Journal of Experimental Social Psychology 45 (2009) 845–852

Contents lists available at ScienceDirect

Journal of Experimental Social Psychology

journal homepage: www.elsevier.com/locate/jesp

Reports

Counterfactual thinking facilitates behavioral intentions

Rachel Smallman *, Neal J. Roese

Department of Psychology, University of Illinois at Urbana-Champaign, Champaign IL 61820, United States

ARTICLE INFO

Article history:
Received 4 August 2008
Revised 26 February 2009
Available online 9 March 2009

Keywords:
Counterfactual thinking
Intentions
Goal cognition

ABSTRACT

People often ponder what might have been, and these counterfactual inferences have been linked to behavior regulation. Counterfactuals may enhance performance by either a content-specific pathway (via shift in behavioral intentions) and/or a content-neutral pathway (via mindsets or motivation). Three experiments provided new specification of the content-specific pathway. A sequential priming paradigm revealed that counterfactual judgments facilitated RTs to complete behavioral intention judgments relative to control judgments and to a no-judgment baseline (Experiment 1). This facilitation effect was found only for intention judgments that matched the information content of the counterfactual (Experiment 2) and only for intention judgments as opposed to a different judgment that nevertheless focused on the same information content (Experiment 3). These findings clarify the content-specific pathway by which counterfactuals influence behavior.

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People often imagine how the past might have been different. "If she hadn't been driving so fast, she wouldn't have been in an accident"; "If only I'd studied harder, I'd have passed the exam"; "If he'd kept his mouth shut, he'd still be working here today." Termed *counterfactuals*, these thoughts are mental representations of alternatives to past occurrences, features, and states (for a recent review, see Epstude & Roese, 2008). Counterfactuals often take the form of "if-then" conditional propositions in which the "if" specifies a personal action and the "then" specifies a goal. Counterfactual thinking impacts how individuals reason about, and find meaning in, the events that befall them (Galinsky, Liljenquist, Kray, & Roese, 2005; Markman & McMullen, 2003; McAdams & Albaugh, 2008). Counterfactuals furnish benchmarks against which events are appreciated; they influence emotions both in magnitude and in kind; and they impact a range of judgments, such as blame, likelihood, suspicion, and decision-making (Roese, 1997).

More generally, counterfactuals may serve a behavior regulating function, involving behavior change and performance improvement (Markman & McMullen, 2003; Roese, 1994, 1999; Roese & Maniar, 1997; Roese & Olson, 1995, 1997; Saffrey, Summerville, & Roese, 2008; Segura & Morris, 2005). We draw a distinction between content-neutral and content-specific pathways by which counterfactual thinking influences behavior. Originally introduced to clarify the influence of goals on action (i.e., goal striving; Gollwitzer & Moskowitz, 1996), the same distinction may clarify the role of counterfactual thinking in goal-related behavior (Epstude & Roese, 2008). The content-neutral pathway describes cases in which counterfactuals influence behavior in domains that are independent of the counterfactual context. That is, the simple act of considering alternatives evokes unrelated behavior change. Thus, a counterfactual in one domain (e.g., academics) can influence behavior in a different domain (e.g., health behavior). Examples of content-neutral effects include mindset priming (which involves a change in the mere style of processing information, e.g., Galinsky & Moskowitz, 2000; Kray, Galinsky, & Wong, 2006; Markman, Lindberg, Kray, & Galinsky, 2007) and motivational effects, as when negative affect evoked by failure induces greater effort and striving on a subsequent task (e.g., Markman, McMullen, & Elizaga, 2008; McMullen & Markman, 2000; Reb, 2008; Roese, Hur, & Pennington, 1999).

In contrast, the content-specific pathway focuses on how counterfactuals influence relevant behavior via the formation of behavioral intentions that involve the same behavior specified by the counterfactual (e.g., a counterfactual of the form "should have studied harder" activates a behavioral intention to study more for the next exam, which in turn results in an increase in actual subsequent studying behavior). Stated differently, negative events, counterfactuals, behavioral intentions, and behavior are tied together in a feedback loop that governs ongoing behavior and involves continuing connections in memory (e.g., Bargh, Gollwitzer, Lee-Chai, Barndollar, & Trotschel, 2001; Carver & Scheier, 1998). This regulatory loop preserves homeostasis by increasing activity level during a problem until there is successful resolution of the problem, at which point activity level is reduced. This process consists of three steps: (1) a problem activates counterfactual thinking, (2) counterfactual thinking activates a behavioral intention, and (3) the behavioral intention evokes the corresponding behavior.

Prior research has documented the first link, such that negative outcomes activate counterfactual thinking. Counterfactuals are more likely after losing a bet (Gilovich, 1983), receiving negative

* Corresponding author.
E-mail address: rsmallm2@illinois.edu (R. Smallman).

0022-1031/$ - see front matter Published by Elsevier Inc.
doi:10.1016/j.jesp.2009.03.002

feedback on laboratory tasks (Roese & Hur, 1997), and performing poorly on an exam (Sanna & Turley, 1996). Much research has also supported the third link, that of the effect of behavioral intentions on behavior (Abraham & Sheeran, 2003; Ajzen, 1991; Ajzen & Fishbein, 1980; Gollwitzer & Sheeran, 2006; Sheeran, 2002; see Webb & Sheeran, 2006 for meta-analysis). Some research also supports the middle link, the effect of counterfactuals on behavior intentions, but there is an important ambiguity that clouds this prior research.

Three papers have reported an effect of counterfactuals on behavioral intentions, with demonstrations centering on academic performance (Roese, 1994), computer purchasing (Krishnamurthy & Sivaraman, 2002), and smoking cessation (Page & Colby, 2003). In all three demonstrations, the counterfactual manipulation was implemented on a between-subject basis (some subjects were encouraged to generate "if only" possibilities; others were not), followed by a Likert intention rating. The ambiguity centers on whether the effect was due to the information in the counterfactual furnishing the basis of the behavioral intention, or whether it instead involved a more generic motivational effect, in which the negative affect evoked by dwelling on "what might have been" pushed subjects to persist longer and work harder, which might impact not just the behavior contained in the counterfactual, but other unrelated behaviors as well. The counterfactual might also have activated a "counterfactual mindset", in which the individual might consider alternative possibilities even in the context of unrelated behavioral contexts (Kray et al., 2006). For example, if a consumer is prompted to consider the benefits that might have been realized if she had bought an Apple computer instead of a Dell computer, the consequence might involve only a shift in likelihood of buying a new Apple computer in the future, or might it also impact the purchasing of meals, automobiles, and clothing (cf. Albarracin et al., 2008; Xu & Wyer, 2008). In the present research, we resolved this ambiguity by directly manipulating whether or not the counterfactual focuses on the same action as the behavioral intention. That is, in Experiment 2, we tested whether the effect of counterfactuals on behavioral intentions varies as a function of whether the counterfactual and the intention center on the same vs. a different behavioral act. If the effect of counterfactuals on behavioral intentions mainly involves a content-specific pathway, a larger effect would be expected when counterfactuals and intentions focus on the same vs. different behaviors. On the other hand, if the effect of counterfactuals on intentions involves mainly a motivated persistence mechanism or a mindset activation mechanism (i.e., content-neutral), then we should see a similar degree of impact of counterfactuals on behavioral intentions when they share vs. do not share a focus on the same actions.

By integrating theoretical ideas from the goal cognition literature, the impact of counterfactuals on behavioral intentions may be conceptualized in terms of goal priming (Epstude & Roese, 2008). Accordingly, we used a sequential priming paradigm to test the facilitating effect of counterfactuals on the latency to respond to behavioral intention judgments. In observing such a facilitation effect, a key question is whether the underlying mechanism reflects semantic priming vs. a functional relation. Semantic priming involves the activation of information in memory by another piece of information that is similar in meaning. For example, hearing the word "doctor" makes the word "nurse" momentarily more accessible from memory, because both share meaning centering on health care provision (Higgins, 1996; Meyer & Schvaneveldt, 1976). Semantic priming is a broadly generic effect, expected to be involved in many kinds of situations. By contrast, a functional relation in memory reflects a more specific, goal-related phenomenon. In a functional relation, information that is repeatedly used for or directed at a particular goal is particularly likely to be activated by that goal, and vice versa (Shah, Friedman, & Kruglanski, 2002). In the same way that a shovel is functionally related to digging a hole, the cognitive representation of means is functionally connected to representations of goals because means are used to achieve goals (Bargh, 1990; Bargh & Gollwitzer, 1994; for reviews see Austin & Vancouver, 1996; Chartrand & Bargh, 2002). For example, Shah and Kruglanski (2003) demonstrated that information regarding means is sufficient to activate information in memory regarding ends, and that this activation was independent of semantic priming. The priming of goal constructs by means constructs is not reducible to mere semantic priming, but rather involves the knowledge that means are used to achieve goals (Aarts & Dijksterhuis, 2000; Bargh et al., 2001; Shah, Kruglanski, & Friedman, 2003). We argue that, like a shovel and a hole, counterfactuals generally are linked to behavioral intentions by way of a functional relation. Further, this conception underscores the goal-directed nature of counterfactual thinking. As a simple test of this idea, in Experiment 3 we examined whether counterfactuals influenced both a behavioral intention judgment but also a completely different judgment, while holding constant (across trials and participants) whether the two kinds of judgment focused on the same actions. According to a semantic priming explanation, an equivalent effect should be found across both kinds of judgment, because both share the same degree of information overlap with the counterfactual prime. By contrast, we predicted that the impact of counterfactuals would be greater for the behavioral intention judgment, a finding that would be consistent with a functional relation between counterfactuals and behavioral intentions.

In the present research, we used a sequential priming paradigm to shed new light on the effect of counterfactual thinking on behavioral intentions. By using multiple speeded trials and testing variation in reaction time, we could locate effects that were relatively spontaneous and less susceptible to demand characteristics. The benefits of sequential priming have until now eluded counterfactual research, mainly because the syntactic complexity of a counterfactual does not align with the need for priming stimuli to be brief and simple. A further challenge was to manipulate "counterfactualness" cleanly. To do so, the control condition would need to hold constant the main informational content of the priming judgment while varying only the presence of a counterfactual component. Our solution was to manipulate (within a series of trials) only the cue preceding the informational content (which involved a behavioral act), but not the information itself. Thus, the cue contained either a counterfactual marker ("if only") vs. a control marker focusing on non-counterfactual (i.e., factual) aspects of the action statement that followed.

In each trial, participants made two judgments in succession: the prime (action) judgment and the target (intention) judgment. As the trial began, participants first saw a negative event, designed to establish the context (e.g., "got a bad sunburn"). Their instruction was to think about the event happening to them personally. Two seconds later, the prime judgment appeared below the event description and consisted of a cue plus an action phrase. There were two prime conditions, manipulated on a within-subject basis: counterfactual vs. control. In the counterfactual trials, a counterfactual cue was paired with the action phrase (e.g., "should have" + "worn sunscreen"). Participants decided if this behavior (e.g., wearing sunscreen) was something that could have changed the outcome of the event (e.g., getting a bad sunburn). Participants pressed a key labeled "yes" or "no" to indicate their decision. In the control trials, a factual cue was combined with the action phrase. Two different control tasks were used (across different experiments). Experiment 1 used a frequency judgment (e.g., "common behavior:" + "worn sunscreen"). Participants decided if the behavior (e.g., wearing sunscreen) was something that they did frequently. Experiments 2 and 3 used a recency judgment (e.g., "In the last week have" + "worn sunscreen"). Participants decided whether they had performed this behavior (e.g., wearing sun-

screen) within the past week. In both control conditions, participants pressed a key labeled "yes" or "no" to indicate their decision. Action phrases were randomly paired with either counterfactual or control cues.

The second judgment, the target task, was a behavioral intention judgment. It consisted of an intention cue and a future action phrase. Participants decided whether they would be likely to perform the behavior in the future, pressing a key labeled "yes" or "no" to indicate their decision. In Experiments 1 and 3, the action was always related to the event in the prime task (e.g., "In the future I will" + "wear sunscreen"). In Experiment 2, half of the actions were unrelated (e.g., "In the future I will" + "go to the gym"). In both cases, participants determined whether they would be likely to do this behavior in the future. Thus, our procedure permitted a within-subject manipulation of counterfactual thinking that controlled for similarity in content across counterfactual and control trials (See Fig. 1 for overview of procedure).

Three experiments are reported. Experiment 1 provided initial support for the facilitating effect of counterfactuals on behavioral intentions, using both a control condition and also a baseline condition to demarcate the effect. Experiment 2 tested whether the effect occurred only when the counterfactual and behavioral intention focused on the same action, or whether counterfactuals facilitate to the same degree behavioral intentions focusing on completely different actions. The latter pattern would suggest a mechanism that is content-neutral (i.e., involving a motivational or mindset mechanism). The former pattern, however, would embody a content-specific pathway. Experiment 3 was designed to further clarify the facilitation effect by testing whether it is specific to behavioral intention judgments, or whether it generalizes to other sorts of judgments as well. The latter effect would be consistent with a semantic priming mechanism, whereas the former effect would suggest a functional relation in memory between counterfactuals and behavioral intentions.

Experiment 1

Experiment 1 was designed to provide initial support for the hypothesis that counterfactual thinking facilitates behavioral intention judgments. Using a within-subject sequential priming paradigm, negative events were judged in one of three ways: counterfactual, control, or no-judgment baseline, with reaction time (RT) to a subsequent behavioral intention statement serving as the dependent variable.

Method

Thirty students participated for course credit. In all research reported here, testing was implemented using desktop computers running MediaLab and DirectRT software.

Participants completed 86 trials consisting of 28 or 29 trials in each of the three experimental conditions. Each trial comprised of two tasks: the prime (action) judgment (manipulated) and the target (behavioral intention) judgment.

The prime task was structured around a question about negative everyday life events. Events were selected to be representative of the daily mishaps that college students normally encounter (see Appendix A). A simple negative event (e.g., "spilled food on shirt") appeared on the screen first. Participants imagined that the event happened to them. After a 2 s delay, the prime judgment appeared below the event and consisted of a cue and an action phrase. The manipulation hinged on the cue that preceded this action statement (i.e., counterfactual vs. control vs. baseline).

In the counterfactual trials, a counterfactual cue was paired with the action phrase. For example, if the event was "spilled food on shirt," then a counterfactual cue would be paired with a related action statement (e.g., "should have eaten more carefully"). Participants decided if this behavior (e.g., eating carefully) was something that could have changed the outcome of the event (e.g., spilling food on a shirt). In the counterfactual trials, one of two cues was randomly inserted prior to the action statement ("could have" or "should have"). This variation was introduced to rule out the interpretation that effects depended on particular syntax.

In the control trials, by contrast, a factual cue was combined with the action phrase. Participants decided if the behavior (e.g., eating carefully) was something that they did frequently. In these trials, either of two cues was inserted randomly: "common behavior" and "rare behavior." Thus, for control trials, participants saw a frequency cue paired with the action phrase (e.g., "common behavior: eaten more carefully"). In both counterfactual and control trials, par-

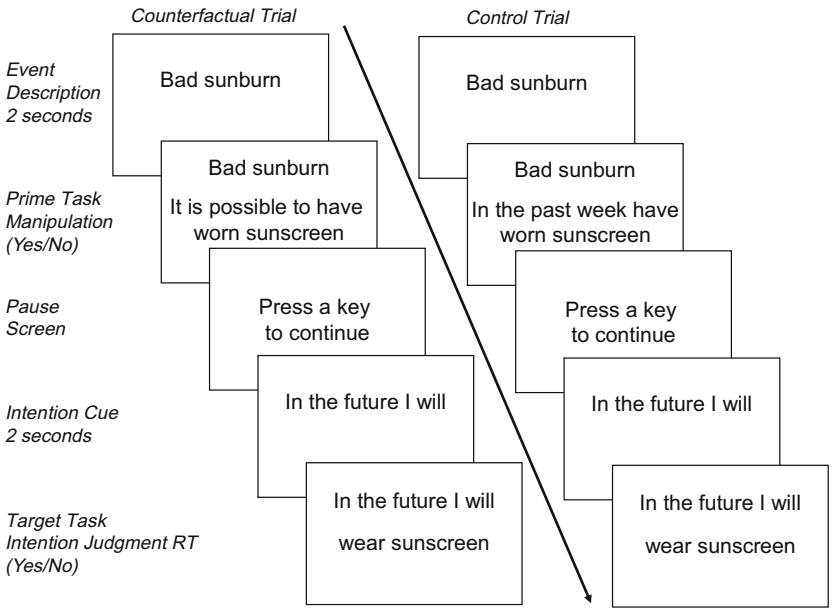

Fig. 1. Overview of sequential priming paradigm.

ticipants pressed a key labeled "yes" or "no" to indicate their decision. In the baseline trials, neither action phrases nor cues appeared below the event description. Rather, participants saw the event for 2 s, imagined that the event happened to them, and were prompted to press a key to continue to the target task. Between the prime (action) task and the target (intention) task in each trial, a blank screen appeared, asking participants to press a key to continue. This "pause" screen was included to eliminate the influence of motor facilitation on RTs (i.e., remove the effect of successive identical key presses).

The target task was an intention judgment. Participants made a judgment about possible future behaviors, all of which were related to the event in the prime task (e.g., spilling food on a shirt). The target task consisted of an intention cue and a future action phrase. On each trial, the cue "In the future I will" appeared first on the screen. After a 2 s delay, an action phrase appeared directly below the cue (e.g., "eat more carefully"). Participants decided whether they would be likely to perform the behavior in the future, pressing a key labeled "yes" or "no" to indicate their decision. Trial order was randomized across participants.

Results and discussion

Outlier RTs, defined on a within-subject basis as RTs > 2.5 *SD*s above the within-condition mean, RTs < 2.5 *SD*s below the within-condition mean, or RTs < 200 ms, were trimmed (3.7% of RTs). Outliers were distributed equally between counterfactual, control, and baseline conditions (36%, 32%, and 32%). Data were log-transformed to correct for skewed distribution; untransformed means are presented for clarity.

To provide a more sensitive test of our hypothesis, we examined RTs only for intentions judgments in which participants responded "yes" (85% of all trials). Because we were interested in whether counterfactuals facilitated responding to an intention, the effect depends on subjects considering the intention plausible and desirable. The subset of intention RTs with "yes" responses were distributed evenly across the counterfactual, control, and baseline conditions (34%, 34%, and 33%). A oneway ANOVA performed with the 3 levels of prime judgment as the independent variable revealed a significant main effect, $F(1,29) = 106.0$, $p < .001$, $d = 3.76$ (see Fig. 2). Counterfactual judgments facilitated intention RTs relative to baseline (*M*s = 726 ms vs. 1122 ms), $t(29) = 10.30$, $p < .001$, $d = 1.15$, and also relative to control judgments (*M*s = 726 ms vs. 787 ms), $t(29) = 2.31$, $p = .03$, $d = 0.22$. This experiment thus provided initial evidence that counterfactual thinking facilitates behavioral intentions.

Experiment 2

The first experiment showed that counterfactuals facilitated judgments involving behavioral intentions that were specific to the events (i.e., related to the counterfactuals). That is, the counterfactual prime judgment relied on the same semantic content (i.e., focused on the same action, such as being more careful) as the target intention judgment. Although consistent with the idea of a content-specific pathway, the design of Experiment 1 could not rule out the alternative that this effect was influenced by the content-neutral pathway. That is, it is possible that the counterfactual prime judgment produced a momentary motivational "kick," which might then facilitate any subsequent intention judgment, regardless of whether it is related or unrelated to the event and counterfactual (e.g., affective motivation; Markman et al., 2008; McCrea, 2008). To address this possibility, Experiment 2 added a manipulation of information match vs. mismatch to the paradigm used in Experiment 1. Thus, half of all trials involved a match between counterfactual and behavioral intention (i.e., both focus on same action), whereas the other half of trials involved a random mismatch between counterfactual and behavioral intention (i.e., they focused on different actions). If the facilitation occurred in both conditions, then some of the effect must involve content-neutral mechanisms, such motivation or mindsets. We predicted, however, a significant interaction, such that the facilitating effect observed in Experiment 1 would be much stronger when the counterfactual and the behavioral intention focused on the same action.

Experiment 2 introduced a different control judgment against which to benchmark the counterfactual facilitation effect. In Experiment 1, the control judgment involved frequency estimation, and it is possible that such a judgment is more difficult than the counterfactual judgment, which might in turn slow down the subsequent intention judgment. Further, the control phrases were somewhat awkward in their phrasing, in that they did not comprise sentences that were as straightforwardly clear as the counterfactual phrases. Accordingly, Experiment 2 used a new control judgment (deciding if they had performed a specified action in the last week) that was more closely matched to the counterfactual judgment in readability.

Method

Forty-six students participated for course credit. As in Experiment 1, each trial included an event description, followed by two judgments in succession: the prime (action) judgment and the target (intention) judgment. In counterfactual trials, the priming task consisted of a counterfactual cue and an action phrase, with participants deciding if the behavior was something that could have changed the outcome of the event. In the control trials, a factual cue was combined with the action phrase. The control trials involved a recency judgment. Participants decided whether they had performed the action within the past week. In both conditions, participants pressed a key labeled "yes" or "no" to indicate their decision (see Fig. 1). The baseline condition was identical to the one in Experiment 1. Participants saw the event for 2 s, imagined that the event happened to them, and were prompted to press a key to continue to the target task.

The second judgment, the target task, was an intention judgment in which participants decided whether they would be likely to perform a certain behavior in the future, pressing a key labeled "yes" or "no" to indicate their decision. Participants were instructed that some of these future behaviors would be related to the prior action judgment, but that other future behaviors would be unrelated to the prior action judgment. In both cases, they were asked to focus only on whether they would be likely to implement the behavior in the future. This instruction was designed to emphasize to participants that they should focus only on the likelihood of performing the specified behavior, regardless of its association with the earlier action judgment. In half of the judgments, the behavioral intention matched the counterfactual prime judg-

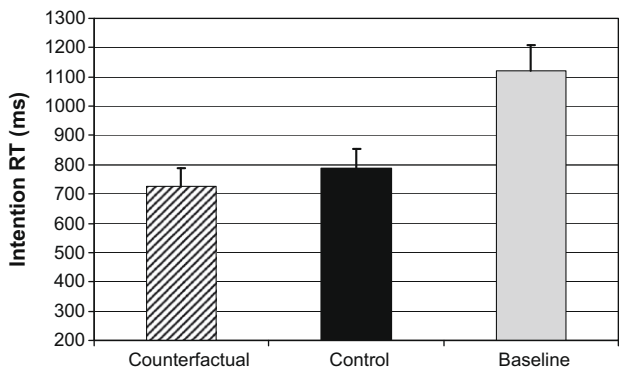

Fig. 2. Intention RTs as a function of prime judgment task (Experiment 1).

ment in terms of focusing on the same action. Thus, if the event described a bad sunburn and the counterfactual focused on "should have worn sunscreen", the corresponding behavioral intention centered on wearing sunscreen in the future. The other half of the intention judgments did not match the counterfactual prime. Thus, if the counterfactual focused on wearing sunscreen, the subsequent intention judgment focused on an unrelated behavior (e.g., eating healthy foods). One hundred trials were used, evenly split between conditions and fully randomized across participants.

Results and discussion

Outliers were trimmed as before, eliminating 3.2% of the RT data. Outliers were distributed evenly across experimental conditions (counterfactual/matched and counterfactual/mismatched = 13% each; control/matched = 22% and control/mismatched = 18%; baseline/matched = 22% and baseline/mismatched = 13%). As before, only the intention judgments in which participants responded "yes" (82% of all trials) were analyzed (these were evenly distributed between conditions: matched = 53%, mismatched = 47%).

A 3 × 2 ANOVA revealed a main effect of prime judgment (counterfactual vs. control vs. baseline), $F(1,45) = 44.98$, $p < .001$, $d = 1.98$, and a main effect of whether the counterfactual and behavioral intention focused on matching actions (match vs. mismatch), $F(1,45) = 237.4$, $p < .001$, $d = 4.54$. The interaction effect indicated that the pattern of facilitation by counterfactual relative to control and baseline judgments varied as a function of matching, $F(1,45) = 16.51$, $p < .001$. When there was a match, the facilitation effect from Experiment 1 was replicated: counterfactuals produced faster behavioral intention judgments relative to baseline (*M*s = 1097 ms vs. 1339 ms), $t(45) = 7.98$, $p < .001$, $d = 0.74$, and relative to control judgments (*M*s = 1097 ms vs. 1155 ms), $t(45) = 2.12$, $p = .04$, $d = 0.2$. Control judgments also sped up intention RTs relative to baseline (*M*s = 1155 ms vs. 1339 ms), $t(45) = 5.42$, $p < .001$, $d = 0.55$. When there was a mismatch, however, counterfactuals did not facilitate behavioral intentions relative to baseline (*M*s = 1578 ms vs. 1646 ms), $t(45) = 1.52$, $p = .14$, $d = 0.14$, nor relative to control judgments (*M*s = 1578 ms vs. 1596 ms), $t(45) = 0.36$, $p = .72$, $d = 0.04$. Control judgments did not speed up behavioral intention judgments relative to baseline (*M*s = 1596 ms vs. 1646 ms), $t(45) = 1.12$, $p = .27$, $d = 0.11$.

The results of Experiment 2 are therefore consistent with a content-specific pathway, in which counterfactuals impact behavioral intentions by way of the information contained within the counterfactual. Although content-neutral mechanisms, such as motivation and mindset have been demonstrated to mediate counterfactual effects on behavior under some circumstances, these mechanisms were not sufficient to account for the facilitation effect we have discovered.

Experiment 3

Experiment 3 examined whether counterfactuals produce a facilitation effect that is unique to behavioral intentions per se, or whether other kinds of semantically related judgments might be similarly influenced. As noted in the introduction, this question speaks to the deeper theoretical issue of whether the facilitating effect of counterfactuals on behavioral intentions reflects a semantic priming mechanism vs. a functional relation. Drawing on insights from the goal priming literature, we hypothesized that the goal-related nature of counterfactual thinking embodies a functional relation with representations of behavioral intentions. In Experiment 3, we again used a semantic priming paradigm, but manipulated the type of target judgment made by participants. In the previous experiments, the target judgment was always a behavioral intention; in the present experiment, this judgment was manipulated on a within-participant basis to be either a behavioral intention vs. a different type of judgment, with the action focus (i.e., what the judgment is about), held constant across participants.

If the facilitation effect observed in the previous experiments was due mainly to semantic priming, then in the present experiment there should be an equivalent facilitation effect on both the intention judgments as well the alternative target judgments (i.e., because both share equivalent semantic overlap with the counterfactual prime). On the other hand, based on the concept of a functional relation, we hypothesized that there would be a larger effect of counterfactuals on the behavioral intention judgments than on the alternative target judgments.

Method

Fifty students participated for course credit. As in previous experiments, each trial included an event description, followed by two judgments in succession: the prime (action) judgment and the target judgment. The prime task was modified to generalize further the counterfactual facilitation effect. In counterfactual trials, the counterfactual cues ("could have" or "possible to have") were paired with an action phrase, with participants deciding if the behavior was something that could have changed the outcome of the event. The control trials were identical to Experiment 2. No baseline condition was included.

The second judgment, the target task, was a judgment about a behavior included in the prime judgment. The type of judgment made about the behavior was manipulated, such that half of the judgments centered on behavioral intentions ("In the future I will ..."), whereas the other half centered on the ease of performing the behavior, in terms of requiring much or little effort ("It is easy for me to ..."). For both judgments, participants pressed a key labeled "yes" or "no" to respond. This alternative task was designed to focus on behavioral action without specifying a personal intention, and to embrace the same order of difficulty as the intention judgment. As is clear from the results, both judgments involved similar RT means and variance. One hundred trials were used, fully randomized within and between participants.

Results and discussion

Outliers were trimmed, eliminating 4.3% of the RT data. Outliers were equally distributed in the intention vs. ease judgment RTs (about 50% each). As before, only the target judgments in which participants responded "yes" (82% of all trials) were analyzed (these were evenly distributed between conditions: 50% in the intention judgment trials vs. 50% in ease-of-action judgment trials).

A 2 × 2 ANOVA revealed a main effect of prime judgment (counterfactual vs. control), $F(1,49) = 6.89$, $p = .01$, $d = 0.74$, and a main effect of target judgment (intention vs. ease-of-action), $F(1,49) = 9.71$, $p = .003$, $d = 0.88$. The interaction between prime judgment and target judgment was not significant, $F(1,49) = .90$, $p = .35$, however. Within intention RTs, however, counterfactual judgments resulted in faster responses relative to control judgments (*M*s = 665 ms vs. 716 ms), $t(49) = 2.65$, $p = .01$, $d = 0.2$, replicating the previous experiments. By contrast, on the ease-of-action RTs, counterfactual judgments did not produce significant facilitation (*M*s = 718 ms vs. 742 ms), $t(49) = 1.02$, $p = .31$, $d = 0.09$.

General discussion

Imagining how the past might have been different is a common feature of the mental landscape (Summerville & Roese, 2008). Although there are numerous reasons why counterfactual thoughts

come to mind, one is that they help to regulate behavior. Epstude and Roese (2008) summarized past findings in terms of two ways that counterfactuals can influence behavior, a content-specific and a content-neutral pathway. Whereas the content-specific pathway involves the effect of counterfactuals on behavior via formation of relevant behavioral intentions, the content-neutral pathway describes cases in which counterfactuals produce behavioral effects in domains that are independent of the content of the counterfactual. Both pathways contribute to the impact of counterfactuals on behavior. The present research provided new evidence for one aspect of the content-specific pathway: the link from counterfactuals to behavioral intentions.

Three experiments demonstrated that counterfactual thinking facilitates the response times for behavioral intention judgments. Whereas previous research had examined this effect using Likert intention ratings (Krishnamurthy & Sivaraman, 2002; Page & Colby, 2003; Roese, 1994), the present research used a sequential priming paradigm. Specifically, counterfactual judgments facilitated intention judgments relative to a no-judgment baseline and to a control judgment involving frequency estimation (Experiment 1). Given that this paradigm was based on a within-subject design involving multiple trials, necessitating relatively quick responses, the present findings are less susceptible to a demand characteristics explanation than methods based on Likert ratings. Further, this facilitation effect was found to occur only when the counterfactual and the intention focused on the same behavior (Experiment 2), thus ruling out the interpretation that a content-neutral mechanism explained the effect (e.g., that mere recognition of a counterfactual might evoke a brief motivational burst that facilitates both related and unrelated behavioral intentions). Rather, within the semantic priming paradigm, counterfactuals only influence those behavioral intentions that focus on the same behavior.

For counterfactual thinking, the content-specific pathway corresponds to a regulatory loop that governs behavior (e.g., Bargh et al., 2001; Carver & Scheier, 1998). Thus, counterfactuals, behavioral intentions, and behavior are tied together in a feedback loop that involves continuing connections in memory (Epstude & Roese, 2008). As such, the link between counterfactuals on behavioral intentions may be conceptualized in terms of goal priming. A key question derived from the goal priming literature is whether the mechanism underlying the counterfactual-intention effect reflects semantic priming vs. a functional relation. Semantic priming involves the activation of information in memory by another piece of information that is similar in meaning (Higgins, 1996; Meyer & Schvaneveldt, 1976). By contrast, in a functional relation, information that is repeatedly used for or directed at a particular goal is likely to be activated by that goal, and vice versa (Chartrand & Bargh, 2002; Shah, 2005). The connection of counterfactuals to behavioral intentions may well be an example of a functional relation in memory. Experiment 3 we examined whether counterfactuals influenced both a behavioral intention judgment but also a completely different judgment, while holding constant (across trials and participants) whether the two kinds of judgment focused on the same actions. If equivalent facilitation had been found by counterfactuals on both kinds of judgments, a semantic priming mechanism would be suggested, in that both kinds of target judgments shared equivalent overlap with the prime judgment. Instead, the results of Experiment 3 revealed a stronger facilitation effect for the behavioral intention judgments than for the alternative judgment type. This finding is consistent with a functional relation between counterfactuals and behavioral intentions. More generally, this finding underscores the goal-directed nature of counterfactual thinking.

The present research suggests several connections to recent theoretical work on goal cognition. For example, recent research provides examples of how intentions differentially influence behavior. Accordingly, research inspired by the theory of reasoned action and the theory of planned behavior have found that behavioral intentions have a moderate effect on behavior (e.g., Ajzen, 1991; Ajzen & Fishbein, 1980; Gollwitzer & Sheeran, 2006; Sheeran, 2002). Additionally, implementation intentions can influence behavior, and goal intentions are more likely to influence behavior when supplemented with an implemental strategy (Gollwitzer, 1990, 1993, 1999; Gollwitzer & Sheeran, 2006; Sherman, 1980; Webb & Sheeran, 2006). This distinction between different kinds of intentions has not previously been explored in counterfactual thinking research (e.g., Krishnamurthy & Sivaraman, 2002; Page & Colby, 2003; Roese, 1994). The present research has taken some first steps in exploring these interconnections by focusing on behavioral intentions. Future research may investigate the connections between counterfactuals on implementation vs. goal intentions.

The present experiments introduced a novel paradigm that may be useful for exploring other issues in the counterfactual research literature. One of the most intriguing questions for future research involves learning generalization. Specifically, the question is the extent to which a highly specific counterfactual inference (e.g., "If only I had checked the lock before leaving, the burglary might have been avoided") generalizes to a range of compatible behaviors (e.g., checking the house for other potential problems). Demonstrating this generalization to close but not distant semantic associates would lend weight to the argument that counterfactual thinking is akin to learning from experience. A related question concerns the influence of an event's temporal distance on learning generalization. It is perhaps the case that recent events (spilling hot coffee on myself yesterday) would have limited generalization (being more careful when drinking hot coffee today). By contrast, distant events (spilling hot coffee on myself a year ago) may be more likely to become generalized to a range of behaviors (being more careful when drinking any hot drink) because the relevant cognition takes place at a more abstract level of analysis. This prediction is rooted in construal level theory, which argues that distant future situations are construed on a higher level, using more abstract and central features than near future situations (Liberman & Trope, 1998; Trope & Liberman, 2003).

Importantly, the present demonstrations should not be taken to mean that the content-specific pathway is more common nor more important than any of the content-neutral mechanisms specified in previous research. Moreover, there is no reason to expect the two pathways to be mutually exclusive (cf. Gollwitzer & Moskowitz, 1996). Rather, we suggest that both pathways may produce functional benefits for behavior both independently and interactively. If the pathways interact synergistically, then a stronger impact of counterfactuals on intentions may result. This idea connects to a range of past research showing that compatibility between two psychological processes (e.g., value from fit) explains linkages among affect, motivation, goals, and behavior (Higgins, 2005; Strack & Deutsch, 2004). However, there may be times when the two pathways are incompatible. For example, recent research has demonstrated that there are at least two counterfactual mindsets that elicit different consequences (Markman et al., 2007). Specifically, a subtractive counterfactual mindset enhances analytical and problem-solving tasks, which might strengthen the links within the content-specific pathway. For example, poor performance on an exam might activate both a counterfactual mindset that speeds a search for novel behavioral solutions, as well as specific intentions for preparations regarding a subsequent exam. By contrast, an additive counterfactual mindset was shown by Markman et al. (2007) to evoke creativity and broader conceptual thinking, which might instead disrupt content-specific intentions. These speculations regarding the interaction between content-neutral and content-specific effects of counterfactuals on behavior await future

research (see Epstude & Roese, 2008, for further discussion of these points).

Why do people engage in counterfactual thinking? People often think about what might have been, yet rarely do they ponder what might have been if the sky were purple or if they had the powers of a superhero. Rather, counterfactual thinking typically abides by the laws of physics and the rules of commonsense plausibility (Seelau, Seelau, Wells, & Windschitl, 1995). More pivotally, counterfactual thinking often focuses on personal goals, desires, and ambitions: "I should have worked harder on the class project"; "I wish I hadn't adopted that stray cat"; "If only I had asked him out." Counterfactual thinking in daily life typically centers on how personal actions might have brought about personally important goals (academic success, domestic calm, romantic bliss, etc.). In short, counterfactual thinking is deeply connected to the regulation and coordination of goal-directed behavior.

Acknowledgements

This research was supported by National Institute of Mental Health grant R01-MH055578. We are indebted to the undergraduate students who helped to run these experiments (including several preliminary experiments not reported here): Hazer Adiguel, Linda Anderson, Joseph Baker, Justas Birgiolas, Justin Cheng, Stefanie Cramer, Maureen Farrell, Stacy Friel, Michael Gajos, Katherine Mimnaugh, Christina Pieracci, Gregory Scott, Kristen Seemayer, Anita Shankar, Lauren Simpson, and John Siy. We are also grateful to Chi-Yue Chiu, Kai Epstude, Keith Markman, and K.C. McCulloch for providing feedback on previous drafts of this paper.

Appendix A. Sample of everyday negative events (and associated actions)

1. Did nothing all day. (Make to-do list)
2. Got blister on foot. (Wear comfortable shoes)
3. Forgot appointment. (Write it on calendar)
4. Bad hangover. (Drink moderately)
5. Movie sold out. (Arrive earlier)
6. Got speeding ticket. (Drive slower)
7. Hit car in a parking lot. (Check mirrors)
8. Overslept. (Set alarm clock)
9. Burnt dinner. (Check food often)
10. Soaked by rain. (Bring umbrella)
11. Yelled on phone. (Speak calmly)
12. Ate too much. (Eat smaller portion)
13. Got lost. (Ask for directions)
14. Messy room. (Put things away)
15. Spilled food on shirt. (Eat carefully)
16. Got car sick. (Take Dramamine)
17. Got angry. (Control temper)
18. Bad sunburn. (Wear sunscreen)
19. Got a cavity. (Brush teeth often)
20. Sick with flu. (Get flu shot)
21. Gum on shoe. (Look where walking)

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