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Story Understanding and Counterfactual Reasoning

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D. Kahneman and A. Tversky (1982), in a seminal study on counterfactual reasoning, claimed empirical support for a *simulation heuristic* wherein ease of converting unusual conditions determines their selection as causes over normal conditions. Discourse analysis of their stories revealed a confounding of explanation and normality. A connectionist simulation of online comprehension and memory access of alternative conditions without conversion accounted for their data. Normality and explanation were varied independently in 2 experiments. Explanation but not normality affected the rank ordering of counterfactual conditions after reading. Access of alternative conditions in simulation was again the best predictor of empirical findings. Comprehension and memory operate where stories communicate information for decision making such as counterfactual reasoning and hindsight bias.

Introduction

In 1820, the whaling ship *Essex* was attacked and sunk by a sperm whale and was the only known case of a whale attacking a ship (Philbrick, 2000). This event became the inspiration for Herman Melville's novel, *Moby Dick.* The whale had attacked twice. First Mate Owen Chase aimed a lance at the whale as it began its second attack. Chase hesitated and did not throw the lance. He was afraid that if he wounded the whale, its thrashing would damage the ship's rudder.

Philbrick (2000) gives two different causal accounts for the sinking of the Essex. The first is through the eyes of Owen Chase, who survived and published his diary. Later that night, Chase is described as thinking that if he had only hurled the lance, he might have prevented the sinking of the ship. The second causal account is that of Philbrick, who formulates an alternative explanation: Male whales make clicking signals that are steady with regular, 0.5-s intervals: These signals are designed to warn other males of their presence. As it turns out, Chase and others were repairing the hull of one of the ship's boats using a hammer to nail boards in place. The tapping of the hammer is hypothesized to have resembled a whale's signals and led the whale to perceive that the *Essex* was a second, male whale invading its territory.

The story of the *Essex* illustrates how different people engage in different kinds of causal reasoning about the same event. First Mate Chase and Philbrick both search the past for a set of conditions that, for them, serve as causes. The first mate assigns himself responsibility for not doing something that could have prevented the sinking. Philbrick, in contrast, provides an explanatory account based upon scientific knowledge not available in 1820. He focuses on a different set of conditions that could have produced the attack. The first mate's causal attribution involved explicit counterfactual reasoning. The author's causal analysis implies that if the sailors had not been repairing boats using hammers, the attack and the sinking might have been prevented. Both counterfactuals take on the form: If not A then not B (Mackie, 1980).

The psychological study of counterfactual reasoning has focused on the undoing of past outcomes by altering their causal antecedents. In a seminal study by Kahneman and Tversky (1982), participants were asked to imagine what could have prevented the death of a fictional agent, Mr. Jones. Participants read a story in which Mr. Jones leaves his office at a certain time, takes a particular route, stops at an amber light at an intersection, and resumes his journey when the light turns green. Mr. Jones is killed when a speeding truck, driven by a teenaged boy who is on drugs, strikes his vehicle in the intersection. Across two story versions, Kahneman and Tversky varied whether the time of departure or the route taken was normal or unusual. Following the reading of the narrative, the participants were asked to complete the thoughts of a family member in response to an "If only. . ." stem. The participants' completions were analyzed according to which one of four conditions (time of departure, route taken, the stopping at an intersection, or the state of the truck driver) was mentioned first. The condition that was described in the story as unusual tended to be mentioned first.

Kahneman and Tversky (1982) proposed a *simulation heuristic* to account for their findings. They assumed that the conditional part of a counterfactual requires conversion of what was done (e.g., taking a regular route) to an alternative that was not done (e.g., taking of an unusual route) in order to undo the consequence (e.g., Mr. Jones's not being killed). They assumed that the conversion of an unusual condition to its normal alternative was easier to accomplish than the conversion of a normal condition to its unusual alternative. The difference in the ease of conversion was the reason for the observed preference in selection of unusual over normal conditions as causes. Wells, Taylor, and Turtle (1987), in a repli-

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For additional developments see our World Wide Web page at http://www.ccp.uchicago.edu/~tomt/textnet/. A Windows version of the program is also available from Tom Trabasso.

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cation and extension of Kahneman and Tversky, claimed to find support for the hypothesis that unusual events are more easily converted (*mutable*). Kahneman and Miller (1986) in their article on "norm theory" interpreted the findings of Kahneman and Tversky in terms of the logic of available choices. They claimed that unusual events evoke normal alternatives but that normal events do not evoke unusual alternatives and, as a result, unusual events are more likely targets for undoing. Roese (1997), in a review of the study of counterfactuals, concluded that as far as content is concerned, unusual conditions are more likely to be negated than are normal conditions.

Kahneman and Tversky (1982) presented their participants with a story and asked them to take the perspective of a family member in order to make a decision about which conditions in the story could serve as causes to be undone in a counterfactual. It seems reasonable to suppose that participants had to read, understand, and represent the situation in order to decide which conditions might be selected as causes. The simulation heuristic, however, focuses only on the basis for deciding which conditions are easiest to convert. The roles of story understanding, memory, and representing the situation are ignored.

A central purpose of the present article is to examine the role that comprehension plays in counterfactual reasoning and decision making, with a focus on the study by Kahneman and Tversky (1982). Pennington and Hastie (1993), in their analysis of jury decision making, pointed out that decision makers do not base their decisions on a complete rational analysis of the situation, but often represent a situation as a story favoring the decision that fits best into the representation that they have constructed. Kintsch (1998) applied his construction and integration comprehension theory to decision-making tasks such as the conjunction fallacy (*Linda the bank teller* and *Asian disease problems*) studied by Tversky and Kahneman (1983). Kintsch (1998) suggested that these tasks could be performed by constructing a network representing the text and using spreading activation to integrate the network. If readers construct a text representation at the narrative level and base their decisions on the activation values of decision-relevant propositions in the text representation, then the kind of decision "errors" made by participants could be understood. Kintsch (1998) was able to simulate empirical findings of the conjunction fallacy and other problems.

This article presents a study of story comprehension and decision making in a counterfactual task. The approach taken is consistent with the text representation, integration, and memory access of Kintsch (1998). Two questions are addressed: (a) How do participants understand the stories of Kahneman and Tversky (1982)? (b) How do they use their representations of the text to decide which conditions to select as causes in a counterfactual reasoning task?

Causal reasoning and explanation-based understanding is central to story understanding (Schank, 1975; Stein & Glenn, 1979; Trabasso, Secco, & van den Broek, 1984). The discourse analysis of Trabasso, van den Broek, and Suh (1989) is adopted here to study how stories are understood and represented. This analysis identifies the causal inferences that connect clauses in the text and enable a reader to construct a situation-level, text representation. The text representation is a causal network of clauses and relationships. Integration of clauses in the text representation is achieved by processing the clauses and their causal links with a connectionist model (Langston & Trabasso, 1999). The model outputs connection strength values for clauses that index their accessibility in memory. These measures are used in simulation to predict which conditions are accessed as causes in counterfactual decisions. The predictions are evaluated against the data of Kahneman and Tversky (1982).

Preliminary Discourse Analysis of the Mr. Jones Story

In the Mr. Jones stories, normality of the same condition (either route or time) was a between-versions variable. However, normality also varied for route and time within a condition. A preliminary discourse analysis of the story versions revealed that normality of conditions was confounded with explanation.

In the route version, the unusual route taken by Mr. Jones was explicitly stated and explained. A normal route was referenced but not explained. To illustrate, consider first the following five clauses from the route version: (a) Mr. Jones did not drive home by his regular route. (b) The day was exceptionally clear, and (c) Mr. Jones told his friends at the office that (d) he would drive along the shore (e) to enjoy the view. Clauses (b) through (e) provide the reader with reasons why Mr. Jones drove home by the shore and did not take his regular route. This unusual action is explained by weather conditions and Mr. Jones's goal to enjoy the view. In the time version, Mr. Jones took his normal ("regular") route. This action is not explained, but the unusual route is discounted. The following four clauses of the time version contrast with those for the route version: (a) Mr. Jones drove home along his regular route. (b) Mr. Jones occasionally chose to drive along the shore (c) to enjoy the view on exceptionally clear days, but (d) that day was just average. Discounting clauses (b) and (c) negates their existence as conditions in the story. Because they did not occur in the situation model of story, they have no causal antecedents or consequences. The fact that the day was average in Clause d is a reason why Mr. Jones took his regular route.

Between versions, the route taken receives more explanation when it is unusual than when it is normal. The difference in explanation could make the unusual route more accessible in the route version than the normal route in the time version. Kahneman and Tversky (1982) found that more participants generated the route as a cause in the route than in the time version.

In the time version, the unusual time that Mr. Jones left the office was referenced and explained, whereas the normal time was not mentioned. Consider the following three clauses of the time version in which Mr. Jones leaves earlier than usual: (a) Mr. Jones left the office earlier than usual (b) to attend to some household chores (c) at his wife's request. Clauses b and c provide goals that explain why Mr. Jones left his office earlier than usual. In contrast, in the route version, in which the time of departure is normal, the above reasons for leaving earlier are discounted in Clause e: (a) Mr. Jones left his office at the regular time. (b) He sometimes left early (c) to take care of home chores (d) at his wife's request, (e) but this was not necessary on that day. Clause e is one reason why Mr. Jones left at the normal time, but it also discounts the unusual time alternative. The difference in explanation could make the unusual time condition more accessible in the time version than the normal time in the route version. Kahneman and Tversky (1982) found that more participants generated time as a cause after reading the time version than the route version.

Within versions, the normality-explanation confound also operates. This is particularly important since it is within a version that

a reader selects causes. For example, in the route version, the unusual route taken receives more explanation than the normal time taken; likewise, in the time version, the unusual time taken receives more explanation than the normal route taken. Within a version, the normality manipulation is confounded with content; that is, the reader must choose between route and time conditions as causes.

Confounding explanation, normality, and content might account for the relative differences in the proportions of participants who selected the particular conditions as causes. Explanation provides the conditions necessary for a particular condition in the circumstances of the story (Mackie, 1980) and increases the number of causal connections that readers could infer between conditions. The number of connections is directly related to the connection strength of a condition and connection strength is a valid, quantitative predictor of accessibility in online comprehension and recall (Langston & Trabasso, 1999). Within the same story in which different contents are compared, explanation of the unusual condition is likely to enhance its accessibility at the expense of the normal condition that is discounted and not explained. Across stories where the same content is compared, the unusual condition that is explained is more accessible than the normal condition that is discounted and not explained.

The simulation heuristic of Kahneman and Tversky (1982) implies that, for any cause to be selected, at least two conditions—the normal and the unusual—would have to be accessed, converted, and compared. In the Mr. Jones story, there are actually four conditions of actions taken and four corresponding alternative conditions not enacted. For the reader to make choices based on the relative ease of conversion of each of the four conditions related to Mr. Jones's death, it would be necessary to access all eight conditions, convert each of them to their alternative, and compare the results of the eight conversions with regard to ease. These processes, complex as they are, seem necessary if the simulation heuristic is to account for all the differences found between the likelihood of selecting each of the four causes. These processing demands are extremely high and, as things now stand, there are no independent measures of the ease of conversion for different kinds of conditions to test the simulation heuristic. Further, Kahneman and Tversky's explanation appears to be circular because it is based on a redescription of the result (i.e., unusual causes were selected more often) and thus, is equivalent to the hypothesis that unusual causes are easier to convert. They provide no independent evidence on the ease of conversion and no manipulation checks were carried out to explain whether participants inferred the normality of conditions.

Is conversion of an antecedent cause necessary to generate a counterfactual and alter the consequent? The main means of forming a counterfactual is to simply negate the antecedent condition and the consequent (Lewis, 1973). If Mr. Jones had not driven along the shore he would not have been killed. Negation is not equivalent to conversion. Conversion, in our view, means that readers transform what was done to an alternative that was not carried out; that is, *if Mr. Jones took a different route, he would have lived,* or *if Mr. Jones took his regular route he would not have been killed.* If participants negate an antecedent in order to negate the consequent, then they would have to access the conditions that actually occurred; for example, Mr. Jones's leaving time, route taken, stop at the intersection, and the boy driving the truck at high speeds while on drugs. In the simulations we will present, we test whether the accessibilty of the actions taken predicts the likelihood of selecting them as causes in the counterfactual task.

Another way in which counterfactuals could be generated without conversion is through the accessing and selection of an alternative condition that was not taken as the antecedent in a counterfactual conditional. If the participants acting as family members wished that Mr. Jones had lived, they could access directly the alternative condition. In the route version, for example, they could generate *if only Mr. Jones had taken his regular route, then he would have lived.* Access of alternative conditions to those actually taken is possible because they were mostly available in the stories and, presumably, were also available in memory. In the simulation, we tested whether access of alternative conditions of actions that were not taken predict the likelihood of selecting causes.

Kahneman and Tversky (1982) explicitly ruled out availability as an explanation of their data. They may have done so because they believed that they referenced the alternative conditions in the stories, and hence, made them "available." Assume that participants read, understood, and represented in memory both the unusual and the normal conditions. If so, then both conditions were available. However, availability in memory is not the same as accessibility in memory, a distinction made by Tulving (1967). The differences in explanation for conditions might have made one condition more accessible than another, even though they were both available in memory.

Purpose of the Present Study

The present study provides an alternative process account of how, which, and to what degree conditions are accessed and selected as causes in counterfactual tasks. To accomplish these aims, we used a theory of dynamic understanding of narratives proposed by Langston and Trabasso (1999). This approach corresponds to the three-pronged approach advocated by Magliano and Graesser (1991) in the study of discourse processes. The test of the theory uses (a) a discourse analysis and (b) a connectionist process model to (c) predict behavioral measures of comprehension. The theory allows one to identify which conditions might be accessed as causes, quantify the accessibility of conditions, and use these measures of accessibility to predict the likelihood of each condition being selected in counterfactual decision making.

The discourse analysis of Trabasso et al. (1989) allows the a priori identification of potential causal connections between clauses that could be inferred by readers who construct a text representation during comprehension. The connectionist process model of Langston and Trabasso (1999) integrates clauses into a text representation on the basis of their connections and measures the connection strength of clauses. Construction and integration are simulated when causal networks derived from the discourse analysis are presented to the connectionist model for processing, one pair at a time. The model outputs an $n \times n$ matrix of connection strengths between all possible pairs of conditions processed up to any point in the story. From this matrix, average connection strengths of a condition or the connection strength between a pair of conditions are obtained. Appropriate measures of connection strength are used to predict accessibility in behavioral measures of comprehension. Which measure is selected depends on whether one or multiple conditions are assumed to activate a particular condition. For example, in free recall, multiple connections are activated, so the appropriate measure is the average

connection strength of a clause. In priming, a single condition activates another condition, so connection strength between the two conditions is the appropriate measure (see Langston & Trabasso, 1999, for several examples of successful simulations of comprehension data that use single or multiple access measures). In the simulations presented below, we examine whether single or multiple means of access best predict the data.

Simulation 1 is of the data from the Kahneman and Tversky (1982) study. Our experimental goal was to unconfound normality, explanation, and content by between-story comparisons with the same conditions that vary independently in their normality and explanation. In this regard, we report two new experiments on counterfactual reasoning with independent variation of these variables. We assessed the accessibility of causes after reading a story by having participants rank order alternative conditionals that would have prevented the actual outcome. Theoretical accessibility is measured by average connection strengths of conditions as output from a connectionist model. Simulation 2 tests how well the measures of connection strength predict accessibility of conditions in Experiments 1 and 2.

Simulation 1

Discourse Analysis

We parsed the route and time versions of the Mr. Jones story into clauses. Each clause had one predicate, usually a verb, and a predicate may have one or more nouns as arguments. In the parsing, goals expressed as infinitives and space or time information were separated as clauses from sentences containing them and a verb predicate. The parsed route and time stories are shown in Table 1. Each clause is numbered as to the surface order in which it occurred in the story along with its episodic classification that is explained below. Tom Trabasso trained Jake Bartolone on parsing using a set of stories taken from Trabasso et al. (1989). The authors then parsed each version of the Kahneman and Tversky (1982) study independently. Using Tom Trabasso's decision as a "signal," the hit rate (rate of agreement) for parsing was .94 for each version. The false-alarm rates for the route and time versions were .06 and .00, respectively. The respective miss rates were .00 and .06. The overall kappa for each version was .92 (a value of .75 or higher is normally judged to be reliable). These data indicated high agreement and reliability for parsing.

We then classified the parsed clauses according to the episodic story scheme described in Trabasso, van den Broek, and Suh (1989). The classification provides a basis for organizing the story into episodes and aids in identifying causal relations. Trabasso et al.'s (1989) episodic categories are based on those of Stein and Glenn (1979). Each author classified each clause of each parsed version independently. The hit rates on classification with the five categories were .92 and .91 for the respective route and time versions. The respective false-alarm rates were .08 and .09; there were no misses. The overall kappa was .89 for each version. These data indicate that the episodic classification of clauses is highly reliable.

Causal Networks

Causal relations were found for each clause in each version based on Trabasso et al.'s (1989) procedures. The two authors independently identified causal relations among the clauses for each version. Tom Trabasso was taken as the target and Jake Bartolone as the observer. The respective hit rates were .87 and .85. The respective false alarm rates were .02 and .06; the respective miss rates were .11 and .08. The overall kappa was .93 and .92 for the respective versions, indicating high reliability on identification of causes. Differences between the authors were resolved by discussion.

Figure 1 shows the resulting causal-network representations of the versions. To facilitate identification of alternative conditions, the labels of time, route, and crossing in Figure 1 are those for alternative conditions. The exception is for time in the route version because there was no alternative time referenced in this version. Here, the actual condition is labeled. There also was no alternative condition given in either version for the state of the boy, so the actual condition is labeled for the statements about the boy's state.

In Figure 1, a directed arrow labels a causal relation. The causal analysis assumes that a cause is temporally prior to a consequence. The stories had several temporal inversions of events so that the surface order of clauses does not correspond to the actual temporal order of conditions. Inversions can be seen in Figure 1 where nodes higher in number are causes of nodes lower in number (e.g., goal G17 motivates goal-attempt G/A16).

Causal chains and conditions. The necessity in the circumstances of the story for each causal relationship was tested in the form of a counterfactual: If not A, then not B (Mackie, 1980). This logical criterion aids in identifying causal relations (Trabasso et al., 1984; 1989). A successful counterfactual test of the individual necessity assumption indicates that there is a causal dependency between two conditions. In both networks, a causal chain can be traced from an initial action in which Mr. Jones leaves the office (A6) at a certain time (S7 or A7) to an outcome in which Mr. Jones is killed (O33 or O30). Negating any condition on this chain prior to these respective outcomes would prevent Mr. Jones's death. That is, in the circumstances of the story, if he did not leave at the time he did (S7 or A7), he would not have been killed (O33 or O30). Or, if he had driven home by a different route (A13 or A10), he would not have been killed (O33 or O30) in the circumstances of the story. Or, if he had not stopped at the crossing (A24 or A21), he would not have been killed (O33 or O30) in the circumstances of the story. Finally, if the boy's truck had not rammed his car, he would not have been killed (O33 or O30) in the circumstances of the story. These four conditions constituted the vast majority (95%) of those selected by participants in the Kahneman and Tversky (1982) study. Conditions on the causal chain are those that actually occurred in the Mr. Jones story so that their negation makes the counterfactual true in the circumstances of the story. We note that in the route version, the alternative conditions of regular route in A13, time in A8, and crossing in S26, and in the time version, the alternative conditions of route in G/A12 and crossing in S23 enable the formulation of counterfactuals without negation or conversion.

Common nodes. The networks in Figure 1 are identical in structure except for information concerning or directly related to the time of departure and the route taken. Once Mr. Jones leaves the office in A6, the structures are the same. The route version has three more clauses than the time version before Mr. Jones begins driving so that the surface numbers of the clauses do not correspond across versions. In the respective route and time versions,

Table 1
Route and Time Versions of the Mr. Jones Story

Surface order	Category	Clause
		Route
1	Setting	Mr. Jones was 47 years old,
2	Setting	(Mr. Jones was) the father of three, and
3	Setting	(Mr. Jones was) a successful banking executive.
4	Setting	His wife has been ill at home for several months.
5	Setting	On the day of the accident,
6	Attempt	Mr. Jones left the office
7	Setting	(left) at the regular time.
8	Attempt	He sometimes left early
9	Goal	to take care of home chores
10	Event	at his wife's request,
11	Setting	but this was not necessary
12	Setting	on that day.
13	Attempt	Mr. Jones did not drive (home) by his regular route.
14	Goal	(to go) home
15	Attempt	and Mr. Jones told his friends at the office
16	Goal	that he would drive along the shore
17	Goal	to enjoy the view.
18	Setting	The day was exceptionally clear.
19	Outcome	The accident occurred
20	Setting	(occurred) at a major intersection.
21	Event	The light turned amber
22	Attempt	as Mr. Jones approached.
23	Outcome	Witnesses noted that
24	Attempt	he braked hard to stop
25	Setting	(stop) at the crossing
26	Setting	although he could easily have gone through.
27	Setting	His family recognized this
28	Setting	as a common occurrence in Mr. Jones' driving.
29	Attempt	As he began to cross
30	Event	after the light had changed
31	Event	a light truck charged into the intersection at top speed
32	Outcome	and rammed Mr. Jones' car from the left.
33	Outcome	Mr. Jones was killed instantly.
34	Outcome	It was later ascertained that
35	Setting	the truck was driven by a teenage boy
36	Setting	who was under the influence of drugs.
		Time
1	Setting	Mr. Jones was 47 years old,
2	Setting	(Mr. Jones was) the father of three, and
3	Setting	(Mr. Jones was) a successful banking executive.
4	Setting	His wife has been ill at home for several months.
5	Setting	On the day of the accident,
6	Attempt	Mr. Jones left the office
7	Attempt	(left) earlier than usual
8	Goal	to attend to household chores
9	Event	at his wife's request.
10	Attempt	Mr. Jones drove (home) by his regular route.
11	Goal	(to go) home
12	Goal/attempt	Mr. Jones occasionally chose to drive along the shore
13	Goal	to enjoy the view.
14	Setting	on exceptionally clear days
15	Setting	but that day was average
16	Outcome	The accident occurred
17	Setting	at a major intersection.
18	Event	The light turned amber
19	Attempt	as Mr. Jones approached.
20	Outcome	Witnesses noted that
21	Attempt	he braked hard to stop
22	Setting	(stop) at the crossing
23	Setting	although he could easily have gone through
24	Setting	His family recognized this

Table 1 (*continued*)

Surface order	Category	Clause
	Time (*continued*)	
25	Setting	as a common occurrence in Mr. Jones' driving.
26	Attempt	As he began to cross
27	Event	after the light had changed
28	Event	a light truck charged into the intersection at top speed
29	Outcome	and rammed Mr. Jones' car from the left.
30	Outcome	Mr. Jones was killed instantly.
31	Outcome	It was later ascertained that
32	Setting	the truck was driven by a teenage boy
33	Setting	who was under the influence of drugs.

the key common conditions are not driving (A13) or driving (A10) the regular route, stopping at the crossing (A24 or A21) and the boy's drugged state (S36 or S33). Depite the differences in the number of clauses prior to Mr. Jones's driving, the pairs of identical conditions have similar networks and should be similar in accessibility.

Explanation and connectivity. The explanation effect on connectivity can be seen in Figure 1. In the route network, the actual, unusual condition is attempt A13 in which Mr. Jones drives along a route that is not his regular one. The inferred actual route is the shore, given in a goal-attempt clause, G/A16. The text sentence that contained attempt A13 also had an embedded goal to go home. The goal to go home was separated out as G14 from the attempt in A13 to drive along a route other than his regular one. The separation was done since a goal has a different structural role in causal explanation than does an attempt. Clause A13, an attempt, has four causal antecedents that either motivate or enable it. Goal G14 motivates Mr. Jones to drive along a route. The goal to go enjoy the view in G17 motivates his driving along a route different than normal in A13. The not taking of his regular route, stated in A13, is explained by the goal/attempt in G/A16 to drive along the shore. Finally, leaving the office in attempt A6 enables driving along a route in A13. Counterfactual tests are offered in support for the four causes identified for A13. In the circumstances of the story, Mr. Jones would not have been able to drive along a particular route, if he had not left his office. Furthermore, he would not have taken a different route, if he had not desired to have a good view.

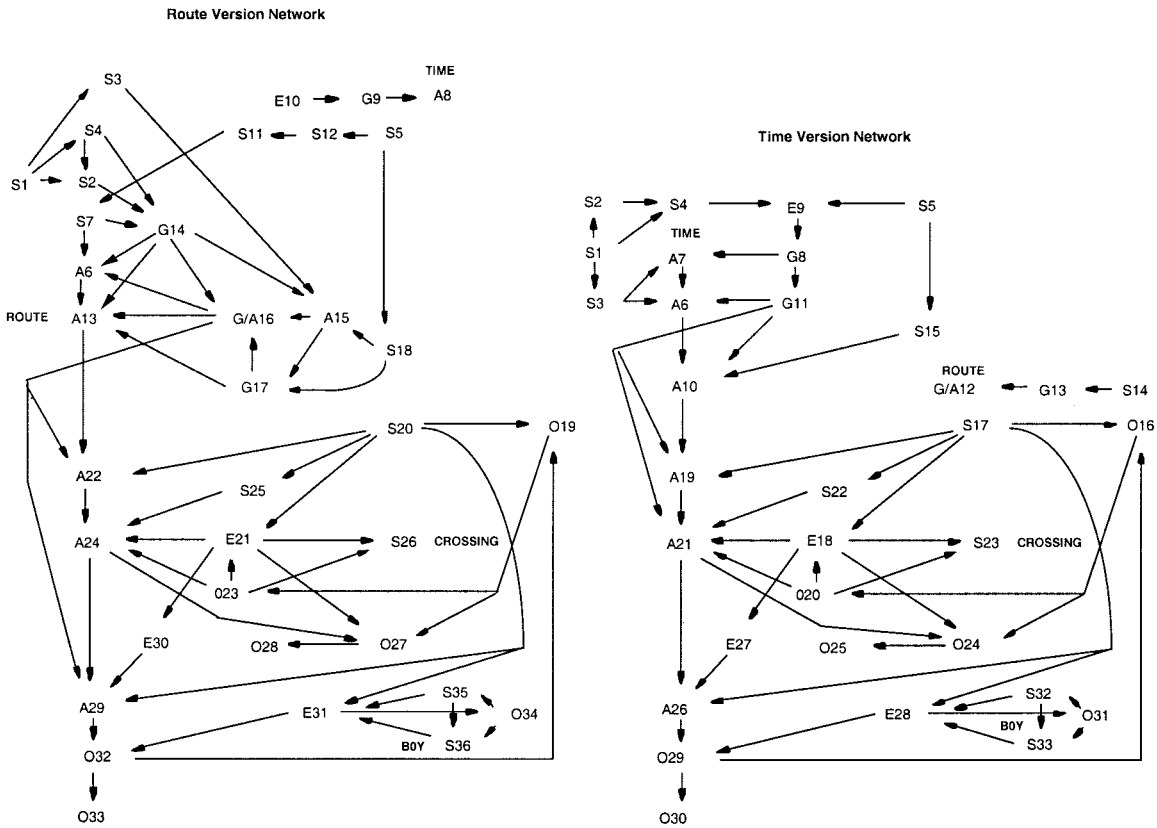

Figure 1. Route and time version causal network. Arrows indicate a causal relation. S = setting; E = event; A = attempt; G = goal; G/A = goal/attempt; O = outcome.

Also, he would have taken his regular route if he had not wanted to drive along the shore. He would not have driven on a particular route if he had not desired to go home.

In the route story, information on the route actually taken, the shore, is contained in the goal attempt G/A16, whereas information on the route not taken is contained in attempt A13. The desire to take the shore in G/A16 is motivated by a goal to enjoy the view in G17 and by the goal to go home in G14. Mr. Jones telling his friends at the office in A15 enables communication of his goals in G/A16 and G14. We discussed the dependencies among these clauses in our illustration of the explanation-normality confound above.

The route taken in the route version was the shore, an unusual route, and it is explained by three conditions. The route not taken in the route version was the normal route and its clause was explained by four causes. The causal analysis thus indicates that while the unusual route taken is explained, so too is the information given in A13 on the normal route. Explanation in the route version actually increased the connectivity of both the unusual route that is taken and its normal alternative. The unusual route should be nearly as accessible as the normal route within the route version.

In the time version, the regular or normal route that is actually taken is in A10. This attempt is motivated by a goal to go home in G11 and is enabled by Mr. Jones's leaving the office in A6. If he did not want to go home and if he did not leave the office, he would not have driven home by his regular route in the circumstances of the story. The alternative unusual route that was not taken is expressed in G/A12 as a combined goal and attempt. Clauses G/A12, G13, and S14 are, however, discounted by setting S15, an average day. The consequence is to isolate, causally, these three clauses in the time version network. Goal G13, to enjoy the view, would have motivated G/A12, and G13 would have been enabled by a setting of a clear day in S14. But, these interrelated conditions do not exist and are therefore not carried out in the story. As a result, they have no causal antecedents or consequences other than the explanations in the isolated chain that they form. Across versions, the unusual route is more connected in the route than in the time version.

In the time version, the unusual time of leaving the office early in A7 is actually carried out. It is explained by a goal to do chores in G8 as a result of the event of Mr. Jones's wife's asking him in clause E9. Her request in E9 is causally related to her state of being ill in the setting S4. The office is a condition that is enabled by Mr. Jones's profession. In the route version, in contrast, the alternative time of leaving early in A8 would have been explained by G9, a goal that would have been psychologically caused by the event E10. However, the chain of the three conditions is discounted by the setting clause, S11, that they were not necessary that day. Consequently, these three clauses as a group have no causal antecedents or consequences and are thus isolated from the rest of the network.

Participants read only one version so that the prediction of conditions that are selected as causes depends on comparisons between a normal route and an unusual time in the route version, and a normal time and an unusual route in the time version. Explanation increased the connectivity of the normal route in the route version and the normal time in the time version, whereas the unusual time in the route version and the unusual route in the time version were unconnected through discounting. The expectation is that, within a story, the normal conditions would be more accessible than the unusual conditions.

Connectionist Model

The technical details of the Langston and Trabasso connectionist model may be found in Langston and Trabasso (1999) and Langston, Trabasso, and Magliano (1998). The model is implemented in the software of the construction–integration model of Kintsch and others (Goldman & Varma, 1995; Kintsch, 1988; 1992; Kintsch, Welsch, Schmalhofer, & Zimny, 1990; Tapiero & Denhiere, 1995). The Langston and Trabasso (1999) version allows access to long-term memory during the processing of new information because information stored in long-term memory has to be kept directly accessible by means of retrieval cues in short-term memory. The reader is also referred to Kintsch and Welsch (1991), Ericsson and Kintsch (1995), and Kintsch, Patel, and Ericsson (1999) for further arguments on the relaxation of working memory processing constraints.

The Langston and Trabasso (1999) model has a long-term storage called the *text representation* that contains nodes, connections between nodes, and quantitative values that change over time as each new node is processed. The nodes correspond to clauses from the discourse being modeled. Each node has an associated *activation value* that changes over time as the text representation is constructed. Each connection represents the relationship between a pair of clauses in the text, as identified by the discourse analysis. Each connection between nodes has a *connection strength*. Connection strengths change as new nodes and their connections are integrated into the existing text representation. The activation values and connection strengths reflect, through processing, both the current memory representation of the reader and the history of his or her comprehension. The network is processed one node at a time to simulate reading. The model incorporates each new node and its connections into an existing text representation, and spreads activation among the nodes. Once activation has settled, the activation values are used to adjust the strengths of the connections between the nodes. At any time during or after this processing, connection strength values may be obtained. Although activation values, settling rates, or connection strengths index accessibility in memory and each could be used in simulation, Langston et al. (1998) found empirically that connection strength was the most reliable and psychologically meaningful predictor.

Processing of causal networks by the model. To simulate the Kahneman and Tversky (1982) data, we entered the respective networks shown in Figure 1 as input to the Langston and Trabasso (1999) connectionist model. Each node and its connections to prior nodes were input one node at a time. All nodes were processed before connection strength measures were obtained to simulate the long-term memory representation after reading and understanding the entire story. Clauses that were frequently explained or served as explanations have more connections, should have been activated often, and should increase or maintain their connection strength over time; those clauses with fewer connections should have been activated less and showed decline in connection strength over time.

Access and sources of activation of conditions. Which conditions are accessed and how might participants access them? Participants might access either the actual condition of action taken or its alternative. The access of the actual condition taken would require its negation in order to form a counterfactual: *If only Mr.*

Jones had not driven by the shore, then he would not have been killed. Access of the alternative condition satisfies the truth of the conditional: *If only he had taken a different route* or *if only he had left later* implying that *he would not have been killed* or *he would have lived.* Faster or equal access of the alternative compared to the actual condition would indicate that conversion from the actual to the alternative was not necessary.

The connectionist model provides two measures of access. The average connection strength is the arithmetic average of the connection strengths that a node has to all other nodes and is used when access is achieved by activation of multiple nodes as sources. The connection strength between a pair of nodes is used when access is assumed to be the result of direct activation of a node by another node. For example, *Mr. Jones was killed* could activate *Mr. Jones stopped at the crossing.*

Multiple access: Average connection strength. The average connection strength was found respective to actual and alternative conditions in each version and is given in Table 2 along with the observed proportion of participants who selected each condition. Predictions of the observed proportions were evaluated by regression analyses and the percentage of variance was accounted for by the measures of connection strengths for the conditions. Accessibility of alternative conditions accounted for a substantial amount of variance whereas accessibility of the actual condition accounted for substantially less variance. These data clearly favor the idea that participants accessed alternative conditions rather than actual conditions in order to form the counterfactual.

The success of these predictions depended largely on differences in accessibility of the alternative route and time conditions within and between versions. Table 2 shows that an interaction occurred between the version and content of alternative conditions. In the route version, the alternative route's average connection strength was considerably larger than the alternative time-of-departure average connection strength (4.24 vs. 0.58). In the time version, the respective values are reversed (0.63 vs. 3.33). The correlation between the alternative route and time conditions' average connection strength with the observed proportion was high and positive ($r = .93$), $F(1, 4) = 12.99$, $p = .07$. Accessibility of alternative route and time conditions accounted for 87% of the variance (adjusted percent = 80). In contrast, the actual condition's average connection strengths did not show this interaction. The values for route were higher across versions. The correlation between the four average connection strengths of time and route with the observed proportions was nonsignificant ($r = .69$), $F(1, 4) = 1.79$, $p = .31$, and accounted for 47% of the variance (adjusted percent = 21). The causal networks indicated that these differences were a result of explanation, isolation through discounting, and connectivity.

Table 2
Observed Proportion of Participants in the Kahneman and Tversky (1982) Study Who Selected Each Condition Compared With the Average Connection Strengths (CS) of Actual and Alternative Conditions and Alternative Condition Proportions

Condition/version	Actual CS	Alternative CS	Alternative Condition CS proportion	Observed proportion ($N = 64$)
Route/Route	4.35	4.24	.42	.51
Time/Route	3.38	0.58	.06	.03
Crossing/Route	3.86	2.74	.27	.22
Boy/Route	2.61	2.61	.26	.20
Route/Time	3.95	0.63	.07	.13
Time/Time	3.33	3.33	.34	.26
Crossing/Time	4.12	3.04	.31	.31
Boy/Time	2.61	2.61	.28	.29
Percent variance (R^2)	13	82	82	
Adjusted R^2	0	79	79	
$F(1, 6)$	< 1	27.29**	27.68**	

** $p < .01$.

Since Kahneman and Tversky (1982) reported their data as proportions, we used Luce's (1959) choice axiom to convert the average connection strengths within each version to probabilities of access. A ratio of each alternative condition's average connection strength to the sum of the average connection strengths for all four alternative conditions was found for each version. For example, the predicted probability of selecting the alternative route condition in the route version was equal to 4.24/10.17 = .42, where 4.24 is the average connection strength of the route alternative condition and 10.17 is the sum of the average connection strengths of the route, time, crossing, and boy alternative conditions for the route version in Table 2. Four ratios were found for each version: The set of eight proportions, listed in Table 2, were correlated with their respective connection-strength ratios. The results of this regression analysis, reported in Table 2, yielded identical results to those found for predictions based on average connection strength. One interpretation is that accessibility of information about conditions depends upon a probabilistic race between alternative conditions activated in proportion to their average connection strengths.

The simulation heuristic of Kahneman and Tversky (1982) implies that participants access both conditions, convert, and compare them as to the ease of conversion in order to decide which condition is the cause to be undone to prevent the outcome. We modeled the access of both kinds of conditions as predictors of the observed probabilities. Multiple-regression analysis showed that adding access of the actual condition to the access of its alternative increased the amount of variance accounted for by 5.6%. The adjusted values were 82% versus 79.2%, an increase difference of 2.8%. A stepwise-regression analysis indicated that only the alternative condition significantly correlated with the observed proportions, $F(1, 6) = 27.68$, $p < .01$. The addition of the actual condition to that of the alternative was not accepted in stepwise regression.

In the stories, the alternative time condition was available in the route version but not in the time version and no alternative condition was stated for the boy not being on drugs. As a result, in the above analysis, we used as estimates the connection strengths of actual conditions for these three entries in Table 2. Access of alternative conditions for the time or the boy's state could be accomplished by inferring a contradictory state, either a different time or an absence of drugs. The actual connection strengths for the boy's state do not increase the amount of the variance accounted for by the model since the variance accounted for was largely a function of the route and time conditions. The respective average connection strengths for the crossing clause and the boy clause varied slightly and were largely unaffected by the story version. A plot of the predicted versus observed alternative-

condition proportions, shown in Figure 2, indicates that the use of the actual time condition in the time version overestimates accessibility of the alternative time condition. We ran a simulation in which the alternative time condition entered as a node connected to the actual time condition. The estimate of the alternative time condition's connection strength was lower by .70 and increased the predicted probability of the route condition in the time version. The amount of variance accounted for increased by 5%.

Direct or single condition access: Connection strength between conditions. The connection strengths of the condition of Mr. Jones being killed with the actual or alternative conditions were found and used as predictors. The results of these predictions are shown in Table 3. Of the two models, access of alternative conditions accounted for the most variance, mainly because the unusual time and unusual route conditions in the route and time versions were respectively zero. These effects were predictable from the isolation of these conditions in the causal analysis. Direct access of alternative conditions, however, accounted for substantially less variance than access from multiple clauses.

Discussion

The simulation results favor the idea that participants accessed alternative conditions from multiple story sources in the counterfactual task. The *if only* prompt may focus the participant on alternative conditions and outcomes and away from actual conditions. The access of the alternative condition as a cause facilitates the completion of the counterfactual. The simulation also shows that accessibility of alternative conditions was produced by an increase in causal connectivity through provision of causal explanations in the stories. The analysis that explanation increases connectivity and access to alternative conditions provides an alternative explanation to that offered by Kahneman and Tversky (1982) for their findings. However, because the two variables of explanation and normality were confounded, we wanted to decide empirically between them as to which determined the selection of conditions as causes. We now report two experiments that removed the confounding of normality and causal explanation.

Experiments

We carried out two experiments in which explanation and normality were varied independently. The independent variation in a between-subjects design removes confounds between normality, explanation, and content observed in the original Kahneman and Tversky (1982) study. We also studied how normality is communicated. Kahneman and Tversky marked a normal action explicitly as *regular* or *usual.* This marking, in itself, should not be necessary if the normal course of action is known or can be inferred. In norm theory (Kahneman & Miller, 1986), norms should preexist as internal representations in the participants. The presentation of actions that are habitual, valued, desired, or efficient should activate or lead to inferences that they are normative. For example, leaving one's office at the time of closing is likely to be a norm; leaving earlier is likely to be unusual or exceptional. In the interest of saving time going from work to home, taking a shorter route might be normal; taking a longer route might be unusual.

The explicit contrasting in the text of two actions has the advantage that it makes both actions available, removing a possible confound between normal actions that are available and unusual

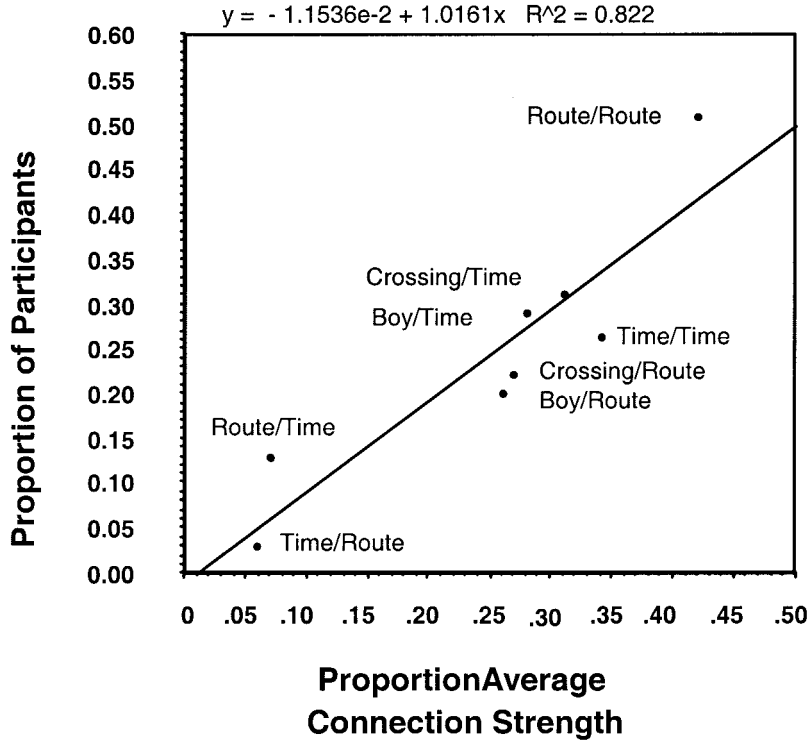

Figure 2. Prediction of Kahneman and Tversky (1982) probabilities by proportions of average connection strength of each alternative condition as a cause.

Table 3
Conditions From the Route and Time Versions and the Observed Proportion of Participants Who Select Each Condition Compared With the Connection Strengths (CS) of Conditions to Mr. Jones's Death

Condition	Observed proportion ($N = 64$)	CS of actual condition to Mr. Jones's death	CS of alternative condition to Mr. Jones's death
Route/Route	.51	4.02	3.01
Time/Route	.03	2.01	0.00
Crossing/Route	.22	4.02	3.01
Boy/Route	.20	4.00	4.00
Route/Time	.13	2.01	0.00
Time/Time	.26	1.00	1.00
Crossing/Time	.31	4.02	3.01
Boy/Time	.29	4.00	4.00
CS prediction			
% variance (R^2)		49	58
Adjusted (R^2)		24	37
$F(1, 6)$		1.94	3.04
p		.21	.13
Proportion CS prediction			
% variance (R^2)		24	58
Adjusted (R^2)		12	34
$F(1, 6)$		1.94	3.04
p		.21	.13

ones that are not. In addition, the contrast in actions should increase the chances that participants compare actions and infer one action as normal and the other as unusual. We tested this inference in manipulation checks that are reported for each experiment.

In Experiment 1, variation on time and route conditions was made across stories. For the time versions, the contrast was: *Mr. Jones left the office at 5:00 p.m. when the office closed, instead of leaving earlier* versus *Mr. Jones left the office at 3:00 p.m. instead of later when the office closed.* The actions were not explicitly marked in the text as normal or unusual. What was normal or unusual could be inferred since the norm for leaving work is usually at closing. For the route versions, the contrast was: *Mr. Jones drove along the main highway instead of taking the longer route, the shore* versus *Mr. Jones drove along the shore instead of taking the shortest route, the main highway.* Saving time going to work is a desirable norm in that the shortest route usually means shorter time. The presence of both actions in a story gave participants an opportunity to know the actual and alternative conditions, making both conditions available in memory. Differences in accessibility, however, could arise when one condition is explained more than another or when one condition is normal and the other unusual.

In Experiment 2, we explicitly marked normality using procedures similar to those of Kahneman and Tversky (1982). A normal action was explicitly marked as *normal* or *regular.* For the time versions, we used the term *normally: Mr. Jones left the office at 5:00 p.m. when the office normally closed instead of leaving earlier* versus *Mr. Jones left the office at 3:00 p.m. instead of later when the office normally closed.* For the route version, the term *regular* was used: *Mr. Jones drove along his regular route, the main highway, instead of taking the shore* versus *Mr. Jones drove along the shore instead of taking his regular route, the main highway.*

Ease of conversion or ease of accessibility should affect preferences for which conditions are selected as causes. In both experiments, after reading the passage, participants were given four negated conditions in the context of the *if only* stem. For example, *if only he had taken a different route home* or *if only he had left at a different time.* Participants were first asked to rank the four alternatives and to justify each of the four statements.

The task of ranking was assumed to measure preferences for conditions as causes. The choices were stated in the positive form of the counterfactual. A preference should be influenced by the accessibility of a condition that provides a truth value of the conditional, *if only* stem. Access of an alternative condition matches the *if only* content of taking a different course of action. This match should facilitate determining the truth value of a conditional through verification against what is accessed (Trabasso, Rollins, & Shaughnessy, 1971).

Participants were asked to justify their rankings in order to permit explicit expression of counterfactual thinking by participants. That is, for *if only he had taken a different route home,* the participant could justify this choice by stating *then he would not have been killed* or *if he had taken the main highway he would not have been killed.* Thus, participants could generate counterfactual statements of the form: *if not A therefore not B* or *if A then B* as justifications. Since the simulation heuristic of Kahneman and Tversky (1982) assumes that unusual conditions are easier to convert than are normal conditions, participants should also be more likely to generate a counterfactual justification when the actual condition was unusual than when it was normal in the story.

Experiment 1

Kahneman and Tversky (1982) contrasted two alternative conditions. Within a story, the actual conditions of the route or time taken were contrasted with unmarked alternatives. For example, an unmarked *shore* was contrasted with a negated *regular route* and an *earlier* time was contrasted with an unmarked normal time of departure. In Experiment 1, we contrasted unmarked, alternative courses of action that implied which was normal or unusual. Independent of normality, we provided more reasons for one condition over another as explanation. If norms are inferred from the text information on actions, normality should affect preferences for a condition as a cause. If causal relations are inferred from reasons, explanation should affect the accessibility and, in turn, a preference for a condition or a cause. The selection of a cause that is used in a counterfactual is thus open to influence by text variables of normality or explanation.

In Kahneman and Tversky (1982), normality was varied within story so that in their route version, route was unusual and time was normal, and in their time version, time was unusual and route was normal. This within-version variation confounded content with normality as well as explanation. To remove this confound, we varied the normality of the same condition across different story versions by making normality of the same content a between-subjects variable. That is, we compared the selection of the identical route condition across stories where the route is either normal or unusual and explained or not explained. When the route was contrasted, the time of leaving was held constant. Likewise, we compared selection of an identical time condition across stories where the time is either normal or unusual and explained or not explained, and the route taken was held constant.

Table 4
Story Versions for Experiments 1 and 2

Surface order	Category	Clause
		Route: Unusual and explained
1	Setting	Mr. Jones was 47 years old,
2	Setting	the father of three, and
3	Setting	a successful banking executive.
4	Setting	On the day of the accident,
5	Attempt	Mr. Jones left the office at 5:00 p.m.
6	Event	when the office closed.
7	Outcome	That morning, he had attended to household chores at
8	Event	his wife's request.
9	Outcome	He also had seen his doctor about
10	Setting	his weight problem.
11	Attempt	Mr. Jones told his friends at the office that
12	Goal	he was going to drive along the shore instead of taking the shortest (his regular) route,
13	Outcome	the main highway.
14	Goal	There, he could relax
15	Goal	and think about pleasant things.
16	Setting	The day was clear
17	Goal	and he wanted to enjoy the view.
18	Outcome	The accident occurred at a major intersection.
19	Event	The light turned amber as
20	Attempt	Mr. Jones approached.
21	Outcome	He stopped at the crossing.
22	Attempt	As he began to cross
23	Event	after the light had changed
24	Event	a truck charged into the intersection at top speed
25	Outcome	and rammed Mr. Jones' car from the left.
26	Outcome	Mr. Jones was killed instantly.
		Route: Unusual and not explained
1	Setting	Mr. Jones was 47 years old,
2	Setting	the father of three, and
3	Setting	a successful banking executive.
4	Setting	On the day of the accident,
5	Attempt	Mr. Jones left the office at 5:00 p.m.
6	Event	when the office closed.
7	Outcome	That morning, he had attended to household chores at
8	Event	his wife's request.
9	Outcome	He also had seen his doctor about
10	Setting	his weight problem.
11	Attempt	Mr. Jones said goodbye to his friends at the office.
12	Attempt	he drove along the shore instead of taking the shortest (his regular) route,
13	Outcome	the main highway.
14	Internal response	He was relaxed
15	Internal response	and thought about pleasant things.
16	Setting	The day was exceptionally clear
17	Outcome	and he had a good view.
18	Outcome	The accident occurred at a major intersection.
19	Event	The light turned amber as
20	Attempt	Mr. Jones approached.
21	Outcome	He stopped at the crossing.
22	Attempt	As he began to cross
23	Event	after the light had changed,
24	Event	a truck charged into the intersection at top speed
25	Outcome	and rammed Mr. Jones' car from the left.
26	Outcome	Mr. Jones was killed instantly.
		Time: Unusual and explained
1	Setting	Mr. Jones was 47 years old,
2	Setting	the father of three, and
3	Setting	a successful banking executive.
4	Setting	On the day of the accident,
5	Attempt	Mr. Jones left the office at 3:00 p.m.

Table 4 (*continued*)

Surface order	Category	Clause
		Time: Unusual and explained (*continued*)
6	Outcome	instead of later when the office (normally) closed.
7	Goal	That afternoon, he had to attend to household chores at
8	Event	his wife's request.
9	Goal	He also had to see his doctor about
10	Setting	his weight problem.
11	Attempt	Mr. Jones said goodbye to his friends at the office.
12	Goal/Attempt	He drove along the shore.
13	Internal Response	He was relaxed and
14	Internal Response	thought about pleasant things.
15	Setting	The day was clear
16	Setting	and he had a good view.
17	Outcome	The accident occurred at a major intersection.
18	Event	The light turned amber as
19	Attempt	Mr. Jones approached.
20	Outcome	He stopped at the crossing.
21	Attempt	As he began to cross
22	Event	after the light had changed,
23	Event	a truck charged into the intersection at top speed
24	Outcome	and rammed Mr. Jones' car from the left.
25	Outcome	Mr. Jones was killed instantly.
		Time: Unusual and not explained
1	Setting	Mr. Jones was 47 years old,
2	Setting	the father of three, and
3	Setting	a successful banking executive.
4	Setting	On the day of the accident,
5	Attempt	Mr. Jones left the office at 3:00 p.m.
6	Outcome	instead of later when the office (normally) closed.
7	Outcome	That morning, he had attended to household chores at
8	Event	his wife's request.
9	Outcome	He also had seen his doctor about
10	Setting	his weight problem.
11	Attempt	Mr. Jones said goodbye to his friends at the office.
12	Goal/Attempt	He drove along the shore.
13	Internal Response	He was relaxed
14	Internal Response	and thought about pleasant things.
15	Setting	The day was clear
16	Setting	and he had a good view.
17	Outcome	The accident occurred at a major intersection.
18	Event	The light turned amber as
19	Attempt	Mr. Jones approached.
20	Outcome	He stopped at the crossing.
21	Attempt	As he began to cross
22	Event	after the light had changed,
23	Event	a truck charged into the intersection at top speed
24	Outcome	and rammed Mr. Jones' car from the left.
25	Outcome	Mr. Jones was killed instantly.

Method

Experimental design. We created eight different versions of the Mr. Jones story. Four versions focused on the route; four versions focused on the time of departure. The variable of route taken or the time of departure is a called the *focal cause.* Each version contained a focal cause that was either explained or not explained and that was implicitly either normal or unusual. The crossing of explanation and normality resulted in four versions for each focal cause. The three independent variables were: focal cause (route or time), explanation (explained or not explained), and normality (normal or unusual) and constituted a $2 \times 2 \times 2$ between-subjects factorial design.

Materials. For reference, versions of four stories are shown in Table 4 and will be discussed as to clausal parsing and categorization later. Each version had three sections. Across versions, Sections 1 and 3 were the same. The middle, Section 2, varied in content. For route versions, Section 1 provided the setting information about Mr. Jones and the fact that he had attained two goals. Section 3 described how the accident occurred. The middle part of the story in Section 2 had four different texts that resulted from independent variation in explanation and normality. The unusual and explained conditions of the route version had the following content in Section 2:

> *Mr. Jones told his friends at the office that he was going to drive along the shore instead of taking the shortest route, the main highway. There, he could relax and think about pleasant things. The day was clear and he wanted to enjoy the view.*

The unusual and not explained conditions of the route version had the following content in Section 2:

Mr. Jones said goodbye to his friends at the office. He drove along the shore instead of taking the shortest route, the main highway. He was relaxed and thought about pleasant things. The day was exceptionally clear and he had a good view.

When the route taken was explained, the explanations were given as the goals (to go home, to relax, to think about pleasant things, and to enjoy the view) that he had before he left the office for taking a given route. When the route was not explained, the clauses were rewritten as outcomes after he had left the office. When Mr. Jones took the normal main highway route, the unusual shore route was marked as the longest; when he took the unusual shore route, the normal main highway route was marked as the shortest. The time of departure was constant across versions: *He left at 5:00 p.m. when the office closed.*

Section 1 of the time versions introduced Mr. Jones: *Mr. Jones was 47 years old, the father of three, and a successful banking executive.* Section 3 began with his saying goodbye to his friends at the office. The route was constant: *He drove along the shore.* The remaining content was the same as the normal route version.

For the middle Section 2, the unusual and explained version of the time story was:

On the day of the accident, Mr. Jones left the office at 3:00 p.m., instead of later when the office closed. That afternoon, he had to attend to household chores at his wife's request. He also had to see his doctor about his weight problem.

In the unusual and not explained time version, the goals of household chores and seeing the doctor were changed to goal outcomes in the middle Section 2:

On the day of the accident, Mr. Jones left the office at 3:00 p.m., instead of later when the office closed. That morning, he had attended to household chores at his wife's request. He also had seen his doctor about his weight problem.

The time of departure is explained by goals (household chores and doctor visit) that he had before leaving the office; when time of departure was not explained, the same content was presented as outcomes or satisfied goals. For normal time, the unusual time was changed to *Mr. Jones left the office at 5:00 p.m. when the office closed, instead of leaving earlier.*

Manipulation checks. To assess whether participants could infer which actions were normal versus unusual, eight University of Chicago students or research assistants independently rated the normality of 12 sentences that contrasted route or time actions taken with those not taken. We took sets of 4 sentences each from the stories used in Experiment 1, Experiment 2, and by Kahneman and Tversky (1982). In each case, the 4 sentences represented a cross of focal cause (route or time) with normality (normal or unusual). The 12 sentences were presented in a random order with the restriction that no two route or time sentences from the same story would occur in succession. Participants rated each sentence on a 5-point scale in which *normal* appeared below numeral 5 and *unusual* appeared below numeral 1. We gave participants a four-page booklet with instructions on the first page. The participant was instructed to read each sentence, to focus on the action taken by Mr. Jones, and to judge how normal or unusual it was on the 5-point scale. Four different sentences were presented on each of the remaining three pages of the booklet. We report here the manipulation check results on the materials used for Experiment 1. We compare the results for materials of Experiments 1 and 2 with those on the sentences from the Kahneman and Tversky (1982) stories in the *Method* section of Experiment 2.

The judges' ratings of the sentences from Experiment 1 showed that participants made a clear distinction between normal and unusual actions. A Focal Cause $\times$ Normality within-subjects analysis of variance (ANOVA) yielded a significant effect of normality, $F(1, 7) = 32.00$, $p < .01$ (power = .999). There was no effect of focal cause. The mean rating and standard error ($n = 8$) for normal pairs was 4.88 and .12, respectively, compared with 2.88 and .35, respectively, for the unusual pairs. Readers anchored their normal judgments and regarded unusual actions as deviations from the high anchor. As we intended, readers clearly inferred that taking the main highway versus the longer shore route was normal, whereas taking the shore route versus the shorter main highway was unusual, and that leaving at 5:00 p.m. when the office closed was normal; whereas leaving at 3:00 p.m. instead of later was unusual.

Participants. The participants were 64 University of Chicago undergraduates recruited as paid volunteers from two advanced, introductory psychology courses. All volunteer students were given a packet of materials in class and were instructed to complete the experiment at home and to return it to the experimenter. A different packet of forms was used for each of the eight versions and packets were randomly assigned to participants. Participants were paid $5 each for returning the completed experimental packet.

Procedure. Participants were randomly assigned to one of the eight versions of the Mr. Jones story. They were given a packet with one version of the story. The instructions were to read the story, to turn the page, and, without referring back to the story, to rank and justify each of the four choices. The four choices were completions of a sentence. The wording of the conditional stem was based on that of Kahneman and Tversky (1982). The ranking instruction was:

As commonly happens in such situations, Mr. Jones' family and friends often thought and often said, "if only . . . ," during the days that followed the accident. How did they continue this thought? Please rank order the answers listed below and justify each answer.

If only he had taken a different route home

If only he had left at a different time

If only he had not stopped at the amber light

If only the truck had not charged into the intersection

For each of the eight versions, the order of the completions was counterbalanced across participants.

Results and Discussion

Ranking of Alternatives

The rank of each *if only* choice by each participant provided the basic set of data. The ranks of the time choice following reading of the time versions, and the route choice following reading of the route versions served as the dependent variables called *relevant ranks.* Relevant ranks were analyzed in a $2 \times 2 \times 2$ between-subjects ANOVA with normality, explanation, and focal cause as the independent variables. Explanation showed a significant main effect, $F(1, 56) = 6.30$, $p < .02$; but neither normality ($F < 1$) nor focal cause, $F = 1.77$, $p = .19$, were significant (dfs = 1, 56, $N = 64$). There were no significant interactions.

The respective mean ranks and standard errors ($n = 32$) were for (a) explained versus not explained causes, 1.88 and .16 versus 2.41 and .16, (b) normal versus unusual, 2.16 and .16 versus 2.13 and .17, and (c) route versus time, 2.00 and .16 versus 2.28 and .17.

Justifications

We analyzed participants' justifications for inclusion of counterfactuals. A justification was scored as a counterfactual justifi-

cation if it included both an antecedent and a consequent (e.g., *if Mr. Jones had gone home via a different route, then he wouldn't have been at that intersection when the truck ran through the red light*) or the justification used the given *if only* stem as an antecedent and completed the consequence of the counterfactual (i.e., given *if only Mr. Jones had left at a different time* the justification was *then he wouldn't have been killed in that accident).*

Counterfactual thinking was found to be prompted by the *if only* format for 30% of the rankings. The percentages were nearly equal for the normal versus unusual conditions (31 vs. 28, respectively). The same percentages were found for explained versus unexplained conditions. Thus, we found no evidence favoring the idea that unusual conditions would prompt more counterfactuals than do normal conditions. These generation data are contrary to expectations based on ease of conversion of unusual conditions by the simulation heuristic.

Experiment 2

Experiment 2 replicated and extended Experiment 1. In Experiment 1, normality was implicit, whereas, in Experiment 2, it was made explicit by marking the normal action with the adjectives *regular* for the route and *normal* for the time of closing the office.

Method

The procedures, instructions, number of versions, focal causes, explanations, and story content were the same in Experiment 2 as in Experiment 1, except for how variation in normality was communicated in the text. For the route versions in Experiment 2, *regular* was substituted for *the shorter* route of Experiment 1, as in: *Mr. Jones told his friends at the office that he was going to drive along the shore instead of taking his regular route, the main highway* or *Mr. Jones drove along his regular route, the main highway, instead of taking the shore.* For the time versions of Experiment 2, the adverb *normally* was added to the versions used in Experiment 1, as in: *Mr. Jones left the office at 3:00 p.m. instead of later when the office normally closed* or *Mr. Jones left the office at 5:00 p.m. when the office normally closed instead of earlier.*

Manipulation check. The manipulation check for Experiment 2 was described in the *Method* section of Experiment 1. It was found that participants in Experiment 2 clearly distinguished between sentences in which Mr. Jones's actions were normal versus those that were unusual. The means and standard errors ($n = 8$) for the normal and unusual actions in Experiment 2 were 5.00 and 0.00, and 3.00 and .33, respectively; $F(1, 7) = 49$, $p < .01$, power = 1.00. Ratings of the materials of Experiments 1 and 2 were compared with those of the Kahneman and Tversky (1982) study in a 3 (study) $\times$ 2 (normality) within-subjects ANOVA. Only the normality effect was significant, $F(1, 7) = 43.07$, $p < .01$ (power = 1.00). Study and the interaction of Study $\times$ Normality were not significant, Fs < 1. For comparison, the means and standard errors ($n = 8$) for the normal and unusual actions of the Kahneman and Tversky materials were 4.62 and .18, and 2.75 and .49, respectively. As far as the normality of actions was concerned, the sentence materials of Experiments 1 and 2 were comparable with those of Kahneman and Tversky (1982). In all three studies, participants distinguished between normal and unusual actions to approximately the same degree regardless of variation in wording and contrastive markers.

Participants. The participants were 64 University of Chicago undergraduates who were recruited as unpaid volunteers from advanced introductory psychology courses. All students were given a packet of forms and asked to return them to the experimenter. A different packet of forms was used for each of the eight versions, and packets were randomly assigned to participants.

Results and Discussion

Ranking of Alternatives

The relevant ranks were analyzed in a 2 $\times$ 2 $\times$ 2 between-subjects ANOVA. The significant explanation effect of Experiment 1 was replicated, $F(1, 56) = 11.62$, $p < .01$; as was the null normality effect, $F(1, 56) = 1.01$, $p = .32$. There was also a significant effect of focal cause, $F(1, 56) = 10.11$, $p < .01$. No interactions were significant. The mean ranks and standard errors ($n = 32$) for explained conditions were 1.59 and .11, respectively; and for not explained conditions they were 2.22 and .16, respectively. For the normal versus unusual variable, the mean ranks and standard errors were 2.00 and .15 versus 1.81 and .14, respectively. For route versus time, they were 1.57 and .12 vs. 2.21 and .14, respectively.

Justifications

Justification of the *if only* task prompted counterfactuals by 42% of the participants. For the 64 participants, the conditional probability of a counterfactual justification given a normal antecedent was .53, whereas it was .31 given an unusual antecedent, a direction opposite to an expectation based on the simulation heuristic. The difference did not, however, reach statistical significance, $\chi^2(1, N = 64) = 2.31$, $p > .05$. The making of a counterfactual justification was not more likely in the unusual than in the normal condition, contrary to the expectations formed on the basis of the simulation heuristic.

Some participants incorrectly remembered in their justifications whether an antecedent was normal or unusual. The number of transformations from normal to unusual versus those from unusual to normal differed: Of a total of 12 transformations observed, 11, or 91%, were from normal to unusual. These data indicate that participants misremembered or mentally transformed normal conditions far more often than they transformed unusual conditions. This finding appears to contradict an assumption of the simulation heuristic that unusual conditions are easier to transform than normal ones.

Simulation 2

The ranking data of Experiments 1 and 2 were simulated following the same procedures as Simulation 1: discourse analysis, connectionist modeling of causal networks, and prediction of the results. We compared regression models of multiple- and direct-access measures on alternative versus actual conditions.

Results of Experiments 1 and 2

We first examined whether the relevant rank data for the eight versions of the two experiments differed. An ANOVA with explanation, normality, focal cause, and experiment (1 vs. 2) as factors indicated that there was a significant effect of explanation, $F(1, 95) = 6.39$, $p < .01$; and focal cause, $F(1, 95) = 8.21$, $p < .01$, but not normality ($F < 1$). There were also no significant interactions between experiment and explanation ($F < 1$) or between experiment and focal cause ($F < 1$). We pooled the rank data of Experiments 1 and 2 for purposes of simulation.

Discourse Analysis

Discourse analyses were carried out on the four versions that combined Focal Cause × Explanation. The versions were parsed into 26 clauses, and each clause was categorized according to its episodic function. Using Tom Trabasso as the target, the average hit, false-alarm, and miss rates on clause agreement were .94 (range = .88 to .96), .06 (range = .04 to .12), and .00, respectively; the average kappa was .81 (range = .78 to .84). For categories, the respective hit, false-alarm, and miss rates were .91 (range = .85 to .96), .07 (range = .04 to .12), and .02 (range = .00 to .08); the average kappa was .89 (range = .80 to .95). These data indicate acceptable reliability. The parsed and categorized clauses for versions are given in Table 4.

We found causal networks for each version. The respective number of causal relations for the route explained, route not explained, time explained, and time not explained versions were 42, 34, 33, and 32, respectively, out of 26(25)/2 = 325 possible. The average hit, false-alarm, and miss rates were .81 (range = .79 to .82), .07 (range = .05 to .12), and .12 (range = .06 to .15); the average kappa was .88 (range = .87 to .89), indicating acceptable reliability. The causal networks for the route versions are presented in Figure 3. The networks for the time versions are presented in Figure 4. Table 4 contains the clause referents for the nodes in the networks.

Common nodes and relations. The networks in Figures 3 and 4 share several nodes and relations. The setting clauses, 1–3, introduce the existence of Mr. Jones, his age, his children, and vocation. The first setting S1 enables S2 and S3 because they depend on Mr. Jones's existence. The setting statements enable clauses 8–11 because they permit inferences about a wife and an office. The networks share a causal chain from the introduction of the day in S4 to Mr. Jones's demise in O25. The day temporally enables the enactment of the events in the story. This setting enables the actions that follow it in the chain, for example, Mr. Jones saying goodbye or telling something to his friends at the office in A11. These attempts enable him to leave in clause A5, drive along a route in the goal-attempt clause, G/A12, approach an intersection (attempts A19 or A20), and so on. The attempts are enabled by other attempts or motivated by the goal to drive along the route taken. Clauses 18, 19, 23, and 24 in the route version, and 17, 18, 22, and 23 in the time version, contain the enabling conditions of an intersection, a light that turns amber and changes, and a truck that enters the intersection. The crash in O25 or O24 explains the fact that an accident occurred at the intersection stated in O17 or O18. If the truck had not rammed the car in the intersection, there would not have been an accident at an intersection.

Network differences. The main contrast between the networks is in the reasons behind the goal of driving along the actual route.

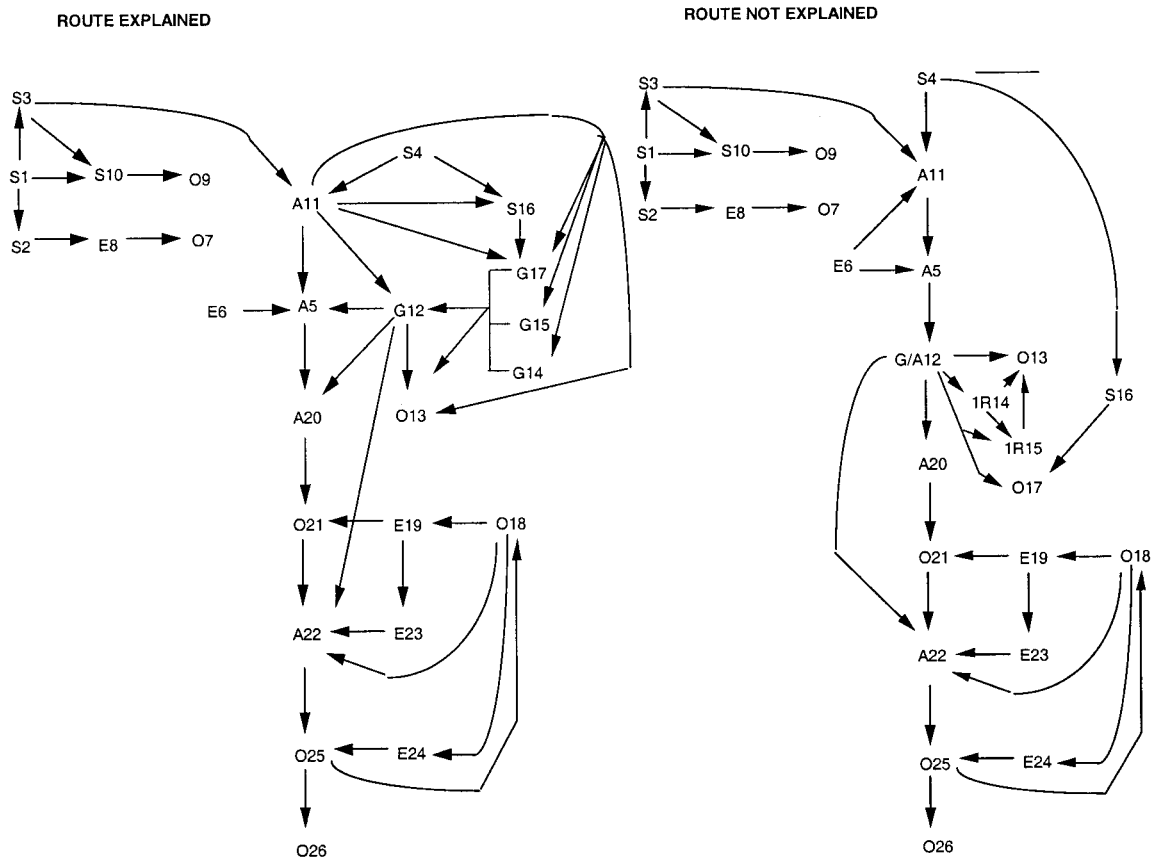

Figure 3. Causal networks for route versions (Experiments 1 and 2). Arrows indicate a causal relation. S = setting; E = event; IR = internal response; G = goal; G/A = goal/attempt; A = attempt; O = outcome.

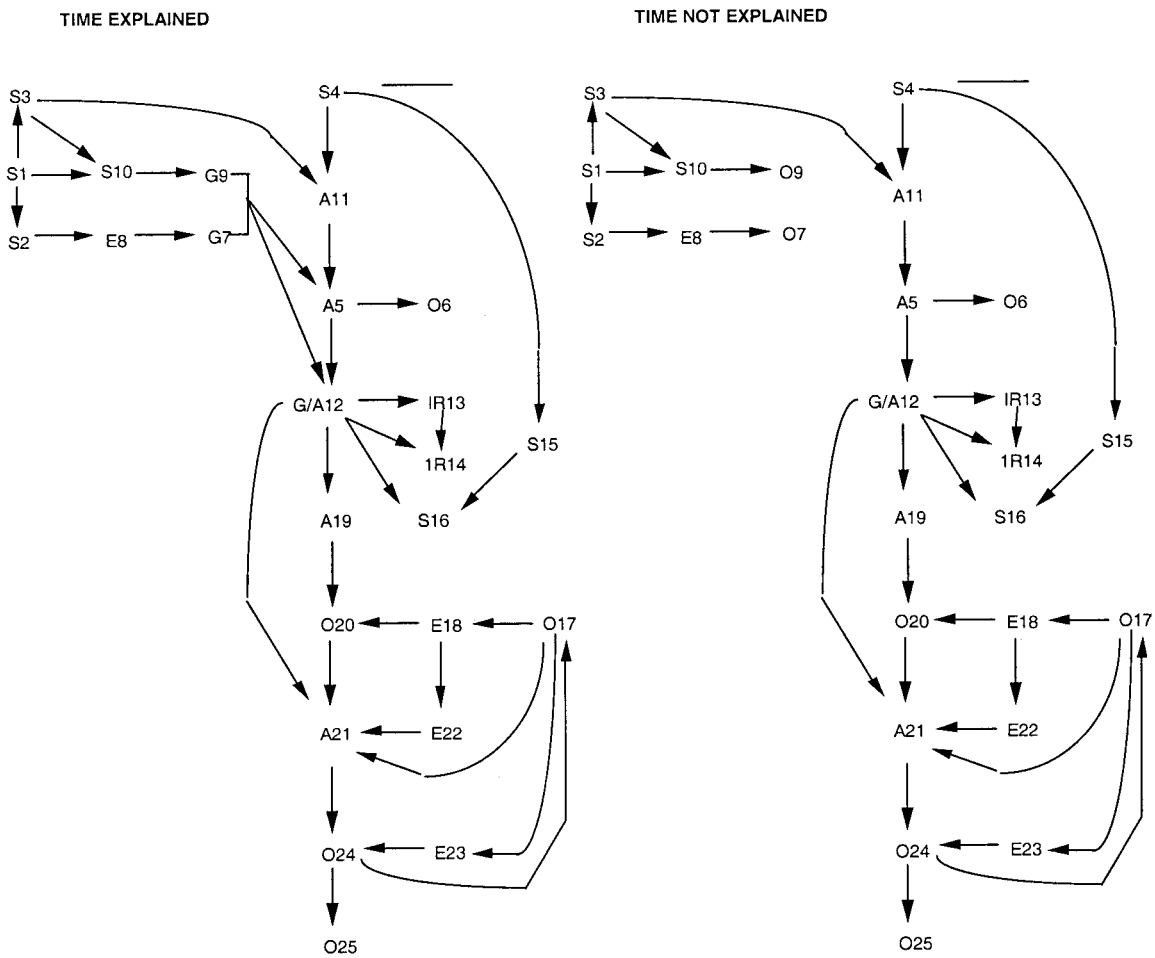

Figure 4. Causal networks for time versions (Experiments 1 and 2). Arrows indicate a causal relation. S = setting; E = event; IR = internal response; G = goal; G/A = goal/attempt; A = attempt; O = outcome.

In the route explained version, A11 plays a major role in enabling the communication of several goals in clauses 12, 13, 14, 15, and 17, and a setting in clause 16 that, in turn, explains the goal of driving along the actual route in G12. Goal 12, in turn, motivates three attempts (A5, A20, and A22).

In the time explained network, Clauses 7 and 9 are goals that motivate the attempt in A5 and the combined goal and attempt in G/A12. In the other three networks, these clauses are outcomes of satisfied goals and have no causal consequences.

In the route not explained version, there are two important excluding conditions. The existence of Goal 12 precludes O13 because the goals to drive along one route are mutually exclusive of the alternative route. We see the same kind of exclusion in the time networks in which leaving at a certain time (A5) precludes leaving at the alternative time (O6). The logic of preclusion is the same as that of necessity, namely, that if the actual route were not taken, then the alternative would have been, and if Mr. Jones had not left at the time stated, then he presumably would have left at the other time. These preclusions are a key assumption in that the alternative condition is connected to actual conditions of action or time, making it accessible as an alternative. The alternative condition's connection strength is related to that of the actual action taken because they are connected. Explanation of the actual route taken increases, indirectly, the number of connections associated with the alternative route.

The last set of clauses of interest is that having to do with the consequences of driving along the route taken. In the time networks, these are internal responses (IR) in IR13 and IR14 that are psychologically caused or enabled by taking the drive. In the route not explained network, these psychological consequences are a basis for inferring why Mr. Jones took the route that he did. That is, IR14 and IR15 are identified as causal reasons for O13 because there is no explanation other than exclusion up to this point.

Connectionist model. We found the average connection strengths after processing the entire network for the route and time actual and alternative conditions in the respective versions. In addition, we found the connection strengths between these conditions with the clause that Mr. Jones died.

We evaluated the accessibility of conditions as in Simulation 1. We made predictions from multiple- and single-access measures of connection strength on ranking measures. Mean ranks were converted to proportions by first subtracting the mean ranks from 4 and dividing the transformed ranks by their sum. The connection-

strength measures were converted to proportions by dividing each measure by the sum of the connection strengths. The respective measures of connection strengths of the conditions were correlated with the respective measures of the ranking data. The results of the regressions are summarized in Table 5.

Simulation 2 replicated the findings of Simulation 1. The data in Table 5 support the interpretation that participants access the alternative conditions from multiple sources in order to rank the choices. In Table 5, this strategy accounted for 88% (83% adjusted) of the variance and was higher than multiple access of the actual or direct access of either the alternative or actual condition.

General Discussion

We assumed no effect of normality in each simulation of counterfactual decision making. Both simulations showed that accessibility of an alternative condition was the best predictor as to which cause was selected. The simulations were successful in predicting the selection of four different conditions as causes that varied in connection strength or accessibility within a story. The simulations accurately predicted situations in which participants either generated causes or made preferential decisions between causes. The main determinant of accessibility of a condition was its number of connections to other conditions. A condition's overall connection strength proved to be the most accurate index of accessibility. Accessibility to conditions, then, depended upon multiple activation rather than direct activation by one condition.

Experiments 1 and 2 provided empirical evidence that preferences for conditions were affected by explanation but not by normality, despite manipulation-check evidence that participants discriminated between normal and unusual actions. The experiments also showed that normality did not affect the generation of counterfactuals as justifications for the conditions selected as causes. Memory transformations in Experiment 2 were more frequent from normal to unusual rather than from unusual to normal as expected from the simulation heuristic. The findings do not support the assumption that the basis for selecting conditions as causes is their ease of conversion to the alternative.

The null findings on normality are not likely to be a result of a failure on the part of participants to infer which action was the norm and which one was exceptional. The manipulation checks clearly showed that participants discriminated between these alternatives and that our materials were comparable to those of Kahneman and Tversky (1982). The manipulation checks also showed that normality was discriminated when actions were either contrastive or not. The use of "instead" might have led participants to presuppose the action not taken rather than the one taken. The comparison of the sentences used in Experiments 1 and 2 with those of Kahneman and Tversky that do not allow these presuppositions appear to rule this out. Thus, contrast of alternative actions does not seem to be the reason why normality failed as a variable. The successful simulations on either open-ended generation or ranking of alternative conditions also rule out an explanation of the null finding of normality in terms of the kind of response required. The findings support the interpretation that explanation was the effective variable in the original Kahneman and Tversky (1982) study rather than normality of events.

Reviewers, in the absence of knowledge about the manipulation-check findings, have raised concerns regarding presuppositions about what is normal. One reviewer raised a concern about the use of ranking rather than open-ended generation in Experiments 1 and 2 compared with the original counterfactual study of Kahneman and Tversky (1982). The use of "instead" may presuppose that readers inferred that the action not taken was normal. The manipulation-check data certainly argue against this assumption. The successful simulation of the original counterfactual study data suggests that the response measure did not matter. To examine empirically whether presuppositions or the kind of response required may have reduced the effect of normality in Experiments 1 and 2, we carried out another experiment in which we removed the *instead* that explicitly contrasted alternative conditions of action and asked participants to complete the *if only* stems exactly as did Kahneman and Tversky. We used four story versions. The route and time stories in Table 4 were the versions used except that the route and time information, respectively, were changed by removing *instead* and creating two sentences as substitutions. For the normal and unusual route versions, respectively, the key sentences were: *He drove along his regular route, the main highway. He could have but did not take the route along the shore* versus *he drove along the shore. He could have but did not take his regular route, the main highway.* For the normal and unusual time versions, respectively, the key sentences were: *Mr. Jones left the office at 5:00 p.m. when the office normally closed. He could have but did not leave earlier* versus *Mr. Jones left the office at 3:00 p.m. He could have but did not wait until the office normally*

Table 5
Comparison of Regression Findings for Multiple and Direct Access of Alternative and Actual Conditions

Experimental variables	Mean rank	Prop rank	Multiple Access: Alternative condition average CS	Prop CS	Actual condition average CS	Direct Access: Alternative condition connection strength to Mr. Jones's death	Actual condition connection strength to Mr. Jones's death
Time explained	1.88	.27	3.98	.26	5.03	1.00	2.00
Time unexplained	2.61	.18	3.42	.22	4.46	1.00	2.00
Route explained	1.59	.31	4.49	.29	4.94	3.01	4.00
Route unexplained	2.04	.24	3.70	.24	4.57	3.00	4.00
R^2			.88	.88	.67	.33	.33
Adjusted R^2			.83	.82	.51	.00	.00
$F(1, 2)$			15.14	14.7	4.01	< 1	< 1
p			.06	.06	.18	.42	.43

CS = connection strength.

closed. These variations made available both conditions in the text and explicitly marked the normal action.

Thirty-six undergraduate volunteers from the University of Illinois, Chicago, served as participants, read a version in each condition, and wrote responses to the counterfactual *if only* stem. Nine participants were randomly assigned to each of four conditions, 2 (focal cause) × 2 (normality). Of the 36 participants, 29 (81%) selected first the appropriate route or time. Of these, 27 out of the 29 (93%) generated a positive counterfactual with the alternative condition, for example, *if only he had taken his usual route home from work.* For these 27 participants, the conditional probability of selecting the unusual alternative, given that the normal action was taken in the story was .56; for selection of the normal alternative, given that the unusual action was taken, the conditional probability was .44. Although the difference was in a direction opposite to the expectation of the simulation heuristic, it was not statistically significant, $\chi^2(1, N = 27) = .03$, $p > .05$. This experiment removed presupposition and kind of response as an alternative explanation for a null normality effect and provides yet another failure to find a normality effect.

It is of interest that participants rarely used negation of the actual condition and preferred overwhelmingly the use of positive counterfactuals with the alternative condition. These data directly support the model that best simulated the data. The high degree of positive counterfactuals may have depended upon the availability of the alternative in the text. We tested whether availability of an alternative influenced the generation of positive counterfactuals by a contrast with counterfactuals made on conditions where there was no alternative available in the text (e.g., the stopping at the crossing, route in the time version, time in the route version, visiting the doctor, leaving work, going to work, driver of the other vehicle, and family regrets or feelings). There were 34 participants who generated one or more counterfactual for the conditions that had no alternative in the text. Of these participants, 82 percent generated one or more positive counterfactuals. This proportion did not differ significantly from the 93 percent where an alternative condition was available in the text, $\chi^2(1, N = 34) = .20$ $p > .05$. Negation of the course of action taken, while satisfying one form of a counterfactual, was clearly not the preferred form. Instead, participants generated positive counterfactuals, independent of an alternative being stated in the text.

The simulation heuristic assumes that unusual events are easier to convert than are normal events. Galinsky, Moskowitz, and Skurnik (2000) reasoned that if unusual conditions were easier to convert than normal conditions, then reading time or recognition priming should be faster for unusual than normal conditions following counterfactuals. They tested whether counterfactual events in a reading task could serve as primes for words related to the normal or unusual conditions in a second, person-perception task. Although they found evidence for priming of the search for both kinds of conditions, unusual and normal primes had the same effect. These priming data do not support the assumption that unusual events are easier to process when both alternatives are available and provide further negative evidence on the assumption of normality as the explanation of the selection of causes in counterfactual reasoning.

In the present studies and in the original study of Kahneman and Tversky (1982), normal and unusual actions were both made available in the stories. Despite their being available in the texts, the findings indicate that they varied in accessibility. Explanation and causal connectivity in the simulation accounted substantially for the variation in accessibility of available conditions. The availability of alternative conditions in the text could have removed a main reason as to why a normal alternative is more accessible than an unusual alternative. If only a normal condition were presented, then decision makers could be faced with a high degree of uncertainty as to what is the alternative condition, especially if the alternatives are not mutually exclusive. If only a deviation from a norm is presented, then the decision maker knows the alternative condition, namely, the norm. Kahneman and Miller (1986) recognized this asymmetry in normal and exceptional events with respect to generating alternatives. The difference in uncertainty as to alternatives, however, raises the question as to whether the asymmetry in uncertainty is the psychologically relevant factor rather than normality in finding an alternative condition. If only the norm is available, the situation is a *contrary* because the alternative conditions are unknown. If only an unusual event that deviates from a norm is known, then the normal alternative is also known and the situation is a *contradictory.* Contradictories should be easier to process than contraries because the alternatives are known (Trabasso et al., 1971).

A failure to make an alternative to an unusual condition available would thus confound uncertainty with normality. This confound may have played a role in a study by Wells et al. (1987). They manipulated normality of three different conditions (day of event and two spatial locations) in their stories. In their Experiment 2, participants were asked to list conditions that could be changed so that the outcome of the story would be different. Unusual conditions tended to be listed earlier than normal ones. An analysis of the materials described in their report indicates that they confounded unusualness with availability of alternatives. A normal alternative condition was always given for each unusual condition. For example, if the protagonist decided to go swimming on a day that was unusual for him, the story also mentioned the day that he normally went swimming. When the day condition was normal, however, no alternative unusual day condition was mentioned. An unusual condition had a clear normal alternative available in the text but the normal condition had no explicit, unusual alternative available. This confound favors the accessibility of the normal alternative for the first condition in the story because it had a contrasting alternative when it was unusual but not when it was normal. All other conditions in the sequence had alternatives available through the use of a map provided to the participants. The expectation, then, is that the first unusual condition would be more accessible than the remaining unusual conditions. The Wells et al. data support this expectation. They found a normality effect only for the first day condition but a very small effect for the second and third spatial conditions in the story sequence. Their confounding of normality with availability of alternatives was further conflated by the method of scoring. Participants listed six ways to undo the outcome of the story, although there were only three causes of interest. If a particular choice was not listed, it was given a rank of 6.0. In fact, the average ranking of the unusual alternative for the first position was 5.8 out of a possible 6.0, meaning that the majority of the participants did not list it at all. This confound between normality and the absence of an obvious alternative casts doubt on the validity of the Wells et al. conclusion regarding normality.

The focus of the research on counterfactual reasoning has been on conversion or "mutability" of causes (Roese, 1997). When

people review the past in order to determine causes, they may look for a "difference that makes a difference" (Mill, 1884). The difference that makes a difference may coincide with unusual occurrences such as a nail on the highway causing a flat tire or the tapping of hammers in a particular manner with a male whale present. In a scientific experiment, the experimenter has control over what is the additional cause that makes the difference. In real life, one can only examine the conditions surrounding the event. The search for a cause requires that an alternative condition in a set of circumstances be found. A cause need not be unusual but merely a difference hypothesized to make a difference.

If people adopt a causal field, select a condition as a cause, and believe that it was necessary for the outcome, then a counterfactual may be an expression of a desire as well as an affirmation of the belief (Mackie, 1980). For example, John Nash in the 1970s is described by Nasar (1999) as ruminating over the death of his father.

> In early September, John Sr. suffered a massive heart attack. . . . The news of his father's death shocked Nash. He couldn't fathom its suddenness, its finality. He was convinced that the death had not been inevitable, might have been prevented if only John Sr. had gotten better medical care, if only . . . (Nasar, 1999, p. 209).

(Note the positive form of the counterfactual involving an alternative condition). Knowledge that his father had not received proper medical care serves as the difference that might have made a difference and as the basis for Nash's causal explanation of his father's death. The counterfactual seems to be a confirmatory test for Nash's belief that his father's lack of proper medical care contributed to his death. It is unclear whether not receiving proper medical care was unusual because economics and areas where one lives could make inadequate medical care the norm.

Roese (1997), in his review of counterfactual reasoning, emphasized that unusual conditions are those that are selected as causes. This position is consistent with the general approach of Hart and Honoré (1985) on the law, but their focus is on abnormal social occurrences such as murder or theft or negligence (see also Hilton and Slugoski, 1986, who adopt this view). The abnormal circumstances theory, however, fails to account for normal processes such as the sun's generation of heat. Causes need not be unusual: Killing someone by use of a gun in American society is not unusual, though murder itself is infrequent. In the case of the *Essex*, the sinking of a ship by a whale was certainly unusual. But the causes of the whale's behavior might have been quite normal with respect to its perception of another male in its territory. What is normative depends on the criterion or circumstances in which one views the conditions as causes. An unusual event may not have an unusual cause.

Collingwood (1938/1961) recognized in his analysis of causation that the search of causes in sets of past conditions is done primarily in order to either prevent or produce something. The causes selected from the conditions depend on the particular perspective used to explain an event. For example, a civic engineer, a policeman, and the driver of a car that turned over while negotiating a curve would offer three very contrasting explanations of the same event. Mackie (1980) argued that theories, termed *causal fields*, determine which conditions are selected as causes. Einhorn and Hogarth (1986) explained causal prediction using this *relativity of causes* view. The selection of causes, then, could arise from a set of conditions surrounding the event that is interpreted within a theoretical frame. A person who tries to explain an event adopts a theory or a causal field to examine conditions and select them as causes. A causal field determines the selection of causes and reduces uncertainty when examining a case.

Whenever important events occur that are unexpected, people are generally motivated to trace causes. For example, in the law, Hart and Honoré (1985) point out that both causes and consequences are traced to determine responsibility and liability for harmful or unlawful outcomes. The tracing of causes also occurs generally with disasters such as that of the crash of the Space Shuttle Challenger in 1986 (Hilton, Mathes, & Trabasso, 1992). The reason that causes are traced is that their discovery (e.g., erosion of O rings in the rocket fuel tanks) enables the prevention of future disasters. Counterfactuals may be used to test beliefs about potential causal explanations (e.g., if *the temperature had been above 57°, then the O rings would have been flexible enough to prevent fuel from exiting and burning through*). The February, 2003 destruction of the Space Shuttle Columbia during reentry into Earth's atmosphere is undergoing a similar analysis for causal explanations at the writing of this article. A candidate cause, namely debris that hit the Columbia during takeoff, was observed and reported as a possible difference that made a difference, and may prove to be the ultimate link in a causal chain that led to the loosening of tiles that provide a heat shield during reentry.

The successful simulations reported in this article support the idea that text comprehension can provide an account for findings in a decision-making task. How the decision maker understands and represents the text determines how information is accessed and used to make a decision. This claim is consistent with Pennington and Hastie's (1993) observation and Kintsch's (1998) approach to comprehension. A promising extension of the present approach is that of Trabasso and Wiley (2002) who simulated comprehension processes that produce *hindsight bias* (Fischhoff, 1975; Hawkins and Hastie, 1990). Trabasso and Wiley used discourse analysis to identify the conditions that could support each possible outcome. They assumed that a particular outcome, when it occurs, leads to an updating of its connection strengths to its causes. To make an outcome prediction, given memory updating (see also Hoffrage, Hertwig, & Gigerenzer, 2000), participants are more likely to access those conditions that favor the given outcome rather than its alternative. Simulations using the connectionist model accurately predicted the hindsight decisions for two sets of seven stories studied by Wasserman, Lempert, and Hastie (1991).

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