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Transitivity of Probability and Strength: A Test of Three Discounting Models

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TRANSITIVITY OF PROBABILITY AND STRENGTH: A TEST OF THREE DISCOUNTING MODELS

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APPROVAL SHEET

This thesis is submitted in partial fulfillment of the requirement for the degree of

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DEDICATION

This work is lovingly dedicated to my mother and father,
Mary Elizabeth and Nicholas Charles Carosella,
both of whom have been unwavering in their support.

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Although it has been several years since I left the College of William and Mary to continue my education at other institutions, the importance of the years spent at the College of William and Mary remain unequalled in terms of education and professional development. For this, I am grateful for the support, guidance and friendship of all the members of the Psychology Department.

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ABSTRACT

The purpose of this study was to evaluate the ability of the discounting models of causal schemata (Kelley, 1972), multiple discrete causes (Shaver, 1981) and minimum causation (Shaklee & Fischhoff, 1982) to predict probability and strength attributions for causes and events. Discounting refers to reductions in the perceived strength, probability, or importance of causal factors that occur when more than one causal factor is assumed present. According to Kelley's model, the role of each potential causes is considered independently, leading to a linear pattern of discounting. Hypothesizing that combinations of causes are evaluated in addition to individual causes, Shaver's multiple discrete cause model proposes a nonlinear pattern of discounting. In contrast, Shaklee and Fischhoff's minimum causation model predicts complete discounting of additional causes once a single cause is found to be sufficient for an event to occur. Transitivity of discounting, or the extent to which judgments regarding the presence or absence of possible causes of a given event were similar to judgments regarding the presence or absence of events given a particular set of causes, also was examined. Finally, this study compared discounting for legal and interpersonal situations.

Sixty-five male and 84 female undergraduates were presented with 6 legal and 6 interpersonal situations, 2 of each associated with 1, 2, and 3 causes. In the events-given condition, subjects were asked to judge the probability and strength of each of the one, two, or three causes presented. In the causes-given condition, subjects were asked to judge the probability and strength of a potential event.

The results of this study suggest that both the minimum causation model and the causal schema model predict discounting in various situations. Little evidence was found to support the multiple discrete cause model. Nontransitivity of discounting and the absence of a single pattern of discounting across situations suggest that no single attribution model can account satisfactorily for the wide variety of situations confronted by individuals.

TRANSITIVITY OF PROBABILITY AND STRENGTH:

A TEST OF THREE DISCOUNTING MODELS

Introduction

The study of causal attribution is fundamentally important to the understanding of both interpersonal and intrapersonal behaviors. Variations in causal ascription have been found to affect a wide variety of phenomena including cancer mortality (Taylor, Lichtman, & Wood, 1984), prejudice (Rothbart, Evans, & Fulero, 1979), and level of depression (Abramson, Seligman, & Teasdale, 1978). In the legal system, assignment of causality takes on societal importance, determining guilt or innocence, and consequently whether an individual faces incarceration or freedom. Whether the event in question is a failed relationship, an automobile accident, or a gruesome murder, the goals behind attributional judgments remain the same: to provide an understanding of the situation and a feeling of control over future events.

Among attribution theories, Kelley's models of covariation and causal schemata (1967, 1972, 1973) perhaps are the most influential descriptions of the processes by which actor and environmental causal forces are distinguished. According to Kelley's principle of covariation, perceivers provided several opportunities to study a situation use distinctiveness, consistency and consensus information to attribute the event to the cause "with which, over time, it covaries" (Kelley, 1973, p. 108). If a particular event occurs only in the presence of a

particular entity and does not occur in the presence of other entities, distinctiveness is considered high with respect to that entity. Consistency refers to the extent to which an event occurs each time a particular entity and a particular actor are present together. Consensus information provides attributional clues by addressing whether or not people other than the perceiver experience the same effect when in the presence of the same entity. Different combinations of high and low distinctiveness, consistency, and consensus information lead to attributions to either the actor, the situation, or the entity. According to Kelly, an event with low consensus, low distinctiveness, and high consistency would lead to a trait attribution. In contrast, this model suggests that an event marked by high distinctiveness, low consistency, and low consensus would lead to a situation attribution. Using an experimental paradigm in which subjects receive ambiguous information contrasting the reaction of the actor with the reaction of other actors (consensus), an actor's response to an entity with his or her response to other entities (distinctiveness) and the consistency of the interaction of the actor and the entity with interactions with other actors and other entities (consistency), past research (Major, 1980; McArthur, 1972) suggests that people attend to each of the three types of covariation information, relying most heavily on consistency information and least heavily on

consensus information. Although not yet subjected to adequate empirical test, the PEAT model recently proposed by Medcof (1990) suggests the need for an experimental paradigm that provides less ambiguous comparisons of the probability of an event in the presence and absence of particular actors, entities, and the combinations of specific actors and entities. According to Medcof, more precise probability information would allow subjects to contrast probabilities across the three domains of actors, entities, and actor/entity combinations as well as within the three domains. Medcof argues that the ambiguous information presented in past research does not allow subjects to make comparisons across domains, and thus provides an opportunity to examine only a small proportion of possible combinations of high and low consistency, consensus, and distinctiveness information (Medcof, 1990).

When repeated observations are not possible and causal information is limited, Kelley suggests that causal schemata are used to conduct attributional searches. These causal schemata are abstract conceptions of the interactions among potential causes that provide a framework for the inference of cause-effect relationships in ambiguous situations. According to Kelley, schemata facilitate causal analysis, but are not as accurate as more complete techniques, permitting only "reasonably good" causal inferences to be drawn (Kelley, 1972, p. 152).

Two main categories of schemata, multiple necessary causal schema (MNC) and multiple sufficient causal schema (MSC) are proposed in Kelley's schema model. The MSC schema model describes situations in which, although several factors could produce an event, only one needs to be present for the effect to occur. In contrast, the MNC schema model assumes that the presence of each of two or more causes is necessary for the production of an event. In the presence of only one of the necessary causes, the event will not occur. Using variations of these two "thought models", Kelley proposes that the lay attributor has a wide "repertoire of causal schemata" (p. 118, 1973).

Some of the schemata variations Kelley describes (1972) assume that the attributor is able to distinguish not only between the presence or absence of causes and effects, but also among degrees of causation, or variations in causal strength. In contrast to this view, Shaver's (1981) model of multiple discrete causes asserts that individuals do not recognize degrees of causation. Whether people do or do not believe that causes can vary in strength is an important question to explore in order to understand the process by which people make attributions in multiple cause situations. Although these two models make different predictions regarding how people evaluate each cause as the number of causes increases, the models have not been compared

empirically. In the following sections, these two models will be discussed and their opposing hypotheses outlined.

Kelley's Causal Schema Model

According to Kelley's causal schema model (1972), both causes and effects can be perceived as either discrete or quantitatively graded in strength. When a cause is discrete, the effect occurs in the presence of the cause and does not occur in its absence. In contrast, an effect may not result even in the presence of a cause if the cause is of insufficient strength to produce an effect by itself and it is not combined with a second causal force. A gunshot wound to the heart is a discrete cause because its mere presence leads to the death of the victim. In contrast, because studying does not lead always to the desired effect of a passing grade, an activity such as studying for an exam could be conceptualized as a graded cause. In some situations, the causal force of studying may be present without bringing about the desired effect of a passing grade if the studying is not of sufficient "strength", or if the ease of the exam does not combine with a lesser amount of studying to produce a passing grade.

Use of graded causes is assumed in Kelley's compensatory schema, a variation of the MSC schema (1972). It is thought that people use the compensatory schema to evaluate cause-event relationships when the event could be produced by any one of several potential causes if the one

cause is of sufficient strength, or when the event could be produced if several causes of lesser strength are combined. The compensatory schema model proposes that each of the quantitatively graded causes is ranked on the schema structure according to increasing strength. Consider the schema for an event with two quantitatively graded causes diagrammed in Figure 1. On the vertical side, Cause 1 is nonexistent in the left upper corner and is of greatest strength in the left lower corner. On the horizontal axis, Cause 2 is absent in the left corner and is strongest in the right corner. In this example, the effect is present when either Cause 1 or Cause 2 is present and is of high strength, or when both are present and at least one is of moderate strength. When both causes are of low strength, or only one cause is present and is of low or moderate strength, the effect does not occur.

Given information regarding the presence or absence of an effect, use of this schema allows inferences to be drawn regarding the presence and strength of these two causes. Conversely, if the perceiver knows whether or not the various causal forces are present, he or she can make inferences regarding the presence and strength of the effect. Referring back to the studying example, the compensatory schema would predict that either moderate studying or a moderately easy exam would lead to a passing grade. The magnitude of the passing grade could range from

a grade of "D" to a grade of "A+" depending on the particular combination of studying effort and exam difficulty. Thus, this model assumes that people can distinguish between degrees of effects as well as between degrees of causal strength.

When more than one causal force is involved in an event, Kelley proposes two rules by which a person can make causal inferences. These rules of augmentation and discounting require that people consider causes to be either facilitative or inhibitory. A facilitative cause is a cause that increases the likelihood of an event, whereas an inhibitory cause reduces the likelihood that an event will occur. If an event occurs despite the presence of an inhibitory cause, Kelley states that perceivers employ the augmentation principle (1972). Perceiving an event to occur in the presence of an inhibitory cause, the attributor infers that a facilitative cause must also be present and must be of adequate strength to overcome the effects of the inhibitory cause. Consequently, the strength of this facilitative cause is perceived to be greater than it would have been to produce the event in the absence of the inhibitory cause.

In the presence of more than one facilitative cause, Kelley predicts that discounting will occur. The discounting principle states that "the role of a given cause in producing a given effect is discounted if other plausible

causes are also present." (Kelley, 1973, p. 113). According to this principle, when told of an event of constant magnitude and the presence of two or more causes, an attributor will reduce the perceived strength of each cause in order that the combined strength of the causes is equal to the strength of the effect. Reduction in strength is assumed to proceed in a linear function with the addition of each new causal element. If the effect varies in strength as causes are added, Kelley proposes an additive effects schema, such that as one or both causes increase in strength, the strength of the resulting effect increases as well. When both the effect and one cause of sufficient strength to produce the effect are known to be present, the discounting principle suggests that predictions regarding the presence of additional causes will be marked with ambiguity.

Judgments regarding discounting, as well as cause-effect relationships in general, assume that individuals are capable of probabilistic judgments. Although probability judgments have been found to be biased by cognitive heuristics such as salience (Fiske & Taylor, 1991), availability and representativeness (Tversky & Kahneman, 1973; 1974), it is appropriate for several reasons to discuss probability estimates in the context of attribution judgments. First, by their very nature, attributional judgments require perceivers to make judgments regarding

causes they think are most likely to be responsible for an effect. Second, these probability judgments generally involve relative ratings of probability rather than precise judgments. Thus, what is important in reference to discounting is whether or not attributors assume that the likelihood that any particular cause was responsible for an effect is reduced as new causes become evident, not the actual probability rating assigned to any one particular cause. Furthermore, past research (e.g. Cheng & Novick, 1990; Dunning, & Parpal, 1989; Leddo, Abelson, & Gross, 1984) indicates that subjects are able to evaluate the probabilistic connection between various causes and particular events. According to Medcof (1990), if attributional theory is to move toward maturity, research will need to use paradigms that address the probabilistic nature of judgments less ambiguously than frequently done in the past (e.g. Major, 1980; McArthur, 1972).

Shaver's Multiple Discrete Cause Model

In contrast to Kelley's model employing continuously graded causes, Shaver's multiple discrete model (1981) recognizes only discrete causes. Invoking the Aristotelian philosophical tradition, Shaver claims that quantitatively graded causes present conceptual and logical problems. Defining a cause as discrete, or "a thing or event that by its mere presence, produces an effect," (Shaver, 1981, p. 353) Shaver disagrees with Kelley's view that a cause may be

present, but of insufficient strength to produce an effect. By adding conditions of strength to the requirement of presence, Shaver argues that graded effects "destroy[s] the category assignment rule inherent in the definition" (1981, p. 353) of a cause. To avoid the inconsistency inherent in defining causes as both graded and discrete, Shaver proposes the adoption of a multiple discrete cause approach.

According to Shaver, the defining characteristic of a cause is that it contributes to the production of an effect. Using this definition, any force that is present but does not produce an effect is not a cause. This multiple discrete cause model states that changes in an effect are not produced by a change in the strength of a cause, but rather changes in the number or nature of other causal elements. Furthermore, this model states that causal elements of different "magnitude" are qualitatively different, not simply variations of a single cause. Thus, "to study" and "to study hard" are two discrete causes, not a variation of a single cause. The absence of these would be "not to study" or "not to study hard," rather than "not to study hard enough," which implies continuous degrees of effort.

Although he does not outline the proposal in detail, Shaver suggests that this approach logically would extend to the concept of discrete, rather than graded, effects as well. According to this approach, the effects produced by

greater numbers of causal elements would not differ in magnitude, but rather in kind. Thus, to receive a "D" on an exam, and to receive an "A+" on the same exam are not two points on a continuum, but are two distinct events.

The multiple discrete cause approach focuses its criticism of Kelley's causal schema model on the compensatory causal schema. Arguing that the definition of a cause as an inhibitory force contradicts the definition of a cause as that which contributes to the production of an outcome, Shaver recommends that this term be replaced by the term obstacle. Shaver also argues that to label a cause as facilitative is repetitive and confusing. Thus, according to Shaver, a facilitative force should be referred to simply as a cause.

The multiple discrete cause model does not rule out the possibility that more than one cause may be involved in the production of an effect. In Shaver's model, the concept of graded causes is replaced with the concepts of minimally sufficient causal subsets and redundant causal subsets. A minimally sufficient subset is any set of causes that is capable of creating an effect only if all the elements of the set are present. Within each minimally sufficient causal subset, each causal element is discrete and nonredundant in that each causal element is necessary for the occurrence of the effect.

Because many events can happen in a variety of ways, the attributor is often faced with the task of assessing redundant subsets. These redundant subsets consist of elements contained in multiple subsets. In the case of the effect with two possible causes portrayed in Figure 1, the causal combination of *Cause 1: High Strength + Cause 2: Low Strength*, and the causal subset of *Cause 1: High Strength* are redundant causal subsets because they both contain *Cause 1: High Strength*.

Like Kelley's model, Shaver's model predicts that the role of each cause will be discounted as the number of causes increases. The two models differ, however, on the actual form this discounting would take. Whereas Kelley's theory states that discounting should proceed in a linear fashion as a function of the actual number of causes considered, Shaver states that discounting should increase in a nonlinear fashion as a function of the number of combinations of redundant and nonredundant causal elements.

Shaver (1981) outlines several advantages his model provides over Kelley's model. First, this model avoids the definitional confusion inherent in identifying causes sometimes by their mere presence, and distinguishing between causes of differing strength at other times. Second, the multiple discrete cause approach restates both discounting and augmentation principles in clear presence-absence terms. Finally, because intent can be more clearly discerned in

qualitatively different events than events that differ only in magnitude, Shaver argues that his model's fine-grained analysis of events is more closely aligned with recent advances proposed by reasons-explanation philosophers to explain human action in terms of intentionality.

Despite the clear advantages Shaver's model offers, the extent to which his model captures the attributional process is unclear. Although it is logical to discuss causes and events in terms of presence or absence rather than in terms of amounts of presence or absence, it is important to know how the naive perceiver use these concepts. Because one of the main purposes of the theory of attribution is to determine how causality is assigned in everyday situations, it seems logical that the definitions of fundamental concepts should reflect common usage.

Although results from numerous studies suggest that attributors discount the importance of multiple causal elements in some fashion, a direct comparison of Kelley's linear model with Shaver's nonlinear model does not exist. Thus, it is impossible to determine which model best depicts the process by which discounting proceeds. Perhaps in part because Shaver's model has been proposed more recently (1981) and waits to be tested empirically, Kelley's concepts of graded causes and effects typically are used to explain empirical evidence of discounting. Use of Kelley's theory to explain much of present empirical evidence, however,

cannot rule out the value of Shaver's theory as an alternative explanation for discounting practices.

An example of discounting explained with Kelley's causal schema model is Cunningham and Kelley's (1975) study of attributions for "normal" and "extreme" outcomes. Hypothesizing that people use a multiple necessary causal schema to explain the occurrence of an event more often when the event in question is of great magnitude, the authors asked subjects for inferences of causes for interpersonal events and news stories of both ordinary and extreme magnitude. Subjects were asked to judge on a 7-point scale the extent to which each of several causes contributed to the event. The results appeared to support the authors' prediction that people switch from a multiple sufficient causal schema to a multiple necessary causal schema as the magnitude of an event increases, making attributions to more than one cause when the event in question is of great magnitude, but making attributions to only one of the possible causes when the event in question is a more "normal" moderate one.

This study suggested that subjects perceive at least two kinds of multiple necessary causal schemata, an emergent effects schema and a resultant effects schema. Emergent effects schemata have several causes that contribute in unique combination such that their effect is not simply the sum of the individual contributions (Kelley, 1972). In

contrast, resultant effect schemas describe results that are produced by the composite, or additive effect of two or more causes (Kelley, 1972). The additive schema is very similar to a multiple sufficient cause schema in that an effect will appear in the presence of either of the causes, as well as in the presence of both causes. This schema assumes that attributors not only determine whether an effect is present or absent, but also calculate the difference in strength of an effect produced by the additive effect of both causes, "EE," and the strength of an effect produced by only one cause, "E."

Although the results of this study suggested that subjects consider the strength or magnitude of an event when judging causality, and were able to conceptualize the effects of different combinations of causes, it did not provide conclusive evidence of linear discounting utilizing graded causes and effects. The results of this study could be used to defend Shaver's (1981) model of discrete causes if the results were discussed in terms of qualitative rather than quantitative differences. In other words, the effect "EE" could be described as qualitatively different than the effect "E," rather than simply a difference in strength. To determine which model best described the discounting process Cunningham and Kelley found, a more quantitative study would be needed.

Anderson's information integration theory (1974) perhaps presents the most conclusive evidence that attributors discount by grading both causes and effects. His quantitative analysis of Kelley's (1973) discounting and augmentation principles indicated that subjects' perceptions of the strength of a second causal factor were altered in order to compensate for changes in the strength of the first causal factor. Furthermore, Anderson's analysis of data from Jones, Davis, and Gergen (1961) provided quantitative evidence for an additive model of graded causal factors. This reanalysis failed to reveal a significant interaction between the two causal factors, suggesting that attributors recognized variations in the strength of effects as well as causes in such a way that the sum of the attributed causal strengths continued to equal the strength of the effect.

Anderson (1974) concluded that subjects used an averaging model more often than a simple additive model. These averaging models are similar to additive models, but use the concept of weight as well as scale values. Non-parallelism of attributed values confirms that the weight of the scaled values is increased as a function of perceived increases in the magnitude of an effect. Plotting data from Anderson and Butzin's (1974) study of judgments of performance, motivation, and ability, Anderson found a bilinear fan shape, illustrating use of a multiplicative model. This pattern of non-parallelism suggests that

perceivers can attribute greater strength to causal forces in such a manner that the product of the causal strength continues to equal the strength of the effect, even as the magnitude of the effect increases.

Despite the numerous studies that have found evidence for high ambiguity regarding the presence of additional causes when one cause sufficient to produce an effect is known to be present, some studies have failed to show that perceivers employ the discounting principle. Not finding evidence that perceivers experienced ambiguity regarding the possible presence of a second cause, Kun, Murray, and Sredl (1980) concluded that attributors use a variant-effects schema rather than the multiple sufficient schema proposed by Kelley (1972). Based on their empirical findings, the authors concluded that perceivers compare the strength of the presented effect to the strength of a given cause. In contrast to the graded-effects schema that states that the presence or absence of a second cause will be perceived equally probable in any instance where an event is produced in the presence of a sufficient cause, the variant-effects schema hypothesizes that the attributor will infer that a second cause is not present if the strength of the first cause matches the strength of the event. If, however, the strength of the cause does not match the strength of the event, the variant-effects schema hypothesizes that the attributor will assume that a second cause was present.

Because the attribution is made by comparing the strength of the cause to the strength of the event, ambiguity regarding the possible presence of multiple causes is minimized. Although this study did not support Kelley's ambiguity hypothesis, it nonetheless suggests both that subjects are sensitive to discrepancies between the strength of a cause and the magnitude of an event and that judgments involve consideration of quantitative differences in the strength of both causes and events.

Several other studies suggest that perceivers tend to ignore completely the possible contribution of a second causal factor when another sufficient cause is present (Shaklee & Fischhoff, 1982; Smith, 1975). The minimum causation model of Shaklee and Fischhoff (1982) represents an attempt to explain this observed failure to discount. This model claims that attributors tend to be "lazy", ignoring possible contributions of additional causes once a single cause is found to be sufficient. Shaklee and Fischhoff's minimum causation model suggests that people conduct a truncated serial search for information to help in making cause-effect inferences. According to Shaklee and Fischhoff, pertinent information about one possible cause is gathered before information is sought regarding other potential causes. Once a cause has been found to explain adequately the described event, the perceiver is thought to abandon the search for information regarding other potential

causes. Although this truncated search provides a simplified attribution process, it also provides substantial potential for mistaken attributional judgments. If the perceiver correctly identifies the single cause of an effect, this strategy works well. If, however, the perceiver identifies an incorrect cause, this strategy does not allow the gathering of information about other possible causes that would allow the perceiver to recognize the error. Additionally, in the many instances of multiple causes, the utilization of this strategy would lead to incomplete attributions. Without the identification of all contributing forces, prediction and control of future events is lessened.

In summary, numerous studies suggest that attributors discount the importance of multiple causal elements in some fashion. Without direct comparison of Kelley's linear model with Shaver's nonlinear model, however, it is impossible to determine whether discounting proceeds in a linear or nonlinear fashion. To add to the mystery of discounting are the several studies that have failed to find evidence of any type of discounting (Pryor & Kriss, 1977; Shaklee & Fischhoff, 1982; Smith & Miller, 1979). These conflicting results provide evidence of the difficulty inherent in testing the discounting principle empirically (Shaver, 1981).

The primary purpose of this study was to determine whether discounting of probability and strength would support Shaklee and Fischhoff's (1982) minimum causation model, Kelley's graded causes model (1972), or Shaver's multiple discrete cause model (1981). Using trend component analysis, probability and strength judgments were evaluated for cause-event relationships with one, two, and three causes. Failure to find evidence of either linear or quadratic discounting would support the minimum causation model (Shaklee & Fischhoff, 1982), whereas a linear function of discounting would support Kelley's causal schema model. The presence of both linear and quadratic functions would support Shaver's multiple discrete cause approach, suggesting that subjects consider both nonredundant and redundant causal subsets when discounting.

A second purpose of this study was to determine the extent to which judgments regarding the presence or absence of possible causes of a given event were transitive with judgments regarding the presence or absence of events given a particular set of causes. Typical attribution research presents subjects with an effect and asks for judgments regarding the importance or probable presence of a proposed cause or number of causes in the production of that effect. Because researchers assume that subjects accept the presented effect without question and concentrate solely on determining the causal elements and the strength of each,

rarely have studies presented causal elements as "givens" and asked subjects to indicate their judgments of the likelihood that the proposed event followed.

Yet, outside the social psychology laboratory, it is not difficult to imagine the presence of potential causes intended to produce a particular effect that fail to produce this effect. Consider, for example, a situation in which A fires a gun at B. Although the causal shot is fired, unless A is an excellent marksman, there is a significant probability that the event, injury to B, will not result. Whether the event occurs or not will affect the magnitude of perceiver's response to the perpetrator and the legal charges brought against him or her. Although this example clearly indicates that the presence of a potential cause may not lead to the production of the intended event, the psychological study of causality makes the assumption that the average attributor takes for granted the presence of the typical effect when asked to evaluate the consequences of a particular set of causes. Without testing the transitivity of discounting practices, it is impossible to determine whether this assumption is correct, or if attribution studies are hampered by a high level of artificiality.

On the other hand, nontransitivity of discounting might occur because particular causes are likely to produce a limited number of events, whereas events can often be produced by more numerous causes. This might lead

individuals to judge the probability of an event occurring in the presence of a set of causes to be greater than the probability that any one set of causes was responsible for a particular event.

Nontransitive results might suggest that different discounting models account for assessment of strength and probability in the two directions. Whereas the minimum causation model (Shaklee & Fischhoff, 1982) suggests that additional causal factors would not be considered once a single factor was determined adequate, both the causal schema model (Kelley, 1972) and the multiple discrete model (Shaver, 1981) assume that attributional judgments often involve multiple causal forces. According to Kelley's (1972) causal schema model, the overall probability of an event increases with the addition of causal elements because the addition of causal elements would lower the strength of other causes necessary for the production of an event. According to Shaver (1981), the introduction of additional causes increases the probability of an event because the additional causes increase the number of combinations of causes that could lead to the event. According to Shaver's model, the perceived likelihood of an event should increase more rapidly because perceivers evaluate both the redundant and nonredundant combinations of causes.

Finally, this study addressed the question of whether or not peoples' attributions differ depending on the

situation in question. Because the consequences of legal attributions are often more binding and serious, it is possible that more thorough, thoughtful attributional searches are made for legal situations than for interpersonal situations. It is also possible that the relatively rare occurrence of legal attributions would result in attributions that would be more simple and naive than attributions for interpersonal situations. Although there is little research comparing discounting attributions for different types of situations, a study of the tendency to make dispositional and situational attributions (Allen, 1985) showed significant differences in attributions for different situations. When asked to make trait attributions for interpersonal (date, concert, assignment) and legal situations (traffic ticket), trait attributions were higher for the majority of the interpersonal situations than they were for the legal situation.

The following hypotheses were made:

1. Nontransitivity of discounting was predicted such that subjects would disregard multiple causes when one cause was found to be sufficient in the events-given condition, whereas subjects in the causes-given condition would consider each additional cause, increasing the perceived probability that the event occurred as the number of causes increased. In other words, it was hypothesized that Shaklee & Fischhoff's minimum causation model (1982) would be

employed when events were presented and subjects were asked to determine the importance of individual causes, whereas it was predicted that discounting would be evident when causes were presented and events predicted. Thus, when causes were presented, a main effect was predicted for number of causes, such that as the number of causal elements increased, the perceived likelihood of the event occurring would increase significantly. As stated earlier, discounting could show evidence of either linear or non-linear changes as the number of causes increased. If the pattern of discounting was linear, Kelley's causal schema model would be supported, whereas more rapid, nonlinear discounting would provide support for Shaver's multiple discrete schema model.

2. Because the number of causes that can produce a given effect typically is greater than the number of events that can be produced by a particular cause or set of causes, a significant main effect for experimental condition was predicted such that the perceived probability that a set of causal elements contributed to a given event was predicted to be less than the perceived probability that a particular event followed from given causal elements.

3. Attributions for legal situations were predicted to follow simpler rules of discounting than interpersonal situations because legal and interpersonal attributions differ on several dimensions. First, legal situations usually involve attributions made to a single human factor,

with attributions to additional or intervening causes playing relatively minor roles in judgments. Thus, it was predicted that subjects would be more likely to ignore the influence of additional causes once a single cause was found sufficient to explain a particular event in legal situations than in interpersonal situations. Additionally, these two types of attributions are likely to differ because legal attributions are not as common as interpersonal attributions. Lack of familiarity with legal attributions was predicted to lead to reliance on simpler attribution rules whereby the contribution of more than one potential cause would be ignored when a single cause was found sufficient to produce the event. Thus, a significant Situation by Number of Causes interaction was predicted such that subjects would employ the minimum causation model (Shaklee & Fischhoff, 1982) more consistently in legal situations than in interpersonal situations.

Method

Subjects

In the main study, 65 male and 84 female undergraduates participated in partial fulfillment of a research course requirement. Nineteen male and 20 female undergraduates participated in pretesting of the stimulus materials. All subjects were told that they were participating in a study of causal relationships and were assigned randomly to the experimental conditions.

Materials

Pretesting was conducted on 10 legal and 10 interpersonal situations used in previous attribution studies conducted by Cunningham and Kelley (1975), Major (1980), McArthur (1972), Schustack and Sternberg (1981) and Shaklee and Fischhoff (1982) as well as situations created by the author. The six interpersonal and six legal situations chosen for the main study were those found to have the fewest additional causes and events judged possible from the cause/event relationship and the fewest number of mediating factors thought needed for the event to occur. For both legal and interpersonal situations, two situations were presented with one, two, and three causes. In both the events given and the causes given conditions, the number of causes as well as the specific causes remained constant for each cause-event association.

Pretesting

Groups of 9 or 10 students evaluated 10 legal and 10 interpersonal situations with three causes on one of four dimensions during pretesting. In each of the four pretesting sessions, subjects evaluated the same 20 events and the same three causes associated with the events. The purpose of these pretests was to identify six situations of each type perceived to have the fewest number of mediating causes, the fewest number of unsolicited effects and the

fewest number of prompted and unprompted causal attributions differing from those causes presented with the event.

The first pretesting measured the assumed causal proximity of the presented causes to the events. Ten subjects were presented with the 20 situations and the associated 1, 2, or 3 causes. The subjects were asked to list "any mediating forces that would have to occur between the listed cause or causes and the final event". This pretesting excluded use of cause-event situations judged to have more than two intervening causes.

The second pretesting evaluated the number of effects subjects believed possible from the presence of the presented cause or causes. Ten subjects were presented with the three causes associated with the above situations. The effects, however, were not presented to the subjects. The subjects were then asked to "list all events that could occur in the presence of the cause or causes listed". The purpose of this pretesting was to compare events listed by the subjects with the events associated with the cause-event situations. This pretesting identified situations with two characteristics. First, in comparison to the other situations pretested, the particular event associated with the cause-event pairing was more frequently listed by subjects as leading to the event. Second, given the listed causal factors, few alternative events were though to be possible.

The third and fourth pretestings evaluated the numbers of causal attributions made for presented effects. The third pretesting presented the subjects with the 20 events without the corresponding causes. The 10 subjects were asked to "list all causes that would lead to the event". This pretesting identified situations with two characteristics. First, this pretesting identified situations in which the associated causes were most often thought to be responsible for the presented event. Additionally, cause-event situations with the least number of causes not associated with the stimulus cause-event situation were identified. In the fourth pretesting, nine subjects were presented with both the event and the three causes associated with the event. Subjects were asked to "list any other causes that could lead to the presented event". The purpose of this pretesting was to identify the cause-event situations with few potential causes differing from those listed.

From the results of the pretesting, six interpersonal and six legal situations were chosen for the main study. The number of causes associated with each situation was determined through the pretesting. The events associated with the fewest causes in pretesting became the "one-cause" situations in the main study. For these cause-event associations, the cause most often cited during pretesting was used as the one cause to be presented to subjects in the

main study. The events associated with the next fewest causes became the "two-cause" situations in the study. Again, the two causes most often cited during pretesting as causes likely to lead to the effect were used as the two causes to be presented to subjects in the main study. For the three-cause situations, the three causes presented during pretesting were used during the main study. The pairing of causes and situations remained constant across conditions.

Procedure

Sixty-five males and 84 females undergraduates participated in the main study. Subjects participated in groups ranging in size from 16 to 26. In both the events-given and the causes-given conditions, subjects were informed that they were taking part in a study of causal relationships and were presented six legal and six interpersonal situations. For both interpersonal and legal situations, two situations were presented with one cause, two with two causes, and two with three causes. To determine whether discounting involved reductions in the strength of each presented cause and event as well as the probability of presence, subjects were asked to consider changes in both strength and probability.

For each situation in the events-given condition, subjects were given an event and one, two, or three possible causes. Subjects were asked to determine how probable it

was that each cause contributed to the production of the event independently of the other causes. Probability was measured on a 10-point scale with 1 meaning Not at all Probable and 10 meaning Very Probable. Subjects were then asked to assume that the causes were present and were asked to determine the strength of each cause independent of the other causes on a 7-point scale with endpoints labeled Not at all Important and Very Important.

In the causes-given condition, subjects were presented with one, two, or three causes and asked to determine the probability that a particular event resulted from the presence of the cause or causes. Probability was again measured on a 10-point scale with 1 meaning Not at all Probable and 10 meaning Very Probable. Subjects were then instructed to assume that the event actually did occur and were asked to estimate the strength of the event on a 7-point scale with endpoints labeled Not at all Strong and Very Strong.

At the end of each experimental session, subjects were told that the research was studying the influence of multiple causes on inferences regarding both the probability and strength of events and causes in particular cause-event situations. Subjects were thanked for their participation and were offered an opportunity to receive the final results of the study.

Results

In the events-given condition, subjects were given two legal and two interpersonal situations with one, two, and three possible causes each. Asked to estimate the probability and importance of each cause, subjects were instructed to consider each cause separately regardless of the number of potential causes presented. In the causes-given condition, subjects considered the same set of six legal and six interpersonal situations. In this condition, however, the cause or causes were presented as a group and the subject was asked to determine the likelihood that the proposed event did occur, and the strength of the occurrence given the cause or group of causes. In this experimental condition, the one, two, or three causes were considered as a group whereas in the events-given condition, the probability and strength of each causes was estimated separately. Because of this difference between conditions, discounting processes in the multiple cause situations were analyzed separately by condition. In the events-given condition, probabilities assigned to each of the causes in the two and three potential cause situations were averaged for each situation for the purpose of analysis.

Probability Estimates

Events-Given Condition. It was predicted that additional causes in the events-given condition would be disregarded when one cause was found to be sufficient for

the production of the event. Thus, discounting was not predicted to occur and subjects were predicted to use Shaklee and Fischhoff's (1982) minimum causation model. A 2 x 3 (Situation Type x Number of Causes) analysis of variance with repeated measures on the number of causes variable revealed a significant interaction, F (1, 68) = 4.84, p < .01, suggesting that discounting proceeds differently for different types of situations. Trend component analysis conducted on the data revealed a significant quadratic component for the interaction term, F (1, 68) = 10.58, p < .01. Contrary to predictions, mean probability ratings for legal situations indicated that subjects perceived the probability that any particular cause was present to be reduced as the number of causes increased from one (M = 6.69) to two (M = 6.08) to three causes (M = 5.29). For interpersonal situations, perceived probability also dropped significantly as the number of potential causes increased from one (M = 7.72) to three (M = 6.42). The similar mean probability rating for the two cause (M = 6.52) and the three cause interpersonal situations (M = 6.42) indicate that the amount of discounting for interpersonal situations did not differ as a function of the number of additional causes presented.

Insert Table 1 about here

Causes-Given Condition. In the causes-given condition, it was predicted that estimates of the probability of an event occurring would increase as the number of presented causes increased. Thus, it was predicted that subjects would use either Kelley's (1972) causal schema model or Shaver's (1981) multiple discrete cause approach when evaluating the probability of an event when given one, two, or three causes. Additionally, it was predicted that probability estimates would show a less rapid increase for legal situations than for interpersonal situations. A 2 x 3 (Situation Type x Number of Causes) analysis of variance with repeated measures on the number of causes variable revealed a significant interaction term, F (2, 150) = 12.85, $p < .001$. Trend component analysis revealed a significant linear component for the interaction term, F (1, 75) = 18.58, $p < .001$. Unlike discounting in the events-given condition, however, discounting in the causes-given condition did not show a significant quadratic component, indicating that the nature of the discounting function differed depending on the direction of the attribution. Inspection of the means in Table 1 suggests that people estimated an event to be more likely as the number of causal elements increased for interpersonal events, but not for legal events. Mean probability ratings for interpersonal situations revealed probability increases when the number of presented causes increased from one cause (M = 7.03) to two

causes (M = 8.15) to three causes (M = 8.82). For legal situations, mean probability ratings remained fairly stable as the number of presented causes increased from one (M = 6.68) to two (M = 6.76) to three (M = 6.90).

Strength Estimates

Predictions for the strength dependent variable were similar to the predictions for the probability dependent variable. To test these predictions, 2 x 3 (Situation x Number of Causes) analyses of variance with repeated measures on the number of causes variable were conducted on the dependent measure of strength for both the causes-given and the events-given conditions.

Events-Given Condition. In the events-given condition, the results did not confirm the prediction of the minimum causation model for either legal or interpersonal situations. The analysis of variance revealed a significant main effect for number of causes, F (1, 68) = 67.53, $p < .001$. Unlike discounting of probability, discounting of strength showed no significant Situation x Type interaction term. Trend component analysis revealed a significant quadratic component, F (1, 68) = 4.88, $p < .05$. As the means listed in Table 2 indicate, mean importance ratings for causes decreased for legal situations as the number of proposed causes increased from one (M = 6.24) to two (M = 5.60) to three (M = 5.28). For interpersonal situations, mean importance ratings for the causes decreased in a

similar pattern as the number of causes increased from one (M = 6.35) to two (M = 5.72) to three (M = 5.35).

Insert Table 2 about here

Causes-Given Condition. The analysis of variance revealed a significant interaction term for event strength, F (2, 150) = 9.62, p < .001. A significant linear component in the trend component analysis suggests that the changes in the estimates of event strength occurred linearly, F (1, 75) = 14.09, p < .001. Listed in Table 2, the mean ratings for event strength in the causes-given condition suggest that people use different rules for making judgments in legal and interpersonal situations. For interpersonal situations, mean event strength ratings increased as the number of causes increased from one (M = 4.78) to two (M = 4.76) to three (M = 4.97). In contrast, however, judgments of event strength in legal situations actually decreased as the number of causes increased from one (M = 5.97) to two (M = 5.66) to three (M = 5.22).

Test of Transitivity for One-Cause Situations

Because particular causes are likely to produce a limited number of events, whereas events can often be produced by countless causes, non-transitivity of discounting was predicted such that probability and strength judgments would be greater for the causes-given condition

when probability and strength of an event were judged than for the events-given condition where subjects judged the probability and strength of proposed causes. To determine whether attributions made in the causes-given condition matched attributions made in the events-given condition, 2 x 2 (Situation x Attribution Direction) analyses of variance were conducted for both strength and probability dependent variables for one-cause situations.

Probability. The analysis of variance conducted on the dependent variable of probability revealed a significant Situation by Attribution Direction interaction, F (1, 143) = 4.54, $p < .05$. Non-transitivity was obtained, although the pattern of differences was opposite to the predicted pattern. As listed in Table 3, the mean probability rating for interpersonal situations in the causes-given condition (M = 7.03) was lower than the mean probability rating in the events-given condition (M = 7.72), indicating that the proposed cause was judged more probable than the corresponding event. Mean probability ratings did not differ between the causes-given condition (M = 6.68) and the events-given condition (M = 6.69) for legal situations, suggesting that subjects judged the proposed cause equally probable as its corresponding event.

Insert Table 3 about here

Strength. The analysis of variance on the dependent variable of strength revealed a significant Situation by Attribution Direction interaction, F (1, 143) = 35.94, p < .001. Mean strength ratings for interpersonal situations were also lower in the causes-given condition (M = 4.78) than in the events-given condition (M = 6.35). Unlike mean probability ratings, however, this trend was also seen in the mean strength ratings for legal situation in the causes-given condition (M = 5.97) and in the events-given condition (M = 6.24). Thus, subjects judged the importance of a cause to be greater than the strength of the corresponding event.

Story Effects

Before concluding that different discounting processes explain attributional judgments in different types of situations, it is important to determine whether or not the different situations used to represent the two different types of situations, interpersonal and legal, were treated similarly by subjects. To determine whether or not subjects appeared to use the same discounting rules for the various situations within the categories of legal and interpersonal situations, one of the two situations with each of one, two, and three causes within each category was assigned randomly to one of two groups, Group A or Group B. Discounting across these two sets of three situations was analyzed using a 2 x 3 (Group X Number of Causes) ANOVA conducted

separately for legal and interpersonal situations. Significant interaction effects were found for both interpersonal situations, F (2, 136) = 4.84, p = .009, and legal situations, F (2, 136) = 4.92, p = .009. As Table 4 indicates, the amount of decrease in subjects' mean probability ratings appears to be more dependent on the particular situation, and perhaps the particular set of causes under evaluation, than the number of possible causes presented.

Insert Table 4 about here

Examination of the pattern of probability estimates across causes in each situation with multiple causes would provide information regarding the role of presentation order in probability judgments. Separate ANOVAs were conducted for two and three cause situations of each situation type. Comparison of probability judgments across the causes presented in multiple cause situations revealed significant interactions for interpersonal situations with three causes, F (2, 136) = 67.48, $p < .001$, and for both three cause legal situations, F (2, 136) = 69.96, $p < .001$, and two cause legal situations, F (1, 68) = 36.67, $p < .001$. The pattern of means listed in Table 5 suggests that subjects' probability judgments are based primarily on the

plausibility of individual causes rather than the order of presentation.

Discussion

The results of this study suggest that subjects do not make identical attributions when given an event and asked to judge the probability or strength of a cause or causes as they do when given a cause or causes and asked to judge the probability or strength of a subsequent event. Interaction terms between legal and interpersonal events in both directions suggest at first glance that discounting practices differ depending on whether interpersonal or legal situations are under consideration. Further analysis, however, indicates that subjects may be using different discounting procedures depending on the particular situation under evaluation rather than the category of situation. The different conclusions that can be drawn depending on whether the results of this study are analyzed according to category of attributional task or according to individual situation are testament both to the difficulty inherent in studying discounting and the need to develop a typology of situations that might provide insight into the meaningful conceptual distinctions between situations. To evaluate the extent to which conclusions would differ depending on whether situations were grouped or whether situations were analyzed separately, the conclusions that could be drawn using each method of analysis will be compared.

Legal versus Interpersonal Categorization of Situations

When an event is given and subjects are asked to determine the likelihood that a cause or each of a number of causes contributed to the event, discounting occurs in a linear pattern for legal situations and a non-linear pattern for interpersonal situations. Thus, it appears that Kelley's causal schema model of linear discounting is used when judging legal situations. Depending on whether the slope changed more or less rapidly as the number of presented causes increased, the non-linear pattern of discounting observed in interpersonal situations could indicate utilization of either Shaver's multiple discrete cause approach or Shaklee and Fischhoff's minimum causation model. If the slope of the discounting function increased as the number of causes increased, it would suggest that subjects were using Shaver's multiple discrete cause model, considering individual causes as well as combinations of causes. Examination of the results indicate that the amount of discounting was equivalent for two and three cause situations. Thus, although subjects' predictions for events with one cause differed from events with more than one cause, predictions for events with two causes were similar to those with three causes. Because subjects discounted as much for one additional cause as for two additional causes, it appears that Shaklee and Fischhoff's (1982) minimum causation model predicts discounting in interpersonal

situations when subjects are given an event and asked to determine the likelihood that a cause or each of a number of causes contributed to the event.

When presented with one, two, or three causes and asked to predict the likelihood of a particular event occurring, subjects appear to use Kelley's (1972) causal schema model of linear discounting for interpersonal situations. This linear function suggests that subjects consider each additional cause presented, but not all possible combinations of causes as would be predicted by Shaver's model. For legal situations, it appears that subjects used a minimum causation model when judging the likelihood of a legal event. This model states that people disregard the possible contribution of additional causes when a single cause has been found sufficient to produce an event.

When asked to estimate the strength of a cause or each of a number of causes that were responsible for the production of a given event, the mean strength estimated decreased in a nonlinear manner. Unlike probability estimates, strength estimates did not differ between legal and interpersonal situations in the events-given condition.

When given a cause or causes and asked to determine the strength of the resulting event, subjects' answers were somewhat surprising. Whereas estimates for interpersonal situations remained fairly level, estimated event strength for legal situations actually decreased as additional causes

were presented. This result appears counterintuitive; it would be expected that the strength of an event would either increase with the contribution of additional causes, or perhaps stay stationary if the contribution of additional causal forces was perceived to be superfluous to the production of an event. It is possible that subjects were confused when asked to judge the strength of an event. Whereas people frequently consider the strength of a cause and the relationship between the strength of a cause and the production of an event, it may be less common for people to assess the actual strength of an event. Instead of thinking in terms of event strength, people often register only whether an event occurred or not. The unfamiliarity of the concept of "event strength" was made evident by the number of subjects who asked the experimenter to define the term.

Focusing on one-cause situations, comparison of probability and strength attributions across the different attribution directions for both legal and interpersonal situations provides direct evidence that attributions are not always made transitively. The results of these comparisons indicate that both probability and strength estimates differed between the causes-given condition and the events-given condition for interpersonal situations. Judgments of interpersonal situations indicate higher estimates of probability and strength of causes when the event is given and probability or strength of possible

causes is measured than when a cause is given and subjects are asked to judge the probability and strength of an event. In contrast, legal situations were attributed similar probability and strength regardless of the direction of the attribution. Although strength inferences follow a pattern similar to the pattern of probability inferences, one must be cautious in interpreting the strength estimates because many subjects appeared confused regarding the term "event strength."

Discounting Within the Legal and Interpersonal Domains

Although categorization of the situations used in this study into legal and interpersonal situations reveals a complex pattern of attributions, the pattern of results appears even more complex when attributions are analyzed for each situation separately. Clearly, the form of the discounting function used is not dependent on the domain of the situation in question. Perhaps familiarity with particular situations influences the attribution model used. Specifically, individuals may have developed more complete schemata for more frequently encountered or evaluated situations, allowing for more complex attributional decisions to be made for these situations. When asked to make judgments regarding less uncommon situations, the attributor may rely on less developed schema. As such, the attributor may be unable to consider the influence of more than one cause. It is likely that situations within both

the legal and interpersonal domains vary in terms of familiarity. Alternatively, discounting may be the result of the use of cognitive heuristics such as salience, representativeness, or availability (Fiske & Taylor, 1984). These heuristics, involving differences in the ease of recall or the strength of association between a cause and an event, may influence the discounting process more than the number of causes presented.

Summary

Despite the confusing picture painted by these results, this study offers insight into the complexity of the attribution process and the inconsistent manner by which the naive attributor makes cause and event inferences. At times, the lay person appears to consider only one cause, whereas at other times he or she appears able to evaluate the possible contributions of additional causes. This study provides little evidence that subjects consider various combinations of potential causes.

These results suggest that no single discounting model can adequately describe the attribution process. Further research is needed to determine the limits of each model and to outline the circumstances under which each is used.

Failure to find transitivity of probability attributions points to a flaw in the assumptions inherent in most attribution research. Most studies present an event as a given, rather than as an uncertainty. When these studies

conclude that subjects automatically discount causes when more than one cause is presented, possible changes in perceptions of the likelihood of the event occurring are not considered. Discounting implies that less additional information can be gathered by studying each successive additional cause. This is true if the probability of an event is assumed to be stable, but not if the likelihood of an event changes as new causes are added. It is quite probable that research supporting the discounting principle places structure on the attribution task that is not present in everyday attribution situations where event probability is considered.

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Table 1

Mean Probability Scores for One, Two, and Three Cause Situations For Events Given and Causes Given Legal and Interpersonal Situations

		Number of Causes		
Condition		One	Two	Three
Events-given				
Legal	*M*	6.69	6.08	5.29
	SD	1.44	1.33	1.25
Interpersonal	*M*	7.72	6.51	6.42
	SD	1.30	1.17	1.19
Causes-given				
Legal	*M*	6.68	6.76	6.90
	SD	1.81	1.60	2.11
Interpersonal	*M*	7.03	8.15	8.82
	SD	1.68	1.35	1.47

Note. Probability measured on a 10 point scale.

Table 2

Mean Strength Scores For One, Two, and Three Cause Situations For Events Given and Causes Given Legal and Interpersonal Situations

Condition		Number of Causes		
		One	Two	Three
Events-given				
Legal	*M*	6.24	5.60	5.28
	SD	0.78	0.86	0.69
Interpersonal	*M*	6.35	5.72	5.35
	SD	0.61	0.68	0.80
Causes-given				
Legal	*M*	5.97	5.66	5.22
	SD	0.86	0.80	1.20
Interpersonal	*M*	4.78	4.76	4.97
	SD	1.41	1.15	1.44

Note. Strength measured on a 7 point scale.

Table 3

Mean Probability and Strength Estimates for One Cause Legal and Interpersonal Situations in Events Given and Causes Given Conditions

Dependent Measure		Condition: Events-given	Condition: Causes-given
Probability			
Legal	*M*	6.69	6.68
	SD	1.44	1.81
Interpersonal	*M*	7.72	7.03
	SD	1.30	1.68
Strength			
Legal	*M*	6.24	5.97
	SD	0.78	0.86
Interpersonal	*M*	6.35	4.78
	SD	0.61	1.41

Note. Probability was measured on a 10 point scale and strength was measured on a 7 point scale.

Table 4

Mean Probability Ratings for Causes for Each of the Six Interpersonal and Six Legal Situations

	Number of Causes		
	One	Two	Three
Interpersonal			
Group A	8.00	6.52	6.93
Group B	7.45	6.51	5.92
Legal			
Group A	7.10	5.93	5.11
Group B	6.28	6.24	5.47

Table 5

Probability Estimates for Each Cause Presented in Multiple Cause Situations as a Function of Presentation Order

	Presentation Order		
Condition	First	Second	Third
Two Cause			
Interpersonal			
Situation A	6.09	6.96	
Situation B	6.26	6.75	
Legal			
Situation A	5.87	6.61	
Situation B	7.07	4.78	
Three Cause			
Interpersonal			
Situation A	5.62	7.07	8.09
Situation B	6.25	6.39	5.13
Legal			
Situation A	6.64	3.23	6.54
Situation B	3.91	6.00	5.42

Figure 1. Compensatory Schema for an Event with Two Causes

Cause 1	Cause 2			
	Absent	Low Strength	Moderate Strength	High Strength
Absent			Effect	Effect
Low Strength			Effect	Effect
Moderate Strength	Effect	Effect	Effect	Effect
High Strength	Effect	Effect	Effect	Effect

VITA

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