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Report

## Spontaneous causal inferences<sup>☆</sup>

Ran R. Hassin,<sup>\*</sup> John A. Bargh, and James S. Uleman

*Department of Psychology, New York University, 6 Washington Place, New York, NY 10003-6634, USA*

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### Abstract

Three studies examine the hypothesis that people spontaneously (i.e., unintentionally and without awareness of doing so) infer causes (the Spontaneous Causal Inference, or SCI, hypothesis). Using a cued-recall paradigm, Study 1 examines whether SCIs occur and Study 2 allows for a comparison between implicitly inferred and explicitly mentioned causes. Study 3 examines whether SCIs can be fully explained in terms of spreading activation to general, abstract schemes. It is suggested that STIs (e.g., Winter & Uleman, 1984), and spontaneous predicting inferences (e.g., McKoon & Ratclif, 1986a, 1986b), may be better understood in their relation to SCIs. © 2002 Elsevier Science (USA). All rights reserved.

Inferring causal relations among the constituent elements of this world, be they physical objects or living things, is one of the most important tasks the cognitive system has to perform (e.g., Heider, 1944; Kant, 1965; Kelley, 1967; Michotte, 1963; Weiner, 1985). Moreover, in a dynamic world, full of shifting conditions and sudden surprises, inferring causes is a task that the cognitive system has to perform very frequently and very swiftly. This frequent need for rapid causal understanding might place an overwhelming demand for cognitive resources. Since these resources are limited (Kahneman, 1973), it seems that some of the work related to inferring causality has to be done in a way that demands less cognitive resources, that is—automatically.

Previous research regarding the automaticity of causal attribution has focused on its efficiency, that is—on whether causal attributions can occur with minimal cognitive resources. At present, there is a consensus on the fact that the characterization of a behavior can occur with minimal cognitive resources (e.g., the characterization “this was a dishonest act” upon seeing Ap shoplifting; Gilbert, Pelham, & Krull, 1988; Trope, 1986). There is less agreement, however, on what other

steps of causal attribution—if any—can occur with minimal cognitive resources.

In this paper, we focus on another aspect of the automaticity of causal inferences; namely, *spontaneity*. An inference is defined here as spontaneous if: (1) it is not suggested by the experimental instructions, (2) people are usually unaware of their intentions to make it, and (3) people are usually unaware of the inference itself (see Uleman, 1989). As argued above, the importance of causal inferences on the one hand, and the limited capacity of the conscious cognitive system on the other hand, lead us to hypothesize that causal inferences can be spontaneous.

### Previous research on non-instructed causal attribution

Previous research, which used a more lenient notion of spontaneity, examined whether causal attributions can occur without explicit instructions to make them (criterion 1 above; see, e.g., Hastie, 1984; Krull & Dill, 1998; Lau, 1984; Liu, Karasawa, & Weiner, 1992; Malle & Knobe, 1997; Roese & Olson, 1995; Sanna & Turely, 1996; Weiner, 1985). As noted by Kanazawa (1992), however, participants in these earlier studies were specifically directed to ask themselves questions, and hence, the evidence gathered cannot conclusively speak to the spontaneity of causal attributions. With this problem in mind, Kanazawa then conducted a new set of studies, in which participants were asked to retell a scenario they

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<sup>\*</sup> Corresponding author.

E-mail address: ran.hassin@nyu.edu (R.R. Hassin).

had been presented with. Participants were asked to “reconstruct [the story] in your own head” and to retell the story such that “[a] friend can fully understand the events” (p. 664). Conscious, effortful activities of this kind are likely to be affected by lay theories about the characteristics of “good stories” and “full understanding.” These lay theories may suggest, for example, that an important aspect of (re)telling stories is to explain *why* unexpected events have occurred. If this were the case, and there is nothing in Kanazawa (1992) to suggest otherwise, then studies such as Kanazawa’s cannot conclusively examine the question of (lenient) spontaneity either.

### Inferences during narrative comprehension

In a related field, psychologists interested in text comprehension are examining inferences that occur during narrative comprehension. An important part of this literature revolves around inferences that occur during “casual” reading conditions, that is—when reading is not accompanied by internally or externally induced goals to infer underlying structures (for overviews see Graesser, Singer, & Trabasso, 1994; McKoon & Ratcliff, 1992). The consensus in this field seems to be that when people engage in casually reading narrative texts, they make inferences that are important for achieving coherence (e.g., Graesser et al., 1994; McKoon & Ratcliff, 1992; Trabasso & Suh, 1993). Importantly, one of the main factors that determines coherence is causality: out of the seven types of inferences that help us in achieving coherence, at least *four* are directly related to causal structure (Graesser et al., 1994).

The consensus regarding the occurrences of causal inferences on the one hand, and the emphasis on examining “casual” reading on the other, may suggest that, as argued above, people may sometimes engage in spontaneous causal inferences. To the best of our knowledge, however, spontaneous inferences of causes (vs. causal structure) were not examined in this literature. Moreover, after reviewing the literature on inferences of causal structure, McKoon and Ratcliff (1992, p. 462) conclude that the evidence for their occurrence is still not conclusive (for an elaborate discussion of these issues see Hassin, 2002).

### Spontaneous trait inferences

Perhaps, the most relevant literature for the current purposes is that regarding spontaneous trait inferences (e.g., Winter & Uleman, 1984), where the spontaneity of inferences has been repeatedly demonstrated. So, for example, this literature shows that upon reading sentences like “Henk refused to drink a new brand of beer,”

people spontaneously infer traits (in this case—*Picky*). Inferences of this kind occur when participants are asked to memorize sentences, when they read such sentences as distractors in another “main” task, and when they are merely asked to familiarize themselves with the sentences (Uleman, 1999; Uleman, Newman, & Moskowitz, 1996; see also Skowronski et al., 1998).

One of the prominent ways to think of traits is as internal causes, which drive people to behave in the certain ways that they do (e.g., Henk refused to drink the beer *because* he is picky).<sup>1</sup> Hence, STIs may be viewed as specific sub-category of the hypothesized SCIs, that is inferences of internal causes.

### Overview of the present research

The spontaneity of causal inferences is examined in three studies. The first provides a demonstration of spontaneous causal inferences and the second extends this finding by comparing explicitly mentioned and implied causes. The third study examines whether spreading of activation to schemes can account for SCIs.

#### Study 1

##### Overview

The study has three distinct parts. In the first, participants read short scenarios and were asked to rate “how interesting they are.” Then, they engage in a filler task that served to remove all contents of the scenarios from short-term memory. Upon finishing the filler task, participants were presented with a surprise cued-recall task for the scenarios presented in the first part.

The scenarios either implied a certain cause (e.g., “*After spending a day exploring beautiful sights in the crowded streets of New York, Jane discovered that her wallet was missing*” implies that Jane was *pickpocketed*) or not (e.g., “*Before leaving home for a day of exploring beautiful sights in the crowded streets of New York, Jane discovered that her wallet was missing*”).<sup>2</sup> In the recall stage, participants were presented with two types of cues: the implied causes (e.g., *pickpocket*) and words from the scenarios (e.g., *sights*). Based on Tulving’s encoding specificity principle (Tulving and Thompson, 1973), we hypothesize an interaction, such that causal cues will help retrieve cause-implicating scenarios more

<sup>1</sup> It is important to note, however, that not all traits, and not all contexts, allow for such interpretation (for a discussion about the relationships between traits and causes see Newman & Uleman, 1989).

<sup>2</sup> A comprehensive list of the stimuli is available from the first author, at ran.hassin@nyu.edu.

than scenarios that do not imply these causes, but no such pattern would be found when words from the scenarios are used as cues.

### Method

#### Participants

Thirteen female and 7 male NYU undergraduates enrolled in the Introductory Psychology course (mean age 20) participated in the study in partial fulfillment of course requirements.

#### Materials

A list of 38 target scenarios was constructed such that each of these scenarios implied a certain cause (Cause Implied version or CAI). Then, each of these scenarios was slightly changed to create a version in which the cause was not implied (CANI condition). Words that were judged by the authors to be semantically associated with the cause were used in both versions.

In a pilot study, 28 participants were asked a forced choice “Why” question about one version of each of the scenarios. For each scenario, we computed a difference score between the proportion of responses containing the designated cause in the CAI version and the corresponding proportion in the CANI version. The 20 scenarios with the highest difference scores were selected for the study itself.

Each short scenario had two different recall cues. One was the implied cause (Causal cues condition) and the other was a word taken from the sentence (Repetition condition).

#### Design

The scenarios were presented in one of the two random orders (Order factor). To control for the effects of the specific versions of the sentences, one half of our participants viewed one half of the sentences in their CAI form and the other half in their CANI form; the other half of the participants received the complementary forms (Scenario-version factor). And finally, to control for the effects of specific versions of cues, one half of our participants viewed one half of the cues in their Cause form and the other half in their Repetition form; the other half of the participants received the complementary forms (Cue-version factor).

The resulting design is a 2(Target : CAI vs. CANI scenarios; within-participants)  $\times$  2(Cue : Cause vs. Repetition; within-participants)  $\times$  2(Order; between-participants)  $\times$  2(Scenario-version; between-participants)  $\times$  2(Cue-version; between-participants).

#### Procedure

Participants were run either individually or in small groups. The instructions for each part were given separately. In the first part, they were asked to read 20 sce-

narios and judge how interesting they were (see McKoon & Ratcliff, 1986a, 1986b). The distraction task, in which participants were asked to fill the names of the states in a blank US map, immediately followed. After 5 min, the experimenter interrupted the participants and introduced the third part—the surprise cued-recall. Participants were told that the cues might help them to retrieve the scenarios and they were asked to write down everything they could remember from the sentences. After the completion of the cued-recall task, participants were debriefed.

#### Scoring

Each answer was rated by two judges on a scale of 0–2, where 0 indicated no memory at all for the scenario, 1 indicated partial recall, and 2 indicated that the scenario was almost fully or fully recalled. The inter-judge agreement was 89% and it did not differ with condition. All disagreements were resolved in discussion.

#### Results and discussion

None of the between-participant factors had a significant effect on the results, all  $F$ s < 1.17,  $p$ s > .30. Hence, the analysis was collapsed across these factors and a 2(Context : CAI vs. CANI)  $\times$  2(Cue : Cause vs. Repetition) within-participant ANOVA was conducted. In line with our hypothesis, the effectiveness of the causal cues depended on the Target manipulation—CAI scenarios were recalled more often than CANI scenarios—but no such effect was found for the repetition cues,  $F(1, 19) = 6.80$ ,  $p < .05$  (see Table 1). The two main effects were also significant: CAI targets were recalled more often than CANI targets,  $F(1, 19) = 5.06$ ,  $p < .05$ ; and Causal cues were more effective in retrieving the scenarios than Repetition cues,  $F(1, 19) = 37.51$ ,  $p < .001$ .

Contrast analysis yielded the predicted pattern. With causal cues, the difference in recall between CAI and CANI scenarios was significant,  $F(1, 19) = 8.09$ ,  $p < .05$ , while the equivalent difference in the Repetition condition was not significant,  $p = .62$ .

Participants’ awareness and intentions were assessed in a thorough debriefing stage. When confronted with

Table 1  
Mean recall as a function of Target scenarios and Cue manipulation: Study 1

Retrieval Cue	Target scenarios	
	CAI	CANI
Cause	0.98 (0.40)	0.60 (0.43)
Repetition	0.35 (0.42)	0.38 (0.38)

Note. Means are on a scale of 0–2; numbers in parentheses are  $SD$ s. CAI is the condition in which the causes that were used as cues were implied by the scenarios; in CANI, the causes that were used as cues were not implied by the scenarios.

indirect questions such as “how did you decide how interesting the sentences were,” none of our participants noted causality in any manner. Participants were also confronted with more direct questions such as “did you try to figure out the causes for the events in the scenarios?” and “try to assess what this study examined.” Only one participant indicated awareness of causal-related thoughts and her data were excluded from the analysis. The results of the debriefing, then, seem quite clear: participants indicated neither intention to nor awareness of the inferences they have just made, thus, supporting the SCI hypothesis.

The examination of awareness in debriefings is not exhaustive, though, and it leaves open the possibility that participants were aware of their inferences when they actually made them, but forgot them by the time they got to the debriefing stage.

To further examine this alternative interpretation of the results, we computerized the task and gave it to 29 participants under the same instruction set. After the presentation of a randomly chosen causal scenario the experiment stopped and the experimenter handed a questionnaire to the participants without saying a word. The first question in the questionnaire was: “please write down every thought or image that passed through your mind while reading and rating the last sentence.” The second question was: “what were the determinants that affected your last judgment.”

Out of the 29 participants, three explicitly mentioned the cause that was implied by the scenario they have just read. One participant indicated that he had thought about “the reasons” for the events in the scenarios. Twenty five participants, however, mentioned neither the cause nor causality-related thoughts.

There are two important points to note about these findings. First, very few participants report awareness or intention, even when the questions are asked immediately after participants read a cause-implicating scenario. Given this very short time-interval—between 10 and 30 s—the results are highly suggestive: it seems that participants were unaware of inferring causes. Second, the proportion of participants reporting awareness or intention is very similar to the corresponding proportion in Study 1, thus, suggesting that under certain circumstances a thorough debriefing might be quite accurate in tapping awareness or intentions.

## Study 2

Study 2 examines the strength of SCIs through a comparison to scenarios in which the cause is stated explicitly. Thus, this study adds a third version of each scenario, one in which causes are explicitly mentioned (CAM condition). Our hypothesis is that causal cues will be most effective for the retrieval of CAM scenarios, a

little less effective for the CAI scenarios, and less effective still for CANI scenarios. The repetition cues, however, should have the same effect on all three kinds of sentences.

## Method

### Participants

Thirty (21 females and 9 males) NYU undergraduates enrolled in the Introductory Psychology course (mean age 20) participated in the study in partial fulfillment of course requirements.

### Materials

Eighteen of the 20 scenarios used in Study 2 were used in the current study. As mentioned above, we created a third version for each scenario by specifically mentioning the causes. Each short scenario had two recall cues: the implied cause (Causal condition), and a word from the sentence (Repetition condition).

### Design

The scenarios were presented in one of the two random orders (Order factor). To control for the effects of the specific versions of the sentences, participants were randomly assigned to one of the six groups, created by the assignments of different groups scenarios to the CAI, CANI, and CAM conditions (Scenario-version factor). And last, to control for the effects of specific versions of cues, one half of our participants viewed one half of the cues in their Trait form and the other half in their Repetition form; the other half of the participants received the complementary forms (Cue-version factor.)

The resulting design is a 3(Context : CAM vs. CAI vs. CANI scenarios; within-participants)  $\times$  2(Cue : Trait vs. Repetition; within-participants)  $\times$  2(Order; between-participants)  $\times$  2(Scenario-version; between-participants)  $\times$  2(Cue-version; between-participants).

### Procedure and scoring

These were identical to those of Study 1. The inter-judge agreement was 87% and it did not differ with condition. All disagreements were resolved in discussion.

### Results and discussion

None of the between-participant factors had a significant effect on the results, all  $F_s < 1.05$ ,  $p_s > .32$ . Hence, these factors were collapsed and a 3(Target : CAM vs. CAI vs. CANI)  $\times$  2(Cue : Cause vs. Repetition) within-participant ANOVA was conducted. The effects of both the Target and the Cue factors, and their interaction, were significant, all  $F_s > 5.55$ ,  $p_s < .001$  (see Table 2).

Table 2  
Mean recall as a function of Target scenarios and Cue manipulation:  
Study 2

Retrieval Cue	Target scenarios		
	CAM	CAI	CANI
Cause	1.12 (0.61)	0.81 (0.62)	0.41 (0.42)
Repetition	0.37 (0.39)	0.47 (0.53)	0.50 (0.51)

*Note.* Means are on a scale of 0–2; numbers in parentheses are *SDs*. CAI is the condition in which the causes that were used as cues were implied by the scenarios; in CAM causes are explicitly mentioned in the sentences; and in CANI, the causes that were used as cues were not implied by the scenarios.

To examine our hypotheses more closely, we conducted a series of *t* tests. All the means in the repetition cue condition were statistically equivalent,  $t_s < 1.22$ ,  $p_s > .22$ , consistent with our hypothesis that the effects of repetition cues are the same in all three levels of the Target factor. The means in the causal cue condition, however, were significantly different from each other, all  $t_s > 2.41$ ,  $p_s < .05$ . Thus, when the cue is a cause that is explicitly mentioned in the sentence, it helps in retrieval more than when the cue is a cause that has to be inferred from the sentence; and the latter, in turn, is more helpful than a cue that is a cause, which is not implied by the sentence.

As in the first study, participants' awareness and intentions were assessed in the debriefing stage. Two participants did mention that the cues seemed to contain words that "were related to the sentences, but did not explicitly appear in them." Their exclusion from the analysis did not change the pattern of the results.

### Study 3

In a related field of study, researchers have shown that readers infer instruments or tools required for accomplishing an action. For instance, in reading "Andrew cooked dinner" people might infer *stove* (Paris & Lindauer, 1976). However, the literature on instrument inferences suggests that *stove* serves as an efficient retrieval cue (in cued-recall paradigms), even when the target sentence is "Andrew cooked dinner on campfire" (Corbett & Doshier, 1978). In light of these findings, it has been suggested that implicit instruments are effective cues for recall not because they are inferred from target scenarios, but by virtue of their representation in abstract schemes or scripts that are suggested by the scenarios (e.g., COOKING DINNER).

The same suggestion might apply for SCIs. For example, *earthquake* might serve as a helpful cue for retrieving *Joe's house in Los Angeles suffered severe damage* not because *earthquake* had been inferred, but rather due to spreading of activation from *earthquake* to such abstract schemes as COLLAPSING HOUSES IN LA. More generally, it may be argued that in the pre-

vious studies causes did not serve as helpful retrieval cues because they were inferred, but due to their semantic relations to abstract schemes.

This suggestion is investigated in Study 3, using the same design that was used to examine instrument inferences (Corbett & Doshier, 1978). Thus, for example, using *ski* as a cue Study 3 contrasts the recall of sentences like (1) "While spending his winter vacation in the Rockies John broke his heel and his friend had to take him to the physician" with the recall of sentences like (2) "John spent his winter vacation in the Rockies, where he broke his heel during an advanced Karate lesson." If *ski* serves as a helpful cue due to its relations to abstract schemes such as WINTER VACATIONS, then it should be as efficient in retrieving (2) as it is in retrieving (1). It is our contention, however, that SCIs cannot be fully explained by spreading of activation to schemes. Therefore, we hypothesize that causal cues should be more helpful in retrieving sentences like (1) than sentences like (2) and that no such effect would be found with repetition cues.

### Method

#### Participants

Twelve female and six male NYU undergraduates enrolled in Introductory Psychology (mean age 19) participated in the study in partial fulfillment of course requirements.

#### Materials

Eighteen of the scenarios used in Study 1 were used in this study. In one condition, we used 18 slightly changed CAI scenarios (the changes were due to our stipulation that scenarios in both conditions will be similar in terms of their length). In the other condition, we used similar scenarios, but added an explicit, different, cause for the events in the scenario (the Different Cause or DIC condition). Thus, for example, consider the following example:

CAI: after a day-long walk in the desert sun, Alex felt dizzy and went to the emergency room where he was examined for a long time (implied cause: *dehydration*).

DIC: after a day-long walk in the desert sun, Alex felt dizzy and went to the emergency room where he was treated for a severe ear infection.<sup>3</sup>

<sup>3</sup> It might be argued that it seems that the DIC scenarios *do not imply* the "old" cause. We tend to agree. It seems that when the scenarios explicitly suggest "new" causes, the "old" causes are weakly implied. Note, however, that this is exactly the case with the instrument implying sentences described above. Any difference between the two cases results, we argue, from the crucial differences between these inferences and SCIs: part of what makes the latter interesting is that the implication here is not semantic, as shown by the control conditions in all three studies. It is precisely the *causal structure* of the events depicted that creates the implication, not the meaning of the words used, or the relevant schemes.

As in the previous studies, each short scenario had two different recall cues. One was the implied cause (Causal condition) and the other was a word taken from the sentence (Repetition condition).

### Design

The scenarios were presented in one of the two random orders (Order factor). To control for the effects of specific versions of the sentences, one half of our participants viewed one half of the sentences in their CAI form and the other half in their DIC form; the other half of the participants received the complementary forms (Scenario-version factor). And last, to control for the effects of specific versions of cues, one half of our participants viewed one half of the cues in their Cause form and the other half in their Repetition form; the other half of the participants received the complementary forms (Cue-version factor.)

The resulting design is a 2(Target : CAI vs. DIC scenarios; within-participants)  $\times$  2(Cue : Cause vs. Repetition; within-participants)  $\times$  2(Order; between-participants)  $\times$  2(Scenario-version; between-participants)  $\times$  2(Cue-version; between-participants).

### Procedure and scoring

The procedure and scoring were identical to those of Studies 1 and 2. The inter-judge agreement was 83% and it did not differ with condition. All disagreements were resolved in discussion.

### Results and discussion

Two subjects did not recall even one scenario and another three indicated intention or awareness of inferring causes. Their data were excluded from the analysis. None of the between-participant factors had a significant effect on the results, all  $ps > .30$ . Hence, these factors were collapsed and a 2(Target : CAI vs. DIC)  $\times$  2(Cue : Cause vs. Repetition) within-participant ANOVA was conducted. In line with our hypothesis, the effectiveness of the causal cues depended on the Target condition—CAI scenarios were recalled more often than DIC scenarios—but no such effect was found for the repetition cues,  $F(1, 13) = 8.58$ ,  $p < .05$  (see Table 3). The main effect of cues was significant, such that Causal cues were more effective in retrieving the scenarios than Repetition cues,  $F(1, 13) = 17.5$ ,  $p < .001$ . However, the main effect of Target was not significant,  $p = .94$ .

Contrast analysis revealed a surprising pattern. With repetition cues, the DIC scenarios were better recalled than the CAI scenarios,  $F(1, 13) = 6.16$ ,  $p < .05$ , thus, suggesting that the DIC scenarios were overall easier to recall than the CAI ones. To correct for this difference in baseline recall, we computed corrected scores per each

Table 3

Mean recall as a function of Target scenarios and Cue manipulation: Study 3

Retrieval Cue	Target scenarios	
	CAI	DIC
Cause	0.95 (0.56)	0.75 (0.54)
Repetition	0.32 (0.28)	0.54 (0.29)

*Note.* Means are on a scale of 0–2; numbers in parentheses are *SDs*. CAI is the condition in which the causes that were used as cues were implied by the scenarios; DIC is the condition in which different, explicit causes were mentioned in the scenarios.

participant: the mean recall using Repetition cues was subtracted from the mean recall using the Causal cues. An analysis of these means revealed that, as hypothesized, causal cues led to a significantly better recall of the CAI scenarios ( $M = .63$ ,  $SD = .48$ ) relative to that of the DIC scenarios ( $M = .21$ ,  $SD = .44$ ),  $F(1, 13) = 8.59$ ,  $p < .05$ .

Unlike the case of instrument inferences, then, alternative causes that were explicitly mentioned in the scenarios reduced the effectiveness of the “old” causal cues. This result suggests therefore that associations between abstract schemes and retrieval cues cannot fully explain the results of the previous studies. Thus, they support our contention that causes are spontaneously *inferred* during the reading of cause-implicating scenarios.

### General discussion

The results of three studies demonstrate that people spontaneously infer causes. These results suggest that the epistemic hunger for causes not only drives us to ask causal questions (e.g., Heider, 1944; Sanna & Turely, 1996; Weiner, 1985), but it also drives our cognitive system to spontaneously attach a “cause tag” even to events whose causes are not given to us explicitly. This cause tag is attached not only when the cause is a person’s trait (as is the case with STIs), but also in the more general case where the cause is a physical event or an action.

In a related series of studies, McKoon and Ratcliff (1986a, 1986b) have demonstrated what they call “predicting inferences.” Thus, for example, the cue “dead” helps in retrieving the sentence “The director and cameraman were ready to shoot close-ups when suddenly the actress fell from the 14th story,” more than it helps in retrieving the sentence “Suddenly the director fell upon the cameraman, demanding close-ups for the actress on the 14th story.” When taken together with the current findings it seems, then, that the mind not only spontaneously attaches a “cause tag”—it also attaches an “effect tag,” hence, spontaneously covering the whole range of causal relations.

## Inferences at encoding vs. at retrieval

Critics of the surprise-cued-recall paradigm as a measure of inferences at *encoding* suggest that the benefit in memory created by the cues may result from retrieval processes (e.g., McKoon & Ratcliff, 1986a, 1986b). There are two main ways in which this could happen. The first is by activating concepts that are semantically related to the cue that, in turn, help in retrieving the target scenario. Consider the target scenario (1) “*After spending a day exploring beautiful sights in the crowded streets of New York, Jane discovered that her wallet was missing.*” According to the first account, the cue “*pick-pocket*” might activate such concepts as “*wallet*” and the latter may help in retrieving the target sentence. Second, when given a cue participants may try to recall events that are related to it, causally or in other ways, and the resulting list of events might make the target scenario more accessible. So, for example, the cue “*pick-pocket*” might make participants think that “*pickpocketing usually happens while walking in crowded streets,*” thus, facilitating the recall of the target scenario.

Note, however, that all versions of our target scenarios shared the words that bear semantic relations with the cues (e.g., “*wallet,*” “*crowded streets*”), thus, making the first suggestion above less than plausible as an alternative explanation. Moreover, we have tried to rule out the second objection by keeping constant as many events and behaviors as possible. Thus, e.g., the non-causal version of (1) was (2) “*Before spending a day exploring beautiful sights in the crowded streets of New York, Jane discovered that her wallet was missing.*” Lastly, the results of Study 3 suggest that semantic relations between cues and abstract schemes implied by the scenarios cannot fully account for the current set of results.

While we acknowledge that the above arguments and evidence cannot rule out the possibility that at least some causal inferences were made at retrieval, we think that they render this interpretation of the results less probable. Moreover, we think that the alternatives to the cued-recall paradigm (e.g., on-line primed-recognition) are themselves open to alternative accounts. While the controversy between cued-recall and on-line paradigms is beyond the scope of the present paper, let us just note that the latter paradigms suffer from a severe shortcoming: they cannot show that spontaneous inferences are encoded into long-term memory (for a more elaborate discussion of related points see Hassin, 2002). Thus, studies of both kinds (and hopefully more) should be conducted to obtain convergent evidence regarding the spontaneity of causal inferences.

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