EFFORTLESS CONTROL PROCESSING: A HEURISTIC STRATEGY FOR REDUCING COGNITIVE BIAS IN JUDGMENTS OF CONTROL

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EFFORTLESS CONTROL PROCESSING: A HEURISTIC STRATEGY FOR REDUCING COGNITIVE BIAS IN JUDGMENTS OF CONTROL

How accurate are people in judging how much control they exert over events? An important line of research in this area is concerned with the relationship between humans' subjective judgment about contingencies between their actions and events and objective contingencies. A promising method for assessing humans' capacities for subjective representation of contingencies was developed by Jenkins and Ward (1965). They presented subjects with a series of contingency problems in an instrumental learning situation. For each problem, subjects were given 60 trials on which a choice between two responses was followed by one of two possible outcomes. All subjects received some problems in which responses and outcomes were contingently related and other problems in which responses and outcomes were noncontingently related. Jenkins and Ward used problems in which success occurred frequently but noncontingently and problems in which it occurred infrequently but noncontingently. Following each problem, subjects were asked to rate, on a 0 to 100 scale, the degree of control (contingency) that their response choices had exerted over the outcomes. The researchers argued that a contingency between response and outcome exists when the probability of that outcome given
the occurrence of one response differs from the probability of that outcome given the occurrence of another response. Thus, when this contingency occurs the outcome is controllable. When, for all responses, there is no difference between these conditional probabilities, the outcome is said to be uncontrollable. This method permitted Jenkins and Ward to reconceptualize control to include the degree of control (or contingency). They defined it as the magnitude of the difference between two relevant conditional probabilities.

The results from Jenkins and Ward's (1965) studies showed that although at times people do accurately judge how much control they have over events, often they misjudge their degree of control. Regardless of the actual degree of contingency, subjects' rating of degree of control correlated highly only with the number of successful trials and were unrelated to the actual degree of control.

A consistent finding in a review on the work on the judgment of control suggests that people often treat uncontrollable situations as if they were in control (for example, Abramson & Alloy, 1980; Abramson, Alloy, & Rosoff, 1981; Alloy & Abramson, 1979; 1980; 1982; Alloy, Abramson & Viscusi, 1981; Crocker, 1981; Jenkins & Ward, 1965; Jennings, Amabile, & Ross, 1980; Langer, 1975; Nisbett & Ross, 1980). One variable that is likely to affect people's judgment of contingency is the frequency of the desired
outcome. People may be more likely to believe that they are in control when successful outcomes occur with relatively high frequency. For instance, Alloy and Abramson (1979) showed that nondepressed college students overestimated the degree of control they exerted over objectively uncontrol-lable events that occurred with high frequency or that were associated with success. On the other hand, they underestimated how much control they had over objectively controllable events that were associated with failure.

Similar results have been reported by investigators in the operant learning tradition. They have shown that people engage in superstitious behavior in situations in which rewards are delivered noncontingently of responses but are frequent and/or occur in close temporal contiguity to responses. For example, Bruner and Revusky (1961) found that human subjects in an instrumental learning situation developed complex response patterns which were irrelevant to the production of reinforcement. Also, Wright (1962) showed that subjects' response patterns were more orderly at high levels of noncontingent reward than at intermediate levels. Finally, in a stimulus prediction situation, Hake and Hyman (1953) found that subjects did not respond to a random series of binary digits as if it were random. An intriguing finding in studies on belief in personal control is that in certain situations, people exhibit an illusion of control (Langer, 1975) and act as if uncontrollable events
are controllable. For example, Langer (1975) showed that when elements ordinarily associated with skill situations are introduced into situations in which events are objectively uncontrollable, people's expectancies of success are far higher than the objective probabilities would warrant. Apparently, the more similar a purely chance situation is in appearance to a real skill situation, the more likely we are to believe in our own ability to control the outcome.

Success at a task may also create an illusion of control. In another study, Langer and Roth (1975) asked subjects to predict coin tosses and planned the outcome so that people either experienced early success and later failure or early failure and later success. Early experience with success created a belief in the ability to control the outcome.

Recent research (Alloy & Abramson, 1979) has shown that depressed people are less likely than nondepressed people to succumb to an illusion of control. In their experiments, Alloy and Abramson (1979) reported that, unlike nondepressed college students, depressed students did not overestimate how much control they had over objectively uncontrollable events that occurred with high frequency or that were desireable and associated with success. In general, depressed students accurately assessed their impact on events and, unlike nondepressed
students, also did not underestimate how much control they
had over objectively controllable events that were associated
with failure.

Following Langer's (1975) work, Golin, Terrell, and
Johnson (1977) similarly found that depressed college
students did not show an illusion of control in an objec-
tively chance task in which elements ordinarily associated
with skill had been introduced, whereas nondepressed students
did develop an illusion of control. Golin, Terrell, Weitz,
and Drost (1977) extended these findings to a clinical
environment and found that similar to mildly depressed
college students, more severely depressed inpatients did
not show an illusion of control. In contrast, nondepressed
psychiatric inpatients, most of whom were diagnosed as
schizophrenics, succumbed to an illusion of control.

A finding by Alloy and Abramson (1982) demonstrated
that when nondepressed people have previous experience with
control, an illusion of control may not develop. In this
study, nondepressed college students were pretreated with
controllable outcomes. Following pretreatment, subjects
judged how much control they had in a noncontingency learning
problem. Under both conditions of success and failure,
nondepressed subjects previously exposed to controllable
outcomes judged control accurately. Nondepressed subjects
previously exposed to uncontrollable noises succumbed to
an illusion of control.
Langer (1975) has suggested that the illusion of control is the inverse of learned helplessness. Furthermore, Chanowitz and Langer (1980) argue that the illusion of control is only an illusion from the observer's perspective. From the actor's point of view, involvement predicated upon a belief in potential control may be an important part of realizing control. In a series of studies, Langer and associates (Chanowitz & Langer, 1981; Langer, 1978; Langer, Blank & Chanowitz, 1978; Langer & Imber, 1979, 1980; Langer & Newman, 1979; Langer & Weinman, 1981) attempted to distinguish between the ways humans are able to experience the exercise of control. Chanowitz and Langer (1980) suggest that, in fact, control may be best understood through the mindlessness-mindfulness distinction. This distinction relies on the degree of involvement, the amount of cognitive effort, and the manner of information processing that characterizes the activity of control, that is, "the intentional manipulation of material in order to produce desired outcomes" (Chanowitz & Langer, 1980).

When an individual is mindless, he "interacts with the environment in a passive, reactive fashion and fails to ask questions about the environment, fails to reconsider pre-formed categories, and fails to seek new distinctions among stimuli" (Langer & Imber, 1980). Langer and Imber (1979) suggest that repeated experience with an activity permits the details of the situation to be ignored and facilitates
decreased cognitive involvement. While the mindless person may quickly, efficiently, and automatically execute over-learned skills, it has been shown that mindless subjects actually exercise less control: the decreased control of mindless subjects who were going through the motions of control (Langer, Blank & Chanowitz, 1978); susceptibility to negative external circumstances (Langer & Imber, 1980); poor listener comprehension (Langer & Newman, 1979); misplaced confidence (Langer & Weinman, 1981); inarticulate speech (Langer & Weinman, 1981); and the rigid and maladaptive use of initially irrelevant information, resulting in performance decrements (Chanowitz & Langer, 1981).

In contrast, mindfulness is described (Langer & Imber, 1980) as "a cognitively active state characterized by conscious manipulation of the elements of one's environment, in which case the individual questions old categories or constructs new ones". Effortful attention is a necessary, but insufficient, condition (Langer & Newman, 1979). Mindfulness also requires the active manipulation of the objects of attention (Chanowitz & Langer, 1980).

In Langer (1978) and Langer, Blank and Chanowitz (1978), it was argued that mindful information processing of cues will occur under two circumstances: when the situation is novel (where automatic or habitual responding are inappropriate and ineffective), and when mindlessness is more costly, in
terms of behavioral effort, than mindfulness. A good deal of research suggests that much of the time, adults tend to interact mindlessly with their environment unless they are provoked into mindfulness (Chanowitz & Langer, 1980, 1981; Langer, 1978, 1979; Langer, Blank & Chanowitz, 1978; Langer & Newman, 1979; Langer & Weinman, 1981). Processing the few cues that signal a subsequent course of action may simply be the most expedient strategy for moving through the environment. If this were the case, why would people want to devote the cognitive effort necessary for mindful control?

Chanowitz and Langer (1980) summarize the adaptive consequences of mindful control vs mindlessness in the following ways:

(a) the relative capacity to perceive during, rather than after, a sequenced activity that something foreign to the sequence is intruding;
(b) the relative capacity to recognize the character of that foreign element and, accordingly, to adjust the fixed sequence in order to continue achieving desired outcomes;
(c) the degree to which the environment that is controlled and the self that is controlling are seen as labile or rigid;
(d) the degree to which the self-as-agent within a sphere of activity does or does not change as a
result of continued activity in that particular sphere; and
(e) the generalized affective and emotional consequences that ensue for the person as a result of continued activity.

In Langer's view, cognitive effort is a prerequisite for mindful control. The dominant view of cognitive effort has followed Kahneman's (1973) position. Kahneman proposed a capacity model of attention in which there is a general limit on the energy available for performing mental operations. Limitations do not apply to any specific stage of cognitive processing. Capacity can be flexibly allocated to different stages of processing. Mental operations differ in the amount of attentional capacity or effort they require. He argued that the early stages of cognitive processing (that is, sensory and perceptual analysis) do not demand attention but that attentional requirements increase as the operation moves closer to the response end of the system.

In the past several years, a number of influential articles have argued that some mental operations can occur with only minimal effort and attention being allocated to them (Hasher & Zacks, 1979; Posner & Snyder, 1975; Schneider & Shiffrin, 1977; Shiffrin & Schneider, 1977). These operations which require considerable effort and attentional capacity have been called "effortful" (Hasher & Zacks, 1979), "conscious" (Posner & Snyder, 1975), or "controlled"
(Schneider & Shiffrin, 1977). In this study, these latter operations will be referred to as **effortful control processes**.

Effortful control processes require effort and limit the individual's ability to simultaneously engage in other effortful control processes. Their efficiency increases with practice and their use is voluntary. Often they occur only with specific instructions. They almost always occur consciously.

Many different kinds of effortful control operations are possible. Voluntary mental operations include hypothesis generation, attention focusing, memory search, and rehearsal, to name only a few. With sufficient practice, some of these operations may become automatic.

Automatic processes operate continually. They encode attributes of whatever information is the focus of attention. Once these processes become automatic, they can no longer be improved upon by instructions or additional practice. They do not require either awareness or intention. They require little effort and demand minimal attentional capacity.

Hasher and Zacks (1979) suggest that there are two types of automatic processes: innate and learned. Innate processes require minimal experience for the acquisition of automaticity. Learned processes result from practice. Evidence suggests that the amount of practice is extensive

Hasher and Zacks (1979) argue that the operations that encode frequencies, spatial locations, and time of events are automatic at least in part because of innate factors. These processes should be commonly shared and only minimally influenced by differences in age, culture, early experience, and education.

Most dual process theorists do not distinguish between learned and innate automatic processes (for example, see Fisk & Schneider, 1984). They tend to ignore their differences and treat them both as learned. Consequently, there is some confusion as to whether automatic processing results in any long-term memory (LTM) storage. One view is that relevant cues must be attended, but once attended certain attributes are learned without additional processing. This view has been termed: learning without awareness (Brewer, 1974), implicit learning (Reber, Kassin, Lewis & Cantor, 1980), unconscious learning (Silver, Saltz & Modigliani, 1970), and innate automatic processing (Hasher & Zacks, 1979). In this view, long-term storage may occur without conscious attention.

On the other hand, a number of experiments showed little evidence of LTM storage when effortfully controlled processes were allocated to another task (Fisk & Schneider, 1984; Gleitman & Jonides, 1976; Gordon, 1968, Moray, 1959;
Underwood, 1976; Wolford & Morrison, 1980). In this view, LTM storage is a function of the amount and type of effortfully controlled processing. Automatic performance occurs with little or no LTM storage. In fact, Fisk and Schneider (1984) interpret what Hasher and Zacks (1979) refer to as automatic processing "as early asymptotic controlled process encoding of event frequency". Fisk and Schneider (1984) prefer to reserve the term "automatic" for only learned, that is, very well practiced (for example, 2,000 training trials) processes. In contradistinction, Hasher and Zacks (1979) are referring to "genetically prepared" operations that have been identified by Flavell (1977) as "basic" memory processes which are the hardware of the memory system. They show limited developmental trends that are completed by an early age (by 1½ - 2 years of age) and development is largely a function of maturation (Attig & Hasher, 1980; Hasher & Chromiak, 1977; Hasher & Zacks, 1979; Kausler & Puckett, 1980; Zacks, Hasher, & Sanft, 1982).

It would appear that the different views on automatic processing are a consequence of researching differing phenomena under the same rubric. In this study, innate automatic processes are referred to as effortless processes.

From this discussion, it is apparent that what Langer and her associates refer to as "mindlessness" is the widespread usage of learned automatic processes in social situations. What is referred to as "mindfulness" is, in
effect, the occasional use of effortfully controlled processing in novel or demanding situations. Nevertheless, effortful control processing (mindfulness) results in the
cognitive bias that Langer (1975) terms an "illusion of control".

In general, nondepressed people will succumb to an illusion of control in contingency judgment situations (Alloy & Abramson, 1979). The determination of control results from the accurate estimation of frequency of events (Jenkins & Ward, 1965). But, frequency processing, in Hasher and Zacks' (1979) view, is neither a learned automatic response (mindlessness) nor an effortfully controlled response (mindfulness), but an effortless response (an innate automatic encoding process).

Again, it is apparent that cognitive effort may be responsible for cognitive bias. For example, Alloy and Abramson (1979, 1982) demonstrated that depressives, while exhibiting the well known deficits in effortful control processing, do not succumb to an illusion of control. Further, Abramson, Alloy and Rosoff (1981) showed that depressed people do exhibit a cognitive bias (in the opposite direction) when an effortful control process is required to exert maximum control. From the foregoing discussion, it is argued that effortless processing would more accurately assess control (degree of contingency) than effortful control processing.
The present investigation was designed to test the prediction that nondepressed students can accurately estimate degree of contingency between their responses and environmental outcomes when noncontingent outcomes are frequent and desired if they effortlessly process the relevant information as a mindful control strategy. The deliberate activation of effortless mental operations is referred to here as effortless control processing. This cognitive strategy is based on the work of Schneider & Fisk (1981, Experiment 2B) who showed that LTM modification occurs when a subject allocates controlled processing resources to an automatic task. Performance potentially may exhibit the speed associated with automatic processing, but the capacity limitations associated with effortfully controlled processing. Unlike learned automatic processes which result in little, if any, LTM storage, effortlessly controlled processing will also exhibit the memory modification associated with effortfully controlled processing. Thus, the parallel between the attention and memory literature suggests that although remembering may require control (attention) it may not necessarily require effort. Effort, however, may be paradoxically necessary to develop effortless control.

Several functional properties characterize effortless control processing. In general, these processes combine features of both automatic and effortful mental operations.
Effortless control processes are slow and require conscious attention. They are both instituted and changed by instruction. Similar to Posner and Snyder's (1975) strategies, Shiffrin and Schneider's (1977) accessible controlled processes, and Hasher and Zacks's (1979) effortful processes, effortless control processes require attention capacity and so limit one's ability to engage simultaneously in effortful control processes.

Effortless control processes may be understood in terms of Kahneman's (1973) capacity model of attention. In effortless control processing, attention is deliberately allocated to the early stages of information processing (that is, sensory-perceptual analysis). These stages do not require attention, but are accessible to awareness. Attentional demands ordinarily increase as mental operations move closer to the response end of the system. Since even some complex operations (including stages up to overt responding) can occur automatically with only minimal attentional capacity being allocated to them, the stages of sensory-perceptual analysis ordinarily remain veiled, that is, "preattentive" (Neisser, 1967).

Effortful learning operations depend on innate automatic processes for flexibility in learning mechanisms (Hasher & Zacks, 1979). If only learned automatic processes were available, behavior would be highly stereotyped (Blumenthal, 1977) or mindless (Langer, 1978) and the handling of novel
kinds of information would be severely hampered, as would be responding to unfamiliar tasks.

Effortless control processing enables us to cognitively orient to both the novel and routine flow of events in our environment. These processes should be widely shared and minimally influenced by individual differences (see Hasher & Zacks, 1979).

Effortless control processing is the discipline and effort to stay aware in the present. Such processing is a seeing-without-reacting to the whole process of our world of experience. When one is consciously processing perceptual information, the attention is not on evaluating the object of perception, forming concepts of good or bad, familiar or unfamiliar in regard to it. Rather, the attention becomes an awareness of the process of perception, the fact of perceiving, rather than the facts associated with perceiving. The concepts follow the experience. Effortless control processing focuses on the moment of the process rather than on the reflection of it in concepts. Awareness is directed at the present moment, to the process itself. Expectations are consciously inhibited.

In effortless control processing, every activity, event, experience, or other item of behavior is designated by a label, preferably an active verb. Where appropriate and useful, adjectives and adverbs that reflect action as a process are permitted. Effortless control processing
allocates the attention to the continuously changing content of sensory-perceptual information. This strategy focuses on description of the activity itself; it avoids further interpreting the description.

The situation or activity to be processed is heuristically fragmented into a set of parts that best captures its spirit. As the activity proceeds, effortless control processing is activated by making mental notes of each momentary part of the action. Initially, the activity may be fragmented into only a few parts. With practice, the activity may be progressively dismantled into more and smaller pieces. For example, physical movements are noted in their various aspects as lifting, pushing, putting, turning, or placing. The mental note of each movement must be made. This procedure is extended to every action, breaking it into smaller and smaller pieces. The individual becomes aware of the process as a series of moments. For example, walking could initially be reduced to left, right, left, right. Left, right could be further dismantled into rising, falling or lifting, putting. Finally, the action of walking becomes the process of lifting, swinging, placing, or some other similar designation. When physical activity ceases, effortless control processing may be maintained by focussing on the activity of breathing. The awareness is directed on the sensation of movement either of the abdomen or of air passage in the nostrils. Then make a
mental note, rising for the outward movement, falling for the inward movement; or inhaling, exhaling for the breath movement. Do not repeat the words aloud unless there are distractions. Ordinarily a mental note is made silently as the activities occur.

In these studies on belief in control, people often treated uncontrollable events as if they were controllable. They behaved as though outcomes were dependent on responses when they were not, and as though one event could be predicted from another when it could not. From these studies, it was reasonable to surmise that a variable likely to systematically affect the relationship between subjective contingencies and objective contingencies is the frequency of the desired outcomes. People were more likely to believe that a contingency existed between their responses and desired outcomes when those outcomes occurred with relatively high frequency.

The research reviewed indicated that although depressed people are unable to exert cognitive effort, their ability to automatically process information is unaffected. Frequency processing, an innate automatic process, is equally effective in both depressed and nondepressed individuals. Nondepressed individuals, however, tend to process frequency information effortfully where personal control is involved.
The present investigation tested the prediction that effortless control processing, the deliberate activation of innate automatic encoding mechanisms, will enable non-depressed persons to accurately judge degree of control. Subjective judgment of control in nondepressed students was examined by a modification of the method developed by Jenkins and Ward (1965). The modification was based on Hasher and Zacks' (1979) version of the method. Several measures were used to assess students' representations of control. Students were asked to judge the degree of control their responses had over outcomes rather than the degree of contingency between responses and outcomes. Contingency is a general term and refers to the degree of relationship between any two events. In the instrumental learning situation, the two events consist of the responses and some outcome or reinforcer. The relationship between these events can be construed as one of controllability. The response has either some or no degree of control over the outcome. In this study, control was defined as the dependence of an outcome on a response. The terminology of control was used with subjects in the present investigation to convey the technical meaning of contingency in common language (Jenkins & Ward, 1965).

To facilitate comparison of prior studies on the judgment of contingency with the present study, Jenkins and Ward's (1965) index of the actual degree of control was used.
Their index used the magnitude of the difference between the conditional probability of an outcome given the occurrence of one response versus the conditional probability of the outcome given the occurrence of another response as representing degree of control or contingency. Although the phi coefficient (\( \phi \)) is commonly used to quantify the degree of relation between two events, the Jenkins and Ward index (1965) is a close approximation to phi and, in fact, is highly correlated with phi.

In this experiment, students instructed in effortful control processing and effortless control processing were presented with a series of problems in which there was no contingency between their responses and outcomes. The problems differed in the degree of favorable outcome frequency. Students' abilities to detect noncontingency between responses and outcomes under different conditions of outcome frequency was examined.

**Method**

**Subjects**

Sixty-four students, 32 males and 32 females, were recruited from North Texas State University and Texas Woman's University. Subjects were accepted for participation on the basis of their Beck Depression Inventory (BDI) scores (Beck, 1967). The BDI is a well-validated measure of relatively enduring mood (Beck, 1967; Hammen, 1980). Bumberry, Oliver, and McClure (1978) found that the BDI is
a valid instrument for measuring depression in a college student population. Only subjects with BDI scores of 8 or lower were used in both groups. The sample consisted of 32 students processing with effortless control strategies (16 males and 16 females) and 32 students processing with effortful control strategies (16 males and 16 females). Subjects were randomly assigned to two experimental conditions, with the restriction that each condition contain equal numbers of males and females. All of the subjects in each condition were tested by one experimenter.

**Experimental Design**

The experiment was a 2 (Problem Type) x 2 (Processing Strategies - effortless control, effortful control) x 2 (sex - male, female) factorial design. The two problems differed in the percentage of reinforcement but did not differ in degree of control. In Problem 1 (25-25), subjects had no control and were reinforced ("right" verbal reply) on 25% of the trials. In Problem 2 (75-75), subjects also had no control, but were reinforced on 75% of the trials. Of the 64 subjects, 32 (8 males/effortful control processing, 8 females/effortful control processing, 8 males/effortless control processing, 8 females/effortless control processing) were assigned to each problem.

**Dependent Measures**

Following Alloy and Abramson (1979), the major dependent measures were four judgment scales. On the Judgment of
Control scale, subjects were asked to rate the degree of control their responses (matching and not matching) exerted over the experimental outcome ("right" verbal reply). On the second judgment scale, Judgment of Total Reinforcement, subjects estimate the overall percentage of trials on which the "right" reply occurred regardless of which response they made. The last two scales, Judgment of Reinforcement if Match and Judgment of Reinforcement if Not Match, were designed by Alloy and Abramson (1979) to assess whether subjects know the actual data necessary to compute the conditional probabilities that are necessary for making an accurate judgment of control. On these two scales, subjects estimated the percentage of trials on which the "right" reply came when they matched and when they did not match, respectively.

Because Jenkins and Ward (1965) discovered that subjects frequently used invalid heuristics of percentage of successes and confirming cases in arriving at their verbalized judgments of control, these measures were used in the present study. Following Jenkins and Ward (1965), percentage of favorable outcomes was defined as the percentage of trials on which the "right" reply appears when the subject matched cards.

Several additional dependent measures were included on a post-experimental questionnaire. First, subjects were asked to rate how certain they were of the accuracy
of their judgments of degree of control. Second, the subjects were asked to describe the evidence that convinced them that they either had or did not have control. Finally, subjects who were effortfully processing were asked what hypotheses (for example, sequential or time dependent patterns) they employed during the contingency learning problems.

**Materials**

The experiment was conducted in a single room. Subject and experimenter were seated face to face with a table placed between them.

The stimulus presentation consisted of the four stimulus cards and the first 40 response cards of the Wisconsin Card Sorting Test (WCST). Subjects' responses were indicated on the WCST recording form.

The contingencies between subjects' responses (matching cards and not matching cards) and experimental outcomes ("right" verbal reply or "wrong" verbal reply) were programmed onto the WCST recording form. The outcomes were controlled by the experimenter. The recording form indicated to the experimenter the schedule of "right" and "wrong" replies following the subjects' response. A match response indicated one schedule; a no match response indicated another schedule. The experimenter's reply, thus was determined by the subject's responses. (See Experimental Design section for the actual programmed contingencies).
The BDI (Beck, 1967), four judgment scales, and a post-experimental questionnaire constituted the experimental materials. Each of the four judgment scales was marked off in units of five with extreme values of 0 and 100. For the Judgment of Control scale, the extreme values were labeled No Control and Complete Control and the 50% point was labeled Intermediate Control. The other three scales (Judgment of Total Reinforcement, Judgment of Reinforcement if Match, and Judgment of Reinforcement if Not Match) were simply labeled as percentages.

Procedure

When the subject entered the room, he or she was seated at a table and administered the BDI. The experimenter was not present while the subject filled out the inventory. After completing the Inventory, the subject was assigned to an experimental condition. The actual procedure for each of the contingency problem groups was identical. Each of the contingency problems consisted of 40 trials on which the subject had the option of either matching a card to form or not matching. At the end of each trial, a "right" or "wrong" reply was presented dependent on the subject's response and the outcome frequency problem to which the subject had been assigned. Detailed instructions to the subjects are described in the appendix.

After the subjects were read the instructions, the experimenter proceeded with the contingency learning
problem. Following the completion of 40 trials, the subjects completed each of the four scales by placing an X on the scale corresponding to his or her estimate. The subjects who were asked to develop hypotheses regarding the task were administered the post-experimental questionnaire. Both experimental groups were carefully debriefed.

Results

A Problem X Process X Sex analysis of variance of the judgment of control scores yielded significant main effects for problem, $F(1, 56) = 38.55, p < .001$; process, $F(1, 56) = 12.81, p < .001$; and sex, $F(1, 56) = 5.13, p < .05$; and a significant Problem X Process interaction, $F(1, 56) = 16.14, p < .001$. The significant main effect for sex indicated that females reported more control than males. The significant Problem X Process interaction indicated that subjects using strategies for effortful control judged they had more control than the subjects using the effortless strategy in the high frequency reinforcement problem. In the low frequency problem, however, there was no significant difference in judgments of control between the two strategies. The judgments of the subjects using the effortless control strategy did not differ between the two reinforcement problems. Table 1 (Appendix B) presents the means and standard deviations for the judgment of control ratings for all experimental groups. In addition, Figure 1 (Appendix C) portrays the Problem X Process interaction.
A Problem X Process X Sex analysis of variance of the confidence index also revealed a significant Problem X Process interaction, $F(1, 56) = 5.28$, $p < .05$. Subjects with the effortless strategy were more confident of their judgments of control in the frequent reinforcement problem than in the infrequent reinforcement problem. Subjects with effortful strategies did not differ in their confidence ratings between the two problems.

Figure 2 (Appendix D) illustrates that subjects were relatively accurate in estimating the frequency of reinforcement associated with both matching and not matching. The mean scores of discrepancy between judged percentage of reinforcement and actual percentage of reinforcement with matching were 3.9 for the high frequency reinforcement problem and -5.0 for the low frequency reinforcement problem. A Problem X Process X Sex analysis of variance of these discrepancy scores showed a significant problem main effect, $F(1, 56) = 20.69$, $p < .001$, and no other significant main effects or interactions. The mean discrepancy scores (judged - actual) for percentage of reinforcement associated with not matching were 1.875 for the high frequency problem and -6.25 for the low frequency problem. A Problem X Process X Sex analysis of variance yielded a significant problem main effect, $F(1, 56) = 17.86$, $p < .001$, with no other significant main effects or interactions. The subjects tended to underestimate the frequency of reinforcement in
the low frequency problems and overestimate the frequency of reinforcement in the high frequency problems.

A Problem X Process X Sex analysis of variance of the scores measuring the discrepancy between judgment of total reinforcement and actual total reinforcement yielded a significant main effect for problem, $F(1, 56) = 18.96$, $p < .0001$. Again, the main effect reflects the subjects' tendencies to underestimate in the low frequency problem and overestimate in the high frequency problems.

A post-experimental questionnaire was completed by the subjects asked to try complex hypotheses (effortful control processing) as a strategy to accurately judge degree of control. All 32 subjects reported trying complex patterns of responding.

Discussion

This experiment provided evidence for the hypothesis that when favorable outcomes are frequent, nondepressed persons can, by employing the effortless control processing strategy, reduce cognitive bias in their judgments of control when there is a noncontingent relation between their responses and favorable outcomes. Under similar experimental conditions, nondepressed persons who used effortful control processes in their judgments showed illusions of control. This latter finding is in line with Alloy and Abramson's (1979) hypothesis that nondepressed people should overestimate the degree of contingency between
their responses and outcomes when favorable outcomes are frequent. Neither strategy proved superior in conditions where favorable outcomes were infrequent. Females showed a greater tendency regardless of which cognitive strategy they employed to overestimate the degree of control under both experimental conditions (frequent and infrequent favorable outcomes). These results are somewhat inconsistent with Langer's (1975) hypothesis that males are more susceptible to illusions of control in situations where there is less emphasis on rationality. Evidence to support such a hypothesis would require that males employing the effortless strategy succumb to a greater illusion of control. This was clearly not the case.

Judgments of control can be conceived as instances of making inferences from raw data. Errors in judgment could result from either not obtaining a relevant data sample or not appropriately organizing the data. Since the subjects in this experiment were able to accurately estimate the frequency of reinforcement in both problems, it is likely that their errors in judgment resulted from the inappropriate organization of raw data. This would also suggest that both processing strategies were equally effective in the encoding of frequency information. From this study it is apparent that effortless control processing somehow interferes with the biased organizational efforts involved in the control judgments of nondepressed people. Cognitive
effort appears to misprepare the person for accurate control judgments. Effortless control processing may better prepare the person for accurate control judgments by reducing efforts to solve a potentially unsolveable problem.

Research has demonstrated (Langer, 1978, 1981) that much complex social interaction is accomplished without an awareness of the relevant details that would seem necessary to accomplish that interaction successfully. Such mindless behavior, this position asserts, results from accumulated experience in familiar or similar situations. Chanowitz and Langer (1981) have also demonstrated that such mindlessness may also come about upon initial exposure to information. Such premature cognitive commitment (Chanowitz & Langer, 1981) occurs when the individual responds to an already constructed environment. Similarly, the subjects in this study were encouraged to accept the definition of the situation uncritically. When subjects were asked to make a judgment of control they were invited to accept the problem as structured for them. Given this form of introduction, the subjects' completion of behavior relied on the passive, mindless acceptance of the problem as defined by the experimenter. It is possible that the subjects in this study may have prematurely committed themselves to the "truth" of the information and subsequently responded to this information without realizing its distorted character.
Subjects asked to effortlessly process the details of the reinforcement problem were less biased in their judgments of control. It is possible that encouraging them to continually review the individual elements of the task enabled them to reformulate the task itself. A premature acceptance without question of an interpreted problem obscures the fact that the problem is open to other interpretations. Although the subjects employing the effortless strategy were similarly misinformed about the noncontingent reinforcement problems, they were not asked to direct their attention, that is, mental effort, exclusively toward the problem's solution. Rather, their attention was directed toward the changing details that together composed the problem as a process. It is possible that this strategy permitted them to more flexibly reinterpret the problem.

Chanowitz and Langer (1980) argue that the illusion of control is a necessary part of gaining control. In their view, contingency is presumed and the person is involved in determining the character of that contingent relation. The very presumption of contingency, however, results in cognitive bias (Chapman & Chapman, 1969; Jennings, Amabile, & Ross, 1980). Thus, insofar as one is involved in determining the character of a contingent relation (degree of control), one is precluded from entertaining the possibility of noncontingency. The exertion of cognitive effort to ascertain the degree of control, in
effect, rules out the possibility of the alternate interpretation of no control. Chanowitz and Langer's (1980) view of mindfulness argues for the presumption of control and against the expectation of no control. Consequently, in their position there can be no control without an illusion. The present study, however, suggests the possibility for control without an illusion (accurate control judgments without cognitive bias) at least in judgments of noncontingency. Although the noncontingent case is interesting, it is only one type of contingency and therefore it is not appropriate based on this study to make broad inferences about people's general concept of contingency. Further research is necessary to determine whether nondepressed persons can, with heuristic cognitive strategies, accurately judge the degree of control their responses exert over outcomes in situations with different degrees of contingency.

The present investigation provides evidence to suggest that nondepressed people can, with appropriate cognitive strategy, accurately assess response-outcome contingencies as well as depressed persons (Alloy & Abramson, 1979). The generation of complex hypotheses seems to interfere with accurate judgments of control in the noncontingent situation. These results are in line with Abramson, Alloy, and Rosoff (1981), who found that depressed persons will rarely generate complex hypotheses when making contingency judgments. When
depressed persons were required to generate a complex hypothesis, they too exhibited a cognitive bias, however, in the opposite direction. Is it possible that any expectation of control or no control results in cognitive bias? More work is needed to clarify this point. Nevertheless, this discussion of the cognitive components interfering with contingency judgments suggests new directions for future research. Only when the techniques of effortless control processing have been fully tested in different contingency situations, will we know where to search for appropriate applications.
Appendix A

All subjects were given the following instructions:

In this problem-solving experiment, it is your task to learn what degree of control you have over whether or not you make a correct response. I want you to put each of these cards (pointing to the response cards) in separate piles beneath the ones lying on the table (pointing to the stimulus cards) or into a pile at the right (pointing to the right of the stimulus cards). In this problem, you are to either match each card for form or not match by placing the card in a separate pile. On some trials, matching for form will be the correct response; on other trials, not matching will be the correct response. You are to avoid matching for color or number since these responses are always wrong.

Try to get as many correct responses as you can. Be sure to sample both responses, matching and not matching, often. After you place each card I will tell you whether you are right or wrong. Again, your object is to get as many as possible right. Do you understand?

When it was clear that the subject understood the outline of the task, he or she was shown the Judgment of Control scale and the concept of control was discussed briefly:

Forty trials will constitute the problem. After the problem, you will be asked to indicate your judgment
of control by putting an "X" somewhere on this scale: at 100 if you have complete control over getting a "right" reply, at 0 if you have no control over getting a "right" reply, and somewhere in between these extremes if you have some but not complete control over getting a "right" reply. Complete control means that getting a "right" reply on any given trial is determined by your choice of responses, either matching or not matching. In other words, whether or not you get a "right" reply is totally determined by whether you choose to match or not match. No control means that you have found no way to make response choices so as to influence in any way the getting of a "right" reply. In other words, getting a "right" reply has nothing to do with what you do. Another way of looking at no control is that whether or not you get a "right" reply on any given trial is totally determined by factors such as chance or luck, rather than by your choice of matching or not matching. Intermediate degrees of control means that your choice of responses, either matching or not matching, influences when you receive a "right" reply even though it may not completely determine whether you receive it or not. In other words, what you do or don't do matters to some extent but not totally. Another way of looking at having intermediate control is that one response,
whether matching or not matching, produces a "right" reply more often than does the other response. So, it may turn out that you will have some degree of control, either complete or intermediate, that is, one response produces a "right" reply more frequently than does the other. Any questions?

The experimenter then provided these additional instructions to the experimental group designated effortfully controlled processing (effortful):

In this problem, you are asked to try at least two or three strategies in the attempt to get as many "right" replies as possible. Possible strategies might include matching or not matching the cards according to different ratios, for example: 3 to 1, 2 to 1, or 3 to 2. Another strategy might be to determine if the sequence of "right" replies follows a particular pattern. It might also be helpful to determine if the pattern of "right" replies is time-dependent. Time-dependent would mean that a "right" reply was a function of the passing of time, not a function of your particular response. Are there any questions?

The experimental group designated effortlessly controlled processing (effortless) was given these additional instructions:

During the problem, you are asked to be aware of the activity as an ongoing process. Rather than focussing
on the solution to the problem, simply be aware as the activity unfolds. Do not hurry, but attempt to pace yourself so as not to get lost in thinking. Try to break the activity into comfortably discrete sequences. It will be helpful to make mental notes that describe the activity while it occurs. During the problem you are asked to verbalize these mental notes as you complete the task. For example, when reaching for a card, say reaching; when lifting a card for identification, say lifting, or looking; when putting the card in one or the other stacks, say matching for stars, circles, crosses, or triangles, whichever is correct; when the experimenter replies "right" or "wrong", repeat right or wrong. In effect, you are asked to describe aloud the ongoing activity as it occurs. Do you have any questions?
## Appendix B

### Table 1

Means and Standard Deviations of Judgment of Control Scores by Problem, Process, and Sex

<table>
<thead>
<tr>
<th>Problem</th>
<th>Effortless Males</th>
<th>Effortless Females</th>
<th>Effortful Males</th>
<th>Effortful Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>25/25</td>
<td>15.6</td>
<td>12.1</td>
<td>13.1</td>
<td>8.8</td>
</tr>
<tr>
<td>75/75</td>
<td>14.1</td>
<td>18.0</td>
<td>33.1</td>
<td>22.4</td>
</tr>
</tbody>
</table>
Figure 1. Judgment of control for effortful and effortless cognitive strategies as a function of problem type.
Figure 2. Discrepancy between judged and actual percentage of reinforcement for matching and not matching as a function of problem type.
References


