16.46)	6.25 (5.36)	6.67 (7.95)	4.75 (5.17)	3.17 (2.95)

Note. Means are based on n=12.

the Aversiveness package (Factor 4) showed a significant effect for Sex, $F(3, 106) = 6.93$, $p = .0003$; but not for Control, $F(3, 106) = 1.07$, $p = .3658$; Prediction/success, $F(6, 212) = 1.07$, $p = .3840$; and not for any of the interactions (each $p > .05$). (Aversiveness package means and standard deviations are presented in Tables 8 and 9.)

Followup ANOVAs for significant MANOVA Aversiveness effects showed that male participants (as compared to female participants) gave lower ratings of Annoyance on Questionnaire #2, $F(1, 108) = 7.84$, $p = .0061$; and estimated that they could listen to the noise Longer, $F(1, 108) = 18.84$, $p < .0001$. No significant difference was found for Annoyance on Questionnaire #1 ($p > .05$).

Miscellaneous analysis. Results of the MANOVA for the Miscellaneous package (unloaded or remaining variables) showed a significant effect for Prediction/success, $F(6, 212) = 5.57$, $p = .0001$; but not for Control, $F(3, 106) = .64$, $p = .5927$; Sex, $F(3, 106) = 1.40$, $p = .2458$; and not for any of the interactions (each $p > .05$). (Miscellaneous package means and standard deviations are presented in Tables 10 and 11.)

Table 8

Means (Standard Deviations) for Variables in the Helplessness Package for Male Participants

Dependent Measure	Prediction HighSuccess 0%-Control	Prediction HighSuccess 25%-Control	Prediction LowSuccess 0%-Control	Prediction LowSuccess 25%-Control	Noprediction 0%-Control	Noprediction 25%-Control
Questionnaire #1						
HelpC1	5.88 (2.23)	3.38 (0.92)	5.50 (2.33)	4.38 (1.06)	5.75 (2.19)	4.63 (1.77)
HelpP1	3.88 (2.30)	3.75 (1.28)	5.00 (2.20)	4.38 (0.92)	4.50 (2.14)	4.63 (1.77)
Questionnaire #2						
HelpC2	4.50 (2.78)	4.63 (1.60)	5.88 (1.81)	4.75 (1.04)	5.75 (1.58)	4.88 (1.55)
HelpP2	3.50 (2.00)	3.88 (1.13)	5.00 (1.77)	4.25 (0.89)	4.25 (1.91)	4.25 (1.17)

Note. Means are based on n=8.

Table 9

Means (Standard Deviations) for Variables in the Helplessness Package for Female Participants

Dependent Measure	Prediction HighSuccess 0%-Control	Prediction HighSuccess 25%-Control	Prediction LowSuccess 0%-Control	Prediction LowSuccess 25%-Control	Noprediction 0%-Control	Noprediction 25%-Control
Questionnaire #1						
HelpC1	5.75 (1.71)	3.67 (1.50)	5.25 (1.66)	4.75 (1.36)	5.58 (1.88)	5.33 (1.44)
HelpP1	5.17 (2.04)	4.42 (1.31)	4.67 (1.15)	5.17 (0.72)	5.17 (1.70)	5.25 (1.06)
Questionnaire #2						
HelpC2	5.58 (1.68)	4.17 (1.70)	5.25 (2.14)	4.92 (1.08)	5.83 (1.53)	5.75 (0.97)
HelpP2	5.42 (1.44)	4.08 (1.56)	3.92 (2.07)	5.00 (1.21)	5.25 (1.96)	5.33 (0.65)

Note. Means are based on n=12.

Table 10

Means (Standard Deviations) for Variables in the Miscellaneous Package for Male Participants

Dependent Measure	Prediction				Noprediction	
	HighSuccess		LowSuccess			
	0%-Control	25%-Control	0%-Control	25%-Control	0%-Control	25%-Control
Questionnaire #1						
AccTotal	3.13 (6.94)	-1.75 (10.51)	-4.00 (5.35)	-5.63 (5.68)	0.25 (5.99)	0.50 (4.21)
AccControl	4.50 (8.33)	4.38 (6.44)	0.75 (2.12)	-0.13 (1.81)	2.38 (4.60)	1.63 (1.92)
Questionnaire #2						
Duration	5.50 (2.07)	6.13 (2.64)	9.00 (10.60)	6.63 (2.39)	6.63 (2.72)	6.25 (3.37)

Note. Means are based on n=8.

Table 11

Means (Standard Deviations) for Variables in the Miscellaneous Package for Female Participants

Dependent Measure	Prediction				Noprediction	
	HighSuccess		LowSuccess			
	0%-Control	25%-Control	0%-Control	25%-Control	0%-Control	25%-Control
Questionnaire #1						
AccTotal	1.58 (3.65)	-0.25 (3.49)	-5.50 (3.75)	-5.00 (5.29)	-4.42 (3.96)	-4.42 (3.70)
AccControl	6.00 (8.86)	4.58 (6.49)	1.75 (2.63)	1.58 (5.35)	0.83 (2.89)	0.50 (2.61)
Questionnaire #2						
Duration	6.00 (1.91)	5.75 (2.67)	6.08 (2.02)	7.25 (3.55)	5.33 (2.77)	6.33 (2.89)

Note. Means are based on n=12.

Followup ANOVAs for significant MANOVA

Miscellaneous effects showed a difference across the three levels of Prediction/success for Accuracy in Estimating the Number of Total Trials, $F(2, 108) = 12.03$, $p = .0001$; and for Accuracy in Estimating the Number of Controllable Trials, $F(2, 108) = 7.15$, $p = .0012$. No significant difference was found for Estimating the Duration of Noise Exposure ($p > .05$).

Post hoc pairwise comparisons of significant ANOVA effects using the Scheffé test showed that participants with 100%-prediction/success (as compared to those with 100%-prediction/failure and those with 0%-prediction) gave more accurate estimates of the Number of Total Trials (means = 0.68 versus -5.08 and -2.50, respectively); and Number of Controllable Trials (means = 4.95 versus 1.13 and 1.20, respectively).

Discussion

In accordance with the reconceptualization of control and prediction (Nickels, 1980; 1991), the present study separated the effects of these two variables by including a predictionless control condition. The present study also: eliminated physical contact with any outcome-related object; differentiated controlling responses in terms of choices that make a difference in outcomes (control) and choices that make no difference in outcomes (no-control); and examined whether participants could recognize a small difference in control (specifically, the difference between 0%-control and 25%-control). It was expected that prediction would increase participant ratings of prediction and confidence (Hypothesis #1), and that control would increase participant ratings of control and influence (Hypothesis #2).

Hypothesis #2 was supported, but Hypothesis #1 was only partially supported, with prediction significantly increasing participant ratings of confidence but not ratings of prediction. The expectation that there would be no interaction between the independent variables of prediction and control was also confirmed. Although it was expected that prediction and control would decrease participant ratings of aversiveness (Hypothesis #3), the data failed to support this hypothesis. Hypothesized as well as non-hypothesized findings will be discussed in terms of the separate dependent variable packages used in the present study.

<u>Predictability Package</u>

<u>Prediction/success condition.</u> Impact Theory predicts that participants with higher levels of

prediction over the amount of time they spend listening to noise than other participants will give higher ratings of prediction, regardless of controllability. Specifically, it was hypothesized under Hypothesis #1 that participants under 100%-prediction conditions (24 predictable trials) will give higher ratings of prediction and confidence than those under 0%-prediction conditions (0 predictable trials). The results partially supported this hypothesis. It was observed that providing participants with 100%-prediction increases their ratings of confidence regarding the amount of time they spent listening to the aversive noise (on both Questionnaire #1 and #2), regardless of whether they have control or no-control cues. This finding is consistent with previous results (Nickels et al., 1992) and supports the idea that participants able to view the count-down timer obtained predictability which increased their confidence that they knew how long they would be listening to the noise.

However, the Predictability manipulation had no effect on ratings of prediction. While the possibility that Impact Theory is incorrect must be acknowledged, intuitively, one would expect that participants with prediction would have increased ratings of prediction. Although some studies (Burger & Arkin, 1980; Guttormson, 1984) have observed an increase in prediction ratings for participants with prediction, failure to find a significant effect for prediction ratings is not inconsistent with previous findings (Echols, 1983). One possible explanation was suggested by Echols (1983). Specifically, failure to observe an effect of the Prediction manipulation on ratings of predictability may be due to difficulties with the wording of the dependent measure. The prediction measure on Questionnaire #1 reads: "Your goal has been to get the greatest possible reduction in the amount of time you must spend listening to the noise. How much of this possible reduction do you predict you will get?" Participants were then asked to rate the predicted amount of reduction on a 7-point scale. Although this measure was designed to assess prediction (regardless of success of failure), it may have actually been assessing anticipated success. A more promising measure of prediction perceived by participants might have read: "How well do you feel you are able to predict the amount of time you will spend listening to the noise?" This question may be relatively outcome-free.

To assess the effect of success on responding, data were analyzed according to high and low success. Participants with 14 or more successes were included in the predictive success condition and those with 10 or fewer successes were included in the predictive failure condition. The findings indicate that participants in the predictive success condition felt a higher level of success than those in the predictive failure condition, but only on Questionnaire #1 (before the noise exposure period). Participants under predictive success and predictive failure did not differ in their ratings of success on Questionnaire #2 or on ratings of failure (or on any other variable) on either questionnaire. This similarity in ratings may have been due to success participants anticipating a rather short time period (high success) on Questionnaire #1 (before the noise exposure period), but feeling disappointed at the discrepancy between their anticipated high success and the actual 10 minutes they did spend listening to the noise. (Ten minutes was probably much longer than they had expected to listen to the noise.) As a result, these participants might have rated themselves as less successful on Questionnaire #2 (after the noise exposure period), thus removing the differences between the success and failure conditions observed on Questionnaire #1. Since success and failure conditions did not differentiate ratings of failure on either questionnaire, participants evidently saw themselves as becoming less of a success but not more of a failure.

To assess the effect of prediction on responding, data were analyzed according to predictive success/failure on the one hand and unprediction on the other. Participants with 100%-prediction/success (as compared to those with 0%-prediction) rated themselves as being more successful at the task (on Questionnaire #1) and had lower estimates of failure on both Questionnaires. They also expected to receive more of a time reduction before the noise and felt they had received more of a time reduction after the noise than participants with 0%-prediction. However, as discussed previously, predictive success and predictive failure did not show differential effects. This finding is surprising considering that participants in both these conditions were given clear information regarding their number of successes by the display of the count-up counter. One explanation for this result might be that only the number of successes was shown to participants; number of failures was not visible to participants. This may have led participants to be more oriented towards their successes on the task; thus, even participants who had a small number of successes felt somewhat successful in regards to their performance resulting in underestimations of failure.

Control condition. Two significant effects were observed for the Control manipulation. Specifically, participants with 25%-control (as compared to those with 0%-control) reported higher estimates of failure on Questionnaire #1 and lower estimates of confidence regarding their time period on Questionnaire #2. A possible explanation for these findings may relate to increased feelings of responsibility experienced by those with 25%-control. Previous research indicates that having control increases participants' ratings of responsibility (Echols, 1983) and credit or blame (Nickels et al., 1992) regarding the outcome. Although ratings of responsibility were not assessed in the present study, one might speculate that participants with 25%-control (as compared to those with 0%-control) may have had increased feelings of responsibility for their success or failure. However, since all participants exercised control before they knew which choice would bring them a success, they could not enhance their control with this information. As a result, participants who controlled their success may have justifiably felt more responsibility for the outcome, but also felt less hopeful that they would be successful because they did not have the necessary information to assist them in using their control effectively. Thus, these participants may have minimized their success and given inflated ratings of failure on Questionnaire #1. In comparison, participants with 0%-control may have viewed the card positionings as a chance task and anticipated that they would be successful about half the time.

This explanation might also account for the fact that participants with 25%-control (as compared to those with 0%-control) gave lower confidence ratings on Questionnaire #2. Following exposure to the noise, these participants might have felt less confident about their estimates regarding their time period because their early expectations of failure were not realized. Although these participants may have been quite sure of their anticipated failure on Questionnaire #1, the 10 minute exposure to the noise may have seemed shorter in comparison to their anticipated length of exposure as indicated on the first questionnaire; and as a result, they were less certain about the degree to which they had succeeded and/or failed.

It should be noted that no interaction between the variables of Prediction/success and/or Control and/or Sex was observed. This may suggest that control and prediction function independently and that measures of control do not require the concept of success as in the difference metric (i.e., Alloy & Abramson, 1979). Therefore, measures of control such as the make-a-difference metric (which excludes the variable of success) may be more useful as a measure of pure control.

Sex condition. No significant effects were observed for the Sex manipulation in the Predictability package suggesting that gender was unrelated to the prediction and prediction-related measures.

Controllability Package

Control condition. Impact Theory predicts that participants with higher control over the amount of time they spend listening to noise than other participants will give higher ratings of control, regardless of predictability. Specifically, it was hypothesized under Hypothesis #2 that participants under 25%-control conditions (6 controllable trials) will give higher ratings of control and influence than participants under 0%-control conditions (0 controllable trials). The results confirm this hypothesis and show that providing participants with 25%-control (whether they received prediction or no-prediction cues) increases their estimates of the amount of control and influence they have over the amount of time they spent listening to the aversive noise (on both Questionnaire #1 and #2). Thus, participants who made blind choices that made a difference perceived more control and influence over the outcome. This supports the findings of other studies which suggest that people recognize predictionless control to be genuine control and will thus give it higher estimates of control (Guttormson, 1984; Nickels et al., 1992) and control-related measures (Echols, 1983; Guttormson, 1984; Nickels et al., 1992) than those without predictionless control.

These findings also demonstrate that participants can recognize a small difference in levels of control. In this study, only 6 of the 24 trials were controllable for participants under control conditions.

Despite this small number of controllable trials, however, participants with control gave higher estimates of control and influence than those with 0 controllable trials. This suggests that people recognize even small differences in controllability.

While the traditional view (Langer, 1975) would attack previous research by saying that any increase in control ratings may be due to the introduction of cues normally associated with affecting an outcome (e.g., the exercise of choice), such an argument cannot explain the results of the present study in which both controlling and uncontrolling participants made choices between alternatives. According to Langer (1975), all participants should demonstrate elevated and comparable estimates of control if this were an instance of illusory control because all participants made choices. However, since those whose choices made a difference in the received outcome (as compared to those whose choices made no difference) demonstrated a significantly higher increase in ratings of control and influence, it appears that making a choice is not sufficient to bring about a sense of control. Instead, it is a choice that makes a difference in the received outcome that is sufficient to bring about a sense of control.

The observed differences in control and influence ratings for participants with 0%-control and 25%-control also suggest that although physical involvement in a chance-determined situation may be sufficient to produce an illusion of control (Langer, 1975), such contact is not necessary to provide people with a sense of control. In the present study physical contact with an outcome-related object was not allowed for any participant; and yet, control effects were found.

Prediction/success and sex conditions. No significant effects were observed for the Prediction or Sex manipulations in the Controllability package. The absence of Prediction effects on the Controllability package variables is consistent with the reconceptualization and with previous research (i.e., Nickels et al., 1992) which indicates that control and prediction are related to different variables.

Helplessness Package

Although not specifically hypothesized, the effects of the Prediction/success, Control, and Sex on participants' ratings of helplessness were assessed.

Control condition. Analyses revealed that participants with higher levels of control (as compared to those with lower levels of control) felt less helpless in regards to controlling the card task. Specifically, participants under 25%-control conditions gave lower ratings of helplessness in controlling the card task than participants under 0%-control conditions (on Questionnaire #1 and #2). This finding replicates earlier findings (Nickels et al., 1992, Study 2) and is consistent with the learned helplessness model (Seligman, 1975), which would predict that participants with 0%-control (exposed to uncontrollable outcomes) would experience feelings of helplessness and, thus, give increased helplessness ratings as compared to those with 25%-control.

This finding also suggests that predictionless control is recognized by participants to be genuine control and is effective in reducing feelings of helplessness resulting from uncontrollability. These findings further demonstrate that even a small amount of control can reduce the debilitating effects of uncontrol since only 6 of the 24 trials were controllable. It should also be noted that helplessness in predicting noise reduction failed to be affected by control. These findings further support previous findings that control and prediction differentially affect different variables (e.g., Nickels et al., 1992).

<u>Prediction/success and sex conditions.</u> No significant effects were observed for the Prediction and Sex conditions in the Helplessness package. The absence of significant prediction effects on ratings of helplessness in both predicting and controlling the task outcome is consistent with the learned helplessness model (Seligman, 1975) which supposedly specifies control and not prediction as the necessary variable in reducing feelings of helplessness. This finding is also consistent with the reconceptualization which suggests that control and prediction are related to different variables.

<u>Aversiveness Package</u>

<u>Control and prediction/success conditions.</u> Given that control and prediction have been shown to decrease the aversiveness of a noxious stimulus (Miller, 1979; Wortman, 1976), it follows that participants with both higher prediction and higher control (as compared to those with lower levels of both prediction and control) will give lower ratings of aversiveness regarding the noise (as long as duration of noise is held constant). Therefore, although not specifically addressed by

Impact Theory, Hypothesis #3 stated that participants in the 25%-control/100%-prediction condition would give lower aversiveness ratings regarding the noise than those in any of the other conditions. It was observed, however, that neither the Prediction nor Control manipulation was associated with how aversive participants found the noise or how much longer they thought they could listen to the noise. Although previous research (Glass et al., 1973) indicates that both perceived control and perceived prediction are important factors in reducing perceptions of aversiveness noise, failure to observe lower perceptions of aversiveness for participants with control and/or prediction is consistent with the findings of previous studies (Echols, 1983; Nickels et al., 1992). In both these studies (Nickels et al., 1992, Study 1), it was suggested that these findings may be due to the low level of stimulus aversiveness relative to other studies.

In consideration of this explanation, the present study used what was considered to be a more aversive stimulus to test this possibility in that various annoying sounds were presented in an unpredictable order. Thus, aversiveness was defined in terms of both the intensity and quality of the sound stimulus. Despite this attempt to increase stimulus aversiveness, it is possible that this stimulus was also not sufficiently aversive to produce the effect. The noise level used in this study appeared to be somewhat less intense than that used in a previous study which observed the effect (Glass et al., 1973). Perhaps predictability and controllability become less important in reducing the debilitating effects of a stressor when the stressor is too mild. An alternative explanation is that prediction and control have little or no effect on participants' ratings of stimulus aversiveness.

Sex condition. Sex was significantly related to two of the dependent variables in the Aversiveness package. Specifically, it was observed that females rated the noise as being more annoying than males (with means of 4.79 and 3.90, respectively), but only for Questionnaire #2. Consistent with this finding, males estimated the length of time they could have spent listening to the noise to be longer as compared to female participants (with a mean of 19.65 for males and a mean of 5.85 for females). These findings support the results of a previous study (Echols, 1983), which reported that males experienced greater endurance of an aversive stimulus than females. Although at first glance, these findings seem to reflect cultural stereotypes of the "macho" male attitude/presentation, two other explanations may be forwarded for this finding. Previous noise annoyance research shows that women are more annoyed by noise than men and that the "uncomfortable loudness level" is lower for women than it is for men (Thomas & Jones, 1981).

Although the findings of the present study support these previous findings and suggest that males found the noise far less aversive than female participants, a second explanation may be forwarded for these observations. Specifically, these results may also indicate a response bias for males or females, with males either minimizing or underreporting their level of discomfort resulting from exposure ot the noise or females exaggerating or overreporting their level of discomfort resulting from exposure to the noise. Previous research indicates that females are more likely to engage in self-disclosure than males (Stokes, Childs, & Fuehrer, 1981). Thus, it follows that the observed elevation in aversiveness ratings for females could be due to a discrepancy in self-disclosure between male and female participants.

It should be noted that no significant differences were observed for ratings of annoyance on Questionnaire #1. This may be due to the fact that participants had received only a brief exposure to the noise at the time these ratings were obtained, resulting in a relatively mild aversive stimulus. Perhaps it is only after a longer exposure to the noise that stimulus aversiveness was sufficiently increased to produce the observed differences for males and females.

Miscellaneous Package

Although not specifically hypothesized, the effects of Prediction/success, Control, and Sex on additional dependent variables were assessed. The dependent variables included in this package represent the remnants of those measures not already included in the four factors isolated by factor analysis.

Prediction/success condition. Two accuracy measures were included in the Miscellaneous package. These measures indicate the extent to which participant ratings are above or below the number of (a) total trials and (b) control trials actually presented. Analysis of the miscellaneous variables shows that participants with 100%-prediction/success (as compared to those with 100%-prediction/failure and 0%-prediction) gave estimates that more closely approximated the actual number of total trials (means = 0.68 versus -5.08 and -2.50, respectively). Although the former participants appear to be rather accurate in their estimates, participants in the latter two conditions tended to underestimate the number of total trials. Differences between these estimates may be due to the magnitude of the number shown on the count-up counter display. Each participant in the 100%-prediction/success conditions saw a number on the counter that was relatively close to the actual number of trials (i.e., 24); thus, when estimating the number of total trials, each participant had only to add a small number (representing failure trials) to the number on the counter in order to be accurate. Each participant in the 100%-prediction/failure conditions, however, was shown a relatively small number on the count-up counter display. Thus, each of these participants would have had to add a larger number of trials to the number shown on the count-up counter display in order to be accurate. Similarly, each participant in the 0%-prediction condition did not receive any predictive cues regarding success and as a result, each would have had to add an even larger number to that shown on the display (0) in order to be accurate.

Analyses also revealed that participants with 100%-prediction/failure and those with 0%-prediction (as compared to those with 100%-prediction/success) gave estimates that more closely approximated the actual number of control trials (means = 1.13 and 1.20, versus 4.95). Although the former participants appear to be more accurate in their estimates, participants in all conditions tended toward overestimating the number of controllable trials. The greater overestimations of control observed for those in the 100%-prediction/success condition is consistent with previous research (Simon & Feather, 1973; Sweeney, Moreland, & Gruber, 1982) investigating how attributional patterns are related to performance outcomes. Specifically, it was shown that when participants are successful on a task, they attribute their good performance to internal factors (i.e., effort and ability) rather than external factors (i.e., luck or task difficulty). In accordance with these findings, participants in the present study who were given predictive success information might have attributed this success to such internal factors and thus, overestimated their degree of control (as indicated by their higher estimates of the number of controllable trials).

Since the accuracy measure for controllable trials is based on estimates of how many trials were controlled, it can be considered to be a measure of control that is different from the previously discussed ratings of control. Thus, the tendency of participants to overestimate the number of controllable trials indicates the tendency of successful participants to greatly overestimate their degree of control. This is consistent with previous findings which showed that participants with 0%-control (Cramer, 1992) and 25%-control (Guttormson, 1984) overestimated the amount of control they had over an outcome.

While traditionalists may argue that this finding represents illusory control brought about by misleading cues of controllability (making choices), it should be noted that participants in the present study were not misled regarding their degree of control. Since control was defined in terms of choices that make a difference, all participants were given accurate cues as to their degree of control. According to Impact

Theory (Nickels, 1980; 1991), it is precisely an overestimation of control in situations where accurate control cues are provided that should be referred to as "illusory control." In a recent article, Langer & Brown (1992) suggest that it may be more correct to consider that in all cases participants' estimates of control are legitimate, so illusory control may not be a useful concept. While still acknowledging the importance of the actors' perspective, Impact Theory suggests that the concept of illusory control may be useful, particularly when there is an overestimation of control in the presence of accurate cues of controllability.

The Prediction manipulation did not have a significant effect on participants' estimates of duration of noise exposure suggesting that prediction is unrelated to this measure.

Control and Sex conditions. No significant effects were observed for the Control or Sex manipulations in the Miscellaneous package suggesting that both level of control and gender are unrelated to the Miscellaneous variables. The absence of Control effects is consistent with the reconceptualization and with previous research (i.e., Nickels et al., 1992) which indicates that control and prediction are related to different variables.

Implications for Future Research

Methodological Implications. Contrary to the traditional view which has confounded prediction and control and questioned whether predictionless control is possible (Miller, 1981; Seligman, 1975), the results of the present study lend additional credibility to the reconceptualization. Specifically, findings suggest that people not only recognize predictionless control cues to be genuine control but extend this recognition to the control-associated concept of influence. Similar to previous findings (Echols, 1983; Guttormson, 1984; Nickels et al., 1992), no interactions between the variables of control and prediction were found. The finding that control and prediction affect different variables and the failure to observe an interaction between control and prediction supports the idea that these variables operate differentially.

In addition to supporting previous findings, however, the present study also demonstrates that people do not require physical contact with outcome-related objects in order to perceive controllability. Instead, choices that make a difference seem to be sufficient to produce a sense of control. It was also shown that even a small degree of control can increase people's perceptions of controllability.

Although the present study provides additional insights into the concepts of control and prediction, future research might do well to consider some alterations in measures and methodology. Specifically, refinement of the prediction measure seems necessary. As in previous research (Echols, 1983), the present investigation failed to find an effect of predictability on the prediction measure. Careful wording of this measure to eliminate it's possible confounding with success and other variables may help to clarify the predictability concept.

As in previous research (Nickels et al., 1992), the control and prediction manipulation had no effect on the aversiveness measures. Although it was anticipated that the effect might be observed if a highly aversive stimulus were used, this solution is questionable given the obvious ethical concerns that all researchers must consider. One possible alternative might be to evaluate control and prediction effects in situations where participants are those who are going to be exposed to aversive stimuli that represent a serious real-life event. For example, chemotherapy treatments are considered to be highly aversive to cancer patients. Devising methods that increase patients' control and/or predictability of these treatments might allow researchers to investigate the effects of these variables on such a highly aversive stimulus. Such methods would also further the differentiation between illusory and actual control. Additionally, the effects of prediction and control on positive outcomes are worthy of investigation.

Similar to previous studies (e.g., Nickels et al., 1992), the present investigation used self-report measures to assess the effects of the control and prediction manipulations. Although the effects of control and prediction on a behavioural measure have been assessed previously (Nickels et al., 1992, Study 1), future research could investigate the relationship between these variables and other measures aside from ratings (i.e., behavioural measures such as performance on a task). Such investigations could increase our understanding of how control and prediction affect our actions and provide insights into practical applications of this knowledge.

Conducting research in field settings versus the traditional experimental setting is another possibility for future investigations. Research investigating the effects of different levels of control and prediction in various self-improvement programs, diet programs, and other resources designed to assist individuals assume more control in their lives would be worthy of future research.

Theoretical implications. The results of the present investigation serve to corroborate some of the basic ideas put forward by Impact Theory. Specifically, Impact Theory holds that prediction and control can be defined separately without recourse to the other concept. The finding that prediction and control (independent of each other) affect different variables supports this perspective. Also, in contrast to traditional theory which says that any choice or involvement will typically lead to high control ratings (illusion of control), Impact Theory says that when choice or involvement is held constant, only choices that make a difference will yield high ratings of control. This idea put forward by Impact Theory is supported by the results of the present study since all participants were allowed to make choices but only those that were given choices that made a difference in outcomes had high control ratings.

It appears that other researchers previously associated with traditional theory are beginning to approach the study of prediction and control from the view of Impact Theory. In a recent article, for example, Langer and Brown (1992) reassess the validity of current theories of control. Specifically, the distinction between objective and perceived control is examined. Previous research has considered and defined control largely from the experimenter's perspective. However, Langer and Brown (1992) suggest that it may be more legitimate to consider the actor's perspective when defining control. "If we recognize that choice and prediction are legitimately independent, we may begin exploring the implications of this independence from the actor's perspective" (Langer & Brown, 1992, p. 273).

The present study, together with previous investigations conducted in accordance with Impact Theory (Echols, 1983; Cramer, 1992; Guttormson, 1984; Nickels et al., 1992), not only supports the idea that choice (control) and prediction are legitimately independent, but also explores the effects of these variables from the actor's perspective. Although all participants in the present study received the same noise exposure period and, thus, did not have "actual" control over the received outcome, control was defined according to the information provided to the participants (i.e., 0 versus 6 "controllable" trials).

The present investigation serves to provide some insights regarding the implications of the independence of control and prediction. Many other questions remain to be answered and still others arise. Specifically, if control is defined from the actor's perspective, how should illusory control be defined? Should the distinction between actual and perceived control be eliminated? Impact Theory provides a promising alternative to the traditional view of control from which to conduct future investigations.

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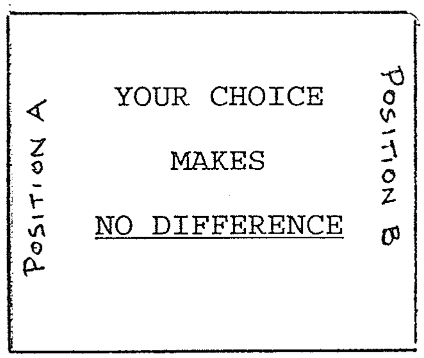
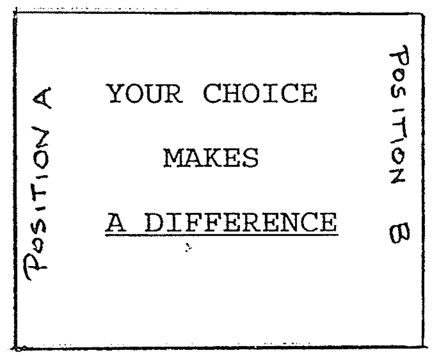
Appendix A

Front of Cards

Card (a) and (c):

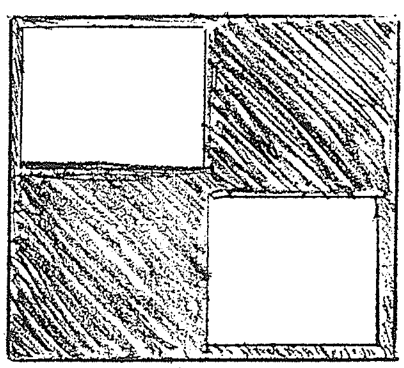


Card (b):

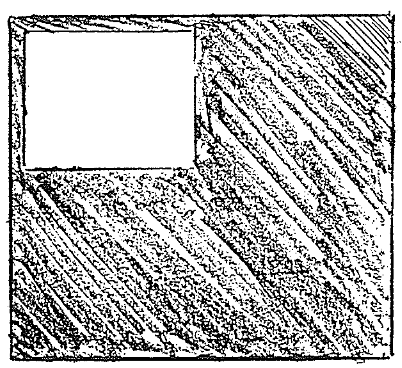


Back of Cards

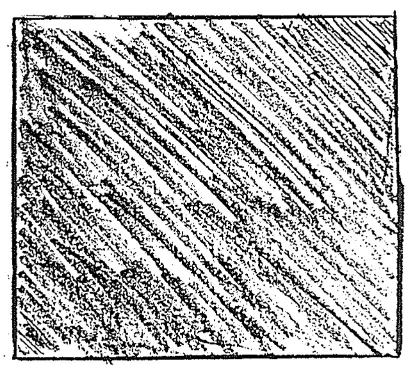
Card (a):



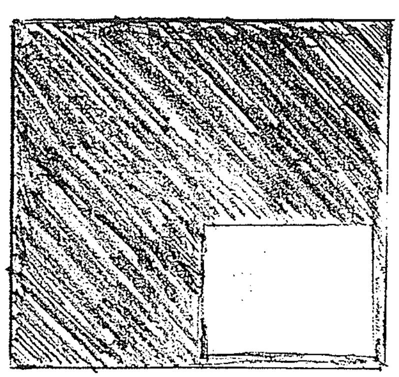
Card (b):



Card (c):



or:



Appendix B

Questionnaire #1

Please answer all questions below:

1. Your goal has been to get the greatest possible reduction in the amount of time you must spend listening to the aversive noise. How much of this possible reduction do you predict you will get? (Circle the most appropriate number.)

minimum amount 1...2...3...4...5...6...7 maximum amount

2. How confident are you that you will get the extent of reduction you indicated in the previous question? (Circle the most appropriate number.)

not at all confident 1...2...3...4...5...6...7 totally confident

3. Your goal has been to get the greatest possible reduction in the amount of time you must spend listening to the noise. How much of this possible reduction have you controlled? (Circle the most appropriate number.)

minimum amount 1...2...3...4...5...6...7 maximum amount

4. Your goal has been to get the greatest possible reduction in the amount of time you must spend listening to the noise. To what extent do you consider that you succeeded? (Circle the most appropriate number.)

no success 1...2...3...4...5...6...7 total success

(Please go to next page.)

5. Your goal has been to get the greatest possible reduction in the amount of time you must spend listening to the noise. To what extent do you consider that you <u>failed</u>? (Circle the most appropriate number.)

no failure 1...2...3...4...5...6...7 total failure

6. Your goal has been to get the greatest possible reduction in the amount of time you must spend listening to the the noise. How much of this possible reduction have you <u>influenced</u>? (Circle the most appropriate number.)

minimum amount 1...2...3...4...5...6...7 maximum amount

7. Your goal has been to get the greatest possible reduction in the amount of time you must spend listening to the noise. How much of this possible reduction do you <u>expect</u> to get? (Circle the most appropriate number.)

minimum amount 1...2...3...4...5...6...7 maximum amount

8. How <u>annoying</u> did you find the noise during the demonstration? (Circle the most appropriate number.)

not annoying at all 1...2...3...4...5...6...7 extremely annoying

9. According to the instructions, what is it that reduces the amount of <u>time</u> you must spend listening to the noise?

____

____

(Please go to next page.)

10. How many trials (card-positionings) do you think there were? (Give the exact number.)

____

11. On how many trials (card-positionings) did your positioning of the card <u>make a difference</u> in whether you did or did not reduce the time you must spend listening to the noise? (Give the exact number.)

____

12. On how many trials (card-positionings) was the card positioned and inserted into the Card-Reader <u>as you had indicated</u>? (Give the exact number.)

____

13. How <u>helpless</u> do you feel about the extent to which you have "controlled" the amount of time you must spend listening to the noise? (Circle the most appropriate number.)

no helplessness 1...2...3...4...5...6...7 total helplessness

14. How <u>helpless</u> do you feel about the extent to which you can "predict" the amount of time you must spend listening to the noise? (Circle the most appropriate number.)

no helplessness 1...2...3...4...5...6...7 total helplessness

Appendix C

Questionnaire #2

Please answer all questions below.

1. Your goal has been to get the greatest possible reduction in the amount of time you must spend listening to the noise. How much of this possible reduction do you think you got? (Circle the most appropriate number.)

minimum amount 1...2...3...4...5...6...7 maximum amount

2. How confident are you that you got the extent of reduction you indicated in the previous question? (Circle the most appropriate number.)

not at all confident 1...2...3...4...5...6...7 totally confident

3. Your goal has been to get the greatest possible reduction in the amount of time you must spend listening to the noise. How much of this possible reduction have you controlled? (Circle the most appropriate number.)

minimum amount 1...2...3...4...5...6...7 maximum amount

4. Your goal has been to get the greatest possible reduction in the amount of time you must spend listening to the noise. To what extent do you consider that you succeeded? (Circle the most appropriate number.)

no success 1...2...3...4...5...6...7 total success

(Please go to next page.)

5. Your goal has been to get the greatest possible reduction in the amount of time you must spend listening to the noise. To what extent do you consider that you failed? (Circle the most appropriate number.)

no failure 1...2...3...4...5...6...7 total failure

6. Your goal has been to get the greatest possible reduction in the amount of time you must spend listening to the noise. How much of this kpossible reduction did you influence? (Circle the most appropriate number.)

minimum amount 1...2...3...4...5...6...7 maximum amount

7. How annoying did you find the noise during the noise exposure period? (Circle the most appropriate number.)

not annoying at all 1...2...3...4...5...6...7 extremely annoying

8. How much longer do you think you could have listened to the noise?

____________minutes

9. How long do you think you actually listened to the noise?

____________minutes

10. Could you see the cycling of the numbers on the Count-Down Timer throughout the entire noise exposure period? (Circle the most appropriate alternative.)

yes no

(Please go to next page.)

11. How <u>helpless</u> do you feel about the extent to which you "controlled" the amount of time you spent listening to the noise? (Circle the most appropriate number.)

no helplessness 1...2...3...4...5...6...7 total helplessness

12. How <u>helpless</u> do you feel about the extent to which you "predicted" the amount of time you spent listening to the noise? (Circle the most appropriate number.)

no helplessness 1...2...3...4...5...6...7 total helplessness

(Please go to next page.)

15. What were you <u>thinking about</u> while you listened to the noise?

____

____

16. What do you think the purpose of this experiment was?

____

____

____

17. During the experiment, did you have the impression that the experimenter was misleading you about anything? (Circle the most appropriate response.)

yes no

18. If you answered "yes" to the previous question, in what way(s) do you think the experimenter was misleading you?

____

____

____

Appendix D

Instructions

Preparation and Demonstration

T: We are interested in your performance on a card positioning experiment. This experiment consists of two parts: (1) a card-positioning task during which you will hear NO noise and (2) a noise exposure period during which you will hear noise. The amount of time you spend listening to a prerecorded, irritating noise during the second part of the experiment will depend on the extent to which the overall time for the experiment is reduced during the first part of the experiment. Your goal is to have the greatest possible reduction in the amount of time you must spend listening to the noise.

Before you are told how this time is reduced, please put on the earphones, and you will be given a brief demonstration of the noise you will be listening to during the noise exposure period.

STOP (E points to earphones, P puts on earphones, and E turns on tape recorder for 10 seconds. Then, E turns off tape recorder and instructs P to remove earphones.)

In front of you is a count-down timer. (E points to timer.) This timer will be started at 999 when you begin the card-positioning task, and it will keep counting down throughout both the card-positioning task and the noise exposure period. When it reaches 000, the noise will turn off and the noise exposure period and the experiment will be completed. (E turns on timer.) Remember, the greater the reduction of time during the card-positioning task, the less time will be left for you to listen to the noise during the noise exposure period.

In front of you are the cards that will be used during the experiment. You are asked NOT to touch these cards until the experiment is over. There are three different types of cards: one with two white areas on the back, one with one white area on the back, and one with no white areas on the back. (E shows P one of each type of card.)

In front of you is a card-reading apparatus. You can see that inside this apparatus is a black tube. (E points to the apparatus and tube.) You can also see that there is a card-slot positioned in front of the tube. (E puts a card in the slot.) Inside this tube is a photocell which is connected to the count-down timer. This photocell is sensitive to differences in light intensity. When the photocell detects a high light intensity, it will trigger the count-down timer to cycle rapidly downward for a few seconds. For example, when the experimenter places a card in the slot with a white area opposite the photocell, the speed at which the numbers are counting down on the display becomes faster for a couple of seconds. The photocell registers a high reflectance of light off the white surface of the card, so the count-down timer briefly increased the speed at which it was counting down.

<u>STOP</u> (E demonstrates by inserting card with the white area placed across from photocell.)

E: Did you see this brief period of rapid count down after the card was inserted into the slot?

T: On the other hand, when the experimenter places the same card in the slot, only this time with a black area opposite the photocell, the photocell registers a low reflectance of light off the black surface of the card, so the count-down timer continues to cycle at the original, slow count-down speed.

STOP (E inserts the card with the black area opposite the photocell.)

E: Did you see that the timer continued to cycle at the same speed after the card was inserted into the slot?

T: To get a rapid reduction in time, the white area must be opposite the photocell. On top of the timer is a counter. (E points to counter mounted on count-down timer). The counter increases by one number each time the timer displays a rapid count down. For example, if a white area is opposite the photocell, the timer counts down rapidly for a few second and the counter goes up by one. (E places the white area in front of photocell.) This means you can tell by looking at this counter how many time-reductions you have gotten so far.

Your goal is to have a white area in front of the photocell as often as possible, so the total amount of time you will spend later listening to the noise will be shortened. Otherwise, you will have to listen to the noise for close to the maximum length of time.

During the card-positioning task, the experimenter will take these cards, one at a time, from the card box and will hold up a card so that you can see the message on the front of the card. You will NOT be shown the back of the card, so you will NOT be able to see whether there are any white areas on the back of the card--and if there are any, where they are located. You are to indicate to the experimenter, by saying either "POSITION A" or "POSITION B," which side of the card you want to extend beyond the top of the card-reader. If you choose "POSITION A," the experimenter will insert the card with "POSITION A" showing (E inserts a card in POSITION A into the card-reader). For this demonstration you can see which area will be positioned in front of the photocell. (E points to the area which will be read.) If you choose "POSITION B," the experimenter will insert the card with "POSITION B" showing (E inserts a card in POSITION B into the card-reader). For this demonstration you can see that the opposite area will be positioned in front of the photocell. (E points to the area which will be read.)

During the experiment you will NOT be able to see the areas on the back of the card. However, the words "YOUR CHOICE MAKES A DIFFERENCE" and "YOUR CHOICE MAKES NO DIFFERENCE" will always be visible on the front of each card. Therefore, throughout the card-positioning task you will know at the time the card is placed in the card-reader whether the two areas of the card are the same or different. In other words, on each trial you will know that the message "YOUR CHOICE MAKES NO DIFFERENCE" means that you will get the same brightness on either side of the card regardless of which card-position you select. There will either be two white areas or no white areas on the back of the card--but you won't know which. At the same time, you will know that the words "YOUR CHOICE MAKES A DIFFERENCE" means that you will get a different brightness on either side of the card depending on which card-position you select--but, again, you won't know how the white and black areas are positioned. Please note, however, that when there is only one white area on the back of a card, it will sometimes be opposite the photocell in position A and sometimes in position B. The total number of time reductions you obtain across all trials will be the number of white areas you have positioned in front of the photocell as revealed by the counter. (E points to counter.)

In front of you are three piles of cards from which the experimenter will select a smaller number to be used during the card-positioning task (E points to the pile of 54 cards.) At NO point are you to touch any of these cards. Look at these cards as the experimenter holds them up, and you will note that only those cards with the words "YOUR CHOICE MAKES <u>A DIFFERENCE</u>" printed on the front have a single white area on the back. All other cards will have the words "YOUR CHOICE MAKES <u>NO DIFFERENCE</u>" printed on the front, and will have either two black or two white areas on the back.

<u>STOP</u> (E shows P both sides of all 54 cards.)

<u>Prediction Conditions</u>

E: Throughout the experiment you will be able to see the displays of both the timer and the counter. Thus, you will know after each trial whether you did or did not get a time reduction.

<u>No Prediction Conditions</u>

E: During the experiment, you will NOT see the displays of either the timer or the counter because they will be covered by this black cloth. Thus, you will NOT know on any trial whether you did or did not get a time reduction. However, the experimenter will preserve the order and position of the cards used during the card-positioning task, so you can examine your choices and outcomes at the end of the experiment.

E: Are there any questions?

Before the timer is turned on, I will run through a few demonstration trials. First, I will show you the front and back of a card, and will then turn it to Position A. You will be asked whether you will or will not get a time reduction; then I will put the card in the card reader to see if you are correct. (E and P run through demonstration trials until P states correct expectations for both positions for two consecutive cards.) Are there any questions?

Card-Positioning Task

T: Now that you have seen the cards and gone through a demonstration of how to use them, the experimenter is going to take some of them and put them into a prearranged order in the card-box.

STOP (E arranges the cards in the prearranged order according to the numbers on the back of the card and places them in the the card-box.)

To review, the experimenter will be taking a card, one at a time, from the card box, and will hold it up so you can see the message on the front of the card. Your task is to read the message on the front of each card, choose how you want the card to be inserted into the Card-Reader, and indicate the chosen position by saying either the words "POSITION A" or "POSITION B." Please do NOT converse with the experimenter except for these words. The experimenter will then insert the card as you requested into the

Card-Reader for 3 seconds, remove it, and then hold up the next card from the card box. The experimenter will now start the timer, so the card-positioning trials can begin. Remember, although you will NOT hear the noise, the timer will keep counting down during the card-positioning trials. The more time is reduced during the card-positioning trials, the less time you will have to spend listening to the noise during the noise exposure period.

STOP (E starts count-down timer, and 24 trials are completed as per previous instructions.)

Pretask Questionnaire

T: You have now finished the card-positioning trials. Before the noise exposure period begins, you are asked to complete a questionnaire about your thoughts and feelings at this point. When you finish, the noise exposure period will begin. (E places questionnaire and pencil in front of P, and P completes questionnaire.) The timer will remain running while you complete this questionnaire. You have been allotted a sufficient amount of time to complete the questionnaire before we begin the noise exposure period. Once you are finished, put down your pencil and sit quietly until the experimenter gives you further instructions.

STOP (P completes questionnaire and sits quietly until a total of 5 minutes has elapsed.)

Aversive Task

T: Please put on your earphones. The noise exposure period will now begin. It will end when the timer reaches 000. Please sit quietly without movement or action until the noise turns off. (P puts on earphones and the tape recorder is turned on; noise shuts off after 10 minutes when the count-down timer has reached 000, and P removes headphones.)

Posttask Questionnaire

E: The count-down timer has reached 000. You are now asked to complete a second questionnaire, and then the experiment is over. (E places questionnaire #2 and a pencil in front of P, and P completes questionnaire.)

No-Prediction Conditions

E: The experimenter will now show you the outcome of the trials. (E shows cards to P.)

Appendix E

Trial #	0%-control				25%-control			
	37.5%Suc		62.5%Suc		37.5%Suc		62.5%Suc	
	PosA	PosB	PosA	PosB	PosA	PosB	PosA	PosB
1	S	S	F	F	S	F	F	S
2	F	F	S	S	F	S	S	F
3	F	F	S	S	F	F	S	S
4	S	S	F	F	S	S	F	F
5	F	F	S	S	F	F	S	S
6	F	F	S	S	F	F	S	S
7	F	F	S	S	F	F	S	S
8	F	F	S	S	F	F	S	S
9	S	S	F	F	S	S	F	F
10	F	F	S	S	F	S	S	F
11	F	F	S	S	F	F	S	S
12	F	F	S	S	F	F	S	S
13	S	S	F	F	S	F	F	S
14	F	F	S	S	F	F	S	S
15	F	F	S	S	F	F	S	S
16	F	F	S	S	F	F	S	S
17	S	S	F	F	S	S	F	F
18	F	F	S	S	F	F	S	S
19	F	F	S	S	F	F	S	S
20	F	F	S	S	F	F	S	S
21	F	F	S	S	F	F	S	S
22	S	S	F	F	S	F	F	S
23	F	F	S	S	F	S	S	F
24	F	F	S	S	F	F	S	S

Note: 37.5%Suc = 37.5%-success; 62.5%Suc = 62.5%-success; F = failure; S = success; PosA = position A; PosB = position B.

Appendix F

Debriefing

That ends the experiment. The purpose of the study was to investigate how people's influence over success at reducing the time spent listening to noise is related to their estimates of success and ratings of how annoying they find the noise. We were also interested in what people think about while they listen to the noise. After I have completed data collection I will be returning to your class and will tell you more about the study at that time. Do you have any questions?

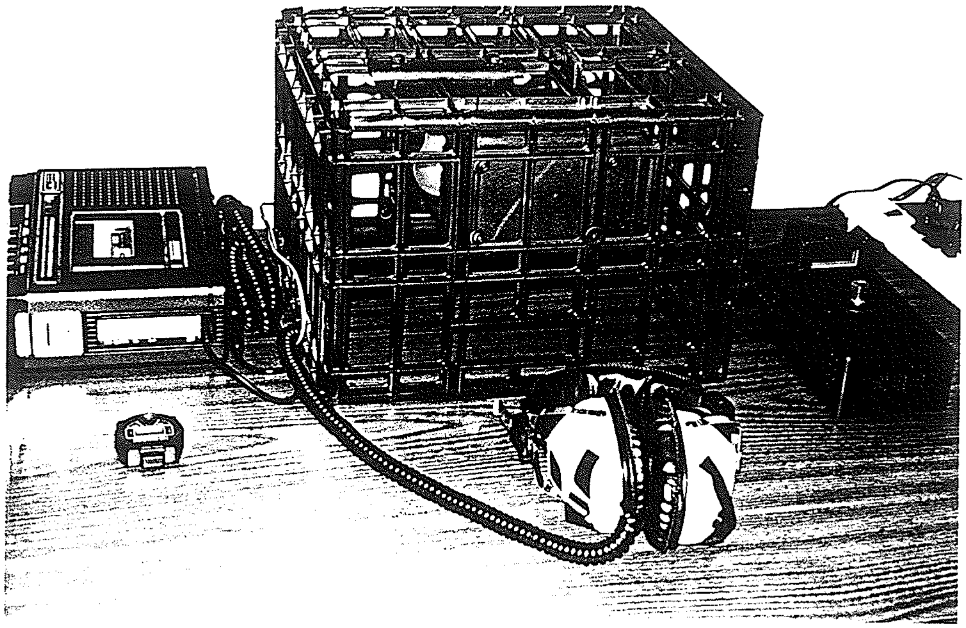
During experiments, participants often come up with their own ideas about what the experimenter is studying. Did you have any thoughts or concerns about what I was investigating?

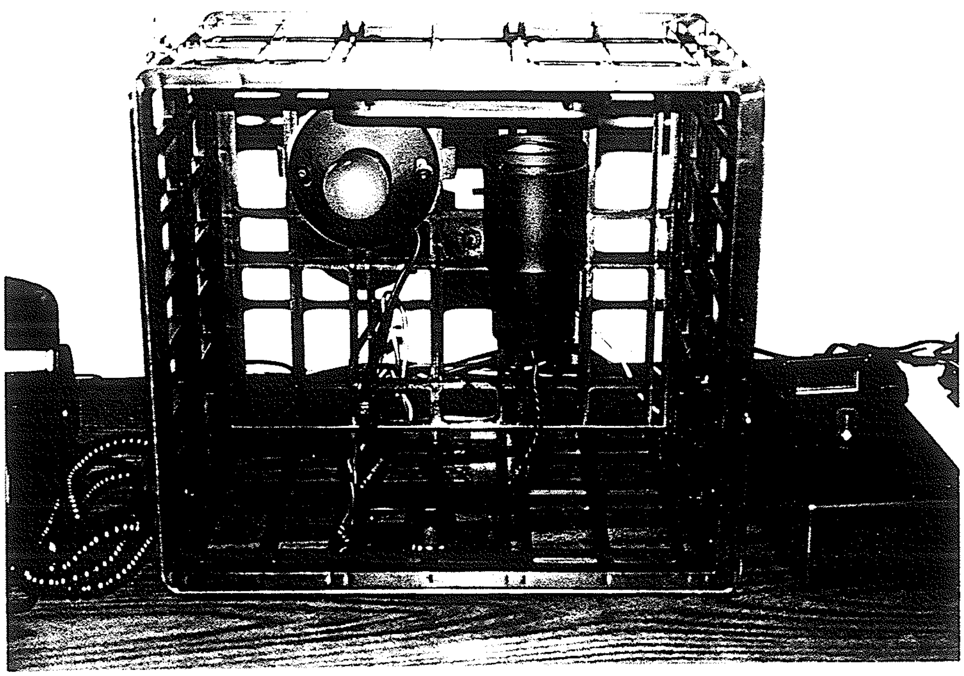
Sometimes, participants get the impression that the experimenter is misleading them about some aspect of the experiment. Did you have any such thoughts during this experiment?

Thank you for participating in this study. I look forward to sharing the findings with you at a later time.

Appendix G

Photographs of Apparatus





Appendix H

The Five Factor Packages and Their Corresponding Dependent Measures

Factors and Items	Item Location	Factor Loading 1	2	3	4	5
1. PREDICTION						
ReceivedTR	#1 on Q1	71*	13	- 5	- 1	
Expect	#7 on Q1	69*	11	1	- 7	
Success2	#4 on Q2	69*	12	- 5	- 8	
Predict	#1 on Q1	66*	8	24	-15	
Confidence1	#2 on Q1	55*	- 5	- 9	- 8	
Success1	#4 on Q1	54*	27	- 4	-15	
Confidence2	#2 on Q2	43*	-25	-17	- 3	
realnt	#10 on Q2	24	4	-16	-16	
Fail1	#5 on Q1	-64*	8	13	7	
Fail2	#5 on Q2	-65*	25	27	1	
2. CONTROL						
Influence2	#6 on Q2	6	80*	-18	- 9	
Influence1	#6 on Q1	- 6	76*	-18	- 7	
Control2	#3 on Q2	18	70*	-15	6	
Control1	#3 on Q1	6	69*	- 9	10	
realnc	#11 on Q2	- 6	23	- 4	- 1	
3. HELPLESSNESS						
HelpC2	#13 on Q2	-10	-62*	39*	0	
HelpC1	#13 on Q1	-11	-63*	53*	-11	
HelpP1	#14 on Q1	- 8	-29	71*	8	
HelpP2	#12 on Q2	-13	-30	62*	20	
4. AVERSIVENESS						
Annoy2	#7 on Q2	-20	3	22	74*	
Annoy1	#8 on Q1	-16	1	- 9	57*	
Longer	#8 on Q2	12	- 2	-12	-46*	
5. MISCELLANEOUS						
duration	#9 on Q2	-15	3	22	-27	*
accTotal+						*
accControl+						*

Note: Values were multiplied by 100 and rounded to the nearest integer. Values greater than 0.3 are flagged by an '*'. Items flagged with an '+' were not included in the factor analysis.