INFLATED CONTINGENCY IN NONDEPRESSED PERSONS: ERROR IN JUDGMENT OR ERROR IN METHOD?

BY

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Abstract

Several methodological problems, including low sample size, an unclear definition of actual control, and a frequent prediction-control confound (stemming from trial-by-trial feedback, hindsight, and self-serving bias), currently beset research on depressive realism (depressives' accurate contingency judgments) and nondepressive optimism (nondepressives' inflated contingency judgments). The present study tested the contributions of prediction knowledge (trial-by-trial success information) and control knowledge (trial-by-trial influence information) on nondepressed participants' control measures following a 50-trial computer task, where participants tried to be successful (by pressing or not pressing a button). Although it was expected that participants unaware of their control would indicate higher control estimates than participants who knew they controlled half or none of the trials, participants who controlled none of the trials greatly inflated their control estimates, while the other participants' estimates were realistic. Results confirmed that task-winners felt more control than both task-losers and participants unaware of their final outcome. These results cast serious doubt on past depressive realism research, suggesting that methodology plays an important role in producing the depressive realism phenomenon.

Introduction

It appears to be a wish of most people to have as much control over their lives as possible; in fact, control may not be simply a desire, but rather, a necessary agent of life. Adler (1930) wrote that the need to control one's personal environment was "an intrinsic necessity of life itself" (p. 398). Both Averill (1973) and Lefcourt (1973) agree that an increase in personal control will improve the quality of one's life. Lefcourt even stated that "the sense of control has a definite and positive role in sustaining life" (p. 424).

By having the ability to change or control the events in one's life, especially events with unfortunate outcomes (e.g., failing health), the individual is more able to adapt to his/her environment and reach both short and long term goals. According to White (1959), the behaviour of control or competence "is directed, selective, and persistent, and it is continued not because it serves primary drives . . . but because it satisfies an intrinsic need to deal with the environment" (p. 18). DeCharms (1968) wrote that "Man's primary motivation propensity is to be effective in producing changes in his environment. Man strives to be a causal agent, to be the primary locus of causation for, or the origin of, his behaviour; he strives for personal causation" (p. 269).

Due to the advent of experimental methodology allowing the direct manipulation of the control people and animals have over events in the environment (Mineka & Henderson, 1985), research in the area of controllability has expanded greatly in the past 25 years. The extent of this research has become so vast that, as a result, the area has diversified into a number of different fields (locus of control, desire for control, perceived control, etc.). The research over the last 25 years can be conceptualized in terms of the distinction between actual controllability (whether or not an event is affected by an action) and perceived controllability (whether or not an event is seen to be affected by an action). This classification, as shown in Figure 1, can be broken down as follows: Cell 1 (veridical control: both actual and perceived control), Cell 2 (illusory control: no actual but perceived control), Cell 3 (illusory uncontrol: actual but no perceived control), and Cell 4 (veridical uncontrol: neither actual nor perceived control). (See Figure 1.)

Veridical Control and Veridical Uncontrol

Seligman was the principle researcher in the

		Actual Control	
		yes	no
Perceived Control	yes	veridical control cell 1	illusory control cell 2
	no	illusory uncontrol cell 3	veridical uncontrol cell 4

Figure 1. Controllability alternatives generated from the interaction of actual control with perceived control.

investigation and comparison of veridical control and uncontrol, demonstrating the positive behavioural effects in an organism associated with a contingency between response and outcome (veridical control) and the negative behavioural effects in an organism associated with the lack of such a contingency (veridical uncontrol) (relevant studies include Maier & Seligman, 1976; Maier, Seligman, & Solomon, 1969; Overmier & Seligman, 1967; Seligman, 1975; Seligman & Maier, 1967; Seligman, Maier, & Geer, 1968; Seligman, Maier, & Solomon, 1971). The first demonstration of the differences between controllability and uncontrollability in the laboratory was the escapable/inescapable shock paradigm used by Overmier and Seligman (1967). It was shown that roughly two thirds of dogs exposed to inescapable shock in a Pavlov harness subsequently failed to learn to escape shock, whereas dogs first exposed to escapable shock subsequently learned to escape in the shuttle box as rapidly as did nonshocked controls.

These findings were conceptualized in Seligman's theory of <u>learned helplessness</u>, which states that when exposed to uncontrollable stimulation, an organism learns to expect it has no control, resulting in three behavioural deficits: (a) a cognitive or associative deficit, which makes it very difficult for the organism subsequently to learn that it does have control; (b) a motivational deficit, in which the organism has less incentive to initiate active coping responses because it believes that responding will not bring relief; and (c) an emotional or affective deficit, characterized by sadness or depression, which stems from the feelings of helplessness (Maier et al., 1969; Overmier & Seligman, 1967; Seligman, 1975; Seligman & Maier, 1967; Seligman et al., 1971). Additional research on the aforementioned behavioural deficits of helplessness, as reviewed by Maier and Seligman (1976), includes studies by Glass and Singer (1972), Hokanson, DeGood, Forrest, and Brittain (1971), Maier and Testa (1975), Maier and Weiss (1969), Miller and Norman (1979), Roth (1980), Seligman et al. (1968), and Weiss (1971).

Research has also demonstrated the effects of learned helplessness in humans (Hiroto & Seligman, 1975). Hiroto (1974) compared three groups of college students: An _escapable_ group that received experience with noises contingent on button pressing responses, an _inescapable_ group that received experience with noises noncontingently related to button pressing, and a _no noise_ group. All groups were subsequently tested on a human shuttle box for escape/avoidance from noise. The results were similar to those obtained with other species: Students who had received prior training to inescapable noise showed reduced performance of the requisite escape/avoidance response in the shuttle box test compared to students receiving prior exposure to contingent noise or no noise. In addition to impaired problem-solving and increased passivity (Seligman, 1975), there are also mood changes, such as increased anxiety, hostility, and/or depression (Gatchel, Paulus, & Maples, 1975; Miller & Seligman, 1973, 1975), increased subjective and psychophysiological indices of pain and distress (Miller, 1979; Thompson, 1981) and increased susceptibility to disease and unhappiness in the elderly (Langer & Rodin, 1976; Rodin & Langer, 1977).

Attributions of Veridical Control and Uncontrol

Despite the extensive volume of research on the motivational and emotional deficits associated with helplessness, support for the cognitive/associative deficit in humans has been lacking (Abramson, Seligman, & Teasdale, 1978; Alloy & Seligman, 1979; Alloy, Peterson, Abramson, & Seligman, 1984; Weiner, 1985). These studies indicate no decrement in learning rates in people previously exposed to uncontrollable situations. Based on these findings, learned helplessness theory had to be reformulated, with its focus centred not exclusively around the noncontingencies of a situation, but rather around the individual's attributions of the situation's uncontrollability. In the reformulation, Abramson et al. (1978) maintained that the effects of perceived uncontrollability were determined largely by people's attributions to failure, or rather, why people thought they lacked control. The three orthogonal dimensions on which such attributions may be made were (a) internal vs. external (the locus of causality), (b) stable vs. unstable (the perceived permanency of the uncontrollable situation), and (c) global vs. specific (the contribution of others to the situation's uncontrollability).

According to this theory, internal, stable, and global attributions for situations of failure are most likely to lead to long-lasting, generalized helplessness effects, including performance deficits, depression, and lowered self-esteem. By contrast, individuals who make external, unstable, and specific attributions to failure are less likely to show both persistent and generalized performance deficits and experience major mood changes (i.e., depression). While results have not been consistent across studies (cf. Coyne & Gotlib, 1983), more recent studies suggests that depressed individuals tend to have an attributional style that makes them prone to blame failure and lack of control on internal, stable, and global causes (Heimberg, Klosko, Dodge, Shadick, Becker, & Barlow, 1989; Johnson, Petzel, & Munic, 1986; Klein, Fencil-Morse, & Seligman, 1976; Kuiper, 1978; Mikulincer, 1988a, 1988b, 1989; Peterson & Seligman, 1984; Seligman, Abramson, Semmel, & von Baeyer, 1979; Sweeney, Anderson, & Bailey, 1986; Sweeney, Schaeffer, & Golin, 1982; Zemore & Johansen, 1980; Zuroff, 1981).

Illusory Control and Illusory Uncontrol

Following the original proposal of learned helplessness theory, it remained unclear the extent to which the deficits associated with uncontrollability were due to a knowledge of a noncontingent relationship between action and outcome or simply the perception of a nonrelationship. Maier (1970) showed that learned helplessness was not the superstitious development of passivity (Seligman, 1975), but in fact the actual learning of an independence between behaviours and outcome. These results led researchers to speculate whether a superstition of contingency was sufficient to offset the negative effects of helplessness in an uncontrollable situation. Could one's perceptions override the actual circumstances of the situation?

Cells 2 and 3 in Figure 1 (_illusory control_ and _illusory uncontrol_) represent the mismatch between the actual level of control in a situation and the level of control perceived by the organism. Illusory control (perceived but not actual control) denotes an overestimation of one's control in a situation, while illusory uncontrol (actual but not perceived control) denotes an overestimation of one's uncontrol.

Langer (1975), who coined the term _illusion of control_, tested participants' perceptions of control under a variety of conditions, contending that simply the _belief_ that one can cause an outcome is sufficient to override the negative effects of noncontingency between response and outcome. In a series of experiments, Langer showed that by providing participants with control cues (e.g., choice, active or passive participation, task familiarity, or competition with a seemingly incompetent opponent) in an uncontrollable situation, such as a random lottery, the negative effects of helplessness could be eliminated.

One such experiment (Langer, 1975, Experiment 2) was conducted in an office building, where one group of participants chose a ticket for an upcoming lottery while the other group was assigned a ticket. When asked to sell back their $1.00 tickets, participants whose tickets were assigned offered an average resale price of $1.97, while the participants given a choice of tickets offered a price of $8.67 ($p<.005$). Although the probability of winning the lottery was the same in both groups (choice, no choice), the choice of ticket provided the control cue leading participants to perceive more control over the lottery, and thus inflate their ticket's value.

Langer and Rodin (1976) extended these findings to an institution for the elderly. In an 18 month follow-up (Rodin & Langer, 1977), they found that residents who could choose their daily menus and the arrival of visitors were healthier, appeared happier, and lived longer than participants who were not given such choices. Additional evidence for the benefits of perceived control comes from Corah and Boffa (1970), Geer, Davison, and Gatchel (1970), Glass and Singer (1972), Langer and Roth (1975), Sherrod, Hage, Halpern, and Moore (1977), Stotland and Blumenthal (1964), and Wortman (1975).

Literature discussing the illusion of uncontrol, however, has been scant and nebulous. Several researchers have attempted to explain variants of the phenomenon (e.g., Langer, 1979; Langer & Benevento, 1978; Cramer & Nickels, 1988; Nickels, Cramer, & Gural, 1991, Experiment 2), but the greatest contribution to the understanding of illusory uncontrol comes from its serendipitous demonstration in the investigation of learned helplessness. The original experiments demonstrated that subjects previously exposed to uncontrollable situations would learn to expect uncontrollability in subsequent situations, even where a contingency between response and outcome existed. What the learned helplessness experiments truly uncovered was the deleterious effects of a perception of uncontrollability in a controllable situation, or the illusion of uncontrol (Maier et al., 1969; Maier & Seligman, 1976; Overmier & Seligman, 1967; Seligman, 1975; Seligman & Maier, 1967; Seligman et al., 1971). While both the similarities and differences between illusory uncontrol and learned helplessness have not been clearly explained, Langer (1975) does state that "the illusion of control is the inverse of learned helplessness" (p. 325), which seems plausible if one assumes illusory uncontrol and learned helplessness are synonymous.

The illusion of uncontrol may, however, be inferred from discussion of a variety of different yet related concepts. Langer (1979) discusses the <u>illusion</u>

of incompetence, whereby an individual erroneously infers a lack of competence from situational factors, and develops deleterious symptoms similar to learned helplessness. Langer points out a variety of ways an individual might acquire the behavioural deficits of illusory incompetence without direct exposure to uncontrollable situations. Whereas the illusion of control may be induced by the inclusion of control cues such as choice, active or passive involvement, task familiarity, and competition with an incompetent opponent in an uncontrollable situation, the illusion of uncontrol or incompetence may be induced by the absence of these cues from a controllable situation.

In addition, Langer and Benevento (1978) discuss illusory uncontrol in the context of self-induced dependence, or an "erroneous judgment of incompetence from interpersonal situational factors" (p. 886). In a study beginning with an initial assessment of performance on a word-finding task, pairs of high-school boys were divided into two groups: Pairs in group 1 were given labels of either boss or worker, while pairs in group 2 were given no labels. The results showed that boys labelled as workers showed impaired performance when retested on the word-find task relative to (a) their own previous performance,

(b) the performance of their boss, and (c) the performance of the unlabelled participants. The subordinate label of worker was sufficient to make participants underestimate the amount of control they perceived in the situation, in which no differential level of actual control existed. A perception of incompetence was thought to be reducing the task performance in the workers, leading the authors to conclude "that a helplessness effect may be brought about without prior experience with an uncontrollable aversive outcome" (p. 892).

Finally, two significant studies have indirectly demonstrated the phenomenon of illusory uncontrol. Abramson, Alloy, and Rosoff (1981) found that depressed individuals underestimated the control they exerted over an outcome when they were required to generate a relatively complex hypothesis for exerting control. Moreover, Alloy and Abramson (1979, Experiment 4) found an underestimation of control in nondepressed individuals who lost money.

Attributions of Illusory Control and Uncontrol

Attributions have also been found to vary with participants' perceived controllability of a situation. Tiggemann and Winefield (1987) showed uncontrollability to be the major determination of attributional self-ratings. They reported that while participants in the uncontrol group did not act helpless, they did feel helpless, rating themselves as having less control than they really had.

Contingency and Depression

Although the learned helplessness model was originally designed to explain behavioural deficits in animals, the theory was modified to explain abnormal human behaviour, specifically the affective disorder of depression (Maier & Seligman, 1973; Seligman, 1972, 1975). The learned helplessness theory of depression states that when people acquire the expectation that important outcomes and responses are independent, they exhibit the major motivational, cognitive, and affective deficits of helplessness, which coincide with the symptoms of depression (Beck, 1967, 1976; Seligman, 1975). The theory predicts that depressed individuals should underestimate the degree of contingency (illusory undercontrol) between their responses and environmental outcomes (Miller & Seligman, 1973; Seligman, 1975), while nondepressed individuals should be accurate in their estimations (veridical control).

As an alternative to the four-fold classification of control described earlier, Nickels (1990) also refers to a three-fold classification of control, based on a _relative_ analysis of perceived and actual control. This classification combines veridical control and veridical uncontrol into a single veridical control cell (the case where perceived control and actual control are similar), and differentiates _illusory overcontrol_ (the case where perceived control is higher than actual control) from _illusory undercontrol_ (the case where perceived control is less than actual control). This three-fold classification will be used throughout the remainder of the study.

In a four-experiment study, Alloy and Abramson (1979) tested the depressive undercontrol hypothesis by assessing and comparing both depressed and nondepressed individuals' judgments of contingency to a precalculated actual contingency standard. The authors maintained both a strong and weak prediction, whereby depressed individuals would underestimate (illusory undercontrol) the degree of objective contingency between their responses and outcomes relative to the actual contingency (strong prediction), or relative to the nondepressed individuals' judgments (weak prediction).

In Experiment 2 of the Alloy and Abramson study (1979), 64 depressed and nondepressed male and female undergraduates were randomized into one of two noncontingency conditions: 75-75 and 25-25. Actual contingency (cf. Jenkins & Ward, 1965; Ward & Jenkins, 1965) was calculated as the difference between the probability of a desired outcome given a response (the first number) and the probability of that same outcome given no response (the last number). When the two probabilities are equal, response and outcome are considered to be noncontingently related. The following example, as taken from Alloy and Abramson (1979, p. 447), illustrates the dynamics of the metric. If there is a 90% probability of getting an "A" on a test (outcome) as a result of studying (response), and a 10% probability of getting an "A" on a test from not studying (no response), the contingency (for getting an "A" on a test) is 90%-10%, or 80%. If, however, the probability of getting an "A" on a test is 90% whether or not the student has studied (90-90), the student would have no control over getting an "A" on a test. Thus, in both the 75-75 and the 25-25 conditions, participant responses were noncontingently related to the outcome. According to Abramson and Alloy (1981), the authors chose this metric because (a) it was a simple but close approximation to the phi coefficient statistic, and (b) it facilitated comparison of results with the results of prior investigations (e.g., Ward &

Jenkins, 1965).

In the study, individual participants were led into the experimental room, where following administration and scoring of the Beck Depression Inventory (BDI), the apparatus was uncovered: two lights (yellow and green) and a black box with a spring-loaded button. Both the 75-75 and 25-25 contingency problems consisted of 40 trials on which the participant had the option of either pressing or not pressing the button at the onset of the yellow light. At the end of each trial, the green light was either presented or not presented depending upon the participant's response and the contingency problem to which the participant had been assigned. The intertrial interval ranged from 10 to 25 seconds with a mean of 14 seconds.

After completing the contingency task, the participants were asked to indicate (on a scale from 0 to 100) the overall degree of control they felt over the onset of the green light (the desired outcome). Results showed illusory overcontrol in nondepressed participants in the 75-75 but not in the 25-25 contingency problem, whereas depressed participants showed veridical control by being accurate in their contingency estimates on both problems. These results run counter to the theory's prediction: The depressed participants, expected to underestimate the actual contingency (illusory undercontrol), were accurate in their judgments (veridical control); whereas nondepressed participants' judgments, expected to be accurate (veridical control), were overestimations of the degree of actual contingency (illusory overcontrol). Based on these findings, Alloy and Abramson concluded that "at times depressed people are sadder but wiser than nondepressed people" (p. 463). The terms depressive realism (Mischel, 1979) and nondepressive optimism were introduced to refer to accurate contingency judgments of depressed individuals and control overestimations in nondepressed individuals (Alloy & Abramson, 1988, p. 223).

Alloy and Abramson (1988) examined the phenomenon of depressive realism and nondepressive optimism in a review of the relevant literature. The authors showed that the understanding of the phenomenon has come from the manipulation of a number of independent variables. In addition to the mood and sex of the participant, studies have varied the company of the participant (Alloy, Abramson, & Viscusi, 1981; Martin, Abramson, & Alloy, 1984), the level of reinforcement (Alloy & Abramson, 1979, Experiment 2; Vázquez, 1987, Experiment 2), the actual contingency (Vázquez, 1987, Experiment 1), and the controllability of noise (Alloy & Abramson, 1982). Other independent variables include the valence of task outcome (Alloy & Abramson, 1979, Experiments 3 & 4; Alloy & Abramson, 1982; Vázquez, 1987, Experiments 3 & 4), mind set (Gollwitzer & Kinney, 1989), time of response (Abramson et al., 1981), reversed contingencies (Alloy & Abramson, 1979, Experiments 1 & 4), and reference of feedback (Vázquez, 1987, Experiment 3 & 4).

Research outside the contingency judgment paradigm has also provided support for the phenomenon of <u>depressive realism</u> and <u>nondepressive optimism</u>, showing that depressed individuals have a more realistic and balanced view of their world than individuals who are happy (DeMonbreun & Craighead, 1977; Raps, Peterson, Reinhard, Abramson, & Seligman, 1982; Ruehlman, West, & Pasahow, 1985; Taylor & Brown, 1988, for a review; Watson & Clark, 1984). By introducing elements of skill to a chance situation, Golin and her colleagues attempted to induce an illusion of overcontrol in both depressed and nondepressed participants. Whereas the nondepressed participants overestimated the degree of control they had (illusory overcontrol), depressed participants were accurate in their estimations (veridical control), refusing to succumb to an illusion of overcontrol (Golin & Terrell, 1977; Golin, Terrell, & Johnson, 1977; Golin, Terrell, Weitz, & Drost, 1979). Lewinsohn, Mischel, Chaplin, and Barton (1980) found that depressed patients accurately assessed their social competence whereas nondepressed psychiatric and normal controls perceived themselves more positively than other people saw them. Rizley (1978) found that relative to nondepressives, depressives self-attributed more interpersonal influence and causality for both evaluatively positive and negative behaviour changes in another persons. And finally, Rozensky, Rehm, Pry, and Roth (1977) reported that nondepressed control patients rewarded themselves to a greater degree than their objective performances would warrant. Although depressed patients also tended to overreward themselves, they were more accurate in self-reward than were nondepressives.

Despite considerable support for the phenomenon of depressive realism and nondepressive optimism, some studies have indicated no such effect. For example, results from both Benassi and Mahler (1985) and Bryson, Doan, and Pasquali (1984) indicated an underestimation of the actual contingency in depressed participants while nondepressed participants were accurate in their judgments. In addition, Abramson, Alloy, and Rosoff (1981) found that when participants were asked to generate complex hypotheses for exerting control over an outcome, depressed individuals underestimated the control they exerted. Vázquez (1987) reported that depressed participants overestimated contingency judgments when outcomes were negative self-referent rather than positive self-referent statements. And finally, despite accurate control judgments in depressed individuals, Alloy and Abramson (1979, Experiment 4) found an underestimation of control in nondepressed individuals who lost money.

The implications of the various studies on depressive realism and nondepressive optimism are enormous. As stated by Alloy and Abramson (1988), "the phenomenon of depressive realism directly challenges the basic postulates of the major cognitive theories of depression" (p. 224). In addition, the findings also challenge the traditional approach to the understanding of normal behaviour and processes, whereby scientists investigate behavioural deviations and abnormal behaviour (Freud, 1920). Finally, the findings challenge our basic theoretical notions of psychopathology. It was assumed that all individuals who deviate from normal behaviour (e.g., paranoia, hysteria, and depression) could be characterized by an exaggeration in irrational and biased beliefs about their world. Depressive realism studies show this is not necessarily the case in "at least one group of psychopathological individuals . . . characterized by less, rather than more, cognitive bias and distortion" (Alloy & Abramson, 1988, p. 224).

Problems in Depressive Realism Research

In the investigation of the depressive realism phenomenon, many studies (e.g., Alloy et al., 1981; Martin et al., 1984; Vázquez, 1987) have employed the original Alloy and Abramson paradigm. Despite considerable support for depressive realism and its far reaching implications, the results of these studies are suspect due to serious methodological shortcomings, implying that accurate depressed and inflated nondepressed control estimates may result not from differential cognitive processes of the two populations, but rather from result-biasing variables left uncontrolled. The three methodological problems: (1) low sample size, (2) the conceptualization of actual control, and (3) a frequent prediction-control confound, will be examined separately with reference to compensating methodological procedures.

<u>Low Sample Size</u>

An examination of the depressive realism studies shows, for the most part, relatively small cell sizes. In accord with Robins' (1988) argument that the greatest shortcoming in depression research is the low statistical test power due to small sample sizes, the number of participants in the depressive realism research rarely exceeds eight subjects per cell, and often has cells with as few subjects as four. Interestingly, studies in which the sample sizes are comparatively larger (e.g., Bryson et al., 1984; Benassi & Mahler, 1985, with 22 subjects per cell) do not replicate the depressive realism phenomenon. If the assessment of main effects and not interactions is the intent of an experiment, then low cell sizes are not as critical, since the combined cell sizes increases the power of the test. However, if the interactions are of interest, then cells require a minimum of 12 participants to have sufficient statistical power to detect differences between two or more independent variables (Tabacknik & Fidell, 1989). The interactions between independent variables have been of interest in many depressive realism and nondepressive optimism studies (e.g., Alloy & Abramson, 1979, Experiment 1, 3, & 4; Bryson et al., 1985;

Dresel, 1985) where sample sizes were not sufficiently large to detect interactive differences, indicating that the individual cell sizes should be higher than 12 participants. Although the findings across a variety of studies appear consistent, it is not clear which of the studies' unfalsified hypotheses are not rejected due to a lack of relationship between variables or due to poor statistical power.

As a final note, these studies' low sample size also restricts the generalizability of the phenomenon of depressive realism to a larger and more broad population.

Conceptualization of Actual Control

A second problem with the depressive realism research concerns the terms used to define the actual controllability of a situation. Specifically, there are three issues which warrant discussion: (1) calculation of actual control, (2) experimental specification of actual control, and (3) participant knowledge of actual control. Each issue will be discussed separately, with both supporting evidence and suggested solutions.

Calculation of actual control. In an extensive critique of the Alloy and Abramson (1979) experiments, Schwartz (1981) argued that nondepressive errors may not have been errors at all, but rather accurate judgments compared to an inappropriate control standard. For example, if participants perceive their control to be 50%, this level would be considered unrealistically inflated if the calculated level of actual control was 0%, accurate if the actual control level was 50%, and unrealistically deflated if the actual control level was 100%. In fact, the metric used in the Alloy and Abramson experiments to compute actual control may not have represented actual control at all. According to Alloy and Abramson (1979), control was defined as "the dependence of an outcome on a response" (p. 447). Their calculation of actual control, as taken from Ward and Jenkins (1965), involved a difference metric, or the difference between the probability of getting the outcome of interest, one response, rather than the alternative response.

Nickels (1990) maintains that the Alloy and Abramson conceptualization of control, while very straightforward, is too simplistic, and represents not a measure of actual contingency (control), but rather a difference in predicting a success by using one option rather than another. That is, in a 75-50 contingency situation, there is a 25% greater likelihood of obtaining success from responding versus not responding. When the difference is zero, or rather, when neither option is more advantageous to the attainment of the desired outcome (i.e., 75-75, 50-50, or 25-25), then outcome and response are considered to be noncontingently related.

Control, as defined by Nickels (1990), means influence. To have control, then, implies that "an organism makes an impact upon an event, regardless of whether or not one can predict that event" (p. 4). Using this definition, the reinforcement probabilities for the two response possibilities become irrelevant to the computation of actual control. According to this view, control is best represented by a mean metric, or the average number of trials on which the choice of one option results in a different outcome than the choice of an alternative option (converted to a percent). For instance, if on a given trial, the same desired outcome (success) occurs regardless of whether or not one gives either a response or nonresponse, then clearly a successful outcome will be received on that trial regardless of the option chosen; that is, nothing the participant can do will change the outcome of the trial. As taken from Nickels (1990), Figure 2 represents the three possible forms actual control can take in Alloy and Abramson's simple 50-50 difference

	Method #1 press/nopress	Method #2 press/nopress	Method #3 press/nopress
	light----light	light----light	light----nolight
	light----light	light----nolight	light----nolight
	nolight--nolight	nolight--light	nolight--light
	nolight--nolight	nolight--nolight	nolight--light
Difference Metric Control	0%	0%	0%
Mean Metric Control	0%	50%	100%

Figure 2. Comparison of two control measures across different methods of obtaining a 50-50 proportion of presses and nopresses.

metric. The reinforcement level is consistent across all three methods (i.e., 50-50, or a 50% probability of the desired outcome given either a response or nonresponse), and Alloy and Abramson interpret this to mean all three cases represent 0% control or noncontingency. However, the degree of actual control defined as outcome-influence in each method can vary considerably depending upon the paired sequences of reinforcement. According to Nickels (1990), in any given block of four trials, Method #1 has no instance whereby the outcome can be altered by an action (0% actual control). Two of the four trials in Method #2 offer control of the outcome (50% actual control), while all of the four trials in Method #3 offer control over the outcome (100% actual control). Nickels (1990) points out that the difference metric used in the Alloy and Abramson (1979) experiments is actually measuring "sufficient conditions" for a particular outcome rather than contingency, which is based on both sufficient and necessary conditions.

The difference metric was used in the depressive realism research to compute the level of actual control (contingency) to which participants' control judgments were compared. If one does not accept the difference metric as the best measure of actual control, it is unclear whether the unrealistic control in nondepressed individuals and realistic control in depressed individuals is due to their different perceptions of control or to the contingency standard (computed by the difference metric) to which their perceptions were compared.

Specification of actual control. In the original Alloy and Abramson (1979) experiments, the authors never gave sufficient information to derive the mean metric. The first experiment in the study provides the best example of this nonspecification, where participants worked under a 75-50, a 75-25, or a 75-0 difference metric. Although the authors indicated the actual control level in terms of the difference metric (25%, 50%, and 75%, respectively), it is unclear whether these were the levels of actual control as defined by the mean metric. Perusal of Figures 2 and 3 shows that only in methods 1, 4, 6, and 8 would the difference metric match the mean metric (see Figure 3).

Additionally, the contingencies in Experiment 2 (i.e., 25-25 and 75-75) were described as noncontingent (p. 458). These conditions would also represent noncontingency (0% control) according to the mean metric, but not for the reasons specified by the authors. Although the difference metric calculates the

	Method #4 press/nopress	Method #5 press/nopress	Method #6 press/nopress	Method #7 press/nopress	Method #8 press/nopress
	light----light light----nolight light----light nolight--nolight	light----light light----nolight light----nolight nolight--light	light----light light----nolight light----nolight nolight--nolight	light----nolight light----nolight light----nolight nolight--light	light----nolight light----nolight light----nolight nolight--nolight
Difference Metric Control	25%	25%	50%	50%	75%
Mean Metric Control	25%	75%	50%	100%	75%

Figure 3. Comparison of two control measures across different methods of obtaining an unequal number of presses and nopresses.

resulting contingency in both the 25-25 and the 75-75 contingency problems to be zero, this does not necessarily represent the level of actual control as defined by the mean metric. Both contingencies, if taken in four-trial blocks, could have had an actual control level of 50% or 0%; however, because participants supposedly received <u>exactly</u> 25% and <u>exactly</u> 75% success in the total number of trials, it may be reasonable to conclude that participants were given no opportunity to change the outcome of any of the 40 trials, resulting in a mean metric level of 0%.

It would appear then that in order to determine whether participants' response are realistic, it is necessary both to specify and vary systematically participants' levels of control as defined by the mean metric.

<u>Knowledge of actual control</u>. One may suspect that if participants were clearly told the information needed to accurately judge the contingency, then nondepressed judgments would less likely be inflated and would tend <u>not</u> to show unrealistic control estimates. In fact, Alloy and Abramson (1979) state that "if [nondepressed] subjects do err in their judgments of contingency, it could be either because they have not collected the appropriate raw data or

because they have drawn incorrect inferences from a set of appropriate raw data" (p. 448). While their discussion pursues the latter possibility, the former suggestion on the availability of necessary data merits debate.

A study by Guttormson (1984) varied the degree of control participants had over the matching of letters to a preset pattern. In a 16-letter pattern, control was based on the number of trials (either 4, 8, or 12) on which participants were able to alter the choice of one of two possible responses. Following a significant MANOVA ($\underline{F}$ = 3.101, $\underline{p}$ = 0.003) and extended Scheffé tests, Guttormson concluded that "the higher the level of real [actual] control, the higher the level of perceived control" (p. 30).

Based on these findings, it would appear that nondepressed contingency judgments may not be unrealistic if the individuals are provided with all the control information necessary to draw a clear judgment of actual control as given by the reconceptualization (i.e., the average number of trials on which the choice of one option results in a different outcome than the choice of an alternative option). The extent to which participants need certain data would be more clear if their knowledge of the control could be systematically varied.

Predictability-Controllability Confound

The final problem in the depressive realism research paradigm concerns a potential prediction-control confound. Nickels (1990) discusses prediction and control as separate concepts. Control denotes the exercise of making "an impact on an event, regardless of whether or not the individual can anticipate the event"; prediction denotes the "anticipation of an event through the availability of relevant information about an event, regardless of whether or not the individual affects this event" (p. 4). For instance, in finding a set of light switches in an unfamiliar house, you would have control without prediction if you flipped one of the switches which turned on a light, regardless of your knowledge about which switch turns on which light. Conversely, you would have prediction without control if you knew that a particular switch turned on a particular light and that someone else flipped that switch.

It has been traditionally assumed that, at least in nature, prediction and control come in three forms: (a) prediction-control (e.g., a labelled television remote control device), (b) prediction-uncontrol (e.g., the weather), and (c) unprediction-uncontrol (e.g., a plane whose collision with another aircraft in midflight was completely unforetold and unavoidable by the passengers). It has also been traditionally assumed that unprediction-control cannot exist; that is, the forecastability of an event is inherent in the ability to influence that event. Nickels (1990) contends, however, that situations do exist whereby one may control an unpredictable event, as indicated previously in the example of light switches. One may switch on a light in an unfamiliar house without knowing what light the switch activates. An additional example would be an unlabelled television remote control device being used for the first time. The individual could influence the state of the television by pressing one of two buttons (one for volume and one for channel selection), but would do so unpredictably.

Although the debate continues on the possible separability of predictability and controllability, with some claiming that the two concepts are nonoverlapping (Nickels et al, 1991, Experiment 1 & 2; Nickels, 1990; Tan, 1981), and others contending their inseparability (Averill, 1973; Mineka & Kihlstrom, 1978; Seligman, 1975), it has been shown that if not properly controlled, predictability and controllability can confound one another and contaminate the results of a study (Averill, 1973; Burger & Arkin, 1980; Geer & Maisel, 1971; Hokanson et al., 1971; Staub, Tursky, & Schwartz, 1971, Experiment 2; Wortman, 1975). Therefore, a study showing high controllability ratings may be a result of the predictability element, the controllability element, or some interaction between them. Traditional research suggests then that unless controlled for, participants who can influence an event also probably possess some degree of knowledge of that event.

Three types of predictability may be contaminating the results of the depressive realism experiments:
(a) trial-by-trial feedback, or information given to participants following their choice to press or not press the button on each trial of the task;
(b) hindsight bias, or the reinterpretation of an event following knowledge of that event's outcome, and
(c) self-serving bias, where people take credit for successful outcomes and reject responsibility for failures. Each bias will be discussed separately, with supporting research, possible effects on the depressive realism findings, and the implications for the present study.

Trial-by-trial feedback bias. Seligman has shown that animals that have received prior inescapable shock generally take longer to escape shock in subsequent shock escape tasks than animals that have first received either escapable shock or no shock (Maier & Seligman, 1976; Overmier & Seligman, 1967; Seligman, 1975). These findings have been interpreted under the learned helplessness theory, such that the animals receiving inescapable shock quickly learn that any and all responses will be ineffective to escape the shock.

Starr and Mineka (1977, Experiment 2) demonstrated, however, that if an external feedback stimulus is associated with shock relief, the fear associated with inescapable shock can be reduced. The authors taught a group of rats to lever-press for food. After lever-pressing had stabilized, the animals were assigned to one of the following three conditions: A group which received escape/avoidance training, a yoked group which received the same CS-US presentations, or a yoked-feedback stimulus group where a 3-second light was coincident with a shock-relieving response from the animal. Following this phase of training, all animals were returned to the lever-pressing situation for a CER test. The authors reported that the escape and yoked-feedback groups showed less suppression to the CS during extinction testing than the yoked group which did not receive a feedback stimulus. These findings suggest that control over shock did not play a critical role in reducing the CS-induced fear but rather the feedback stimulus for the yoked-feedback group and the proprioceptive feedback derived from responding for the escape-avoidance groups decreased fear to the electric shock.

Additional research by Mineka, Cook, and Miller (1984) has shown that providing a feedback stimulus to an animal which has control over shock termination reduces fear of the context compared to an animal which has control but no feedback stimulus. They suggested that these effects on contextual fear are due solely to the predictability of shock absence, since they would expect an additive effect if fear in this situation were independently affected by controllability and predictability. Therefore, many of the effects of exposure to uncontrollable aversive events which have been attributed to uncontrollability may indeed be due to the unpredictability of the absence of the event. These results have been confirmed by Volpicelli, Ulm, and Altenor (1984), who demonstrated the ability of a feedback stimulus during helplessness training to reduce the performance deficits common to inescapable shock.

Finally, in a series of experiments, Rosellini and his colleagues (i.e., DeCola, Rosellini, & Warren, 1988; Rosellini, DeCola, & Warren, 1986; Rosellini, Warren, & DeCola, 1987) showed that providing subjects with feedback of performance following a training trial significantly reduced the amount of fear in the subjects. Rosellini et al. (1986) found that animals exposed to yoked shock with a feedback stimulus were equivalent to animals which received escapable shock, and both these groups showed less fear of the shock than did yoked animals given no feedback. They concluded that it remained uncertain the extent to which a learned helplessness effect could be attributable to the controllability of the shock, as proposed by learned helplessness theory (Maier & Seligman, 1976) or to the predictability of the shock-free periods. The varied effects of controllability, particularly controllability of shock termination, may result not from controllability *per se* but from predictability of shock absence.

Rosellini et al. (1987) used the three standard groups (escapable shock, yoked feedback, and yoked no-feedback) and tested for differences across a number of different training trials (20, 40, and 80). The authors found that for groups receiving 80 training trials, those animals that were exposed to yoked-inescapable shock with a feedback stimulus were no more fearful of the shock context than animals having control over shock termination, and were less fearful than animals exposed to yoked-inescapable shock without a feedback stimulus. These results replicate their earlier findings under similar training conditions (Rosellini et al., 1986) and are also consistent with the findings of DeCola et al. (1988), Jackson and Minor (1988), Maier and Keith (1987), and Mineka et al. (1984). These and other findings further suggest that the effects of controllability may be reducible to the effect of predictability of shock absence.

While the previous experiments tested _animals_ for reduced fear from a feedback stimulus, the phenomenon has also been demonstrated in humans. Ward and Jenkins (1965) asked participants to judge the amount of control exerted by cloud seeding over rainfall, so chosen because the outcome appeared to be chance determined. One group (trial-by-trial feedback) was told what response they made (i.e., _seed_ or _no seed_), and the result of their response (i.e., _rain_ or _no rain_). A second group was given the same experimental treatment except they were shown a summary statement of the information presented following all the trials.

Their results showed that the group given no trial-by-trial feedback was accurate in their estimations of zero-contingency.

The research clearly demonstrates that the addition of a feedback stimulus following escape from an aversive situation reduces the fear to that situation. This trial-by-trial feedback is provided in the depressive realism experiments and may be confounding the results. In the typical depressive realism experiment, participants are given the trial outcome (green light does or does not come on) following their choice to press or not press the button. The participants then know the outcome of every trial following a response and this knowledge may be providing a potentially confounding element of predictability, leaving it unclear as to whether the participants' judgments of contingency are not in fact judgments of predictability (the degree to which they know the trial outcome). Future depressive realism research could highlight the effects of the feedback variable by systematically varying the degree of feedback given to the participants.

Hindsight bias. The second potential source of predictability comes from what has been called the hindsight bias. Fischhoff (1975) coined the term to represent the tendency for people considering a past event to exaggerate that event's likelihood to occur or not occur. Also known as the "I knew it all along" effect, research has shown that people who possess information regarding an outcome, such as the winner of a football game, will alter their estimates of that event's probability to occur. Moreover, people not only tend to view an event that has happened as having been inevitable but also to view it as having appeared inevitable before it happened (Fischhoff, 1977; Hasher, Attig, & Alba, 1981; Hawkins & Hastie, 1990; Hoch & Loewenstein, 1989; Wasserman, Lempert, & Hastie, 1991).

The hindsight bias appears to be a robust phenomenon, due to consistent demonstration in a number of applied settings, including politics (Fischhoff & Beyth, 1975; Leary, 1982; Synodinos, 1986), historical judgment (Fischhoff, 1980), psychotherapy case histories (Fischhoff, 1975), and employee evaluation (Mitchell & Kalb, 1981). It has also been demonstrated using a number of different types of knowledge, including football game results (Leary, 1981), medical diagnoses (Arkes, Wortmann, Saville, & Harkness, 1981), and even general knowledge (Fischhoff, 1977; Hell, Gigerenzer, Gauggel, Mall, & Muller, 1988; Wood, 1978).

The typical hindsight bias study divides participants into two groups, providing one group with information concerning an uncertain event. On the basis of this information alone, the informed group is asked to estimate the probability that the event will occur. The other group receives the outcome of the event and is asked to estimate the likelihood that they would have assigned to the event if they had not been informed of the outcome. Hindsight is then assessed by comparing the probability judgments of the two groups.

In the depressive realism research paradigm, participants are told the final outcome of the contingency task before they respond to the dependent measures questionnaire. Participants are in fact responding in hindsight to a past event, the outcome of which they already know. This bias could be eliminated by asking participants to judge the contingencies before they are given the final outcome.

Self-serving bias. Either alone or in conjunction with hindsight bias, the self-serving bias may also be an additional source of predictability confounding the depressive realism findings. Coined by Snyder, Stephen, and Rosenfield (1976), self-serving bias represents a "tendency to attribute outcomes in a way that puts oneself in the most favourable light" (p. 436). Particularly in the area of attribution research, it has been shown that people will take credit for positive outcomes in their lives while blaming others or the environment for negative outcomes. Snyder et al. (1976) showed that participants in a "rigged" competitive game (i.e., the outcome was not dependent on the participant's skill but was secretly controlled by the experimenter) made internal attributions when they won and external attributions when they lost.

A study of naturally occurring success and failure was conducted to test the self-serving bias outside the laboratory (Carver, DeGregorio, & Gillis, 1980). These researchers examined the attributions of the head coach and assistant coaches of a college football team that had experienced a losing season, and it was shown that the coaches took credit for the positive aspects of their players' performance but tended to blame the other coaches when the players performed poorly.

In the discussion of the relation between attributions and outcome feedback (success or failure), Cohen (1964) writes that people tend to attribute desired outcomes to internal factors (ability and effort) but blame external factors (task difficulty and luck) for failures. Research investigating this relationship supports this claim. Streufert and

Streufert (1969) had participants in dyads make tactical decisions in a simulated international decision-making situation. The participants, believing they were playing against another team, were given feedback about the correctness of their decisions (although the wins and losses were preprogrammed). During intermissions of the playing period, participants were asked what percentage of the present situation they attributed to decisions made by their team, to decisions made by the opposing team, and to external factors (i.e., chance). Results indicated self-attributed successes and other-attributed failures. Fitch (1970) gave false feedback to participants who estimated the number of dots on slides presented to them, and found that participants attributed success to their ability, and failures to luck and other external factors. Additional support for the self-serving bias in attributions is provided by Forsyth and Schlenker (1977), Lau and Russell (1980), Miller and Ross (1975), Wortman, Costanzo, and Witt (1973), and Zuckerman (1979).

Finally, Baumgardner, Heppner, and Arkin (1988) tested the influence of mood on causal attributions for success and failure. A positive, neutral, or negative mood was induced in participants who then learned they had either succeeded or failed on an aptitude test taken previously. Relative to neutral mood control conditions, participants in both positive and negative mood conditions showed a pronounced self-serving bias following success. Participants internalized success more when induced to experience either a positive or a negative mood, in relation to a neutral mood.

In a number of the depressive realism experiments (Alloy & Abramson, 1979, Experiments 3 & 4; Alloy & Abramson, 1982; Vázquez, 1987, Experiments 3 & 4), participants are given the final outcome of the contingency task (either win or lose) before the contingency measures are taken. Internal and control-inflated contingency judgments for outcomes of success and external and control-deflated judgments for outcomes of failure may in fact indicate a self-serving bias and not genuine cognitive distortions.

Summary of prediction-control confound. In summary, then, participants' control estimates may be confounded by three prediction elements: trial-by-trial feedback bias, hindsight bias, and self-serving bias. If participants are given trial-by-trial information as to their performance on a task, estimates of control are likely be inflated in the direction of the information. In addition, if participants know the outcome of an event before judging that event, a hindsight bias is likely to confound the results, and perceptions will be exaggerated in the direction of the outcome's result. And, finally, by providing participants with the outcome of the task before assessment of the perceived contingencies, participants may be responding with a self-serving bias, such that participants who receive a successful outcome will attribute control to be more internal, and will feel more control, responsibility, and less helplessness than participants who receive an outcome of failure.

Present Study

The present study will examine whether inflated nondepressive control and contingency estimates result from errors in judgment or from errors in the research itself by using the following compensatory procedures for the three methodological problems: (a) employment of a relatively large sample for increased statistical power, (b) manipulation of a novel conceptualization of actual control (Nickels, 1990), and (c) manipulation of task predictability (and its effect upon trial-by-trial feedback, hindsight, and self-serving bias). The assessment of nondepressives' control judgments, contingency judgments, and other control- and prediction-associated measures will follow the manipulation of both control knowledge of trial-by-trial influence on a contingency task and prediction knowledge of trial-by-trial success on a contingency task. The effects of the two independent variables will be assessed on the dependent variables of perceived control, certainty of successful outcome, and judgments of contingency (probability of success by a response, overall probability of success, and perceived number of controlled trials).

Hypotheses

DeCola et al. (1988), Mineka et al. (1984), Rosellini et al. (1986, 1987), and Volpicelli et al. (1984) demonstrated that subjects given a feedback stimulus following an escape response showed less fear and helplessness than subjects given no feedback stimulus. Moreover, research on the hindsight and self-serving biases, including Fischhoff (1975, 1977, 1980, 1982) Hell et al. (1988), Baumgardner et al. (1988), and Snyder et al. (1976), shows that participants who are told an outcome prior to estimating its probability assign higher probabilities to events which do occur and lower probabilities to events which do not occur than participants who are not told the outcome beforehand. Based on these findings, it is hypothesized that (1) regardless of control knowledge, participants given trial-by-trial feedback indicating high success will report unrealistically higher control judgments, higher certainty of outcome judgments, and higher contingency judgments than participants given no trial-by-trial feedback, who will report unrealistically higher control judgments, higher certainty of outcome judgments, and higher contingency judgments than participants given trial-by-trial feedback indicating low success.

Langer (1975) found that individuals' ratings of perceived control varied with situational cues erroneously suggesting a chance task was a skill task. Guttormson (1984) found that individuals' ratings of perceived control varied with the actual level of control given to the participants. And finally, Alloy and Abramson (1979) gave participants no indication of difference metric control and found inflated contingency judgments. Therefore, based on these findings, it is hypothesized that (2) regardless of prediction knowledge, participants given no indication beforehand whether or not a trial is controllable will report unrealistically higher control judgments, higher certainty of outcome judgments, and more inflated contingency judgments than participants who are given such an indication (at either 0% or 52% control level), who will report realistic control judgments, accurate certainty judgments, and realistic contingency judgments. Based on Tan's (1981) findings that predictability influenced control ratings and controllability influenced prediction ratings, and no interaction occurred between the two variables, only main effects and no interactive effects between prediction knowledge and control knowledge are anticipated.

Method

Participants and Experimenter

An equal proportion of 81 male and 90 female undergraduate students enrolled in the Introductory Psychology course at the University of Manitoba obtained course credit for participation in the experiment. There was no restrictions on either the age or the race of the participants. Participants were screened for depression in order to test the hypotheses relevant only for nondepressives.

Although the original Alloy and Abramson experiment (1979, Experiment 3) demonstrated sex effects, whereby females showed greater control inflations than males, other studies (i.e., Bryson et al., 1984; Martin et al., 1984) have found no such sex difference. Although a test for an overall sex effect was conducted, the present study controlled for sex effects by employing an equal proportion of males and females in each group. Aside from this restriction, participants were randomly assigned to experimental conditions. The experimenter for all groups was a 23-year-old White male.

Overview

Participants were randomly assigned to one of three prediction knowledge groups so an equal number ended up in each group. The groups consisted of (a) those with a Known 24-24 difference metric (success occurred on 24% of the trials if either response choice was consistently selected), (b) those with a Known 76-76 difference metric (success occurs on 76% of the trials if either response choice was consistently selected), and (c) those with an Unknown success level difference metric for 50 separate trials. Participants in each prediction knowledge group were also randomly assigned to one of three control knowledge groups, with an equal number in each group. The groups consisted of (a) those with a 0% mean metric (choice of response made a difference on no trials), (b) those with a 52% mean metric (choice of response made a difference on half of the trials), or (c) those with an unknown mean metric (choice of response made a difference on an unknown number of the trials). On each trial, participants chose to either press or not press a button to get a successful outcome.

Instruments, Apparatus, and Materials

Personality Inventories. Participants were screened for depression with the Beck Depression Inventory (BDI; Beck, 1967; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961; see Appendix A). The BDI is a useful assessment for depression as it is self-administered and relatively short; it moreover provides quantitative information for assessing the depth of depression and is well validated (Beck, 1967, 1976; Bumberry, Oliver, & McClure, 1978; Metcalfe & Goldman, 1965). Participants with BDI scores of eight or less met the criterion for nondepression (as outlined by Beck, 1967) and were eligible to participate. Data of participants with BDI scores of nine or greater were not included in the study. Participants also received the Multiple Affect Adjective Check List (see Zuckerman & Lubin, 1965). In keeping with Alloy and Abramson (1979), the Check List was given, but the results were not employed (see Appendix B).

Computer and Programme. A personal computer was used both to present instructions and stimuli to the participants (via a 30 cm wide x 20 cm high monochrome visual display) and to record the participant's responses on a standard computer keyboard.

A 76-76 and a 24-24 contingency programme, written in BASIC programming language by the experimenter (see Appendix C), involved a number of randomly generated preset configurations received by all same-condition participants. In the 76-76 difference metric condition, there were 38 outcomes of success and 12 outcomes of failure for each response option (i.e., press or nopress), such that a 76% success level would have been received following the 50th trial if the same response (press or nopress) had always given. In the 24-24 difference metric condition, there were 12 outcomes of success and 38 outcomes of failure for each response option, such that a 24% success level would have been received following the 50th trial if the same response had always given.

Participants who worked on either a 24-24 or a 76-76 difference metric task with a 0% mean metric had no opportunity on any of the 50 trials to decide the outcome via a response. Alternatively, participants who worked on either a 24-24 or a 76-76 difference metric task with a 52% mean metric had the opportunity to decide the outcome on 26 of the 50 trials by either pressing or not pressing the button. An illusory overcontrol measurement would be impossible in a 100% mean metric, whereas an illusory undercontrol measurement would be impossible in a mean metric of 0%. The computer was also used to retain information on each participants' button pressing responses during the experiment.

At the beginning of every trial, the computer display showed the trial number at the top of the screen. Moreover, prediction feedback and control feedback was provided to feedback participants. For example, if trial 4 was controllable, that is, if the outcome given a press was different from the outcome given a nopress, then the words "DIFFERENT OUTCOMES" appeared immediately after the trial number was presented. If the trial was uncontrollable, that is, if the press outcome and the nopress outcome were the same, then the words "SAME OUTCOMES" appeared. Three seconds from the start of the trial, the appearance of the words "PRESS OR DON'T PRESS" asked participants to choose to press or not press the button. Three seconds later, regardless of whether or not the button was pressed, the choice phrase (PRESS OR DON'T PRESS) disappeared, a beep sounded, and prediction feedback participants viewed the trial outcome of "SUCCESS" or "FAILURE" for four seconds. A beep sounded, the screen cleared, and participants were told to "Prepare for the next trial", at which point a new trial began.

Figure 4 shows the location on the visual display of all stimuli presented.

Questionnaires. Two versions of the same dependent measures questionnaire, designed specifically for the present experiment, assessed participants' judgments of prediction, control, contingency, and success as well as manipulation checks on control and success feedback. Data were obtained on percentage- as well as frequency-judgments, counterbalanced in the two versions of the questionnaire (see Appendix D; two versions were used to counterbalance differential responding to frequency and percentage questions). A post-experimental questionnaire was also given at the end of the study to assess participant suspicion and knowledge of the experimental hypothesis (see Appendix E).

Independent and Dependent Variables

The experimental design involved a 3 (prediction knowledge) x 3 (control knowledge) between-subjects fixed factorial design. The first independent variable, prediction knowledge, included the three

Trial 4 of 50

SAME/DIFFERENT OUTCOMES

PRESS OR DON'T PRESS

SUCCESS/FAILURE

Figure 4. Location on the visual display of all stimuli presented.

levels of prediction-success, prediction-failure, and unprediction conditions. In the prediction conditions, participants received trial-by-trial success feedback via the computer screen at the end of every trial. Prediction success participants received a success rate of 56% or higher, while prediction failure participants' success rate will not exceed 44%. Unprediction participants, however, were not told the trial-by-trial outcome.

The second independent variable, control knowledge, included the three levels of control-0, control-52, and unaware control. Participants in the control-0 and control-52 conditions were given the reconceptualized definition of control (where control exists when a choice makes a difference in the outcome) and were informed at the start of every trial when the trial outcomes would be different depending upon the participant's choice of responses ("DIFFERENT OUTCOMES"). They were not told which response option rendered the trial a success, just simply that their choice would have an impact. The DIFFERENT OUTCOMES signal appeared on 26 of the 50 trials for control-52 participants and on none of the 50 trials for control-0 participants. In the unaware control condition, participants were not told whether they had control over the trial outcome in a difference metric problem with 52% actual control (on 26 of the 50 trials the outcome given a response is different given a nonresponse), and were not told when the choice of responses resulted in different outcomes. The unaware control level of control knowledge was comparable to the information given to participants in the original Alloy and Abramson (1979) experiments. The combination of the above two independent variables produced nine conditions of prediction knowledge and control knowledge (see Figure 5).

The dependent measures came from two sources. The computer recorded (a) the number of bar presses and nopresses each participant made in the 50 trials, (b) the success rate on button press and nopress trials, (c) actual bar press and nopress contingencies, (d) the number of successes received due to presses and nopresses, and (e) the ratio of the total number of successful trials to the total number of trials. In addition, participants ratings of prediction, control, and contingency and success were obtained through the use of the dependent measures questionnaire, asking participants to indicate their perceived control, certainty of final outcome (overall success or failure), and contingency judgments (degree of control

		CONTROL KNOWLEDGE	
	UNAWARE	CONTROL-0	CONTROL-52
PREDICTION KNOWLEDGE UNPREDICT 76-76	Unpredict 76-76-U condition 1	Unpredict 76-76-C0 condition 2	Unpredict 76-76-C52 condition 3
PREDICT-SUCCESS 76-76	Predict-S 76-76-U condition 4	Predict-S 76-76-C0 condition 5	Predict-S 76-76-C52 condition 6
PREDICT-FAILURE 24-24	Predict-F 24-24-U condition 7	Predict-F 24-24-C0 condition 8	Predict-F 24-24-C52 condition 9

Figure 5. Experimental conditions.

over success given a response, degree of success given no response, overall degree of control over success, and the estimated number of controllable trials).

Design and Procedure

Experimental conditions were randomized for each week of running times, while an equal proportion of males and females were randomized across all conditions. Prior to each participant entering the experimental setting, the experimenter typed each participant's experimental group (i.e., level of feedback, control knowledge, and overall outcome) into the computer.

Each participant entered a room containing a chair and table, on which was located both papers and pencils. It was explained that personality traits may play a significant part in the study and thus it was necessary to assess each participant's present mood, whereupon each participant completed the Beck Depression Inventory (BDI) and then the Multiple Affect Adjective Check List alone. When finished, each participant was directed to the experimental room and told to sit down at a table upon which was located a personal computer, black button box, and a keyboard.

Participants were told they were taking part in a problem solving experiment. See Appendix F for complete instructions. The problem, delivered by the computer, consisted of 50 trials, on each of which participants were to choose to press or not press the black button. On each trial, a press was preset to bring about either a success or failure. Also, on each trial, a nopress was preset to bring about a success or failure. On some trials, a press brought about one outcome, and a nopress its opposite outcome. On these trials, the response the participant chose to give completely determined (decided) the outcome the participant received. It was the participant's goal to learn how to acquire as many successful trial outcomes as possible.

Each participant who knew the level of actual control (i.e., control-0 or control-52) was told which trials were controllable and which were uncontrollable; that is, they were told before each trial whether pressing or not pressing responses resulted in different or same outcomes.

After the instructions were clearly understood, each participant began the computer task, at which time the experimenter left the room and scored the participant's depression inventory. If the score of the inventory indicated moderate or severe depression (i.e., scores greater than 17) or if there was evidence of intent to harm (i.e., question 9), the experimenter pointed it out to the participant, with the suggestion of on-campus counselling services (see Appendix G for an example description in the case of intent to harm). At the end of the 50 trials, participants completed the dependent measures questionnaire.

The questionnaire assessed the dependent measures of perceived control, predictability, confidence, and contingency judgments. The questionnaire also assessed each participants' recollection of the number of successful trials, the number of those trials in which they pressed the button, and the number of successful trials that were controllable. The same information was assessed for failure trials. Manipulation checks were included to assess whether the participants knew if they received trial-by-trial success feedback or trial-by-trial control feedback. Additional checks were included to determine whether participants in high-success feedback groups recognized themselves as successful and whether participants in low-success feedback groups recognized themselves as unsuccessful.

Before being debriefed, participants were asked to complete a post-experimental questionnaire, used to assess participant awareness of the research hypothesis. Participants were then debriefed as to the actual purpose of the experiment (see Appendix H), and any questions participants had were answered. Finally, after the participant left the experimental room, the experimenter accessed the computer for additional data on the session, including the actual contingency for button pressing and nopressing, the total number of button presses and nopresses, the total number of button press and nopress successes earned, and the ratio of the total number of successes to the total number of trials. Data was not included in the final analysis if the participant obtained an ambiguous success level (i.e., 22 through 28 successes over the 50 trials). This means that all participants in the high-success groups had at least 56% success, and all participants in the low-success groups had no more that 44% success.

Data Analysis

Each of the hypotheses were tested using a 3 x 3 multivariate analysis of variance (MANOVA) with prediction knowledge (predict-success, predict-failure, unpredict) and control knowledge (control-0, control-52, unaware control) as the independent variables. Dependent variables included ratings of perceived control, certainty of successful outcome, and judgment of contingency measures (perceived probability of success by button pressing, overall probability of success, and number and percentage of controllable trials). In order to compute the degree of unrealism in participants' judgments of contingency, a difference score was calculated between the participants' estimates and the participants' actual levels of the variable (i.e., control, success, etc.). Significant prediction knowledge and control knowledge effects were further analyzed with Tukey's Post Hoc Studentized Range (Honestly Significant Difference) comparison tests, with all tests based on a significance level of 0.05. Finally, inter-correlations were run on all dependent variables.

Results

Based on 171 cases containing no missing values, pairwise linearity was checked using within-group scatterplots, analyses were run to test for multicollinearity, and both were found to be satisfactory.

Based on the correlation matrix of all dependent measures (see Table 1), variables were separated into six packages for the test of the various hypotheses. Package 1 (control-associated measures) contained unrealism measures for (a) the number of trials controlled, (b) the number of success trials

Table 1

Correlation Matrix of All Dependent Measures

Dependent Variable	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Number Controlled	78	46	60	42	52	-4	-4	-2	21	3	4	9	1	16	-17	15
2. Percent Controlled		53	60	46	51	7	7	2	15	-7	-2	2	-8	17	-14	15
3. Number Success Controlled			58	30	24	8	4	24	13	-8	-4	-5	-12	32	-28	5
4. Percent Success Controlled				39	39	-6	-4	11	34	6	4	14	-7	30	-31	8
5. Number Failure Controlled					60	-25	-26	-16	-3	24	24	37	6	-17	19	2
6. Percent Failure Controlled						-3	1	-20	-8	3	1	-1	-1	-12	15	5
7. Number Success							90	40	8	-100	-87	-36	-6	13	-12	15
8. Percent Success								36	14	-91	-84	-32	-1	19	-17	17
9. Number Success Pressed									43	-40	-37	-10	4	3	2	11
10. Percent Success Pressed										-8	-15	14	7	31	-34	12
11. Number Failure											87	36	6	-13	12	15
12. Percent Failure												29	5	-14	12	-8
13. Number Failure Pressed													29	10	-7	-3
14. Percent Failure Pressed														-20	22	-2
15. Certainty of Outcome															-85	18
16. Anticipated Outcome																-11
17. Motivation to Succeed																

Note. N = 171; $r(p<.05) = \pm 15$; decimals have been removed.

controlled, and (c) number of failure trials controlled. The package also contained unrealism measures for (d) the percentage of trials controlled, (e) the percentage of success trials controlled, and (f) the percentage of failure trials controlled. Package 2 (control-irrelevant success measures) contained unrealism measures for the number and percentage of success trials, and number and percentage of success trials pressed. The third package (control irrelevant failure measures) contained the unrealism measures for the number and percentage of failure trials, and number and percentage of failure trials pressed. The remaining three dependent variables (certainty of outcome, anticipated outcome, and motivation to succeed) were individually analyzed with univariate analyses of variance (ANOVAs), as the distributions of their scores correlated significantly with none of the other variables.

The dependent variables in each package plus the remaining three dependent variables were examined through two BMDP (i.e., BMDPAM and BMDP7D) programmes for accuracy of data entry and fit between their distributions and the assumptions of multivariate and univariate analysis. Using Mahalanobis distance with a critical probability of $p<.001$, 3 cases (about 2%) were identified as multivariate outliers in their own groups. Because the number of cases was low, the outlier cases were replaced, resulting in satisfactory distances ($p > .001$). Dependent variable skewness and kurtosis measures in each group were consistent and statistically satisfactory.

As a preliminary check for robustness, sample variances for each dependent variable in each package were compared across the nine groups. For no dependent variable did the ratio of largest to smallest variance approach 20:1, a ratio deemed too large by some statisticians (Tabacknik & Fidell, 1989). The largest ratio was 15:1 for Group-5 (0% Control winners) versus Group-9 (52% Control losers) on the unrealism measure of number of failure trials pressed.

Manipulation Checks

Three manipulation checks were included in the dependent measures questionnaire to ensure that control and prediction participants realized the feedback they had received. These feedback checks may be divided into three types: (a) a control check (i.e., "Were you told whether the trial was controllable?"), (b) a prediction check (i.e., "Were you told whether the outcome of each trial was either a success or failure?"), and (c) an outcome check (i.e., "Were you told the final outcome?"). Seven, eight, and seven participants, respectively, were eliminated from the study because of their incorrect reports to the three check types.

Manipulation checks were also included to determine the effectiveness of the experimental manipulations. These effectiveness checks can be divided into two types: (a) a control check (i.e., "How many of the 50 trials did you control?") to assess whether participants given control felt more control than participants given no control; (b) an outcome check (i.e., "On how many of the 50 did you succeed?") to assess whether participants given high or low success feedback perceived themselves as succeeding or failing overall at the computer task. Group means for each of these checks indicated that the experimental manipulations were successful.

Sex Differences

A test for differences between the 80 males and 91 females in the sample was initially run on the three packages and remaining three dependent measures to determine the presence of sex effects. For the first three packages, all multivariate F's were nonsignificant for control, $F(6, 164) = 0.72$, $p > .05$; for success, $F(4, 166) = 1.47$, $p > .05$; and for failure, *F*(4, 166) = 0.57, *p*>.05. Two-sample t-tests were used to analyze the remaining dependent measures of certainty of outcome, *t*(169) = 0.24, *p*=0.81; anticipated outcome, *t*(169) = -0.83, *p*=0.41); and motivation to succeed, *t*(169) = -1.22, *p*=0.22; revealing no sex differences.

Prediction Knowledge and Control Knowledge

The first three packages were tested separately using a 3 x 3 between-subjects MANOVA with prediction knowledge (Unprediction, Prediction Win, Prediction Lose) and control knowledge (Unaware Control, 0% Control, 52% Control) as the independent variables.

Control-Associated Measures Package

Through the use of Wilks' criterion, the MANOVA revealed that the combined dependent variables were significantly affected by prediction knowledge, *F*(12, 314) = 10.39, *p*<.0001; control knowledge, *F*(12, 314) = 11.84, *p*<.0001; and their interaction, *F*(24, 549) = 7.62, *p*<.0001 (see Table 2 for multivariate and univariate *F*-ratios, degrees of freedom, and *p*-values).

Number of trials controlled. Both the prediction knowledge and control knowledge main effects were significant, but not the interaction. Tukey's Post Hoc Studentized Range (Honestly Significant Difference)

Table 2

MANOVAs and ANOVAs of Control-Associated Measures

Independent Variable Dependent Variable	F	df	p
Prediction Knowledge MANOVA	10.39	12, 314	<.0001
Number Controlled	4.06	2, 162	.0189
Percent Controlled	2.62	2, 162	.0758
Number Success-Controlled	9.24	2, 162	.0002
Percent Success-Controlled	19.31	2, 162	<.0001
Number Failure-Controlled	1.50	2, 162	.2270
Percent Failure-Controlled	9.95	2, 162	.0001
Control Knowledge MANOVA	11.84	12, 314	<.0001
Number Controlled	25.94	2, 162	<.0001
Percent Controlled	34.27	2, 162	<.0001
Number Success-Controlled	11.58	2, 162	<.0001
Percent Success-Controlled	32.00	2, 162	<.0001
Number Failure-Controlled	14.53	2, 162	<.0001
Percent Failure-Controlled	54.74	2, 162	<.0001
Prediction x Control MANOVA	7.62	24, 549	<.0001
Number Controlled	2.37	4, 162	.0543
Percent Controlled	0.83	4, 162	.5057
Number Success-Controlled	2.46	4, 162	.0476
Percent Success-Controlled	11.52	4, 162	<.0001

Number Failure-Controlled	2.35	4, 162	.0563
Percent Failure-Controlled	9.71	4, 162	<.0001

Note. *N* = 171.

contrast tests run on both prediction knowledge and control knowledge marginal means showed that while Unpredictors (participants given no trial-by-trial success feedback) differed from neither Prediction Winners (participants given trial-by-trial success feedback indicating high success) nor Prediction Losers (participants given trial-by-trial success feedback indicating low success), the latter two groups were significantly different. (See Table 3 for means and standard deviations). Furthermore, 0% Controllers (participants given trial-by-trial feedback indicating none of the trials were controlled) felt they controlled a greater number of trials than both 52% Controllers (participants given trial-by-trial control feedback indicating half the trials were controlled) and Unaware Controllers (participants given no trial-by-trial control feedback), whose mean estimates did not significantly differ.

The control effectiveness check (i.e., "How many of the 50 trials did you control?") indicated that the manipulation of actual control (absolute control level) was successful, since the group means corresponded to expectation: 0% Controllers felt they controlled less trials (M = 16.63) than 52% Controllers (M = 28.83) and Unaware Controllers (M = 25.74). These group positions

Table 3

Means (Standard Deviations) of Realism Difference Measure for Number of Trials Controlled

Control Knowledge	Prediction Knowledge		
	Unprediction	Prediction Win	Prediction Lose
Unaware Control	3.16 (13.12)	4.58 (8.71)	-8.00 (11.35)
0% Control	11.84 (17.97)	22.79 (18.07)	15.26 (15.58)
52% Control	4.53 (8.48)	2.53 (11.06)	1.42 (10.68)

Note. *N* = 19 participants per cell.

changed when looking at realistic judgments, where the actual number of trials controlled was subtracted from the participants' perceptions. The realism measures revealed control inflations in 0% Controllers ($\underline{M}$ = 16.63) relative to the accurate control judgments of 52% Controllers ($\underline{M}$ = 2.83) and Unaware Controllers ($\underline{M}$ = 0.74).

Percentage of trials controlled. This variable was only affected by the control knowledge variable. Tukey tests (see Table 4 for means and standard deviations) revealed that 0% Controllers felt they controlled a greater percentage of trials than 52% Controllers and Unaware Controllers, between the two of which no significant differences were found.

Number of success trials controlled. Affected by prediction knowledge, control knowledge, and their interaction, Tukey tests showed Prediction-winners' and Unpredictors' means were significantly greater than the estimates of Prediction-losers (see Table 5 for means and standard deviations). In addition, 0% Controllers felt they controlled a greater number of success trials than both 52% Controllers and Unaware Controllers, between the two of which no significant differences were found. The two main effects should be interpreted very carefully as the interaction was significant.

Table 4

Means (Standard Deviations) of Realism Difference Measure for Percentage of Trials Controlled

Control Knowledge	Prediction Knowledge		
	Unprediction	Prediction Win	Prediction Lose
Unaware Control	-2.62 (34.78)	4.74 (11.97)	-15.79 (26.10)
0% Control	31.58 (22.94)	39.47 (32.91)	35.26 (32.89)
52% Control	6.95 (11.97)	3.79 (23.17)	-6.73 (20.65)

Note. N = 19 participants per cell.

Table 5

Means (Standard Deviations) of Realism Difference Measure for Number of Success Trials Controlled

Control Knowledge	Prediction Knowledge		
	Unprediction	Prediction Win	Prediction Lose
Unaware Control	5.03 (10.28)	1.63 (9.51)	-0.39 (4.20)
0% Control	7.16 (10.10)	15.11 (12.01)	5.58 (5.03)
52% Control	5.00 (8.51)	6.26 (10.87)	-2.74 (4.04)

Note. N = 19 participants per cell.

Tukey tests showed that 0% Control winners felt they controlled a greater number of success trials than all Prediction-losers, all Unaware Controllers, and Control-winners. Moreover, although not significantly different from each other, 0% Control unpredictors and 52% Control-winners felt they controlled a greater number of success trials than 52% Control-losers.

Percentage of success trials controlled. This variable was also affected by both prediction knowledge and control knowledge, and by their interaction. As with Number-Success-Controlled, Prediction-losers felt they controlled the least percentage of success trials, which differed significantly from the estimates of Prediction-winners and Unpredictors, whose means did not differ (see Table 6 for means and standard deviations). In addition, 0% Controllers felt they controlled a greater percentage of success trials than both 52% Controllers and Unaware Controllers, between which no significant differences were found. Finally, in the examination of the interaction, Tukey tests showed that 0% Control winners and all Unpredictors felt they controlled a greater percentage of success trials than Unaware Controllers and 52% Control-losers. 0% Control losers felt they controlled a greater percentage of success trials than Unaware Control

Table 6

Means (Standard Deviations) of Realism Difference Measure for Percentage of Success Trials Controlled

Control Knowledge	Prediction Knowledge		
	Unprediction	Prediction Win	Prediction Lose
Unaware Control	11.06 (27.87)	-1.58 (25.22)	-23.16 (23.35)
0% Control	20.56 (30.82)	41.05 (37.55)	37.37 (37.39)
52% Control	16.75 (10.06)	17.60 (25.84)	-49.10 (33.47)

Note. *N* = 19 participants per cell.

winners and losers, and 52% Control-losers. Unpredictors and Control-winners felt they controlled a greater percentage of success trials than 52% Control-losers and Unaware Control-losers. Finally, Unaware Control winners felt they controlled a greater percentage of success trials than 52% Control-losers.

Number of failure trials controlled. Affected significantly by only control knowledge, Tukey tests revealed that 0% Controllers felt they controlled a greater number of failure trials than 52% Controllers and Unaware Controllers, between the two of which no significant differences were found (see Table 7 for means and standard deviations).

Percentage of failure trials controlled. Both prediction knowledge and control knowledge and their interaction significantly affected this variable. Tukey tests showed that Prediction-losers felt they controlled a greater percentage of failure trails than Prediction-winners and Unprediction participants, whose estimates did not differ significantly from each other (see Table 8 for means and standard deviations). In addition, 0% Controllers felt they controlled a greater percentage of failure trials than Unaware Controllers, whose estimates were significantly greater than those of 52% Controllers. In the examination of the

Table 7

Means (Standard Deviations) of Realism Difference Measure for Number of Failure Trials Controlled

Control Knowledge	Prediction Knowledge		
	Unprediction	Prediction Win	Prediction Lose
Unaware Control	-1.50 (6.34)	1.79 (4.08)	-0.76 (11.00)
0% Control	6.05 (8.65)	7.26 (5.54)	10.68 (10.67)
52% Control	3.37 (8.04)	-2.95 (5.73)	4.11 (12.69)

Note. N = 19 participants per cell.

Table 8

Means (Standard Deviations) Percentage Realism Difference Measure for Percentage of Failure Trials Controlled

Control Knowledge	Prediction Knowledge		
	Unprediction	Prediction Win	Prediction Lose
Unaware Control	-6.32 (28.33)	2.53 (28.62)	-11.58 (28.14)
0% Control	21.58 (30.96)	36.84 (36.37)	37.89 (35.37)
52% Control	-46.84 (13.76)	-42.63 (32.46)	15.32 (24.87)

Note. N = 19 participants per cell.

interaction, Tukey tests showed that although not significantly different from each other, 0% Control winners and losers felt they controlled a greater percentage of failure trails than all Unaware Controllers and both 52% Control-winners and 52% Control unpredictors. Finally, 0% Control unpredictors felt they controlled a greater percentage of failure trials than both 52% Control-winners and unpredictors. It should be noted that although 52% Control-winners and 52% Control unpredictors did not significantly differ from each other, they considerably underestimated the percentage of failure trials they controlled (*M* = -42.63 and *M* = -46.84), and these estimates differed from all other groups.

Control-Irrelevant Success Measures Package

Through the use of Wilks' criterion, the MANOVA (containing unrealism measures for both number and percentage of success trials, and number and percentage of success trials pressed) revealed that the combined dependent variables were significantly affected by prediction knowledge, $F(8,318) = 10.00$, $p<.0001$; control knowledge, $F(8,318) = 2.55$, $p<.05$; and their interaction, $F(16,486) = 2.83$, $p<.0005$ (see Table 9 for multivariate and univariate *F*-ratios, degrees of freedom, and *p*-values).

Table 9

MANOVAs and ANOVAs for Control-Irrelevant Success Measures

Independent Variable Dependent Variable	F	df	p
Prediction Knowledge MANOVA	10.00	8, 318	<.0001
Number Success	17.89	2, 162	<.0001
Percent Success	13.89	2, 162	<.0001
Number Success-Press	8.48	2, 162	.0003
Percent Success-Press	20.13	2, 162	<.0001
Control Knowledge MANOVA	2.86	16, 486	.0105
Number Success	1.07	2, 162	.3467
Percent Success	0.75	2, 162	.4738
Number Success-Press	4.81	2, 162	.0093
Percent Success-Press	0.33	2, 162	.7207
Prediction x Control MANOVA	2.83	16, 486	.0002
Number Success	2.38	4, 162	.0536
Percent Success	2.21	4, 162	.0701
Number Success-Press	5.27	4, 162	.0005
Percent Success-Press	1.36	4, 162	.2515

Note. *N* = 171.

Number of success trials. Affected by only prediction knowledge, Tukey tests showed that Unpredictors estimated they received a greater number of success trials than Prediction-losers and Prediction-winners, whose estimates did not significantly differ (see Table 10 for means and standard deviations).

The success effectiveness check (i.e., "On many of the 50 trials did you succeed?") indicated that the manipulation of the level of reinforcement (absolute success level) was successful, since the group means corresponded to expectation: Prediction Winners felt they succeeded on more trials (M = 36.00) than Unpredictors (M = 29.81) and Prediction Losers (M = 12.03). These group positions changed when looking at realistic judgments, where the actual number of success trials was subtracted from the participants' perceptions. The realism measures revealed success inflations in the Unpreditors (M = 4.81) relative to the accurate success judgments of Prediction Winners (M = -2.00) and Prediction Losers (M = 0.03).

Percentage of success trials. This variable was significantly affected by prediction knowledge only. Tukey tests revealed that Unpredictors felt they were successful on a greater percentage of trials than both

Table 10

Means (Standard Deviations) of Realism Difference Measure for Number of Success Trials

Control Knowledge	Prediction Knowledge		
	Unprediction	Prediction Win	Prediction Lose
Unaware Control	5.16 (7.22)	-1.21 (4.66)	-1.53 (3.22)
0% Control	7.68 (11.20)	-2.53 (4.69)	0.42 (3.85)
52% Control	1.58 (8.68)	-2.26 (3.31)	1.21 (3.94)

Note. *N* = 19 participants per cell.

Prediction-winners and -losers, whose estimates did not significantly differ (see Table 11 for means and standard deviations).

Number of success trials pressed. This variable was affected by prediction knowledge, control knowledge, and their interaction. Tukey tests revealed that Unpredictors estimated a greater number of success trial presses than Prediction-losers and Prediction-winners, whose estimates did not significantly differ (see Table 12 for means and standard deviations). In addition, while Unaware Controllers did not differ from either group in their estimates of number of successes pressed, 52% Controllers gave significantly greater estimates than 0% Controllers. Finally, in the examination of the interaction, Tukey tests showed that Unaware Control winners and Unaware unpredictors estimated the number of successes pressed to be significantly greater than the estimates of Unaware Control winners and losers, and 0% Control winners and unpredictors.

Percentage of success trials pressed. Affected by only prediction knowledge, the Tukey tests indicated that while estimates from both Unpredictors and Prediction-winners did not significantly differ, both were significantly greater than the estimates of

Table 11

Means (Standard Deviations) of Realism Difference Measure for Percentage of Success Trials

Control Knowledge	Prediction Knowledge		
	Unprediction	Prediction Win	Prediction Lose
Unaware Control	9.47 (16.15)	-2.21 (9.86)	-6.05 (8.24)
0% Control	12.89 (24.11)	-5.26 (11.89)	-3.05 (8.31)
52% Control	1.05 (15.95)	-5.68 (9.43)	0.00 (9.40)

Note. *N* = 19 participants per cell.

Table 12

Means (Standard Deviations) of Realism Difference Measure for Number of Success Trials Pressed

Control Knowledge	Prediction Knowledge		
	Unprediction	Prediction Win	Prediction Lose
Unaware Control	5.13 (7.55)	-2.63 (4.95)	-1.68 (2.45)
0% Control	-2.32 (6.39)	-1.21 (3.49)	0.26 (3.86)
52% Control	5.29 (7.58)	0.47 (5.03)	0.16 (3.53)

Note. *N* = 19 participants per cell.

Prediction-losers (see Table 13 for means and standard deviations).

Control-Irrelevant Failure Measures Package

Through the use of Wilks' criterion, the MANOVA (containing unrealism measures for both number and percentage of failure trials, and number and percentage of failure trials pressed) revealed that the combined dependent variables were significantly affected by prediction knowledge, $F(8,318) = 10.42$, $p<.05$, and the interaction of prediction knowledge and control knowledge, $F(16,486) = 1.91$, $p<.05$, but not by control knowledge alone, $F(8,318) = 1.37$, $p>.05$ (see Table 14 for multivariate and univariate F-ratios, degrees of freedom, and p-values).

Number of failure trials. Affected by only prediction knowledge, Tukey tests showed that estimates from Prediction-winners and Prediction-losers did not significantly differ, but both groups' estimates were significantly higher that those of Unpredictors (see Table 15 for means and standard deviations).

Percentage of failure trials. Affected only by prediction knowledge, Tukey tests showed that while Prediction-winners' and losers' estimates did not differ, both significantly differed from those of Unpredictors, whose estimates were unrealistically low

Table 13

Means (Standard Deviations) of Realism Difference Measure for Percentage of Success Trials Pressed

Control Knowledge	Prediction Knowledge		
	Unprediction	Prediction Win	Prediction Lose
Unaware Control	5.79 (22.19)	-6.87 (17.30)	-26.68 (27.58)
0% Control	-6.93 (12.91)	-5.08 (11.74)	-18.84 (25.25)
52% Control	3.68 (18.92)	-4.45 (15.50)	-21.09 (22.89)

Note. *N* = 19 participants per cell.

Table 14

MANOVAs and ANOVAs for Control-Irrelevant Failure Measures

Independent Variable Dependent Variable	F	df	p
Prediction Knowledge MANOVA	10.42	8, 318	<.0001
Number Failure	17.98	2, 162	<.0001
Percent Failure	13.84	2, 162	<.0001
Number Failure-Press	5.66	2, 162	.0042
Percent Failure-Press	4.11	2, 162	.0182
Control Knowledge MANOVA	1.37	8, 318	.2103
Number Failure	1.07	2, 162	.3467
Percent Failure	1.79	2, 162	.1700
Number Failure-Press	0.16	2, 162	.8490
Percent Failure-Press	1.94	2, 162	.1466
Prediction x Control MANOVA	1.91	16, 486	.0174
Number Failure	2.38	4, 162	.0536
Percent Failure	1.40	4, 162	.2377
Number Failure-Press	2.67	4, 162	.0343
Percent Failure-Press	2.61	4, 162	.0374

Note. N = 171.

Table 15

Means (Standard Deviations) of Realism Difference Measure for Number of Failure Trials

Control Knowledge	Prediction Knowledge		
	Unprediction	Prediction Win	Prediction Lose
Unaware Control	-5.16 (7.22)	1.21 (4.66)	1.53 (3.22)
0% Control	-7.68 (11.20)	2.53 (4.69)	-0.42 (3.85)
52% Control	-1.58 (8.68)	2.26 (3.31)	-1.21 (3.94)

Note. N = 19 participants per cell.

(see Table 16 for means and standard deviations).

Number of failure trials pressed. Significant for prediction knowledge, and for the interaction of prediction knowledge and control knowledge, Tukey tests showed that although Unpredictors' and Prediction-winners' estimates did not differ, they were significantly different from the estimates of Prediction-losers (see Table 17 for means and standard deviations). In the examination of the interaction, Tukey tests showed that 52% Control unpredictors felt they pressed the button on significantly more failure trials than 52% Control-losers.

Percentage of failure trials pressed. This variable was significantly affected by prediction knowledge and the interaction of prediction knowledge and control knowledge. Tukey tests indicated that although Unpredictors' estimates did not differ from the estimates of other participants, Prediction-losers felt they pressed on a greater percentage of failure trials than Prediction-winners (see Table 18 for means and standard deviations). In the examination of the interaction, 52% Control-unpredictors felt they pressed on a significantly greater percentage of failure trials than 52% Control-winners, Unaware Control winners, and 0% Control unpredictors.

Table 16

Means (Standard Deviations) of Realism Difference Measure for Percentage of Failure Trials

Control Knowledge	Prediction Knowledge		
	Unprediction	Prediction Win	Prediction Lose
Unaware Control	-11.05	2.21	3.16
	(16.29)	(10.09)	(10.76)
0% Control	-15.53	2.11	-0.53
	(23.97)	(10.19)	(12.00)
52% Control	-3.16	5.16	-1.05
	(17.01)	(8.98)	(9.80)

Note. *N* = 19 participants per cell.

Table 17

Means (Standard Deviations) of Realism Difference Measure for Number of Failure Trials Pressed

Control Knowledge	Prediction Knowledge		
	Unprediction	Prediction Win	Prediction Lose
Unaware Control	-1.34 (5.49)	0.79 (3.49)	-0.21 (5.68)
0% Control	2.16 (5.22)	1.10 (2.21)	-2.26 (5.43)
52% Control	3.39 (7.35)	-0.11 (3.37)	-3.58 (9.38)

Note. N = 19 participants per cell.

Table 18

Means (Standard Deviations) of Realism Difference Measure for Percentage of Failure Trials Pressed

Control Knowledge	Prediction Knowledge		
	Unprediction	Prediction Win	Prediction Lose
Unaware Control	-14.21 (21.16)	-21.59 (24.26)	-7.81 (13.64)
0% Control	-21.93 (28.00)	-20.18 (23.59)	-4.62 (19.13)
52% Control	1.05 (14.49)	-14.98 (20.42)	-11.60 (16.94)

Note. N = 19 participants per cell.

Remaining Analyses

Univariate ANOVAs were run on each of the remaining dependent measures of certainty of outcome, anticipated outcome, and motivation to succeed.

Certainty of outcome. The ANOVA indicated a significant effect by prediction knowledge, $F(2,162) = 443.42$, $p<.0001$, but no significant effect by control knowledge, $F(2,162) = 0.84$, $p>.05$, or the interaction of prediction knowledge and control knowledge, $F(4,162) = 2.36$, $p=.0552$. Tukey tests showed all prediction marginals to be significantly different: Prediction-winners were very certain they earned more than 25 successes, Unpredictors were uncertain of their outcome, and Prediction-losers were very certain they earned less than 25 successes. (See Table 19 for means and standard deviations).

Anticipated outcome. Due to the lack of variation in these dependent measure data from Prediction winners and Prediction losers, a one way ANOVA was run only on Unpredictors' data, with control knowledge as the independent variable. The ANOVA proved nonsignificant, $F(2,54) = 2.53$, $p=.09$, indicating no differences between the control knowledge groups anticipation of their outcome. (See Table 20 for means and standard deviations).

Table 19

Means (Standard Deviations) of Certainty of Outcome

Control Knowledge	Prediction Knowledge		
	Unprediction	Prediction Win	Prediction Lose
Unaware Control	7.53 (2.73)	13.58 (1.02)	0.32 (1.39)
0% Control	9.00 (2.71)	13.11 (1.49)	0.53 (1.26)
52% Control	7.84 (3.82)	12.05 (2.17)	1.21 (1.75)

Note. N = 19 participants per cell, scale of 0 (certain failure) through 7 (uncertain outcome) to 14 (certain success).

Motivation to succeed. The ANOVA showed motivation to be significantly affected by prediction knowledge, $F(2,162) = 3.34$, $p<.05$, but not by control knowledge, or by their interaction ($p<.05$). Tukey tests revealed that Prediction-winners were more motivated to succeed than Prediction-losers, while Unprediction participants did not differ from either group (see Table 21 for means and standard deviations).

Number of trials pressed. Another 2 x 2 ANOVA was computed for the number of trials on which participants pressed the button, and the data were provided by the computer following each participant's session. The analysis showed this variable was affected by both prediction knowledge, $F(2,162) = 4.10$, $p<.025$; and control knowledge, $F(2,162) = 6.69$, $p<.0025$; but not their interaction ($p>.05$). Tukey tests showed that Winners did not differ from other participants, but Losers pressed the button significantly more than Unpredictors. Moreover, while Unaware Controllers and 52% Controllers did not differ in the number of presses they made, both groups pressed the button more than 0% Controllers ($M = 25.32$). A t-test showed that 0% Controllers presses were significantly greater than zero, $t(57) = 60.28$, $p<.0001$. (See Table 22 for means and standard deviations.)

Table 20

Means (Standard Deviations) of Anticipated Outcome for Unpredictors

Control Knowledge	Prediction Knowledge
	Unprediction
Unaware Control	1.25 (0.45)
0% Control	1.11 (0.32)
52% Control	1.42 (0.51)

Note. *N* = 19 participants per cell, scale = 1 (outcome of success) or 2 (outcome of failure).

Table 21

Means (Standard Deviations) of Motivation to Succeed

Control Knowledge	Prediction Knowledge		
	Unprediction	Prediction Win	Prediction Lose
Unaware Control	4.95 (1.87)	5.79 (1.65)	4.37 (1.86)
0% Control	4.58 (1.95)	5.05 (1.54)	4.79 (1.81)
52% Control	5.00 (1.67)	5.63 (1.50)	4.95 (1.75)

Note. N = 19 participants per cell, scale 1 (no motivation to succeed) to 7 (motivated to a great extent).

Table 22

Means (Standard Deviations) of Actual Number of Trials Pressed

Control Knowledge	Prediction Knowledge		
	Unpredict	Predict-Win	Predict-Lose
Unaware Control	28.47 (7.47)	29.84 (6.85)	33.11 (4.78)
0% Control	22.42 (13.39)	24.89 (12.11)	28.63 (4.81)
52% Control	30.37 (7.43)	24.63 (7.37)	31.47 (4.57)

Note. N = 19 participants per cell.

Discussion

The present study was conducted to test the degree to which methodology contributes to nondepressive optimism findings. Through increased sample size, a novel definition of actual control, and manipulation of task predictability (and its effect upon trial-by-trial feedback, hindsight, and self-serving bias), the present results demonstrated that the control, prediction, and contingency estimates by nondepressed persons are affected by variables (i.e., prediction knowledge and control knowledge) left uncontrolled in much of the past research. The present study asserted two hypotheses for the effect of prediction knowledge and control knowledge on control, contingency (success), and prediction measures.

Prediction Knowledge Hypothesis

It was hypothesized that Winners would be more unrealistic in their judgments of control and success, and would be more certain of an outcome of success than Unpredictors, who would be more realistic than Losers. This hypothesis was partially confirmed. Winners' control estimates were significantly more inflated than Losers' estimates, and higher than those of Unpredictors', though not significantly so. These results support the findings of Alloy and Abramson

(1979, Experiment 2), Bryson et al. (1984), and Vázquez (1987, Experiment 2), who found that nondepressed winners inflated their control estimates to a greater degree than nondepressed losers. In addition, Unpredictors were uncertain of their outcome, but Winners and Losers were certain of their outcomes (success and failure, respectively). The hypothesis was not confirmed in the success measurement, whereby Winners' and Losers' realistic estimates differed significantly from Unpredictors' inflated estimates.

The control estimates were clearly affected by the prediction knowledge manipulation, and this potential bias within the paradigm may possibly have contaminated previous research; however, the source of the bias remains unclear: Is the bias due to trial-by-trial feedback bias (feedback stimuli relieve feelings of uncontrollability), hindsight bias (reinterpretation of events in the direction of their outcome), or self-serving bias (responsibility for success, but not for failure)?

Trial-by-trial feedback bias. The presence of a feedback bias would be indicated by greater perceived control in participants who received trial-by-trial feedback of their performance (i.e., Winners and Losers) than in nonfeedback participants

(Unpredictors). The data from the present study showed that Winners felt more control than Losers, and Unpredictors differed from neither group, suggesting then that it was the _type_ of feedback (success versus failure) rather than merely _having_ feedback which was responsible for the added predictability in the control measures.

Hindsight bias. The presence of a hindsight bias would be suggested by significantly higher control estimates in Winners, Unpredictors, and Losers, in that order. According to Fischhoff (1975, 1977), Hasher et al. (1981), Hawkins and Hastie (1990), and Hell et al. (1988), Winners should overestimate their control, Unpredictors should be accurate, and Losers should underestimate their control. The data only partially confirmed this, such that Unpredictors did not differ from the other groups, Winners estimated they controlled a greater number of trials than Losers, and all prediction groups overestimated their actual control level. A power test was run on the prediction knowledge marginal mean estimates of number of trials controlled to determine whether a moderate difference could be detected given the number of participants in each marginal. The test revealed a power level of 0.74 in the contrast, inferring sufficient confidence that there was no difference between Unpredictors' and Predictors' (Winners' and Losers') control estimates. In summary then, although the group means appear in the order hindsight bias proponents would predict, the test was powerful enough to rule out control estimate differences with Unpredictors, indicating that hindsight bias cannot account entirely for the added predictability.

Self-serving bias. In addition to hindsight bias, the presence of a self-serving bias was detected through the comparison of the control estimates of Winners and Losers only, excluding the Unpredictors. If a self-serving bias contributed to the control inflations, then Winners (participants receiving many successes) should feel more control in general than Losers (participants receiving few successes). The data clearly support this expectation.

One may also infer the effects of self-serving bias if Winners feel more control (responsibility) over their success trials than Losers, while Losers feel more control (responsiblity) over their failure than Winners. The data indicate that when good outcomes occur (i.e., success), Winners, like Unpredictors, feel more control (responsibility) than Losers. In addition, 0% Controllers feel more control (responsibility) for their successes than both 52% Controllers and Unaware-controllers. It should be noted that 0% Control winners (with a mean metric control value of zero) greatly overestimated the number ($\underline{M}$ = 15.11) and percentage ($\underline{M}$ = 41.05) of success trials controlled, more so than all other groups (with the exception of 0% Control unpredictors).

When the outcomes were not positive (failure), both number and percentage data showed that Losers felt more control (responsibility) than Winners and Unpredictors. Moreover, 0% Controllers still felt more control (responsibility) than both 52% Controllers and Unaware-controllers.

To summarize then, Winners and Unpredictors felt more control (responsibility) for their success than Losers, while Losers felt more control (responsibility) for their failure than Winners and Unpredictors. Moreover, regardless of the outcome (i.e., whether it was a success or failure), 0% Controllers felt responsible for <u>all</u> of their outcomes, while Unaware-control losers (participants whose only feedback was their failing outcomes) tended to feel little responsibility for <u>any</u> of their outcomes.

These results run counter to a great volume of attribution research, which consistently finds that nondepressed individuals assume no responsibility for their failures, only for their successes (Heimberg et al, 1989; Klein et al, 1976; Kuiper, 1978; Mikulincer, 1988a, 1988b, 1989; Seligman et al, 1979; Sweeney et al, 1986). In the present study, certain participants may have taken more responsibility for their failures than they should have, as was evident in the 0% Control participants' inflations of the control (responsibility) ratings for the failure trials. The conclusion to be drawn regarding the effects of predictability on control measures, particularly for future research, is that participants are not affected merely by the presence a feedback stimulus (informing them of their performance through the task), but rather by the direction of that feedback (success or failure).

Control Knowledge Hypothesis

It was hypothesized that Unaware-controllers would inflate their control and success judgments, and would indicate high certainty of success, while 52% Controllers and 0% Controllers would be more realistic. This hypothesis was also partially confirmed. Not only 52% Controllers but also Unaware-controllers were realistic in their control estimates, while the 0% Controllers (participants given trial-by-trial no-control feedback and expected to be accurate), gave large overestimations (a pattern consistent across all control-associated measures). The remaining measures of success and outcome certainty were not affected by the control knowledge variable.

Indeed the most puzzling result in testing this hypothesis involved the high overestimations of both number and percentage of control reported by the 0% Control group. These participants were told on each trial that the trial was uncontrollable; that is, they would receive the same outcome on that trial regardless of their choice to press or not press the button. Despite persistent no-control feedback, these participants felt that on the average they controlled 17 of the 50 trials (number measure), and 35% of all trials (percentage measure) were controllable, when, in fact, they controlled no trials.

Further analysis of 0% Controllers' control estimates (see Figure 6) reveals two distinct populations: Realists (24 individuals who were accurate in their estimate of no controllable trials) and Inflators (33 individuals who overestimated the number of no controllable trials). Further research may wish to determine the variables, if any, which differentiate the two within-group populations.

The inflated control ratings of the 0% Control

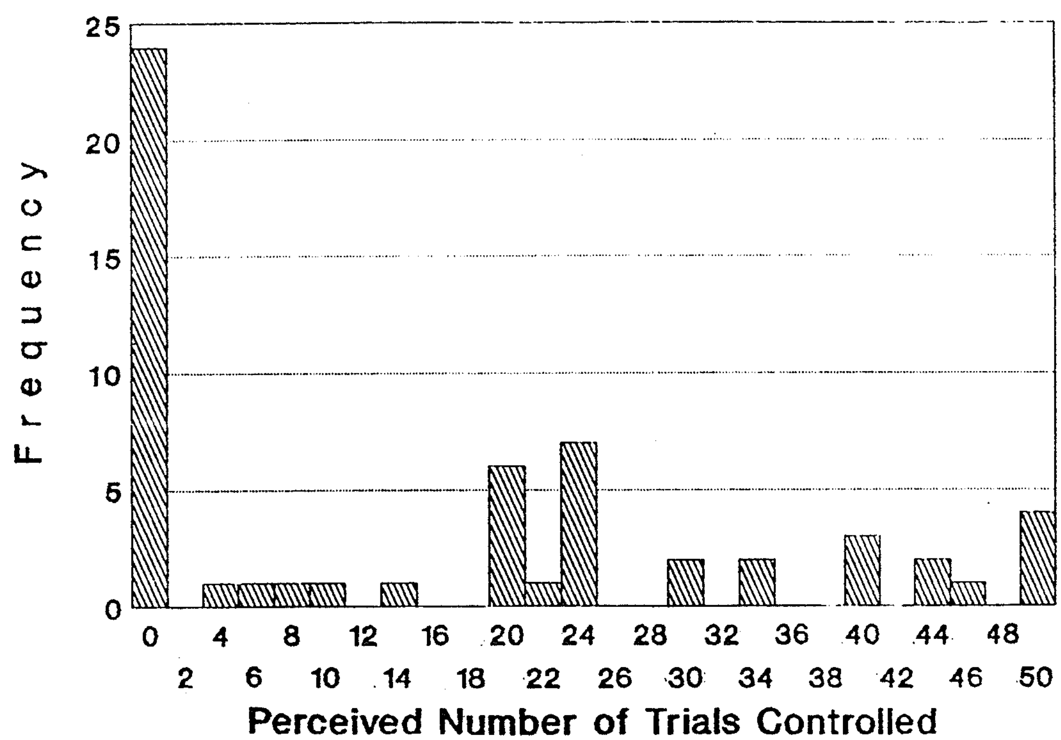

Figure 6. Frequency distribution for 0% Controllers of realism measure for number of trials controlled.

participants would not seem unreasonable to Alloy and Abramson. In a similar experiment (Alloy & Abramson, 1979, Experiment 2), nondepressed persons inflated their control judgments in the 75-75 contingency condition, but not in the 25-25 condition, on which they accurately reported no control (both difference metric and mean metric control values were zero). While participants in the Alloy and Abramson experiment were not told their control level, 0% Control winners and losers in the present study showed control inflations. Moreover, the Control participants, who were told they controlled half of the trials, showed no such inflations, which indicates that more than just nondepressive optimism inflated the nondepressed judgments, else the non-zero mean metric control group (52% Controllers) would show similar control inflations.

One may, however, assert an alternative explanation for these results. Perhaps these 0% Control participants could not believe that none of the 50 trials were uncontrollable, particularly following such an extensive explanation in the instructions of how to differentiate controllable from uncontrollable trials. Group comparison of the perceived number and percentage of controllable trials (actual rather than realism values) showed 0% Control estimates to be below the estimates of the other groups; however, after the actual control factor was subtracted out (where the 0% Control actual control factor was zero, resulting in no change), thus converting the measure into a measure of realism, the 0% Control estimates become huge inflations.

If the hypothesis of unbelieved instructions is true, then these 0% Control participants should not only <u>feel</u> control, but also try to <u>exercise</u> it, which might be interpreted by them as pressing rather then not-pressing the button. If they accepted their 0% control feedback as valid, then there would be no need for them to press the button, as their choice to press or not press the button would be irrelevant in their predetermined success or failure. However, if 0% Control participants doubted or even disbelieved the control feedback they were receiving, then the number of trials on which they pressed the button should be significantly greater than zero, since their choice made no difference to the outcome. Results showed that the number of 0% Controller button presses was significantly greater than zero, indicating some degree of disbelief in the computer instructions.

If 0% Control participants could not believe the computer instructions because of the absence of any controllable trials, then perhaps the presence of a few controllable trials would make the instructions appear credible. If 5 of 50 trials (one in every 10) had been controllable (mean metric of 10%), perhaps participants would have been more convinced of their uncontrollability and their control estimates would become more accurate.

Contingency Measurements

To be comparable to prior depressive realism studies (Alloy & Abramson, 1979, 1982; Alloy et al, 1981; Abramson et al, 1981; Benassi & Mahler, 1985; Bryson et al, 1984; Martin et al, 1984; Tang & Critelli, 1990; Vázquez, 1987), measures of the contingency components were included. Two measures (i.e., number and percentage of success trials pressed) were included in the present study and provided the most accurate indication of participants' perceptions of the existing contingency. Data indicate that all Prediction Winners and Prediction Losers tended to be within at least 5 trials to the actual number of success trials on which they pressed, but Unpredictors showed higher contingency judgments as compared to Winners and Losers. Moreover, 52% Controllers also tended to inflate their contingency judgments compared to 0% Controllers.

The percentage data, however, appear different. The percentage estimates of Unpredictors and Winners were more realistic than the estimates of Losers, who said the percentage of successes they received when they pressed was about 20% below its actual value. It appears then that reality estimates may vary according to the type of question asked (number question versus percentage question), and not to the variables manipulated (prediction knowledge and control knowledge).

However, because the present study failed to include a measure of the contingency participants believed existed between button nopressing and a successful outcome, the results are not completely comparable to those of previous studies.

Number versus Percentage Estimates

The dependent measures correlation matrix shows that number measurements correlated quite strongly with their corresponding percentage measurements. In fact, the percentage estimate magnitudes tended to be double the number magnitudes, while maintaining the positive or negative valence. There were, however, some notable exceptions. To begin, 52% Control unpredictors tended to inflate the number of failure trials controlled, but considerably deflated the percentage estimate. For number of success trials pressed, 52% Control and 0% Control losers gave small inflations on the number question, but large deflations on the percentage question. On the same variable, 52% Control-unpredictors' number estimates were greatly inflated, while their percentage estimates were still inflated, but to a lesser degree. Finally, when estimating the number of failure trials pressed, 0% Control unpredictors and winners provided accurate judgments (M = +2.0), but when estimating the same variable on a percentage scale, both groups' judgments were tremendously deflated (M = -20).

This discrepancy between number and percentage data may be due in part to the simple arrangement of the question. In the number estimates, particularly in regard to success and failure, participants provide an initial estimate of either the success or failure. Based on that estimate, participants give the number of controlled and pressed trials. In the percentage questions, participants are given no such anchor, and thus have less of the constraining boundaries that are present in the number questions. It appears, in examining the data, that participant errors are more likely to occur in the percentage data than in the number data possibly due to this lack of anchorage. It should be noted in closing that all prior research has collected percentage and not number data, confirming at least one possible explanation of the errors.

Informationless Groups

In the analysis of the data, it was difficult to assign to the Unaware Control group a control standard upon which to judge their estimates as realistic. Indeed, this same dilemma occurred when assigning the success and failure standard upon which to judge the success and failure estimates of the Unpredictors. It became difficult to speak of realism within these groups, since they were given no information to correctly make an accurate judgment. A similar problem could involve the guessing of the number of marbles contained in a large opaque jar. If the individual knew the jar could only hold 50 marbles, just as participants in the study knew there could only be a maximum of 50 trials controlled, the number of marbles the jar contained must range between 0 and 50. Probably the most reasonable guess for these individuals to make would be the midpoint of the range, or 25 marbles. Based on this reasoning, we assigned a midpoint standard value to the comparison of the No-information control, success, and failure estimates.

Unrealism was still difficult to determine for No-information participants; in fact, realism itself becomes a nebulous concept, as there was no information available to these participants to suggest a reasonable standard upon which to base their estimates. For example, the assignment of equal groups to different but unknown control levels of 0%, 50%, and 100% dismisses the discussion of realism, since the control level remains unknown. To speak of realism, or a standard upon which the estimates can be considered reasonable, in this situation of unrealized control is perhaps itself unreasonable.

A theoretical review by Dobson and Franche (1989) on depressive realism includes discussion of the definition of realism, whether the empirical studies define it as absolute or as relative. Absolute, or naive realism, assumes that "reality presents the same face to all onlookers," while the relativism approach assumes that "reality is individual to everyone" (p. 421). Despite the depressive realism research assumption of a naive realism by which to compare the depressed and nondepressed reality estimates, withholding the actual reality from the participants, as discussed earlier, still leaves the results of the estimate comparison moot.

<u>Misperception of Excluded 52% Control Losers</u>

Among the 52% Control-losers (participants who controlled half of the trials but failed on 3 of every 4 trials), five considered themselves to be successful overall. Their data were excluded from the study; when approached on this question following the session, they indicated their realization during the computer task that all uncontrollable trials resulted in failures, but also realized that the controllable trails resulted in an equal occurrence of success and failure. By disregarding the uncontrollable trials (and their failing outcomes), these participants tended to evaluate their performance on the controllable trials alone, a performance judged to be quite satisfactory, and thus rate themselves as successful overall.

<u>Predictionless Control</u>

Despite the widespread acceptance of the traditional view of control and prediction, that one's feelings of perceived control over an event is impossible without the perceived prediction of that event, the present findings provide results to the contrary. The traditional supporters would expect that Unpredictors (participants given no trial-by-trial feedback, or prediction) would experience very little control as compared to participants who did receive such feedback (i.e., Winners and Losers). This expectation was not confirmed, as the Unpredictors failed to differ in their control estimates from either Winners or Losers. This suggests, as Nickels (1990) indicates, that the concepts of prediction and control are distinct, and individuals may experience the little-investigated combination of the two (predictionless control), traditionally deemed impossible. The present data showed that the prediction measures (e.g., anticipated outcome and outcome certainty) were not affected by the manipulation of control knowledge, but the control measures (e.g., number of trials controlled, number of success trials controlled, number of failure trials controlled, etc.) were affected by the manipulation of prediction knowledge and control knowledge, which coincides with previous research (Nickels et al, 1991, Experiment 1).

One may ask whether the participants' high control ratings were illusory in nature. Indeed, control ratings were high, but it is important to point out that control ratings were merely higher than the control standard assigned. Therefore, it is difficult to conclude confidently that high control ratings were due to an illusion of control, since control judgments are relative to the actual control level. It is, however, safe to conclude that many participants overestimated their control relative to the control standard to which they were assigned (but may or may not have realized), labelled as illusory overcontrol (Nickels, 1990). Illusory control, as it is, would better refer to a person perceiving more control than objectively exists even though the cues indicating the actual level of control (veridical control) are available to the person (Nickels, 1990). Thus, crucial in this judgmental process is the information available to the decision-maker: If incorrect or incomplete information is provided through false control cues (e.g., choice, active or passive participation, task familiarity, or competition with a seemingly incompetent opponent; see Langer, 1975; Wortman, 1975), then individuals' control inflations may be interpreted as their best judgments (and not misjudgments) in the face of adverse circumstances.

Beyond debate, however, is whether the control inflations in the present study were really inflations of control, or inflations of another variable, such as prediction. One example of this confusion has been demonstrated in a recent gambling experiment by Dykstra and Dollinger (1990), who supposedly measured participants' control inflations, but actually measured the participants' success inflations. One questionnaire item asked: ". . . how many successes do you predict for yourself?" (p. 236). Participants inflations in this study were not actually of control, but rather of prediction, or more correctly, of success.

Nondepressed Optimism and the Difference Metric

Depressive realism research consistently indicates that in only a handful of situations can nondepressed individuals be realistic in their control judgments (e.g., where money is lost); however, the present study suggests that is not the case. Only when control feedback consistently indicated no-control did participants inflate their control estimates (illusory overcontrol), and only when participants given no control feedback failed overall at the task were control estimates deflated (illusory undercontrol). Five of the nine groups in the present study accurately estimated the control level, suggesting that to speak of nondepressed persons as consistently optimistic is not completely substantiated.

Certainly, one source of discrepancy between previous results and those of the present study was the methods used to calculate actual control. Previous research has employed a difference metric, while the present study used a mean metric (Nickels, 1990). By maintaining a difference metric of zero in all groups, and by altering only the mean metric (0% and 52%), the extent to which nondepressed individuals are affected by the actual control level and not the contingency of reinforcement could be determined. With the difference metric unchanged across the groups, results showed control inflations in groups with a mean metric of 0%, and accurate control estimates in groups with a mean metric of 52%, suggesting that people are not necessarily sensitive to the reinforcement or contingency arrangement, but rather to the level of impact they have over the outcome.

Learned Helplessness Theory

Seligman's original learned helplessness theory stated that feelings of helplessness and even depression occurred when people were exposed to frequently uncontrollable outcomes in a given situation (Seligman, 1975). Subscribers to the learned helplessness model would predict in the present study that 0% Controllers would report little if any control, while the control estimates of 52% Controllers and Unaware controllers would be higher than those of 0% Controllers. These expectations were not confirmed;

in fact, it was the 0% Controllers' estimates that were most unrealistic. Certainly what demands mention is that participants exposed to a high number of failure trials with no control feedback (Unaware Control Losers) deflated their control estimates, suggesting little control and perhaps feelings of helplessness over the computer task. Moreover, while control knowledge (save the surprising 0% Controllers) appeared to have little effect on participants control ratings, prediction appeared to have a more substantial effect: Participants who received many failures felt less control than participants who received few failures, suggesting that the degree of failure and not uncontrollability played the greater role in determining feelings of uncontrol and helplessness. While a host of research (Boyd, 1982; Coyne, Metalsky, & Lavelle, 1980; Frankel & Snyder, 1978; Kuhl, 1984) appears to confirm this finding of a greater mediation of helplessness by intensity of failure and not uncontrollability, more recent studies show helplessness feelings occur by exposure to uncontrollable outcomes independent of perceived failure (Buys & Winefield, 1982; Jardine & Winefield, 1981; Kofta & Sedek, 1989; Winefield, Barnett, & Tiggemann, 1985; Winefield & Rourke, 1991). It suggests at least that additional and more exact research is needed to determine the precise effects of control knowledge and prediction knowledge on individuals' feelings of helplessness.

Future Research

There appear to be several directions in which future research could proceed. To begin, further study of 0% Control group inflations with controlled predictability is needed, to see if different participants or independent variables will still yield inflated control judgments. Certainly it may seem more fruitful to add a control group with a small nonzero mean metric level (e.g., 10%), to see if participants are believing the computer instructions or they simply feel a great amount of control in situations where little or no control exists. Future researchers may wish to avoid the control inflations of the 0% Controllers by using a low control group, whose level is above 0 but below 25. In addition, it may help to alter the instructions to inform participants of the possibility that one may experience either all controllable trials, all uncontrollable trials, or a mixture of controllable and uncontrollable trials.

Additional research could use the same design and independent variables but a different set of dependent variables, such as new contingency measures (e.g., degree of association between pressing and success, between nopressing and success, and between one's choosing to press or not and success). One may also opt to examine participants perceived attributions to the outcomes. Research on control and mood (i.e., depression) has shown that nondepressed individuals internally attribute only successful outcome events, while depressed individuals internally attribute all events, regardless of their outcome (Rizley, 1978). The present study demonstrated that nondepressed persons have high responsibility for failure, as well as success, but only if the individual is failing overall and knows it. Indeed the variant of the learned helplessness theory, the Hopelessness theory of depression (Abramson et al, 1978; Peterson & Seligman, 1984), employs individual causal attributions as the mitigating factor in determining the impact of experiences and perceptions of uncontrollability. The present findings shed new light on possible directions for development of the Hopelessness theory (see Alloy, Abramson, Metalsky, & Hartlage, 1988 for a review).

A distinction should be made between prediction as it relates to forecast (i.e., anticipating the outcome of a future event) and prediction as it relates to feedback (i.e., knowing the outcome of a past event, which can then be used to forecast a future event). In the present study, the questionnaire measured feedback prediction (i.e., "How certain are you that you got more/less than 25 successes?"), rather than forecast prediction (i.e., "On how many of 50 future trials do you hope to succeed?"). Feedback prediction asks for participants to indicate how sure they are that they will be told that they received more or less than 25 successes. Future research may wish to include additional dependent variables to measure both types of predictability (i.e., forcast vs. feedback).

The manipulation of other independent variables may illuminate the effects of prediction and control knowledge on participants' control estimates. Mood would certainly illustrate the differences, if any, between depressed and nondepressed individuals' estimates, and would extend the present findings beyond the sample of nondepressed participants. Moreover, the contingencies used in the present study were objectively, according to the difference metric, zero, indicating no relationship between action (pressing) and outcome (success or failure). While manipulating prediction knowledge and control knowledge, future studies could employ different contingency values (e.g., 50-25, 75-0) as an additional independent variable to assess participants' control estimates when the difference metric is not zero, as was used by Alloy and Abramson (1979, Experiment 1), Abramson et al, 1981, Tang and Critelli (1990), and Vázquez (1987, Experiment 1 & 3).

One could vary the value of the success and failure obtained, as was used by Alloy and Abramson (1979, Experiment 3 & 4). In such a design, Winners would try to earn as many credits as possible, but they would only earn a credit if they succeeded on the trial. Winners would lose no credits if they failed on the trial. Losers, however, would start with a set amount of credits and would lose one for each failure, and none for each success.

In closing, it should be emphasized that the use of a computer in any psychological research must balance the advantage of precise experimental control of stimuli administration with the disadvantage of participants' possible perceptions of the computer ans a device of deceipt.

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Appendix A

Beck Depression Inventory

On this questionnaire are groups of statements. Please read each group of statements carefully. Then pick out the one statement in each group which best describes the way you have been feeling in the PAST WEEK, INCLUDING TODAY! Circle the letter beside the statement you picked. If several statements in the group seem to apply equally well, circle each one.

Be sure to read ALL statements in each group before making your choice.

1. a) I do not feel sad.
   b) I feel sad.
   c) I am sad all the time and I can't snap out of it.
   d) I am so sad or unhappy that I can't stand it.

2. a) I am not particularly discouraged about the future.
   b) I feel discouraged about the future.
   c) I feel I have nothing to look forward to.
   d) I feel that the future is hopeless and that things cannot improve.

3. a) I do not feel like a failure.
   b) I feel I have failed more than the average person.
   c) As I look back on my life all I can see is a lot of failures.
   d) I feel I am a complete failure as a person (student, parent, husband, wife, etc.)

4. a) I get as much satisfaction out of things as I used to.
   b) I don't enjoy things the way I used to.
   c) I don't get satisfaction out of anything any more.
   d) I am dissatisfied with everything.

5. a) I don't feel particularly guilty.
   b) I feel guilty a good part of the time.
   c) I feel bad or unworthy practically all the time now.
   d) I feel as though I am very bad or worthless.

6. a) I don't feel I am being punished.
   b) I feel I may be punished.
   c) I expect to be punished.
   d) I want to be punished.

7. a) I don't feel disappointed in myself.
   b) I am disappointed in myself.
   c) I am disgusted with myself.
   d) I hate myself.

8. a) I don't feel I am any worse than anybody else.
   b) I am critical of myself for my weaknesses or mistakes.
   c) I blame myself for my faults.
   d) I blame myself for everything bad that happens.

9. a) I don't have any thoughts of harming myself.
   b) I have thoughts of harming myself but I would not carry them out.
   c) I would like to kill myself.
   d) I would kill myself if I had the chance.

10. a) I don't cry any more than usual.
    b) I cry more now than I used to.
    c) I cry all the time now. I can't stop it.
    d) I used to be able to cry but now I can't cry even though I want to.

11. a) I am no more irritated now than I ever am.
    b) I get annoyed or irritated more easily than I used to.
    c) I feel irritated all the time.
    d) I don't get irritated at all at the things that used to irritate me.

12. a) I have not lost interest in other people.
    b) I am less interested in other people now than I used to be.
    c) I have lost most of my interest in other people and have little feeling for them.
    d) I have lost all my interest in other people and don't care about them at all.

13. a) I make decisions about as well as ever.
    b) I try to put off making decisions.
    c) I have great difficulty in making decisions.
    d) I can't make decisions at all any more.

14. a) I don't feel I look any worse than I used to.
    b) I am worried that I am looking old or unattractive.
    c) I feel that there are permanent changes in my appearance and they make me look unattractive.
    d) I feel that I am ugly or repulsive looking.

15. a) I can work about as well as before.
    b) It takes extra effort to get started at doing something.
    c) I have to push myself very hard to do anything.
    d) I can't do any work at all.

16. a) I can sleep as well as usual.
    b) I wake up more tired in the morning than I used to.
    c) I wake up 1-2 hours earlier than usual and find it hard to get back to sleep.
    d) I wake up early every day and can't get more than 5 hours sleep.

17. a) I don't get any more tired than usual.
    b) I get tired more easily than I used to.
    c) I get tired from doing anything.
    d) I get too tired to do anything.

18. a) My appetite is no worse than usual.
    b) My appetite is not as good as it used to be.
    c) My appetite is much worse now.
    d) I have no appetite at all any more.

19. a) I haven't lost much weight, if any, lately.
    b) I have lost more than 5 pounds.
    c) I have lost more than 10 pounds.
    d) I have lost more than 15 pounds.

I am purposely trying to lose weight by eating less (YES / NO).

20. a) I am no more concerned about my health than usual.
    b) I am concerned about aches and pains or upset stomach or constipation.
    c) I am so concerned with how I feel or what I feel that it's hard to think of much else.
    d) I am completely absorbed in what I feel.

21. a) I have not noticed any recent change in my interest in sex.
    b) I am less interested in sex than I used to be.
    c) I am much less interested in sex now.
    d) I have lost interest in sex completely.

Appendix B

Multiple Affect Adjective Check List

Directions: On this sheet you will find words which describe different kinds of moods and feelings. Circle the words which describe how your feeling RIGHT NOW. Some of the words may sound alike, but we want you to CIRCLE ALL THE WORDS THAT DESCRIBE YOUR FEELINGS. Work as quickly as you can.

active
adventurous
affectionate
afraid
agitated
agreeable
aggressive
alive
alone
amiable
amused
angry
annoyed
awful
bashful
bitter
blue
bored
calm
cautious
cheerful
clean
complaining
contented
contrary
cool
cooperative
critical
cross
cruel
daring
desperate
destroyed
devoted
disagreeable
discontented
discouraged
disgusted
displeased
energetic
enraged
enthusiastic
fearful
fine
fit
forlorn
frank
free
friendly
frightened
furious
gay
gentle
glad
gloomy
good
good-natured
grim
happy
healthy
hopeless
hostile
impatient
incensed
indignant
inspired
interested
irritated
jealous
joyful
kindly
lonely
lost
loving
low
lucky
mad
mean
meek
merry
mild
miserable
nervous
obliging
offended
outraged
panicky
patient
peaceful
pleased
polite
powerful
quiet
reckless
rejected
rough
sad
safe
satisfied
secure
shaky
shy
soothed
steady
stubborn
stormy
strong
suffering
sullen
sunk
sympathetic
tame
tender
tense
terrible
terrified
thoughtful
timid
tormented
understanding
unhappy
unsociable
upset
vexed
warm
whole
wild
willful
wilted
worrying
young

Appendix C

Computer Programme

```
90    KEY OFF:CLS
100   DIM C$(10), AC$(10), W$(10), Y$(10), C(10,50),
      R(10,50), NR(10,50), J(50)
105   N=VAL(MID$(TIME$,7,2)):FOR X=1 TO N:T=RND(1):
      NEXT X
110   LOCATE 1,20:PRINT "LOADING PROGRAMME--PLEASE WAIT"
120   Y$(1)="YES":Y$(0)="NO":W$(1)="WIN":W$(2)="LOSE"
130   AC$(1)="52%":AC$(2)="0%":AC$(3)="UNKNOWN"
150   NR=0:R=0:RS=0:NRS=0:NRA=0:RA=0:Q=0:CC=0:A=50
155   DATA 24-24-0,24-24-52,76-76-0,76-76-52:FOR X=1 TO
      4:READ C$(X):NEXT X
165   REM
174   REM                   24-24-0
176   DATA 2,2,2,2,1,1,1,1,2,2,2,2,2,2,1,1,2,2,2,2
178   DATA 2,2,2,2,2,2,1,1,2,2,2,2,1,1,2,2,2,2,2,2
180   DATA 1,1,2,2,2,2,2,2,2,2,2,2,2,2,1,1,2,2,2,2
182   DATA 2,2,2,2,2,2,2,2,1,1,2,2,2,2,2,2,1,1,1,1
184   DATA 2,2,2,2,2,2,1,1,2,2,1,1,2,2,2,2,2,2,2,2
248   REM                   24-24-52
250   DATA 2,2,2,2,1,2,1,2,2,2,2,1,2,2,2,2,2,1,1,2
251   DATA 2,1,2,2,2,2,1,2,2,1,2,2,1,2,2,2,1,2,2,2
252   DATA 1,2,2,2,1,2,2,2,2,2,2,2,2,1,2,2,2,1,2,2
253   DATA 1,2,1,2,2,1,2,2,2,1,2,1,2,2,1,2,2,2,2,2
254   DATA 2,2,2,1,2,2,2,1,2,1,1,2,1,2,2,2,2,2,2,1
255   REM                   76-76-0
276   DATA 1,1,1,1,2,2,2,2,1,1,1,1,1,1,2,2,1,1,1,1
278   DATA 1,1,1,1,1,1,2,2,1,1,1,1,2,2,1,1,1,1,1,1
280   DATA 2,2,1,1,1,1,1,1,1,1,1,1,1,1,2,2,1,1,1,1
282   DATA 1,1,1,1,1,1,1,1,2,2,1,1,1,1,1,1,2,2,2,2
284   DATA 1,1,1,1,1,1,2,2,1,1,2,2,1,1,1,1,1,1,1,1
288   REM                   76-76-52
290   DATA 1,1,1,1,2,1,2,1,1,1,1,2,1,1,1,1,1,2,2,1
291   DATA 1,2,1,1,1,1,2,1,1,2,1,1,2,1,1,1,2,1,1,1
292   DATA 2,1,1,1,2,1,1,1,1,1,1,1,1,2,1,1,1,2,1,1
293   DATA 2,1,2,1,1,2,1,1,1,2,1,2,1,1,2,1,1,1,1,1
294   DATA 1,1,1,2,1,1,1,2,1,2,2,1,2,1,1,1,1,1,1,2
295   FOR I=1 TO 4
296   FOR X=1 TO A
300   READ R(I,X)
310   READ NR(I,X)
320   IF R(I,X)=NR(I,X) THEN C(I,X)=2 ELSE C(I,X)=1
330   NEXT X
340   NEXT I
400   NR=0:R=0:RS=0:NRS=0:NRA=0:RA=0:Q=0:CC=0
435   NCS=0:NCF=0:NUS=0:NUF=0:RCS=0:RCF=0:RUS=0:RUF=0
```

```
450  CLS:PRINT "NO FEEDBACK...........NO CONTROL
     (1)....CONTROL-0 (2)....CONTROL-52 (3)"
460  PRINT:PRINT "HIGH-SUCCESS FEEDBACK.NO CONTROL
     (4)....CONTROL-0 (5)....CONTROL-52 (6)"
470  PRINT:PRINT "LOW-SUCCESS FEEDBACK..NO CONTROL
     (7)....CONTROL-0 (8)....CONTROL-52 (9)"
480  PRINT:PRINT:INPUT "CHOOSE A NUMBER BETWEEN 1 AND
     9...";CH
485  IF INT(CH)=0 THEN 5000
490  IF INT(CH)<1 OR INT(CH)>9 THEN 480
500  ON INT(CH) GOTO
     510,520,530,540,550,560,570,580,590
510  F=0:AC=3:W=1:SCH=4:GOTO 600
520  F=0:AC=2:W=1:SCH=3:GOTO 600
530  F=0:AC=1:W=1:SCH=4:GOTO 600
540  F=1:AC=3:W=1:SCH=4:GOTO 600
550  F=1:AC=2:W=1:SCH=3:GOTO 600
560  F=1:AC=1:W=1:SCH=4:GOTO 600
570  F=1:AC=3:W=2:SCH=2:GOTO 600
580  F=1:AC=2:W=2:SCH=1:GOTO 600
590  F=1:AC=1:W=2:SCH=2
600  CLS:LOCATE 1,24:PRINT "RECORDED CONFIGURATIONS"
602  LOCATE 2,23:PRINT "~~~~~~~~~~~~~~~~~~~~~~~~~"
605  PRINT:PRINT:PRINT "NUMBER OF
     SUCESSIONS:";B,,"NUMBER OF TRIALS:";A
615  PRINT:PRINT "PARTICIPANT GROUP:  ";CH
620  PRINT:PRINT,"FEEDBACK/OUTCOME.............";Y$(F)
630  PRINT:PRINT,"OVERALL FINAL OUTCOME........";W$(W)
640  PRINT:PRINT,"ACTUAL
     CONTROL...............";AC$(AC)
650  PRINT:PRINT,"REINFORCEMENT
     SCHEDULE.......";C$(SCH)
633  PRINT:PRINT:PRINT:PRINT
636  INPUT "TO CHANGE CONFIGURATIONS, TYPE <1> AND HIT
     <ENTER>";CHNG
637  IF CHNG=1 THEN 650 ELSE IF CHNG=0 THEN 700 ELSE
     600
650  CLS:GOTO 450
700  CLS
725  GOTO 3000
735  CLS
755  IF INKEY$="?" THEN 970 ELSE 755
970  FOR X=1 TO A
975  Q=0
980  CLS:LOCATE 2,25:PRINT "Trial";X;" =>"
1000 IF AC=3 THEN 1050
1010 IF R(SCH,X)<>NR(SCH,X) THEN 1030 ELSE 1040
1030 LOCATE 2,38:PRINT "DIFFERENT OUTCOMES":GOTO 1050
1040 LOCATE 2,38:PRINT "SAME OUTCOMES      "
```

```
1050 FOR T=1 TO 1000:NEXT T:LOCATE 13,29:PRINT "PRESS
     OR DON'T PRESS"
1060 Q=Q+1
1070 IF INP(957)<127 THEN 1200
1075 IF Q<400 THEN 1060
1085 REM
1090 REM              NON RESPONSE SEQUENCE
1093 REM
1100 J(X)=2:NR=NR+1:IF NR(SCH,X)=1 THEN 1150
1120 O$="FAILURE"
1125 IF C(SCH,X)=2 THEN 1128
1127 NCF=NCF+1:GOTO 1500
1128 NUF=NUF+1:GOTO 1500
1150 O$="SUCCESS"
1155 NRS=NRS+1
1160 IF C(SCH,X)=2 THEN 1167
1165 NCS=NCS+1:GOTO 1500
1167 NUS=NUS+1:GOTO 1500
1182 REM
1190 REM              RESPONSE SEQUENCE
1195 REM
1200 SOUND 40,3:V=2000-Q:FOR T=1 TO V:NEXT T:J(X)=1
1205 R=R+1:IF R(SCH,X)=1 THEN 1250
1220 O$="FAILURE"
1221 IF C(SCH,X)=2 THEN 1227
1225 RCF=RCF+1:GOTO 1500
1227 RUF=RUF+1:GOTO 1500
1250 O$="SUCCESS":RS=RS+1
1260 IF C(SCH,X)=2 THEN 1280
1270 RCS=RCS+1:GOTO 1500
1280 RUS=RUS+1:GOTO 1500
1400 REM
1450 REM
1500 IF F=0 THEN GOTO 1519
1510 LOCATE 19,33:PRINT O$
1519 LOCATE 13,29:PRINT "                    ":PLAY "A"
1520 FOR T=1 TO 1250:NEXT T:CLS
1525 IF X=A THEN 1532
1530 LOCATE 13,24:PRINT "PREPARE FOR THE NEXT
     TRIAL":GOTO 1535
1532 PLAY "c":LOCATE 13,29:PRINT "END OF COMPUTER TASK"
1535 FOR T=1 TO 1750:NEXT T
1536 NEXT X
1537 FOR T=1 TO 1750:NEXT T:CLS:TS=RS+NRS
1540 IF INKEY$<>"!" THEN 1540
1541 CLS
1542 LOCATE 6,20:PRINT "SUCCESS OF ";TS;"IN";A;"TRIALS"
1550 IF INKEY$<>")" THEN 1550
1555 CLS:LOCATE 1,25:PRINT "SESSION";Y;"     GROUP";CH
```

```
1560 LOCATE 2,1:PRINT "NUMBER OF RESPONSES:";R,,"NUMBER
     OF NON-RESPONSES:";NR
1570 LOCATE 3,1:PRINT "NUMBER OF RESPONSE
     SUCCESSES:";RS,"NUMBER OF NON-RESPONSE
     SUCCESSES:";NRS:RCMT=INT(10000*TS/A)/100
1572 RA=RS/R:NRA=NRS/NR
1575 LOCATE 5,1:PRINT "ACTUAL RESPONSE
     PROBABILITY:";INT(10000*RA)/100;"%"
1576 LOCATE 5,43:PRINT "ACTUAL NORESPONSE
     PROBABILITY:";INT(10000*NRA)/100;"%"
1578 LOCATE 6,1:PRINT "SUCCESS OF";TS;"IN";A;"TRIALS
     OR";INT(100*RCMT)/100;"%"
1579 LOCATE 8,1:PRINT "CNTRBL RESP SUCCESSES:
     ";RCS,,"UNCNTRBL RESP SUCCESSES: ";RUS
1580 LOCATE 9,1:PRINT "CNTRBL RESP FAILURES:
     ";RCF,,"UNCNTRBL RESP FIALURES:  ";RUF
1581 LOCATE 10,1:PRINT "CNTRBL NRESP
     SUCCESSES:";NCS,,"UNCNTRBL NRESP SUCCESSES:";NUS
1582 LOCATE 11,1:PRINT "CNTRBL NRESP FAILURES:
     ";NCF,,"UNCNTRBL NRESP FAILURES: ";NUF
1670 PRINT:PRINT " 1  2  3  4  5  6  7  8  9  0":PRINT
1680 FOR X=1 TO 10:PRINT J(X);:NEXT X:PRINT
1681 FOR X=11 TO 20:PRINT J(X);:NEXT X:PRINT
1682 FOR X=21 TO 30:PRINT J(X);:NEXT X:PRINT
1683 FOR X=31 TO 40:PRINT J(X);:NEXT X:PRINT
1684 FOR X=41 TO 50:PRINT J(X);:NEXT X:PRINT
1688 PRINT:PRINT
1691 PRINT:PRINT:INPUT "WANT TO QUIT <1> OR CONTINUE
     <ENTER>";I
1692 IF I=1 THEN END
2000 GOTO 400
```

Appendix D

Questionnaire #1 - Form A

last name　　given name(s)　　sex M/F　　student #

time　　am/pm　　day/month/year

Please answer all questions below:

1. On what percentage of all 50 trials did your responses of pressing and no pressing CONTROL your trial-by-trial success? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

2. On what percentage of all 50 trials did you get a SUCCESS? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

3. On what percentage of all SUCCESS-trials did you give a PRESS response? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

4. On what percentage of all SUCCESS-trials did the outcome depend on your responses? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

5. On what percentage of all 50 trials did you get a FAILURE? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

6. On what percentage of all FAILURE-trials did give a PRESS response? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

7. On what percentage of all FAILURE-trials did the outcome depend on your responses? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

8. To what extent are you CERTAIN that you obtained more than or less than 25 successes? (Circle the MOST appropriate number.)

7	6	5	4	3	2	1	0	1	2	3	4	5	6	7

I am very CERTAIN I got LESS THAN 25 SUCCESSES — I am very UNCERTAIN whether I got MORE/LESS than 25 SUCCESSES — I am very CERTAIN I got MORE THAN 25 SUCCESSES

9. To what extent did you WANT to obtain MORE than 25 successes on the computer task? (Circle the MOST appropriate number.)

not at all | 1 2 3 4 5 6 7 | to a great extent

10. Do you consider yourself to be MORE OF A SUCCESS or MORE OF A FAILURE at the computer task? (Circle the MORE appropriate term.)

MORE OF A SUCCESS MORE OF A FAILURE

11. Did the computer indicate at the BEGINNING of each trial whether the trial consisted of DIFFERENT or SAME OUTCOMES? (Circle the MOST appropriate term.)

Yes No I don't know

12. Did you find out at the END of each trial whether each trial was a SUCCESS or FAILURE? (Circle the MOST appropriate term.)

Yes No I don't know

13. On how many of the 50 trials <u>did your responses of pressing and no pressing CONTROL your trial-by-trial success</u>? (Write your estimate below).

____
(0 - 50)

14. On how many of the 50 trials <u>did you get a SUCCESS</u>?

Number of SUCCESSES: __________ (0-50)

On how many of the 50 trials <u>did you get a FAILURE</u>?

Number of FAILURES: __________ (0-50)

(Write each of the estimates in the appropriate space. Remember, your FAILURES = 50 - SUCCESSES.)

15. Based on the number of SUCCESSES you indicated in Question 14, on how many of these SUCCESS-trials <u>did you give a PRESS</u>? (Write your estimate in the space below.)

____

16. Based on the number of SUCCESSES you indicated in Question 14, on how many of these SUCCESS-trials <u>did the outcome depend on your responses</u>? (Write your estimate in the space below.)

____

17. Based on the number of FAILURES you indicated in Question 14, on how many of these FAILURE-trials <u>did you give a PRESS</u>? (Write your estimate in the space below.)

____

18. Based on the number of FAILURES you indicated in Question 14, on how many of these FAILURE-trials <u>did the outcome depend on your responses</u>? (Write your estimate in the space below.)

____

Appendix D

Questionnaire #1 - Form B

last name ____ given name(s) ____ sex M/F ____ student # ____

time ____ am/pm ____ day/month/year ____

Please answer all questions below:

1. On how many of the 50 trials did your responses of pressing and no pressing CONTROL your trial-by-trial success? (Write your estimate below).

____ (0 - 50)

2. On how many of the 50 trials did you get a SUCCESS?

Number of SUCCESSES: ____ (0-50)

On how many of the 50 trials did you get a FAILURE?

Number of FAILURES: ____ (0-50)

(Write each of the estimates in the appropriate space. Remember, your FAILURES = 50 - SUCCESSES.)

3. Based on the number of SUCCESSES you indicated in Question 2, on how many of these SUCCESS-trials did you give a PRESS? (Write your estimate in the space below.)

____

4. Based on the number of SUCCESSES you indicated in Question 2, on how many of these SUCCESS-trials did the outcome depend on your responses? (Write your estimate in the space below.)

____

5. Based on the number of FAILURES you indicated in Question 2, on how many of these FAILURE-trials did you give a PRESS? (Write your estimate in the space below.)

____

6. Based on the number of FAILURES you indicated in Question 2, on how many of these FAILURE-trials did the outcome depend on your responses? (Write your estimate in the space below.)

____

7. To what extent are you CERTAIN that you obtained more than or less than 25 successes? (Circle the MOST appropriate number.)

7	6	5	4	3	2	1	0	1	2	3	4	5	6	7

I am very CERTAIN I got LESS THAN 25 SUCCESSES — I am very UNCERTAIN whether I got MORE/LESS than 25 SUCCESSES — I am very CERTAIN I got MORE THAN 25 SUCCESSES

8. To what extent did you WANT to obtain MORE than 25 successes on the computer task? (Circle the MOST appropriate number.)

not at all | 1 2 3 4 5 6 7 | to a great extent

9. Do you consider yourself to be MORE OF A SUCCESS or MORE OF A FAILURE at the computer task? (Circle the MORE appropriate term.)

MORE OF A SUCCESS MORE OF A FAILURE

10. Did the computer indicate at the BEGINNING of each trial whether the trial consisted of DIFFERENT or SAME OUTCOMES? (Circle the MOST appropriate term.)

Yes No I don't know

11. Did you find out at the END of each trial whether each trial was a SUCCESS or FAILURE? (Circle the MOST appropriate term.)

Yes No I don't know

12. On what percentage of all 50 trials did your responses of pressing and no pressing exert CONTROL over your trial-by-trial success? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

13. On what percentage of all 50 trials did you get a SUCCESS? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

14. On what percentage of all SUCCESS-trials did you give a PRESS response? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

15. On what percentage of all SUCCESS-trials did the outcome depend on your responses? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

16. On what percentage of all 50 trials did you get a FAILURE? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

17. On what percentage of all FAILURE-trials did give a PRESS response? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

18. On what percentage of all FAILURE-trials did the outcome depend on your responses? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

Appendix D

Questionnaire #2 - Form A

last name   given name(s)   sex M/F   student #

time   am/pm   day/month/year

Imagine that you will work under 50 new trials run UNDER EXACTLY THE SAME CONDITIONS AS BEFORE. Please give your best estimates of what you expect knowing that you would be working UNDER EXACTLY THE SAME CONDITIONS AS BEFORE.

1. On what percentage of the next 50 trials will your responses of pressing and no pressing CONTROL your trial-by-trial success? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

2. On what percentage of the next 50 trials will you get a SUCCESS? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

3. On what percentage of all future SUCCESS-trials will you give a PRESS response? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

4. On what percentage of all SUCCESS-trials will the outcome depend on your responses? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

5. On what percentage of the next 50 trials will you get a FAILURE? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

6. On what percentage of all FAILURE-trials will you give a PRESS response? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

7. On what percentage of all FAILURE-trials will the outcome depend on your responses? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

8. To what extent are you CERTAIN that you will obtain more than or less than 25 successes? (Circle the MOST appropriate number.)

7 6 5 4 3 2 1 0 1 2 3 4 5 6 7

I am very CERTAIN I will get LESS THAN 25 SUCCESSES	I am very UNCERTAIN whether I will get MORE/LESS than 25 SUCCESSES	I am very CERTAIN I will get MORE THAN 25 SUCCESSES

9. To what extent will you WANT to obtain MORE than 25 successes on the computer task? (Circle the MOST appropriate number.)

not at all | 1 2 3 4 5 6 7 | to a great extent

10. Assuming that you work under conditions which are IDENTICAL to the previous 50 trials, will the computer indicate at the BEGINNING of each trial whether the trial consists of DIFFERENT or SAME OUTCOMES? (Circle the MOST appropriate term.)

Yes No I don't know

11. Assuming that you work under conditions which are IDENTICAL to the previous 50 trials, will you find out at the END of each trial whether each trial is a SUCCESS or FAILURE? (Circle the MOST appropriate term.)

Yes No I don't know

12. On how many of the next 50 trials <u>will your responses of pressing and no pressing CONTROL your trial-by-trial success</u>? (Write your estimate below).

____
(0 - 50)

13. On how many of the next 50 trials <u>will you get a SUCCESS</u>?

Number of SUCCESSES: ____________ (0-50)

On how many of the next 50 trials <u>will you get a FAILURE</u>?

Number of FAILURES: ____________ (0-50)

(Write each of the estimates in the appropriate space. Remember, your FAILURES = 50 - SUCCESSES.)

14. Based on the number of SUCCESSES you indicated in Question 13, on how many of these future SUCCESS-trials <u>will you give a PRESS</u>? (Write your estimate in the space below.)

____

15. Based on the number of SUCCESSES you indicated in Question 13, on how many of these future SUCCESS-trials <u>will the outcome depend on your responses</u>? (Write your estimate in the space below.)

____

16. Based on the number of FAILURES you indicated in Question 13, on how many of these future FAILURE-trials <u>will you give a PRESS</u>? (Write your estimate in the space below.)

____

17. Based on the number of FAILURES you indicated in Question 13, on how many of these future FAILURE-trials <u>will the outcome depend on your responses</u>? (Write your estimate in the space below.)

____

Appendix D

Questionnaire #2 - Form B

______________ last name   ______________ given name(s)   ______ sex M/F   ______ student #

______________ time am/pm   ______________ day/month/year

Imagine that you will work under 50 new trials run UNDER EXACTLY THE SAME CONDITIONS AS BEFORE. Please give your best estimates of what you expect knowing that you would be working UNDER EXACTLY THE SAME CONDITIONS AS BEFORE.

1. On how many of the next 50 trials will your responses of pressing and no pressing CONTROL your trial-by-trial success? (Write your estimate below).

______________ (0 - 50)

2. On how many of the next 50 trials will you get a SUCCESS?
Number of SUCCESSES: ______________ (0-50)

On how many of the next 50 trials will you get a FAILURE?
Number of FAILURES: ______________ (0-50)

(Write each of the estimates in the appropriate space. Remember, your FAILURES = 50 - SUCCESSES.)

3. Based on the number of SUCCESSES you indicated in Question 2, on how many of these future SUCCESS-trials will you give a PRESS? (Write your estimate in the space below.)

____

4. Based on the number of SUCCESSES you indicated in Question 2, on how many of these future SUCCESS-trials will the outcome depend on your responses? (Write your estimate in the space below.)

____

5. Based on the number of FAILURES you indicated in Question 2, on how many of these future FAILURE-trials will you give a PRESS? (Write your estimate in the space below.)

____

6. Based on the number of FAILURES you indicated in Question 2, on how many of these future FAILURE-trials will the outcome depend on your responses? (Write your estimate in the space below.)

____

7. To what extent are you CERTAIN that you will obtain more than or less than 25 successes? (Circle the MOST appropriate number.)

7	6	5	4	3	2	1	0	1	2	3	4	5	6	7

I am very CERTAIN I will get LESS THAN 25 SUCCESSES

I am very UNCERTAIN whether I will get MORE/LESS than 25 SUCCESSES

I am very CERTAIN I will get MORE THAN 25 SUCCESSES

8. To what extent will you WANT to obtain MORE than 25 successes on the computer task? (Circle the MOST appropriate number.)

not at all | 1 2 3 4 5 6 7 | to a great extent

9. Assuming that you work under conditions which are IDENTICAL to the previous 50 trials, will the computer indicate at the BEGINNING of each trial whether the trial consists of DIFFERENT or SAME OUTCOMES? (Circle the MOST appropriate term.)

Yes No I don't know

10. Assuming that you work under conditions which are IDENTICAL to the previous 50 trials, will you find out at the END of each trial whether each trial is a SUCCESS or FAILURE? (Circle the MOST appropriate term.)

Yes No I don't know

11. On what percentage of the next 50 trials will your responses of pressing and no pressing CONTROL your trial-by-trial success? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

12. On what percentage of the next 50 trials will you get a SUCCESS? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

13. On what percentage of all future SUCCESS-trials will you give a PRESS response? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

14. On what percentage of all SUCCESS-trials will the outcome depend on your responses? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

15. On what percentage of the next 50 trials will you get a FAILURE? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

16. On what percentage of all FAILURE-trials will you give a PRESS response? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

17. On what percentage of all FAILURE-trials will the outcome depend on your responses? (Circle the MOST appropriate number.)

< 0....10....20....30....40....50....60....70....80....90....100 >

Appendix E

Post-Experimental Questionnaire

last name　　given name(s)　　sex M/F　　student #

time　am/pm　　day/month/year

Please answer <u>all</u> questions below:

1. What was the purpose of this experiment and what were you supposed to do:

2. During the experiment, did you ever have the idea that its purpose might be something other than what I was telling you? (Circle the appropriate term.)

Yes　　No

3. If you answered "yes" to the previous question, what alternative experimental purpose did you think of:

4. Please make any other comments that you feel might help us understand your reaction to this experiment:

Appendix F

Instructions

Before you begin the actual study, I need to get your opinion and outlook on certain things. Please fill out these questionnaires and tell me when you are finished. **Experimenter distributes the BDI and MAACL and leaves the room.**

The study you are about to participate in is an investigation of how well people perform on a rapid-paced problem-solving task. the task consists of 50 trials, and it is your task to learn how to get as many successful trials as possible.

On each of the 50 trials, you will either succeed or fail. On some trials, your success or failure will depend on whether or not you press this button, because pressing gets you one outcome and nopressing gets you the other outcome. However, on other trials, your outcome will be preset, so your pressing or nopressing will in no way influence whether you are a success or a failure. On each trial, you are asked to give a press or nopress. (If you delay pressing beyond 3 seconds, a nopress will be registered).

In this experiment, some participants will be told whether the outcome of each trial depends on their responses, whereas other participants will not be given this information. Likewise, some participants will be told whether they succeeded or failed on each trial, whereas other participants will not be given this feedback.

To demonstrate, the top of the screen contains information showing the trial number and whether the outcome depends on your pressing or nopressing. For instance, trial 1 could have different outcomes (so your response will make a difference), or trial 1 could have the same outcome (so your response makes no difference). Now the words PRESS OR DON'T PRESS appear (you will have 3 seconds to make your choice). Then participants given feedback will be shown their outcome whether it is a SUCCESS or a FAILURE. This same sequence will be repeated for all of the 50 trials.

Since you have a 50-50 chance of getting a success on each trial, you can consider yourself an overall SUCCESS if you succeed on MORE THAN half of the trials (i.e., over 25 successes). On the other hand, you can consider yourself an overall FAILURE if you fail on MORE THAN half of the trials (i.e., over 25 failures).

After you have completed all 50 trials, you will be asked to make several judgments about the task, such as your influence, success, etc.

The conditions under which you will be working in this problem-solving task are:

(1) you will (not) be told whether the outcome of each trials depends on you, and

(2) you will (not) be told whether you succeeded or failed on each trial.

Do you have any questions before we begin?

Please position your hand near the button and we shall begin; try to get as many successful trials as you can; let me know when you have finished all 50 trial. **Experimenter leaves the room to score the BDI while the participant begins the computer task, returning when the participant is finished.**

Now I'd like to get an idea of your thoughts and feelings about the task at this time; please fill out this questionnaire, and let me know when you are finished. **Experimenter hands out the experimental questionnaire and leaves the room, returning when the participant is finished.**

The experiment is now ended. However, we would like to get your expectations about the experiment assuming you were to go through 50 new trials under exactly the same conditions as before. Therefore, I would like you to fill out this second questionnaire. **Experimenter hands out the second questionnaire and**

leaves the room, returning when the participant is finished.

Now that the experiment is over, by knowing your questions and thoughts during the experiment, I can be clearer in giving instructions to future participants. So if you could please fill out this brief questionnaire. **Experimenter distributes the post-experimental questionnaire.**

Appendix G

Statement Made to Participants with Possible Intent to Self-Harm

While going over the personality survey you completed, I couldn't help but notice you marked one of your answers as if you may have thoughts of harming yourself. If you really feel this way and out of concern for your well-being, I'd like to inform you that there is a counselling service available on campus, namely the Counselling Centre. If you would like the phone number for this service, I would be glad to pass it on to you.

Appendix H

Debriefing Procedure

That concludes the experiment. We were particularly interested in your ratings of how your prediction of the outcome and how much control you felt you had depended upon how much prediction and control information you were given. Also of interest was the accuracy of your recollection of your success rate in the experiment. Because we expected differences, we ran this study.

Do you have any questions?

The final results of the study will be posted at a location within the building here at a later date. When the results are available, I will visit your classroom to inform you of the location.

Do you have any further questions?