Discounting in Multicausal Attribution:

The Principle of Minimal Causation

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Abstract

A series of three experiments investigated the effect of information about one possible cause of an event on inferences regarding another possible cause. Experiment 1 showed that the presence of a second possible cause had no effect on the perceived probability that the first possible cause influenced the event. However, if the second cause is cited as having definitely influenced the event, then the probability that the first possible cause influenced the event is reduced. Experiment 2 showed that the presence of a second possible cause does reduce the judged probability that a given cause was present at the time of an event. The final experiment revealed that the tendency (found in Experiment 1) to discount the involvement of the first cause given the involvement of a second cause diminishes when subjects were more highly motivated and confronted with their own discounting. These results are inconsistent with Kelley's account of discounting and provide some support for a proposed explanatory heuristic, the principle of minimal causation. Users of this principle analyze a situation until they have identified a minimal set of sufficient causes; other possible causes are ignored or dismissed.

Discounting in Multicausal Attribution: The Principle of Minimal Causation

Attributional research has reliably found that the presence of any single cause at the time of a given event is judged to be less likely if an additional possible cause is added to the attributional situation. This reduction in perceived likelihood, called discounting, has been well documented in a variety of settings in social psychological research. Whether accounting for their own (Bem, 1967) or another person's behavior (Jones & Davis, 1965; Jones & McGillis, 1976; Kelley, 1972a), people seem to believe a given possible cause is less likely to be present when alternative explanations are available. Related research in developmental psychology suggests that this judgment pattern begins to appear somewhere between the second and fourth grade (Karniol & Ross, 1976; Schultz, Butkowski, Pearce & Shanfield, 1975; Smith, 1975).

The early interest in this effect focused on its role in inferences about the presence of traits and motivational states. Not until Kelley's (1972a, 1972b) discussions did attention turn to the source of the phenomenon. According to Kelley, people learn through experience that each of several causes may be sufficient to produce a given event. If that event occurs with only one possible cause present, the attributor can be fairly confident about its role in the event. However, the presence of alternative causes renders the role of any individual cause ambiguous. Thus, Kelley suggests that discounting is due to the uncertainty inherent in multicausal situations.

Although Kelley does identify conditions under which discounting

might logically occur, the studies he cites in support of his thesis only approximate these conditions. Specifically, his theoretical discussions concern judgments of causal influence made when multiple causes are known to be present, whereas his supporting experiments ask subjects to judge whether or not more than one cause is present. For example, subjects might be asked about the likelihood of an actor possessing some internal state (e.g., intrinsic motivation) when an alternative, external source of the observed behavior was present (an external "ulterior" motive in most cases). In general, subjects have been less inclined to infer the presence of the internal cause in the presence of the external cause. If subjects thought a second cause was unlikely to have been present, it is not clear that they were ever judging a (Kelley-type) situation in which more than one cause is present. The evidence suggests that people may not find multi-causal situations ambiguous, but simply unlikely to occur. People who know one cause is present seem to believe that the second cause is actually absent. Such discounting suggests attributional certainty, not uncertainty. Two experiments in multicausal attribution (Kun & Weiner, 1973; Smith, 1975) support this view. Subjects who knew that one cause was present indicated confidence about the absence of the other cause. Subjects seem to be treating a potentially ambiguous multicausal event as an unambiguous single causal one.

At the same time as it raises questions about Kelley's model, such evidence suggests a second possible source of the effect. That is, people may search for causes until a minimal set of sufficient causes has been identified. All other possible causes are then either ignored or dismissed. Such a simplifying heuristic could be described as a "principle of minimum causation."

The strength of these two suggested processes models hinges on the conditions under which discounting occurs. Kelley suggests that discounting is a function of the number of possible causes present at an event. In this view, a subject should rate a cause as more likely to have influenced an event if it is the only cause present than if it is present along with other possible causes (comparison of single vs. multiple causes). According to the principle of minimum causation, it is the knowledge that a cause sufficiently explains an event that is critical. That is, a cause that is present should be judged as a less likely influence when an alternative sufficient cause is known to have influenced the event than when the alternative is merely a possible contributor.

In Experiment 1, subjects made attributional judgments under one of three conditions. In the first, subjects were given descriptions of events with one possible cause (A or B) listed as definitely having been present at each event but not necessarily having influenced the event (one possible cause). A comparison group read the same event descriptions, this time with two possible causes (A and B) cited as having been present at each event but not necessarily having influenced the event (two possible causes). A third group read the same event descriptions with the additional information that one of the causes known to be present (A or B) was also known to have contributed to the event. The other cause was suggested as a possible cause (one known one possible cause). In each condition, subjects judged the likelihood that each of the possible causes actually contributed to the event. According to Kelley, probability assessments should be highest when only one possible cause is present. Uncertainty should increase when

other possible causes are available, resulting in lower probability assessments for a given cause when presented in the two-possible-causes condition than when presented in the one-possible-cause condition. The principle of minimum causation implies that subjects should discount the influence of possible causes once one sufficient cause is known to have contributed to the event. Therefore, lower probabilities of involvement should be assigned in the one-known/one-possible-cause condition than in the two-possible-causes condition. The two results are not incompatible. Discounting could reflect both strategies of explanation.

Experiment 1

Method

A questionnaire was developed with 24 one-sentence descriptions of everyday events (E). Two possible causes (A and B) were derived for each event, with the constraint that each cause be a potentially sufficient explanation for the event. Each cause was presented as a fact in the situation. Subjects were to assess the probability that each possible reason actually contributed to the event. Subjects responded under one of three conditions.

One possible cause. For each event, one known fact was described which could have contributed to the event. Form A/E listed Cause A as a fact; Form B/E listed Cause B. For example, A/E:

Susan made a $25 donation to a cancer research fund.

Possible Reason: Someone close to Susan recently died of cancer.

What is the probability that this fact contributed to the event?____

Or B/E:

Susan made a $25 donation to a cancer research fund.

Possible Reason: Susan often gives money to charity.

What is the probability that this fact contributed to the event?____

Two possible causes. For each event, two known facts which could have contributed to the event were described. Subjects assessed the probability that each fact contributed to the event. For example:

Susan made a $25 donation to a cancer research fund.

Possible Reason 1: Someone close to Susan recently died of cancer.

What is the probability that this fact contributed to the event?____

Possible Reason 2: Susan often gives money to charity.

What is the probability that this fact contributed to the event?____

One known/one possible cause. As in the two-possible-causes form, two known facts which could have been causes were described for each event. One fact (A or B) was known to have contributed to the event; subjects assessed the probability that the other fact was also a cause. For example:

Susan made a $25 donation to a cancer research fund.

Known Reason: Someone close to Susan recently died of cancer.

Possible Reason: Susan often gives money to charity.

What is the probability that this second fact contributed to the event?____

Form B/A,E listed Cause A as the known reason, Cause B as the possible reason. Form A/B,E reversed the roles of the two causes.

Instructions to the subjects in the two-possible-causes condition were as follows, with modifications in brackets for the one-known/one-possible-cause form. Instructions for the one-possible-cause form refered to one fact for each event.

This is a questionnaire about causes of events. In each of the questions that follow, an event is described. Listed below the event are two facts, each of which is known to have been

true when the event occurred. [The first fact (labeled "Known Reason") is known to have contributed to the event. The second fact (labeled "Possible Reason") may or may not also have been involved.] We'd like you to indicate the probability that each of these facts [this fact also] contributed to the event's occurrence.

For example:

(Sample item here.)

In the space provided write a number from .00 to 1.00 to express the probability that each fact [the second fact (Possible Reason)] actually contributed to the event. .00 means that there is no chance that the fact contributed to the event; 1.00 indicates that the fact definitely contributed to the event.

Subjects. Subjects were recruited by an advertisement in city and university newspapers. A total of 165 people responded to one of the five forms: 35 completed one-possible-cause Form A/E; 36 responded to one-possible-cause Form B/E; 29 completed one-known/one-possible-cause Form B/A,E; 30 completed one-known/one-possible-cause Form A/B,E; 35 responded to the two-possible-causes form.

Results

Each item of the 24 had two possible causes, each of which was presented in all three conditions, affording 48 comparisons between the conditions.

One possible vs. two possible. Mean responses for causes listed as the only suggested cause (one possible) were compared with responses for the same cause when an alternative possible cause was present (two possible causes). There was no systematic difference between the two

judgments. In 19 cases, causes received a higher mean probability of involvement in the one-possible-cause condition (indicating discounting); in 28 cases, causes received higher mean probabilities in the two-possible-causes condition. The mean difference for the 48 cases was .007 (with probabilities for two possible causes being very slightly larger).

Two possible vs. one known/one possible. As predicted by the principle of minimum causation, probability assessments were lower in the one-known/one-possible-cause condition than in the two-possible-causes condition. Such discounting occurred on 44 out of the 48 comparisons. The mean difference was .120.

Discussion

The results indicate that Kelley's conditions are neither necessary nor sufficient for discounting. The presence of two rather than one possible cause had no influence on subject's assessments of their causal role, suggesting that discounting has little to do with the ambiguity of multicausal situations. However, congruent with the principle of minimum causation, knowledge that a sufficient cause influenced the event did lead subjects to discount the involvement of the other cause. Such consistent discounting across a wide variety of causes and events (albeit all in one format) suggests that this pattern of response may represent a widely applied heuristic in explanation.

The similarity of responses in the one-possible-cause and two-possible-causes conditions here stands in sharp contrast to the systematic differences observed in previous studies of discounting. Whereas previous research asked subjects about the probability of causes being present, we have argued that a judgment of the likelihood of causal influence is a more appropriate assessment of the proposed processes. We would attribute our contrasting results to this shift in response.

An alternative explanation is that the difference between the present and previous results is due to some artifact of experimental format. Perhaps the causes and events used in this research differed systematically from those used previously. Having subjects rate so many different cause-effect relationships may have influenced the decision strategies they used. To evaluate these hypotheses, it is important to observe judgment patterns on these items under the conditions used in previous discounting work. Experiment 2 was planned as such a replication.

The same causes and events were used in a pair of conditions that required subjects to make likelihood judgments for causal presence rather than for the likelihood of causal influence. One group of subjects read the event statements and judged the likelihood that a given cause was present. A second group judged the likelihood that the same cause was present, knowing that a second cause was definitely present at the event.

Experiment 2

Method

The questionnaire for Experiment 2 was composed of the 24 cause-event items used in Experiment 1. For each item, subjects were to assess the probability that a possible cause was present at the event. Subjects made judgments under one of two conditions.

One possibly present. One possible cause was listed for each event. Form A/E suggested Cause A as a possible cause of E; Form B/E suggested Cause B. For example, A/E:

Ellen lost her match in the tennis tournament.

____Her opponent had an especially good serve.

or B/E:

Ellen lost her match in the tennis tournament.

____She was a little weak from a recent bout with the flu.

One known/one possibly present. Two possible causes (A and B) were listed for each event. In this case, however, one cause (A or B) was stated as a fact in the sitution; the alternative cause was suggested as a possible cause. For example:

Ellen lost her match in the tennis tournament. Her opponent had an especially good serve.

____She was a little weak from a recent bout with the flu.

Form B/A,E listed Cause A as known, Cause B as possible; Form A/B,E reversed the roles of the two causes.

Instructions on all forms were as follows (with appropriate modifications in brackets):

This is a questionnaire about the causes of events. In each of the questions that follow, an event is described, with a [two] possible cause[s] listed below. We'd like you to indicate the probability that the [each] listed cause was present when the event occurred.

For example:

(Sample item here)

In each space provided write a number from .00 to 1.00 to express the probability that the [each] suggested cause was present when the event occurred; .00 means that there is no chance that the cause was present at the event; 1.00 indicates that the cause was definitely present when the event occurred.

Subjects. Subjects were recruited as before. A total of 162 people participated, each completing one of the questionnaire forms: 39 subjects responded to one-possibly-present Form B/E, 35 to one-possibly-present Form A/E; each of two groups of 44 subjects completed one of

the one-known/one-possibly-present forms.

Results

As before, two possible causes for each of 24 events generated 48 possible comparisons between conditions. Discounting, reflected by a lower mean probability of presence when a second cause was known to have been present, occurred on 37 out of the 48 items. The mean difference was .09.

Discussion

Considered together, Experiments 1 and 2 make considerable progress in clarifying the nature of the discounting effect. Experiment 2, using the response of previous experiments (probability of presence) produced the type of discounting Kelley used in support of his argument. Thus, there seems to be nothing special about the stimuli used in this present research. Under these circumstances, discounting could have more than one interpretation. Kelley's position might account for the data if lowered probabilities are interpreted as reflecting the ambiguity of multicausal attribution. Alternatively, subjects may be using a principle of minimal causation. By definition, an event will occur once a sufficient cause is present. Additional causes are unnecessary for the event to occur and, thus, may be seen as less likely to have been present.

Experiment 1 is much more diagnostic for discriminating the possible sources of discounting. Contrary to Kelley's argument, discounting seems to be unaffected by the mere presence of alternative causes. Rather, it is the knowledge that one cause contributed to an event which leads subjects to discount the likelihood that a second cause was also involved. Such a pattern suggests judgment according to a principle of minimum

causation. Causes unnecessary to an event are seen as unlikely to have influenced that event.

The existence of a sufficient cause carries no logical implication regarding the role of other causes. However, other aspects of the cause-effect relationship may lead to logical inferences about the relative influences of possible causes for a given event. For example, two causes may be known to interact so as to produce an effect different from the main effects of each of those two causes. One such interaction pattern, particularly appropriate when there are two contributory causes (as there were in these examples), is Kelley's (1972b) graded effects schema: while the involvement of either cause is sufficient to produce the event, the involvement of both will produce the event with greater intensity. In this schema, given that an event has occurred (at a particular level of intensity), information about the involvement of one cause may change one's judgments regarding the involvement of another cause. Consider the sample item given earlier in which Susan gave $25 to a cancer fund. If $25 is not a lot of money for Susan, then giving that amount would suggest the involvement of only one of the two possible causes, being charitable or having a friend who died of cancer. According to the schema, if both causes were involved, she would have given more than $25. In this way, the role of a second cause may be determined once the strength of an event and first cause are defined.

Given these considerations, the propriety of a minimal causal strategy is difficult to evaluate. Whereas conditions can be defined in which minimum causal reasoning would be inappropriate, such reasoning may be logically sound in a graded effects context. Thus, the appropriateness of the heuristic is context dependent and hard to evaluate without a model

of the underlying causal process in a particular context.

Experiment 3 was designed to identify subjects' own beliefs about appropriate causal reasoning. Subjects were asked to make both multiple-possible and multiple-known judgments. We hoped that a within-subject design in which both judgments were simultaneously available would prompt subjects to think more deeply about the interrelationships between causes and events. Within-subject designs have been found to reduce a number of judgmental biases originally observed in experiments using between-subject designs (Fischhoff, Slovic & Lichtenstein, 1978). Thoughtful judgment was further encouraged by instructions emphasizing judgmental accuracy.

Since causes and effects are the same as those used previously, causal interactions (as in the graded effects schema) should be constant across experiments. Thus, subjects who are responding to perceived graded effects relationships between the causes and events should persist in discounting under these conditions. The principle of minimal causation makes no necessary predictions for this experiment, although its conditions might be expected to encourage some subjects to use more complex (multicausal) models.

Method

The first 15 events and their causes from the questionnaire developed for Experiments 1 and 2 were selected for use in Experiment 3. Each item described an event and two possible reasons known to have been present at the event. Subjects were asked to assess the probability that each of the two causes known to have been present contributed to the event. They were then told that the second possible reason definitely contributed to the event and were asked for the probability that the

first reason also contributed to the event. Their first two judgments corresponded to those made by subjects in the two-possible-causes condition of Experiment 1; their final judgment corresponded to that made by subjects in the one-known/one-possible-cause condition of Experiment 1. A sample item:

Tom sold his downhill skis and boots.

I. Possible Reason 1: Downhill skiing was getting too crowded for him to enjoy.

____What is the probability that this fact contributed to this event?

II. Possible Reason 2: He needed money for tuition.

____What is the probability that this fact contributed to this event?

III. You learn that the fact that Tom needed money for tuition definitely contributed to this event.

____What is the probability that the fact that downhill skiing was getting too crowded for him to enjoy also contributed to this event?

Form A/B used Cause A as Possible Reason 1, Cause B as Possible Reason 2. Form B/A reversed the roles of the two causes. In each case, Question I asked subjects to judge the probability that Possible Reason 1 contributed to the event when Reason 2 was also possible; Question II was identical to Question I with the roles of Reasons 1 and 2 reversed; and Question III asked the probability that Possible Reason 1 contributed to the event when Reason 2 was known to have contributed. A lower probability in III than in I represents discounting.

Instructions to the subjects were as follows:

> This is a questionnaire about the causes of events. We'd like you to help us find the most accurate estimate of the relationships between events and their possible causes. In each of the questions that follow, a different event is described. Listed

below the event are facts which are known to have been true when the event occurred. Your task throughout the questionnaire is to estimate the probability that each of these facts was a cause of the event. In the space provided, write a number from .00 to 1.00 to express the probability that each fact actually contributed to the event described; .00 means that there is no chance that the fact contributed to the event; 1.00 indicates that the fact definitely contributed to the event. Remember that your goal is to give the most accurate estimate for each item.

Subjects. As before, subjects were solicited by newspaper advertisement; 25 completed Form A/B, and 28 completed Form B/A.

Results

Discounting remained a common, but no longer dominant, strategy. Over all subjects and items, discounting occurred (I > III) 37.9% of the time, but III > I judgments were equally common (33.0%). I = III judgments represented 29.1% of the items. The mean I > III difference was .296, the mean III < I difference .283, and the mean overall difference was .010 in the direction of discounting.

The extent of discounting for items under these experimental conditions bore little relationship to the extent of the discounting in Experiment 1. A correlation over items between discounting in the two experiments was not significant (r = .19).

Discussion

If discounting in Experiment 1 was due to a preponderance of situations in which graded effects schemata applied among our items, one would expect the same high level of discounting in Experiment 3. Similarly, if discounting was due to the nature of the items, there should

be some relationship between the relative extent of discounting for each item in the two experiments. Neither effect was observed. Either subjects were not relying on graded effects schemata in Experiment 1 or the conditions of Experiment 3 caused them to change their minds about those causal relations. Such a change could be interpreted as indicating that when we are not forced to think very hard, we tend to see events as fitting graded effects schemata in order to justify using the minimal causal principle. Of course, if people aren't working too hard, they might just use the principle and not worry about elaborate justifications.

Subjects' judgments in Experiment 3 raise similar questions about the role of the principle of minimal causation. One possible position is that, while it was a potent contributor to judgments in Experiment 1, the changed instructions and opportunity to compare judgments in Experiment 3 encouraged the use of other strategies for multicausal attribution. A second possible position is that the use of the principle is just as prevalent. That is, in both experiments, subjects were equally prone to search for explanations for an event until a minimal set of sufficient causes has been identified (and to view additional possible causes as superfluous). However, the conditions of Experiment 3 led subjects to invoke different, perhaps more complex, schemata as describing the interrelation between causes and events. These schemata required a larger set of causes in order to constitute the minimal set. Subjects may have used graded effects schemata (which encourage discounting) less and multiple sufficient schemata (consistent with I = II) more.

The contrast between Experiments 1 and 3 suggests that explanatory strategies may vary with motivation and context. At one extreme, people may act like scientists checking out all possible contributing causes in order to maximize their power to predict and control events. At the

other, given that a desire to explain events is evoked at all, people may be content simply to make sense out of the environment. Reliance on the principle of minimal causation would suit this latter aim quite well. Given the ambiguity inherent in many causal relationships, people may feel quite comfortable about adopting the simplest interpretation congruent with their observations. Indeed, the very ambiguity of many events with multiple causes would make it unlikely that any derivation of the principle of minimal causation would be clearly refuted by subsequent experience. In order to make a clearer statement about the prevalence and propriety of using that principle, some control or independent assessment of people's perceptions of the causal schemata underlying the judged situations is needed.

It is clear, though, that uncritical use of the principle of minimal causation can lead to trouble. The order in which information is received about an event is often happenstance, meaning that chance may determine which possible cause is positively implicated first and which is discounted. Once one cause is known to have been involved, adherents to the principle of minimal causation should become uninterested in information regarding other causes. Such apathy could be particularly damaging when the first evidence complicating a cause is unreliable or erroneous. In such cases, the true cause may never be evaluated because the question was closed prematurely.

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