The Undoing of Scenarios

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Scenarios with dramatic outcomes often evoke counterfactual thinking, mentally undoing that outcome by mutating events in the causal scenario and thereby allowing for the mental simulation of new outcomes. In Experiment 1, we manipulated the order of four events in a scenario. Each of these events could be mutated to alter the outcome, and each event was described as having caused the event that followed it. People preferred to change the first event and showed no preference for changes to the subsequent events. We proposed that perceived mutability of an event is constrained by the existence of prior events that are believed to have caused the event. Experiment 2 examined characteristics of the events themselves, rather than their order, that affect their mutability. When these were framed as a norm, people were relatively unlikely to mutate the event in order to undo the outcome, instead preferring to mutate the exceptions. The norm or exception status of other events in the scenario did not affect the mutability of a focal event. Discussion includes the conditions that naturally trigger counterfactual thinking and the role of counterfactual thinking in affective reactions.

Situations that have dramatic outcomes often are evaluated by considering what "might have been" or what "could have been." For instance, consider the following scenario:

> Ted was waiting in a checkout line to purchase groceries and try his luck on a scratch-and-win ticket given with every purchase. As he was about to check his groceries, Ted let a woman go before him because she had only two items. Her ticket won $5000.

Evaluation of such scenarios appears to evoke an "if only" type of response, or *counterfactual thinking*. For example, if only Ted hadn't let that woman go ahead of him, then he would have won the $5000. We assume, as did Kahneman and Tversky (1982) and Kahneman and Miller (1986), that cognitive and affective reactions to dramatic scenario outcomes such as this depend in part on the extent to which alternative scenarios easily come to mind.

Kahneman and Tversky (1982) proposed that people evaluate dramatic scenario outcomes by engaging in a mental simulation of the events. In these mental simulations, a person can assume a starting point and mentally manipulate subsequent event sequences, thereby generating several possible outcomes, or a person can presuppose an outcome and work backwards to generate several event sequences leading up to the dramatic outcome. Kahneman and Tversky argued that "the ease with which the simulation of a system reaches a particular state is eventually used to judge the propensity of the (real) system to produce that state" (1982, p. 201).

The idea of a mental simulation or *simulation heuristic* might be of considerable theoretical import for understanding how people evaluate scenarios. For example, a recent study showed that people rated a person who recovered from food poisoning as being luckier, happier, and more satisfied than a person who won $25 and narrowly missed the grand prize in a sweepstakes (Johnson, 1986). A comparison of the two situations on an absolute level, one person being painfully ill for a period of time and the other being the recipient of a $25 unexpected prize, would lead most people to think of the latter person as happier, luckier, and more satisfied than the former person. However, the scenarios that described these persons' situations were constructed to implicate a mental simulation of alternative outcomes (e.g., "if only he hadn't gotten medical treatment, he might have died" or "if only he had one different number, he would have won the grand prize sweepstakes").

Our interest in the simulation heuristic is to discover some of the rules that govern the manner in which people select events that they mentally manipulate in undoing scenarios.[1] Why, for example, don't people change the critical-illness outcome by imagining that he hadn't eaten the spoiled food, a consideration that surely would lead them to think of him as unlucky? Or why don't people change the $25-prize outcome by imagining that he had a mismatch on some other number, thereby winning

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[1] The question of how these rules of mental simulation in turn translate into evaluative judgments (e.g., regret, happiness, disappointment) is a subsequent step in our research program. Our first goal is to discover the primary rules that govern the simulation heuristic.

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nothing and leading people to think of a $25 prize as a lucky outcome?

Little is known about the mental simulation of alternative scenarios. Kahneman and Tversky (1982) proffered two general rules that guide the generation of alternative scenarios when people are asked to undo a scenario outcome. First, they proposed that people are more likely to change an event in the sequence from an exceptional state to its normal state than vice versa (a conception developed in greater depth by Kahneman & Miller, 1986). For example, given a scenario in which a driver is said to have left work earlier than usual and subsequently is killed in an automobile accident, it readily comes to mind that the outcome could have been different if only he had left work at the usual time. However, if the driver left work at his regular time and the same misfortune befell him, it doesn't readily occur to people that the accident could have been avoided had the driver left at an earlier or later time.[2] Kahneman and Tversky argued that the psychological distance from an exception to the norm it violates is far less than the psychological distance from the norm to an exception.

The second rule proposed by Kahneman and Tversky (1982) is that people are more likely to alter a scenario outcome by deleting an event in the sequence than they are to introduce a new event into the sequence. The previous scenario involving Ted at the checkout counter could be considered an example of this process. When the scenario includes the event of Ted letting the woman go ahead of him, it readily comes to mind that by deleting this event, Ted would have won the money. However, a scenario in which Ted was behind the woman from the outset might require people to assume the addition of a new event (e.g., the woman letting Ted precede her as she fumbles through her purse for money), something more difficult to simulate mentally.

Kahneman and Tversky (1982) proposed that the mental changes people make when undoing scenarios can be classified as taking one of three forms: *Uphill changes* are the addition of unlikely events, *downhill changes* are the deletion of unlikely events, and *horizontal changes* are changes of a continuous variable from one arbitrary value to some other arbitrary value. They conducted one study to examine the relative frequency with which these three types of changes are made.

Kahneman and Tversky (1982) presented two groups of participants with different versions of a story concerning a Mr. Jones. In one version, Mr. Jones leaves work earlier than he usually does and proceeds home via his regular route. In the other version, Mr. Jones leaves work at his usual time but takes a different route home. In both versions, Mr. Jones is halfway home when he is hit by a truck running a red light, killing him instantly. Kahneman and Tversky asked their participants to undo the outcome by finishing a sentence that began "If only ______." Their results showed that participants "undo the accident by restoring a normal value of a variable [rather] than by introducing an exception" (1982, p. 205). In the left-early version, for example, participants predominantly cited the factor "if only he had left work at his usual time," thereby removing a nonnormal event and replacing it with a normal event. Participants who received the different-route version predominantly cited the factor "if only he had taken his usual route," again using a downhill change. Uphill changes (e.g., "if only he had left work late that day" or "if only he had gotten a flat tire") were rare in Kahneman and Tversky's study, and horizontal changes were virtually nonexistent.

Our research has tended to confirm Kahneman and Tversky's (1982) observations about the rarity of uphill changes, but we have found that horizontal changes are not at all uncommon (Taylor, Turtle, & Wells, 1986). Using various versions of a motorcycle accident, we found that people's preferences for downhill and horizontal changes depended on how the causal events were framed. For example, just prior to the motorcycle accident, the motorcyclist was described as having either a 25-min conversation or a 10-s exchange with a pedestrian. In the latter conditions, people deleted the conversation altogether, whereas in the former conditions people shortened or lengthened the conversation.

The current studies concerned the question of what makes some events more mutable than other events. In our motorcycle-accident scenario, for instance, there were 14 separate events that our subjects mutated in order to change the outcome, but 3 of these events accounted for almost 50% of all mutations. Why were these 3 events so much more mutable than the other 11 events? The current experiments were designed to examine two main factors that might affect people's preferences for which events to change in a scenario when trying to undo the outcome. The first experiment concerned the role of possible event-order effects, whereas the second experiment concerned characteristics of the events themselves, specifically their norm or exception status.

Experiment 1

An examination of possible order effects is basic to the issue of how people mentally undo scenarios. The process of mentally simulating a new outcome (e.g., motorcyclist does not get hit by a car) can be achieved by changing an early event in the scenario and assessing its impact on subsequent events, which in turn alters the outcome: a process we call *forward search*. Alternatively, one can mentally simulate a new outcome by working backward through the sequence to find an event that could be changed: a process we call *backward search*. A third possibility is that the events affecting the outcome are accessed randomly.

We did not expect that the random-access model would characterize the way people engage in a search for events to undo. A coherent scenario, like a coherent story, is mentally organized in a sequential form (see Abelson, 1976; Schank & Abelson, 1977), and it seemed unlikely that people would use a random search process for events to undo. It was not as clear, however, whether the search would be forward or backward.

A backward search might have certain advantages over a forward search in terms of cognitive load. Specifically, in order to simulate the effect of an early-event change on the outcome, the mental simulator must calculate the effect of that event on subsequent events before assessing its impact on the outcome. A backward search, however, allows the mental simulator to discover an event that is contiguous or nearly contiguous to the

[2] We return to this issue of changing events from a norm to an exception in Experiment 2.

outcome; therefore, the impact on the outcome of changing that event can be easily assessed. An event temporally contiguous to the outcome has the additional advantage of being perceived as especially causal of the outcome (e.g., see Siegler & Liebert, 1974). If a backward process characterizes the way people search for an event to undo, then an event immediately preceding the outcome ought to be listed earlier in subjects' if-only statements than would antecedent events in the sequence.

Although a backward search might lead quickly to the discovery of events that can be assessed easily regarding their impact on the outcome, the causal direction of the event sequence is forward, thus creating potential difficulties for backward processing. Consider the event sequence A–B–C with outcome X, in which it can be said that A causes B, which in turn causes C, resulting in outcome X. Although the removal of C involves fewer mental calculations to ascertain that outcome X would be altered, it might be relatively difficult to imagine the absence of C, given that events A and B are part of the alternate scenario. In this sense, it might be easier to imagine the absence of the more distant cause, A, which has no explicit antecedent.

Kahneman and Miller (1986) recently proposed that "the second member of an ordered pair of events is more mutable than the first" (p. 145). Kahneman and Miller noted, for example, that most people change a consonant pair (e.g., XF) by changing the second letter rather than the first. Although this might appear to indicate that a backward search would characterize the undoing process, their observation probably does not apply to our scenarios. Unlike the stringing of letters, event sequences have a causal-chaining property such that the early events affect the later events. Because of this, it might be relatively difficult to imagine an effect, F, having not occurred in an X–F causal sequence without first imagining the cause, X, having not occurred. Thus, we did not necessarily expect the second member of an ordered pair of events to be more mutable than the first, as Kahneman and Miller's consonant-pairing data suggest. We suggest that causes are more mutable than effects in cases where the effect is certain to follow the cause. However, it might also be true in cases where the effect does not follow with certainty from the cause. It seems to us, for example, that the cancerous death of a smoker is less likely to make people imagine alternatives to the effect (e.g., if only he hadn't gotten cancer) than it is to imagine alternatives to the cause (e.g., if only he hadn't smoked).

We created a scenario for Experiment 1 in which the event components could be counterbalanced with regard to their order within the scenario. In other words, we created a scenario for which the causal events could be rearranged in their sequence without compromising the coherence of the story. Counterbalancing of their order guaranteed that characteristics of the events themselves were not confounded with their order in the sequence.

Method

Participants. The participants were 58 students from the introductory psychology research pool at the University of Alberta. Each participant was given one credit for partial fulfillment of introductory psychology course requirements.

Materials. Four versions of a scenario were constructed. The basic story centered on William and his attempts to get to a store across town in order to take advantage of a sale on a limited number of stereo systems. His progress was impeded by four minor misfortunes: a speeding ticket, a flat tire, a traffic jam, and a group of senior citizens crossing the street. William arrived at the store 35 min after the sale started only to find that the last stereo system had been sold just a few minutes before.

Each of the four versions had a different ordering of event sequences, arranged according to a conjugate Latin square design; each event appeared equally often in each of the four possible positions in the scenario. The scenario involved a causal chain in which each event affected subsequent events and yet the removal of each event was sufficient to undo the outcome. In one version, for example, William experienced the misfortunes in the order of (a) speeding ticket, (b) flat tire, (c) traffic jam, and (d) senior citizens crossing the street. In this scenario, participants read that the speeding ticket put William behind schedule, which made him take a shortcut. Here, he encountered glass causing a flat tire, which, after changing, put him in the time frame of rush hour, causing him to encounter a traffic jam, which in turn led him to contend with a group of slow senior citizens at a crosswalk. This scenario allows a change in sequence without a change in the coherence of the scenario. For example, in another version, the flat tire caused William to fall behind schedule, which made him encounter the traffic jam and then senior citizens at the crosswalk, ultimately getting a speeding ticket, and so on. These events were structured to represent some exception to a norm: William, for example, doesn't usually get a flat tire and he doesn't usually get a speeding ticket.

Design. The design of the experiment was 4 (different scenarios) × 4 (order) × 4 (event: speeding ticket, flat tire, traffic jam, senior citizens crossing street) in a conjugate Latin square 4 × 4 design.

Procedure. Participants were given a three-page booklet containing a cover page with instructions, one of the four versions of the stereo story, and an answer sheet. The version of the story that any given participant received was randomly determined prior to the experiment. The instructions asked the participants to read the story carefully and list six ways in which the events in the story could be changed so that the outcome of the story would be different. They were also informed in the instructions that they could refer to the story if they wished. Participants were run in groups of about 20, with an average session lasting about 30 min, after which the participants were debriefed.

Results

The responses from the participants were summarized independently by two coders. This summarization involved briefly paraphrasing the changes to the story into shorter, more manageable units while retaining the essential ideas put forth by the participant.

The two coders then examined a subset of the responses and used this subset to develop a coding scheme. As seen in Table 1, the final coding scheme contained 10 unique categories of responses. After the coding scheme was finalized, the entire data set was coded by the two people without awareness of the experimental conditions. Overall, the intercoder reliability was approximately 90% in classifying each unit according to the coding scheme. Discrepancies were resolved via discussion.

As seen in Table 1, the four events for which we manipulated order constituted the dominant cluster of events that subjects mentally altered (67.5% of all changes that were made). Among these four events, we calculated two indexes of the extent to which they were readily available for mental alteration (i.e., mutable) as a function of their order in the scenarios. First we calculated the percentage of subjects for whom the event was men-

Table 1
Experiment 1: Categories and Frequencies of Responses to the Undoing of the Stereo Scenario

If only . . .	Frequency of response	% of all responses
He hadn't received a speeding ticket	52	20.2
There had not been a traffic jam	44	17.1
He hadn't got a flat tire	41	15.9
There weren't so many pedestrians at the crosswalk	37	14.3
More stereos had been available	22	8.5
He hadn't heard the ad on the radio	19	7.4
He had heard the ad sooner	18	7.0
He had phoned ahead to the store	12	4.7
The store had been closer	7	2.7
He had stayed home/not tried	6	2.3

Note. Although all 58 participants listed six responses, some were uncodable (e.g., "it was just fate"). In addition, some responses were collapsed into one response. For example, a participant might have said "if he hadn't got a flat tire" and then have listed separately "if there hadn't been glass in the road." These two responses were combined in the above coding scheme to indicate only one response. Thus, the total number of responses in this table does not equal our sample size (58) times 6.

tioned first among the four events according to its position in the sequence. These percentages are displayed in Table 2.

A 4 (event) × 4 (order) chi-square analysis on the frequencies in these cells indicated no main effect for events, $\chi^2(3, N = 58) = 2.47, p < .50$. The order variable, however, produced a main effect, $\chi^2(3, N = 58) = 43.9, p < .001$. We could not directly calculate the interaction between the event itself and its order in the scenario sequence because more than 20% of the cells had expected frequencies less than 5. Therefore, we collapsed Orders 2, 3, and 4 (where all the expected frequencies were extremely low) and tested for an interaction between events and the two orders.[3] This interaction component was not significant, $\chi^2(3, N = 58) = .53, p < .90$. An analysis comparing Event Orders 2, 3, and 4 indicated no significant differences, $\chi^2(2, N = 58) = 1.7, p < .20$. The first event, however, differed significantly from the other three events, $\chi^2(1, N = 58) = 42.5, p < .001$.

Regardless of whether the first event was a speeding ticket, a flat tire, a traffic jam, or senior citizens at a crosswalk, its appearance in the first position made it over twice as likely (and sometimes over 10 times as likely) as any other order position to be the first of the four events mentioned. This represents a robust effect for the order variable in which the first event is more likely to be changed than the other three events combined.

The second index of mutability was the number of events altered prior to altering a given event. Because each subject listed exactly six event changes, we could examine a measure of average rank without confounding it with the total number of changes made by a subject. Table 2 displays the mean rank for each event as a function of its order in the scenario; rank is defined as the number of changes made to other events before changing the target event. Thus, a maximum score was 6; a score of 6 indicates that the event was not changed at all and that six other events were changed before this particular event change came to mind. A minimum score is 0; a score of 0 indicates that the event was the first one changed by the subject and that no other event changes preceded it.

A 4 (event) × 4 (order) analysis of variance (ANOVA) on the rank scores revealed a main effect for the events, $F(3, 228) = 3.134, p < .05$, but no Event × Order interaction, $F(6, 222) < 1$. A Newman–Keuls analysis revealed that the speeding ticket had a lower rank than did the other three events, which did not differ from each other. The Latin square design also permitted an analysis of the scenarios themselves (i.e., the specific event-order combinations used in the conjugate design). The scenario component was not significant, $F(3, 228) = 1.008$.

Importantly, the order variable had significant effects on mean ranks, $F(3, 228) = 5.356, p < .01$. Table 2 shows that the mean rank across events when the event appeared in the first position was 2.6, whereas the second, third, and fourth positions produced mean ranks of 3.3, 3.7, and 3.8, respectively. The second, third, and fourth event positions do not differ in mean rank according to a Newman–Keuls analysis, whereas the first position differs from each of the other three. Also, this preference for changing the event in the first position is consistent across each individual event, which is consistent with the lack of an interaction between event and order.

Discussion

The purpose of Experiment 1 was to determine what method a mental simulator will use in selecting an event to change so as to undo a dramatic scenario outcome. We found that people had a tendency to focus on the first event in the scenario, followed by a somewhat random selection of the remaining events. Although all four of the manipulated events could be said to have controlled the outcome of the scenario, subjects tended to make changes to the first event before considering the other events, regardless of whether the first event was the flat tire, the speeding ticket, the traffic jam, or the senior citizens at the crosswalk. This is somewhat surprising given that a change to the first event requires the mental simulation of many possible subsequent events that could have unpredictable effects on the outcome. For example, when the flat tire appears as the first event, removal of that event requires the mental simulation of the remainder of the trip, during which many other potential misfortunes (e.g., an accident) could have delayed the driver. When the flat tire is the last event, however, it should be easy to simulate mentally the short remainder of the trip, where it would seem certain that nothing further could interfere with William's on-time arrival.

It is possible that people changed the first event because it is perceived to have a larger impact on the outcome than subsequent events have. Consider the case where the flat tire is the first event. Participants might reason that if it weren't for a flat

[3] These chi-square analyses did not violate independence assumptions because each subject contributed only one data point to the analyses regardless of whether we collapse over orders or events. This is because we counted only the first mutation that was made by each subject. Furthermore, any analyses of nonmentions would be redundant with these chi-squares because all subjects made a change to one of the four manipulated events.

Table 2
Experiment 1: Mean Rank of Event Changes as Functions of the Events and Their Order in the Scenario

Event	1	2	3	4	*M* across order
1. Speeding ticket					
Rank	1.9	2.3	3.0	3.7	2.7
%	80.0	33.3	11.8	6.7	33.1
2. Flat tire					
Rank	2.8	3.5	4.3	3.8	3.6
%	58.3	6.7	20.0	17.6	26.0
3. Traffic jam					
Rank	2.5	3.4	4.1	3.6	3.4
%	58.8	20.0	6.7	0.0	23.5
4. People at crosswalk					
Rank	3.1	4.1	3.4	4.2	3.7
%	53.0	11.8	8.3	6.7	19.2
M over events					
Rank	2.6	3.3	3.7	3.8	
%	62.5	18.0	11.7	7.8	

Note. The rank refers to the average number of events that were changed before changing the event identified in the row (maximum score = 6). The percentages represent the percentage of participants for whom the event was the first one changed among the four events.

tire, William would not have needed to take the shortcut, which led to the traffic jam, which led him to take the road where the senior citizens were crossing, which led him subsequently to speed because he was behind schedule. Thus, removal of the last event (speeding ticket) might have saved him 10 min, but removal of the first event could have saved him 30 min. Although removal of each event alone would have been sufficient to have allowed William to arrive on time, the first event has the greatest overall impact on the amount of time saved. The overall-impact hypothesis, however, does not characterize preferences for changing the first event, because the hypothesis predicts a linear trend across the order variable. That is, because a change to the second event has a greater overall impact than does a change to the fourth event, there should also be differences in preference for changing the second over the fourth event. Instead, however, only the first event yielded a preference; Events 2, 3, and 4 were equal. Thus, we do not favor the overall-impact hypothesis as an explanation for the order effect.

We suggest instead that people prefer to change the first event because it is difficult to imagine the later events not occurring given that the prior event did occur. For example, the driver was speeding because he got a flat tire (which put him behind schedule) in the version where the flat tire preceded the speeding. In this case, it is relatively difficult to imagine the driver not getting a speeding ticket without first undoing the flat tire. In the version where the speeding ticket preceded the flat tire, the scenario pointed out that the ticket put him behind schedule, which in turn made him try a shortcut where he encountered glass on the road. In this case, it is relatively difficult to imagine the driver not getting a flat tire without first undoing the speeding ticket. This interpretation is consistent with the finding that there was a preference for changing the first event and thereafter no order preference for the other events. Specifically, after changing the first event, it is relatively easy to imagine any of the subsequent events being different because the instantiation of the causal chain is thereby absent.

Our findings do not necessarily conflict with Kahneman and Miller's (1986) hypothesis that the second member of an ordered pair is more mutable than the first. In our study, the later events were caused by earlier events rather than merely being ordered. On the other hand, our findings potentially are in conflict with Kahneman and Miller's suggestions regarding the relative mutability of causes as opposed to effects. In their discussion of causes and effects, Kahneman and Miller noted that a child may be described as "big for her age" but not "young for her size" (1986, p. 144). As well, they found that when they presented people with a surprising performance by a weight lifter and asked them to make an adjustment, people were more likely to alter the weight lifted than the size of the athlete. Using these examples, Kahneman and Miller argued that effects are more mutable than causes.

Thus, it appears that Kahneman and Miller's (1986) argument (that effects are more mutable than causes) is inconsistent with our argument (that effects are relatively immutable because they are constrained by prior causes). In fact, however, we suggest that no true inconsistency exists. Kahneman and Miller were concerned primarily with cause–effect situations for which there was a violation of the normal cause–effect relation in the specific instance (as in the size–age and weight-lifting examples). Thus, in the statement "he pulled the trigger; the gun did not fire," there is a violation of normality. In such cases, the effect (misfire) would undoubtedly be more mutable than the cause (he pulled the trigger). Our scenarios, however, were not violations of cause–effect normality. Thus, a more appropriate example for our research would be the statement "he pulled the trigger; the gun fired." In this example, the effect is immutable relative to the cause. Or consider an example in which a man is badly burned after spraying charcoal lighter fluid on an open flame. It is unlikely that people will alter the effect ("if only he had not been burned") and more likely that they will alter the cause ("if only he hadn't sprayed the lighter fluid on the flame").

Kahneman and Miller (1986) were concerned with cases in which the observed effect does not normally follow the cause, whereas we are dealing with cases where the effect normally follows the cause. For this reason, we do not propose that our conclusion about the relative mutability of causes and effects is a contradiction of their conclusions. However, their examples do not necessarily deal with causes and effects. The child is not big because of her age (but in spite of it); the athlete does not lift a heavy weight because of his slight stature (but in spite of it); and the gun does not fail to fire because of the trigger being pulled (but in spite of it). The causes of these effects lie elsewhere, and the high mutability of these effects owes to their status of being nonnormal. Thus we argue that when an effect is the result of a prior cause (rather than in spite of the cause), the effect will be less mutable than the cause.

Our findings that the first causal event is more mutable than are the subsequent events has an interesting parallel in research by Vinokur and Ajzen (1982) on causal primacy. They found that prior causes in a chain of events are attributed greater importance than are later, more immediate causes. Similar results have been reported with two-event sequences by Brickman, Ryan, and Wortman (1975). In explaining causal primacy, Vinokur and Ajzen speculated that "because there are no obvious factors controlling the prior events, they may be perceived to have greater freedom of occurrence or nonoccurrence" (1982, p. 822). Although Vinokur and Ajzen collected only measures of the perceived importance of events, our data indicate that prior causes are indeed perceived as having greater freedom of occurrence and nonoccurrence, a factor we call *mutability*. Thus, our data tend to confirm Vinokur and Ajzen's speculation about the reasons for causal primacy.

We do not suggest that the order of events in a causal chain is the only determinant of relative mutability or even that it is the primary determinant. Vinokur and Ajzen (1982), for instance, found that their primacy effect was limited to situations in which the events were of approximately equal relevance to the final outcome. Our second experiment was designed to examine characteristics of the events themselves, rather than their causal order, that might make some events more mutable than others.

Kahneman and Tversky (1982) suggested that "the psychological distance from an exception to the norm it violates is smaller than the distance from the norm to the same exception" (p. 205). This observation is the core of Kahneman and Tversky's argument for why people prefer to change exceptional events rather than normal events in undoing scenario outcomes. Kahneman and Miller (1986) similarly suggested that "exceptions tend to evoke contrasting normal alterations, but not vice versa" and that "an event is more likely to be undone by altering exceptional than routine aspects of the causal chain" (p. 143). Experiment 2 was designed to test the idea that people prefer to change an exceptional event rather than a typical or normal event.

Experiment 2

Uphill changes, the introduction of an unlikely or exceptional event, presumably are avoided because it is easier to imagine changing an exception to a norm than to imagine changing a norm to an exception (Kahneman & Tversky, 1982). Kahneman and Tversky used the Mr. Jones scenario to provide some tentative evidence for this idea. Recall that two versions of the scenario were written so that Mr. Jones either left work at his usual time and took a new route home or left work at an unusual time and took his usual route home. When asked to undo the resulting accident, subjects tended to cite a change to the route when the route was described as unusual and tended to cite a change to the time when the time was described as unusual.

In this experiment, we created eight versions of a scenario in which each of three events could be described as an exception or a norm independently of the others. Thus, all three events could be exceptions, all three could be norms, or an event could be described as an exception in the context of two other norms, and so on. This design allowed us to isolate the effect of changing a given event from an exception to a norm or vice versa with and without changing the other events.[4] The design also allowed analyses of context, specifically whether or not people were more likely to change a given event if it was paired with two normal events than if it was paired with two exceptions.

We considered two different approaches to operationalizing the concept of exceptional versus normal as it pertains to an event in a scenario. We rejected the approach of selecting exceptional and normal events because the events would likely differ in numerous ways that in effect would result in different scenarios. We decided instead to use behavioral events for which we could describe the behaviors as typical or atypical of the actor (intrapersonal norms; Kahneman & Miller, 1986). In this way we were able to make the behavioral events equivalent, resulting in the same scenario for all eight versions.

Method

Participants. The participants were 116 students from the introductory psychology research pool at the University of Alberta. Each participant was given one credit for partial fulfillment of introductory psychology course requirements.

Materials. Eight versions of a scenario were constructed. The basic story focused on Tony as he walked to the Aquatic Center for his weekly swim. As he neared the Center, he turned a corner and ran into a man carrying a gun. Tony knocked the man down with his gym bag, grabbed the gun, and ran off. It later turned out that this man was a police officer in pursuit of a bank robber.

Each story version consisted of three events, each framed as either a norm or an exception. First, Tony decided to go swimming on Saturday, although he usually goes on Sunday (exception) or he goes on Saturday as he always does (norm). Second, Tony takes Jefferson Avenue when that is described as the typical route (norm) or when Campbell Boulevard is the typical route (exception). Finally, Tony walks around a field he normally cuts across (exception) or he walks around the field as usual (norm).

Design. A 2 (norm or exception frame for focal event) × 4 (context; other two events are framed as norms, framed as exceptions, Mixed Case A, or Mixed Case B) × 3 (event) mixed factorial design was used. The event factor was a within-subjects factor. Mixed cases of the context factor refer to the cases where one of the nonfocal events is framed as a norm whereas the other is framed as an exception. Mixed Case A merely is a counterbalanced version of Mixed Case B. Thus, for example, Mixed Case A refers to cases where Event 1 (Tony's decision to swim on Saturday) was framed as an exception and Event 3 (Tony decides to walk around the field) was framed as a norm for Focal Event 2, regard-

[4] In the Kahneman and Tversky (1982) study, changing one event from an exception to a norm was always associated with changing the other event from a norm to an exception.

less of how Focal Event 2 itself was framed; Mixed Case B refers to cases where Event 1 was framed as a norm and Event 3 was framed as an exception for Focal Event 2, and so on.

Note that the design does not allow for an analysis on the order of events in this experiment because, unlike Experiment 1, the events were not counterbalanced across order, and we cannot assume that the events were equally related to the outcome. Recall that Vinokur and Ajzen (1982) found that their causal primacy effect held only when the causes had relatively equal relations to the outcome.

Procedure. Participants were given a four-page booklet containing a cover page with instructions, a map detailing Tony's path to the Aquatic Center, one of the eight versions of the thief story, and an answer sheet. The version of the story that any given participant received was randomly determined prior to the experiment. The instructions asked the participants to read the story over carefully and list six ways in which the events in the story could be changed so that the outcome of the story would be different. They were also informed in the instructions that they could refer to the story or the map if they wished. Participants were run in groups of about 20, with an average session lasting about 30 min, after which they were debriefed.

Results

The responses from the participants were summarized independently by two coders. This summarization involved briefly paraphrasing the changes to the story into shorter, more manageable units while retaining the essential ideas put forth by the participant.

The two coders then examined a subset of the responses and used this subset to develop a coding scheme. After the coding scheme was finalized, the entire data set was coded by the two people without awareness of the experimental conditions. Overall, the intercoder reliability was approximately 85% in classifying each unit according to the coding scheme. Discrepancies were resolved via discussion. As seen in Table 3, the final coding scheme contained 13 unique categories of responses. The three manipulated events (Tony's decision to swim on Saturday, his decision to take Jefferson Avenue, and his decision not to take the shortcut across the field) were the three most frequent events changed by participants.

As in Experiment 1, we calculated two indexes of event mutability. First we calculated whether or not each of the three events was the first of the six events mentioned as a function of how the event was framed (norm vs. exception) and whether the event was in the context of two other norms, two other exceptions, or one of the two mixed cases (i.e., one norm and one exception). Unfortunately, this index precluded separate chi-square analyses of the 4 (context) × 2 (frame of event norm vs. exception) design for each individual event because of the low expected frequencies in some of these cells. Collapsing over the three event replications, however, resulted in a sufficient expected frequency for conducting a 4 (context) × 2 (frame of event) chi-square analysis.[5] The interaction component in this analysis was not significant, $\chi^2(3, N = 116) = .84, p < .95$. A chi-square test on the main effect for context was also not significant, $\chi^2(3, N = 116) = 1.6, p < .65$. Finally, a chi-square test for the framing of the event (norm vs. exception) was significant, $\chi^2(1, N = 116) = 15.4, p < .001$.

As with the data from Experiment 1, each of the three events was assigned a rank ranging from 0 to 6, depending on where they appeared in a participant's list of six responses. Therefore,

Table 3
Experiment 2: Categories and Frequencies of Responses to the Undoing of the Thief Scenario

If only . . .	Frequency of response	% of all responses
He had taken Campbell Boulevard	108	23.1
He had taken the shortcut	96	20.5
He had gone on Sunday	46	9.8
He had not swung his gym bag	43	9.2
He had not gone swimming	37	7.9
He had run ino the thief rather than running into the police officer	30	6.4
He had left earlier or later	29	6.2
He had checked out the Bijou first	23	4.9
There had been a sidewalk crossing the field	23	4.9
He had been shot by the police officer or the thief	16	3.4
There had been no robbery	8	1.7
He had taken a bus/cab/bike/car	6	1.3
He did not have a gym bag	3	0.6

Note. Although all 116 participants listed six responses, some were uncodable (e.g., "it was just fate"). In addition, some responses were collapsed into one response. For example, a participant might have said "if only he had left earlier" and then have listed separately "if only he had left later." These two responses were combined in the above coding scheme to indicate only one response. Thus, the total number of responses in this table does not equal our sample size (116) times 6.

if a particular event was the first thing mentioned, it was assigned a score of 0; if it was not mentioned, the event was given a rank of 6. The average rank for each event according to its position in any given scenario is presented in Table 4.

Separate 2 (normal vs. exceptional frame for event) × 4 (context) ANOVAS were conducted for each of the three events. For the first event, context had no significant effect, and context did not interact with the event frame. The event frame (normal vs. exceptional), however, produced a significant main effect, $F(1, 108) = 117.3, p < .001$. Specifically, Tony's decision to swim on Saturday produced a lower mental-alteration rank when it was framed as an exception than when it was framed as a norm (Ms = 2.7 vs. 5.9, respectively).

The mean mutability rank for the second event, Tony's decision to take Jefferson Avenue rather than Campbell Boulevard, was unaffected by context, and context did not interact with the event frame. However, there was a main effect for the event frame such that the mean mutability rank for changing the Jefferson Avenue event was 1.1 when framed as an exception and 1.7 when framed as a norm, $F(1, 108) = 4.405, p < .05$.

A similar pattern of results emerged for the third event, Tony's decision not to cut across the field, wherein there was no Context × Frame interaction but framing the event as an

[5] As with Experiment 1, each subject contributed only one data point to these chi-square analyses. This is true regardless of whether we collapse over events because we counted only the first of the three events that was mutated by each subject. Thus, these analyses do not violate the independence assumption in chi-square analyses, and any analysis of nonmentions would be redundant with these analyses.

Table 4
Experiment 2: Mean Rank of Event Changes as Functions of the Events and Their Norm or Exception Status

Focal event	Context (normality of other two events)				
	Both norms	Both exceptions	Mixed Case A	Mixed Case B	*M* across context
Goes swimming on Saturday					
Norm: Usually goes on Saturday	6.0	6.0	5.6	5.8	5.8
Exception: Usually goes on Sunday	3.4	2.3	3.3	1.9	2.7
Takes Jefferson Avenue					
Norm: Usually takes Jefferson Ave.	1.3	1.5	2.1	1.9	1.7
Exception: Usually takes Campbell Boul.	1.3	1.5	0.7	0.8	1.1
Walks around field					
Norm: Usually walks around field	2.4	4.0	2.6	3.4	3.1
Exception: Usually cuts across field	2.1	2.5	1.9	2.5	2.3
M across focal events	2.8	3.0	2.7	2.7	

Note. Mixed Case A was one in which Event 2 was normal and Event 3 was exceptional for Focal Event 1; Event 1 was normal and Event 3 was exceptional for Focal Event 2; Event 1 was normal and Event 2 was exceptional for Focal Event 3. Mixed Case B reversed the norm and exception status of the nonfocal events.

exception produced a lower average mutability rank ($M = 2.3$) than did framing it as a norm ($M = 3.1$), $F(1, 108) = 7.902$, $p < .001$. Unlike the first two events, however, context had a significant main effect on the mutability of the third event, $F(3, 108) = 2.788$, $p < .05$.

Because this third event was the only one to show a context effect, we collapsed over events to see if the context effect was significant for the combined events even though it failed to reach significance for two of the three events. The context effect failed to surface when collapsed over events, and the resulting *F* ratio was less than 1.0.

Discussion

Experiment 2 lends strong support to Kahneman and Tversky's (1982) and Kahneman and Miller's (1986) assertion that exceptional events are more psychologically mutable than are normal events. Events that were depicted as violating an intrapersonal norm were more likely to be the first event changed by our participants. In addition, these exceptions received a lower average rank in the participants' list of changes than did events depicted as normal for the actor. We see no reason to question the idea that exceptions are more psychologically mutable than are norms, and we suspect that there are several reasons why this differential-mutability effect occurs. First, an exceptional event is perhaps more likely than is a normal event to be focal and attention getting, and Read (1985) reported that focal events are more mutable than are background events. Exceptional events may also be more likely to be perceived as causes than are normal events (Kahneman & Miller, 1986), and of course the task of undoing is directed at causes. Exceptions may also be more likely than norms to be mentally coded as occurrences whereas norms are more likely to be mentally coded as nonoccurrences, and thus the perceived correlation between exceptions and outcomes may be stronger than the perceived correlation between norms and outcomes (e.g., Chapman & Chapman, 1967).

Interestingly, we did not find support for the idea that a given event would be more mutable in the context of normal events than it would be in the context of exceptional events. In other words, an exceptional or normal event was no more or less likely to be altered when the other two events were both exceptions, both norms, or a mixture of norm and exception. Our lack of effect in changing the normality of surrounding events on the mutability of a given event may be related to Kahneman and Miller's (1986) model of norms. In contrasting normality with probability, they proposed that "unlike probability, the normality of a value of an attribute can increase without a corresponding reduction in the normality of any other" (p. 140). In the case of the events that were manipulated in Experiment 2, the comparisons were more stimulus centered than category centered, a continuum for defining normality that Kahneman and Miller related to the evocation of norms. Category-centered norm judgments "can be biased by context or background" (1986, p. 140), whereas stimulus-centered norm judgments "tend to be recruited directly from the stimulus" (p. 140). In this sense, the evocation of norms in the scenario for Experiment 2 were independent; the normality of Tony's swimming on Saturday, for example, is unaffected by whether he usually takes a shortcut to the Aquatic Center.

Although the average mutability rank of a given manipulated event was unaffected by the normality of the other two events, the average rank of all three manipulated events was affected by whether all three of these events were norms (average rank = 3.2) or whether all three were exceptions (average rank = 2.1). In other words, the unmanipulated events in the scenario (e.g., Tony taking a bus or not carrying a gym bag) were more likely to be changed if the manipulated events were all at their normal values than if they were exceptional.

General Discussion

We began our research on mental undoing with a question about order effects in causal scenarios. In spite of the fact that it would take fewer mental calculations to simulate the effects of an event contiguous to the outcome than an event several steps removed from the outcome, people showed a strong preference for changing the first of the four events in the causal chain. The fact that there was no order preference for changing the subsequent three events suggests to us that it is difficult to imagine the subsequent events not having occurred, given that the first event set a causal course for the subsequent events. In other words, Events 2, 3, and 4, although causes of the outcome, are also effects of a prior cause. As effects, these events are constrained in terms of plausible alternatives unless or until their prior cause, Event 1, is removed. This effect for the first event held strongly regardless of which of the four events was rotated into the first position.

Our second experiment provides strong support for the contention of Kahneman and Tversky (1982) and Kahneman and Miller (1986) that exceptional events are more mutable than are normal events. This effect held across all three manipulated events and was achieved by merely reframing the events (as intrapersonally normal or exceptional) rather than by selecting events that were exceptional or normal in themselves. We suspect that the effect would be even more robust if events were selected for their exception or norm properties rather than merely framing a given event toward the exception or toward the norm.

There is a conceptual relation that might not be readily apparent between our contention that effects are less mutable than are causes and the observation that norms are less mutable than are exceptions. Our contention is that an event becomes relatively immutable to the extent that it is perceived to have been caused by some prior set of conditions because these prior conditions constrain the range of imaginable possibilities. Conversely, this range of imaginable possibilities is increased if no prior cause or an inhibiting cause for the event is known to exist. In the context of the norm–exception distinction, we think it is possible that normal events are perceived to be constrained by prior causes (e.g., social rules, legal rules, habit), whereas exceptions to the norm epitomize the essence of events that occur in spite of rather than because of these constraints. Thus, the event "the gun fired" is normal and immutable given the prior condition "he pulled the trigger," whereas it is exceptional and mutable given the prior condition "no one pulled the trigger." Perhaps it isn't the normal or exceptional status of the event per se that affects mutability, but instead it is the constraints imposed by the prior cause; in the former case, the gun fired because of the prior cause, whereas in the latter case it fired in spite of the prior cause.

Our description of the undoing process might have implications for the role of imagination on the prediction of future outcomes and the explanations given to hypothetical outcomes (e.g., see Carroll, 1978; Ross, Lepper, Strack, & Steinmetz, 1977; Sherman, 1980; Sherman, Cialdini, Schwartzman, & Reynolds, 1985). We suggest, for example, that the events that people choose to undo in order to alter an outcome are the same events that make the outcome easy to explain. It might be that when asked to explain an outcome, people run a mental simulation to see which events, if changed, would alter the outcome, and then use the occurrence of those events to explain the outcome. As for the prediction of future outcomes, the undoing process might be one of the heuristics that a predictor uses in evaluating the likelihood that a given outcome will occur. Specifically, the predictor might imagine outcome X and reject it as improbable to the extent that it is easy to undo the outcome through simple event mutations. The outcome that is most difficult to undo, because of the perceived immutability of the hypothetical prior events, is the one predicted to occur.

Research on how people mentally simulate alternative outcomes to scenarios might have implications for the study and understanding of counterfactual emotions. Feelings of regret, disappointment, grief, and so on may be all the more intense when one can easily simulate an alternative event sequence that would have led to a different outcome (Kahneman & Miller, 1986; Kahneman & Tversky, 1982). Grief over the loss of a loved one, for example, might be especially profound when one of the events in the scenario could easily have been different in a way that would have not resulted in the loss; if that event was an action of the griever, the seemingly endless if-only thoughts might prove particularly traumatic. Knowing how and why people focus on certain events more than others when mentally simulating alternative outcomes might aid in the understanding of such counterfactual emotions.

Suppose, for example, Mrs. Jones phoned and asked Mr. Jones to come home early one day, and in doing so he suffered a fatal crash. The results of Experiment 1 suggest that the plague of focusing on the phone request with if-only thoughts might not be placated by implicating later events (such as Mr. Jones' decision to turn right or left at some intersection) because it was Mrs. Jones' telephone request that set the causal chain on its course to death. However, drawing Mrs. Jones' attention to a prior event that caused her phone call (e.g., a flooding basement) should make her action appear to be an effect constrained by a prior event and thereby relatively immutable. Experiment 2 suggests further that it would allay her feelings very little, if at all, to point out other causal events that are exceptional (e.g., he usually takes Seashore Drive but he took St. James Road); however, reframing the problematic event itself (e.g., she always calls and he comes home early when the basement floods) should reduce its perceived role in the outcome.

In addition to addressing the role of event mutability in affective reactions, future research should address the question of when people will naturally or spontaneously engage in counterfactual thinking. Our research, and that of Kahneman and Tversky (1982) and Kahneman and Miller (1986), describes how people choose events to mutate when requested to undo a scenario outcome. But what are the conditions that naturally trigger these counterfactual thoughts? We suspect that the most robust of these natural triggers is likely to be the valence of the outcome. Sequences of events that produce negative outcomes seem to us to evoke more strongly thoughts of what might have been than do sequences that lead to neutral or positive outcomes. Perhaps this is because people expect positive or neutral outcomes more than they expect negative outcomes.[6] Alternatively, people might be motivated toward mentally simulating alternative events that could somehow prevent negative outcomes so as to know how to avoid (or whether they can avoid) such outcomes in their own lives.

[6] We credit Igor Gavanski with this idea.

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1988 APA Convention "Call for Programs"

The APA "Call for Programs" for the 1988 annual convention will appear in the October issue of the *APA Monitor.* The 1988 convention will be in Atlanta, Georgia, from August 12 to August 16. Deadline for submission of programs and papers is December 21, 1987. This early deadline is required because the 1988 convention is earlier in August than in the past. Additional copies of the "Call" will be available from the APA Convention Office in October.