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THE EFFECT OF OUTCOME KNOWLEDGE ON LIKELIHOOD JUDGMENTS AND INFORMATION SEARCH BEHAVIOR

The Ohio State University

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THE EFFECT OF OUTCOME KNOWLEDGE ON LIKELIHOOD JUDGMENTS AND INFORMATION SEARCH BEHAVIOR

Dissertation

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By
Elliot Scott Schwartz, B.A., M.A.

* * * * *

The Ohio State University
1983

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ACKNOWLEDGMENTS

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CHAPTER I
INTRODUCTION

One way in which individuals can improve their decision making skills is to learn from their mistakes. For this to occur, the individuals must accurately determine how they came to their decision. That is, if a person makes a judgment concerning an outcome of an event and after the event occurs, discovers that his/her judgment was in error, then this person should reconstruct the pre-outcome situation in order to review his/her judgment process. In order to do this, the individual must be able to accurately remember or reconstruct the information available before the judgment was made. A good deal of experimental evidence indicates that this is not always possible. Several studies have found that on hindsight, individuals believe that they could have made the correct judgment, even though in foresight, they actually made the wrong judgment. Therefore, instead of the individual recognizing that, given the information available at the time, the actual outcome may have been unpredictable, the individual believes that it couldn't have happened any other way and therefore the right judgment could and should have been made.
This tendency for people to believe that reported outcomes were relatively inevitable has been termed "creeping determinism". Creeping determinism is different from philosophical determinism. According to philosophical determinism, what happens is, by definition, inevitable, but not necessarily predictable. A person can be surprised at the outcome of an event and agree that individuals could not have predicted the outcome, given the information available at the time. For example, the philosophical determinist would say that the bombing of Pearl Harbor was inevitable, but not necessarily predictable.

In contrast, according to creeping determinism, things happen because they just couldn't happen any other way. By using the information correctly, a person should always be able to predict the outcome and therefore not be surprised. So, according to the creeping determinist, not only was Pearl Harbor inevitable, but also foreseeable, since it couldn't have happened any other way.

This phenomenon is by no means recent. The historian Georges Florovsky (1969) noted:

In retrospect we seem to perceive the logic of the events which unfold themselves in a regular order, according to a recognizable pattern, with an alleged inner necessity, so that we get the impression that it really could not have happened otherwise. (p. 364)

According to Florovsky, the goal of perfectly recreating past events is unattainable:

2
The past as such cannot be "observed" directly. It has actually passed away and therefore is never given directly in any possible experience. The knowledge of the past is necessarily indirect and inferential. It is always an interpretation. The past can only be reconstructed. (p. 352)

Creeping determinism has received considerable attention in recent years. Studies of the "knew-it-all-along" effect (Fischhoff, 1977; Wood, 1978; Fischhoff and Byeth, 1975; Fischhoff, 1975a; Slovic and Fischhoff, 1977; Fischhoff, 1976) have demonstrated that foresight judgments are systematically different from hindsight judgments, under a wide variety of circumstances. Variables such as the amount of time between foresight and hindsight judgments, the extent of outcome knowledge, the presence of debiasing instructions, and the temporal setting of the events have all been examined in reference to this phenomenon. In addition, research has been conducted demonstrating the presence of creeping determinism in such diverse areas as statistical principles (Tversky and Kahneman, 1971), attribution of responsibility (Walster, 1967), and psychiatric diagnosis (Rosenhan, 1973). We now turn to a discussion of these findings.

Literature Review

One of the first studies of creeping determinism was conducted by Fischhoff and Byeth (1975). In this study, subjects were asked to make predictions concerning the
probabilities of various outcomes of President Nixon's trips to China and the Soviet Union during 1972. Sometime after the relevant trip took place, the subjects were asked to remember or reconstruct their predictions as accurately as possible. The instructions indicated that this was a memory experiment and the experimenter was interested in whether the subject could accurately remember his/her prediction, regardless of whether it turned out to be correct or not. The events that the subjects had to predict were not mutually exclusive and were chosen in hopes of creating a high range of probabilities.

According to creeping determinism, reporting an event's occurrence should increase its perceived inevitability, resulting in hindsight probabilities being higher than foresight probabilities. For events that are reported to have not occurred, hindsight probabilities should be lower than foresight probabilities.

The results supported the phenomenon of creeping determinism in that 67% of the subjects misremembered and/or misconstructed the probabilities in the appropriate direction. For events that did occur, 75% of the subjects assigned higher after-event probabilities, while for events that did not occur, 57% of the subjects assigned lower after-event probabilities. This difference was statistically significant. In addition, for events that did occur, 84% of the subjects who had a long period of
time (months) between judgments exhibited the bias compared to 67% of the subjects who had a shorter period of time (weeks) between the judgments. For events not occurring, 64% and 51% of the subjects with long and short intervals, respectively, exhibited the bias.

In another study, Fischhoff (1977) used a between subjects design to measure this difference between hindsight and foresight judgments which he called the knew-it-all-along effect. In this study, the stimuli were basic information questions with two possible answers for each question (e.g., absinthe is a (a) precious stone (b) liqueur). Subjects were assigned to one of three experimental conditions: memory, hypothetical, or reliability. All subjects had to indicate for one of the alternatives the probability of it being the correct alternative.

Memory subjects, after providing these probabilities, were later given the same questions with the correct alternative circled as the answer, and were asked to remember the original probability for the alternative that they had estimated, i.e., they were told to ignore the outcome information; it was provided "for your general information". Reliability subjects did exactly as memory subjects except the correct alternative was not indicated on the second set of judgments. Hypothetical subjects were only given one set of judgments, with the correct
alternative circled, and were told to indicate the probabilities as they would have had they not been given the answer.

According to the hypothesis of the knew-it-all-along effect, subjects in the Hypothetical group should have given higher probabilities to correct answers and lower probabilities to incorrect answers than subjects in the Reliability group. For 20 out of 25 correct items (i.e., those items where subjects estimated items that were later circled), the mean probabilities for Hypothetical subjects were higher than the mean probabilities for Reliability subjects. For 15 out of 25 incorrect items, Hypothetical mean probabilities were lower than Reliability mean probabilities. Also, there was a significant difference in the number of responses that were correctly remembered between subjects in the Reliability and Memory groups (66% and 53%, respectively), providing additional evidence that supplying the answers interfered with the memory task. The bias, as indicated above, was much greater for correct alternatives than for incorrect alternatives. For incorrect alternatives, probabilities only went down when the initial probabilities were high.

A related second experiment in this study measured the effect of giving subjects warnings about the bias. The results indicated that there were no differences between such a Hypothetical-Debiasing group and a
Hypothetical group. Both of these groups replicated the findings found in the first experiment.

In another study, Fischhoff (1975a) examined two additional factors related to creeping determinism. First, he measured the extent to which outcome knowledge would affect not only judgments of prior probabilities, but judgments of the relevance of the pieces of information that were used to make the prior predictions. Second, he measured the extent to which individuals were aware of outcome knowledge affecting their perceptions.

In this study, subjects read descriptions of events (e.g., information regarding the British-Gurka war in 1814) and were asked to (1) estimate the likelihood of occurrence of four alternatives (e.g., (a) Britain won (b) Gurka won (c) Military stalemate with peace (d) Military stalemate without peace) and (2) evaluate the relevance of each piece of information (e.g., The Gurkas were only some 12,000 strong) in determining the outcome. Some subjects (Before) were given the four alternatives and asked to make estimates of the probability of each outcome occurring, while other subjects (After) were given the four alternatives with one of them indicated as the "true" outcome and asked to make estimates of the probability of each outcome, using the information provided. The events were chosen so that they were familiar, but that subjects probably did not know the outcome, and so that four
mutually exclusive and exhaustive outcomes could be supplied.

The knew-it-all-along effect would be evidenced by probability estimates for "true" alternatives for After subjects being higher than the probability estimates for the corresponding alternatives for Before subjects. This is exactly what occurred. In addition, using Before subjects' probabilities as prior odds and After subjects' probabilities as posterior odds, the mean likelihood ratio obtained was 1.96, indicating that supplying the answer made that outcome twice as likely. It was also found that the more unlikely an outcome (as expressed in prior odds), the higher the impact of the answer (as expressed in the likelihood ratio).

Regarding relevance judgments, a strong Correct Answer X Piece of Information interaction was found, indicating that subjects weighted the information differently depending on the correct outcome. Thus, outcome knowledge does affect individuals' estimates of relevance of information.

To examine the second factor, whether subjects were aware of the bias, this experiment was replicated, except that only After subjects were included and they were specifically told to respond as if they were not given the answer. The results indicated that the findings of Experiment 1 were replicated, but were somewhat weaker. In a
third experiment, subjects were asked to respond as others would if the others weren't given the answer, and again the results were replicated. Fischhoff therefore concluded that individuals are indeed not aware of the bias, in that the instructions to ignore the answer did not demonstrably reduce the effect.

One problem with some of the above studies is that there could be a demand characteristic of the knew-it-all-along effect, i.e., "If I'm not supposed to use the (outcome) information, then why is it provided?". A study by Wood (1978) was designed to test this hypothesis. In addition, Wood varied the degree of outcome knowledge in order to see if this would have an impact on the knew-it-all-along effect.

In this study, subjects were asked to rate the plausibility (i.e., indicate probabilities of true and false) of various statements in order to provide the experimenter with data relating to the general knowledge of individuals. Three different sets of items were used and subjects were divided into four groups based on two factors. In Stage 1, all subjects were asked to rate the plausibility of item sets A and B. In Stage 2, half of the subjects were given the answers to item sets A and C, while the other half of the subjects were given the answers to item sets B and C. In Stage 3, subjects were asked to rate the plausibility of all three item sets,
either as a typical college student would (Peer condition) or as they had in Stage 1 (Memory condition).

For each subject, the dependent variable was obtained by calculating the difference between the mean plausibility rating for true statements and the mean plausibility rating for false statements. The higher this score, the better the subject discriminated between true and false statements. The results indicated that the scores for items obtained at Stage 3 were significantly higher than the corresponding scores for items obtained at Stage 1, thus producing the knew-it-all-along effect. There was no effect due to either the item set or the instructions. Thus, the knew-it-all-along effect does not appear to be due to demand characteristics.

To measure the effect of the degree of outcome knowledge, as well as the possibility that the knew-it-all-along effect is item specific, Wood ran another experiment. The degree of outcome knowledge was varied by having subjects given either one or three learning trials in Stage 2. Item specificity was tested by taking those items with the highest mean difference scores obtained in Experiment 1 and placing them in one set, and taking those items with the lowest mean difference scores and placing them in another set. In addition, the instruction (peer vs. memory) manipulation was included.
The results indicated that the knew-it-all-along effect was not item specific, it was affected by degree of learning (with three learning trials producing more of an effect than one trial), and that, this time, it was influenced by instructions (with memory subjects showing more of a bias than peer subjects). There was also an interaction of instruction and item set, such that for memory subjects, there was a difference between the two item sets, while for peer subjects there was no such difference.

In all of the above studies, in addition to outcome knowledge, the difference between foresight and hindsight judgments was the temporal setting. Foresight judgments were always of the form "What do you think will happen" or "What will be the correct answer", while hindsight judgments involved making judgments "If you didn't know the correct outcome, what would you have predicted".

A study by Fischhoff (1976) examined whether the temporal setting of an event (i.e., past or future) affects the judgment of likelihood of that event. The two hypotheses that were tested were Hypothesis L, that past events are judged more likely than future events, and Hypothesis E, that past events are judged more extreme than future events.

In Experiment 1, subjects read event descriptions, written in either past or future tense, and their task was to judge the likelihood of a given outcome. The results
indicated that the median probabilities of past and future subjects were identical, providing strong evidence against Hypothesis L. Looking at the dispersions of subjects' probabilities from the median, there were no differences between the groups, providing strong evidence against Hypothesis E.

In Experiment 2, instead of having the experimenter produce the outcomes, the subjects produced their own outcomes and then gave probabilities for all of the outcomes that they had produced. In this case, there was some slight support for Hypothesis L, with the median probability of past subjects slightly higher than the median probability of future subjects. Again, there was no support for Hypothesis E.

The above study provides fairly strong evidence supporting the hypothesis of no effect of temporal setting on probability judgments. However, it is not only the tense of the description that is different between foresight and hindsight judgments. The complexity of the task is also different. Both foresight and hindsight judgments require using the available information to reach a decision, but hindsight judgments, in all of the studies that have been reviewed, require the subjects to go through another step, that of ignoring the outcome information.

Slovic and Fischhoff (1977) conducted a study in which they tried to eliminate this confounding variable.
In their study, all subjects were given descriptions of several pieces of scientific research, along with two possible outcomes for each piece of research. For example, one of the experiments involved injecting blood from a mother rat into a virgin rat immediately after the mother rat had given birth. After injection, the virgin rat was placed in a cage with the newly born baby rats without the mother rat. The possible outcomes were (a) the virgin rat exhibited maternal behavior (b) the virgin rat failed to exhibit maternal behavior.

Foresight subjects were asked, for each possible outcome, to (a) assign a probability to each outcome in the first trial, (b) explain why each outcome could occur, and (c) estimate the probability that the event that occurred in the first trial would occur in all, some, or none of a given number of replications. Hindsight subjects were told that one of the two outcomes had occurred on the first trial and were asked to (a) explain why it occurred and (b) estimate the probability that that outcome would re-occur on all, some, or none of the same number of replications. In our example, foresight subjects would be asked to assign probabilities for the rat exhibiting and not exhibiting the maternal behavior, explain why each event could occur, and estimate probabilities of each event being replicated, totally, partially, or not at all. Hindsight subjects would be told that
either the rat did or didn't exhibit maternal behavior on the first trial and would be asked to explain why this happened and estimate the probability of it being replicated, totally, partially, or not at all.

There are two important facets of this design that should be noted. First, all of the outcomes that the subjects estimated were set in the future. Second, it was the foresight subjects who had the more complex judgment, having to make their judgments "assuming this outcome occurs on the first trial". The results showed that hindsight subjects' probabilities of the initial outcomes occurring in all replications were still significantly higher than foresight subjects' probabilities.

In Experiment 2, all of the outcomes remained set in the future, but foresight subjects only had to assume that one of the alternatives had occurred. Hindsight subjects were given the additional question "If the experiment had turned out the other way, how would you explain it?". The results indicated that one- and two-alternative foresight subjects (Experiments 2 and 1, respectively) gave practically the same responses, while two alternative hindsight subjects (Experiment 2) gave different responses from these groups, but not as different as one alternative hindsight subjects (Experiment 1).

In Experiment 3, the research descriptions were much more detailed, with foresight subjects receiving
Introduction and Method sections of a journal article and hindsight subjects receiving Introduction, Method, and Results sections of an article. All subjects had to indicate the surprisingness of the results as well as the stability of the results, with hindsight subjects responding for the given outcome, and foresight subjects responding for both outcomes. Creeping determinism was again apparent, as hindsight subjects reported that the outcome was less surprising and more stable than foresight subjects.

All of the above research deals with creeping determinism or the knew-it-all-along effect as a phenomenon of theoretical interest. There are also several studies that have been done in areas of psychology that are very different from the above studies and that demonstrate the presence of creeping determinism in other ways.

For example, consider individuals' mistaken belief in the "law of small numbers" put forth by Tversky and Kahneman (1971). According to this "law", small samples will be highly representative of the population from which they were drawn, much more representative than sampling theory indicates. If any sample is going to have basically the same properties as the population, then any two samples drawn from the same population should have basically the same properties. Tversky and Kahneman discuss this mistaken belief in terms of experimental replications. For example:
Suppose you have run an experiment on 20 subjects and have obtained a significant result which confirms your theory ($z=2.23$, $p<.05$, two-tailed). You now have cause to run an additional group of 10 subjects. What do you think the probability is that the results will be significant, by a one-tailed test separately for that group?

The median answer of a group of Mathematical Psychologists was .84, while the correct answer is roughly .48. This is an example of creeping determinism in that this inflated estimate of replication can be viewed as due to the belief that the data couldn't have turned out any other way.

Another setting where creeping determinism has been shown to be evident is in the field of psychiatric diagnosis. Rosenhan (1973) conducted an experiment in which eight people who had never experienced any symptoms of severe psychiatric disorders gained admittance to several different psychiatric hospitals by posing as pseudopatients, complaining of hearing voices that were saying things like "hollow" and "empty". Except for alleging these symptoms and lying about name, vocation, and employment, all of the information that was given upon admittance was completely true. All of the patients, except one, were admitted under a diagnosis of schizophrenia. Once the pseudopatient gained admittance into the hospital, all of the symptoms were immediately ceased. It was quite common for the pseudopatients to be recognized as being phony by the other patients, but none of them were
ever detected by the staff. All of them were discharged under a diagnosis of schizophrenia "in remission".

This can be considered an example of creeping determinism in that once the person was identified as a psychiatric patient, information about the individual prior to his/her diagnosis was perceived in a way that gave validity to the diagnosis. For example, consider the following set of facts relating to the life of one pseudopatient:

(1) As a child, he had a close relationship with his mother, but not his father.

(2) During adolescence his relationship with his mother cooled and he got very close to his father.

(3) His relationship with his wife was close, friction was minimal, and the children were rarely spanked.

These facts were translated into the following, obtained from the patient's case summary:

This white 39-year-old male . . . manifests a long history of considerable ambivalence in close relationships, which begins in early childhood. A warm relationship with his mother cools during his adolescence. A distant relationship to his father is described as becoming very intense. Affective stability is absent. His attempts to control emotionality with his wife and children are punctuated by angry outbursts and, in the case of the children, spankings. And while he says that he has several good friends, one senses considerable ambivalence embedded in those relationships also . . .

Obviously outcome information (the diagnosis of a psychiatric disorder) affected the judgment of prior information (the individual's past history).
The phenomenon of creeping determinism has also been found in research dealing with attribution of responsibility. Walster (1967) conducted a study to measure the extent of "second guessing" behavior and also the relationship between the severity of the outcome and the degree of second guessing. In this study, all subjects listened to the identical tape of a woman, Mrs. W., discussing how she came to a decision to buy a house. Subjects were divided into seven groups, based on information given to them by the experimenter. Three groups were told that Mrs. W. eventually made a (very large, somewhat large, or slight) financial gain on the house when it was sold sometime later. Three other groups were told that Mrs. W. eventually made a (very large, somewhat large, or slight) financial loss on the house when it was sold sometime later. The remaining group was not given any additional information.

All subjects were told to evaluate the woman based on information from the tape (e.g., voice, self-expression, confidence). After hearing the tape, all of the subjects were asked: (a) Would you have been able to guess whether the outcome of purchasing the house would have been good or bad, based on the available information? and (b) How responsible was Mrs. W. for the consequences of the purchase?
Creeping determinism was evident for both events that
did occur and those that did not, but the effect was sig-
nificantly stronger for events that did occur. The
results indicated that there was a significant positive
relationship between what the subjects were told happened
and their predictions (e.g., slight loss subjects said
that they would have been able to predict a loss, while
slight gain subjects said that they would have been able
to predict a gain). This result is consistent with creep-
ing determinism in that subjects believed that they could
have correctly anticipated the outcome, whatever it would
have been.

If subjects felt that they could have predicted the
outcome, there is reason to believe that they would have
held Mrs. W. responsible for whatever occurred. Based
upon past research, it was predicted that there would be
a quadratic relationship between the net gain of the sale
and the attribution of responsibility, with the highest
degree of responsibility occurring with the largest gain
or loss. In fact, a quadratic relationship was found, but
exactly the opposite of what was predicted. Responsibili-
ity decreased as the severity of the outcome increased.
This result contradicts the first result obtained in that
subjects believed that they could have correctly antici-
pated the outcome, but didn't hold others responsible for
having that same ability.
The above studies represent the research that has been conducted to determine the nature of creeping determinism. As is evident, there are several variables that are related to this phenomenon, and a wide variety of situations under which the knew-it-all-along effect has been demonstrated. We now turn to a discussion of the possible explanations of these findings.

Explanations

One explanation for creeping determinism is the anchoring and adjustment hypothesis. According to this theory, "a natural starting point is used as a first approximation to the judgment, an anchor so to speak. This anchor is then adjusted to accommodate the implications of additional information." (Slovic, 1972, p. 16) In the present setting, individuals who are making hindsight judgments may find themselves so "anchored" in their present state of mind (i.e., with outcome knowledge) that they cannot adjust themselves fully to their previous state of mind (without outcome knowledge). Thus, for events that occurred (or correct answers), the anchor probability is 100% and is adjusted downward while for events that did not occur (or incorrect answers), the anchor probability is 0% and must be adjusted upward. A deficiency in adjustment would lead to differences between foresight and hindsight probability estimates consistent with the knew-it-all-along effect.
While this theory certainly seems to explain the phenomenon, it is not congruent with most of the effects associated with the knew-it-all-along effect. In particular, the anchoring and adjustment hypothesis is not able to explain why there would be a greater effect for events that did occur (or correct answers) than for events that did not occur (or wrong answers) (Fischhoff and Byeth, 1975; Fischhoff, 1977). In addition, it would seem reasonable that if the knew-it-all-along effect was mainly due to faulty adjustment, debiasing instructions should have decreased the bias, which it did not (Fischhoff, 1977). This hypothesis also cannot explain the finding that outcome information affects the perceived relevance of individual pieces of information (Fischhoff, 1975a). Finally, the anchoring and adjustment hypothesis does not explain Slovic and Fischhoff's (1977) finding that there is a stronger knew-it-all-along effect for one-alternative hindsight judgments than for two-alternative hindsight judgments. The only finding that the anchoring and adjustment hypothesis can explain is the effect of degree of outcome knowledge on the knew-it-all-along effect found by Wood (1978). According to the anchoring and adjustment hypothesis, this occurs because the stronger the degree of outcome knowledge, the stronger the anchor, and hence the weaker the adjustment.
Another explanation that has been offered to account for creeping determinism is the assimilation hypothesis (Fischhoff, 1975a). This hypothesis states that immediately upon receiving outcome knowledge, individuals assimilate it with information already available and are unable to later separate it from the previously held set of information. This assimilation is done in order to create the most coherent whole out of the entire set of information. This process may include altering the way in which the original information was perceived in order to better form a "whole interpretation" that includes the reported outcome. This process is so immediate that individuals are not aware that it is happening. As a result, they overestimate how much information they had before the outcome knowledge was obtained, thus producing the knew-it-all-along effect.

This hypothesis is consistent with many of the effects found associated with the knew-it-all-along effect. It is consistent with the effect of degree of outcome knowledge on the knew-it-all-along effect found by Wood (1978) in that three trials allows more of a chance for assimilation than does one trial. It is consistent with the finding that debiasing instructions have no effect on the knew-it-all-along effect found by Fischhoff (1977) in that the assimilation is so immediate and natural that it goes unnoticed. And it is consistent
with the effect of outcome knowledge on the judged impact of individual pieces of information found by Fischhoff (1975a) in that the assimilation can include re-interpretation of some of the original information. This is exactly what occurred in the Rosenhan (1973) study.

This hypothesis does not fit all the data, however. It, like the anchoring and adjustment hypothesis, cannot explain the different effects found for events that did and did not occur (Fischhoff and Byeth, 1975; Fischhoff, 1977). It also is not consistent with the findings relating to one- and two-alternative hindsight judgments (Slovic and Fischhoff, 1977) as there is no reason for the judgment of an additional alternative to decrease the effect of assimilation.

A third explanation, the availability of reasons hypothesis (Slovic and Fischhoff, 1977), states that hindsight judgments are different from foresight judgments in that in hindsight there is a difficulty in considering the feasibility of alternative outcomes. That is, in making hindsight judgments, individuals unduly focus their attention on the reported outcome and find it difficult to see how the outcome could have been different. Hindsight subjects, instead of looking ahead, are moving backwards in time from the outcome to the original situation. Such temporal reversal can obscure ways in which the reported event could have not taken place, just as proceeding
backwards in a maze can obscure false paths that might be taken if the maze were started at the beginning.

This explanation has a great deal of intuitive appeal and has been used to explain the presence of creeping determinism in historical settings. Consider, for example, the following quote from Wohlsetter (1962, p. 387) describing the difference between the way in which we view Pearl Harbor and the way it was perceived before the attack:

In short, we failed to anticipate Pearl Harbor not for want of the relevant materials, but because of a plethora of irrelevant ones. Much of the appearance of wanton neglect that emerged in various investigations of the disaster resulted from the unconscious suppression of vast congeries of signs pointing in every direction except Pearl Harbor. It was difficult later to recall these signs since they had led nowhere.

This theory is also consistent with most of the other findings concerning the knew-it-all-along effect. It is consistent with the effect of degree of outcome knowledge on the knew-it-all-along effect (Wood, 1978), in that an increased degree of knowledge serves to increase the salience of the reported outcome relative to the other outcomes. It is consistent with the effect of outcome knowledge on the judged impact of individual pieces of information found by Fischhoff (1977) in that only the pieces of information that support the reported outcome are attended to. Lastly, unlike the other two hypotheses,
it can explain the findings of Slovic and Fischhoff (1977) relating to one and two alternative hindsight judgments. According to the availability of reasons hypothesis, providing a second alternative to be judged increases the salience of that outcome (i.e., it forces the individual to examine the path in the maze ending with this outcome), and therefore reduces the difference between the saliences of the reported outcome and this second outcome, causing a decrease in the knew-it-all-along effect.

The availability of reasons hypothesis, however, does not fit all of the data. It is not able to explain the absence of an effect of debiasing instructions on the knew-it-all-along effect (Fischhoff, 1977), in that one would assume that it is possible to train an individual to consider the paths that were not taken. Also, like the other two hypotheses, the availability of reasons hypothesis is unable to explain the different effects for events that did and did not occur (Fischhoff and Byeth, 1975; Fischhoff, 1977).

None of the three hypotheses discussed above can explain why there is a stronger effect for events that do occur than for events that do not occur. Two other explanations have been offered as to why this is the case. First, it may be that the complexity of the question, "had you not known that this was not going to happen, how likely would you have thought it was?", is too great to
produce reliable results. This is supported by Jones' (1966) finding that subjects have a hard time following instructions with implicit negatives. A second explanation is that a report of an occurrence of an event may have more impact on an individual than a report of a non-occurrence of an event. Most of our learning is concerned with what has happened and not what hasn't happened, as Carr (1961, p. 26) claims, "History is by and large a record of what people did and not what they failed to do". It is, then, reasonable to expect an individual's perceptions to be affected much more by what did happen than by what did not happen.

Walster (1967) offered an explanation for creeping determinism that differs from the above explanations in that instead of considering creeping determinism maladaptive, she offered an explanation as to why it is adaptive. According to Walster, individuals have a need to believe in a predictable world and creeping determinism insures that the world is perceived as predictable.

In summary, we have three hypotheses, anchoring and adjustment, assimilation, and availability of reasons, that explain why creeping determinism, and thus the knew-it-all-along effect, occurs, and, in varying degrees, account for the findings associated with the knew-it-all-along effect. None of these hypotheses can explain the different effects found for events that did and did not
occur, although we have found two explanations for this finding. The availability of reasons hypothesis and the assimilation hypothesis both account for all of the other effects associated with the knew-it-all-along effect except one. For the availability of reasons hypothesis, it is the absence of an effect of debiasing instructions on the knew-it-all-along effect, while it is the different effects found for one- and two-alternative hindsight judgments for the assimilation hypothesis. The anchoring and adjustment hypothesis fares far worse than these hypotheses, explaining only the effect of degree of outcome knowledge on the knew-it-all-along effect.

Present Study

In the present study, three experiments were conducted in order to further our understanding of creeping determinism. Experiment 1 attempted to distinguish between the two explanations discussed above that do the best job of accounting for all of the data, the availability of reasons hypothesis and the assimilation hypothesis. Experiment 2 attempted to demonstrate the presence of creeping determinism when the responses were something other than probability estimates. Experiment 3 provided data which were used to test an alternative model to creeping determinism that would explain the results found for Experiment 2.
In Experiment 1, subjects were given background information concerning an event and four detailed scenarios describing four possible outcomes of the event. Foresight subjects were asked to judge the plausibility of each of the four scenarios, i.e., how likely is it, given the information above, that this outcome would actually occur? Hindsight subjects were asked to make the same judgments, except that one of the scenarios was labeled as the "actual" outcome. The knew-it-all-along effect would be evidenced by hindsight subjects' estimates of the "actual" outcome being higher than foresight subjects' estimates of that outcome.

This setting is different from the previous studies on the knew-it-all-along effect in that in the previous research only alternative outcomes, not alternative scenarios, were given to the subjects. By providing these detailed accounts of not only several possibilities of what could happen, but also of how each of them could happen, the saliences of the reasons for each of the outcomes occurring could be equalized (i.e., by showing the subjects all of the paths, not just all of the outcomes, subjects were forced to consider the other paths).

According to the availability of reasons hypothesis, it is the differential salience of the reasons for the actual outcome versus the other outcomes that causes the knew-it-all-along effect to occur. In this experiment,
then, according to the availability of reasons hypothesis, the knew-it-all-along effect should not have occurred. Using our maze analogy, by forcing individuals to examine each path, they should have been equally aware of all of the paths and so on hindsight would not pay exclusive attention to the correct path.

In order to directly compare the results obtained in this experiment with the previous work done, another manipulation was included in this experiment. In addition to the hindsight and foresight subjects who received scenarios, there were also hindsight and foresight subjects who received only outcomes, i.e., the last sentence of the scenarios.

This design provided an opportunity to collect data which would help discriminate between the availability of reasons hypothesis and the assimilation hypothesis. If the knew-it-all-along effect (differences between foresight and hindsight judgments in the appropriate direction) was found equally strong under both the outcome and scenario conditions, then this would suggest that there is something other than availability of reasons (viz., assimilation) that causes the knew-it-all-along effect. If the knew-it-all-along effect occurred in the outcome condition but not in the scenario condition, then this would suggest that availability of reasons is the sole cause of the knew-it-all-along effect. Finally, if the
knew-it-all-along effect occurred in both conditions, but stronger in the outcome condition, then this would suggest that availability of reasons is a cause of the knew-it-all-along effect, but not the only cause.

Experiment 2 involved a different aspect of creeping determinism. In all of the previous studies, the amount of knowledge the subject had concerning the outcome was measured by probability estimates. Although this seems to be a very reasonable response to use, it is not one that is used in our everyday lives to measure knowledge.

In everyday situations we do not normally estimate probabilities of each alternative occurring, given the available information. Something we do often is to determine whether we have enough information to make a decision or whether we need to collect more information. It would then be informative to know whether we can demonstrate creeping determinism by measuring the amount of information a subject gathers before he/she makes a decision.

In this experiment subjects had to determine how much information should be provided to another individual in order for that individual to make a correct decision, with a cost to the subject for each piece of information supplied and a reward for the subject if the decision was made correctly. There was a tradeoff, then, between the quality of the other individual's decision, based on the amount of information supplied, and the cost involved with
making the decision. Under these conditions, the optimal strategy for the subject was to provide the minimum amount of information necessary for the individual to make the correct decision.

Since outcome knowledge creates a feeling of having known it all along, hindsight subjects (subjects told the correct decision) should have felt that they didn't need to supply that much information. Creeping determinism would predict, then, that foresight subjects would provide more information than hindsight subjects. If such a finding did not occur, it would suggest that creeping determinism was measurable only by judgments of likelihoods of outcomes.

Experiment 3 was designed to test whether something other than creeping determinism could produce differences between the information search behavior of foresight and hindsight subjects. In particular, Experiment 3 examined the optimal information search behavior of foresight and hindsight subjects, given the payoff strategy used in Experiment 2.
CHAPTER II
EXPERIMENT 1

Method

Subjects

The subjects who participated in this experiment were 319 undergraduate students enrolled in an introductory psychology course at The Ohio State University. Subjects were randomly assigned to one of ten experimental conditions. Data from four subjects were not used because the subjects failed to follow the instructions.

Design

There were two independent variables in this study, perspective and detail. The perspective variable dealt with whether the subject was told which of four possible outcomes was the actual outcome. Hindsight subjects were given this information while foresight subjects were not. This manipulation yielded five conditions, one foresight condition (FS) and four hindsight conditions, one for each possible outcome (HS1, HS2, HS3, HS4). The detail variable dealt with whether subjects received detailed scenarios describing the possible outcomes (Scenario), or just one-sentence statements of the outcomes (Outcome). Together,
these two variables defined ten experimental conditions. There were approximately 30 subjects assigned to each condition.

Procedure

There were two account descriptions which were used in this study, AD1 involving a mental hospital patient, and AD2 involving a small businessman. Subjects were run in small groups, usually 3 or 4 to a group.

All subjects within a group were assigned to the same condition for AD1. Their assignment to conditions for AD2 was made according to the following rules: (1) The level of detail for AD2 was the same as that for AD1. (2) If subjects were in the foresight condition for AD1, then they were in the foresight condition for AD2. (3) Subjects who were in one of the hindsight conditions in AD1 were assigned to a hindsight condition in AD2 in such a way as to counterbalance the alternative that was labeled "actual".

Each subject received an experimental booklet containing the following six items. (See Appendix A for a sample booklet):

(1) AD1, the account description of the mental patient. The description consisted of a set of general information and four scenarios (or outcomes). In addition, for hindsight subjects, one
of the scenarios (outcomes) was labeled as the actual scenario (outcome). The instructions asked the subjects to judge how likely each scenario (outcome) was in light of the given information by assigning a percentage to each scenario (outcome) such that the four percentages summed to 100%.

(2) Relevance judgments in which each datum from the general information appeared on a separate line followed by a seven-point scale on which subjects were asked to indicate how relevant or important each datum was in determining the event's outcome.

(3) A Personal Opinion questionnaire containing five questions concerning the subject's attitude towards mental hospitals.

Items 4, 5, and 6 were the likelihood judgments, relevance judgments, and Personal Opinion questionnaire for AD2, the account description dealing with a businessman.

Instructions were read aloud to the subjects (See Appendix B). Subjects were then told to complete all of the items in the booklets.

**Pilot Data**

Pilot data for Experiment 1 was collected for two purposes. First, data was collected on the likelihood
judgments for both account descriptions in order to insure that none of the alternatives were perceived to be either totally implausible or totally inevitable (i.e., likelihood judgments close to the extremes, 0% and 100%). The second purpose for collecting pilot data was to obtain variance estimates of the likelihood judgments so that a power analysis could be conducted. The power analysis was used to determine the sample size necessary to detect differences between the foresight and hindsight groups.

Pilot data was collected for each of the ten experimental conditions, although a disproportionately higher number of subjects were run in the foresight conditions. This was done because this was the data that would be used for the likelihood estimates and the power analysis.

Table 1 presents the descriptive statistics for the foresight likelihood judgments for AD1 and AD2. As can be seen, the mean likelihood judgments ranged from 9.3% to 42.8%, while the standard deviations ranged from 7.1% to 21.1%. While this represents considerable variability among the judgments, both between and within the alternatives, it was felt that the distribution of judgments was within an acceptable range. Therefore, the account descriptions were not modified in any way.

The power analysis was designed to determine the sample size necessary to achieve sufficient power to detect differences between foresight and hindsight groups for each
alternative. A power analysis is based on four parameters: \( \alpha \), the probability of a Type I error; ES, the effect size desired to be detected; \( n \), the sample size; and power, the probability of not making a Type II error. Given values for any three of the above parameters, the value of the remaining parameter can be computed. In this case, the values of \( \alpha \) and ES were fixed, and values of power were computed for several values of \( n \).

**TABLE 1**

DESCRIPTIVE STATISTICS FOR FORESIGHT PROBABILITY ESTIMATES ON PILOT DATA FOR EXPERIMENT 1

<table>
<thead>
<tr>
<th>Scenario (N=15)</th>
<th>Outcome (N=16)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Std.</td>
<td>Mean Std.</td>
</tr>
</tbody>
</table>

**AD1**

**Alternative**

| 1 | 23.47% 17.7% | 14.81% 12.4% |
| 2 | 26.67% 8.7%  | 9.25% 7.1%  |
| 3 | 31.67% 14.8% | 32.50% 15.6% |
| 4 | 18.87% 10.4% | 42.81% 21.1% |

**AD2**

**Alternative**

| 1 | 41.30% 14.6% | 30.63% 19.7% |
| 2 | 21.80% 9.9%  | 16.25% 9.7%  |
| 3 | 14.80% 7.8%  | 28.75% 15.5% |
| 4 | 21.47% 9.0%  | 24.38% 16.4% |
In this analysis, \( \alpha \) was set to .05, based on standard experimental procedure. This \( \alpha \) applied to a 1-tailed rejection region, since there was a directional alternative hypothesis, that hindsight likelihood judgments were greater than foresight likelihood judgments.

For detecting differences between two populations, the effect size, ES, is defined as the hypothesized difference between the two population means, divided by their common standard deviation (Cohen, 1977, p. 20). The hypothesized difference between the two population means was set at 10.8%, in accordance with previous results (Fischhoff, 1975a; Fischhoff, 1977). The population standard deviation was estimated using the pilot data. Each of the 16 standard deviations given in Table 1 was squared and averaged, yielding an average variance. The square root of this average variance was used as the estimate of the population standard deviation. (The variances were averaged rather than pooled because the sample sizes were approximately the same.) This resulted in an estimated standard deviation of 14.14%, yielding a value of .76 for ES.

Given the above values for \( \alpha \) and ES, several values of \( n \) and their associated power levels were examined. The value of \( n \) selected was 30, which resulted in a power of .89. Thus, a total of 300 subjects (30 per condition)
were required in order to achieve this power for each alternative in every condition.

### Results

#### Likelihood Judgments

Each account description had four alternative outcomes and thus four sets of data to compare foresight and hindsight judgments. Within each account description, there were two conditions, scenario and outcome. Together, there were then 16 settings (4 alternatives x 2 levels of detail x 2 account descriptions) to test for the knew-it-all-along effect.

Table 2 gives the mean foresight and hindsight judgments for each setting. For 15 out of the 16 cases, the hindsight probability was higher than the foresight probability (p<.001, Sign Test). Ten of these differences were individually significant. The differences between the hindsight and foresight means ranged from -1.4% to 15%, with a mean of 8.1%.

Following the procedure of Fischhoff (1975a), foresight means were transformed into prior odds and hindsight means into posterior odds. The ratio of posterior to prior odds provided an estimate of the likelihood ratio, the impact of outcome information on the probability estimate. The 16 likelihood ratios, along with their prior and posterior odds are displayed in Table 3. As can be seen,
the likelihood ratios ranged from .93 to 2.35, with an average of 1.57. This indicated that, on the average, reporting an event's outcome increased its likelihood of occurrence by 50%.

**TABLE 2**

MEAN HINDSIGHT AND FORESIGHT PERCENTAGES FOR 16 SETTINGS IN EXPERIMENT 1

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Detail</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>AD1</td>
<td>Scenario</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hindsight</td>
<td>25.43</td>
<td>36.77*</td>
<td>39.31*</td>
<td>28.20</td>
</tr>
<tr>
<td></td>
<td>Foresight</td>
<td>20.43</td>
<td>23.93</td>
<td>26.11</td>
<td>29.54</td>
</tr>
<tr>
<td></td>
<td>Outcome</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hindsight</td>
<td>23.29</td>
<td>23.83*</td>
<td>46.44*</td>
<td>40.04</td>
</tr>
<tr>
<td></td>
<td>Foresight</td>
<td>18.78</td>
<td>11.75</td>
<td>35.36</td>
<td>34.10</td>
</tr>
<tr>
<td>AD2</td>
<td>Scenario</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hindsight</td>
<td>38.37</td>
<td>25.86*</td>
<td>29.63*</td>
<td>35.78*</td>
</tr>
<tr>
<td></td>
<td>Foresight</td>
<td>37.96</td>
<td>18.68</td>
<td>15.48</td>
<td>27.88</td>
</tr>
<tr>
<td></td>
<td>Outcome</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hindsight</td>
<td>37.35*</td>
<td>34.68*</td>
<td>32.01*</td>
<td>32.42</td>
</tr>
<tr>
<td></td>
<td>Foresight</td>
<td>25.90</td>
<td>19.67</td>
<td>24.53</td>
<td>30.85</td>
</tr>
</tbody>
</table>

*Hindsight significantly greater than Foresight, p<.05.

In addition, a highly significant negative relationship (r=-.66, p<.01) was found between prior odds and the likelihood ratio, indicating that the lower the likelihood
TABLE 3
PRIOR ODDS, POSTERIOR ODDS, AND LIKELIHOOD RATIOS FOR 16 SETTINGS IN EXPERIMENT 1

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Scenario</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Prior Odds</td>
<td>Posterior Odds</td>
</tr>
<tr>
<td>AD1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>.26</td>
<td>.34</td>
</tr>
<tr>
<td>2</td>
<td>.31</td>
<td>.58</td>
</tr>
<tr>
<td>3</td>
<td>.35</td>
<td>.65</td>
</tr>
<tr>
<td>4</td>
<td>.42</td>
<td>.39</td>
</tr>
<tr>
<td>AD2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>.61</td>
<td>.62</td>
</tr>
<tr>
<td>2</td>
<td>.23</td>
<td>.35</td>
</tr>
<tr>
<td>3</td>
<td>.39</td>
<td>.56</td>
</tr>
<tr>
<td>4</td>
<td>.34</td>
<td>.60</td>
</tr>
</tbody>
</table>
of an outcome, the greater the impact of reporting its occurrence.

In order to compare the knew-it-all-along effect across alternatives and level of detail, the following procedure was carried out. For each of the eight hindsight conditions within each account description, a KIAA score was obtained for every subject by subtracting the appropriate mean foresight probability from the subject's hindsight probability. For example the KIAA score for a subject in the Scenario HS2 condition would be computed by subtracting the mean FS Scenario probability for alternative two from that subject's probability for alternative two. Thus, the KIAA score indicated the degree to which the subject exhibited the knew-it-all-along effect. A large positive number would demonstrate a large effect while a number near zero would indicate that the subject's judgment was approximately the same as the average foresight judgment.

For the remainder of this paper, two different names will be used for the variable which compares alternatives. The variable perspective will refer to the comparison of the five groups (FS, HS1, HS2, HS3, and HS4) while the variable alternative will refer to the comparison of the four hindsight groups (e.g., when KIAA is the dependent variable).

AD1 Across all judgments for AD1, the mean KIAA score was 7.94%, with a standard deviation of 17.61%. This
mean was significantly greater than zero, $t(244)=7.06$, $p<.001$, 1-tailed.

Subsequently, this KIAA score was used as a dependent variable in a two-factor, alternative x detail, analysis of variance. The ANOVA table is given in Table 4, with the corresponding means displayed in Table 5. The only

TABLE 4

ANOVA SUMMARY TABLE FOR LIKELIHOOD JUDGMENTS FOR AD1

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative</td>
<td>3</td>
<td>1629.7</td>
<td>5.53*</td>
</tr>
<tr>
<td>Detail</td>
<td>1</td>
<td>60.2</td>
<td>.20</td>
</tr>
<tr>
<td>Alternative x Detail</td>
<td>3</td>
<td>279.8</td>
<td>.95</td>
</tr>
<tr>
<td>Error</td>
<td>237</td>
<td>294.9</td>
<td></td>
</tr>
</tbody>
</table>

p<.01

TABLE 5

CELL MEAN PERCENTAGES FOR LIKELIHOOD JUDGMENTS FOR AD1

<table>
<thead>
<tr>
<th>Alternative</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Marginal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detail</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scenario</td>
<td>5.0</td>
<td>12.8</td>
<td>13.2</td>
<td>-1.4</td>
<td>7.48</td>
</tr>
<tr>
<td>Outcome</td>
<td>4.5</td>
<td>12.1</td>
<td>11.1</td>
<td>5.9</td>
<td>8.39</td>
</tr>
<tr>
<td>Marginal</td>
<td>4.75</td>
<td>12.45</td>
<td>12.15</td>
<td>2.25</td>
<td>7.935</td>
</tr>
</tbody>
</table>
significant finding was a main effect for alternative, $F(3,237)=5.53, p<.01$. This re-states the results shown in Table 2 that, for ADI, there were large differences between foresight and hindsight judgments for alternatives two and three (mean differences being 12.45% and 12.15%, respectively), but small differences for alternatives one and four (4.75% and 2.25%, respectively). Post-hoc comparisons using Duncan's test confirmed this, with alternatives one and four being significantly different from alternatives two and three. There was no main effect for detail, nor was there an interaction, indicating no differences between the scenario and outcome conditions.

The above analysis treated KIAA as a continuous variable and compared mean responses across conditions. An alternative approach to analyzing this data would be to treat KIAA as a dichotomous variable, i.e., either an individual exhibits the knew-it-all-along effect ($\text{KIAA}>0$) or does not ($\text{KIAA}\leq 0$), and compare across conditions the number of subjects who exhibit the effect.

The FUNCAT procedure in SAS (Halwig and Council, 1979) does just this, using generalized least squares to produce minimum chi-square estimates, using methods proposed by Grizzle, Starmer, and Koch (1969). In this procedure, independent variables and their interactions are tested in order to see whether they affect the distribution of the (categorical) dependent variable.
In this experiment, the independent variables were alternative and detail, and the dependent variable was KIAA', a dichotomous variable set to one if the subject exhibited the knew-it-all-along effect (KIAA>0) or zero if the subject did not exhibit the knew-it-all-along effect (KIAA<=0). With a dichotomous dependent variable, FUNCAT tests whether the proportion of subjects that fall into one of the categories (e.g., KIAA'=1) differs across the levels of the independent variables. The results of this analysis are displayed in Table 6, with the corresponding distributions of KIAA' across the eight conditions displayed in Table 7.

**TABLE 6**

RESULTS OF FUNCAT PROCEDURE FOR AD1

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Chi-Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1</td>
<td>13.56*</td>
</tr>
<tr>
<td>Alternative</td>
<td>3</td>
<td>16.63*</td>
</tr>
<tr>
<td>Detail</td>
<td>1</td>
<td>.36</td>
</tr>
<tr>
<td>Alternative x Detail</td>
<td>3</td>
<td>4.48</td>
</tr>
</tbody>
</table>

*p<.001

The test of the intercept, equivalent to testing whether the overall proportion of subjects with KIAA'=1 was different from .5, was significant, $\chi^2(1)=13.56$, $p<.001$. As can be seen in Table 7, 152 of the 246 subjects (62%)
### TABLE 7
FREQUENCIES OF SUBJECTS WITH KIAA'=1 FOR AD1

<table>
<thead>
<tr>
<th>Detail</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Marginal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario</td>
<td>12 (.41)</td>
<td>24 (.77)</td>
<td>24 (.77)</td>
<td>12 (.4)</td>
<td>72 (.595)</td>
</tr>
<tr>
<td>Outcome</td>
<td>16 (.5 )</td>
<td>25 (.76)</td>
<td>19 (.66)</td>
<td>20 (.65)</td>
<td>80 (.64)</td>
</tr>
<tr>
<td>Marginal</td>
<td>28 (.46)</td>
<td>49 (.765)</td>
<td>43 (.717)</td>
<td>32 (.524)</td>
<td>152 (.618)</td>
</tr>
</tbody>
</table>

Note: Entries in parentheses are proportions of subjects with KIAA'=1.
exhibited the knew-it-all-along effect. This is analogous to the finding discussed above that the mean KIAA score was significantly different from zero.

The main effect for alternative was also significant, $\chi^2(3)=16.63$, $p<.001$, indicating that the proportion of subjects who exhibited the knew-it-all-along effect differed across alternatives. Again these results were comparable to those found with the variable KIAA, with most subjects in the HS2 and HS3 conditions (77% and 72%, respectively) exhibiting the knew-it-all-along effect, while approximately half of those subjects in the HS1 and HS4 conditions did so (46% and 52%, respectively).

There was no main effect for detail, as the proportion of subjects exhibiting the knew-it-all-along effect was approximately the same for the scenario and outcome conditions (60% and 64%, respectively). The interaction between alternative and detail was also not significant. Once again, these findings mirror those of the ANOVA computed with KIAA as the dependent variable.

**AD2** Analyses analogous to those carried out for AD1 were computed for AD2. The overall mean KIAA score was 8.26%, with a standard deviation of 16.9%. This mean was significantly different from zero, $t(247)=7.7$, $p<.001$, 1-tailed.
The two-factor ANOVA was then computed for this data, with alternative and detail again serving as the independent variables. The ANOVA table is given in Table 8, with the corresponding means given in Table 9. The results were similar to those found with AD1, with a marginally significant main effect for alternative, $F(3,240)=2.51, p<.06$, and

| TABLE 8 |
| ANOVA SUMMARY TABLE FOR LIKELIHOOD JUDGMENTS FOR AD2 |

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative</td>
<td>3</td>
<td>671.4</td>
<td>2.51*</td>
</tr>
<tr>
<td>Detail</td>
<td>1</td>
<td>78.5</td>
<td>.29</td>
</tr>
<tr>
<td>Alternative x Detail</td>
<td>3</td>
<td>1371.6</td>
<td>5.12**</td>
</tr>
<tr>
<td>Error</td>
<td>240</td>
<td>268.02</td>
<td></td>
</tr>
</tbody>
</table>

*p<.06  **p<.01

| TABLE 9 |
| CELL MEAN PERCENTAGES FOR LIKELIHOOD JUDGMENTS FOR AD2 |

<table>
<thead>
<tr>
<th>Alternative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detail</td>
</tr>
<tr>
<td>Scenario</td>
</tr>
<tr>
<td>Outcome</td>
</tr>
<tr>
<td>Marginal</td>
</tr>
</tbody>
</table>
no main effect for detail. The results differed from AD1, though, in that the interaction between alternative and detail was significant, $F(3,240)=5.12$, $p<.01$. This interaction can be explained through examination of Table 9 or Table 2 which show that for alternatives one and two, the scenario KIAA mean (or, in Table 2, the difference between scenario hindsight and foresight means) is much less than the outcome KIAA mean (or corresponding difference between means), while for alternatives three and four, the opposite pattern occurs.

This data was then analyzed using the FUNCAT method described above. The results, shown in Tables 10 and 11, indicated that there was a significant intercept, $\chi^2(1)=34.39$, $p<.001$, a significant main effect of alternative, $\chi^2(3)=13.83$, $p<.001$, and no significant main effect for detail or interaction.

**TABLE 10**

RESULTS OF FUNCAT PROCEDURE FOR AD2

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Chi-Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1</td>
<td>34.39*</td>
</tr>
<tr>
<td>Alternative</td>
<td>3</td>
<td>13.83*</td>
</tr>
<tr>
<td>Detail</td>
<td>1</td>
<td>.1</td>
</tr>
<tr>
<td>Alternative x Detail</td>
<td>3</td>
<td>4.49</td>
</tr>
</tbody>
</table>

*p<.01
TABLE 11
FREQUENCIES OF SUBJECTS WITH KIAA' = 1 FOR AD2

<table>
<thead>
<tr>
<th>Detail</th>
<th>Alternative</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Marginal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario</td>
<td>16 (.53)</td>
<td>25 (.81)</td>
<td>23 (.72)</td>
<td>21 (.7)</td>
<td>85 (.69)</td>
<td></td>
</tr>
<tr>
<td>Outcome</td>
<td>19 (.61)</td>
<td>28 (.90)</td>
<td>24 (.75)</td>
<td>15 (.48)</td>
<td>86 (.69)</td>
<td></td>
</tr>
<tr>
<td>Marginal</td>
<td>35 (.57)</td>
<td>53 (.85)</td>
<td>47 (.73)</td>
<td>36 (.59)</td>
<td>171 (.69)</td>
<td></td>
</tr>
</tbody>
</table>

Note: Entries in parentheses are proportions of subjects with KIAA' = 1.
The significant intercept indicates that the proportion of subjects who exhibited the knew-it-all-along effect was significantly different from .5 (171 of 248, or 69%). The main effect for alternative indicates that these proportions differed across alternatives, with more subjects having KIAA scores of one in the HS2 and HS3 conditions (85% and 73%, respectively) than in the HS1 and HS4 conditions (57% and 59%, respectively). The absence of a significant interaction signifies that this pattern was not different for outcome and scenario conditions. This is the only finding that is not consistent with the ANOVA results, as there was a significant interaction when the dependent variable was KIAA.

In summary, the results across account descriptions and methods of analysis, while not identical, were very similar. In all cases, there was an overall knew-it-all-along effect, an effect of alternative on the strength of the knew-it-all-along effect, and no difference in the strength of the knew-it-all-along effect between outcome and scenario conditions. The only discrepancy among the four analyses concerned the alternative x detail interaction. For both analyses of the data for AD1 and for the FUNCAT analysis for AD2, the interaction was not significant, but when the data for AD2 was analyzed using ANOVA, the interaction was significant.
Relevance Judgments

In analyzing the relevance judgments, the focus was on whether the two independent variables affected how individuals judged the relevance of each piece of general information. In order to answer this question, a three-factor mixed model analysis of variance was computed on the relevance judgment data. The independent variables were detail (scenario vs. outcome), perspective (FS, HS1, HS2, HS3, and HS4), and item (the seven items of general information for AD1 and six items for AD2).

The ANOVA summary table for AD1 is given in Table 12. As can be seen, there was a main effect for

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perspective</td>
<td>4</td>
<td>2.17</td>
<td>.58</td>
</tr>
<tr>
<td>Detail</td>
<td>1</td>
<td>2.82</td>
<td>.75</td>
</tr>
<tr>
<td>Perspective x Detail</td>
<td>4</td>
<td>4.31</td>
<td>1.16</td>
</tr>
<tr>
<td>Error</td>
<td>303</td>
<td>3.73</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>6</td>
<td>150.12</td>
<td>73.37*</td>
</tr>
<tr>
<td>Perspective x Item</td>
<td>24</td>
<td>4.91</td>
<td>2.4*</td>
</tr>
<tr>
<td>Detail x Item</td>
<td>6</td>
<td>9.37</td>
<td>4.58*</td>
</tr>
<tr>
<td>Perspective x Detail x Item</td>
<td>1818</td>
<td>1.10</td>
<td>.54</td>
</tr>
</tbody>
</table>

*p<.001
item, \(F(6,1818)=73.37, p<.001\), an item x perspective interaction, \(F(24,1818)=2.4, p<.001\), and an item x detail interaction, \(F(6,1818)=4.58, p<.001\). No other effects were significant. Since there were significant two-way interactions involving item, the main effect for item was not interpreted. Table 13 gives the means for the item x detail interaction, and as is evident, the interaction is due to the fact that higher judgments alternated between the outcome and scenario conditions across items. For items 1, 3, 4, and 7, scenario judgments were higher, while the reverse was true for items 2, 5, and 6. Simple main effects of detail for each item were not computed because the differences across items differed in direction, not size, and so no additional information would have been gained by computing these tests.

**TABLE 13**

MEANS FOR ITEM X DETAIL INTERACTION OF RELEVANCE JUDGMENTS FOR ADI

<table>
<thead>
<tr>
<th>Detail</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario</td>
<td>4.06</td>
<td>5.5</td>
<td>5.0</td>
<td>3.84</td>
<td>4.96</td>
<td>4.72</td>
<td>4.85</td>
</tr>
<tr>
<td>Outcome</td>
<td>3.60</td>
<td>5.82</td>
<td>4.79</td>
<td>3.57</td>
<td>5.26</td>
<td>4.94</td>
<td>4.45</td>
</tr>
</tbody>
</table>

The interaction between item and perspective indicated that the judgments on each item differed across the five groups. That is, the judgments of how relevant an item was
depended on one's perspective. A logical next step would have been to compute simple main effects of perspective on each item. However, instead of computing overall simple main effects of perspective on each item, a particular contrast was tested on each item. This contrast was based on the hypothesis that those items consistent with the "actual" outcome would be judged more relevant than those items not consistent with the "actual" outcome.

This hypothesis was tested in the following manner. An examination of the four alternatives revealed that alternatives two and four can be generally considered to have positive outcomes while alternatives one and three are somewhat negative in their result (e.g., the outcome for alternative two is that E.B. remains free while the outcome for alternative three is that E.B. is placed back in the mental hospital). This same partitioning can be applied to the items in the general information (see page 121 for the items). Items 1 and 4 reflect positive behavior, items 2, 5, and 7 reflect negative behavior, and items 3 and 6 reflect rather neutral behaviors. The hypothesis described above would then make the following predictions. For items 1 and 4, HS2 and HS4 subjects should judge the information more relevant than HS1 and HS3 subjects. For items 2, 5, and 7, the reverse pattern should occur. Finally, for items 3 and 6, there should be no difference between the two pairs of groups.
These predictions were tested by creating a contrast with coefficients 0, 1, -1, 1, -1 for the FS, HS1, HS2, HS3, and HS4 conditions respectively, and testing whether this contrast was significantly different from zero for each item. With these coefficients, the contrasts for items 1 and 4 should be negative, for items 2, 5, and 7, positive, and for 3 and 6, not different from zero. Table 14 displays the results of these tests. As is evident, the results were exactly as predicted for all seven of the items, providing strong support for the notion that outcome information biases perceptions of relevance of pieces of information.

**TABLE 14**

<table>
<thead>
<tr>
<th>Item</th>
<th>Contrast</th>
<th>Expected Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-1.97*</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>4.17*</td>
<td>+</td>
</tr>
<tr>
<td>3</td>
<td>.01</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>-2.05*</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>1.77*</td>
<td>+</td>
</tr>
<tr>
<td>6</td>
<td>.66</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>3.07*</td>
<td>+</td>
</tr>
</tbody>
</table>

*p<.05, 1-tailed
The same analyses conducted on the data for AD1 were applied to the data for AD2. The ANOVA summary table is given in Table 15. There was a significant main effect for detail, $F(1,305)=2.79$, $p<.05$, 1-tailed. Outcome subjects weighed the information higher than scenario subjects, their respective means being 4.39 and 4.25. There was also a significant main effect due to item, $F(5,1525)=186.6$, $p<.01$, as well as a significant item x perspective interaction, $F(20,1525)=2.95$, $p<.05$. In addition, the item x detail interaction was marginally significant, $F(5,1525)=2.02$, $p<.10$. The item x detail interaction, as displayed in Table 16, was similar in pattern to that found.

**TABLE 15**

ANOVA SUMMARY TABLE FOR RELEVANCE JUDGMENTS FOR AD2

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perspective</td>
<td>4</td>
<td>1.52</td>
<td>.52</td>
</tr>
<tr>
<td>Detail</td>
<td>1</td>
<td>8.10</td>
<td>2.79**</td>
</tr>
<tr>
<td>Perspective x Detail</td>
<td>4</td>
<td>1.04</td>
<td>.36</td>
</tr>
<tr>
<td>Error</td>
<td>305</td>
<td>2.90</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>5</td>
<td>395.06</td>
<td>186.6***</td>
</tr>
<tr>
<td>Perspective x Item</td>
<td>20</td>
<td>5.67</td>
<td>2.95***</td>
</tr>
<tr>
<td>Detail x Item</td>
<td>5</td>
<td>3.88</td>
<td>2.02*</td>
</tr>
<tr>
<td>Perspective x Detail x Item</td>
<td>20</td>
<td>2.22</td>
<td>1.16</td>
</tr>
<tr>
<td>Error</td>
<td>1525</td>
<td>1.92</td>
<td></td>
</tr>
</tbody>
</table>

*p<.10
**p<.05, 1-tailed
***p<.05, 2-tailed
with AD1, with the higher judgment alternating between
scenario and outcome conditions across items.

**TABLE 16**

**MEANS FOR ITEM x DETAIL INTERACTION OF
RELEVANCE JUDGMENTS FOR AD2**

<table>
<thead>
<tr>
<th>Detail</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario</td>
<td>4.98</td>
<td>4.0</td>
<td>5.81</td>
<td>3.19</td>
<td>2.93</td>
<td>4.61</td>
</tr>
<tr>
<td>Outcome</td>
<td>5.27</td>
<td>4.23</td>
<td>5.67</td>
<td>3.05</td>
<td>3.29</td>
<td>4.84</td>
</tr>
</tbody>
</table>

The item x perspective interaction was treated as it was in AD1. Again, alternatives two and four were judged to have positive results, and alternatives one and three, negative ones. The contrast therefore had the same coefficients as in AD1, 0, 1, -1, 1, -1 for the FS, HS1, HS2, HS3, and HS4 groups, respectively. An examination of the six items for AD2 led to the predictions that HS2 and HS4 groups would favor items 2, 4, and 6 (negative contrasts), HS1 and HS3 groups would favor items 1 and 3 (positive contrasts), and the groups would be the same on item 5 (see page 134 for the items). Table 17 displays these contrasts, and, again, the results were exactly as predicted.

In summary, most of the results found with the relevance judgments were consistent across account descriptions. In both account descriptions, there was a significant main effect for item as well as a significant
perspective x item interaction. In neither account
description was there a main effect for perspective, a
perspective x detail interaction, or a perspective x detail
x item interaction. The only discrepancies between the two
account descriptions were the main effect for detail (sig­
nificant for AD2 but not for AD1), and the detail x item
interaction (significant for AD1, marginally significant
for AD2). The most notable of these results was the
perspective x item interaction, found in both account
descriptions, which was shown through a set of contrasts
to be due to the fact that those items which agree with
the actual outcome are perceived as being the most
relevant.

<table>
<thead>
<tr>
<th>Item</th>
<th>Contrast</th>
<th>Expected Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.83*</td>
<td>+</td>
</tr>
<tr>
<td>2</td>
<td>-3.05*</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>3.65*</td>
<td>+</td>
</tr>
<tr>
<td>4</td>
<td>-1.90*</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>-.01</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>-2.6*</td>
<td>-</td>
</tr>
</tbody>
</table>

*p < .05, 1-tailed
Personal Opinion Questionnaires

The personal opinion questionnaires were included in this experiment as filler items and so no specific predictions were made concerning their responses. This data was examined in a very exploratory manner, in order to see if these questions were related to any of the other variables in this experiment.

For example, a discriminant analysis was computed on each set of questions to see if the outcome of the account description affected individuals' opinions on these topics (i.e., mental hospitals or small businesses). In the discriminant analysis, the groups were defined by alternative (i.e., HS1, HS2, HS3, HS4), and the explanatory variables were the five personal opinion questions. The group means on the five questions for AD1 and AD2 are given in Table 18. The results of the discriminant analysis were the same for both account descriptions; none of the questions, individually or collectively, were able to discriminate among the groups. This is reflected by the fact that the group means are very similar on each of the questions. Further exploratory analyses on the questions (e.g., correlations of the questions with each other) failed to reveal any systematic relationships.
TABLE 18
MEANS FOR HINDSIGHT GROUPS ON FIVE PERSONAL OPINION QUESTIONS

<table>
<thead>
<tr>
<th>Group</th>
<th>HS1</th>
<th>HS2</th>
<th>HS3</th>
<th>HS4</th>
<th>Marginal</th>
</tr>
</thead>
<tbody>
<tr>
<td>AD1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>3.16</td>
<td>3.11</td>
<td>3.23</td>
<td>2.95</td>
<td>3.11</td>
</tr>
<tr>
<td>2</td>
<td>2.79</td>
<td>2.75</td>
<td>2.8</td>
<td>2.92</td>
<td>2.81</td>
</tr>
<tr>
<td>3</td>
<td>1.74</td>
<td>1.78</td>
<td>1.85</td>
<td>1.69</td>
<td>1.76</td>
</tr>
<tr>
<td>4</td>
<td>2.89</td>
<td>2.92</td>
<td>2.8</td>
<td>2.84</td>
<td>2.86</td>
</tr>
<tr>
<td>5</td>
<td>3.84</td>
<td>3.92</td>
<td>3.63</td>
<td>3.51</td>
<td>3.73</td>
</tr>
<tr>
<td>AD2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2.92</td>
<td>2.94</td>
<td>2.97</td>
<td>3.0</td>
<td>2.96</td>
</tr>
<tr>
<td>2</td>
<td>3.49</td>
<td>3.60</td>
<td>3.48</td>
<td>3.57</td>
<td>3.54</td>
</tr>
<tr>
<td>3</td>
<td>3.15</td>
<td>3.24</td>
<td>3.16</td>
<td>3.05</td>
<td>3.15</td>
</tr>
<tr>
<td>4</td>
<td>2.05</td>
<td>2.13</td>
<td>1.89</td>
<td>2.02</td>
<td>2.02</td>
</tr>
<tr>
<td>5</td>
<td>2.03</td>
<td>2.15</td>
<td>2.23</td>
<td>2.28</td>
<td>2.17</td>
</tr>
</tbody>
</table>

Discussion

In this section, the major findings of Experiment 1 will be discussed, along with some of the limitations of this study. Implications of the results, as well as recommendations for future research will be discussed in a later section.
Major Findings

The results of Experiment 1 clearly demonstrate the presence of the knew-it-all-along effect. Across all conditions and in both account descriptions, hindsight judgments were found to be consistently higher than foresight judgments. These findings replicate those of Fischhoff and Byeth (1975), Fischhoff (1975a), Fischhoff (1977), and Wood (1978).

Not only was the presence of the knew-it-all-along effect consistent with prior research, the magnitude of the effect was also very similar to past findings. In this study, 65% of the subjects exhibited the knew-it-all-along effect, compared to 69% reported by Fischhoff (1975a). The average effect size in this experiment was 8.1%, compared to 10.8% found by Fischhoff (1977). It is therefore concluded that the manipulation of perspective, foresight vs. hindsight, had the desired effect.

The other independent variable in this experiment, detail, was not found to have a significant effect. In none of the four analyses (two account descriptions x two methods of analysis) was there a significant difference between subjects' responses in the scenario and outcome conditions. This absence of an effect, though, does provide some very relevant information regarding the two explanations of creeping determinism, the assimilation hypothesis and the availability of reasons hypothesis.
According to the availability of reasons hypothesis, there should have been a knew-it-all-along effect in the outcome condition, but not in the scenario condition. The effect should not have occurred in the scenario condition because, by presenting not just the outcome, but the events leading up to the outcome (or, in our maze analogy, by forcing the subject down all the paths instead of just looking at all of the end points), the feasibilities of all of the alternatives were equalized. The assimilation hypothesis, on the other hand, would not predict different results between the scenario and outcome conditions. Under either condition, a subject with hindsight information would assimilate it with the rest of his/her information (be it only outcomes or whole scenarios) and re-organize the set of information to fit the actual outcome.

The results of this study then clearly favor the assimilation hypothesis. Whether one looks at overall differences between foresight and hindsight judgments in the scenario and outcome conditions (main effect of detail in ANOVA), or proportions of individuals who exhibited the knew-it-all-along effect in the scenario and outcome conditions (main effect of detail in FUNCAT), or number of alternatives in which the difference between hindsight and foresight judgments were significantly different in the two conditions (five in each), no difference was found to exist between the two conditions.
The likelihood judgments are not the only data from this experiment in which information discriminating the two explanations was gathered. Consider the results found concerning the relevance judgments. These relevance judgments were included in this experiment in an attempt to replicate Fischhoff's (1975a) finding that outcome information affected individuals' estimates of relevance of pieces of information. In that study, Fischhoff computed a two-factor ANOVA, as was done in this study, and reported a two-way interaction between perspective and item. He did not report any subsequent analyses which explained in further detail the nature of the interaction.

The results of this experiment also included a perspective x item interaction, but in this study it was demonstrated that outcome information affected individuals' estimates of relevance of information in a very systematic manner. Contrasts done on the relevance judgments clearly demonstrated that, on hindsight, the information that was deemed most relevant was the information which was consistent with the actual outcome. In both account descriptions, it was shown that for pieces of information that supported a positive outcome, individuals told that the actual outcome was positive reported those items more relevant than individuals told that the actual outcome was negative. For pieces of information that supported a negative outcome, the reverse pattern was obtained.
This result is exactly what would be predicted by the assimilation hypothesis. According to this hypothesis, assimilation is done in order to create the most coherent whole out of a set of information, and this process may include altering the way in which the original information was perceived in order to form a "whole interpretation" that includes the reported outcome. This is exactly what the contrasts tell us, that the way in which the original information was perceived was affected (i.e., altered) by the receipt of outcome information.

This interaction between item and perspective, per se, is not inconsistent with the availability of reasons hypothesis. That is, the change in perceived relevance of initial information could have been due to the inability to consider other reasons, for if one attends to only one path, only those pieces of information germane to that path will be found relevant.

However, in this experiment, as with the likelihood judgments, the availability of reasons hypothesis would predict that this finding would occur only in the outcome condition and not in the scenario condition. In the latter condition, when subjects were forced to consider all of the paths, they should have attended to them all equally and therefore considered pieces of information germane to any path to be relevant. The availability of reasons hypothesis would then predict an item x perspective x detail
interaction, with an item x perspective interaction occurring in the outcome condition, but not in the scenario condition. This three-way interaction was not found for either account description. Therefore, with the relevance judgments, as with the likelihood judgments, the assimilation hypothesis is clearly favored by the data.

Several other effects which don't have a direct bearing on the discrimination between the two explanations were also found to be significant. In the analysis of the likelihood judgments, for both account descriptions a strong main effect was found for alternative. That is, the size of the knew-it-all-along effect differed greatly across the four alternatives.

For AD1, the knew-it-all-along effect was strongest, in both outcome and scenario conditions, for alternatives two and three. For AD2, not only were the strengths of the knew-it-all-along effect different across alternatives, they also interacted with level of detail. In the scenario condition, alternative three showed the strongest effect, followed by alternatives two and four, and then alternative one. In the outcome condition, alternative two showed the strongest effect, followed by alternative one, then alternative three, and finally alternative four. This finding can be explained by the significant negative relationship
found between prior states and change \( (r=-.66, \text{ prior odds with likelihood ratio}, r=-.48, \text{ foresight likelihood with difference between hindsight and foresight likelihood}) \) in that the two conditions in which there was no knew-it-all-along effect in AD2 (Scenario-1 and Outcome-4) had the highest foresight probabilities. Although this finding explains the interaction, it raises another question, that of the interaction between alternative and detail on the foresight judgments (i.e., why is one scenario judged very likely while its corresponding outcome is judged not very likely). No explanation is offered for this finding.

In the analysis of the relevance judgments, additional findings also occurred. In both account descriptions, a main effect for item was found, indicating that across all conditions, some pieces of information were judged to be more relevant than others. However, because of the systematic item x alternative interaction found, it seems inappropriate to interpret the pattern of mean relevance judgments averaged over alternatives.

A main effect for detail was found in AD2, with outcome subjects weighing the information on the whole more than scenario subjects. This is easily understood, for scenario subjects received a great deal of information concerning each possible alternative while outcome subjects received only one-sentence statements of the alternative outcomes. Therefore, it is not surprising for outcome
subjects to have relied more on the general information than scenario subjects. No explanation is offered as to why this finding did not occur for AD1.

The item x detail interaction was significant in AD1 and marginally significant in AD2. This interaction was not predicted and, as discussed in the previous section, reflects the fact that on items 1, 3, 4, and 7 for AD1, and items 3 and 4 for AD2, scenario subjects judged the items more relevant than outcome subjects, with the reverse pattern occurring for the other items. The above discussion of the main effect for detail would explain the results for the items in which outcome subjects' ratings were higher, and so all that is necessary is an explanation for those items in which scenario subjects made the higher judgments. While this can be done in certain instances, it cannot be done for all of these items. For example, consider item seven of AD1: "He occasionally quarrelled with the patients". It is understandable that this item would be judged higher by the scenario subjects, for it is directly related to a sentence in one of the scenarios (alternative one), which the scenario subjects were exposed to but which the outcome subjects were not. While this explanation applies to other items (e.g., item three, AD2), it does not apply to many others.
Limitations

As with any study, this experiment has its share of limitations and these limitations should be mentioned. First, consider the setting. The environment for this experiment was extremely artificial. Subjects entered an experimental room, were given a booklet containing all of the information that they needed to make some judgments, and were then asked to make these judgments. While the consistency of results across account descriptions provides some justification for generalizing past this experiment, it still should be kept in mind that the setting of this experiment differed from what would be encountered outside of the laboratory.

The quality of the responses used for the likelihood judgments might also be questioned. The analysis of the likelihood judgments was based on the assumption that the probabilities were on the same scale for each subject. That is, a 30% likelihood judgment was assumed to represent the same degree of likelihood for all subjects. While this is not an unreasonable assumption, it should nevertheless be made clear that this assumption has been made.

A limitation related to this issue involves the design of the experiment. This experiment was run with a completely between-subjects design, so that when comparing foresight judgments with hindsight judgments, different groups of subjects were being compared. A more efficient
design would have had the same subjects giving responses both before and after receiving the outcome information. While this kind of design has been used (Fischhoff and Byeth, 1975), it was felt that the methodological problems that this design created outweighed the increased efficiency of the design. In order for the same subjects to make hindsight and foresight judgments, a mechanism needs to be devised that makes it reasonable for the individual to make the judgments twice, once with and once without outcome information. This was not deemed plausible in the present study. Nonetheless, were it possible, a within-subjects design would provide better quality information regarding the knew-it-all-along effect; e.g., questions such as "are there measurable individual differences in the extent to which subjects exhibit the effect" could be answered directly.

The manipulation of detail used in this experiment is also not without its questionable aspects. The obtained results (i.e., no effect of detail on the knew-it-all-along effect) could have occurred just as easily if the availability of reasons hypothesis was the true explanation for creeping determinism, but the detail manipulation did not affect the groups in the desired manner (i.e., if the inclusion of detailed scenarios did not force subjects to consider the feasibility of all of the alternatives when making their judgments). For example, one might argue that
subjects attended only to the outcome and not the process of how the outcome came about when making their judgments. While this explanation is certainly a possible one, it is believed that collectively, all of the data (i.e., two account descriptions, likelihood and relevance judgments) provide quite a compelling case for favoring the assimilation hypothesis.

Lastly, the plethora of unpredicted findings, e.g., extraneous interactions, do give cause to question whether other phenomena may have been occurring in this experiment. Most of these findings are not easily explained and further attention should be paid to these variables in order to gain a better understanding of their relationships.
CHAPTER III
EXPERIMENT 2

Method

Subjects

The subjects who participated in Experiment 2 were the same as those in Experiment 1. The subjects completed all of the tasks in Experiment 1, and then participated in Experiment 2. The subjects were randomly assigned to one of three experimental conditions, Foresight-Other (FS/O), Hindsight-Other (HS/O), or Foresight-Self (FS/S). A larger number of subjects were assigned to the two "Other" conditions, since these conditions were of primary interest. Data for five subjects were not used because the subjects failed to follow instructions. The sample sizes for the FS/S, FS/O, and HS/O groups were 69, 125, and 120, respectively.

Procedure

The primary task of all subjects in this experiment was to decide how much additional information, given some general information, was needed in order to correctly determine the occupation of a man named John.
Foresight-Other subjects were given the following instructions:

In this experiment we are interested in how much information individuals need in order to make correct decisions. Each of you will be provided with some general information about a man named John and several occupations which he may choose to pursue. Each of you will receive different information from everybody else, although the man's name will always be John and the same list of 10 occupations will be used for everybody. Besides the 10 occupations and the general information you will also be given 8 additional pieces of information. Your first task in this experiment is to determine how many of these additional pieces of information in addition to the general information should be given to another individual in order for that individual to correctly determine the occupation that John will choose. After you determine how many pieces of information should be provided, that number of additional pieces of information, along with the general information will be provided to another subject in this room. In the second part of this experiment, then each of you will receive information about somebody else's John, along with some amount of additional information. Your task will then be to determine John's occupation using the information given. If you are correct, both you and the subject who supplied the information to you will receive $1 minus $.10 for each additional piece of information supplied.

For example, suppose Subject 1 decides that three pieces of additional information are needed to correctly determine his John's occupation, and Subject 2 gets Subject 1's John in the second part of the experiment. If Subject 2, given the general information and the first three pieces of additional information, correctly determines that John's occupation, Subjects 1 and 2 both get $.70 ($1-.30).

So, the idea in the first part of this experiment will be to give enough additional
information so that the other subject will
correctly guess John's occupation, but as
little as possible so you can win as much
as possible.

**HS/O** HS/O subjects were given the same instructions
and had to perform the same task as the FS/O subjects with
one exception. For HS/O subjects, along with the eight
additional pieces of information, a sentence stating that
"John chose accounting for his profession" was provided.

**FS/S** Foresight-Self subjects were given the general
information and were then told:

Your task is to determine which occupation
John will choose. If you are correct you
will win $1. There are 8 additional pieces
of information, each costing $.10. You may
make your decision now or after collecting
as many pieces of additional information
as you wish.

All of the subjects run at any one time were in the
same experimental condition. Despite the instructions to
the contrary, all subjects were given the same set of
information about John (See Appendix C for a sample
booklet).

After the subjects decided how much information should
be supplied (or should be examined), they participated in
two additional tasks. First, they were asked to separate
the 10 occupations into two categories, "Still Possible"
and "Definitely Ruled Out", based on all of the available
information (general information and all eight additional
pieces for FS/O and HS/O subjects and general information and the appropriate number of additional pieces for FS/S subjects). For those occupations in the "Still Possible" category, the subjects were then asked to judge their likelihoods, with the likelihoods of all of the occupations in that category summing to 100%. Second, the subjects were asked to make relevance judgments on the items in the general information. These judgments were made on a scale from 1 (Not Relevant) to 7 (Very Relevant).

**Results**

**Manipulation Check**

Before any analyses could be meaningfully applied to the data it was necessary to confirm that the FS/O and HS/O groups were different in their degree of outcome knowledge. In particular, it had to be shown that, given the general information and the eight additional pieces of information, FS/O subjects still possessed some uncertainty regarding John's occupation.

This was verified in two ways. First, the number of occupations FS/O subjects placed in the "Still Possible" category was examined to see if more than one occupation was listed. The mean number of alternatives listed was 3.95 and this was significantly greater than 1, \( t(124) = 24.18, p < .001 \). Moreover, only 1 out of the 125 subjects listed just one alternative. A second source of
information regarding FS/O subjects' uncertainty was the likelihood judgment given to accountant (John's "true" occupation). The mean likelihood judgment for FS/O subjects was 23.53%, with a standard deviation of 16.7%. Thus, it seems reasonable to assume that FS/O subjects possessed considerable uncertainty regarding John's occupation.

MANOVA

The primary focus of this experiment was the comparison of the number of pieces of additional information hindsight and foresight subjects would provide. According to creeping determinism, since outcome knowledge creates a feeling of having known it all along, hindsight subjects should have felt that less additional information was needed, and so would have provided less information.

The foresight and hindsight groups were also compared on two other variables. First, the likelihood judgment given to accountant provided an additional method of measuring creeping determinism. According to creeping determinism, hindsight subjects should have judged the likelihood of the outcome that occurred (i.e., accountant) higher than foresight subjects. The second variable studied was the number of alternatives each subject placed in the "Still Possible" category. The question of interest
here was whether outcome knowledge reduced the number of alternatives perceived as plausible.

To compare the groups on these three variables, a multivariate analysis of variance (MANOVA) was computed on this data. The independent variable was condition, with three levels (FS/S, FS/O, and HS/O). The dependent variables were (a) ADD, the number of additional pieces of information supplied, (b) ACCOUNT, the likelihood judgment given to accountant, and (c) NUMPOS, the number of occupations placed in the "Still Possible" category.

The results of the MANOVA are given in Table 19, with the associated means displayed in Table 20. As can be seen, the multivariate test was significant $F(6,512)=12.35$, $p<.0001$. The univariate test for ACCOUNT was significant,

<table>
<thead>
<tr>
<th>TABLE 19</th>
</tr>
</thead>
<tbody>
<tr>
<td>MANOVA RESULTS FOR EXPERIMENT 2</td>
</tr>
<tr>
<td>Dependent Variable</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>Multivariate</td>
</tr>
<tr>
<td>Error</td>
</tr>
<tr>
<td>ADD</td>
</tr>
<tr>
<td>Error</td>
</tr>
<tr>
<td>NUMPOS</td>
</tr>
<tr>
<td>Error</td>
</tr>
<tr>
<td>ACCOUNT</td>
</tr>
<tr>
<td>Error</td>
</tr>
</tbody>
</table>

$^a$Multivariate Test used Wilks' Lambda.  
*p<.001
$F(2, 258) = 26.85$, $p < .0001$, but the univariate tests for NUMPOS and ADD were not. Post-hoc tests on ACCOUNT, using Duncan's procedure, revealed that the HS/O group was significantly different from both the FS/O and FS/S groups, but that the foresight groups were not significantly different from each other. As can be seen in Table 20, the difference between the foresight and hindsight groups on the variable ACCOUNT was in the predicted direction, with the hindsight likelihood mean being approximately 20% higher than the foresight likelihood mean. Thus, the presence of creeping determinism was strongly supported by ACCOUNT, but not by ADD.

TABLE 20

GROUP MEANS ON DEPENDENT VARIABLES OF MANOVA

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FS/S</td>
</tr>
<tr>
<td>ADD</td>
<td>3.24</td>
</tr>
<tr>
<td>NUMPOS</td>
<td>4.05</td>
</tr>
<tr>
<td>ACCOUNT</td>
<td>25.74%</td>
</tr>
</tbody>
</table>

Further examination of ADD and NUMPOS indicated that in addition to the means of these variables being the same across experimental conditions, the distributions were also similar. For ADD, the modes for the two foresight groups
were four while the mode for the hindsight group was three. A large majority of the subjects' responses (80%) were in the 2-5 range, and this was quite consistent across conditions. The results for NUMPOS were similar. On this variable, the foresight groups' modes were three and the hindsight group's was four. Again, most of the subjects' responses (87%) were in the 2-5 range, and again this was very consistent across conditions.

Occupations

The next data examined were the frequency distributions of each occupation in the "Still Possible" category. Table 21 gives the percentage of subjects who placed each occupation in the "Still Possible" category.

<table>
<thead>
<tr>
<th>Occupation</th>
<th>FS/S</th>
<th>FS/O</th>
<th>HS/O</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artist</td>
<td>3.2</td>
<td>3.2</td>
<td>4.9</td>
<td>3.9</td>
</tr>
<tr>
<td>Engineer</td>
<td>68.3</td>
<td>96.0</td>
<td>91.1</td>
<td>88.4</td>
</tr>
<tr>
<td>Teacher</td>
<td>23.8</td>
<td>24.2</td>
<td>25.2</td>
<td>24.5</td>
</tr>
<tr>
<td>Policeman</td>
<td>46.0</td>
<td>14.5</td>
<td>21.1</td>
<td>23.6</td>
</tr>
<tr>
<td>Salesman</td>
<td>61.9</td>
<td>35.5</td>
<td>59.4</td>
<td>50.3</td>
</tr>
<tr>
<td>Doctor</td>
<td>42.9</td>
<td>55.7</td>
<td>50.4</td>
<td>51.0</td>
</tr>
<tr>
<td>Architect</td>
<td>47.6</td>
<td>62.1</td>
<td>62.6</td>
<td>59.4</td>
</tr>
<tr>
<td>Accountant</td>
<td>76.2</td>
<td>87.1</td>
<td>100.0</td>
<td>92.1</td>
</tr>
<tr>
<td>Truck Driver</td>
<td>23.8</td>
<td>1.6</td>
<td>6.5</td>
<td>8.1</td>
</tr>
<tr>
<td>Carpenter</td>
<td>4.8</td>
<td>6.5</td>
<td>4.1</td>
<td>5.2</td>
</tr>
</tbody>
</table>
occupation in the "Still Possible" category. As can be seen, the percentages varied greatly, both within and between occupations. Some occupations (e.g., Teacher, Artist, Carpenter) had very consistent percentages across conditions, while others (e.g., Engineer, Truck Driver, Policeman) had very different percentages across conditions. Collapsing across conditions, some occupations (Engineer, Accountant) were listed by practically all of the subjects, some (Architect, Salesman, and Doctor) by about half of the subjects, some (Teacher and Policeman) by a minority, and some (Carpenter, Truck Driver, and Artist) by very few.

Relevance Judgments

The purpose of including the relevance judgments in this experiment was to determine if the three groups reported using the general information differently. To test this, a two-factor analysis of variance was computed on the relevance judgments. The independent variables were condition (FS/S, FS/O, and HS/O) and item (the five pieces of general information).

The results, as shown in Table 22, indicated that there was a significant main effect due to condition, $F(2,297) = 9.51, p < .0001$, a significant main effect due to item, $F(4,1188) = 128.5, p < .0001$, and a significant interaction, $F(8,1188) = 12.35, p < .0001$. Because of the significant
interaction, simple main effects of condition for each item were computed. Table 23 gives the means for each condition on each item.

TABLE 22
ANOVA SUMMARY TABLE FOR RELEVANCE JUDGMENTS OF EXPERIMENT 2

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition</td>
<td>2</td>
<td>29.64</td>
<td>9.51*</td>
</tr>
<tr>
<td>Error</td>
<td>297</td>
<td>3.12</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>4</td>
<td>232.25</td>
<td>128.5*</td>
</tr>
<tr>
<td>Item x Condition</td>
<td>8</td>
<td>22.33</td>
<td>12.35*</td>
</tr>
<tr>
<td>Error</td>
<td>1188</td>
<td>1.81</td>
<td></td>
</tr>
</tbody>
</table>

*p<.001

TABLE 23
GROUP MEANS FOR EACH ITEM OF THE RELEVANCE JUDGMENTS

<table>
<thead>
<tr>
<th>Item</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>5.81</td>
<td>5.13</td>
<td>3.53</td>
<td>5.22</td>
<td>5.95</td>
</tr>
<tr>
<td>FS/S</td>
<td>5.98</td>
<td>4.83</td>
<td>3.68</td>
<td>4.44</td>
<td>5.95</td>
</tr>
<tr>
<td>FS/O</td>
<td>5.93</td>
<td>5.13</td>
<td>3.18</td>
<td>4.63</td>
<td>4.32</td>
</tr>
</tbody>
</table>

As can be seen in Table 24, there were significant simple main effects of condition for items three, four, and five, but not for items one and two. Post-hoc tests using
Duncan's procedure revealed that, on item three, the only two groups that were different were FS/O and HS/O. On item four, the FS/S group was significantly different from the other two groups. On item five, the HS/O group was significantly different from the two foresight groups.

<table>
<thead>
<tr>
<th>Item</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 1</td>
<td>2</td>
<td>.56</td>
<td>.41</td>
</tr>
<tr>
<td>Error</td>
<td>297</td>
<td>1.36</td>
<td></td>
</tr>
<tr>
<td>Item 2</td>
<td>2</td>
<td>3.85</td>
<td>1.32</td>
</tr>
<tr>
<td>Error</td>
<td>298</td>
<td>2.91</td>
<td></td>
</tr>
<tr>
<td>Item 3</td>
<td>2</td>
<td>8.47</td>
<td>3.82**</td>
</tr>
<tr>
<td>Error</td>
<td>298</td>
<td>2.21</td>
<td></td>
</tr>
<tr>
<td>Item 4</td>
<td>2</td>
<td>12.28</td>
<td>5.85*</td>
</tr>
<tr>
<td>Error</td>
<td>298</td>
<td>2.10</td>
<td></td>
</tr>
<tr>
<td>Item 5</td>
<td>2</td>
<td>92.52</td>
<td>48.95***</td>
</tr>
<tr>
<td>Error</td>
<td>298</td>
<td>1.89</td>
<td></td>
</tr>
</tbody>
</table>

*p<.05
**p<.01
***p<.001


**Discussion**

**Major Findings**

The results of the MANOVA provide conflicting information regarding the presence of creeping determinism. The hindsight mean likelihood was approximately 20 percentage points higher than the foresight mean likelihoods, thus providing very strong evidence supporting the presence of creeping determinism. However, the presence of creeping determinism was not supported at all by the ADD data. According to creeping determinism, foresight subjects should have provided more additional information than hindsight subjects. Not only was the difference between the hindsight and foresight groups not significant, it was not even in the expected direction.

To gain an understanding of why the foresight and hindsight groups did not provide differing amounts of information, let us examine the manipulation used in this study. This experiment was designed so that there would be a tradeoff between the quality of the decision made by the second individual and the cost involved with making the decision. That is, it was assumed that the more information supplied, the better the decision (i.e., the higher the probability of making a correct decision).

The data collected on the two foresight groups suggests that this assumption was not met. FS/O subjects had seen all eight additional pieces of information when they
made their judgment of ACCOUNT. FS/S subjects had only seen, on the average, three to four pieces of additional information when they made their judgment. Therefore, according to the above assumption, since FS/O subjects saw more information than FS/S subjects, their likelihood judgments for accountant should have been higher. However, the results of the post-hoc tests done on ACCOUNT indicate that the means were not different for the FS/S and FS/O groups, being 25.74% and 23.53%, respectively. This suggests that the last four pieces of additional information did not seem to add information relating to accountant being the correct occupation. Thus, regardless of the presence of creeping determinism, there was no reason for any of the subjects to have supplied more than four pieces of additional information. This issue will be discussed further later in this chapter.

The absence of a difference among the groups on NUMPOS, the number of alternatives placed in the "Still Possible" category, suggests that while outcome information may affect the likelihood of the outcomes, it does not affect the number of outcomes perceived as being possible. That is, although outcome knowledge may decrease the likelihoods of outcomes that did not occur, it does not rule these outcomes out entirely.

The results concerning the prevalence of each occupation appearing in the "Still Possible" category provide
some interesting information about the effects of outcome knowledge. A comparison of the proportions of subjects in the FS/O and HS/O groups who listed each occupation reveals that, for the most part, the proportions are very close to each other. This suggests that although outcome information has been found to affect judgments of how likely the occurring and not occurring events were, it may not affect a dichotomous judgment of whether a given occupation is possible. That is, hindsight subjects seemed to be able to ignore outcome information when they were judging whether a given occupation was possible or not.

A comparison of the FS/O and HS/O groups with the FS/S group does reveal some differences. In the FS/S group, there was less consensus than in the other two groups. This was evidenced by the fact that the highest percentage of subjects in the FS/S group who put a given occupation in the "Still Possible" category was 68.3%, whereas both the FS/O and HS/O groups had Engineer and Accountant placed in the category by more than 85% of the subjects.

The other difference between the FS/S group and the HS/O and FS/O groups was that a higher percentage of subjects in the FS/S group placed Policeman and Truck Driver in the "Still Possible" category than did the subjects in the other two groups. This indicates that the last four
items may have tended to rule out Policeman and Truck Driver for some of the FS/O and HS/O subjects.

The relevance judgments results do support the hypothesis that subjects in the three groups use the general information differently. However, no pattern was found to be consistent across the individual items. This lack of consistency is attributed to the nature of the individual items and so each item will be interpreted separately. The reader is referred to Appendix C for the items.

On item one, there were no differences among the three groups. All three group means were close to six, indicating that all subjects rated this item as very relevant. On item two, again the three groups were not different, although the mean judgments were not quite so high, clustering around five. The absences of differences among the groups on these two items is attributed to the general nature of these items, i.e., they could be appropriate for any occupation.

The three groups were not all the same on item three. The mean relevance judgment of the FS/O group was greater than that of the HS/O group, with the mean judgment of the FS/S group falling in between. For the HS/O subjects who knew that John became an accountant, the fact that his father was an architect was rather irrelevant. This is evidenced by the fact that, of the 15 relevance judgments,
this mean was the lowest. For FS/O subjects, however, John's father's occupation might have been important if John became an architect, an occupation not ruled out.

On item four, the FS/S group had a greater mean judgment than the other two groups. This can be viewed as a difference between the "Self" and "Other" conditions. This difference is attributed to the difference in the amount of total information available to the two kinds of groups. The subjects in both the FS/O and HS/O groups were exposed to all eight additional pieces of information while the subjects in the FS/S group were exposed to, on the average, only three or four additional pieces of information. It is hypothesized that the relevance judgment for this particular item may have been a relative one, i.e., how relevant was this item as compared to the relevance of other items. In that case, this item when 1 of 8 or 9 pieces of information (5 general and 3 or 4 additional for FS/S subjects) may have been somewhat relevant, but when 1 of 13 (5 general and 8 additional for FS/O and HS/O subjects), may have been much less relevant than the others.

On item 5, the HS/O group had a lower mean relevance judgment than the two foresight groups. This difference is a sizeable one and can be attributed to the fact that item five is not particularly relevant to the accounting profession but is relevant to the other occupations that
were usually found in the "Still Possible" category (engineer, doctor, architect).

**Optimal Information Search Behavior**

The absence of a difference in the ACCOUNT means between the two foresight groups, as discussed above, indicates that the final four additional pieces of information did not increase the quality of the decision, as measured by the probability assigned to the correct occupation, accountant. However, this in itself does not completely account for the absence of a difference between the information search behavior of the hindsight and foresight subjects. It is still not known what the impact of the first four items was on the probability of a correct answer. It is also not known what the optimal number of pieces of information that should have been provided was, given the payoff strategy used.

To help answer these questions, consider the following model. Let us assume that at any given stage of information collection (i.e., given the general information and $x$ pieces of additional information), each subject possesses a likelihood distribution, i.e., a distribution of the likelihoods of each occupation being the correct occupation, given the held information. Further, suppose that each subject in this experiment assumed that the person he/she was supplying the information to possessed the same
distribution that the subject did and would guess, at any
given stage, that occupation which had the highest likely­
hood for that stage. Given these assumptions, what are
the optimal strategies for foresight and hindsight
subjects?

At any given stage, subjects won money if the individ­
ual guessed accountant. For hindsight subjects, given the
assumption made above, the expected winnings at stage $x$
is defined as:

$$EW(x) = \begin{cases} 
    1 - (0.10)x & \text{if accountant had the} \\
                   & \text{maximum likelihood} \\
    0 & \text{if accountant didn't have the maximum} \\
                   & \text{likelihood} \\
    \frac{1 - (0.10)x}{y} & \text{if accountant was tied} \\
                   & \text{for the highest likelihood with} (y-1) \text{other} \\
                   & \text{occupations} 
\end{cases}$$

That is, if the maximum likelihood was accountant,
the subject would win. If the maximum likelihood was
not accountant, the subject would not win. Finally, if
accountant was tied for the highest likelihood, it was
assumed that the individual chose randomly among those
occupations which had the highest likelihood.

For foresight subjects, the strategy was slightly dif­
ferent. These subjects did not know what the correct outcome
was and so did not know which occupation the individual
should guess. The likelihood distribution indicated the
likelihood that each occupation was correct. Therefore, if the individual answered with whatever occupation had the maximum likelihood, then this likelihood was the probability that the individual would have guessed correctly, and that the subject would have won. The expected winnings for foresight subjects is therefore defined as:

\[ EW(x) = p \times (1 - x \times 0.1) + (1 - p) \times 0 \]  

(2)

where \( p \) is the maximum likelihood of all of the occupations at stage \( x \). For both hindsight and foresight subjects, the optimal strategy was therefore to provide \( x \) number of additional pieces of information, where \( x \) was the number for which expected winnings (Equation 1 or 2, respectively) was a maximum.

To provide data to compute these optimal values as well as to provide additional information regarding the relevance of the first four pieces of information, Experiment 3 was conducted. In this experiment, foresight and hindsight subjects, at each of 9 stages (i.e., the general information plus 0-8 additional pieces of information), were asked to indicate the likelihood of each occupation being the occupation that John chose. This data was then used to compute, for each subject at every stage, their expected winnings and thus the optimal number of additional pieces of information that should have been provided.
CHAPTER IV
EXPERIMENT 3

Method

Subjects

The subjects who participated in this experiment were 42 undergraduate students enrolled in an introductory psychology course at The Ohio State University. Subjects were randomly assigned to one of two experimental conditions, foresight (N=23) or hindsight (N=19). Subjects were run in small groups, usually three or four subjects to a group.

Procedure

The task in this experiment for all subjects was to judge how likely each of 10 occupations was, given a set of information about a man named John. Upon entering the experimental room, all subjects were given an experimental booklet and were read the following set of instructions (which were also written in their booklets):

In this experiment we are interested in how individuals use information to make judgments. You will be given some general information about a man named John and a list of occupations from which he chose his career. You will then be given eight additional pieces of information, one at a time. At each step, your task will be to judge the probability
of John choosing each occupation, given the information available to you at that time.

Subjects were then given an example of this type of task with a set of information about a girl named Sue and five occupations from which she chose her career. The subjects were then given the list of occupations from which John chose his career, followed by some additional instructions:

As you proceed through the judgments, please make each set of judgments independently. Please do not look back to see what judgments you have already made or look forward to see what the next piece of information will be. Make your judgments using only the information given on that page.

The only difference between the foresight and hindsight conditions was that subjects in the hindsight condition were given one additional piece of information in the instructions: "As an added note, John did choose accounting as his profession." See Appendix D for a sample booklet.

Results and Discussion

The major purpose of conducting Experiment 3 was to collect data which would be used to compute the hindsight and foresight information supply criteria discussed in Chapter 3. First, however, we will examine some other aspects of the Experiment 3 data.
The Knew-It-All-Along Effect

An examination of the foresight and hindsight means for accountant at each stage, as shown in Table 25, reveals that the knew-it-all-along effect did occur, as the hindsight mean was consistently higher than the foresight mean, though this difference was significant at only approximately half of the stages. The difference between the hindsight and foresight means ranged from 4.3% to 14.11%, with a mean of 8.00%. Thus, it is concluded that the

TABLE 25
MEAN HINDSIGHT AND FORESIGHT PERCENTAGES FOR NINE STAGES OF EXPERIMENT 3

<table>
<thead>
<tr>
<th>Stage</th>
<th>Hindsight</th>
<th>Foresight</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>12.89</td>
<td>7.65**</td>
</tr>
<tr>
<td>1</td>
<td>20.79</td>
<td>16.48</td>
</tr>
<tr>
<td>2</td>
<td>20.79</td>
<td>14.61*</td>
</tr>
<tr>
<td>3</td>
<td>23.42</td>
<td>13.0**</td>
</tr>
<tr>
<td>4</td>
<td>22.89</td>
<td>17.09</td>
</tr>
<tr>
<td>5</td>
<td>35.53</td>
<td>30.26</td>
</tr>
<tr>
<td>6</td>
<td>41.58</td>
<td>33.04</td>
</tr>
<tr>
<td>7</td>
<td>39.0</td>
<td>26.91*</td>
</tr>
<tr>
<td>8</td>
<td>40.68</td>
<td>26.56*</td>
</tr>
<tr>
<td>Marginal</td>
<td>28.62</td>
<td>20.62**</td>
</tr>
</tbody>
</table>

*Hindsight significantly greater than foresight, p<.07, 1-tailed.
**Hindsight significantly greater than foresight, p<.05, 1-tailed.
hindsight/foresight manipulation was effective and the absence of a significant difference at some of the stages is attributed to the small sample size.

Effect of Stage on Accountant Likelihood

The next question addressed was whether the mean likelihood judgment for accountant given by foresight subjects increased as more information was collected. It will be recalled that a troubling finding of Experiment 2 was that there was no difference in the mean likelihood judgments of accountant between the FS/O subjects, who were exposed to all eight pieces of additional information, and the FS/S subjects, who were exposed, on the average, to only three or four pieces of additional information.

In order to see whether the likelihood mean for accountant changed over stages, a one-factor repeated measures analysis of variance was computed on this data. The independent variable was stage, viz., how many additional pieces of information were seen, and the dependent variable was the likelihood judgment given to accountant. The ANOVA table is given in Table 26 and as can be seen, there was a significant effect of stage on the likelihood judgment, $F(8,176)=8.08$, $p<.01$. The sum of squares for stage was then partitioned into a linear component and a residual component in order to determine whether the judgments for accountant increased linearly over time. The
linear component was significant, \( F(1,22)=11.5, p<.01 \), indicating that the mean judgments did increase linearly over time. Although the residual component was also significant, \( F(7,154)=4.73, p<.01 \), most of the effect of stage (70% of the sum of squares) was due to the linear component, and so the residual component was not examined further.

**TABLE 26**  
ANOVA SUMMARY TABLE FOR FORESIGHT LIKELIHOOD JUDGMENTS ACROSS NINE STAGES OF EXPERIMENT 3

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage</td>
<td>14127.48</td>
<td>8</td>
<td>1765.93</td>
<td>8.08*</td>
</tr>
<tr>
<td>Stage linear</td>
<td>9947.12</td>
<td>1</td>
<td>9947.12</td>
<td>11.50*</td>
</tr>
<tr>
<td>Stage residual</td>
<td>4180.36</td>
<td>7</td>
<td>597.19</td>
<td>4.73*</td>
</tr>
<tr>
<td>Subjects</td>
<td>26878.39</td>
<td>22</td>
<td>1221.74</td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>38462.74</td>
<td>176</td>
<td>218.54</td>
<td></td>
</tr>
<tr>
<td>Error linear</td>
<td>19029.16</td>
<td>22</td>
<td>864.96</td>
<td></td>
</tr>
<tr>
<td>Error residual</td>
<td>19433.58</td>
<td>154</td>
<td>126.19</td>
<td></td>
</tr>
</tbody>
</table>

*p<.01

This finding is exactly what was assumed in Experiment 2, that the more information supplied, the higher the likelihood judgment given to accountant. This contradicts the results found in Experiment 2 which indicated, at least comparing the judgment after four items (FS/S) with that
after all eight items (FS/O), that more information did not increase the likelihood judgment given to accountant.

Comparing the results of Experiment 3 with those of Experiment 2 we find that the mean likelihoods for the foresight and hindsight groups at stage eight in Experiment 3 are similar to those found for the HS/O and FS/O subjects in Experiment 2: 40.68% and 26.56% for hindsight and foresight subjects in Experiment 3, respectively, and 42.60% and 23.53% for the comparable groups in Experiment 2. The difference between the results of the two experiments lies with the FS/S group of Experiment 2. This group's mean likelihood was 25.74% and the average number of additional pieces of information seen was between three and four. The mean judgments for the foresight subjects in Experiment 3 at stages three and four were 13.00% and 17.09%, respectively.

It should be noted that the FS/S subjects in Experiment 2 saw differing amounts of information and the average amount was three to four. However, the mean judgments for the foresight subjects at stage three (or four) were based on judgments of subjects, all of whom had seen three (or four) pieces of information. The results of Experiment 3 will therefore be given more credence and it is thus concluded, albeit tentatively, that there is in fact a positive linear relationship between the number of additional pieces of information seen and the likelihood judgment.
given to accountant. This conclusion is further supported by the fact that for the FS/S subjects in Experiment 2, there was a significant positive linear relationship between the number of pieces of additional information examined and the likelihood judgment given to accountant ($r=.23$, $p<.05$, 1-tailed).

**Optimal Information Supply Strategies**

We are now ready to look at the data of Experiment 3 as it pertains to the information supply behavior of foresight and hindsight subjects, as discussed in the last section of Chapter III. It will be recalled that separate criteria for foresight and hindsight subjects were developed as to what the optimal number of pieces of information to supply would be.

For hindsight subjects, it was shown that the optimal decision would have been to provide the minimum number of additional pieces of information such that, at that stage, accountant would have the highest likelihood of all the occupations, or if there was a tie, to use expected values based on random choice. For foresight subjects, the optimal decision was defined as providing that number of pieces of additional information which would make the expected winnings, as defined in Equation 2, a maximum.

These criteria were applied to the data provided by the 23 foresight and 19 hindsight subjects who participated
in Experiment 3. Table 27 gives the frequency distribution of the optimal number of pieces of additional information for the foresight and hindsight subjects. As can be seen, the entire foresight distribution lies in the 0-2 range, while the frequencies for the hindsight subjects are more dispersed. The difference between the foresight and hindsight means, .87 and 3.07, respectively, was significant,

<table>
<thead>
<tr>
<th>Number of Additional Pieces of Information</th>
<th>Frequency</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Foresight</td>
<td>Hindsight</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>9</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>8</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>3</td>
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<td>4</td>
<td>0</td>
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<td>6</td>
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<tr>
<td>7</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Optimal Criteria Never Met</td>
<td>0</td>
<td>5&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>

TABLE 27

FREQUENCY DISTRIBUTIONS FOR FORESIGHT AND HINDSIGHT SUBJECTS OF THE OPTIMAL NUMBER OF ADDITIONAL PIECES OF INFORMATION TO BE SUPPLIED

<table>
<thead>
<tr>
<th>Number of Additional Pieces of Information</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Foresight</td>
</tr>
<tr>
<td>0</td>
<td>.87</td>
</tr>
</tbody>
</table>

<sup>a</sup>Likelihood for Accountant was never the maximum likelihood.
Clearly, these results indicate that hindsight subjects should have provided more information than foresight subjects in Experiment 2. This is exactly opposite of the prediction made by creeping determinism. The actual finding, that foresight and hindsight subjects did not provide differing amounts of additional information, may be considered to be the result of these two strategies cancelling one another out.

Summary

In summary, the data from Experiment 3 provided some very significant information regarding two questions raised from the results of Experiment 2. First, regarding the relationship, for foresight subjects, between the number of additional pieces of information seen and the likelihood judgment given to accountant, the data from Experiment 3 refute the finding of Experiment 2 (that there was no relationship), and lead to the conclusion that a significant positive relationship between these two variables does exist. Second, regarding the optimal rules for foresight and hindsight subjects in deciding how many additional pieces of information to provide, the data from Experiment 3 indicate that hindsight subjects should have provided more information than foresight subjects. At worst, then, the results of Experiment 2, that there was no difference between the amount of information supplied
by the hindsight and foresight subjects, can be interpreted as not disputing creeping determinism. At best, these results can be considered to be evidence supporting creeping determinism, since, compared to what would be expected by the optimal strategies, foresight subjects did provide more information than hindsight subjects.
CHAPTER V
GENERAL DISCUSSION

This chapter will consist of three major sections. The first section will review the major findings of the experiments conducted in this study and will discuss some future research needs. The second section will discuss the implications that creeping determinism has for judgment and decision processes. The final section will offer some suggestions as to how we can limit some of the negative consequences of creeping determinism.

Experimental Findings

The major finding of Experiment 1 was that assimilation, and not availability of reasons, is primarily responsible for the presence of creeping determinism. This conclusion was based on the presence of the knew-it-all-along effect in equal strength under both the scenario and outcome conditions.

One of the previous findings discussed in Chapter I was that debiasing instructions had no effect on the knew-it-all-along effect. The debiasing instructions consisted of describing the knew-it-all-along effect to the subjects and informing them that most subjects are susceptible to
this bias and that they should try to avoid making the same mistake. It is not surprising that this type of debiasing instruction would not be effective, for assimilation occurs automatically and immediately. However, there has not been any investigation into whether giving subjects feedback concerning their own behavior might improve their performance. Perhaps by setting up a study in which after each trial feedback was given relating how the foresight and hindsight judgments differed, it would be possible to see a gradual decrease in the knew-it-all-along effect until subjects are no longer susceptible to it. Of course, the question would still remain as to whether this learning would be retained over time, but nevertheless it would be helpful to know whether this kind of training could eliminate the bias, even on a short-term basis.

Creeping determinism is not the only phenomenon under which some type of cognitive assimilation occurs. Bem and McConnell (1970) conducted a study in which, after subjects' opinions on an issue were determined, the subjects were asked to write an essay from the opposing point of view. Immediately after writing the essays, subjects were asked to remember their original opinions. The results indicated that their "remembered" opinions were closer to the opinions of the essay than were their original opinions. Thus, the written opinions assimilated with their
prior opinions to produce opinions that reflected a compromise between the two.

As another example of assimilation, Loftus (1979) has demonstrated that events that intervene between a witnessed episode and testimony concerning that episode can distort the memory of that event and thus affect the testimony. Some of the variables found to affect this distortion have already been looked at in terms of the knew-it-all-along effect (viz., degree of knowledge, level of detail provided, time period between event and report). Still, a great deal of additional work is needed to gain a better understanding of how these types of assimilation are similar and are different.

Although the data from Experiment 1 clearly favor the assimilation hypothesis, one should not assume that this issue had been completely resolved. Further experimentation should be conducted using different paradigms which would provide further discriminating evidence regarding the two hypotheses. For example, the manipulation of how many alternatives subjects are asked to judge used by Slovic and Fischhoff (1977) should be further studied, for Slovic and Fischhoff's results seemed to favor the availability of reasons hypothesis.

One such experiment might utilize a setting like that of Fischhoff and Byeth (1975) where individuals in foresight judge likelihoods of events, and at a later time in
hindsight are asked to remember their judgments. In this setting, one could manipulate the number and extent of detail of the alternatives given to subjects at the time of recall and see how this affects the knew-it-all-along effect.

For instance, at Time 1, subjects could be asked to judge how likely several different events are. At Time 2, the same subjects would be asked to recall their judgments. The effect of the number of alternatives on the knew-it-all-along effect could be examined by having some subjects recall their judgments for just those events that occurred, while other subjects would be explicitly told what events did not occur and are asked to recall their judgments for these events also. The effect of detail on the knew-it-all-along effect could be examined by giving some subjects information concerning only which events occurred and which did not, while other subjects would be given information regarding the process by which the outcomes occurred.

The results of Experiment 3 indicated that the reason that there was no difference in the amount of information provided by the foresight and hindsight subjects in Experiment 2 may have been that the optimal strategy and creeping determinism were working against one another. It would therefore be valuable to develop a paradigm in which the optimal strategies for the foresight and hindsight subjects
would be the same, and then see if the hindsight subjects provided less information.

It should be noted at this time that the development of the appropriate stimuli for the type of task used in Experiment 2 is of critical importance. Several criteria for the set of information used need to be met simultaneously (viz., a negative linear relationship between uncertainty and amount of information, some uncertainty for foresight subjects even with all of the information, appropriate optimal criteria for the foresight and hindsight subjects), and though considerable time and effort were spent preparing the stimuli used in Experiment 2, the results of Experiment 3 indicate that these stimuli were found lacking.

The intent of Experiment 2 was to determine if creeping determinism could be measured by looking at the information search behavior of hindsight and foresight subjects. This was tested indirectly by measuring the amount of information hindsight and foresight subjects believed other subjects would require.

In future research, attempts should be made to assess information search behavior more directly. One problem with Experiment 2 was that the instructions to the subjects were very complex, describing how the subject had to decide how much information should be provided to another individual, then that amount of information would be given to
another individual, then the individual would guess the occupation, and then there would be a payoff. A better design would have the amount of information needed to make a decision measured directly. The problem with achieving this objective lies with the hindsight condition. Here, the subject knows the outcome, but then must decide how much information is needed to determine the outcome. One possible paradigm would require the hindsight subjects to justify how the correct outcome could be determined by the set of information chosen.

Experiments 2 and 3 deal with two theoretical models of information search, creeping determinism and an optimal strategy. Numerous other models exist which could be applied to this kind of task. Also, additional research concerning the process of the information search is needed. Further examination of the effect of outcome information on the relevance judgments could provide some important insights into how hindsight and foresight subjects differ in their use of information as it is collected.

**Implications**

One negative implication of creeping determinism is that individuals find it very easy to blame others after the fact, since those who know what happened do not appreciate others' inability to anticipate the outcome. For example, consider Pearl Harbor. The naval commander,
Admiral H. E. Kimmel, was forced to give up his command because the American public blamed him for the surprise attack and felt that American military security should have performed better. This is a prime example of how an individual (or in this case a group of individuals, the American public) with hindsight blamed another individual (Admiral Kimmel) for not having the foresight to correctly anticipate the outcome (Japanese attack). The basis for deciding whether Admiral Kimmel should have been fired should have been an examination of the information available before the attack, not just the fact that there was an attack. One way to make this decision by using only the information available would be to create a hypothetical scenario that contains analogous information, without an outcome. If a group of individuals using this information is able to correctly anticipate an attack, then we should conclude that Admiral Kimmel was negligent in his duties and deserving of disciplinary measures. If, however, this group of individuals is not able to correctly anticipate the outcome, then we should conclude that the attack is apparent only in retrospect, and instead of blaming Admiral Kimmel, we should take steps so that we better anticipate surprises in the future. After examining the available historical evidence, Wohlseter (1962) arrives at the latter conclusion:
Indeed, at the time there was a good deal of evidence available to support all the wrong interpretations of last-minute signals, and the interpretations appeared wrong only after the event. (p. 392)

Not only does creeping determinism produce unwarranted feelings of blame towards others, it can produce the same feelings directed towards oneself. That is, an individual who anticipates an incorrect outcome could, in hindsight, believe that the correct outcome could have been anticipated, and therefore experience feelings of incompetence and regret. If, on foresight, the correct outcome could not have been anticipated, instead of berating oneself for poor judgment, the individual should accept the fact that surprises and resulting failures are inevitable.

Another negative consequence of creeping determinism is that it hinders individuals from learning from past mistakes. By believing that one knew it all along, one reduces the surprisingness of the outcome. Therefore, instead of learning that a bad prediction was made, perhaps due to the absence of necessary information, one perceives that a good prediction was made. Thus, instead of recognizing that given the situation, predictability is poor, and therefore taking steps to be better prepared next time for surprises, one believes that effective prediction is possible and is then no better prepared for a surprise the next time around. As Fischhoff (1975b) stated, "A surprise free past is prologue to a surprise full future." (p. 76)
When we look back upon our past, we judge the extent to which the rules that we create for ourselves help us to understand the world around us. In a sense, then, we are testing the hypothesis that we understand how and why things occur as they do. If, in hindsight, we consistently underestimate the surprises that we have encountered, then we are changing the data to fit the hypothesis, and thus insuring that the hypothesis will be supported. Since our hypothesis is supported, we find no reason to change them and thus the very outcome knowledge which gives us the false impression that we do understand what the world is about may actually be instrumental in preventing us from truly understanding the events in our lives. Greenwald (1980) discusses several examples of the occurrence of such a "confirmation bias", including memory and information search, response to persuasion, and person impression formation.

As a practical example of how this bias can be detrimental, consider horse racing addicts. To continue betting, bettors must convince themselves that they can accurately predict the winner of the next race, even though they have consistently lost the last several races. How do they accomplish this? By emphasizing obscure details concerning the race that they didn't discover until after the last race (e.g., the track was a bit too slow), but that will help in the next race, or by re-interpreting already known
facts to fit the last race (e.g., instead of Trainer A's morning workouts getting the horses warmed up for the race, it actually tires them out), they convince themselves that this is now the "correct" interpretation. Clearly, it would be better in the long run for the addicts to correctly judge their past record as indicating that they just cannot accurately predict horse races and modify their betting behavior to fit this fact.

Creeping determinism, as illustrated by the knew-it-all-along effect, results in an overestimation of what we know. If we overestimate what we know, then when we receive outcome knowledge, it does not appreciably add to our knowledge, and so we end up underestimating what we have learned from the outcome information. If you knew it all along, then you didn't need the report.

As an example of overestimating what we know, consider once again the results of Rosenhan's (1973) experiment with the pseudopatients. According to Rosenhan, "Whenever the ratio of what is known to what needs to be known approaches zero, we tend to invent 'knowledge' and assume that we understand more than we actually do." (p. 257) Rosenhan argues that in a diagnostic setting, instead of acknowledging that we don't know everything about abnormal behavior, we create labels, such as schizophrenic or psychopathic, and then act as if these words really carried some meaning. As evidenced by the inability of the staff to discover any
of the pseudopatients, it is not really fair to claim that we can distinguish sanity from insanity. Rosenhan claims that this is not something new, that "we have known for a long time that diagnoses are often not useful or reliable, but we have nevertheless continued to use them". (p. 257) The presence of this bias in this area is particularly disturbing, given the severity of the consequences that labeling a person as insane or psychotic can produce.

Another area in which this overestimation of what we know occurs is in the judgment of scientific research. Slovic and Fischhoff's (1977) results indicated that on hindsight, individuals judged scientific research as more predictable than is warranted (as evidenced by foresight judgments). This leads to individuals being unduly critical of scientific research in that, when informed of the results, they tend to feel that they knew it all along and so the research was unnecessary.

This hindsight bias could produce two very serious consequences. First, reviewers judging articles for publication who are susceptible to this bias could erroneously conclude that an article under consideration does not appreciably add to scientific knowledge and therefore is inappropriate for publication. The mistake being made is that the article may not add any appreciable knowledge to the reviewer because he/she has already read it, whereas it
could add appreciable knowledge to the general public who has not seen it yet.

Second, lay observers reading about research who are susceptible to this bias could unfairly judge the research as "uninformative" and deem suggestions for future similar research as unworthy of public support. This is especially pertinent to psychological research where much of the subject matter (e.g., decision making, persuasion, development) is familiar enough to lay people to produce this knew-it-all-along bias.

A dangerous consequence of creeping determinism is that it is possible for individuals to use the presence of creeping determinism to their own gain. According to the historian R. H. Tawney (1961), the re-interpretation of information to fit with an outcome has been used by individuals throughout history who wish to make certain events seem inevitable. According to Tawney, important classes of people encourage an interpretation of history which lends respectability to those aspects of society which they favor and which favor them.

In reality, however, it is only by dragging into prominence the forces which have triumphed, and thrusting into the background those which they have swallowed up, that an appearance of inevitableness is given to existing institutions, which satisfies the desire to see them as links in an orderly chain of unavoidable sequences. (pp. 177-178)
Creeping determinism can be looked upon as another kind of bias, one that also has very severe implications. According to the instructions given to hindsight subjects, judgments were supposed to be made ignoring outcome information. The presence of the knew-it-all-along effect demonstrates that this is not being done. In fact, the knew-it-all-along effect can be viewed as a special case of a general inability of subjects to ignore information. This phenomenon can lead to very serious consequences.

As an example, consider a courtroom setting. It is well known that it is not all that uncommon to have evidence presented in a trial that for one reason or another is ruled inadmissable. When this happens, the judge instructs the jury to ignore that information. However, if as in the present studies, subjects (jurors) are unable to ignore this information, then a serious disservice is being done to the defendant.

Sue, Smith, and Caldwell (1973) conducted an experiment to see if this was indeed happening in the courtroom. Subjects were presented with either a strong or weak case against a defendant. They were then given either additional damaging evidence that was ruled admissable, additional damaging evidence that was ruled inadmissable, or no additional evidence. The results indicated that when the case was strong, there was no effect due to the type of additional evidence presented. However, when the case
was weak, there were significantly more guilty verdicts for subjects who received additional evidence, regardless of whether the evidence was ruled admissible or inadmissible. The conclusion made by the authors was that the additional evidence was used only when it was needed, but when it was needed, subjects did not follow instructions to ignore the inadmissible evidence. Not only is this inability to ignore the inadmissible evidence unfair to the defendant by itself, but it is not unreasonable to suspect that prosecuting attorneys are aware of this fact and use it to their own benefit, introducing evidence that they know will be ruled inadmissible, but that will still have an effect on the jury.

One suggestion the authors give to solve this problem is to conduct a trial on videotape in the absence of jurors, then edit the tape by removing any inadmissible evidence, and then to show it to the jurors. While this idea may be rather impractical, it certainly bears consideration. Clearly, something needs to be done to correct this problem.

Recommendations

Although further research into the nature of creeping determinism is needed, we must also make serious attempts to try to limit the negative consequences of creeping
determinism. This dissertation will close with a discussion of some ways in which this can be done.

The first thing that must be done is to accept the fact that there is uncertainty in our judgment of the past. Once this is achieved, we should try to investigate the past as it was originally experienced. For instance, in judging whether Admiral Kimmel should be held responsible for the disaster at Pearl Harbor, we should examine the information available at the time, looking through records and communications made prior to the attack. Probably the best way to counteract the bias of creeping determinism is to give the problem to a group of foresightful judges.

We can also make attempts to offset the negative consequences of creeping determinism on judgments of scientific research. One way to do this would be to stress in our writing the unpredictability and surprisingness of the results, even if it means intentionally misleading the reader so that the surprisingness will be recognized. For example, consider Lazarsfeld's (1949) discussion of the results of a group of studies dealing with phases of a soldier's life. Lazarsfeld wrote this paper in such a way as to lead the reader to believe that a certain set of results occurred. In fact, the actual results were exactly opposite of these expected results. This misdirected writing creates a real appreciation for the surprisingness of the results, as Lazarsfeld states, "If we had mentioned
the actual results of the investigation first, the reader would have labelled these 'obvious' also." (p. 380)

In conclusion, then, it must be recognized that foresight judgments and hindsight judgments do differ. Regardless of how much we learn about creeping determinism, we can never eliminate all of the differences between the two kinds of judgments. As Florovsky (1969) noted:

We can never remember even our own immediate past, exactly as we have lived it, because, if we are really remembering, and not just dreaming, we do remember the past occurrences in a perspective, against a changed background of our enriched experience. (p. 360)

However, despite the fact that we can never completely eliminate the bias between these judgments, we can learn to deal with it in such a way as to limit as much as possible its negative consequences.
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APPENDIX A

SAMPLE BOOKLET FOR EXPERIMENT 1
Pages 119-122 illustrate the booklet received by a subject in the Scenario Hindsight-1 condition for AD1. Pages 123-131 are the replacements for page 120 for subjects in the other nine experimental conditions.

Pages 132-135 illustrate the booklet received by a subject in the Scenario Hindsight-1 condition for AD2. Pages 136-144 are the replacements for page 133 for subjects in the other nine experimental conditions.
E.B., a teenager, has been a patient at one of the state mental hospitals for about five years. When his case came up for reappraisal he was put under close observation. The following observations were made during that period. While waiting for an appointment, he sat quietly and read a newspaper. He said he was afraid that he would hurt somebody. When he was sitting by himself in the ward one day, an attendant asked him if he'd like to join the rest of the patients, but he refused. After almost every meal, before getting up from the table, he excused himself. During an interview he shivered at the least noise. He said "there's nothing wrong with me". He occasionally quarreled with the patients.

The staff was unsure of E.B. being ready to go back into society, but since there was terrible overcrowding in the hospitals, they decided to release him for a trial period of one year, provided that he continue weekly treatments with a psychiatrist.
Scenario 1 (Actual Outcome)

Occasionally he went to his sessions. During his sessions he constantly talked about weapons. He got a job working as a busboy. One day at his job, he spilled a whole tray of dishes on some customers and was fired. Three days later he was arrested for trying to kill someone in a bar. At the end of the year he was in a prison ward in a state hospital.

Scenario 2

He faithfully attended his sessions with his psychiatrist. Although he was unable to get a job on his own, the psychiatrist got him a job with a construction worker friend of his. All throughout his sessions, E.B. constantly talked about how happy he was to have his freedom. He saved some money from his construction job and bought himself a dog. At the end of the year, the psychiatrist recommended that E.B. remain free and the sessions be stopped.

Scenario 3

He continued to go to most of his treatment sessions. He was not able to hold onto a job because he was always getting into arguments with other workers. During his treatment sessions, he often broke into crying spells, claiming he was a failure. He spent most of his time, day and night, wandering around, picking at garbage. At the end of the year, the psychiatrist recommended that he be placed back in the hospital because he was not able to function in society.

Scenario 4

He attended only 1 session after being released. He was not heard from for the next 10 months. After those 10 months he walked into the psychiatrist's office to make an appointment. He refused to talk about what happened during those 10 months but otherwise was totally cooperative. During the sessions over the next 2 months, the psychiatrist felt that E.B. was a new man, well adjusted and content with himself. The psychiatrist recommended that E.B. remain out of the hospital, with the treatments continuing on a monthly basis.

In light of the information appearing in the general information, what do you think was the likelihood of occurrence of each of the four scenarios? (The likelihoods should sum to 100%.)

Scenario 1 _____
Scenario 2 _____
Scenario 3 _____
Scenario 4 _____

120
For each of the following statements from the general information, please indicate how relevant or important each statement was in determining your likelihood judgments.

1. While waiting for an appointment, he sat quietly and read a newspaper.
   1  2  3  4  5  6  7
   Not Relevant Somewhat Relevant Very Relevant

2. He said he was afraid that he would hurt somebody.
   1  2  3  4  5  6  7
   Not Relevant Somewhat Relevant Very Relevant

3. When he was sitting by himself in the ward one day, an attendant asked him if he'd like to join the rest of the patients, but he refused.
   1  2  3  4  5  6  7
   Not Relevant Somewhat Relevant Very Relevant

4. After almost every meal, before getting up from the table, he excused himself.
   1  2  3  4  5  6  7
   Not Relevant Somewhat Relevant Very Relevant

5. During an interview he shivered at the least noise.
   1  2  3  4  5  6  7
   Not Relevant Somewhat Relevant Very Relevant

6. He said, "there's nothing wrong with me".
   1  2  3  4  5  6  7
   Not Relevant Somewhat Relevant Very Relevant

7. He occasionally quarreled with the patients.
   1  2  3  4  5  6  7
   Not Relevant Somewhat Relevant Very Relevant
Personal Opinion Questionnaire

For each of the following statements, please indicate how that statement agrees or disagrees with your personal opinion.

1. There are too many people kept in mental hospitals.
   1  2  3  4  5
   Strongly Agree  Neutral  Strongly Disagree

2. The mental hospital system is not perfect, but is basically a good system.
   1  2  3  4  5
   Strongly Agree  Neutral  Strongly Disagree

3. I believe that the verdict "Not guilty by reason of insanity" should be changed to "Guilty but mentally ill".
   1  2  3  4  5
   Strongly Agree  Neutral  Strongly Disagree

4. I think that most people that enter a mental hospital eventually are released.
   1  2  3  4  5
   Strongly Agree  Neutral  Strongly Disagree

5. Most of the people in mental hospitals are no more crazy than the average person out on the street.
   1  2  3  4  5
   Strongly Agree  Neutral  Strongly Disagree
Occasionally went to his sessions. During his sessions he
constantly talked about weapons. He got a job working as a
busboy. One day at his job, he spilled a whole tray of dishes on
some customers and was fired. Three days later he was arrested
for trying to kill someone in a bar. At the end of the year he
was in a prison ward in a state hospital.

Scenario 2 (Actual Outcome)

He faithfully attended his sessions with his psychiatrist.
Although he was unable to get a job on his own, the psychiatrist
got him a job with a construction worker friend of his. All
throughout his sessions, E.B. constantly talked about how happy
he was to have his freedom. He saved some money from his
construction job and bought himself a dog. At the end of the
year, the psychiatrist recommended that E.B. remain free and the
sessions be stopped.

Scenario 3

He continued to go to most of his treatment sessions. He was
not able to hold on to a job because he was always getting into
arguments with other workers. During his treatment sessions, he
often broke into crying spells, claiming he was a failure. He
spent most of his time day and night, wandering around, picking
at garbage. At the end of the year, the psychiatrist recommended
that he be placed back in the hospital because he was not able to
function in society.

Scenario 4

He attended only 1 session after being released. He was not
heard from for the next 10 months. After those 10 months he
walked into the psychiatrist's office to make an appointment. He
refused to talk about what happened during those 10 months but
otherwise was totally cooperative. During the sessions over the
next 2 months, the psychiatrist felt that E.B. was a new man,
well adjusted and content with himself. The psychiatrist
recommended that E.B. remain out of the hospital, with the
treatments continuing on a monthly basis.

In light of the information appearing in the general
information, what do you think was the likelihood of occurrence of
each of the four scenarios (The likelihoods should sum to 100%).

Scenario 1 _______%
Scenario 2 _______%
Scenario 3 _______%
Scenario 4 _______%
Scenario 1

Occasionally he went to his sessions. During his sessions he constantly talked about weapons. He got a job working as a busboy. One day at his job, he spilled a whole tray of dishes on some customers and was fired. Three days later he was arrested for trying to kill someone in a bar. At the end of the year he was in a prison ward in a state hospital.

Scenario 2

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Scenario 3 (Actual Outcome)

He continued to go to most of his treatment sessions. He was not able to hold on to a job because he was always getting into arguments with other workers. During his treatment sessions, he often broke into crying spells, claiming he was a failure. He spent most of his time, day and night, wandering around, picking at garbage. At the end of the year, the psychiatrist recommended that he be placed back in the hospital because he was not able to function in society.

Scenario 4

He attended only 1 session after being released. He was not heard from for the next 10 months. After those 10 months he walked into the psychiatrist's office to make an appointment. He refused to talk about what happened during those 10 months but otherwise was totally cooperative. During the sessions over the next 2 months, the psychiatrist felt that E.B. was a new man, well adjusted and content with himself. The psychiatrist recommended that E.B. remain out of the hospital, with the treatments continuing on a monthly basis.

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He continued to go to most of his treatment sessions. He was not able to hold on to a job because he was always getting into arguments with other workers. During his treatment sessions, he often broke into crying spells, claiming he was a failure. He spent most of his time, day and night, wandering around, picking at garbage. At the end of the year, the psychiatrist recommended that he be placed back in the hospital because he was not able to function in society.

Scenario 4 (Actual Outcome)

He attended only 1 session after being released. He was not heard from for the next 10 months. After those 10 months he walked into the psychiatrist's office to make an appointment. He refused to talk about what happened during those 10 months but otherwise was totally cooperative. During the sessions over the next 2 months, the psychiatrist felt that E.B. was a new man, well adjusted and content with himself. The psychiatrist recommended that E.B. remain out of the hospital, with the treatments continuing on a monthly basis.

In light of the information appearing in the general information, what do you think was the likelihood of occurrence of each of the four scenarios (The likelihoods should sum to 100%).

Scenario 1 ________% 
Scenario 2 ________% 
Scenario 3 ________% 
Scenario 4 ________% 

125
Scenario 1
Occasionally he went to his sessions. During his sessions he constantly talked about weapons. He got a job working as a busboy. One day at his job, he spilled a whole tray of dishes on some customers and was fired. Three days later he was arrested for trying to kill someone in a bar. At the end of the year he was in a prison ward in a state hospital.

Scenario 2
He faithfully attended his sessions with his psychiatrist. Although he was unable to get a job on his own, the psychiatrist got him a job with a construction worker friend of his. All throughout his sessions, E.B. constantly talked about how happy he was to have his freedom. He saved some money from his construction job and bought himself a dog. At the end of the year, the psychiatrist recommended that E.B. remain free and the sessions be stopped.

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He continued to go to most of his treatment sessions. He was not able to hold on to a job because he was always getting into arguments with other workers. During his treatment sessions, he often broke into crying spells, claiming he was a failure. He spent most of his time, day and night, wandering around, picking at garbage. At the end of the year, the psychiatrist recommended that he be placed back in the hospital because he was not able to function in society.

Scenario 4
He attended only 1 session after being released. He was not heard from for the next 10 months. After those 10 months he walked into the psychiatrist's office to make an appointment. He refused to talk about what happened during those 10 months but otherwise was totally cooperative. During the sessions over the next 2 months, the psychiatrist felt that E.B. was a new man, well adjusted and content with himself. The psychiatrist recommended that E.B. remain out of the hospital, with the treatments continuing on a monthly basis.

In light of the information appearing in the general information, what do you think was the likelihood of occurrence of each of the four scenarios (the likelihoods should sum to 100%).

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Likelihood</th>
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<td>Scenario 1</td>
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<td>Scenario 4</td>
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</tbody>
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Outcome 1 (Actual Outcome)

He is in a prison ward in a state hospital for trying to kill someone.

Outcome 2

The psychiatrist recommends that E.B. remain free and the sessions be stopped.

Outcome 3

The psychiatrist recommends that E.B. be placed back in the hospital because he is not able to function in society.

Outcome 4

The psychiatrist recommends that E.B. remain out of the hospital, with the treatments continuing on a monthly basis.

In light of the information appearing in the general information, what do you think was the likelihood of occurrence of each of the four outcomes (The likelihoods should sum to 100%)?

Outcome 1 ________%  
Outcome 2 ________%  
Outcome 3 ________%  
Outcome 4 ________%
Outcome 1

He is in a prison ward in a state hospital for trying to kill someone.

Outcome 2 (Actual Outcome)

The psychiatrist recommends that E.B. remain free and the sessions be stopped.

Outcome 3

The psychiatrist recommends that E.B. be placed back in the hospital because he is not able to function in society.

Outcome 4

The psychiatrist recommends that E.B. remain out of the hospital, with the treatments continuing on a monthly basis.

In light of the information appearing in the general information, what do you think was the likelihood of occurrence of each of the four outcomes (the likelihoods should sum to 100%)?

Outcome 1 _____ %
Outcome 2 _____ %
Outcome 3 _____ %
Outcome 4 _____ %
Outcome 1
He is in a prison ward in a state hospital for trying to kill someone.

Outcome 2
The psychiatrist recommends that E.B. remain free and the sessions be stopped.

Outcome 3 (Actual Outcome)
The psychiatrist recommends that E.B. be placed back in the hospital because he is not able to function in society.

Outcome 4
The psychiatrist recommends that E.B. remain out of the hospital, with the treatments continuing on a monthly basis.

In light of the information appearing in the general information, what do you think was the likelihood of occurrence of each of the four outcomes (The likelihoods should sum to 100%).

Outcome 1 _______%
Outcome 2 _______%
Outcome 3 _______%
Outcome 4 _______%
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He is in a prison ward in a state hospital for trying to kill someone.

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The psychiatrist recommends that E.B. remain free and the sessions be stopped.

Outcome 3

The psychiatrist recommends that E.B. be placed back in the hospital because he is not able to function in society.

Outcome 4 (Actual Outcome)

The psychiatrist recommends that E.B. remain out of the hospital, with the treatments continuing on a monthly basis.

In light of the information appearing in the general information, what do you think was the likelihood of occurrence of each of the four outcomes? (The likelihoods should sum to 100%).

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The psychiatrist recommends that E.B. be placed back in the hospital because he is not able to function in society.

Outcome 4
The psychiatrist recommends that E.B. remain out of the hospital, with the treatments continuing on a monthly basis.

In light of the information appearing in the general information, what do you think was the likelihood of occurrence of each of the four outcomes (The likelihoods should sum to 100%).

Outcome 1 ___%  
Outcome 2 ___%  
Outcome 3 ___%  
Outcome 4 ___%
General Information

For the last 15 years, Mr. D. has been a pharmacist at a hospital. While he likes his job, he has been doing the same thing for the last 15 years with nothing to show for it except a small amount of money that he has managed to save over the years. Two blocks from his house a new shopping center is being built and so he considers taking a chance and opening his own drug store. He knows something about running a drug store because all during college he worked in a drug store. His brother, an accountant, urges Mr. D. to not throw his money away since he's very likely to lose everything. Mr. D.'s neighborhood is very highly populated and the nearest drug store to his would be two miles away. Mr. D.'s boss at the hospital tells him that he knew of someone who opened his own store and lost all of his money. Mr. D. was very well liked at the hospital and would miss some of his colleagues. Mr. D. was not in the best of health and his wife was worried that operating the store might be too much for him.

Mr. D. decided to take the risk of opening the store and signed a 1-year lease because he knew that if he didn't he would wonder for the rest of his life whether he could have made it.
Scenario 1 (Actual Outcome)

Mr. D. is doing well with his drug store. He is not making as much money as he thought he would, but he enjoys getting to know the people in his neighborhood. The hours are very long, but he doesn't mind because he is working for himself. When his lease comes up for renewal, he signs a long term lease.

Scenario 2

Mr. D. is finding it very tough going. He has used up all of his savings and he is not getting very much business. He is forced to let two of his employees go and puts in 12 hours a day, 7 days a week running the store. When his lease comes up for renewal, he signs for a year, hoping that things will turn around. Four months later he is forced to close the store and file for bankruptcy.

Scenario 3

The drug store is an immediate goldmine. Mr. D. gets more business than he ever hoped for. He is able to hire more employees and work only when he wants to. When his lease comes up for renewal, he signs up for 10 years, buying out the floundering bookstore next to him and expanding the drug store. Mr. D. begins to look around for a place to open another store.

Scenario 4

Mr. D. is struggling. He has had to use up more of his savings than he originally planned to open the store. Business is slowly growing, but the long hours and constant worries are taking a toll on Mr. D. Six months after he opens his store, a big chain drug store opens two blocks away. When his lease comes up, he reluctantly decides to give up the store while he still has some savings left and go back to work for the hospital.

In light of the information appearing in the general information, what do you think was the likelihood of occurrence of each of the four scenarios (the likelihoods should sum to 100%)?

Scenario 1 ________%
Scenario 2 ________%
Scenario 3 ________%
Scenario 4 ________%
For each of the following statements from the general information, please indicate how relevant or important each statement was in determining your likelihood judgments.

1. He knows something about running a drug store because all during college he worked in a drug store.
   1 2 3 4 5 6 7
   Not Relevant Somewhat Relevant Very Relevant

2. His brother, an accountant, urges Mr. D. to not throw his money away since he's very likely to lose everything.
   1 2 3 4 5 6 7
   Not Relevant Somewhat Relevant Very Relevant

3. Mr. D.'s neighborhood is very highly populated and the nearest drug store to his would be two miles away.
   1 2 3 4 5 6 7
   Not Relevant Somewhat Relevant Very Relevant

4. Mr. D.'s boss at the hospital tells him that he knew of someone who opened his own store and lost all of his money.
   1 2 3 4 5 6 7
   Not Relevant Somewhat Relevant Very Relevant

5. Mr. D. is very well liked at the hospital and would miss some of his colleagues.
   1 2 3 4 5 6 7
   Not Relevant Somewhat Relevant Very Relevant

6. Mr. D. is not in the best of health and his wife is worried that operating the store might be too much for him.
   1 2 3 4 5 6 7
   Not Relevant Somewhat Relevant Very Relevant
**Personal Opinion Questionnaire**

For each of the following statements, please indicate how that statement agrees or disagrees with your personal opinion.

1. I plan to go into business for myself.
   
   1  2  3  4  5  
   | Strongly Agree | Neutral | Strongly Disagree |

2. I agree with the saying "What's good for General Motors is good for the country".
   
   1  2  3  4  5  
   | Strongly Agree | Neutral | Strongly Disagree |

3. The little guy has no real say about what goes on in the country.
   
   1  2  3  4  5  
   | Strongly Agree | Neutral | Strongly Disagree |

4. Too many of the decisions made today are based on the word "profit".
   
   1  2  3  4  5  
   | Strongly Agree | Neutral | Strongly Disagree |

5. I would rather be happy in a job making a little money than unhappy in a job making a great deal of money.
   
   1  2  3  4  5  
   | Strongly Agree | Neutral | Strongly Disagree |
Scenario 1

Mr. D. is doing well with his drug store. He is not making as much money as he thought he would, but he enjoys getting to know the people in his neighborhood. The hours are very long, but he doesn't mind because he is working for himself. When his lease comes up for renewal, he signs a long term lease.

Scenario 2 (Actual Outcome)

Mr. D. is finding it very tough going. He has used up all of his savings and he is not getting very much business. He is forced to let two of his employees go and put in 12 hours a day, 7 days a week running the store. When his lease comes up for renewal, he signs for a year, hoping that things will turn around. Four months later he is forced to close the store and file for bankruptcy.

Scenario 3

The drug store is an immediate goldmine. Mr. D. gets more business than he ever hoped for. He is able to hire more employees and work only when he wants to. When his lease comes up for renewal, he signs up for 10 years, buying out the floundering bookstore next to him and expanding the drug store. Mr. D. begins to look around for a place to open another store.

Scenario 4

Mr. D. is struggling. He has had to use up more of his savings than he originally planned to open the store. Business is slowly growing, but the long hours and constant worries are taking a toll on Mr. D. Six months after he opens his store, a big chain drug store opens two blocks away. When his lease comes up, he reluctantly decides to give up the store while he still has some savings left and go back to work for the hospital.

In light of the information appearing in the general information, what do you think was the likelihood of occurrence of each of the four scenarios (The likelihoods should sum to 100%)

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In light of the information appearing in the general information, what do you think was the likelihood of occurrence of each of the four scenarios (The likelihoods should sum to 100%).

Scenario 1 ________%
Scenario 2 ________%
Scenario 3 ________%
Scenario 4 ________%
Outcome 1 (Actual Outcome)
Mr. D. signs a long term lease.

Outcome 2
He has to close the store and file for bankruptcy.

Outcome 3
He renews his lease, buys out the store next door and expands.

Outcome 4
He gives up the store and goes back to work for the hospital.

In light of the information appearing in the general information, what do you think was the likelihood of occurrence of each of the four outcomes (The likelihoods should sum to 100%).

Outcome 1 ______%  
Outcome 2 ______%  
Outcome 3 ______%  
Outcome 4 ______%
Outcome 1
Mr. D. signs a long term lease.

Outcome 2 (Actual Outcome)
He has to close the store and file for bankruptcy.

Outcome 3
He renews his lease, buys out the store next door and expands.

Outcome 4
He gives up the store and goes back to work for the hospital.

In light of the information appearing in the general Information, what do you think was the likelihood of occurrence of each of the four outcomes (the likelihoods should sum to 100%)?

Outcome 1 ______%  
Outcome 2 ______%  
Outcome 3 ______%  
Outcome 4 ______%
Outcome 1
Mr. D. signs a long term lease.

Outcome 2
He has to close the store and file for bankruptcy.

Outcome 3 (Actual Outcome)
He renew's his lease, buys out the store next door and expands.

Outcome 4
He gives up the store and goes back to work for the hospital.

In light of the information appearing in the general information, what do you think was the likelihood of occurrence of each of the four outcomes (the likelihoods should sum to 100%)?

Outcome 1 ________
Outcome 2 ________
Outcome 3 ________
Outcome 4 ________
Outcome 1
Mr. D. signs a long term lease.

Outcome 2
He has to close the store and file for bankruptcy.

Outcome 3
He renews his lease, buys out the store next door and expands.

Outcome 4 (Actual Outcome)
He gives up the store and goes back to work for the hospital.

In light of the information appearing in the general information, what do you think was the likelihood of occurrence of each of the four outcomes (The likelihoods should sum to 100%).

Outcome 1 ________%
Outcome 2 ________%
Outcome 3 ________%
Outcome 4 ________%
Outcome 1
Mr. D. signs a long term lease.

Outcome 2
He has to close the store and file for bankruptcy.

Outcome 3
He renews his lease, buys out the store next door and expands.

Outcome 4
He gives up the store and goes back to work for the hospital.

In light of the information appearing in the general information, what do you think was the likelihood of occurrence of each of the four outcomes (the likelihoods should sum to 100%)?

Outcome 1 _____%
Outcome 2 _____%
Outcome 3 _____%
Outcome 4 _____%
APPENDIX B
INSTRUCTIONS FOR EXPERIMENT 1
Instructions

In this experiment we are interested in knowing how people judge the likelihoods of possible events. You will be given two account descriptions, one dealing with a mental patient, and one dealing with a businessman. In each of these descriptions, you will be given general background information along with four detailed scenarios (outcomes). We ask you to evaluate the probability of occurrence of each of the four scenarios (outcomes) (including the one that actually occurred) in light of the information supplied. After making these estimates, you will be asked to fill out two short questionnaires.
Pages 149-152 illustrate the booklet received by a subject in the HS/O condition. Page 153 is the replacement for page 150 for subjects in the FS/O condition, and page 154 is the replacement for pages 149 and 150 for subjects in the FS/S condition.
Occupation Alternatives

1. Artist   6. Doctor
2. Engineer   7. Architect
3. Teacher   8. Accountant
4. Policeman   9. Truck Driver
5. Salesman  10. Carpenter

General Information

As a child, math and science were John's favorite subjects. After high school, John went directly into college. John's father is an architect. John has always made friends easily and gets along very well with other people. John has always been fascinated with how things worked.
Additional Information

1. John does not like working with his hands.
2. John isn't especially fond of children.
3. John wanted a job where he would work with people.
4. Making a lot of money is very important to John.
5. John's major in college was math.
7. After college, John had to go for further training for his job.
8. John wanted to make more money than his father makes.

John chose accounting as his profession.

How many of the eight additional pieces of information do you want to provide? ______
Using the information provided to you, both the general information and the additional information, please categorize the ten occupations into the following categories:

<table>
<thead>
<tr>
<th>Still Possible</th>
<th>Definitely Ruled Out</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

For each of the occupations in the Still Possible category please go back and indicate the likelihood of that being John's occupation. (The likelihoods should sum to 100%)
For each of the following statements from the general information, please indicate how relevant or important each statement was in determining John's true occupation.

1. As a child, math and science were John's favorite subjects.
   1  2  3  4  5  6  7
   Not Relevant Somewhat Relevant Very Relevant

2. After high school, John went directly into college.
   1  2  3  4  5  6  7
   Not Relevant Somewhat Relevant Very Relevant

3. John's father is an architect.
   1  2  3  4  5  6  7
   Not Relevant Somewhat Relevant Very Relevant

4. John has always made friends easily and gets along well with other people.
   1  2  3  4  5  6  7
   Not Relevant Somewhat Relevant Very Relevant

5. John has always been fascinated with how things worked.
   1  2  3  4  5  6  7
   Not Relevant Somewhat Relevant Very Relevant
Additional Information

1. John does not like working with his hands.
2. John isn't especially fond of children.
3. John wanted a job where he would work with people.
4. Making a lot of money is very important to John.
5. John's major in college was math.
7. After college, John had to go for further training for his job.
8. John wanted to make more money than his father makes.

How many of the eight additional pieces of information do you want to provide? ______
Occupation Alternatives

1. Artist
2. Engineer
3. Teacher
4. Policeman
5. Salesman
6. Doctor
7. Architect
8. Accountant
9. Truck Driver
10. Carpenter

General Information

As a child, math and science were John's favorite subjects. After high school, John went directly into college. John's father is an architect. John has always made friends easily and gets along very well with other people. John has always been fascinated with how things worked.

I have looked at __________ pieces of additional information.

I think John's occupation is __________.
APPENDIX D

SAMPLE BOOKLET FOR EXPERIMENT 3
Instructions

In this experiment we are interested in how individuals use information to make judgments. You will be given some general information about a man named John and a list of occupations from which he chose his career. You will then be given 8 additional pieces of information, one at a time. At each step, your task will be to judge the probability of John choosing each occupation, given the information available to you at that time.

For example, suppose that you were told that Sue chose one of the following 5 occupations: Nurse, Social Worker, Waitress, College Professor, Bookkeeper. Further, suppose you were given the following information:

Susan is 30 years old and has been working in her job for 8 years.
Susan comes into contact with many people in her job every day.
Many of the people that Susan comes into contact with are better off financially than she is.
Susan makes more money than her friends.
Your set of judgments might look like the following:

| Nurse     | 40% |
| Social Worker | 10% |
| Waitress   | 10% |
| Bookkeeper | 10% |
| College Professor | 30% |

Please note that the probabilities sum to 100%
The 10 occupations from which John chose his career are given below.

<table>
<thead>
<tr>
<th>Occupation Alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artist</td>
</tr>
<tr>
<td>Engineer</td>
</tr>
<tr>
<td>Teacher</td>
</tr>
<tr>
<td>Policeman</td>
</tr>
<tr>
<td>Salesman</td>
</tr>
<tr>
<td>Doctor</td>
</tr>
<tr>
<td>Architect</td>
</tr>
<tr>
<td>Accountant</td>
</tr>
<tr>
<td>Truck Driver</td>
</tr>
<tr>
<td>Carpenter</td>
</tr>
</tbody>
</table>

As you proceed through the judgments, please make each set of judgments independently. Please do not look back to see what judgments you have already made or look forward to see what the next piece of information will be. Make your judgments using only the information given on that page.
General Information

As a child, math and science were John's favorite subjects. After high school, John went directly into college. John's father is an architect. John has always made friends easily and gets along very well with other people. John has always been fascinated with how things worked.

Occupation Alternatives

Artist  ____%  Doctor  ____%
Engineer  ____%  Architect  ____%
Teacher  ____%  Accountant  ____%
Policeman  ____%  Truck Driver  ____%
Salesman  ____%  Carpenter  ____%

Reminder: Please make sure your probabilities sum to 100%.
General Information

As a child, math and science were John's favorite subjects. After high school, John went directly into college. John's father is an architect. John has always made friends easily and gets along very well with other people. John has always been fascinated with how things worked.

Additional Information

1. John does not like working with his hands.

Occupation Alternatives

Artist ____%  Doctor ____%
Engineer ____%  Architect ____%
Teacher ____%  Accountant ____%
Policeman ____%  Truck Driver ____%
Salesman ____%  Carpenter ____%

Reminder: Please make sure your probabilities sum to 100%.
General Information

As a child, math and science were John's favorite subjects. After high school, John went directly into college. John's father is an architect. John has always made friends easily and gets along very well with other people. John has always been fascinated with how things worked.

Additional Information

1. John does not like working with his hands.
2. John isn't especially fond of children.

Occupation Alternatives

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<tr>
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General Information

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Additional Information

1. John does not like working with his hands.
2. John isn't especially fond of children.
3. John wanted a job where he would work with people.

Occupation Alternatives

<p>| | | | |</p>
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Additional Information

1. John does not like working with his hands.
2. John isn't especially fond of children.
3. John wanted a job where he would work with people.
4. Making a lot of money is very important to John.

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</tbody>
</table>

Reminder: Please make sure your probabilities sum to 100%.
General Information

As a child, math and science were John's favorite subjects. After high school, John went directly into college. John's father is an architect. John has always made friends easily and gets along very well with other people. John has always been fascinated with how things worked.

Additional Information

1. John does not like working with his hands.
2. John isn't especially fond of children.
3. John wanted a job where he would work with people.
4. Making a lot of money is very important to John.
5. John's major in college was math.
7. After college, John had to go for further training for his job.
8. John wanted to make more money than his father makes.

Occupation Alternatives

<table>
<thead>
<tr>
<th>Artist</th>
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<th>Doctor</th>
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</thead>
<tbody>
<tr>
<td>Engineer</td>
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<tr>
<td>Teacher</td>
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<td>Accountant</td>
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<tr>
<td>Policeman</td>
<td>%</td>
<td>Truck Driver</td>
<td>%</td>
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<tr>
<td>Salesman</td>
<td>%</td>
<td>Carpenter</td>
<td>%</td>
</tr>
</tbody>
</table>

Reminder: Please make sure your probabilities sum to 100%.