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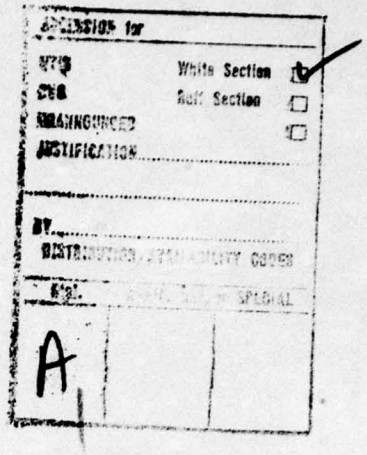
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CHANGES IN BEHAVIOR FOLLOWING CHANGES IN CONTROL OVER OUTCOMES: A THEORY BASED ON RESPONSES TO UNCERTAINTY

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Technical Report 76-3

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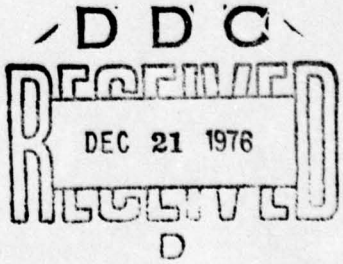
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(Terence R. Mitchell and Lee Roy Beach, Investigators)

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A theory to predict outcome-oriented effort following changes in control over outcomes is proposed. This theory is based on a hypothesized motivation to avoid uncertainty. As uncertainty about control increases individuals should become increasingly motivated to seek uncertainty-reducing information. They should thus become increasingly motivated to exert outcome-oriented effort in an attempt to provide more information about the consequences of their behavior. Changes ~~in outcome-oriented behavior~~ are

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20. seen as a function of one's uncertainty about control both before and after the change in control. The relationship between this theory and several other psychological theories is discussed.

I. Introduction

People experience many outcomes over which they have at least some degree of control some of the time. By outcomes we mean any of the myriad of events, both positive and negative, that can happen to a person. Thus, outcomes refer to such events as receiving monetary rewards and punishments, social praises and reproachments, and physical pleasures and pains. The concept of control summarizes the degree to which these outcomes are contingent upon one's behavior. This paper is concerned with peoples' reactions to varying degrees of control over outcomes, and particularly with their reactions to changes in control.

A substantial amount of both theoretical and empirical work dealing with control over outcomes has already been done. For the most part, however, this work has been concerned primarily with the effects of having total control versus no control (e.g., Averill, 1973; Seligman, 1974, 1975) and with the effects of decreases in control (e.g., Brehm, 1966, 1972; Wortman & Brehm, 1975). The effects of intermediate levels of control and of increases in control have been virtually ignored.

The present paper proposes a theory to predict outcome-oriented behavior following changes in control over outcomes. This theory is more general than previous work in that it deals with all levels of control, and with both increases and decreases in control. The theory is based on a hypothesized motivation to avoid uncertainty. As uncertainty about control increases individuals should become motivated to seek uncertainty-reducing information. One way to gain such information is to actually observe the consequences of one's behavior. It is therefore predicted that

when individuals are uncertain about their control over outcomes they will exert more outcome-oriented effort in an attempt to provide more opportunities to observe the consequences of their behavior.

As a way of demonstrating the generality of this theory, and to show its ability to explain a wide variety of data, its relationship to several other psychological theories will be discussed. These other theories include Decision Theory, Atkinson's Theory of Achievement Motivation, Brehm's Theory of Reactance, and Seligman's Theory of Learned Helplessness.

II. A THEORY BASED ON RESPONSES TO UNCERTAINTY

A. The Nature of Uncertainty

Before proposing a general theory to predict changes in outcome-oriented behavior following changes in control over outcomes, it will be helpful to first understand the terms and assumptions underlying this theory. Thus we will begin by defining uncertainty and discussing it as a motivational concept. We will then define control and integrate these two concepts into a larger theoretical framework based upon uncertainty about control over outcomes.

1. A Definition of Uncertainty

Any thorough attempt to define uncertainty in terms of degrees of knowledge, understanding, or other such indeterminant concepts, would entail an epistemological discussion of much greater length than can possibly be afforded here. We therefore wish to rely on the reader's own visceral feeling for what uncertainty is, and proceed to define the term in a more-or-less operational fashion. While ultimately such a procedure is somewhat less than satisfactory, it does serve to maintain the focus of the paper on the problem at hand.

Uncertainty is defined as the degree to which people are unable to make precise judgments about some characteristic of a given entity, situation, relationship, or event. The less precise one's judgment, the more uncertain one is about the characteristic in question.

To illustrate, suppose we ask a random sample of individuals to give the exact date of both the signing of the Declaration of Independence and the first aeroplane flight of Orville Wright at Kitty Hawk, North Carolina. With regard to the signing of the Declaration of Independence, most people should recall the year, and many will be able to give the exact date (July 4, 1776). With regard to Wright's first flight, however, many might be able to say only that it occurred sometime around the turn of the century, a few might be able to give the year, and probably only one or two aviation buffs will be able to give the exact date (December 17, 1903). Using one's intuitive feeling for what uncertainty is, the reader should conclude that people are in general more uncertain about the date of Wright's flight than they are about the date of the signing of the Declaration of Independence. The same conclusion would be reached using the definition of uncertainty proposed above. Fewer people are likely to give the precise date of Wright's flight than of the signing of the Declaration of Independence, and the majority will probably give a larger range of dates (e.g., some time around the turn of the century) for Wright's flight than for the signing of the Declaration of Independence. According to our definition, both facts indicate a greater uncertainty about the date of Wright's flight than the date of the signing of the Declaration of Independence.

Let us take another example. Suppose our random sample of individuals is asked to view a fifteen minute film of an interview with an adult male psychiatric patient. Suppose further that this film was made in such a way that only the face of the patient appears on the screen. Now imagine that we ask these individuals to make two simple judgments about the patient: one about his age, and the other about his height. It seems

rather unlikely that they would be able to make very precise statements about either dimension. It is not unreasonable, however, to suppose that they would be able to make more precise judgments about the patient's age than about his height, since the film would tend to reveal much more information about his age than his height. Thus, both according to our intuition and according to our definition we should conclude that people viewing this film will tend to be more uncertain about the patient's height than about his age.

There are a number of ways to quantify the degree to which people can make precise judgments. One strategy is to use a measure of variability. This could be done by asking individuals for judgments on several different occasions, with the variability observed over successive judgments taken as the measure of uncertainty. For example, each member of our hypothetical random sample of individuals could have been asked at several different times to give his/her best guess about the patient's exact age, and the variability around his/her mean estimate could be taken as an indicator of uncertainty. However, this is a less than ideal method, since it is time consuming, and requires both that the stimulus be exactly the same at each judgment, and that the successive judgments be independent from one another.

A more straightforward method is to simply ask the respondent how certain he/she is about the accuracy of a given judgment. This latter method is inherent in a strategy used by Beach, Beach, Carter, and Barclay (1974), Beach and Solak (1969), Laestadius (1970) and others in investigating ranges of subjectively acceptable error. These authors asked subjects to make judgments about some characteristic of a given stimulus, and then asked

these same subjects to indicate the range of possible values of the characteristic in question that the stimulus could actually have and still leave them satisfied that their initial judgment was "in the ballpark." Applying this method in our second example, an individual might feel that his/her best estimate of the patient's age is 38, but that the patient's actual age could probably be anywhere from 35 to 41 and his/her initial estimate would still be essentially correct. This range of values is termed an equivalence interval, since all of the values falling within it are assumed to be equivalent, in terms of their accuracy, to the initial judgment. This interval is, in a sense, the phenomenological equivalent of what statisticians refer to as a confidence interval. In terms of the present discussion, the size of the equivalence interval can be taken as a measure of uncertainty; the more uncertain the individual is about the correctness of his/her judgment, the larger should be the size of the equivalence interval. Following our example above, the individual who gave an estimate of 38 years and an interval of from 35 to 41 years is assumed to be more uncertain about his judgment than a person who gives an estimate of 38 years and an interval of from 37 to 39 years.

One important point should be brought up here. Uncertainty, or the degree to which people are unable to make precise judgments, is independent of the correctness of those judgments, and it is uncertainty, not correctness which we are suggesting is the more important variable for predicting behavior. People respond to their world according to their subjective perceptions rather than according to what actually exists. Therefore, the more uncertain they are about various characteristics of their world, the less their behavior should be guided by their judgments regarding those characteristics, whether or not those judgments are actually correct.

2. Uncertainty and Bipolar Scales

People often make judgments about characteristics which can be represented by a continuum with a maximum value at one end and a minimum value at the other. We will refer to these as bipolar scales.[2] It is proposed that when making judgments about such characteristics, individuals will in general be most uncertain about their judgments when the actual value of the characteristic in question falls in the middle of the scale, and will be least uncertain when the actual value falls at either end of the scale.

To illustrate, suppose you were given a sealed box containing an unknown number of marbles, and you were asked to estimate the exact number of marbles it contained. You are allowed to shake and rattle the box, but you can't open it. The only other information you have is that the maximum number of marbles the box can hold is 100. Thus, you are being asked to make a judgment about a characteristic of the box (how many marbles it contains), and this characteristic may be represented by a scale with both a maximum and a minimum value (100 and 0, respectively). If the box actually contains 97 marbles you should be quite certain about your judgment. The box will be heavy and won't rattle much. If the box actually contains only 3 marbles you should again be quite certain about your judgment. The box will be light and will rattle loudly with very distinctive sounds. If, on the other hand, the box actually contains 50 marbles, you will probably be more uncertain about any judgment you make. The box will be somewhat heavy, but its weight relative to the weight of either a full or empty box is difficult to judge. Similarly, it will rattle a great deal, but it will be hard to say whether it rattles as would a box containing 40, 50, or 60 marbles.

As another example, suppose we ask the individuals from our earlier example to make a judgment about the happiness of the psychiatric patient. Happiness can be reasonably represented by a continuum ranging from very happy at one extreme to very sad at the other. It is likely that if the patient consistently exhibits either very euphoric or very sullen behavior, these individuals will be rather certain about their judgments of the patient's happiness. If, on the other hand, the patient exhibits behaviors indicating he is neither happy nor sad, or that he is happy some of the time and sad some of the time, these individuals will probably be somewhat uncertain about their judgments.

The rational here is that judgments about stimulus characteristics can be made only by making comparisons with some known standard or anchor point. Thus we often use a yardstick or ruler to measure length, a thermometer to measure temperature, and an ohmmeter to measure electrical resistance. When we use a bipolar scale quite often only the ends of the continuum provide clear anchor points. Therefore, if asked to report the number of marbles in a box or how happy or sad we think a psychiatric patient is, we immediately want to know about the anchor points: How many marbles can the box possibly hold, and how happy or sad can a person be. As the actual value of the characteristic in question approaches one of these anchor points, judgments about that value become easier to make, and consequently, one is likely to be more certain of the correctness of those judgments. As the actual value of the characteristic moves further and further from the anchor point, such judgments become more and more difficult to make, and one becomes more and more uncertain about them. Uncertainty will also increase as the anchor

points themselves become more and more uncertain. Figure 1 illustrates this proposed relationship between the actual value of a stimulus characteristic and uncertainty about judgments of that value.

Insert Figure 1 about here

This proposed relationship between judgment uncertainty and actual scale value is related to an interesting statistical phenomenon. Responses obtained on any scale will, in general, exhibit the greatest degree of variance when the mean response is in the center of the scale. As the mean approaches one of the extremes, a restriction in variability will be observed. Such a restriction is often considered as an annoyance, and as a source of measurement error to be avoided. It is argued here, however, that in some cases this restriction in variability will be an accurate reflection of the individual's phenomenological experience, and should be treated as such.

It is important to note that the relationship between uncertainty and the actual value of the stimulus characteristic described in Figure 1 holds only when the maximum and minimum value are the only clear anchor points on the scale. If there are other clearly defined anchor points, say for instance at the middle of the scale, the shape of the uncertainty curve will change. However, in every case uncertainty will be maximized at the point mid-way between any two clearly defined anchor points. We have restricted the discussion above to scales where the maximum and minimum values provide the only clear anchor points purely for convenience in presenting later sections of the paper.

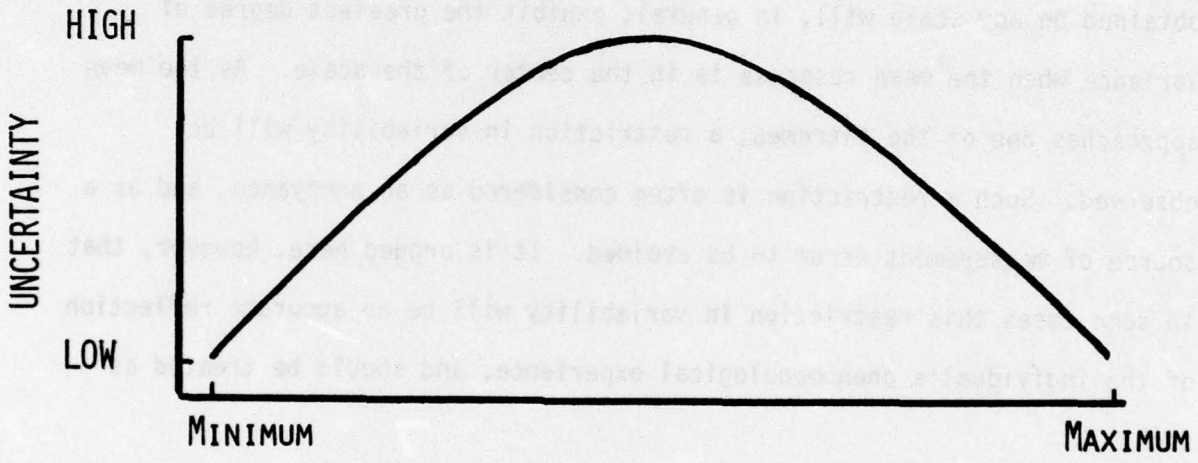


FIGURE 1. PREDICTED DEGREE OF UNCERTAINTY ABOUT JUDGMENTS OF STIMULUS CHARACTERISTIC VALUES AS A FUNCTION OF THE ACTUAL STIMULUS CHARACTERISTIC VALUE.

3. Uncertainty as a Motivator

It is proposed that uncertainty is a noxious state, and that the occurrence of uncertainty arouses the individual to seek information in an effort to reduce that uncertainty. Furthermore, the more important it is for the individual to maintain certainty the more aroused he/she will be to seek uncertainty-reducing information when uncertainty occurs.

This proposition suggests that uncertainty goads the individual to action. In this sense, the arousal brought on by uncertainty is akin to a Hullian drive (cf. Hull, 1943). Not only does this arousal energize behavior, but it also organizes and guides behavior toward the goal of uncertainty reduction. Unlike a Hullian drive, however, this arousal is not assumed to come from any sort of tissue deficit, but rather from a cognitive state. Furthermore, the reduction of this arousal is assumed to result from changes in one's cognitive state, not from any sort of consumatory climax.

A more useful way to conceptualize the arousal generated by uncertainty is in terms of effectance motivation. According to White (1959), "Effectance motivation must be conceived to involve satisfaction--a feeling of efficacy--in transactions in which behavior has an exploratory, varying, experimental characteristic and produces changes in the stimulus field" (p. 329). Thus, satisfaction arises from being able to manipulate and control one's environment. But how is control possible without understanding and certainty about contingencies in the environment? The "explor-

atory, varying, experimental characteristic" of the behaviors described by White serve two distinct functions: (1) to demonstrate one's effect upon the environment, and (2) to gain information about contingencies in the environment. It is likely that the satisfaction described by White (1959) arises from both functions. We argue that the arousal which occurs as a consequence of uncertainty results from the individual's effectance motivation.

A considerable amount of experimental evidence exists suggesting that uncertainty does indeed have arousal properties. No attempt will be made to summarize all of this literature here. A few examples will suffice.

a. Uncertainty about opinion and abilities. Festinger (1954) formulated a theory of social comparison, proposing that "There exists, in the human organism, a drive to evaluate his opinions and his abilities" (hypothesis 1, p. 117). Re-phrased in terms of the present discussion, Festinger proposed that when individuals are uncertain about the correctness of their opinions or about how much ability they have, they will be motivated to seek information regarding their opinions and abilities, and thus reduce their uncertainty. If objective standards are not available for this evaluation, Festinger hypothesized that other people will be used as a standard of comparison.

A number of experimental investigations have demonstrated that individuals are indeed motivated to evaluate their opinions and abilities and thereby reduce their uncertainty. Brickman and Berman (1971), for example, gave students erroneous feedback about their performance on a psychology course exam. They found that students who initially expected to do well on the exam, and who were then told that they had in fact done poorly, expressed more desire to compare their performance with the performance of other class members than similar students whose expectancies were not violated. Presumably, violating expectancies about performance increased uncertainty about ability, and this increased uncertainty motivated the students to search for uncertainty-reducing information. Radloff (1961) asked students to give their opinions on a matter dealing with financing college education. Some students were then given the opportunity to see a bogus distribution of opinions given by other individuals on the issue, while some students were not. Radloff found that students who were not given information about the distribution of opinions, and who were thus more uncertain about their opinion vis-a-vis the opinion of others, expressed more desire to join a discussion group concerning the issue than did students who were given the information about the distribution of opinions of others. Finally, in a rather intriguing study, Wilson (1963) found that the opportunity to compare one's performance with the average performance of a peer group actually served as a positive incentive, even when the comparison was private. Subjects promised the opportunity to evaluate their performance against the average performance of a peer group tended to do better on the performance task than those not offered this opportunity.

b. Uncertainty about emotional states. Schachter (1959, 1964) expanded upon Festinger's original social comparison idea, applying it to uncertainty about one's emotional states. He developed a two-factor theory of emotion, hypothesizing that an emotion depends upon both non-specific arousal and upon contextual cues that indicate the sources of that arousal. Schachter hypothesized that individuals will seek information from other people in order to reduce uncertainty in the labeling process when contextual cues for labeling the source of arousal are not inherent in the environment itself.

Evidence from a number of experimental studies supports this theory. Schachter and Singer (1962), for example, injected subjects with the drug epinepherine. Some of the subjects were told that the injection would result in the kind of physiological arousal generally associated with emotionality. Others were not told of these effects. A third group of subjects were given no injection at all. The subjects were then asked to wait in a room with an experimental confederate who behaved either in a very euphoric manner or in a very angry manner. When the subjects were aroused by the injection, but were not told of the effects the injection would have, they tended to interpret their arousal in terms of the confederate's behavior: When the confederate was happy they felt happy, and when the confederate was angry, they felt angry. These effects were observed in neither of the other experimental groups. Thus, when the subjects were uncertain about the source of their physiological arousal they sought information from the confederate to help them understand what they felt. A study by Gerard (1963) can be understood in a similar light. He threatened groups of same-sex subjects with electric shock and then gave them either certain or less-certain information about the level of emotionality they were experiencing. Although skin conductance

indicated no actual arousal differences between the subjects with certain information and those with less-certain information, the less-certain subjects expressed a stronger desire to be with the other individuals in their group rather than being alone while waiting for the shock. Presumably, the less-certain subjects hoped to better evaluate their emotionality by comparisons with other persons in the group.

4. Summary

In the foregoing pages we have defined uncertainty, described the relationship between uncertainty and judgments about characteristics that can be represented by bipolar scales, and described uncertainty as a motivational concept. These points are summarized in Table 1.

Insert Table 1 about here

B. Uncertainty About Control over Outcomes

From the foregoing discussion it seems quite reasonable to postulate that uncertainty has a motivational quality which causes people to seek uncertainty-reducing information. The type of information gathered, however, as well as the way it is gathered, will depend upon the particular referent of uncertainty. One may be uncertain about many aspects of life. Each of these require a different type of information, and many require different methods of gathering this information if uncertainty is to be reduced. In this paper we are concerned with uncertainty about outcomes, and most particularly with uncertainty about control over outcomes. Before proceeding to a discussion of uncertainty about control over outcomes however, it will be helpful to first define exactly what we mean by control.

Table 1

A Summary of Major Concepts Concerning Uncertainty

Definition:

Uncertainty is the degree to which people are unable to make precise judgments about some characteristic of a given entity, situation, relationship, or event. The less precise one's judgment, the more uncertain one is about the characteristic in question.

It is proposed that . . .

(1) When making judgments about characteristics that can reasonably be represented by a continuum with a maximum value at one end and a minimum value at the other, individuals will in general be most uncertain about their judgments when the actual value of the characteristic in question falls in the middle of the scale, and will be least uncertain when the actual value falls at either end of the scale.

(2) Uncertainty is a noxious state. It arouses the individual to seek information in an effort to reduce that uncertainty. The more important it is for the individual to maintain certainty, the more aroused he/she will be to seek uncertainty-reducing information when uncertainty occurs.

1. A Definition of Control

Control is defined as the degree of contingency between behavior and outcomes.

Unlike our definition of uncertainty, the above definition of control does not refer to a subjective state. Rather, it refers to objective reality, the actual degree of contingency that exists. This definition is similar to what Averill (1973) terms a stimulus modification type of behavioral control. It is prefered to other definitions of control which have been proposed in the literature (see Averill, 1973) for two reasons: First, it seems to best fit our intuitive understanding of what control is, and second, other definitions, particularly the various operational definitions found in the experimental literature, appear to be little more than descriptions of factors which either directly affect the degree of contingency between behaviors and outcomes, or affect one's perceptions of those contingencies. Haggard (1943) and Pervin (1963), for example, operationally defined control and lack-of-control by either having subjects administer aversive outcomes (shocks) to themselves, or having the experimenter administer the outcomes, with subjects in the former condition assumed to have the greater degree of control. This manipulation in no way altered the degree of contingency between behavior and outcomes, since the shocks were not contingent upon the subjects' behavior in either condition. The manipulation may have altered the subjects' perception of the contingencies, however. Perhaps the subjects felt more freedom not-to-receive the shocks when they were self-administered (cf. Langer, 1975).

As the definition above implies, the contingency between behavior and outcomes need not be considered a dichotomous variable. This contingency

may vary to a considerable extent, from a high degree of contingency, to only a moderate degree of contingency, to no contingency at all. These various degrees of contingency can be operationalized in a number of ways. Consider, for example, the reinforcement theorist's notion of a fixed-ratio (FR) schedule of reinforcement. It seems reasonable to describe a fixed ratio schedule, no matter what the ratio, as a situation in which the organism has virtually perfect control over the outcomes it receives, since the outcomes are totally contingent upon its behavior.[3] An interval schedule (IR), on the other hand, is a good example of a situation in which the organism has little or no control over its outcomes, since the occurrence of the reinforcer is contingent upon temporal events rather than upon behavior. Variable ratio (VR) schedules may be thought of as situations with intermediate degrees of control, since reinforcement is contingent partially upon the organism's behavior and partially upon the randomness inherent in the schedule itself.

As another example, imagine a situation in which an individual can emit one of two responses, say A and B. Suppose that every time A occurs the individual gets a reward. This is a fixed ratio schedule (FR-1), and thus represents an example of perfect, or 100% control. Now, imagine that there is a second individual who also can emit A and B, and that in order for the first individual to get his/her reward both individuals must emit response A. If the first individual has no influence upon the behavior of the second, that is, if the responses of the second individual are independent of the first, then we might conclude that the addition of the second individual reduced the control of the first to 50%, since the first individual can emit only half of the behaviors upon which his/her reward is contingent. If we

add a third individual whose responses are independent of the first two, the first individual's control can be thought of as being reduced to 33%, and so on. In these latter situations, the first individual's control over his/her rewards may be greater than 50% and 33%, respectively, if he/she can influence the behavior of the other two persons, say by persuasion.

As a third example of how various degrees of control might be operationalized, consider the amount of time outcomes are contingent upon behavior. Imagine that 85% of the time an individual's outcomes are completely contingent upon his/her behavior, while during the remaining 15% of the time there is no contingency between behavior and outcomes. In such a situation we might say that the individual has an average of 85% control over his/her outcomes. Similarly, if the percentage of time outcomes are contingent upon behavior is reduced to 50%, we may say that the individual's average control over his/her outcomes has been reduced to 50%. Notice that in this example, as well as in the other two above, the notion of control summarizes a relationship extending over both time and occasions. It is difficult to speak of control when the behavior and outcomes in question occur but once. The concept of control becomes meaningful only when it is used to summarize the degree of contingency between behavior and outcomes over repeated occurrences of both.

It is implicit in the foregoing that one's degree of control can change. Thus, as one gains ability, experience, influence, etc., one's sphere of control expands. One can also lose control by losing ability and influence, and by losing the resources with which to obtain outcomes. Many forces external to the individual may also be responsible for changing one's degree

of control. The number of other individuals upon whose behavior one's outcomes depend, for example, may either increase or decrease. The costs associated with obtaining particular outcomes also may either increase or decrease. All of these can affect the degree of contingency between an individual's behavior and the outcomes he/she receives.

Finally, one's degree of control should not be confused with the probability of obtaining an outcome. Control is the degree of contingency between behavior and outcomes. If outcomes are not contingent upon one's behavior this does not mean that they will not occur, it simple means that there is nothing one can do to cause them to occur. Certainly there is nothing I can do to make the tide go out, yet the probability that the tide will indeed go out is very high. Thus it is highly likely that I will be able to obtain the crabs and clams available at low tide, even though I have no control over the tides. Conversely, if outcomes are completely contingent upon one's behavior this does not mean that they will occur, since for the outcome to occur the appropriate behavior must be emitted. The satiated laboratory rat on a fixed-ratio schedule is under complete control of its food rewards, yet as long as it is satiated there is a rather low probability that it will receive this reward.

2. Judgments About Control

In an earlier section of this paper we proposed that when judgments are made about stimulus characteristics that can be represented by bipolar scales, individuals will be most uncertain about their judgments when the actual value of the characteristic in question falls in the middle of the scale, and they will be least uncertain about their judgments when the actual value falls at either end of the scale. Control is just such a characteristic. It summarizes the relationship between behavior and outcomes, and can reasonably be represented

by a bipolar scale, with 100% control at one extreme and 0% control at the other. Thus, our uncertainty about judgments concerning control over specific outcomes should follow this same pattern. If for example, every time we emit behavior A a reward follows, we should be able to say with a good deal of confidence that we have a high degree of control over receiving this reward. If on the other hand, the reward occurred totally independently of our behavior, we should be rather certain in saying that we had very little control. If, however, A is followed by the reward on some occasions but not on others, we should be less certain about any judgment concerning control. Thus, it is proposed that individuals will be most uncertain about their degree of control over particular outcomes when their actual control approaches 50%, and will be least uncertain when it approaches either 0% or 100%. This relationship is expressed graphically in Figure 2.

Insert Figure 2 about here

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3. Responses to Uncertainty About Control

It was also proposed in an earlier section of this paper that uncertainty will motivate individuals to seek uncertainty-reducing information. It is thus predicted that when individuals are uncertain about their degree of control over outcomes they will be motivated to seek information regarding their control. The greater their degree of uncertainty, the greater will be their motivation.

There are two ways in which one can gain information about one's degree of control over outcomes. The first method is to simply ask someone who is likely to know. Thus, the new employee may seek information from his/her boss or fellow employees concerning the degree of contingency between productivity and pay. Quite frequently, however, there will be no one who can

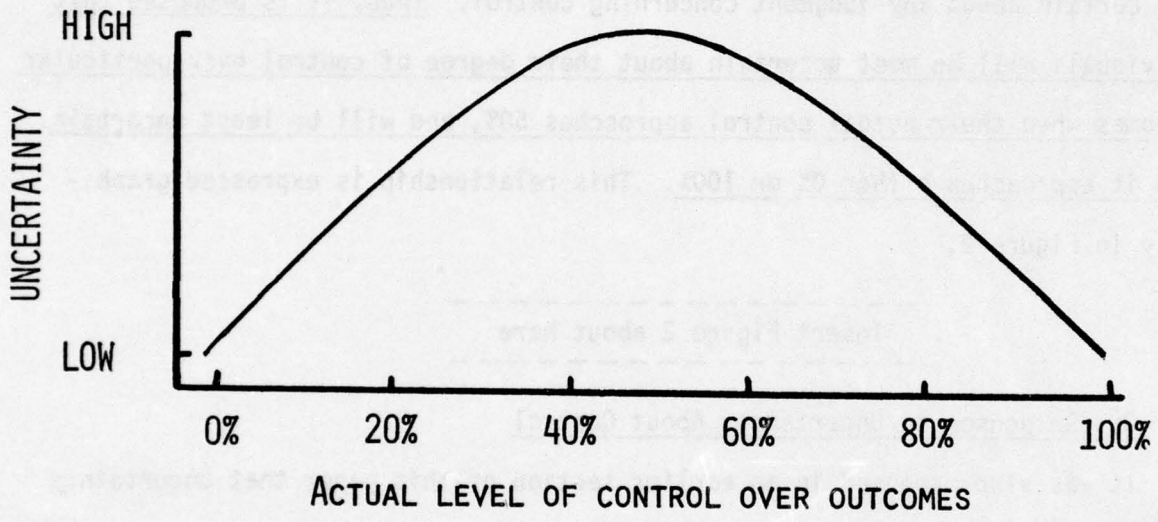


FIGURE 2. PREDICTED DEGREE OF UNCERTAINTY ABOUT THE DEGREE OF ONE'S CONTROL OVER OUTCOMES AS A FUNCTION OF ONE'S ACTUAL LEVEL OF CONTROL OVER OUTCOMES.

accurately tell us what we want to know, and thus we are left to discover the contingencies by observing the consequences of our behavior. That is, we may learn about how much control we have by observing instances of that control. If one has total control over a given outcome, then that outcome can be made to either occur or not-occur at will. We will refer to these two events as positive and negative instances of control, respectively. Both events will result from outcome-oriented behavior, and both may be taken as a demonstration of control. The non-occurrence of the outcome, however, is not likely to be a very convincing demonstration of one's control, since such a negative instance may also result from lack of control. On the other hand, behavior followed immediately by the outcome is rather unlikely to occur when one has no control. Repeated demonstrations of such positive instances of control provide even more conclusive evidence against a lack of control. Thus, it is predicted that when outside sources of information are unavailable, individuals will attempt to reduce their uncertainty about their level of control by trying to demonstrate positive instances of that control. The greater their uncertainty about their control, the more effort they will exert in trying to demonstrate positive instances of that control.

As an example, imagine a young female employee who has come to work for the first time. After receiving initial instructions on what she is to do, she wonders just how much attention her boss will give her, and whether this attention is contingent upon the quality of her work. Surely there must be some degree of contingency, but since all employers are not equally sensitive to the quality of their employees work the exact degree of contingency is highly uncertain. In this case her boss may be an unreliable source of information. It is likely that her fellow employees will also be an un-

satisfactory source of information, since employers are often sensitive to the quality of some employees' work but not others. Thus, she is left to discover the degree of contingency between the quality of her work and her boss's attention by actually observing the consequences of her behavior. It is predicted that she will attempt to produce a specific quality level of work and then observe whether or not she receives attention for that work. If, for example, she is praised for high quality work she can tentatively assume a rather high degree of control over this outcome. She will become more certain of her control if on subsequent occasions high quality work is again followed by praise. If, on the other hand, her high quality work is not followed by praise, she will probably assume a rather low degree of control. Subsequent occurrences of high quality work followed by no praise will confirm this assumption. If after several trials her high quality work is sometimes followed by praise and sometimes not, she may assume an intermediate level of control. It is likely, however, that because this intermediate level of control is more difficult to evaluate, she will continue to spend a considerable amount of time and effort in making this evaluation. Her level of control will also be more difficult to evaluate the longer the delay between when she produces the work and when her boss gives her attention. This too should cause her to spend more time and effort in evaluating her control.

The strategy proposed here is consistent with data presented by Jenkins and Ward (1965). These authors found that subjects' judgments of the degree of contingency between two events was based primarily upon the number of positive instances of contingency rather than upon the actual degree of contingency. That is, they found that subjects would judge B to be

contingent upon A when B followed A, even though B also occurred in the absence of A, and A was often not followed by B. Apparently, when making judgments about contingency these subjects relied on positive instances even more than they should have.

It will also be noted that our argument for evaluating one's actual level of control by relying upon positive instances of control rather than upon negative instances of control is similar to the experimentor's reasoning for never accepting the null hypothesis. In any experiment one never accepts the null hypothesis if the findings are not significant, one simply fails to reject it. This is because the lack of significant between-condition differences could be due either to a true lack of differences, or to a failure of the experiment to detect differences that do exist. Similarly, if one attempts to produce the non-occurrence of an outcome, and in fact the outcome does not occur, it could be due either to one's control or to one's lack of control, and it is impossible to tell which.

a. Motivation to reduce uncertainty at different levels of control. We have just argued that individuals will tend to be more motivated to seek information about their level of control the more uncertain they are about their actual level of control. Based on our earlier proposition concerning the relationship between uncertainty about control and actual level of control (see Figure 2), we now propose that this motivation will be greatest when one's actual level of control approaches 50%, and will be least when one's actual level of control approaches either 0% or 100%. This prediction is expressed graphically in Figure 3.

Insert Figure 3 about here

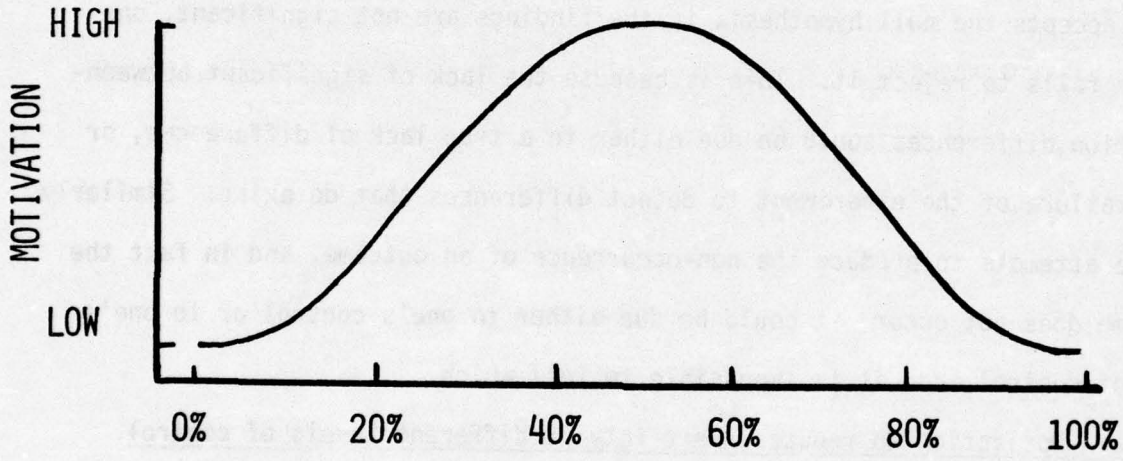


FIGURE 3. PREDICTED DEGREE OF MOTIVATION TO REDUCE UNCERTAINTY ABOUT CONTROL OVER OUTCOMES AS A FUNCTION OF ONE'S ACTUAL LEVEL OF CONTROL OVER OUTCOMES.

As can be seen, the general shape of the motivation curve in Figure 3 is similar to the shape of the uncertainty curve in Figure 2. Since one's uncertainty about control is predicted to be greatest at intermediate levels of control, one's motivation to reduce this uncertainty should also be greatest at intermediate levels of control. Of course, the magnitude of this motivation will also be a function of the importance of maintaining certainty; the more important it is to maintain certainty about one's control, the more motivated one should be to reduce uncertainty about one's control. Thus, Figure 3 actually represents one of a family of curves, each with a local maximum (the highest point on the curve) at 50% control, but with the exact value of the maximum being dependent upon the importance of maintaining certainty about control.

A slight difference between the curves in Figures 2 and 3 occurs at the two extremes of the control continuum. It is expected that individuals will have a certain tolerance for uncertainty. Thus, although uncertainty about control will tend to increase as soon as one's actual level of control departs from either 0% or 100%, individuals will probably not be motivated to reduce this uncertainty until it exceeds a certain tolerance level.

Two important points should be made clear here. First, at the theoretical level uncertainty about control and one's actual level of control are independent concepts, and they may be treated as such in an experimental design (e.g., Pervin, 1963; Staub, Tursley, & Schwartz, 1971). Control is the degree of contingency between behavior and outcomes, while uncertainty

is the degree to which one is unable to make precise judgments about control. At any level of control one may be more or less certain about that level of control. However, it is proposed here that in most everyday situations a curvilinear relationship exists between these two variables. Thus, in many instances the level of control may be seen as providing the stimulus conditions for the observed level of uncertainty.

Second, we are concerned here with a motive to reduce uncertainty about control, not with a motive to seek control. While a discussion of a motive to seek control over outcomes is beyond the scope of this paper, it is worth noting that the experimental literature regarding the existance of this motive is full of ambiguities and contradictory evidence. The interested reader is referred to literature reviews by Averill (1973) and by Miller and Ross (1975).

b. Changes in effort following a change in control. What sort of changes in effort will an individual exhibit following a change in control? The answer to this question depends upon the initial level of control the individual had prior to the change, and the level of control he/she has after the change. If, for example, one's control changes from either 0% or 100% to 50%, an increase in one's motivation to reduce uncertainty is predicted, since uncertainty about control is expected to increase (see Figure 3). If outside sources of information are unavailable, individuals should thus exert more effort toward demonstrating positive instances of their control in order to reduce uncertainty about control. If, on the other hand, one's control changes from 50% to either 0% or 100%,

one's motivation to reduce uncertainty is expected to be at a relatively stable high level prior to the change, since 50% control generates a comparatively high degree of uncertainty which should be difficult to reduce. After the change, however, control will be much easier to evaluate, and once the individual is certain about his/her control, efforts to demonstrate positive instances of control in order to reduce uncertainty should fall off almost completely. Finally, if one's control changes from one point, say 25%, to another point that aroused the same degree of uncertainty, say 75%, there should be no change in outcome-related effort, since no change in uncertainty has occurred.

Although it is a risky business to postulate the operation of cognitive variables such as uncertainty in organisms other than man,[4] it is interesting to note that research results from animal studies are consistent with the predictions made here. It is a well-established finding, for example, that animals which have learned a response on a fixed-ratio schedule of reinforcement will show an immediate increase in response rate when the schedule is interupted (e.g., Skinner, 1938). As mentioned earlier, such a schedule puts the organism in complete control of its rewards. When this control is interupted the animal may become uncertain about the degree of contingency between its behavior and outcomes, and thus increases its response rate to obtain uncertainty-reducing information. Of course, the animal quickly learns that there is nothing it can do to obtain the outcome it desires (control is 0%), and thus response rate drops off. In a similar vein, it has also been shown that when an interval schedule of

reinforcement is interupted response rate increases (e.g., Stadder & Innis, 1966, 1969). As previously described, an interval schedule is one which allows the animal no control, since reinforcement is not contingent upon behavior but upon time. Here too, however, a termination of the schedule might be supposed to produce uncertainty about the reinforcement contingencies. The increased response rate might then be seen as an attempt to determine whether control has shifted to the animal's behavior. We wish to re-emphasize the speculative nature of these interpretations. They are included here only as suggestive evidence in support of the predicted changes in effort individuals should exhibit following a change in control over outcomes. More substantial evidence consistent with these predictions will be mentioned in later sections of this paper when the relationship between the present theory and several other psychological theories are discussed.

c. Moderator variables. As a final note, we wish to mention several variables which may moderate the relationships predicted above. One such variable, importance, has already been mentioned. The amount of motivation individuals will exhibit to seek uncertainty-reducing information is likely to depend in part upon the importance of maintaining certainty about control. The more important it is to maintain certainty about control, the more motivated individuals should be to attain uncertainty-reducing information when uncertainty occurs.

Two personality variables may also affect individuals' motivation to attain uncertainty-reducing information. Tolerance for uncertainty is one of these variables. It was mentioned previously that individuals are likely

to have a degree of tolerance for uncertainty, and that they will probably be motivated to reduce uncertainty only if the level of this uncertainty is above the tolerance level. It is likely, however, that this tolerance level is not the same for all people. Thus, it is predicted that the greater the individual's tolerance for uncertainty, the less will be his/her motivation to reduce that uncertainty.

The second personality variable that is likely to affect individuals' motivation to attain uncertainty-reducing information is one's generalized expectancy for internal versus external locus of control. A considerable amount of evidence exists suggesting that individuals differ in the extent to which they expect to be able to exert control in their lives (e.g., Rotter, 1966). It is predicted that individuals who generally expect to have a lot of control in their lives will show a local maximum on the motivation curve (see Figure 3) somewhat below 50%, while those who generally expect to have little control in their lives will show a local maximum somewhat above 50%. These predictions are based upon the notion that individuals will be most uncertain about their control when their actual level of control in a given situation is inconsistent with their generalized expectancies for control.

4. Summary

In the foregoing discussion we have defined control, described the relationship between uncertainty about control and actual degree of control, and described responses to uncertainty about control. The important concepts from this discussion are summarized in Table 2.

Insert Table 2 about here

Table 2

A Summary of Major Concepts Concerning Uncertainty About Control

Definition:

Control is the degree of contingency between behavior and outcomes.

It is proposed that . . .

(1) Individuals will be most uncertain about their degree of control over particular outcomes when their actual control approaches 50%, and will be least uncertain when it approaches either 0% or 100%.

(2) When individuals are uncertain about their degree of control over outcomes they will be motivated to seek information regarding their control. The greater their degree of uncertainty the greater will be their motivation.

(3) The motivation to reduce uncertainty about control will be greatest when one's actual level of control approaches 50%, and will be least when one's actual level of control approaches either 0% or 100%.

(4) When outside sources of information are unavailable, individuals will attempt to reduce their uncertainty about their level of control by trying to demonstrate positive instances of that control. The greater their uncertainty about control, the more effort they will exert in trying to demonstrate positive instances of that control.

III. The Relationship Between Uncertainty Theory and Several Other Theories in Psychology

As a way of demonstrating the generality of the proposed theory based on uncertainty, and to show its capacity to explain a wide variety of extant data, the relationship between Uncertainty Theory and several other psychological theories will be discussed. We will begin with a discussion of Decision Theory. Decision theorists have long sought to provide normative models for making rational decisions in an uncertain world. A discussion of Decision Theory thus provides a historical context for our present definition and use of the term uncertainty. Atkinson's Theory of Achievement Motivation is discussed next. Atkinson's theory makes specific predictions concerning the amount of effort individuals should exert under different levels of control in achievement-related situations. In some cases these predictions are the same as those made by the present theory, while in other cases they are different. It is argued that the empirical evidence supporting Atkinson's Theory can also be explained by the present theory, and that the present theory has more generality than Atkinson's Theory because it makes specific predictions about behavior in situations other than those with an achievement orientation. Brehm's Theory of Psychological Reactance is also discussed. Reactance Theory makes predictions about changes in effort when control is decreased. Again, in some cases these predictions are the same as those made by Uncertainty Theory, and in other cases they are different. It is suggested that Reactance Theory has only been tested in situations where both theories make the same predictions, and that new situations where the two theories make divergent predictions must be utilized to test between

them. Finally, some of the learned helplessness research is reviewed. The experimental evidence for the learned helplessness phenomenon, as well as the explanation used to account for this phenomenon, are shown to be consistent with the present theory of uncertainty.

We would like to point out here that we are in no way trying to supplant or explain away these other theories. We are simply trying to demonstrate the usefulness of the present theory for explaining empirical findings. Other processes, particularly the achievement motive proposed by Atkinson and the reactance motive proposed by Brehm, may indeed be powerful determinants of behavior. As we will argue, however, these motives are quite often not the only way to explain the experimental findings.

A. Decision Theory

It is appropriate to begin our discussion of the relationship between Uncertainty Theory and other psychological theories with a review of some of the basic concepts of Decision Theory, for decision theorists have long been concerned with decision processes under conditions of uncertainty. Decision Theory does not actually refer to a single theory, but rather to a group of theories all concerned with the process of decision making. In general, these are normative theories, in that they propose models describing how decisions "ought to be made" under various conditions of uncertainty if one is to generate optimal solutions. We will begin our review by describing the classic Decision Theory distinctions concerning the various states of knowledge uncer which decisions can be made. We will next briefly review three of the most widely researched Decision Theory models. Then some empirical evidence will be discussed that demonstrates the inability of these models to deal with uncertainty as it is defined in the present paper. Finally, we will conclude this

section by proposing a modification of these models which will enable them to better accommodate the proposed uncertainty dimension.

1. Certainty, Risk, and Ignorance

Decision theorists usually divide the various states of knowledge under which decisions can be made into three broad categories: certainty, risk, and ignorance (cf. Coombs, Dawes & Tversky, 1970). Certainty refers to a situation in which the decision maker knows for sure the consequences of each possible choice alternative. That is, the outcomes associated with each choice alternative have 100% chance of occurring given that the alternative is selected, and this fact is known by the decision maker. In effect, under conditions of certainty the decision maker actually chooses among the various outcomes themselves. Imagine, for example, a highly reliable vending machine with ten buttons, each button associated with a different type of candy bar. After inserting his/her money, the decision maker must choose one button to push. Since there is virtually a 100% chance of receiving any one of the candy bars given that the appropriate button is pushed, the decision maker can be thought of as making his/her choice under conditions of certainty.

Situations such as the one described above are actually very rare. Seldom will an individual be placed in a situation where there is no doubt about the consequences of a decision. Even vending machines occasionally break down or become empty, and thus the probability that a given outcome will occur as a consequence of opting for a particular choice alternative is usually less than 100%. When this probability is less than 100%, but is still known by the decision maker, he/she makes a decision under conditions of what Knight (1921) referred to as measurable uncertainty, or risk. Suppose, for example, that two fair dice are tossed and our decision maker is asked to wager on the outcome of the toss. In this situation, the decision maker must act under conditions of risk,

since the chance that any given outcome will occur is less than 100% and is known. The probability of the outcome being a 7, for example, is known to be 1/6. Of course, the actual probability that a particular outcome will follow from a given choice alternative may take on any value. In order for a situation to be defined as a risk situation this value must simply be less than 100% and be known to the decision maker.

But what if the decision maker does not know the probability that a given outcome will follow as a consequence of selecting a particular choice alternative? This is referred to as a situation of total ignroance, and the individual will have no rational basis at all upon which to make his/her decision. Suppose, for example, that our decision maker arrives late at the race track and the first race is about to begin. He/she wants to place a bet but has no idea of the odds on the different horses or which is the favorite. How does he/she choose? Perhaps he/she will select "lucky Number 7" and bet $2 to win. The point is that the choice is made in total ignorance, since neither the probability of winning nor the amount to be won is known.

Like decisions made under conditions of certainty, decisions made under conditions that can be classified as either pure risk or pure ignorance are probably rather rare. Usually we know something about the probable consequences of various choice alternatives, although we may not know enough about these consequences to make precise probability estimates. Despite this, decision theorists have generally restricted their concern to decisions under conditions where such probability estimates are possible, that is, conditions of risk, ignoring the fact that the distinction between conditions of risk and conditions of ignorance is one of degree rather than kind.

2. Expected Value Models for Decisions Under Conditions of Risk

Of the various models dealing with decisions under conditions of risk, expected value models have received by far the greatest attention. Stated simply, these models assume that in any choice situation a number can be assigned to each possible alternative that describes the long-run value of that alternative. This number is referred to as the expected value (EV) of the alternative, and can be determined by summing all the values of the possible outcomes resulting from the alternative, each weighted by the probability of the outcome's occurrence. Thus,

$$EV = \sum_{i=1}^{n} p_i v_i \qquad (1)$$

where p_i is the probability of the i^{th} outcome occurring, and v_i is the value of that outcome. According to the EV model, individuals should choose the one alternative with the highest (or lowest negative) expected value.

Let us take an example. Suppose we want to place a $2 bet on one of three horses at the race track. Suppose further that the horses will pay $10, $20, and $30 respectively, if they win, and that the probabilities of them winning are 90%, 40%, and 20%, respectively. In this case the EV's for each horse are .9 x $10 = 9, .4 x $20 = 8, and .2 x $30 = 6, respectively. The expected value model thus predicts that the first horse is our best bet.

It is clear, of course, that people do not adhere to the EV principle, for if they did gambling establishments, which thrive upon individuals' preference for unfavorable odds, would soon go broke. Realizing this, Bernoulli (1738) proposed that people do not choose the alternative with the highest expected value, but rather the one with the highest expected utility (EU). Expected utility is defined as

$$EV = \sum_{i=1}^{n} p_i U_i \qquad (2)$$

where p_i is again the probability of the i^{th} outcome occurring, and U_i is the utility, or subjective value of that outcome. Thus, the EU model differs from the EV model in that subjective value (U_i) is substituted for objective value (v_i).

The EU model holds a distinct advantage over the EV model, in that it allows one to assess the value of outcomes not readily quantifiable on an objective dimension. In our example above, imagine that the excitement of winning is an important outcome. The EV model could not take such an outcome into consideration, since excitement cannot be scaled on any objective dimension. The utility, or subjective value of excitement can be scaled however. Let us suppose that the excitement arising from winning a gamble is inversely proportional to the probability of winning. For the three horses above the utility of excitement from winning would thus be 10, 60, and 80, respectively. Assuming that the utility and value of money are in close accord, the resultant EU's for betting on the three horses would be (.9 x 10) + (.9 x \$10) = 18, (.4 x 60) + (.4 x \$20) = 32, and (.2 x 80) + (.2 x \$30) = 22, respectively.[5] Thus, when both excitement and money are considered, the first horse is no longer the best bet, and in fact, it becomes the worst bet.

If it is reasonable to assume that U_i in equation (2) above should be substituted for v_i, it is equally reasonable that P_i, or the subjective probability of the outcome occurring should be substituted for p_i, the objective probability of the outcome occurring. This second substitution results in a model referred to as the subjective expected utility (SEU) model, and is defined as

$$SEU = \sum_{i=1}^{n} P_i U_i \qquad (3)$$

where P_i is the subjective probability of the i^{th} outcome occurring, and U_i is the subjective value of that outcome.

Imagine, for example, that while we are confident that the probabilities of each horse winning in our earlier examples are as previously stated, a friend does not agree. Rather, she believes that the third horse actually has a 35% chance of winning. Calculating our friend's SEU's for the three horses, they are 18, 32, and 33.25, respectively. The third horse is thus her best bet.

3. When Prophecy Fails

It is not our purpose here to judge the adequacy of the various expected value models for predicting individual choice behavior under conditions of risk. The interested reader is referred to any number of excellent reviews for this purpose (e.g., Becker & McClintock, 1967; Luce & Suppes, 1965; Peterson & Beach, 1967; Rapoport & Wallsten, 1972). Rather, we wish to point out the limited generalizability of these models to situations other than those involving pure risk. Several examples, one involving previously unreported data, will serve to illustrate.

a. Ellsberg's paradox. Imagine yourself as a subject in the following hypothetical experiment. Two urns are placed side by side in front of you. In the first urn there are 50 red and 50 black balls. In the second urn there are 100 red and black balls, but the proportion of red-to-black is completely unknown. As the subject you are asked to make four $1 gambles, with a $100 prize at stake in each:

(1) If a ball is drawn from urn 1 do you prefer to wager that is is red or that it is black?

(2) If a ball is drawn from urn 2 to you prefer to wager that it is red or that it is black?

(3) If a red ball is drawn to you prefer to wager that it comes from urn 1 or urn 2?

(4) If a black ball is drawn to you prefer to wager that it comes from urn 1 or urn 2?

The SEU[6] model predicts that individuals should be indifferent to the first two gambles, because the subjective probabilities and utilities of the outcomes in both gambles are equal. The utility of winning $100 is the same, whether the money is won based on wagering red or wagering black. The probabilities of the outcomes in both gambles are also the same; p(red from urn 1) = p(black from urn 1) = p(red from urn 2) = p(black from urn 2) = .50. This is true in the case of urn 1 because the proportion of red to black is known to be 1/1. It is true in urn 2, on the other hand, because there is no evidence that the probability should be higher or lower, that is, with no information about the probabilities the best assumption is that they are .50.

Ellsberg (1961) actually conducted this experiment, and found that subjects indeed had no preference in the first two gambles. They showed no color perference for balls drawn from either urn. This finding is consistent with the SEU model predictions.

For exactly the same reasons as stated above, the SEU model also predicts indifference in the second two gambles, since again all of the subjective probabilities and utilities are equal. Ellsberg found, however, that subjects show a strong preference for wagers involving urn 1. Subjects prefer to wager both that the red (gamble 3) and black (gamble 4) balls came from urn 1. It thus would seem that individuals prefer to wager on situations where the

probability of winning is known over situations where the probability of winning is unknown, even when the SEU's for the two situations are identical. Clearly, this is inconsistent with the SEU model predictions.

b. Risk, ignorance and uncertainty. The decision situations embodied in Ellsberg's two urns represent situations of risk and ignorance, respectively. As argued earlier, these two conditions are rather rare in real-world settings, and, in fact, most decision situations usually fall between these extremes. That is, we typically know at least something about the probable consequences of various choice alternatives, although we may not know enough to make precise probability estimates. According to our definition of uncertainty given in an earlier section of this paper, this continuum of information about the probable consequences of various choice alternatives, ranging from risk at one extreme to ignorance at the other, represents a dimension of uncertainty about these consequences. Maximum uncertainty is analogous to ignorance, while minimum uncertainty is the same as risk. Note that by defining uncertainty in this way we eliminate the need for the classic decision theory distinction between certainty and risk. Certainty is just a special case of risk, one in which P_i = 100%. Note also that the findings presented by Ellsberg (1961) are in perfect accord with our proposition stated earlier that uncertainty is a noxious state that will be avoided if at all possible. Bets involving risk are preferred to those involving ignorance because ignorance is a more uncertain state than risk.

Becker and Brownson (1964) have shown that this general preference for certainty over uncertainty also extends to intermediate levels of uncertainty. They presented subjects with five urns, each containing 100 red and black balls. The subjects were told that the first urn contained 50 red and 50

black balls, while they were told nothing about the red-to-black ratio in the second urn. The first two urns are thus the same as those used in Ellsberg's (1961) experiment. The subjects were then told that the minimum number of red balls in the third, fourth, and fifth urns was 15, 25, and 40, respectively, and that the maximum number of red balls in these three urns was 85, 75, and 60, respectively. The third, fourth and fifth urns thus represented situations of decreasing uncertainty, since the range of possible red-to-black ratios decreased. Each of the latter four urns was then paired with the first urn, and the subjects were asked to make a small wager (up to 50¢): If a red ball was drawn, would they prefer to bet that it came from urn 1 or from the alternative urn, and how much would they bet. In all of the wagers the subjects stood to win $1. Here again the SEU model suggests that the subjects should be indifferent in all such wagers, since all the subjective probabilities and utilities were equal. However, the authors found that not only did subjects generally prefer to wager on the risk urn (urn 1) over any of the others, but also that the amount of money they were willing to wager on urn 1 increased as the red-to-black ratio in the alternative urn became more uncertain, that is, as the range of possible red-to-black ratios in the alternative urn increased.

A study conducted by the present authors also suggests that this preference for certainty over uncertainty generalizes to more real-life settings involving larger utilities and probabilities other than 50%. Fifty-seven introductory psychology students were asked to state their preferences for four different working conditions in a future psychology experiment. This future experiment was described as investigating stress and fatigue factors associated with errors in monitoring aircraft and spacecraft tracking

instrumentation and subsequent ground control guidance errors. The students were told that participants for this 3 1/2 hour experiment would be sought later in the quarter, that all participants would receive psychology course credit, and that all participants would have an opportunity to earn $15 in the study, provided their performance exceeded a minimum criterion level. Four experimental working conditions were then described, and the subjects were asked to indicate their preference for each. The four working conditions were:

(1) Work alone with exactly a 60% chance of receiving $15 in the study.

(2) Work alone, but with an unknown chance of receiving $15 in the study. The exact chance of receiving the money would be different for each different participant, would not be less than 40% nor greater than 80% and the average chance over all participants would be about 60%.

(3) Work in a three-person same-sex group with exactly a 60% chance of receiving $45 ($15 per person) in the study.

(4) Work in a three-person same-sex group, but with an unknown chance of receiving $45 ($15 per person) in the study. The exact chance of receiving the money would be different for each different group, would not be less than 40% nor greater than 80%, and the average chance over all groups would be about 60%.

It was made clear to the students that they would have a chance to participate in the experiment at a future date, but that their participation was not presently being sought. Rather, they were simply being asked to evaluate how preferable each of the four working conditions seemed to them so that the investigators conducting the research could have some idea of how preferable each of the four working conditions was before the experiment actually began. Preference ratings were obtained on four independent 8-point scales ranging from (1) would not prefer to (8) would prefer.

Based on the SEU model we would predict no difference in preference for the four working conditions, since the subjective probabilities and utilities

of the monetary outcomes in all four conditions were equal. However, based on our hypothesis that uncertainty is a noxious state which will be avoided if possible, and upon the work of Ellsberg (1961) and Becker and Brownson (1964), we predicted a general preference for the exact, 60% chance conditions over the uncertain, 40% to 80% chance conditions. We also predicted a general preference for working alone over working in a group, since group performance situations should serve to highten uncertainty about the probability of receiving the money.

The mean preference ratings for the four working conditions are shown in Table 3. A 2 x 2 repeated measures analysis of variance, in which both the certain/uncertain and alone/group factors were repeated within-subject factors, indicated a highly significant main effect for the certain/uncertain factor. In general, the students gave the certain conditions a higher preference rating than the uncertain conditions ($F(1,57) = 17.03$, $p < .001$). A significant interaction was also found ($F(1,57) = 4.59$, $p < .05$). Students tended to prefer the alone condition to the group condition when the exact probability of receiving the money was uncertain ($t(57) = 1.83$, $p < .08$), but not when the exact probability of receiving the money was certain ($t(57) = .59$, p = ns). In retrospect, this interaction seems reasonable, since certainty is certainty, whether one works alone or in a group. In fact, if the chances of receiving the money are known with certainty, why not make life more pleasant by working in a group. On the other hand, if one is already uncertain about the chances of receiving the money, working in a group will only serve to increase that uncertainty. These findings thus provide further evidence that certainty is preferred to uncertainty, even when the SEU's for the various options are equal.

Insert Table 3 about here

4. Accommodating Uncertainty in Expected Value Models

The findings presented above suggest that the classic decision theory distinctions between certainty, risk and ignorance may well have served to limit the generalizability of the various expected value models. These models cannot accommodate the uncertainty dimension as we have defined it here. They are limited only to those situations where probabilities and values, whether objective or subjective, can be stated with confidence by the decision maker. When probabilities and values can be stated only in more-or-less uncertain terms, these models lose some of their predictive ability.

It may be possible to alter the various expected value models to accommodate the uncertainty dimension. Suppose, for example, we add two more variables to the SEU model. We may call these new variables w_{Pi} and w_{Ui}. These are weights representing the degree to which the decision maker is uncertain about his/her probability and utility judgments, respectively. Let's assume these weights vary from 0 to 1.00, where 0 represents maximum uncertainty, or ignorance, and 1.00 represents minimum uncertainty, or risk. Our new weighted subjective expected utility (wSEU) model might then be defined as

$$wSEU = \sum_{i=1}^{n} w_{Pi}P_i \; w_{Ui}U_i \qquad (4)$$

where P_i and U_i are defined as in equation (3). This model has all of the characteristics of the SEU model defined in equation (3), with the added feature that it also reflects subjects' preference for certainty over uncer-

Table 3

Mean Preference Ratings for the Four Experimental Conditions

	Work Alone	Work in Group
Certain	5.29	5.53
	(2.16)	(2.34)
Uncertain	4.31	3.74
	(2.37)	(2.20)

NOTE. Standard Deviations are given in parentheses.

tainty. The more uncertain the decision maker is of his/her $\underline{P}_i$ and $\underline{U}_i$ estimates, the less weight these will carry.

The values of $\underline{P}_i$, $\underline{U}_i$, $\underline{w}_{Pi}$, and $\underline{w}_{Ui}$ may be determined for each subject by the equivalence interval method described in an earlier portion of this paper. Thus we might ask subjects to make estimates of the probabilities and values of given outcomes, and then ask them to indicate the range of possible probabilities and values that the outcomes could actually have and still have their initial judgments remain essentially correct. The initial estimates of the probabilities and values can be taken as measures of $\underline{P}_i$ and $\underline{U}_i$, respectively. The range of possible probabilities and values can be taken as measures of $(1-\underline{w}_{Pi})$ and $(1-\underline{w}_{Ui})$, respectively. That is, $\underline{w}_{Pi} = (1-\text{Range}_{Pi})$, and $\underline{w}_{Ui} = (1-\text{Range}_{Ui})$. Thus, the larger the range of possible probabilities and values, the more uncertain one's point estimates are, and the less weight these point estimates will carry in the wSEU model.

The model defined in equation (4) is proposed simply as an example of how expected value models might be altered to accommodate the uncertainty dimension. Although the author knows of no other such model,[7] one may well have been proposed elsewhere. The point is, that the more widely researched normative models, describing what individuals ought to do in the face of uncertainty to arrive at optimal solutions, have by and large been designed to deal with what Knight (1921) termed measurable uncertainty, or risk, and are unable to cope with uncertainty as we have defined it in the present paper. Hopefully, future research will be directed towards incorporating this latter type of uncertainty in expected value models so that these models may be useful in a wider variety of everyday decision situations.

B. Atkinson's Theory of Achievement Motivation

Atkinson (1957, 1964) has formulated a theory of achievement motivation which is similar to the expected value theories described in the previous section. Thus it assumes that behavior is dependent, in part at least, upon the probability that various outcomes will occur, and the valence of those outcomes. Unlike the expected value theories, however, Atkinson's Theory assumes that behavior is also partially dependent upon stable personality characteristics of individuals. Moreover, his theory is concerned with a motivational arousal, as evidenced by both the magnitude and persistence of behavior, as well as with cognitive choice behavior. Because the magnitude and persistence of behavior may be classified as types of outcome-oriented effort, Atkinson's Theory has particular relevance to the present problem, and thus warrants a more detailed discussion. The basic concepts of Atkinson's Theory will be presented first. Then we will review some of the predictions made by the theory and the empirical evidence bearing on these predictions. We will conclude this section by discussing the relationship between Atkinson's Theory and the proposed theory based on uncertainty.

1. Basic Concepts of the Theory

According to Atkinson (1957, 1964), the strength of any tendency to perform an activity is a multiplicative function of three types of variables: stable personality characteristics, the subjective probability that the activity will lead to a given consequence, and the incentive value of that consequence. With regard to achievement-related activities, it is hypothesized that there are two opposing personality characteristics upon which behavior is partially dependent: the motive to achieve success, and the motive to

avoid failure. Thus, the strength of the tendency to perform (or not to perform) achievement-related activities, referred to as the achievement-oriented tendency ($\underline{T}_A$), is conceptualized as:

$$T_A = (M_S \times P_S \times I_S) - (M_{AF} \times P_F \times I_F) \qquad (5)$$

where $\underline{M}_S$ is a relatively stable personality characteristic reflecting one's desire to achieve success, $\underline{M}_{AF}$ is a relatively stable personality characteristic reflecting one's desire to avoid failure, $\underline{P}_S$ and $\underline{P}_F$ and the probabilities of success and failure, respectively, and $\underline{I}_S$ and $\underline{I}_F$ are the incentive values of success and failure, respectively.

Although achievement-oriented tendencies are hypothesized to depend upon all of the six factors that make up equation (5), only three of these have been given an independent operational existence in the theory. The strength of $\underline{M}_S$ is usually determined by scoring a Thematic Apperception Test (TAT) according to a prescribed method of content analysis (cf. Atkinson, 1958). The strength of $\underline{M}_{AF}$ is generally determined by scores on the Mandler-Sarason Test Anxiety Questionnaire (TAQ) (Mandler and Sarason, 1952). $\underline{P}_S$ has been defined operationally in a variety of ways, such as by presenting subjects with false norms (e.g., Feather, 1961), controlling reinforcement histories (e.g., Weiner, 1970; Weiner & Rosenbaum, 1965) and varying the actual difficulty of the experimental task (e.g., Atkinson & Litwin, 1960). Of course, by operationalizing $\underline{P}_S$ in this way, one also operationalizes $\underline{P}_F$, and thus $\underline{P}_F$ is taken simply as $1-\underline{P}_S$. $\underline{I}_S$ and $\underline{I}_F$ have also been defined as a function of $\underline{P}_S$: $\underline{I}_S = 1-\underline{P}_S$, and $\underline{I}_F = 1-\underline{P}_F$ or $\underline{I}_F = \underline{P}_S$. Atkinson argues that the incentive value of success ($\underline{I}_S$) is directly related to the subjective

difficulty of the task: The more difficult the task, the greater will be the incentive value (pride) of success. The incentive value of failure (I_F), on the other hand, is inversely related to the difficulty of the task: The more difficult the task, the less will be the incentive value (shame) of failure.

Since there is only one degree of freedom among four expected value factors (P_S, P_F, I_S, and I_F), equation (5) may be mathematically rewritten as

$$T_A = (M_S - M_{AF})\ (P_S \times (1 - P_S)) \qquad (6)$$

It can be seen from equation (6) that the resultant achievement-oriented tendency is a function of the relative strengths of M_S and M_{AF}, and a quadratic function of P_S. The achievement-oriented tendency (T_A) will be positive for individuals with $M_S > M_{AF}$, that is, there will be a general tendency to approach achievement-related situations. On the other hand, T_A will be negative for individuals with $M_{AF} > M_S$, and there will then be a general tendency to avoid achievement-related situations. Moreover, the strength of these tendencies will be a function of P_S. Achievement-oriented tendencies, whether they be to approach or to avoid achievement-related situations, will be greatest when $P_S = .50$. These tendencies will become increasingly smaller as P_S departs from .50. They will reach their smallest value when $P_S = .00$ or $P_S = 1.00$. These relationships between achievement-oriented tendencies, the relative strengths of M_S and M_{AF}, and P_S are shown graphically in Figure 4. As can be seen in Figure 4, for individuals with $M_S > M_{AF}$ the achievement-oriented tendency will be positive (approach), and

will be strongest when P_S = .50. For individuals with $M_{AF} > M_S$ the achievement-oriented tendency will be negative (avoid), and again will be strongest when P_S = .50.

Insert Figure 4 about here

2. Manifestations of Achievement-Oriented Tendencies

The model described above has been used to predict a number of behavioral manifestations of achievement-oriented tendencies. These can be grouped into three categories: (a) choice of activities, (b) magnitude of performance, and (c) persistence of ongoing behavior.

a. Choice behavior. Predictions concerning choice of activities are generally of two types: those concerned with choices between achievement-related alternatives and non-achievement-related alternatives, and those concerned with choices among achievement-related alternatives with different probabilities of success. According to the theory, the achievement-oriented tendency (T_A) will be positive for individuals with $M_S > M_{AF}$, and these individuals should thus tend to approach achievement-related activities. Furthermore, since for these individuals T_A gets more and more positive as P_S approaches .50 (see Figure 4), they should exhibit a stronger tendency to approach achievement-related activities as P_S for those activities approaches .50. Consequently, when given a choice between achievement-related activities and non-achievement-related activities, individuals with $M_S > M_{AF}$ should choose the former, and when given a choice among achievement-related activities with different probabilities of success, they should choose the one with P_S closest to .50. On the other hand, the achievement-oriented tendency (T_A)

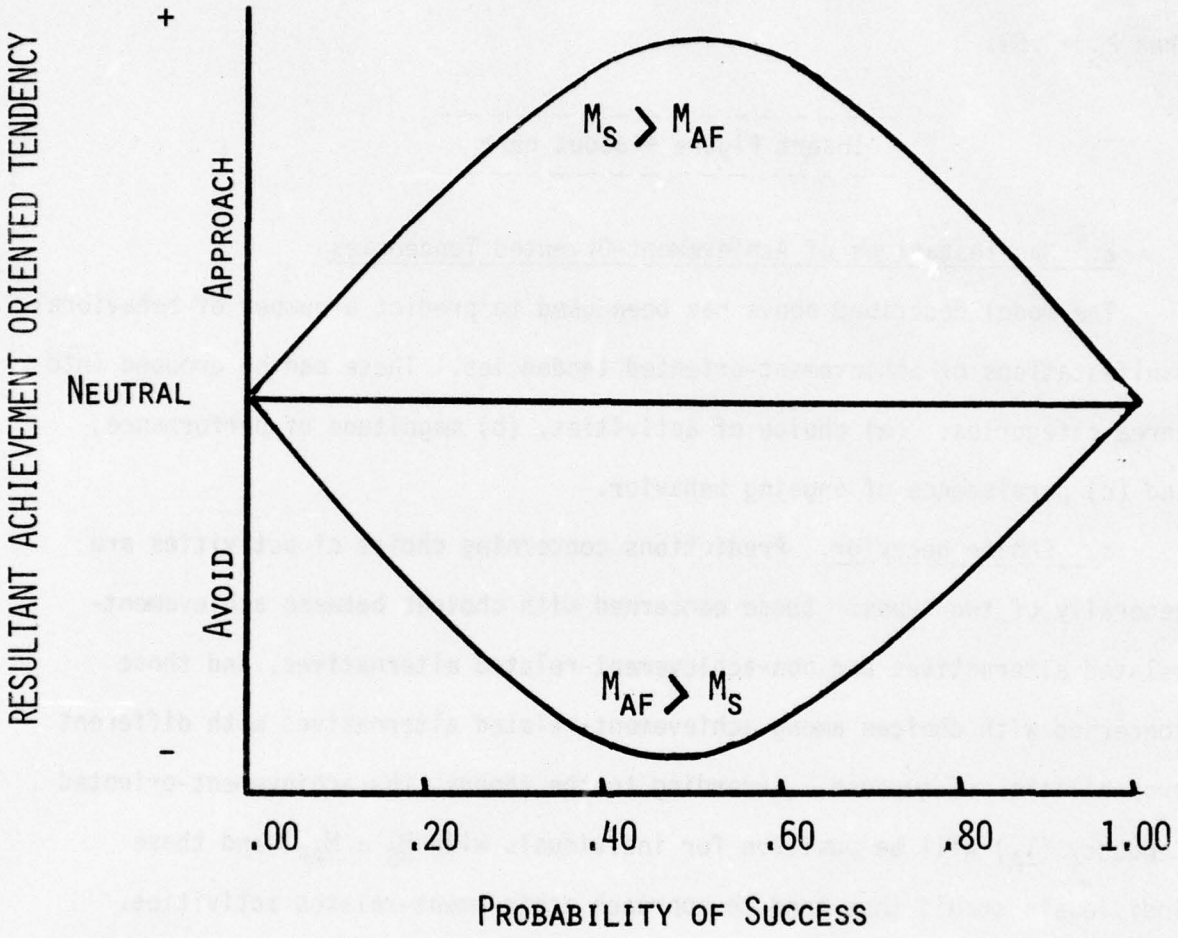


FIGURE 4. RESULTANT ACHIEVEMENT ORIENTED TENDENCY AS A FUNCTION OF MOTIVE CONSTELLATION AND PROBABILITY OF SUCCESS PREDICTED BY ATKINSON'S THEORY OF ACHIEVEMENT MOTIVATION.

will be negative for individuals with $\underline{M}_{AF} > \underline{M}_S$, and these individuals should thus tend to avoid achievement-related activities. Furthermore, since for these individuals $\underline{T}_A$ gets more and more negative as $\underline{P}_S$ approaches .50 (see Figure 4), they should exhibit a stronger tendency to avoid achievement-related activities as $\underline{P}_S$ for those activities approaches .50. Consequently, when given a choice between achievement-related and non-achievement-related activities, individuals with $\underline{M}_{AF} > \underline{M}_S$ should choose the latter, and when forced to choose among achievement-related activities with different probabilities of success they should choose the one with $\underline{P}_S$ furthest from .50.

Considerable experimental evidence exists in support of these predictions. Concerning choices between achievement-related activities and non-achievement-related activities, Atkinson (1953) found that subjects high in need for achievement were more likely to volunteer for an apparent achievement-related activity than were subjects low in need for achievement. Similar results were obtained by Weiner & Rosenbaum (1965). These authors gave subjects a series of choices between an achievement-related and a non-achievement-related task. They found that subjects high in resultant achievement motivation ($\underline{M}_S > \underline{M}_{AF}$) were more likely to undertake the achievement task on the first choice trial than were subjects low in resultant achievement motivation ($\underline{M}_{AF} > \underline{M}_S$). Finally, French (1956) found that subjects high in achievement motivation were more likely to choose work partners who would be instrumental in attaining achievement goals, while subjects low in need for acheivement were more likely to choose work partners who would be instrumental in attaining affiliative goals.

Concerning choices among achievement-related alternatives with different probabilities of success, Isaacson (1964) found that students high in need

for achievement were more likely to select major areas of study perceived as intermediate in difficulty than were students low in need for achievement. Similar findings have been observed concerning occupational choice (e.g., Mahone, 1960; Morris, 1966). Many controlled laboratory studies have found parallel results. Atkinson, Bastian, Earl, and Litwin (1960); Atkinson and Litwin (1960); and Weiner (1965), for example, all have found that subjects with $\underline{M}_S > \underline{M}_{AF}$ prefer tasks where $\underline{P}_S = .50$ more than do subjects with $\underline{M}_{AF} > \underline{M}_S$.

b. Magnitude of performance. Atkinson's Theory predicts that for individuals with $\underline{M}_S > \underline{M}_{AF}$ the achievement-oriented tendency ($\underline{T}_A$) will become more and more positive as $\underline{P}_S$ approaches .50 (see Figure 4). Consequently, when placed in an achievement-related situation, these individuals should perform more and more vigorously as $\underline{P}_S$ approaches .50. On the other hand, for individuals with $\underline{M}_{AF} > \underline{M}_S$ the achievement-oriented tendency ($\underline{T}_A$) will become more and more negative as $\underline{P}_S$ approaches .50. Consequently, when placed in an achievement-related situation, these individuals should perform less and less vigorously as $\underline{P}_S$ approaches .50.

Few studies testing Atkinson's model have included measures of behavior intensity or magnitude as dependent variables, and thus the predictions concerning magnitude of performance have not been thoroughly tested. Furthermore, in studies that have included such measures, the findings do not always support the theory. Atkinson (1958b) found, for example, that subjects performed faster at an arithmetic task when competing against only one other individual (where $\underline{P}_S$ was assumed to be at an intermediate level) than when competing against 20 other individuals (where $\underline{P}_S$ was assumed to be low). However, the performance of subjects high and low in need for achievement were not significantly different, a finding which does not support the

theory. Ryan and Lackie (1965), on the other hand, did find support for the theory. They had subjects perform a ring toss task under either competitive or non-competitive conditions. They found that students high in need for achievement tended to out-perform those low in need for achievement when the ring toss task was presented in a competitive context. When the ring toss task was presented in a non-competitive context, however, those low in achievement motivation tended to out-perform those high in achievement motivation. The general lack of experimental evidence, and the inconsistency in the evidence that does exist, prevents any firm conclusion from being drawn about the accuracy of the predictions made by Atkinson's Theory concerning the magnitude of performance in an achievement-related activity.

c. Persistence of ongoing behavior. Closely related to magnitude of performance is the persistence of behavior. Atkinson's Theory predicts that for individuals with $\underline{M}_S > \underline{M}_{AF}$ the achievement-oriented tendency ($\underline{T}_A$) will become more and more positive as $\underline{P}_S$ approaches .50 (see Figure 4). Consequently, when placed in an achievement-related situation, these individuals should exhibit more and more persistence as $\underline{P}_S$ approaches .50. On the other hand, for individuals with $\underline{M}_{AF} > \underline{M}_S$ the achievement-oriented tendency ($\underline{T}_A$) will become more and more negative as $\underline{P}_S$ approaches .50. Consequently, when placed in an achievement-related situation, these individuals should exhibit less and less persistence as $\underline{P}_S$ approaches .50.

More evidence has been gathered concerning the persistence of ongoing behavior than has been gathered concerning the magnitude of performance, and this evidence generally supports the theory. Atkinson and Litwin (1960), for example, found that students high in resultant achievement motivation persisted longer at a course examination than did students low in resultant

achievement motivation. Similarly, French and Thomas (1958) found that subjects high in achievement motivation persisted longer at an insoluble task than those low in achievement motivation. This latter finding at first seems contradictory to the general hypothesis since the problem was insoluble and thus $\underline{P}_S$ = .00. It should be emphasized, however, that it is not the objective $\underline{P}_S$ that matters. What matters is the subject's subjective estimate of $\underline{P}_S$. When approaching an activity of unknown difficulty one's best estimate of that difficulty is $\underline{P}_S$ = .50. This being the case, individuals with $\underline{M}_S > \underline{M}_{AF}$ should approach activities of unknown difficulty, while those with $\underline{M}_{AF} > \underline{M}_S$ should tend to avoid such activities if at all possible. Only as individuals work at the task will they gain accurate information about the actual level of $\underline{P}_S$. Thus the findings reported by French and Thomas (1958) may be seen as due to the subjects' initial lack of experience with the task, and to their erroneously high initial estimates of $\underline{P}_S$.[8]

3. The Relationship Between Atkinson's Theory of Achievement Motivation and Uncertainty Theory

Both magnitude of performance and persistence may be construed as measures of outcome-oriented effort. If it can be assumed that in achievement-related situations control is synonymous with $\underline{P}_S$,[9] then it is clear that Atkinson's Theory of Achievement Motivation makes explicit predictions concerning both the effort individuals should exhibit at different levels of control in achievement-related situations and the changes in effort they should exhibit following changes in control. According to Atkinson's Theory, for individuals with $\underline{M}_S > \underline{M}_{AF}$ the achievement-oriented tendency ($\underline{T}_A$) will become more and more positive as $\underline{P}_S$ approaches .50. Consequently, when placed in an achievement-related situation, these individuals should perform more

and more vigorously (e.g., work faster) and exhibit more and more persistence (e.g., work longer) as control ($\underline{P}_S$) approaches 50%. For individuals with $\underline{M}_{AF} > \underline{M}_S$, on the other hand, the achievement-oriented tendency ($\underline{T}_A$) will become more and more negative as $\underline{P}_S$ approaches .50. Consequently, when placed in an achievement-related situation, these individuals should perform less and less vigorously (e.g., work slower) and exhibit less and less persistence (e.g., work shorter) as control ($\underline{P}_S$) approaches 50%.

It is clear that at least for some individuals (those with $\underline{M}_S > \underline{M}_{AF}$), the predictions made by Atkinson's Theory are very similar to the predictions made by the proposed theory based on uncertainty. It will be recalled that Uncertainty Theory proposes that outcome-oriented effort will increase as control approaches 50%. Figure 5 presents graphically the degree of outcome-oriented effort predicted for individuals with $\underline{M}_S > \underline{M}_{AF}$ by Atkinson's Theory and for all individuals by Uncertainty Theory. As can be seen in Figure 5, the predictions made by the two theories are very similar, and very highly reliable data would be required to test between them.

Insert Figure 5 about here

Despite the similarity in behavioral predictions, the two theories are in decided conflict as to the underlying causes of these behaviors. Atkinson's Theory predicts that for individuals with $\underline{M}_S > \underline{M}_{AF}$ outcome-oriented effort will increase when control approaches 50% because of a positive affinity for such situations; it is in those situations that the achievement-oriented tendency ($\underline{T}_A$) is maximized. Uncertainty Theory, on the other hand, predicts that outcome-oriented effort will increase when control approaches 50%

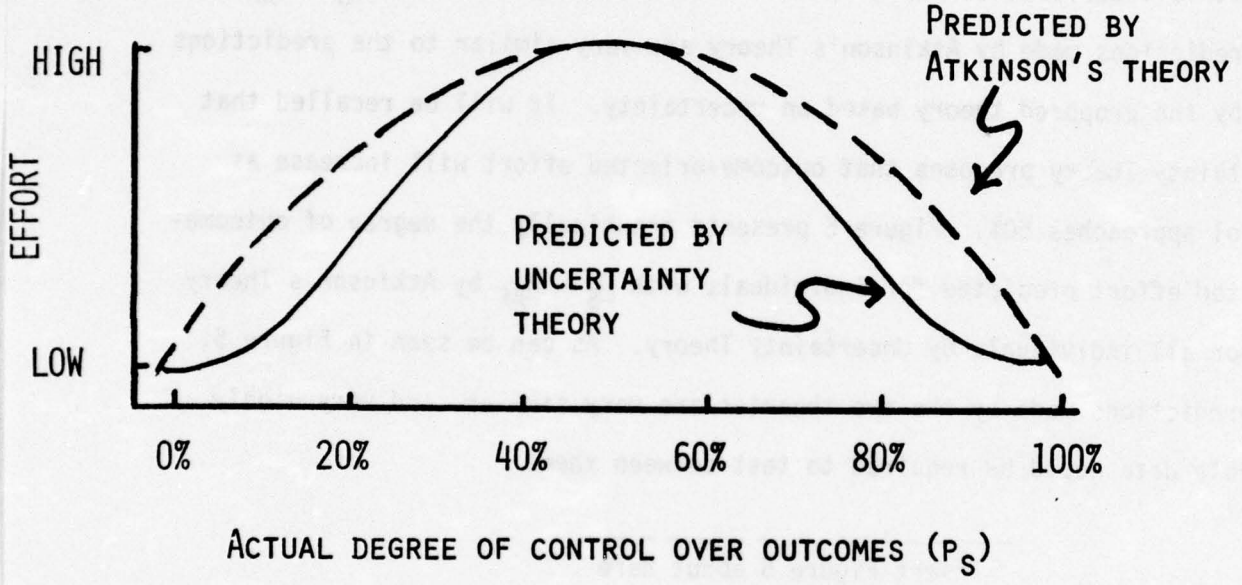


FIGURE 5. DEGREE OF OUTCOME-ORIENTED EFFORT AT DIFFERENT DEGREES OF CONTROL (P_S) PREDICTED FOR INDIVIDUALS WITH $M_S > M_{AF}$ BY ATKINSON'S THEORY AND BY UNCERTAINTY THEORY.

because of a negative affinity for such situations; it is in those situations that uncertainty about control is greatest, and the increased effort is directed toward reducing this uncertainty.

The nature of this underlying conflict can be seen most clearly when considering the research reviewed above on choice preferences among achievement-related tasks with different values of $\underline{P}_S$. As indicated, it has been found that when individuals with $\underline{M}_S > \underline{M}_{AF}$ are given a choice among several achievement-related alternatives they tend to express the greatest preference for the one with $\underline{P}_S$ closest to .50 (e.g., Atkinson, Bastian, Earl, & Litwin, 1960; Atkinson & Litwin, 1960; Weiner, 1965). This finding is quite curious in light of the argument put forth in an earlier section of this paper suggesting that the center of any judgment scale will be the point at which uncertainty concerning the correctness of the judgment will be greatest. If individuals with $\underline{M}_S > \underline{M}_{AF}$ prefer situations where uncertainty about outcomes is greatest, how can a general motivation to reduce uncertainty be postulated?

This question can be answered by a careful examination of the experimental settings in which subject preferences among achievement-related activities with different values of $\underline{P}_S$ are observed. Atkinson and Litwin (1960), for example, has subjects engage in a ring-toss task set up in such a way that they could toss rings at varying distances from a 12 1/2 inch tall target peg. The subjects were expected to choose a distance from which to toss the ring and then try to ring the peg. The distance from the peg was taken as an objective measure of $\underline{P}_S$; the further the subjects stood from the peg, the lower the value of $\underline{P}_S$. Atkinson, Bastion, Earl, and Litwin (1960) used a similar procedure with a shuffleboard task. It was made clear to the subjects in these experiments that the purpose of the experiments was to determine how

good they were at the activities under investigation. But from what distance would the subjects gain the most information about how good they were at the task? As Shannon and Weaver (1949) have noted, information gain is directly proportional to uncertainty reduction. That is, the more uncertainty that is reduced concerning a given entity, situation, relationship, or event, the more information one has gained. The greatest amount of information will be gained when all of the uncertainty is reduced. In the experiments described above, subjects would therefore stand to gain the most information about their ability vis-a-vis the task when working under conditions of maximum uncertainty, that is, when $\underline{P}_S = .50$. It can thus be argued that the individuals with $\underline{M}_S > \underline{M}_{AF}$, who tend to maximize the expected value of success, $(P_S \times (1-P_S))$ by choosing alternatives with $\underline{P}_S = .50$, also tend to maximize the amount of information they can expect to get about their task-related ability. This line of reasoning suggests an additional interpretation for the two motive constellations considered in Atkinson's Theory: Individuals with $\underline{M}_S > \underline{M}_{AF}$ tend to be oriented toward achievement-related situations, while those with $\underline{M}_{AF} > \underline{M}_S$ tend to be oriented away from such situations, and individuals with $\underline{M}_S > \underline{M}_{AF}$ tend to seek information about their abilities, while those with $\underline{M}_{AF} > \underline{M}_S$ tend to avoid such information (cf., Barclay, 1971).

Uncertainty Theory thus provides an alternative explanation for the findings usually interpreted as evidence supporting Atkinson's Theory of Achievement Motivation. It suggests that the reason individuals with $\underline{M}_S > \underline{M}_{AF}$ choose situations with high levels of uncertainty (i.e., those with $\underline{P}_S$ approaching .50) is not because they are particularly attracted to such situations, but rather because those situations allow them the greatest degree of uncertainty reduction. Of course, the validity of both Atkinson's

explanation and the alternative explanation offered here depend on the motive that actually leads to the behaviors under observation. Clearly, such a motive cannot be unquestionably established by selecting subjects with specific motive constellations (e.g., $\underline{M}_S > \underline{M}_{AF}$ or $\underline{M}_{AF} > \underline{M}_S$) for participation in the research, since many motive states and personality characteristics may be correlated with achievement-related motives, and are therefore equally plausible as explanations for the observed behavior (cf., Mischel, 1968). It is up to future research to establish the causal motive by assessing it in the experimental situation itself.

To this point we have generally ignored the fact that for individuals with $\underline{M}_{AF} > \underline{M}_S$ Atkinson's Theory makes predictions just opposite those made by the proposed theory based on uncertainty. Atkinson's Theory predicts that for individuals with $\underline{M}_{AF} > \underline{M}_S$ the achievement-oriented tendency ($\underline{T}_A$) becomes more and more negative as $\underline{P}_S$ approaches .50, and consequently these individuals should exert less and less outcome-oriented effort as control ($\underline{P}_S$) approaches 50%. Uncertainty Theory, on the other hand, predicts that for all individuals outcome-oriented effort should increase as control approaches 50%. Figure 6 presents graphically the degree of outcome-oriented effort predicted for individuals with $\underline{M}_{AF} > \underline{M}_S$ by Atkinson's Theory and for all individuals by Uncertainty Theory.

Insert Figure 6 about here

The reason we have not been greatly concerned with the differences in these predictions is that little empirical evidence has actually been found in support of Atkinson's predictions concerning individuals with $\underline{M}_{AF} > \underline{M}_S$ who

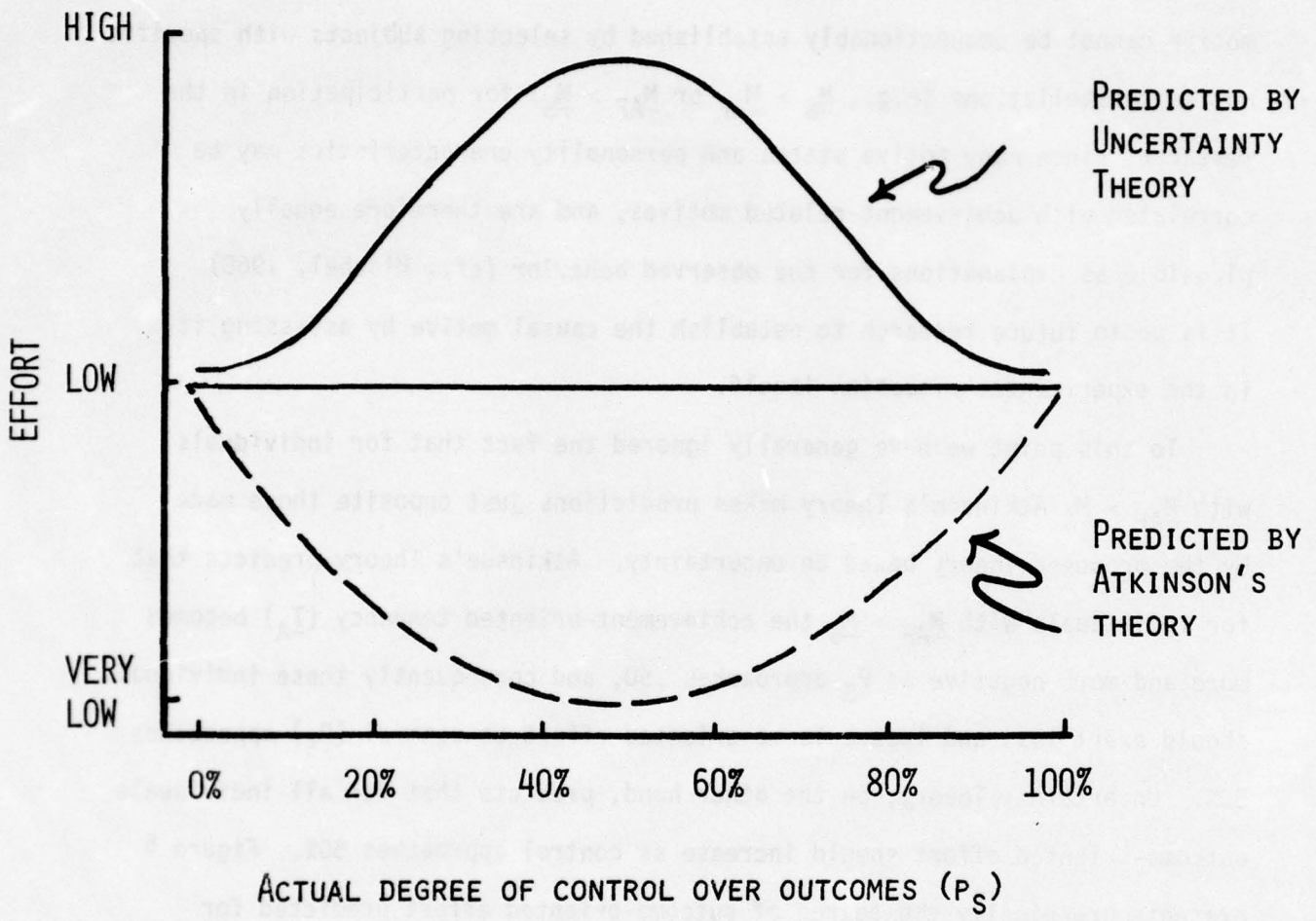


FIGURE 6. DEGREE OF OUTCOME-ORIENTED EFFORT AT DIFFERENT DEGREES OF CONTROL (P_S) PREDICTED FOR INDIVIDUALS WITH $M_{AF} > M_S$ BY ATKINSON'S THEORY AND BY UNCERTAINTY THEORY.

work in achievement-related situations with different probabilities of success. Thus, for example, although Atkinson and Litwin (1960) found that subjects with $\underline{M}_S > \underline{M}_{AF}$ were more likely to choose tasks of intermediate difficulty than were individuals with $\underline{M}_{AF} > \underline{M}_S$, all of their subjects, both those with $\underline{M}_S > \underline{M}_{AF}$ and those with $\underline{M}_{AF} > \underline{M}_S$, tended to prefer tasks with intermediate difficulty over those which were either very easy or very difficult. The point here is that achievement motivation research has focused primarily upon the differences in the behavior of individuals with different motive constellations, and has not concentrated on the behaviors of individuals in different situations. In light of the data presented by Atkinson and Litwin (1960) and others, the interface of the two achievement-oriented tendency curves described in Figure 4 seems somewhat unlikely. Rather, it may be that the relative achievement-oriented tendency curves of individuals with $\underline{M}_S > \underline{M}_{AF}$ and $\underline{M}_{AF} > \underline{M}_S$ look something like those shown in Figure 7. As can be seen in Figure 7, the achievement-oriented tendency increases as $\underline{P}_S$ approaches .50 for all individuals, but the rates of change are different for individuals with different motive constellations. These curves thus suggest that all individuals may tend to exert more outcome-oriented effort in situations of intermediate difficulty, but that individuals with $\underline{M}_S > \underline{M}_{AF}$ tend to exert more effort in these situations than individuals with $\underline{M}_{AF} > \underline{M}_S$ because they are more motivated to seek information and thus reduce their uncertainty.

Insert Figure 7 about here

It should be noted that the proposed motive to reduce uncertainty should have a rather fleeting, short-term effect. When uncertainty arises an

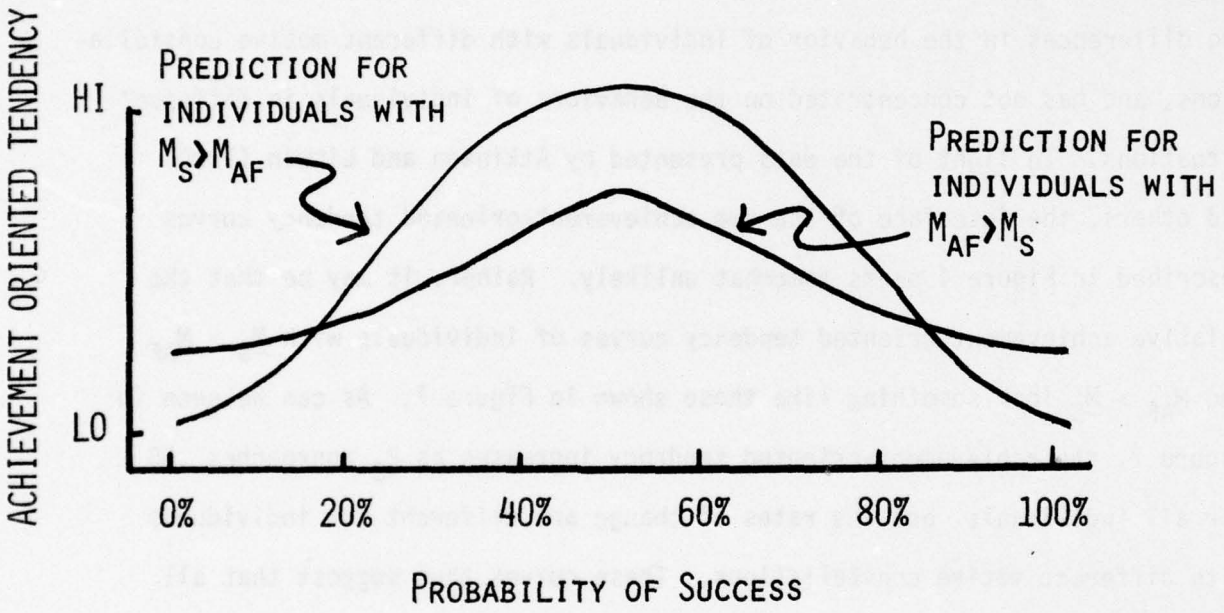


FIGURE 7. PROPOSED ACHIEVEMENT-ORIENTED TENDENCY CURVES FOR INDIVIDUALS WITH $M_S > M_{AF}$ AND FOR INDIVIDUALS WITH $M_{AF} > M_S$.

information search should begin. As soon as the information is obtained the uncertainty-induced arousal will subside and outcome-oriented effort will decrease. In contrast, the achievement-oriented tendencies described by Atkinson should have rather lasting, long-term effects. Thus, it may be that the uncertainty reduction motive guides behavior in the short-term, but that once one is certain about the probability of obtaining various outcomes the achievement-oriented motive takes over. Interestingly, most of the well-controlled laboratory studies investigating Atkinson's model have been rather short-term, and thus they are open to the alternative explanation we have proposed here.

One final comment concerning the usefulness of these two theories should be made. Atkinson's Theory predicts behavior only in a very narrow, albeit important, range of situations. Not only is it limited to achievement-related situations, but also to those achievement-related situations in which the probability of success and the incentive value of success are perfectly negatively correlated.[10] Uncertainty Theory, on the other hand, is applicable in situations which do not have a strong inherent achievement component. Imagine a crew of assembly-line workers, for example. These individuals are seldom called upon to truly test their ability. Rather, it is usually assumed that they have the required ability to perform their assigned tasks. Thus, the evaluative factor which weighs so heavily in the typical achievement setting is considerably attenuated here. Furthermore, success and failure are usually left undefined, except possibly at the broadest levels (e.g., keeping one's job). It is therefore not always clear when one has

attained success. Finally, Uncertainty Theory is not concerned with the probability of attaining outcomes, but rather with the degree of contingency between behaviors and outcomes. Clearly, one can attain an outcome which was not contingent upon behavior. Uncertainty Theory thus has more generality than Atkinson's Theory of Achievement Motivation, in that it can make predictions about changes in effort individuals should exhibit following changes in control over outcomes in a much broader range of settings, whether or not those settings have a strong achievement component.

C. Reactance Theory

Brehm (1966, 1972) has proposed a theory that assumes each individual possesses a set of freedoms, any one of which may be exercised either at the moment or at some time in the future. It is postulated that whenever any one of these freedoms is eliminated or threatened with elimination, the individual will be motivationally aroused to re-establish that freedom. This motivational state is referred to as psychological reactance. As Brehm puts it, ". . . if a person [feels] free to engage in behaviors A, B, and C, and then [learns] that he cannot engage in, for example, A, he [will] experience reactance" (1966, p. 4).

The freedoms individuals possess may be divided into two general categories. Steiner (1970) has termed these decision freedom and outcome freedom. Decision freedom refers to the volition individuals exercise either when they decide whether or not to engage in a specific behavior, or when they decide to engage in one behavior rather than another. In

the example above given by Brehm there is a loss of decision freedom, since the removal of A prevents the individual from opting to engage in A. Outcome freedom refers to the ability of individuals to obtain the outcomes they desire. Thus, individuals will have outcome freedom to the extent that they have the resources (e.g., time, money, ability, etc.), and can afford the costs associated with attaining a given outcome. In Brehm's example above there is also a loss of outcome freedom, since the removal of A prevents the individual from obtaining the outcomes associated with A.

Outcome freedom, as defined by Steiner (1970), and control over outcomes, as defined in the present paper, are closely related variables. As one's control over particular outcomes increases, so too does one's freedom to obtain those outcomes. Conversely, as control diminishes, one's freedom to obtain the outcomes also diminishes.[11] Since outcome freedom and control over outcomes are so closely related, Reactance Theory can be used to make specific predictions about changes in behavior following decreases in control over outcomes, and thus it will be discussed here in some detail. We will begin this section by reviewing some of the behavioral and affective responses that are usually interpreted as manifestations of reactance. Next we will discuss some of the variables which are predicted to moderate the effects of reactance, and review the empirical evidence supporting these predictions. We will then compare the predictions made by Reactance Theory with those made by the proposed theory based on uncertainty. Finally, we will conclude this section with a discussion of the relative merits of the two theories.

1. Manifestations of Reactance

If one's freedom to obtain a given outcome is reduced or eliminated because one has lost some or all control over the outcome, one should experience psychological reactance. Reactance Theory makes a number of specific predictions concerning the manifestations of this reactance. These fall into two broad classes: (a) behavioral manifestations and (b) affective manifestations.

a. Behavioral consequences. Given that reactance is defined as a motivation to re-establish a freedom that has been eliminated or threatened with elimination, it seems reasonable to expect that one immediate consequence of reactance will be a direct attempt to exercise that freedom. When there is a loss of outcome freedom because of a decrease in control over outcomes, Reactance Theory predicts that individuals will attempt to restore that freedom by exerting effort to obtain the outcome in question. Furthermore, Reactance Theory predicts that such attempts will persist either until the original degree of control is re-established, until reactance is reduced in some other way, or until some extraneous event or force interferes with the ongoing activity (cf., Brehm, 1972).

Evidence from a number of experiments supports these predictions. In a field study by Weiner and Brehm (cited in Brehm, 1966), for example, supermarket shoppers were subjected to verbal pressure in the form of a written statement encouraging them to buy a certain brand of sandwich bread. Some of the shoppers received a low-pressure statement, a polite request to

purchase the item. Others received a high-pressure statement, saying rather imperatively "You are going to buy . . ." Furthermore, half of each of these two groups received a complementary 25¢ (the price of the bread), while the other half received 35¢ (10¢ more than the price of the bread). Since receiving both a high-pressure statement and/or 10¢ more than the cost of the bread were interpreted by the authors as threats to the shoppers' freedom to opt not-to-buy that brand of bread, they predicted that shoppers receiving either or both of these high-pressure inducements would be motivated to re-establish the threatened freedom and would actually not buy the bread. Indeed, it was found that shoppers receiving either or both of the high-pressure inducements purchased significantly less of that particular brand of bread than did shoppers receiving both forms of low-pressure inducement. Similar results have also been found in more carefully controlled laboratory settings where other, different types of freedoms have been threatened (e.g., Brehm & Cole, 1966; Brehm & Sensing, 1966; Jones, 1970; Worchel & Brehm, 1971).

Besides direct attempts to exercise one's freedom, Brehm (1972) suggests that the individuals may also try to re-establish their freedom by attacking the agent responsible for the elimination or threat of elimination, or by exercising a related freedom that suggests, by implication, that they could exercise the eliminated or threatened freedom if they really wanted to. Of course, whether or not individuals will engage in any of these alternative behaviors depends to some extent upon the cost of doing so. Furthermore, if a freedom is irrevocably eliminated, such that there is no possibility of ever being able to exercise it again, exercising the freedom is obviously not a way to restore freedom.

b. Affective manifestations. If people are motivationally aroused to re-establish a freedom that has been eliminated or threatened with elimination, certain affective responses are also likely to occur. For example, when asked to evaluate the attractiveness of a given freedom both before and after its elimination, individuals may manifest their reactance by evaluating the freedom more favorably the second time. If outcome freedom is lost due to a loss in control over outcomes, Reactance Theory predicts that the outcome in question will become more attractive.

A good deal of experimental evidence supports this proposition. Brehm, Stires, Sensing, and Shaban (1966); for example, had subjects rate the attractiveness of four phonograph records during each of two different experimental sessions. At the beginning of the first session all of the subjects were given the impression that they would be able to choose one of the records to keep as payment for their participation. However, at the start of the second session half of the subjects were told that, due to circumstances beyond the experimenter's control, one of the records would not be available for choice. The results of these studies were quite clear: The loss of the alternative resulted in increased attractiveness of that alternative. Similar findings have been obtained when, instead of removing the choice alternative, the alternative is simply made more costly to obtain (e.g., Wicklund, 1970). When choice alternatives become more costly to obtain, they increase in attractiveness.

In addition to changes in the attractiveness of an eliminated or threatened freedom, Brehm (1972) has suggested that the elimination or threat of elimination of a freedom may also result in hostile or aggressive feelings

toward the agent responsible for the elimination or threat of elimination. There is some experimental evidence supporting this proposition (e.g., Worchel, 1974), however, a number of ambiguities persist surrounding the exact conditions under which hostile and aggressive feelings will emerge.

Finally, it should be noted that affective responses to losses of freedom are not restricted by costs, resources, and the possibility of restoring freedom, as is true with behavioral responses. It may be for this reason that researchers testing the predictions of Reactance Theory have used affective responses as the dependent measure of interest much more frequently than behavioral responses.

2. Variables that Moderate the Arousal of Reactance

According to Brehm (1966, 1972) reactance can be experienced in degrees from none at all to a great deal. Reactance Theory states that the amount of reactance individuals will experience is a direct function of (a) the degree to which they believed they had the freedom before it was eliminated or threatened, (b) the importance of that freedom, (c) the strength of the threat, and (d) the implication of the elimination or threat of elimination to other freedoms.

a. Prior expectancies of freedom. Brehm holds that individuals may be more or less confident that they can exercise a given freedom. In general, the more confident they are that they can exercise a given freedom, the more psychological reactance will be aroused when that freedom is eliminated. The greatest degree of reactance should thus be aroused when individuals feel very confident they can exercise a given freedom, and then this option is subsequently removed. On the other hand, if they are very confident that they cannot exercise a given freedom, no reactance will be aroused if that

option is subsequently eliminated. Intermediate degrees of confidence should arouse intermediate levels of reactance if the option is eliminated.

Findings from several experiments support these predictions. Hammock and Brehm (1966), for example, had children rank the attractiveness of ten candy bars. Half of the children were told that they would be allowed to choose a candy bar as a prize for being in the study, while the rest were told that they would simply be given a candy bar as a prize for being in the study. All of the children were then given their third ranked candy bar and were asked to re-rank the attractiveness of all ten candy bars. It was found that children who expected to have a choice showed a reactance effect. They tended to derogate the candy bar they received relative to those they did not receive. This was not true for the children who did not expect to have a choice. In fact, those who did not expect to have a choice tended to enhance the attractiveness of the candy bar they received relative to those they did not receive. Similar effects were observed in the study cited earlier by Brehm, Stires, Sensing, and Shaban (1966). Subjects who were led to expect a free choice among four phonograph records tended to enhance the attractiveness of a subsequently eliminated alternative, while subjects who were not led to expect a choice did not enhance it.

b. Importance of the freedom. In general, the more important a given freedom, the more reactance will be experienced when this freedom is eliminated or threatened with elimination. If the freedom is relatively inconsequential, the resultant reactance should be minimal. A number of experimental investigations have found support for this proposition. Brehm and Cole (1966), for example, found that subjects manifested less reactance after receiving a favor when the importance of being unobligated was low than when it was

high. Similar results have recently been demonstrated by Brehm and Mann (1975).

c. Strength of the threat. Reactance Theory predicts that if an individual's freedom is threatened, the amount of reactance he/she will experience is a direct function of the strength of the threat. If the freedom is actually eliminated, the individual should experience more reactance than if it were merely threatened with elimination, or if no threat was made at all.

The study by Weiner and Brehm (cited in Brehm, 1966) described above is a good example of the experimental findings regarding this prediction. They found that shoppers exposed to either or both of two different forms of high-pressure inducements to purchase a certain brand of sandwich bread actually purchased less of that brand of bread than did shoppers receiving both of the low-pressure inducements. Apparently, shoppers receiving either form of high-pressure inducement experienced more reactance than did those receiving only the low-pressure inducements, and consequently they were more likely to exercise their freedom not-to-buy that brand of sandwich bread.

d. Implications for other freedoms. The amount of reactance an individual will experience when a particular freedom is eliminated or threatened with elimination also depends upon the extent to which that threat has implications for other freedoms, or for the same freedom in the future. For example, suppose that one's freedom is threatened because of a decrease in control over outcome A. The more that a decrease in control over outcome A suggests a decrease in control over, say, outcomes B and C, and thus a decrease in freedom to obtain B and C, the more reactance should be aroused. Similarly, the more a present decrease in control over A suggests a decrease in control over A in the future, the more reactance should be aroused.

3. Comparing the Predictions of Reactance Theory and Uncertainty Theory

It is clear from the foregoing discussion that Reactance Theory makes explicit predictions concerning the changes in effort individuals will exhibit when they experience a decrease in control over certain outcomes. Under some circumstances these predictions are similar to those made by the proposed theory based on uncertainty. Under other circumstances, however, the two theories make different predictions.

a. Degree of control lost. Reactance Theory predicts that the amount of reactance aroused by a threat to freedom is directly proportional to the strength of the threat. In terms of the present problem, Reactance Theory predicts that the amount of reactance aroused by a loss of control will be a direct function of the degree of control lost. As more and more control is lost, individuals will become more and more motivated to re-establish their control. They may then attempt to re-establish control by actually trying to obtain the outcome.

Uncertainty Theory, on the other hand, predicts that changes in effort following a decrease in control are contingent, not upon the degree of control lost, but upon how uncertain the individuals are about their degree of control both before and after the decrease in control. As proposed in an earlier section of this paper, individuals will be most uncertain about their degree of control when they actually have an intermediate degree of control (50%). They will be least uncertain about their degree of control when they actually have either complete control (100%) or no control at all (0%). Furthermore, it was proposed that individuals are generally motivated to reduce uncertainty, and that one way to reduce uncertainty about one's degree of control is to exert more effort in an attempt to demonstrate

positive instances of that control. Uncertainty Theory thus predicts that the amount of effort individuals will exert in a given situation will be greatest when they actually have 50% control, and will be smallest when they actually have either 0% or 100% control. The change in effort individuals will exhibit when they experience a decrease in control will therefore be a function both of the initial level of control and the amount of control lost.

Suppose, for example, that an individual has 100% control over a particular outcome. Then imagine that this control is decreased to some lower level. Figure 8 presents the change in effort that both Reactance Theory and Uncertainty Theory predict the individual will exhibit as a function of the actual amount of control lost. As can be seen in Figure 8, Reactance Theory predicts a maximum increase in effort when the individual loses 100% of his/her control. Uncertainty Theory, on the other hand, predicts no increase in effort when 100% control is lost. Rather, Uncertainty Theory predicts a maximum increase in effort when the individual loses 50% of his/her control. Had the initial level of control been 50%, and then that 50% control was completely lost, Reactance Theory would again predict an increase in effort, though not as great an increase as when the initial level of control was 100% (See next section). Uncertainty Theory, on the other hand, would actually predict a decrease in effort, since the level of effort exerted before the decrease is expected to be very high, higher than at any other point along the control continuum, because it is most difficult to evaluate one's control when one actually has 50% control.

Insert Figure 8 about here

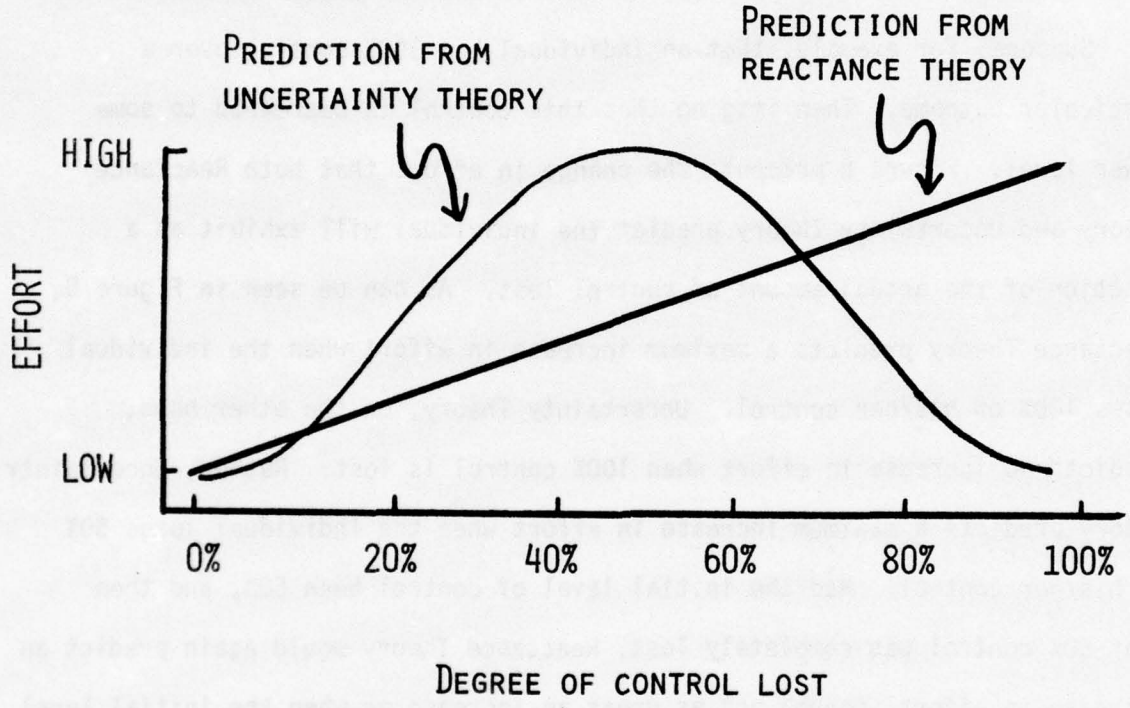


FIGURE 8. REACTANCE THEORY AND UNCERTAINTY THEORY PREDICTIONS ABOUT THE CHANGES IN EFFORT INDIVIDUALS WILL EXHIBIT AS A FUNCTION OF THE AMOUNT OF CONTROL LOST GIVEN THAT INITIAL CONTROL WAS 100%.

It is interesting to note that all of the studies cited by Brehm (1972) in support of Reactance Theory that used behavioral measures to assess reactance (e.g., amount and type of bread purchased, amount of helping, etc.) involved threats to freedoms that the subjects were probably quite certain they had prior to the threat. Furthermore, these threats probably acted to increase the subjects' uncertainty about their control. They may well have reacted to the threats by questioning whether the phonograph record really was unavailable for choice, or whether they really should buy the advocated brand of sandwich bread, etc. According to the proposed theory based on uncertainty, if one is very certain that one may exercise a given freedom (uncertainty is low) and then a threat is made to that freedom (uncertainty increases) there is likely to be an increase in effort to re-establish the threatened freedom (exert positive instances of control). Thus, the findings cited by Brehm as support for Reactance Theory may also be taken as support for the proposed theory based on uncertainty. In order to test between the two theories, situations in which the theories make clearly divergent predictions must be utilized.

b. Degree of initial control. Another important prediction made by Reactance Theory is that the amount of reactance aroused by a threat to freedom is directly proportional to the individual's confidence that he/she had the freedom initially. This prediction too is translatable into the language of the present problem. The amount of reactance aroused by a loss of control will be directly proportional to the amount of control the individual had initially. The greater the degree of initial control, the more reactance will be aroused when some or all of that control is lost. According to Reactance Theory, then, individuals should exert more and more effort to re-establish their control the greater the degree of control they had initially. Again, Uncertainty Theory predicts that the change in effort exhibited by individuals following a change

in control will be a function of both the initial level of control and the amount of control lost.

Imagine, for example, that three different individuals initially have different degrees of control over a particular outcome. The first individual has 100% control, the second has 75% control, and the third has 50% control. Imagine further that the control of each is reduced until all three have only 25% control. Figure 9 presents the changes in effort that both Reactance Theory and Uncertainty Theory predict these three individuals will exhibit as a function of having their control reduced to 25%.

Insert Figure 9 about here

As can be seen in Figure 9, Reactance Theory predicts that the individual who initially had 100% control will show a great increase in effort, the individual who initially had 75% control will show less of an increase in effort, and the individual who initially had 50% control will show only a small increase in effort. In each of these cases, however, the increased effort is seen as an attempt to restore the lost control. Uncertainty Theory also predicts that the individual who initially had 100% control will show an increase in effort, though not as much as is predicted by Reactance Theory. This is because 25% control will generate more uncertainty about control than will 100% control, but less uncertainty about control than will 50% control. The individual who initially had 75% control is predicted to show no change in effort, since the level of uncertainty at 25% control and 75% control will be about the same. Finally, the individual who initially had 50% control is actually predicted to show a decrease in effort, since his/her uncertainty about control will have decreased. Thus, while Reactance Theory suggests that individuals with different levels of initial control will evidence varying degrees of increased effort as a

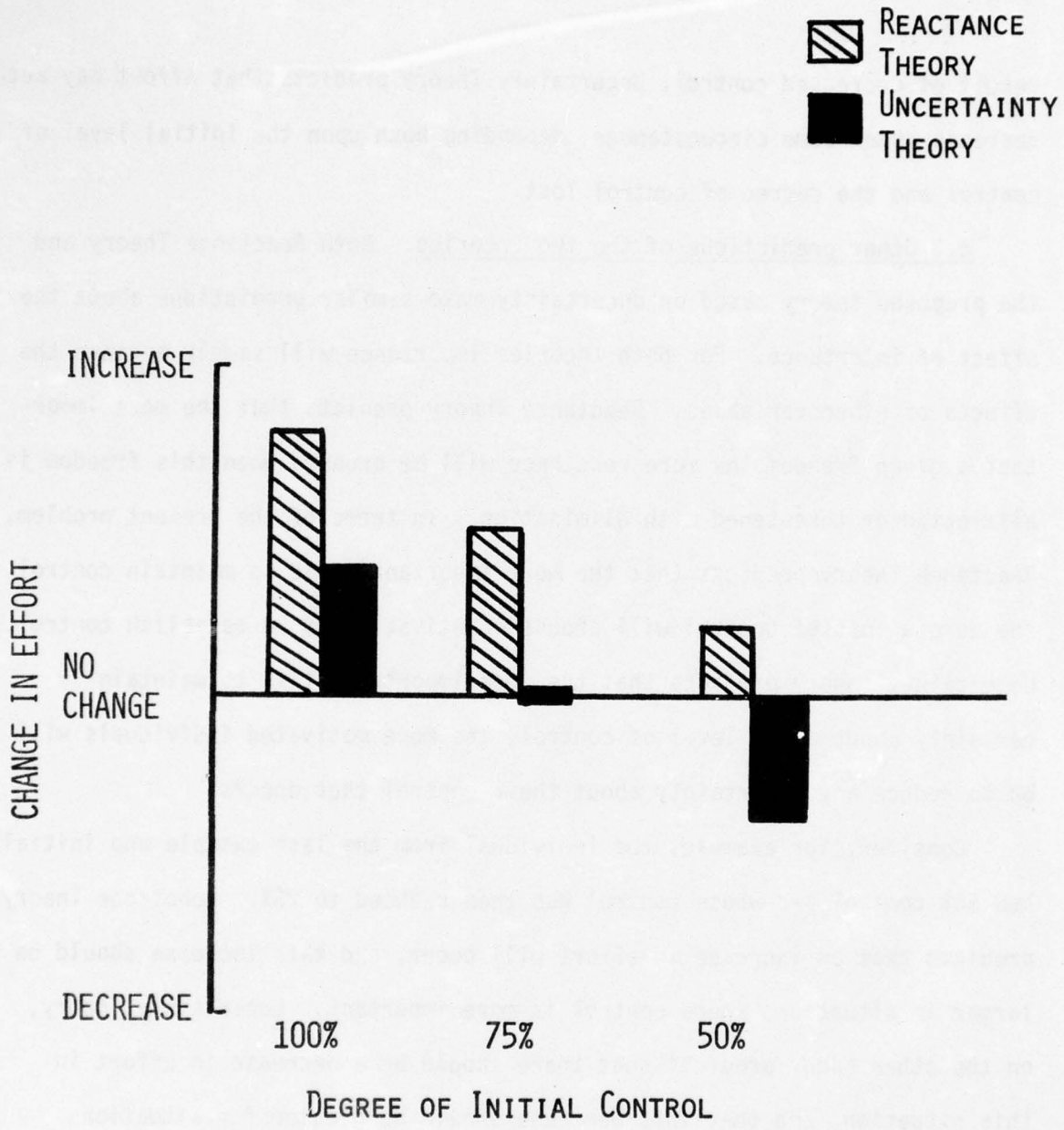


FIGURE 9. REACTANCE THEORY AND UNCERTAINTY THEORY PREDICTIONS ABOUT THE CHANGES IN EFFORT OF INDIVIDUALS WITH THREE DIFFERENT LEVELS OF INITIAL CONTROL WHO'S CONTROL IS DECREASED TO 25%.

result of decreased control, Uncertainty Theory predicts that effort may actually decrease under some circumstances, depending both upon the initial level of control and the degree of control lost.

c. Other predictions of the two theories. Both Reactance Theory and the proposed theory based on uncertainty make similar predictions about the effect of importance. For both theories importance will simply enhance the effects of other variables. Reactance Theory predicts that the more important a given freedom the more reactance will be aroused when this freedom is eliminated or threatened with elimination. In terms of the present problem, Reactance Theory predicts that the more important it is to maintain control the more a loss of control will arouse a motivation to re-establish control. Uncertainty Theory predicts that the more important it is to maintain certainty about one's level of control, the more motivated individuals will be to reduce any uncertainty about their control that occurs.

Consider, for example, the individual from the last example who initially had 50% control and whose control was then reduced to 25%. Reactance Theory predicts that an increase in effort will occur, and this increase should be larger in situations where control is more important. Uncertainty Theory, on the other hand, predicts that there should be a decrease in effort in this situation, and that this decrease should be greater for situations where maintaining certainty is more important.

Reactance Theory also states that the degree of reactance aroused by a threat to one's freedom will be a function of the extent to which the threat has implications for threats to other freedoms and for threats to the same freedom at some time in the future. In terms of the present problem, Reactance Theory predicts that the more a threat to one's control over a

particular outcome implies a threat to one's control over other outcomes, the more that threat will arouse a motivation to re-establish control over the outcome at hand. Uncertainty Theory makes no predictions about the effects of changes in one's control over particular outcomes having implications for one's control over other outcomes. However, it is not hard to imagine that such implications bear directly upon the importance of maintaining certainty about one's control over the original outcomes. The more changes in one's control over particular outcomes have implications for changes in one's control over outcomes, the more important maintaining certainty about control in the original setting becomes. Thus the effect of implications for control over other outcomes should have exactly the same effect for both theories: It should enhance the effects predicted by both theories.

4. Relative Merits of the Two Theories

Several issues regarding the relative merits of Reactance Theory and Uncertainty Theory are worth considering here. The first has to do with the amount of predictability offered by the two theories. With regard to the scope of the present problem, it is clear that Uncertainty Theory makes a much wider range of predictions. Along with Reactance Theory, it makes predictions about changes in effort that result from decreases in control. Uncertainty Theory goes beyond Reactance Theory, however, by also making predictions about changes in effort that result from increases in control. This is a distinct advantage. Furthermore, Uncertainty Theory seems to be at least as heuristic as Reactance Theory in terms of its ability to integrate a wide variety of data. As mentioned elsewhere in this paper, Uncertainty Theory can incorporate findings from Classical Reinforcement Theory, Decision Theory,

and theories of achievement motivation. On the other hand, Reactance Theory has been tested, while the present theory has not. Moreover, Reactance Theory makes predictions about affective responses, a response class not directly dealt with by Uncertainty Theory. Thus, while Uncertainty Theory is able to explain a wide variety of data, it does have the drawback of not being able to predict affective responses, and is as yet untested.

This brings up another issue: testability. Although Reactance Theory makes a variety of explicit predictions concerning both behavioral and affective response classes, the validity of the theory rests upon the existance of the proposed underlying motivational state, reactance. However, reactance, like most other underlying motivations, is difficult to assess directly. No way is presently known to demonstrate the existence of reactance other than by the behavioral and affective manifestations it is predicted to cause. For this reason, the central assumption underlying Reactance Theory is untestable. That the predictions of the theory are supported is, of course, not an adequate test of the underlying reactance process, since a completely different process may actually be causing the observed effects.

Uncertainty Theory, on the other hand, is less susceptible to this criticism. While it is true that un underlying motivation to reduce uncertainty is not directly measurable, uncertainty itself is measurable. Uncertainty is defined as the degree to which one is unable to make precise judgments about some characteristic of a given entity, situation, relationship, or event. Uncertainty about control refers to the degree to which one is unable to make precise judgments about the degree of contingency between one's behavior and outcomes. This uncertainty can be assessed directly, for example, by using the equivalence interval method mentioned earlier in this

paper. Furthermore, uncertainty about control may be operationalized completely independently of the level of control, that is, uncertainty about control and level of control may be manipulated as orthogonal factors in an experimental design. Thus the effects of uncertainty may be assessed independently of level of control. It would seem, therefore, that the proposed theory based on uncertainty is somewhat more testable, in terms of its underlying assumptions, than is Reactance Theory.

A final issue concerns the possibility that both theories may be correct. That is, in any given situation, it may be that the effects predicted by both theories actually occur. For example, if one's control is decreased from 70% to 10%, an increase in reactance and a decrease in motivation to reduce uncertainty may both occur. The resultant change in effort may be some sort of weighted algebraic function of these two motivations. If indeed this is the case, it will become necessary to determine when and in which situations each theory is more predictive than the other. When is reactance the primary determinant of the observed changes in effort, and when are these changes due primarily to the motive to reduce uncertainty? Clearly, a good deal of careful experimentation will be needed before the compatability of these two theories can be fully assessed.

D. Learned Helplessness

We would like to conclude our discussion of the relationship between the proposed theory based on uncertainty and other psychological theories with a brief review of some rather interesting experimental work by Seligman (1974, 1975) and his associates (e.g., Hiroto & Seligman, 1975; Overmier and Seligman, 1967; Seligman & Graves, 1970: Seligman & Maier, 1967; Seligman, Maier, & Solomon, 1971). These authors have been concerned with the consequences of exposing subjects to unavoidable aversive events. They have found that

exposure to unavoidable aversive events has a decided negative effect upon the subjects' ability to learn escape and avoidance responses to avoidable aversive events occurring in the future. This phenomenon, referred to as learned helplessness, is explained in terms of the subjects' learning that their behavior and outcomes are independent, that is, they learn that they have no control over their outcomes. We will first briefly review some of the experimental evidence surrounding this phenomenon and then discuss the relationship between learned helplessness and uncertainty theory.

1. Experimental Evidence

In the typical learned helplessness experiment there are usually three different conditions. In one condition subjects are given one or more training sessions where they are exposed to an unavoidable aversive stimulus. Quite often intermittent unsignaled shock is used for this purpose (e.g., Maier, 1970; Overmier and Seligman, 1967; Seligman and Graves, 1970; and Seligman and Maier, 1967), although other aversive stimuli have also been used, such as intermittent unsignaled noise (e.g., Hiroto, 1970; Hiroto and Seligman, 1975) and experimentally induced failure at a task (e.g., Roth and Bootzin, 1974). In another condition, subjects are exposed to the exact same aversive stimulus, except for them the stimulus is escapable and/or avoidable. That is, there is something that they can do to either escape or avoid the shock or noise, or to succeed at the experimental task. In the third condition, subjects are not exposed to the aversive stimulus at all. These subjects serve as a control group. The subjects from all three conditions are then placed in a test situation where they are to learn a (another) response in order to escape/avoid an aversive stimulus. Generally, the stimulus involved in the test situation is very similar to

or exactly the same as that used in the training session. The dependent measure of interest is usually either the length of time or the number of trials it takes the subject to learn the escape/avoidance response. Learned helplessness is demonstrated when subjects receiving the unavoidable outcome training take more time and/or more trials to learn the new escape/avoidance response than the subjects receiving either the avoidable outcome training or no training with the aversive stimulus at all. This pattern of results has been demonstrated with both animals and humans.

a. Learned helplessness in animals. A number of studies have shown that exposure to unavoidable electric shock interfers with subsequent acquisition of escape and avoidance responses in animals (e.g., Brown and Jacobs, 1949; Carlson and Black, 1960; Leaf, 1964). Overmier and Seligman (1967) argue that this effect cannot be attributed to the learning, during exposure to unavoidable shock, of responses that are incompatible with subsequent escape/avoidance responses, or to adaptation to the shock. Rather these authors suggest that the observed proactive interference is due to the subjects learning that they have no control over the shock. These authors postulated that if the subjects are allowed control over shock presentation they may be "immunized" against the interference.

Seligman and Maier (1967, Experiment 1) tested this proposition directly. They placed 30 dogs in a rubberized cloth hammock specially constructed so that the dogs' legs hung down below their bodies through four holes. The dogs' heads were held in position by wooden head-panels. For 10 of the dogs pressing the head-panels terminated an intermittent unsignaled shock administered to their hind feet. For a "yoked" group of 10 dogs pressing the head-panels had no effect upon the shock. The remaining 10 dogs did

not receive the hammock treatment at all, and thus served as a control group. Twenty-four hours later all of the dogs were given 10 trials of escape/avoidance training in a two-compartment shuttlebox. The dogs had to learn to jump over a barrier from one compartment to the other in order to escape/avoid a shock administered through an electrified floor grid. The authors found that the yoked group of dogs, those who were unable to control shock termination in the hammock training, showed the usual proactive interference. When placed in the shuttlebox these dogs failed to escape the shock more than three times as often as the dogs in the control group. The dogs who were able to control shock termination in the hammock training, on the other hand, did not show this interference. When placed in the shuttlebox, these dogs learned to escape the shock just as often as those in the control condition. Thus, it was not the shock per se, but rather the lack of control over shock which caused the observed proactive intereference. Similar results have also been observed by Maier (1972), Seligman and Graves (1970), and Seligman, Rosellini and Kozak (1975).

The proactive inhibition resulting from experience with unavoidable shock may be minimized by prior experience with control over the shock. Seligman and Maier (1967, Experiment 2), for example, gave two groups of dogs the unavoidable-shock training in the hammock. One of these groups, however, had been given 10 escape/avoidance trials in the shuttlebox on the previous day. It was found that the dogs with no prior avoidable-shock experience exhibited the usual proactive interference in the post-training shuttlebox task while those with the prior avoidable-shock experience did not exhibit this interference. This latter group of dogs also tended to make more escape responses during the unavoidable-shock hammock training.

Finally, some evidence also suggests that the effects of exposure to unavoidable shock may be reversable. Overmeir (1968) and Overmeir and Seligman (1967, Experiment 3), have shown, for example, that the longer the time interval between the unavoidable-shock training in the hammock and the escape/avoidance learning test in the shuttlebox, the less interference there is with the acquisition of the appropriate escape/avoidance response. Also, Seligman, Maier, and Geer (1968) have found that when dogs that have received unavoidable-shock training in the hammock are forcibly exposed to the escape/avoidance contingencies in the shuttlebox, the proactive interference effect is diminished. These authors removed the barrier between the two compartments in the shuttlebox and dragged three "helpless" dogs from side to side, thereby forcibly exposing them to the contingency between their behavior and shock termination. After many such trials, the dogs began to respond on their own, escaping the shock normally even when the barrier between the compartments was replaced. Maier (1972) has cautioned, however, that such a procedure may not actually yield a complete "cure". He finds that rats presented with unavoidable shock, and then given experience with avoidable shock, tend to give up very quickly when faced with a second unavoidable shock situation. Thus, experience with avoidable shock may not completely obliterate the effects of prior experience with unavoidable shock.

b. Learned helplessness in humans. The empirical evidence concerning the learned helplessness hypothesis in animals is fairly consistent. The evidence involving humans, however, is less consistent. Thorton and Jacobs (1971), for example, exposed two groups of subjects to electric shock as they worked at a button-pushing task. One group of subjects could

avoid the shock by pressing the correct button, while the other group could not. A third group of subjects were also exposed to unavoidable shock, but they were not given a task to perform. A final group of subjects were asked to work at the task but were not shocked. All of the subjects were then moved to another room to work at a soluble button-pressing task. It was found that the subjects in the avoidable-shock condition performed significantly better on the second task than did the subjects in the other three conditions. This finding cannot be explained in terms of learned helplessness, however, since the performance of the subjects in the two unavoidable-shock conditions did not differ from the performance of the subjects in the control condition. Rather, a simple practice effect is a more likely explanation; prior experience with avoidable shock enhanced future performance under similar conditions.

A second study by Thronton and Jacobs (1972) also provides data inconsistent with the learned helplessness hpothesis. Two yoked groups of subjects were given shock as they worked at a reaction-time button-pressing task. One group could avoid the shock by pressing the button quickly enough in response to a signal, while for the other group the shock was unavoidable. A third group of subjects worked at the task but received no shock. Both before and after working at the task, all of the subjects were given a short test of mathematical and verbal reasoning and perceptual organization. It was found that subjects who received unavoidable shock improved on the test, while those receiving either avoidable shock or no shock at all, showed no change in performance. This is just opposite to what would be predicted according to the learned helplessness hypothesis.

Roth and Bootzin (1974) also present data opposite to the Learned Helplessness Theory. They found that subjects who experienced unavoidable failure at a concept-formation task behaved in a more controlling manner on a subsequent task than did subjects in a control group.

Even among those studies finding support for the Learned Helplessness Theory, the evidence is not completely unambiguous. Fosco and Geer (1971), for example, presented subjects with a series of 12 problems which required them to guess the correct sequence of buttons to push on a panel. The subjects were given several trials on each problem, and were shocked whenever they made an error. However, some of these problems were insoluble, and different groups of subjects received different numbers of insoluble problems. The number of errors made by these different groups on the last three problems, all of which were soluble, was the main dependent measure. It was found that the more experience the subjects had with insoluble problems, and thus unavoidable failure, the more errors they tended to make on the last three problems. However, since the amount of failure and the degree of control over outcomes are completely confounded in this study, there is no way to determine whether these results are due to the experience of failure per se or to the lack of control. A study by Hiroto (1974) suffers from the same problem. In his study, subjects either could or could not avoid an unsignaled intermittent loud tone. He found that on a subsequent escape-avoidance learning task, the performance of the unavoidable-noise subjects was poorer than the performance of both the avoidable-noise subjects and a group of control subjects. However, the avoidable- and unavoidable-noise subjects were not yoked, and those in the

avoidable-noise condition experienced considerably less noise than those in the unavoidable-noise condition. Thus, the findings can be explained either in terms of the lack of control or the different amounts of aversive stimuli experienced.

Hiroto and Seligman (1975) conducted five studies which improve on those reported by Fosco and Geer (1971) and Hiroto (1974), in that the subjects in the avoidable- and unavoidable-noise conditions were yoked, and thus actually received the same degree of aversive stimulation. A control group was also included in each study. Three dependent measures were taken: (1) the number of trials it took the subjects to learn the appropriate escape/avoidance response, (2) the number of failures to escape, and (3) response latencies. The authors claim strong support for the learned helplessness hypothesis. However, although all but one of the 15 analyses reported were in the right direction, only 7 actually yielded significance beyond the .05 level. These data are thus not as strong as might be hoped. Glass and Singer (1972, pp 109-120) also exposed yoked groups of subjects to either avoidable or unavoidable aversive stimulation. They found that subjects receiving unavoidable shock performed significantly worse on several post-shock performance measures than did subjects receiving either avoidable shock or no shock at all.

It is evident that learned helplessness in humans is not well understood. While the findings presented by Fosco and Geer (1971), Glass and Singer (1972), Hiroto (1974), Hiroto and Seligman (1975) and Thornton and Jacobs (1971) all suggest that exposure to unavoidable aversive outcomes can indeed produce proactive escape/avoidance learning interference in humans, the data presented in some of these studies are also open to alternative explanations. Furthermore, data clearly inconsistent with the learned helplessness hypothesis

have been presented by Thornton and Jacobs (1972) and Roth and Bootzin (1974).

2. Learned Helplessness and Uncertainty Theory

The learned helplessness phenomenon observed in animals, and to a lesser extent in humans, is in complete accord with the predictions made by the proposed theory based on uncertainty. When individuals are in situations where they actually have very little control over the outcomes they receive, whether positive or negative, Uncertainty Theory predicts that they will be able to judge their level of control with a good deal of confidence. As a consequence, they will not be motivated to seek much uncertainty-reducing information. Their efforts to demonstrate positive instances of their control should thus be at a minimum. Consistent with this interpretation, Thornton and Jacobs (1971) found that of those subjects exposed to unavoidable-shock fully 60% reported that they had no control over the shock in the escape/avoidance learning task, "so why try?" The experimental subjects who exhibit the learned helplessness syndrome, whether animal or human, apparently learn that they had little control over the aversive stimuli, and as a result they were simply not motivated to test their level of control even in a new situation. Only if these subjects are forcibly exposed to the escape/avoidance contingencies in the new situation will they be able to overcome the effects of this prior learning (cf. Seligman, Maier, and Geer, 1968).

The lack of consistent evidence for a learned helplessness syndrome in humans is a troublesome point for the learned helplessness hypothesis. Are humans less susceptible to helplessness than animals? The most likely answer would seem to be yes, at least to experimentally induced helplessness.

Dogs, rats, and other such laboratory animals presumably have little experience with hammocks, shuttleboxes, electric shock, etc. before they enter into an experiment. It is thus a relatively easy thing to forcibly immobilize these animals and convince them that they have no option but to receive the shock. Humans, however, and particularly college students, are not so easily swayed. The pre-experimental experience of these subjects is far richer than that of their animal counterparts, and it is safe to assume that they learn to exert, and thus expect, a good deal of control in their everyday lives. Thus, when asked to participate in a psychology experiment, people probably have strong expectations about what they should and should not be able to control. Moreover, people participate voluntarily, and as a consequence never really experience unavoidable aversive outcomes; these outcomes may be avoided by simply leaving the experiment. In this sense, they always have at least a minimal level of control over the aversive event. The psychological impact of the laboratory experience is thus much attenuated for human subjects. It is just too difficult to convince them that their level of control over aversive outcomes has shifted from a very high level to one approaching 0%.[12] This explanation is consistent with data presented by Seligman and Maier (1967, Experiment 2) showing that animals given prior experience with avoidable aversive stimuli do not exhibit the proactive interference caused by subsequent experience with unavoidable outcomes. At best, uncertainty about control increases when these subjects are exposed to unavoidable aversive outcomes, and as predicted by Uncertainty Theory, they attempt to exert more control. Thus, the subjects' degree of control over aversive outcomes prior to entering the experiment, as well as their certainty about their control, lessen the

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impact of experience with unavoidable outcomes. The more the subjects are certain that they possess a high degree of control prior to the experiment, the less likely they will be to exhibit the learned helplessness syndrome.

IV. Concluding Remarks

In this paper we have proposed a general theoretical framework based on responses to uncertainty to predict and explain changes in behavior following changes in control over outcomes. It was proposed that uncertainty is a noxious state, and that it arouses individuals to seek uncertainty-reducing information. When uncertain about their degree of control over outcomes, individuals should thus be motivated to seek information about their control. One way to obtain such information is to observe the consequences of one's behavior. It was therefore predicted that individuals would attempt to reduce uncertainty about their control by trying to demonstrate positive instances of that control. It was hypothesized that individuals would become more and more uncertain about their level of control, and thus more and more motivated to reduce that uncertainty, as their actual level of control approached 50%.

In an effort to demonstrate the generality of this theory, and to show its ability to explain a wide variety of extant data, a substantial amount of theoretical and empirical work concerned with both uncertainty and control was reviewed. Decision Theory, Atkinson's Theory of Achievement Motivation, Brehm's Theory of Psychological Reactance, and Seligman's learned Helplessness Theory were discussed in detail. Some of the main points brought up in the discussions of these theories are summarized in Table 4.

Insert Table 4 about here

Table 4

A Summary of Main Points Brought up in the Discussion of the Four Existing Psychological Theories

(A) Decision Theory

(1) Decision Theory is concerned with providing normative models describing ..how decisions "ought to be made" if one is to generate optimal solutions.

(2) Decision theorists usually divide the various states of knowledge under which decisions can be made into three categories: certainty, risk, and ignorance. It was argued, however, that certainty is a special case of risk, and that the distinction between risk and ignorance is one of degree rather than kind. According to the definition of uncertainty proposed in the present paper, risk is analogous to minimum uncertainty, and ignorance is analogous to maximum uncertainty. Most real-world decision situations probably fall between these two extremes.

(3) The most widely researched decision models, the various expected value models, have generally focused on decision making under conditions of risk. they have not been designed to accomodate the uncertainty dimension as it has been defined here, and as a consequence they lose some of their predictive ability when probabilities and values can be stated only in more-or-less uncertain terms. A modification of the SEU model was proposed to improve its predictability under varying conditions of uncertainty.

(B) Atkinson's Theory of Achievement Motivation

(1) Atkinson's Theory of Achievement Motivation is concerned with choice behavior, magnitude of performance, and persistence of ongoing behavior in achievement-related situations.

(2) Atkinson's theory predicts that the tendency to perform an achievement-related activity is a function of the relative strengths of M_S and M_{AF}, and the value of P_S. Individuals with $M_S > M_{AF}$ are predicted to prefer achievement-related activities over non-achievement-related activities, prefer achievement-related activities with $P_S = .50$, and perform more vigerously and

Table 4

(continued)

persist longer at tasks with P_S = .50. Just the opposite is predicted for individuals with $M_{AF} > M_S$.

(3) Uncertainty Theory makes predictions that are very similar to those made by Atkinson's theory for individuals with $M_S > M_{AF}$. However, Uncertainty theory offers an alternative explanation for these predictions. It suggests that individuals choose situations with high levels of uncertainty (i.e., those with P_S approaching .50) and tend to work hardest in those situations not because they are particularly attracted to such situations, but rather because those situations allow them the greatest potential for uncertainty reduction.

(C) Reactance Theory

(1) Reactance Theory is concerned with the responses of individuals whose freedom is eliminated or threatened with elimination.

(2) Reactance Theory predicts that whenever an individual's freedom is eliminated or threatened with elimination, the individual will be motivationally aroused to re-establish that freedom. The magnitude of this arousal is hypothesized to be a direct function of the degree to which the individual is confident that he/she had the freedom before it was eliminated or threatened with elimination, the importance of that freedom, the strength of the threat, and the implications for the elimination of other freedoms. When the freedom eliminated or threatened with elimination is an outcome freedom, the individual may manifest his/her arousal by exerting effort to obtain the outcome in question.

(3) In contrast to Reactance Theory, Uncertainty Theory predicts that decreases in control over outcomes, and thus outcome freedom, will not always lead to increases in outcome-oriented effort. Under some circumstances an actual decrease in effort is predicted. Uncertainty Theory predicts that whether effort increases or decreases depends upon the individual's uncertainty about his/her degree of control both before and after the decrease in control. It was proposed that Reactance Theory has only been tested in situations where

Table 4

(continued)

both theories make similar predictions, and that new situations where the two theories make divergent predictions must be utilized to test between them.

(D) Learned Helplessness

(1) Learned Helplessness is concerned with the responses of individuals who are exposed to unavoidable aversive events.

(2) The theory predicts that exposure to unavoidable aversive events impairs individuals ability to learn escape/ avoidance resopnses to avoidable aversive events in the future. The empirical evidence relavent to this prediction is generally supportive when animals are used as subjects. The evidence is less consistent when humans are used as subjects.

(3) Learned helplessness theorists explain this phenomenon in terms of the subjects learning that their behavior and outcomes are independent, and then generalizing this learning to new situations. This explanation is completely compatable with the proposed theory based on uncertainty. When one is certain that one has 0% control, there should be little motivation to exert effort and try to demonstrate positive instances of that control. The inconsistent findings with human subjects is explained in terms of the relative difficulty of convincing them that they actually have 0% control.

It is evident from our review that the problem of responses to control and responses to changes in control has not been approached in a very comprehensive fashion. Most of the research dealing specifically with control has focused on the effects of total control over aversive events versus no control over these events (e.g., Averill, 1973; Seligman, 1974, 1975). Responses to intermediate levels of control, and to control over positive outcomes have not received a great deal of attention. Several theories which are not specifically concerned with control, but which nevertheless can be used to make predictions about responses to control and to changes in control also lack comprehensiveness. Atkinson's Theory of Achievement Motivation, for example, can make predictions only in achievement-related situations, and Brehm's Theory of Psychological Reactance can make predictions only about decreases in control. The proposed theory based on uncertainty thus offers an improvement over previous theoretical work. Within one general framework it deals with the entire range of the control continuum, and with both increases and decreases in control.

We would like to conclude this paper by briefly mentioning several issues which have implications for research testing the proposed theory. First is the problem that individuals may have difficulty understanding what various levels of control mean in terms of the likelyhood of obtaining an outcome. It will be recalled that control was defined as the degree of contingency between behavior and outcomes. Defined in this way, control is orthogonal to the probability of obtaining the outcome. Theoretically, the probability of obtaining an outcome can be either high or low no matter what level of control one actually has over that outcome. However, it is likely that in many real-world situations control over an outcome and the

probability of obtaining that outcome are in fact correlated. For example, the joint occurrence of some behavior and a particular event almost always implies a causal relationship. Doors seldom open unless pushed, cars seldom go faster without pressing the gas peddle, and so on. Individuals may generalize from such instances, and thus come to associate control with a high probability of the event occurring and a lack of control with a low probability of the event occurring.

Jenkins and Ward (1965) provide evidence suggesting that individuals do indeed associate the concepts of control and probability. These authors had subjects judge the degree of contingency between their responses and two different outcomes. The subjects could choose between two different responses, and one of two possible outcomes would follow. In general, the subjects tended to judge their control over the outcomes by evaluating their performance against the expectancy that if they had no control the outcome would not occur. The implication here is that it may be rather difficult to set up an experimental situation in which the subjects understand that control and probability can be independent, especially in those situations where control is low but the probability of obtaining the outcome is high. Even though the notion of contingent and non-contingent outcomes can be carefully explained in pre-experimental instructions, the subjects may still tend to attribute the occurrence of non-contingent outcomes to their own behavior. Testing the predictions form Uncertainty Theory concerning the outcome-oriented effort individuals will exert when their control drops to 0% may thus be troublesome because of the difficulty of inducing perceptions of 0% control.

A second, related issue concerns uncertainty at 0% control. Although we have argued that uncertainty about one's control will decrease as one's actual level of control approaches 0%, it is quite likely that one's

uncertainty as to what the outcome does depend on will be maximized at 0% control. To illustrate, an individual may be certain that he/she has no control over his/her boss's verbal praises, but may be quite uncertain about who or what does control them. They may depend on a variety of factors, from the state of the stock market to the weather, but the exact causes are unknown. The only thing that is certain is that they don't depend upon one's behavior. Thus, although 0% control and 100% control may produce the same level of uncertainty about control, 0% control probably produces more generalized uncertainty. The behavioral implications of this increased generalized uncertainty need to be carefully examined.

Finally, since behaviors are usually determined by a variety of motives, it may well be that the effect of the motive to reduce uncertainty will be masked, or at least attenuated by other motives. If, for example, there is in fact both a motive to reduce uncertainty and a motive to re-establish freedoms that have been eliminated or threatened with elimination, what sort of behaviors will occur in situations where Uncertainty Theory and Reactance Theory make divergent predictions? Will the resultant behavior be a weighted algebraic function of these two motives, and if so what will the weights be? Similarly, how might a motive to reduce uncertainty and an achievement motive combine to produce behavior? What are the relative strengths of the two motives, and in which situations is each likely to be the primary causal factor? These are all very difficult questions, and a good deal of experimental work will be needed before they can be answered.

References

Anderson, N. H., & Shanteau, J. C. Information integration in risky decision making. Journal of Experimental Psychology, 1970, 84, 441-451.

Atkinson, J. W. The achievement motive and recall of interrupted and completed tasks. Journal of Experimental Psychology, 1953, 46, 381-390.

Atkinson, J. W. Motivational determinants of risk-taking behavior. Psychological Review, 1957, 64, 359-372.

Atkinson, J. W. (Ed.). Motives in fantasy, action, and society. Princeton, New Jersey: Van Nostrand, 1958. (a)

Atkinson, J. W. Towards experimental analyses of human motivation in terms of motives, expectancies, and incentives. In J. W. Atkinson (Ed.), Motives in fantasy, action and society. Princeton, N.J.: Van Nostrand, 1958. (b)

Atkinson, J. W. An introduction to motivation. Princeton, N.J.: Van Nostrand, 1964.

Atkinson, J. W., Bastian, J. R., Earl, R. W., & Litwin, G. H. The achievement motive, goal setting, and probability preference. Journal of Abnormal and Social Psychology, 1960, 60, 27-36.

Atkinson, J. W., & Litwin, G. H. Achievement motive and test anxiety conceived as motive to approach success and motive to avoid failure. Journal of Abnormal and Social Psychology, 1960, 60, 52-53.

Averill, J. R. Personal control over aversive stimuli and its relationship to stress. Psychological Bulletin, 1973, 80, 286-303.

Barclay, S. Expected value in psychological models. Technical Report 71-1-11, Department of Psychology, University of Washington, 1971.

Beach, L. R., Beach, B. H., Carter, W. B., & Barclay, S. Five studies of subjective equivalence. Organizational Behavior and Human Performance, 1974, 12, 351-371.

Beach, L. R., & Solak, F. Subjective judgments of acceptable error. Organizational Behavior and Human Performance, 1969, 4, 242-251.

Becker, S. W., & Brownson, F. O. What price ambiguity?: Or the role of ambiguity in decision-making. Journal of Political Economy, 1964, 72, 62-73.

Becker, G. G., & McClintock, C. G. Value: Behavioral decision theory. Annual Review of Psychology, 1967, 18, 239-286.

Bernoulli, D. Specimen theoriae novae de mensura sortis. Comentarii Academae Scientiarum Imperiales Petropolitanae, 1738, 5, 175-192. (Translated by L. Sommer in Econometrica, 1954, 22, 23-36.)

Brehm, J. W. A theory of psychological reactance. New York: Academic Press, 1966.

Brehm, J. W. Responses to losses of freedom: A theory of psychological reactance. Morristown, N.J.: General Learning Press, 1972.

Brehm, J. W., & Cole, H. Effect of a favor which reduces freedom. Journal of Personality and Social Psychology, 1966, 3, 420-426.

Brehm, J. W., & Mann, M. The effect of importance of freedom and attraction to group members on influence produced by group pressure. Journal of Personality and Social Psychology, 1975, 31, 816-824.

Brehm, J. W., & Sensing, J. Social influence as a function of attempted and implied usurpation of choice. Journal of Personality and Social Psychology, 1966, 4, 703-707.

Brehm, J. W., Stire, L. K., Sensing, J., & Shaban, J. The attractiveness of an eliminated choice alternative. Journal of Experimental Social Psychology, 1966, 2, 301-313.

Brickman, P., & Berman, J. T. Effects of performance expectancy and outcome on interest in social comparison. Journal of Experimental Social Psychology, 1971, 7, 600-609.

Brown, J. S., & Jacobs, A. The role of fear in the motivation and aquisition of responses. Journal of Experimental Psychology, 1949, 39, 747-759.

Carlson, N. J., & Black, A. H. Traumatic avoidance learning: The effect of preventing escape responses. Canadian Journal of Psychology, 1960, 14, 21-28.

Coombs, C. H., Dawes, R. M., & Tversky, A. Mathematical psychology: An elementary introduction. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1970.

Ellsberg, D. Risk, ambiguity, and the savage axioms. Quarterly Journal of Economics, 1961, 75, 643-669.

Feather, N. T. The relationship of persistence at a task to expectation of success and achievement related motives. Journal of Abnormal and Social Psychology, 1961, 63, 552-561.

Festinger, L. A theory of social comparison processes. Human Relations, 1954, 7, 117-140.

Fosco, E., & Geer, J. H. Effects of gaining control over aversive stimuli after differing amounts of no control. Psychological Reports, 1971, 29, 1153-1154.

French, E. J. Motivation as a variable in work partner selection. Journal of Abnormal and Social Psychology, 1956, 53, 96-99.

Gerard, H. B. Emotional uncertainty and social comparison. Journal of Abnormal and Social Psychology, 1963, 66, 568-573.

Glass, D. C., & Singer, J. E. Urban stress: Experiments on noise and social stressors. New York: Academic Press, 1972.

Haggard, E. A. Experimental studies in affective process: I. Some effects of cognitive structure and active participation on certain autonomic reactions during and following experimentally induced stress. Journal of Experimental Psychology, 1943, 33, 257-284.

Hammock, T., & Brehm, J. W. The attractiveness of choice alternatives when freedom to choose is eliminated by a social agent. Journal of Personality, 1966, 34, 546-554.

Hiroto, D. S. Locus of control and learned helplessness. Journal of Experimental Psychology, 1974, 102, 187-193.

Hiroto, D. S., & Seligman, M. E. P. Generality of learned helplessness in man. Journal of Personality and Social Psychology, 1975, 31, 311-327.

Hull, C. L. Principles of behavior. New York: Appleton-Century-Crofts, 1943.

Isaacson, R. L. Relation between achievement, test anxiety, and curricular choice. Journal of Abnormal and Social Psychology, 1964, 4, 447-452.

Jenkins, H. M., & Ward, W. L. Judgment of contingency between reward and outcome. Psychological Monographs, 1965, 79, No. 1. (Whole No. 594).

Jones, R. A. Volunteering to help: The effects of choice, dependence, and anticipated dependence. Journal of Personality and Social Psychology, 1970, 14, 121-129.

Knight, F. H. Risk, uncertainty and profit. Boston: Houghton-Mifflin, 1921.

Laestadius, J. E. Tolerance for errors in intuitive mean estimations. Organizational Behavior and Human Performance, 1970, 5, 121-124.

Langer, E. J. The illusion of control. Journal of Personality and Social Psychology, 1975, 32, 311-328.

Leaf, R. C. Avoidance response evocation as a function of prior discriminative fear conditioning under curare. Journal of Comparative and Physiological Psychology, 1964, 58, 446-449.

Luce, R. D., & Suppes, P. Preference, utility, and subjective probability. In R. D. Luce, R. R. Bush, and E. Galanter (Eds.), Handbook of Mathematical Psychology, Vol. 3. New York: John Wiley, 1965.

Mahone, C. H. Fear of failure and unrealistic vocational aspirations. Journal of Abnormal and Social Psychology, 1960, 60, 253-261.

Maier, S. F. Failure to escape traumatic shock: Incompatible motor responses or learned helplessness? Learning and Motivation, 1970, 1, 157-169.

Mandler, G., & Sarason, S. B. A study of anxiety and learning. Journal of Abnormal and Social Psychology, 1952, 47, 166-173.

Mischel, W. Personality and assessment. New York: John Wiley, 1968.

Morris, J. Propensity for risk taking as a determinant of vocational choice: An extension of the theory of achievement motivation. Journal of Personality and Social Psychology, 1965, 2, 625-633.

Overmier, J. B., & Seligman, M. E. P. Effects of inescapable shock upon subsequent escape and avoidance learning. Journal of Comparative and Physiological Psychology, 1967, 63, 28-33.

Pervin, L. A. The need to predict and control under conditions of threat. Journal of Personality, 1963, 31, 570-587.

Peterson, C. R., & Beach, L. R. Man as an intuitive statistician. Psychological Bulletin, 1967, 68, 29-46.

Radloff, R. Opinion evaluation and affiliation. Journal of Abnormal and Social Psychology, 1961, 62, 578-585.

Rapoport, A., & Wallstern, T. S. Individual decision behavior. Annual Review of Psychology, 1972, 23, 131-176.

Roth, S., & Bootzin, R. R. The effect of experimentally induced expectancies of external control: An investigation of learned helplessness. Journal of Personality and Social Psychology, 1974, 29, 253-264.

Rotter, J. B. Generalized expectancy for internal versus external locus of control. Psychological Monographs, 1966, 80, No. 1 (Whole No. 609).

Ryan, E. D., & Lackie, W. L. Competetive and non-competetive performance in relation to achievement motivation and manifest anxiety. Journal of Personality and Social Psychology, 1965, 1, 342-345.

Schachter, S. The psychology of affiliation: Experimental studies of sources of gregariousness. Stanford: Stanford University Press, 1959.

Schachter, S. The interaction of cognitive and physiological determinants of emotional state. In L. Berkowitz (Ed.). Advances in experimental social psychology, Vol. 1. New York: Academic Press, 1964.

Schachter, S., & Singer, J. E. Cognitive, social, and physiological determinants of emotional state. Psychological Review, 1962, 69, 379-399.

Seligman, M. E. P. Depression and learned helplessness. In R. J. Friedman and M. M. Katz (Eds.). The psychology of depression: Contemporary theories and research. Washington: Winston-Wiley, 1974.

Seligman, M. E. P. Helplessness. San Francisco, Calif.: W. H. Freeman and Co., 1975.

Seligman, M. E. P., & Graves, D. Non-transient learned helplessness. Psychonomic Science, 1970, 19, 191-192.

Seligman, M. E. P., & Maier, S. F. Failure to escape traumatic shock. Journal of Experimental Psychology, 1967, 74, 1-9.

Seligman, M. E. P., Maier, S. F., & Geer, J. The alleviation of learned helplessness in the dog. Journal of Abnormal Psychology, 1968, 73, 256-262.

Seligman, M. E. P., Maier, S. F., & Solomon, R. L. Unpredictable and uncontrollable aversive events. In F. R. Brush (Ed.), Aversive conditioning and learning. New York: Academic Press, 1971.

Seligman, M. E. P., Rosellini, R. A., & Kozak, M. J. Learned helplessness in the rat: Reversibility, time course, and immunization. Journal of Comparative and Physiological Psychology, 1975, 88, 524-541.

Shannon, C. E., & Weaver, W. The mathematical theory of communication. Urbana, Ill.: University of Illinois Press, 1949.

Skinner, B. F. The behavior of organisms: An experimental analysis. New York: Appleton-Century Crofts, 1938.

Slovic, P., & Lichtenstein, S. Relative importance of probabilities and payoffs in risk taking. Journal of Experimental Psychology, 1968, 78, (3, Part 2).

Stadder, J. E. R., & Innis, N. K. An effect analogous to "frustration" on interval reinforcement schedules. Psychonomic Science, 1966, 4, 287-288.

Stadder, J. E. R., & Innis, N. K. Reinforcement omission on fixed-interval schedules. Journal of the Experimental Analysis of Behavior, 1969, 12, 689-700.

Staub, E., Tursky, B., & Schwartz, G. E. Self-control and predictability: The effects on reactions to aversive stimulation. Journal of Personality and Social Psychology, 1971, 18, 157-162.

Steiner, I. D. Perceived freedom. In L. Berkowitz (Ed.), Advances in experimental social psychology, Vol. 5. New York: Academic Press, 1970.

Thornton, J. W., & Jacobs, P. D. Learned helplessness in human subjects. Journal of Experimental Psychology, 1971, 87, 367-372.

Thronton, J. W., & Jacobs, P. D. The facilitating effects of prior inescapable/unavoidable stress on intellectual performance. Psychonomic Science, 1972, 26, 185-187.

Weiner, B. The effect of unsatisfied achievement motivation on persistence and subsequent performance. Journal of Personality, 1965, 33, 428-442.

Weiner, B. New Conceptions in the study of achievement motivation. In B. Maker (Ed.), Progress in experimental personality research. New York: Academic Press, 1970.

Weiner, B., Frieze, I., Kukla, A., Reed, L., Rest, S., & Rosenbaum, R. M. Perceiving the causes of success and failure. In E. E. Jones, D. E. Kanouse, H. H. Kelley, R. E. Nisbett, S. Valins, and B. Weiner (Eds.), Attribution: Perceiving the causes of behavior. New York: General Learning Press, 1971.

Weiner, B., & Rosenbaum, R. M. Determinants of choice between achievement and non-achievement-related tasks. Journal of Experimental Research in Personality, 1965, 1, 114-122.

White, R. W. Motivation reconsidered: The concept of competence. Psychological Review, 1959, 66, 297-333.

Wicklund, R. A. Prechoice preference reversal as a result of threat to decision freedom. Journal of Personality and Social Psychology, 1970, 14, 8-17.

Worchel, S. The effects of three types of arbitrary thwarting on the instigation to aggression. Journal of Personality, 1974, 42, 300-318.

Worchel, S., & Brehm, J. W. Direct and implied social restoration of freedom. Journal of Personality and Social Psychology, 1971, 18, 294-304.

Wortman, C. B., & Brehm, J. W. Responses to uncontrollable outcomes: An integration of reactance theory and the learned helplessness model. In L. Berkowitz (Ed.), Advances in experimental social psychology, Vol. 8. New York: Academic Press, 1975.

Footnotes

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[2]Technically these are not true bipolar scales. True bipolar scales will have two maximum values, equal but opposite in sign, one at each end of the continuum, with a neutral point in the middle. A continuum with a maximum value at one end, a minimum value at the other, and no neutral point might best be referred to as a monopolar scale. However, since we postulate that judgments about both types of dimensions will exhibit the same phenomenon with respect to uncertainty, this distinction will be ignored here.

[3]It is assumed here that the organism has learned the contingency.

[4]Indeed, there are those who would also say that it is a risky business to postulate the operation of cognitive variables in man!

[5]We assume here that the excitement and monetary variables have been standardized.

[6]Strictly speaking, we should be concerned with only the EV model here, since we have no way of assessing the subjective probabilities and utilities. However, since the probabilities and outcomes are the same in all cases both the EU and SEU models should make the same predictions. Our reasoning here is that although the subjective probabilities and utilities may not match the objective probabilities and values, they should remain constant across stimuli as long as the objective probabilities and values remain the

same. We prefer to use the SEU model in the discussion purely for the sake of continuity.

[7]Anderson and Shanteau (1970) and Slovic and Lichtenstein (1968) have proposed models which also differently weight the various pieces of information to be integrated (e.g., the probability of winning and the amount to be won). However, these are additive models of information integration rather than expected value models, and the weights reflect the importance of the various pieces of information rather than uncertainty.

[8]Shifts in the values of P_S as a function of experience with the task have been the topic of much research related to Atkinson's Theory of Achievement Motivation, and have led to several refinements of the theory itself. These refinements, however, are inconsequential to the present discussion. The interested reader is referred to an excellent review by Weiner (1970).

[9]This assumption does not seem unreasonable for the present discussion. Recall that control was defined earlier as the degree of contingency between behavior and outcomes. If the outcome-oriented behavior occurs in a given situation, then the degree of contingency between behavior and outcomes in fact reduces to the probability of attaining the outcome. In achievement-related settings, at least as they have typically been set up for psychological experiments, this condition is usually satisfied. Subjects are brought into the laboratory and asked to work at an achievement-related task for at least some minimal amount of time. If they comply with this request, their control is indeed synonymous with P_S.

[10]Actually, this latter restriction is not made in Atkinson's initial mathematical formulation of his theory (see equation (5) above). However, he argues verbally (Atkinson, 1964, pp. 242, 244) that such a restriction best reflects the true nature of an achievement-related setting, and in fact I_S is seldom operationally defined independently from P_S. This restriction seems to the present author to be a bit severe, and appears to serve no function other than to limit the generalizability of the theory.

[11]Note that actually obtaining a desired outcome implies neither control nor freedom. If, for example, completely situational circumstances are actually responsible for the occurrence of a desired outcome, one could hardly be said to have either freedom or control over the outcome, since the outcome was not contingent upon the individual's behavior, nor could the individual freely choose to have or not-to-have the outcome.

[12]A similar explanation has been offered by Wortman and Brehm (1975).