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The Role of Thought-Content and Mood in the Preparative Benefits of  
Upward Counterfactual Thinking

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## Abstract

Upward counterfactual thoughts identify how a prior outcome could have been better and have been shown to improve subsequent performance. Both the identification of corrective actions (content-specific effects) and the more general mobilization of effort as a result of negative affect (content-neutral effects) have been suggested to underlie performance benefits. The results of three experiments presented here indicate that counterfactual thoughts have broad benefits for performance, independent of their content and beyond the effects of planning. These benefits were consistently dependent upon the experience of negative affect, but were eliminated when negative affect could be (mis)attributed to an intervening task. This misattribution effect is consistent with the operation of a mood-as-input process in which affect informs judgments of goal progress. Overall, the findings suggest that the benefits of upward counterfactual thinking reflect more broad attempts to improve following a subjectively unsatisfactory performance.

**KEYWORDS:** Counterfactual thinking, motivation, planning, self-regulation, implementation intentions

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Upward Counterfactual Thinking

Upward counterfactual thoughts identify how a prior outcome could have been better (e.g., “I could have done better if I had studied more”, Kahneman & Miller, 1986; Markman, Gavanski, Sherman, & McMullen, 1993; Roese, 1994). These thoughts have been shown in both laboratory and field settings to play an important role in self-regulation following failure, increasing task preparation, persistence, and performance (Markman et al., 1993; Markman, McMullen, & Elizaga, 2008; Nasco & Marsh, 1999; Roese, 1994).

In their Functional Theory of Counterfactual Thinking, Epstude and Roese (2008) argue that there are two pathways by which counterfactuals influence task performance: a content-specific pathway, and a content-neutral pathway. In the content-specific pathway, the corrective action suggested by the counterfactual is translated into a behavioral intention or plan (see Figure 1, top panel). In the content-neutral pathway, any benefits to performance are independent of the behaviors mentioned in the counterfactual thought. For example, upward counterfactuals tend to increase negative affect (Markman et al., 1993; Roese, 1994), which in turn can be interpreted by the individual as indicating that his or her performance was inadequate (Gendolla & Brinkman, 2005; Martin, Ward, Achee, & Wyer, 1993). Dissatisfaction with performance will then lead to greater task persistence and performance (Markman et al., 2008). Despite the important distinction between content-specific and content-neutral pathways made by Epstude and Roese (2008), researchers have only rarely controlled for the strategy specified in the counterfactual thought (see Roese, 1994, for a notable exception). Thus, it is difficult to know how specific the benefits of these thoughts actually tend to be. Second, though the content-specific pathway suggests that counterfactuals are translated into corresponding behavioral intentions, no studies

of which we are aware have compared the consequences of counterfactual thinking to those of forming such a plan. Third, the notion that negative affect resulting from counterfactual thinking influences judgments of goal progress has not been directly examined. The present research seeks to address these important questions.

### **Content-Specific Pathway**

To the extent that a counterfactual thought identifies a controllable cause for a poor performance, individuals can form an intention to change their behavior (Epstude & Roese, 2008). The thought “If I had done  $x$ , I would have done better” can easily be reformulated into the intention “I will do  $x$ !” (Johnson & Sherman, 1990; Roese, 1994). In other words, counterfactual thinking should encourage planning of subsequent behavior. Indeed, recent studies by Smallman and colleagues (Smallman & McCulloch, 2012; Smallman & Roese, 2009) indicate that considering a counterfactual possibility facilitates the formation of a corresponding intention to engage in this behavior in the future. For example, the counterfactual thought “could have worn sunscreen” made after experiencing a bad sunburn facilitates the formation of the behavioral intention “now I will wear sunscreen” (Smallman & McCulloch, 2012).

Once a behavioral intention is formed, one should be more likely to carry out the specified behavior. Epstude and Roese (2008) propose that the intentions resulting from counterfactual thinking have effects similar to those of implementation intentions. Implementation intentions are simple plans that specify a critical situation or cue and connect it to a specific goal-directed response, taking the form “When  $x$  occurs, then I will perform behavior  $y$ ” (Gollwitzer, 1999). These plans can be differentiated from goal intentions (e.g., “I intend to reach  $x$ ”) that specify a certain goal or outcome to be achieved. Implementation intentions form an automatic association between the critical situation and the specific response (Gollwitzer, 1999; Webb & Sheeran,

2007), thereby promoting goal attainment. Numerous studies have documented the benefits of forming these intentions in a variety of domains, including healthy diet (Achtziger, Gollwitzer, & Sheeran, 2008), exercise (de Vet, Oenema, & Brug, 2011), academic and athletic performance (Achtziger et al., 2008; Bayer & Gollwitzer, 2007), and prospective memory (Craig McFarland & Glisky, 2012).

Direct evidence that counterfactual thoughts lead to specific corrective actions is sparse. Roese (1994, Study 3) observed that individuals who generated counterfactuals concerning a particular behavior (i.e., the use of clues on an anagram task) were more likely to engage in that behavior in a subsequent performance. However, the specific behavior mentioned in these thoughts was not experimentally manipulated. As a result, it is not clear whether thought content was causally related to subsequent behavior. Likewise, a study by Markman et al. (2008) found that the usefulness of the strategy contained in the counterfactual (as rated by judges) predicted improved performance. A stronger test of the content-specific hypothesis would involve experimentally manipulating the content of the counterfactual or comparing the effects of counterfactual thinking to those of forming a plan.

### **Content-Neutral Pathway and the Role of Affect**

One manner in which upward counterfactual thoughts could affect performance in a content-neutral manner is by increasing effort mobilization. This proposition is most notably espoused by Markman and McMullen's (2003; Markman et al., 2008) Reflection and Evaluation Model (REM). According to the REM, the affective and motivational consequences of counterfactual thinking depend on whether individuals *reflect* upon the counterfactual alternative in isolation (i.e., vividly imagining the alternative outcome), or *evaluate* the actual outcome relative to the standard of the counterfactual alternative. When individuals evaluate an upward counterfactual,

the comparison of the outcome to a better alternative increases negative affect, whereas reflecting upon a better alternative outcome increases positive affect. Affect is then presumed to serve as input (Cervone, Kopp, Schaumann, & Scott, 1994; Gendolla & Brinkman, 2005; Martin et al., 1993) into decisions concerning whether the goal has been completed and whether additional action is necessary. When holding a “do your best” goal (i.e., a task of unfixed difficulty), experiencing positive affect should lead to the conclusion that one is satisfied with the performance and can cease goal pursuit, whereas experiencing negative affect should lead to the conclusion that one is dissatisfied with the performance and goal pursuit is worth continuing (Cervone et al., 1994; Gendolla & Brinkman, 2005; Markman & McMullen, 2003). Thus, upward counterfactual thoughts increase task effort only when the individual experiences negative affect due to evaluative processing. In other words, resultant affect should moderate the consequences of upward counterfactual thinking.

Several studies have found support for this perspective. Markman et al. (2008) asked participants to generate their own upward counterfactuals after an anagram task. They found that improved persistence and performance increased for individuals who engaged in evaluative (but not reflective) processing of upward counterfactuals. Furthermore, these effects were explained by increased negative affect. Conversely, upward counterfactual thoughts that serve to excuse performance by identifying a self-handicap (and thus decrease negative state self-esteem) undermine subsequent preparative effort and performance (McCrea, 2008; Tyser, McCrea, & Knüpfner, 2012). However, there is only indirect evidence for the mood-as-input explanation of these findings. A stronger test would involve manipulating the ability of affect to serve as a cue to judgments of goal progress.

### **Different Pathways or Different Stages of Goal Pursuit?**

Although the content-specific and content-neutral pathways are conceptually distinct, the question arises whether they are completely independent of each other. Epstude and Roese (2008) suggested that the pathways may at times interact. For example, a counterfactual mindset could increase the strength of intentions formed as a result of subsequent counterfactual thinking. We sought to pose a more basic question, namely, whether these two pathways represent two phases of goal pursuit rather than truly independent processes. Simply put, our view is that content-specific planning is likely to be dependent upon underlying “content-neutral” motivational considerations. For example, would individuals form intentions to change their behavior as a result of counterfactual thinking when they are lacking the motivation to continue goal pursuit? Conversely, if highly motivated to improve on a task as a result of counterfactual thinking, would individuals limit themselves to the corrective actions suggested by the thought?

The Action-Phase Theory of goal-pursuit (Heckhausen, 2003; Heckhausen & Gollwitzer, 1987) is instructive in answering these questions. The Action-Phase model holds that individuals first decide upon a goal, then make plans for how they will pursue the goal, strive towards the goal, and finally evaluate their progress toward the goal. Counterfactual thinking is most likely to take place in this final, post-actional phase of goal pursuit (see also Epstude & Roese, 2008). In this phase, the individual must assess whether the goal was reached, determine whether continued goal pursuit is worthwhile, and identify what, if any, changes in behavior should be made. Importantly, the Action-Phase model suggests that changes will be made only when the individual has determined that continued striving toward the goal is necessary and worthwhile. Similarly, many models of motivation (e.g., Bandura, 1991; Vroom, 1964) suggest action is dependent on the expected value of pursuing the goal. Thus, specific behavioral intentions will only be formed and influence behavior when the individual is motivated to improve on past

performance. In studies demonstrating that counterfactuals facilitate the formation of behavioral intentions (Smallman & McCulloch, 2012; Smallman & Roese, 2009), individuals were first provided with an objectively negative event (e.g., bad sunburn). What if no objective information concerning success or failure is available? In this case, according to the REM (Markman & McMullen, 2003), affect will be used as input into judgments of goal progress. In either case, the corrective actions mentioned in the counterfactual are likely to influence subsequent behavior only when individuals judge their performance as inadequate (Carver & Scheier, 1990).

Having decided to continue pursuing the goal, individuals in the post-actional phase will turn to plan for the future (Heckhausen, 2003). Such plans are likely to be influenced immediately by prior thoughts concerning “what went wrong” (Smallman & McCulloch, 2012; Smallman & Roese, 2009). However, with ample time and opportunity, individuals highly motivated to improve might consider alternative means. Evidence for this proposition comes from recent studies by Myers (2009), which found no effect of the opportunity to consider counterfactual thoughts on the subsequent formation of plans. Given the time to reflect, participants generated plans suggested by the counterfactual and plans not suggested by the counterfactual in equal measure.

To summarize, we view content-neutral and content-specific processes as consecutive steps in the post-actional phase of goal-pursuit rather than as two separate pathways (see also Heckhausen, 2003; Markman & McMullen, 2003). Particularly when goal progress is more subjectively defined (i.e., “do your best”), counterfactual thinking will influence task effort via a mood-as-input process (Markman & McMullen, 2003). Next, counterfactual thinking can suggest corrective actions to be taken. However, it may be difficult to detect content-specific effects on behavior if individuals are highly motivated to improve. Provided the opportunity,



they may identify and pursue additional means of achieving the goal. This proposed content-neutral pathway to performance improvement is presented in Figure 1 (bottom panel).

### **Goals of the Present Work**

We have discussed two pathways by which counterfactual thoughts might improve subsequent performance. The present studies were designed to systematically examine which of these views better accounts for the consequences of counterfactual thinking. Crucial points in addressing this question are 1) whether the benefits of counterfactual thinking are dependent upon perceiving past performance as insufficient, 2) whether mood serves as input into these judgments, and 3) whether counterfactual benefits for subsequent performance reflect the application of a specified strategy or a broader effort to improve.

According to a strict content-specific view (Figure 1, top panel), any benefits of counterfactual thinking should be a) due to changes in the behavior specified by the thought, and b) similar to the benefits of forming an implementation intention. In contrast, according to a strict content-neutral view (Figure 1, bottom panel), any benefits of counterfactual thinking should be a) dependent on negative affect serving as a valid cue to goal progress, and b) largely independent of strategic content of the thought, with quite different consequences for behavior relative to an implementation intention. Based on the theorizing discussed above, we expected counterfactual thoughts to influence performance in a more content-neutral manner, as follows.

Based on the REM (Markman & McMullen, 2003) and the mood-as-input perspective (Gendolla & Brinkman, 2005; Martin et al., 1993), we expected that counterfactual effects would be limited to those experiencing relatively more negative affect following counterfactual thinking. Study 3 directly tested the mood-as-input hypothesis by manipulating whether affect could serve as a valid cue to evaluations of goal progress (see also Gendolla & Krüsken, 2002;

Schwarz & Clore, 1983). When negative affect could be (mis)attributed to an intervening task, we expected that counterfactual benefits for the focal task would be eliminated.

We addressed the question of the relative breadth of counterfactual benefits for performance in two ways. First, by controlling the content of the counterfactual thought, the specificity of consequences for performance could be directly observed. Second, we assessed whether the consequences of considering a counterfactual were the same as those of forming an implementation intention. In Studies 1 and 2, we fully crossed the manipulation of upward counterfactual thoughts and implementation intentions in a 2 x 2 design and examined strategy-specific and strategy-unrelated behaviors.

In summary, the present work represents an advance over past studies in that we systematically controlled for the strategic content of the counterfactual thought, compared the effects of counterfactual thinking to that of forming a plan, and manipulated the informational value of negative mood.

### **Study 1: Improving Performance on an Anagram Task**

We conducted an initial study to test these predictions, adapting the anagram paradigm developed by Roese (1994, Study 3). Participants attempted to solve anagrams under time pressure. They could try to solve an item, skip over the item (minimizing the loss of points) or “buy” a clue (making it easier to solve the item correctly, but with a penalty). Participants received feedback and were then given a chance to complete a second set of items. The counterfactual and implementation intention provided to participants both mentioned the strategy of using a clue after 60 seconds. Performance on a second set of anagrams was then measured.

We expected that implementation intentions would result in the application of the specified strategy, whereas counterfactual thoughts would result in more broad performance improvement.

However, consistent with past work (Markman et al., 2008; McCrea, 2008), we predicted that counterfactual thoughts would only benefit performance when individuals experienced more negative affect. Specifically:

**H1.** The counterfactual thought to use more clues will increase performance in set 2, compared to the control condition, but only among individuals reporting more negative affect. Moreover, this effect should hold even when controlling for clue use.

**H2.** The implementation intention to purchase a clue after 60 seconds will increase the use of this strategy in set 2, relative to no implementation intention. Moreover, any benefits of implementation intentions for performance will be explained by changes in clue use.

## Methods

### Participants and Design

Participants were 95 (39 male, 56 female) students at a German university.<sup>1</sup> Two male participants mentioned either implementation intentions or “if-then intentions” during debriefing and were therefore excluded from the analyses. Participants were either paid 4€ or were given research participation credit upon their completion of the study. They were randomly assigned to conditions in a 2 (counterfactual vs. no counterfactual) x 2 (implementation intention vs. no implementation intention) between-subjects design.

### Materials

The anagram task was adapted from Roesse (1994, Study 3). In that study, participants could purchase a clue which provided the middle letter of the anagram in the correct position at a cost of 30 points (i.e., equivalent to 30 seconds of time). Because clue use was actually found to be harmful to performance, we conducted a pretest to determine whether providing the initial letter of the anagram would improve performance. Twenty-one participants were assigned to complete

20 eight-letter anagram items. Anagrams were created by listing the letters alphabetically. For half of the items, the first letter was provided. Inclusion of this clue was counterbalanced and the order of presentation randomized. Participants solved more items correctly when provided with the clue ( $M = 7.76$ ,  $SD = 1.09$ ) than when not provided with the clue ( $M = 2.71$ ,  $SD = 1.76$ ),  $t(20) = 10.40$ ,  $p < .001$ , and did so faster,  $M_{\text{difference}} = -44.34$  sec,  $t(20) = 9.19$ ,  $p < .001$ . Thus, the clues were objectively helpful in solving the items.

In the main experiment, participants were allotted two minutes to provide a solution to an item before the computer automatically advanced to the next anagram. The order of the anagrams was randomized within each ten-item set, and the sets counterbalanced. Scoring was as follows. Participants gained 120 points for a correct answer, with a point deducted for each second spent on the item. They lost a point for each second spent on an incorrect or unsolved item. It was also possible to skip an item, although participants were unable to return to it later. Thus, participants were advised to skip over anagrams that were too difficult to minimize the loss of points. Participants also had the option to buy a clue (in which the first letter of the correct solution was presented) at the cost of 30 points. Participants were advised that it would behoove them to buy clues on anagrams they were close to solving. Based on the pretest, the cost of the clue (equivalent to 30 seconds of time) did not outweigh the time-savings provided by the clue.

### **Procedure**

Participants were told that the experiment dealt with problem solving under time pressure and to what extent experience impacts performance. The task was described as a “word discovery” task: The study would involve completing two versions of the same task, and participants would receive feedback after each. Participants then completed demographic items.

Next, an example item and scoring procedure for the anagram task was provided. To ensure that participants understood the task and scoring, participants were required to answer a few comprehension questions (e.g., “A person tries to solve an anagram for 110 seconds and then decides to skip over this anagram. How many points is this person awarded?”) and were provided the correct answer. To ensure that all participants held the same goal intention, they were asked to write the goal “I want to achieve as many points as possible” three times. Participants then attempted the first set of anagrams. At the conclusion of the first set, they were provided feedback including total score, number of items correctly solved, number of items skipped, number of clues used, and number of items in which the time limit was exceeded.

At this point, participants were randomly assigned to one of two counterfactual conditions. Those in the counterfactual condition read a statement supposedly made by a past participant, indicating that his or her performance would have been improved by purchasing a clue for the difficult items (“If I had bought a clue after 60 seconds for anagrams that were difficult to solve, then my total score on this test would have been better.”). Participants were asked to write the thought three times and relate this thought to their own past performance. Those in the no counterfactual condition proceeded to the next part of the procedure.

As before, participants in all conditions were asked to write the goal statement three times. Because participants had already completed a similar set of items, received feedback, and formed a “do your best” goal, the second block of items represented a task of unfixed difficulty (Gendolla & Brinkman, 2005).

Participants were then randomly assigned to one of two implementation intention conditions. Those in the implementation intention condition read a statement supposedly made by a past participant concerning his or her future performance, and indicating a plan to purchase a clue for

difficult items (“Whenever I cannot solve an anagram within 60 seconds, then I will buy a clue.”). Participants were then asked to write this thought three times and relate it to their upcoming performance. Those in the no implementation intention condition proceeded to the next part of the procedure.

They were then informed that the researchers were interested in the role of mood in performance. Participants completed a 32-item mood measure which included nine negative mood adjectives (worried, upset, guilty, scared, hostile, jittery, ashamed, anxious, inadequate) as well as positive mood and self-esteem related items (see also Cathy McFarland & Ross, 1982; Watson, Clark, & Tellegen, 1988). Participants were asked how strongly they felt each item at the present time, using a five-point scale (1 = *not at all* to 5 = *very strong*). Participants completed the second anagram set and received feedback. They were then fully debriefed and received compensation for their participation.

## Results

### Overview

We examined effects of negative mood and condition on set 2 scores, controlling for set 1 scores.<sup>2,3</sup> Analyses were conducted on specified strategy use (clues used after approximately 60 seconds) and accuracy (number of anagrams solved). Accuracy and points scored were largely redundant ( $r_s > .83$ ) and so we focus on the former in our presentation of the results. Regression analyses were conducted due to the inclusion of continuous negative mood scores. Negative mood scores ( $M = 14.16$ ,  $SD = 4.96$ , Cronbach’s  $\alpha = .84$ ) were positively skewed, and therefore log transformed ( $M = 2.60$ ,  $SD = 0.31$ ). A 2 (counterfactual vs. no counterfactual) x 2 (implementation intention vs. no implementation intention) ANOVA failed to reveal any significant differences in negative mood by condition,  $F_s < 1.30$ ,  $p_s > .25$ . Following the

recommendations of Aiken and West (1991), mood score was mean-centered, and effects coding was utilized for the counterfactual (no counterfactual = -1; counterfactual = 1) and implementation intention (no implementation intention = -1; implementation intention = 1) conditions. Set 1 scores, negative mood, implementation intention condition, and counterfactual thought condition were entered into the model in an initial step, and all two-way interactions of negative mood and the condition variables were entered into the model in a second step. The three-way interaction of negative mood and the condition variables did not approach significance in any analysis, and so this term was trimmed from the model to increase power (Judd & Kenny, 1981). Significant interactions were plotted and probed using simple-slope tests at  $\pm 1$  SD from the mean (Aiken & West, 1991). Results of the regression analyses are presented in Table 1.

**Clue use.** Given that the strategy mentioned in the implementation intention and counterfactual thought involved using a clue only after 60 seconds had elapsed, we examined the effects of negative mood and condition on the number of clues that were used between 50 and 70 seconds in set 2 ( $M = 0.91$ ,  $SD = 1.88$ ), controlling for the number of clues that were used between 50 and 70 seconds in set 1 ( $M = 0.45$ ,  $SD = 0.83$ ). Only the effect of implementation intention condition was significant. Individuals in the implementation intention condition ( $M = 1.47$ ,  $SD = 2.31$ ) used more clues in the 50-70 sec. time period than did those in the no implementation intention condition ( $M = 0.40$ ,  $SD = 1.16$ ).<sup>4</sup>

**Accuracy.** We next examined the effects of negative mood and condition on the number of anagrams solved in set 2 ( $M = 3.78$ ,  $SD = 2.40$ ), controlling for the number solved in set 1 ( $M = 3.10$ ,  $SD = 2.13$ ). Those reporting more negative mood performed better, and this effect was qualified by a Counterfactual x Negative mood interaction, see Figure 2. Simple-slope tests revealed that individuals high in negative mood performed better in the counterfactual condition

than in the no counterfactual control condition, simple-slope = 0.92,  $t(88) = 2.49$ ,  $p < .02$ , 95% CI: 0.18 to 1.65. The counterfactual effect was not significant among those low in negative mood, simple-slope = -0.15,  $t(88) = 0.42$ ,  $p > .67$ , 95% CI: -0.85 to 0.56. There were no significant effects of implementation intentions.

**Test of content-specificity.** There were no significant effects of counterfactual thought on clue use. We nonetheless conducted an additional analysis to examine whether the Counterfactual x Negative mood interaction on accuracy was even partly due to the specified strategy of using clues. We therefore specified a bootstrap model (Hayes, 2012) predicting set 2 accuracy with counterfactual thought condition as the predictor, negative mood as the moderator, set 2 clue use in the 50-70 sec. time period as the mediator, and set 1 accuracy as a covariate. We observed that the indirect effect through clue use was not significant,  $B = 0.07$ , 95% CI = -0.19 to 0.42. Set 2 clue use was not predictive of accuracy in set 2,  $\beta = .076$ ,  $t(87) = 0.71$ ,  $p = .48$ ,  $f^2 < .01$ , and the Counterfactual x Negative mood interaction was largely unchanged,  $\beta = .212$ ,  $t(87) = 1.91$ ,  $p = .06$ ,  $f^2 = .04$ . Moreover, the effect of counterfactual thought remained significant among those reporting high negative mood when controlling for clue use, simple-slope = 0.90,  $t(87) = 2.43$ ,  $p < .02$ , 95% CI: 0.16 to 1.64.

### Discussion

Counterfactual thoughts did not significantly affect the specified strategy of using clues after 60 seconds. Nonetheless, counterfactual thought led to greater improvement in performance among participants high in negative mood. These individuals improved to a greater extent compared to those in the control condition or who reported less negative mood. In summary, the results were consistent with the hypothesis that counterfactuals would more broadly influence performance, independent of specified strategy, and only when accompanied by negative affect.



Although it is possible that the lack of a counterfactual effect on clue use reflects a Type II error, the benefits of counterfactual thinking among those high in negative mood held even when controlling for this behavior. Thus, the results are inconsistent with a content-specific pathway to performance.

The effects of counterfactual thinking were in sharp contrast to the effects of forming an implementation intention. Forming an if-then plan led to increased use of the specified strategy, but did not significantly affect performance. These findings are consistent with past work on implementation intentions showing benefits to specified behavior, but not other aspects of performance (Parks-Stamm, Gollwitzer, & Oettingen, 2007). It is also important to note that implementation intentions had benefits over and above the effects of counterfactual thoughts. That is, there were additional benefits to forming a behavioral intention even when participants had already considered a related counterfactual thought.

Taken as a whole, the results of Study 1 are consistent with the notion that counterfactuals lead to more broad, content-neutral, performance benefits (Markman & McMullen, 2003; McCrea, 2008; McMullen & Markman, 2000). Specifically, negative affect is a signal that goal progress has been insufficient. Corrective actions are more likely to be taken, potentially including an increase in effortful persistence. Although counterfactuals may suggest specific corrective actions that should be taken, they may also motivate the individual to consider additional means to the goal not explicitly mentioned.

### **Study 2 – Persistence on a Word-Completion Task**

In Study 1, we observed that counterfactuals benefited performance even when tightly controlling the strategic content of the thought and the specified behavior. These findings are consistent with the notion that dissatisfaction with goal progress leads to increased effort

mobilization (Martin et al., 1993). However, we focused exclusively on performance, and not directly on effort put forth on the task. Study 2 was therefore designed to assess persistence of effort (Bandura, 1977), measuring the amount of time participants invested in an insolvable task (see also Markman et al., 2008; Vohs & Heatherton, 2000).

A second issue concerns the nature of our manipulations. Because we wished to tightly control the content of the statements individuals considered, we did not allow individuals to freely generate these thoughts. Rather, the strategies mentioned in these statements were provided. One potential drawback of this method is that there may have been more experimental demand for individuals to pursue the implementation intention, particularly due to the “whenever  $x$  happens, I will do  $y$ ” phrasing. Counterfactuals on the other hand, with their “if only...” phrasing, are more similar to a suggestion and thus may have created less experimental demand to pursue the mentioned strategy. Another potential issue along these lines is that participants may not have accepted the premise of the counterfactual (Petrocelli, Percy, Sherman, & Tormala, 2011). That is, they may not have believed that their performance would have been better using the mentioned strategy, and so they made other plans. To address these concerns in Study 2, participants were asked to generate their own counterfactuals and implementation intentions. In this manner, we could be assured the selected strategy was likely to be believable to participants and freely chosen. We could then examine whether the benefits of upward counterfactual thinking were still independent of their content.

Our predictions were as follows:

**H1:** Counterfactual thinking, regardless of strategic content, should lead to greater persistence compared to a control thought, but only when individuals report more negative affect.

**H2:** Implementation intentions that refer to task persistence should predict greater persistence, compared to a control thought.

Due to the inclusion of insolvable items, we did not make predictions concerning improvement in performance.

## Method

### Participants and Design

Seventy-nine (54 female) students at a German university were recruited to participate in the study. Participants received 3€ or research participation credit as compensation. Participants were randomly assigned to one of four conditions in a 2 (counterfactual vs. no counterfactual) x 2 (implementation intention vs. no implementation intention) between-subjects design.

### Materials

The word-completion task consisted of eight incomplete German words and two non-words. Participants were instructed to successfully complete as many words as possible. Each word was comprised of eight letters. Participants were also provided with a category to which the word belonged and two letters to assist them in solving the items. There was only one possible solution for each word, whereas non-word items had no correct solution. At any point, participants had the option of attempting to complete the item, buying a clue, skipping over the item, or quitting the task altogether. Each time that a clue was bought, a single missing letter appeared. Participants could purchase up to four clues (totalling six of the eight letters). The unsolved items were presented in a loop, such that one could return to any skipped items. Participants were allowed to use as much time as they wished to complete the ten items.

Scores were based on the number of correctly solved items. For each correctly completed word, participants were awarded with six points; however, for every clue bought, one point was

deducted from their score. For example, if they correctly completed a word and bought two clues, then they would be awarded four points. No points were awarded for incorrect or incomplete solutions. After each set of ten items, participants were provided with accurate feedback on their performance, including how many words were correctly solved, how many clues were bought, and total score. They did not have the possibility of seeing which words were correctly solved.

### **Procedure**

Participants were told the experiment involved problem solving, and the effects of practice. Thus, they were told that they would be completing two versions of the same task, receiving feedback each time. They were then assigned a do-your-best goal (“I want to achieve as many points as possible”) and were asked to write this goal three times. Next, participants completed several manipulation checks concerning their understanding and motivation on the task, using a seven-point scale (1 = *not at all* to 7 = *very much*). They indicated to what extent they were willing to put effort into the task, they were motivated to perform well, and they understood what to do on the task. Participants then began the first block of the word completion task, and time spent on the task was recorded. Items presented in the first and second block were counterbalanced.

After quitting the first block, participants received feedback on their performance. They were then randomly assigned to one of two counterfactual conditions. Those in the counterfactual condition were told that people often have different thoughts when considering a past performance and that people often think “If I had only done . . . , then I would have performed better.” Participants were asked to generate such a thought concerning their performance on the first block of trials. They were given the sentence stem: “If only I had . . . , then I would have

achieved more points” and asked to complete the statement. They were then asked to write this same thought two additional times. This procedure was therefore similar to that of Study 1, with the exception that thought content was generated spontaneously.

Those in the control thought condition were told that people often have different thoughts when considering the past and that people often think “What if...” about the past. Participants were asked to generate such a thought about their activities on the previous day. They were given the sentence stem: “If only yesterday I had...” and asked to complete this statement. They were then asked to write this same thought two additional times.

Prior to beginning the second set of items, participants were asked to again write the goal intention (“I want to achieve as many points as possible”) three times. Thus, the second block of word-completion items represented a task of unfixed difficulty (Gendolla & Brinkman, 2005).

Half of the participants were then assigned to an implementation intention condition. They were told that people have different thoughts when considering a future performance, and that these thoughts often take the form of “Whenever ... happens, then I will...” They were asked to generate a thought of this form concerning how they could perform better on the upcoming task. They were given the sentence stem: “Whenever ... happens, then I will...” They were then asked to repeat this thought an additional two times.

Next, participants completed a measure of mood that included the same nine negative mood adjectives as in Study 1, along with eight positive mood items. Next participants completed the motivation and understanding measures again. They then completed the second block of the word-completion task and time-spent was again recorded. Participants received feedback and were debriefed.

## **Results and Discussion**

## Overview

Participants indicated that participants were motivated to perform well ( $M_{\text{set1}} = 6.09$ ,  $M_{\text{set2}} = 5.37$ ) and that they understood what to do on the task ( $M_{\text{set1}} = 5.11$ ,  $M_{\text{set2}} = 5.54$ ). Regression analyses were performed as in Study 1.<sup>5</sup> Negative mood scores (Cronbach's  $\alpha = .88$ ,  $M = 14.06$ ,  $SD = 5.63$ ) were positively skewed. Analyses were therefore conducted using log-transformed scores ( $M = 2.58$ ,  $SD = 0.34$ ). A 2 (counterfactual vs. no counterfactual) x 2 (implementation intention vs. no implementation intention) ANOVA conducted on negative mood scores revealed an unexpected Counterfactual x Implementation intention interaction,  $F(1,75) = 4.21$ ,  $p < .05$ ,  $\eta^2 = .05$ . Simple-effects analyses revealed that, among those in the implementation intention condition, reported negative mood was lower in the counterfactual condition ( $M = 2.49$ ,  $SD = 0.26$ ) than in the no counterfactual condition ( $M = 2.69$ ,  $SD = 0.41$ ),  $t(37) = 2.16$ ,  $p < .05$ ,  $\eta^2 = .11$ . Within the no implementation intention condition, the counterfactual condition ( $M = 2.63$ ,  $SD = 0.35$ ) did not differ from the control condition ( $M = 2.56$ ,  $SD = 0.32$ ),  $t(38) < 1$ ,  $p > .48$ ,  $\eta^2 = .01$ . There were no other effects,  $F_s < 1.13$ ,  $p_s > .29$ . Importantly, diagnostics conducted on the analyses reported below revealed that multicollinearity was not problematic.<sup>6</sup>

## Performance

We examined accuracy in set 2 ( $M = 5.14$ ,  $SD = 2.04$ ), controlling for accuracy in set 1 ( $M = 5.04$ ,  $SD = 1.98$ ). However, the regression analysis revealed no significant effects of mood or condition on performance, all  $t_s < 1$ ,  $p_s > .34$ .

## Reported effort

To ensure that increased persistence on the task did not reflect slower responding due to low motivation, we examined the effects of negative mood and condition on reported willingness to put forth effort in set 2 ( $M = 5.46$  sec,  $SD = 1.46$ ), controlling for willingness to put forth effort

in set 1 ( $M = 5.95$  sec,  $SD = 1.07$ ), see Table 2. The Counterfactual x Negative mood interaction was marginally significant, see Figure 3. Among those high in negative mood, willingness to put forth effort was nonsignificantly higher in the counterfactual condition than in the control condition, simple-slope = 0.20,  $t(74) = 0.89$ ,  $p = .38$ , 95% CI: -0.25 to 0.64. Among those low in negative mood, willingness to put forth effort was nonsignificantly lower in the counterfactual condition than in the control condition, simple-slope = -0.16,  $t(74) = 0.71$ ,  $p = .48$ , 95% CI: -0.60 to 0.28. Thus, individuals reporting high negative mood and assigned to the counterfactual condition were highly motivated to put forth effort on the task, at least as much as participants in any other condition.

### **Persistence**

We next examined the effects of negative mood and condition on the time spent in set 2 ( $M = 474.34$  sec,  $SD = 303.24$ ), controlling for the time spent in set 1 ( $M = 775.26$  sec,  $SD = 457.67$ ). Time spent on each set (in sec) was square-root transformed to reduce skewness (set 1  $M = 26.74$ ,  $SD = 7.82$ ; set 2  $M = 20.81$ ,  $SD = 6.46$ ). The model predicting time spent in set 2 is presented in Table 2. The Counterfactual x Negative mood interaction was significant, see Figure 4. Among those reporting high negative mood, the counterfactual led to significantly more persistence relative to the control condition, simple-slope = 1.88,  $t(74) = 2.22$ ,  $p = .03$ , 95% CI: 0.19 to 3.56. There was no effect of counterfactual condition among those reporting low negative mood, simple-slope = -0.42,  $t(74) = 0.50$ ,  $p = .62$ , 95% CI: -2.09 to 1.25. Consistent with the previous study, counterfactual thoughts affected persistence among those high in negative mood, independent of the opportunity to form implementation intentions. Importantly, these effects are unlikely to represent slower responding due to a lack of motivation in light of results on the self-report measure of willingness to put forth effort.

### **Controlling for thought content**

Two independent judges unaware of the hypotheses coded each statement listed within the counterfactual and implementation intention conditions. Judges assigned each statement to one of two categories: those concerned with patience and time spent on the task, and all other thoughts (e.g., purchasing clues, using a dictionary). Agreement for the counterfactual thoughts was very high (95%,  $\kappa = .90$ ). Frequencies and example counterfactual thoughts in these categories were as follows: time ( $f = 20$ ) “If only I would have given myself more time”; other ( $f = 21$ ) “If only I would have made riskier guesses”. Agreement for the implementation intentions was also good (80%,  $\kappa = .60$ ). Frequencies and example implementation intentions in these categories were as follows: time ( $f = 18$ ) “Whenever I do not know a word, then I will consider longer”; other ( $f = 21$ ) “Whenever I cannot see a solution, I will buy a clue”. Opportunity to generate counterfactual thoughts did not impact the content of generated implementation intentions. In the no counterfactual condition ( $n = 19$ ), 42% of participants generated an implementation intention concerning time, and in the counterfactual condition ( $n = 20$ ), 50% of participants generated an implementation intention concerning time,  $\chi^2(1) = 0.24, p = .62, \phi = .08$ .

In order to examine whether the effects of implementation intentions and counterfactual thoughts on persistence were specific to their content, we decomposed each condition variable into two dummy variables based on the thought coding. Participants in the counterfactual condition had a score of 1 on the time-related thought and 0 on the unrelated thought dummy variables, or vice versa. Those in the control condition were assigned a score of -1 on both variables. Thus, the first dummy variable contrasted those who generated a time-related thought (given a score of 1) with those in the control condition (given a score of -1). The second dummy



variable contrasted those who generated a thought unrelated to time with those in the control condition (1 and -1, respectively). Similarly, participants in the implementation intention condition had a score of 1 on either the time-related thought and 0 on the unrelated thought dummy variables, or vice versa. Those in the control condition were assigned a score of -1 on both variables. Because these dummy variables sum to the original condition variable, this analysis allows for tests of mediation (i.e., including both variables in the model explains the same variance as the original condition variable). We then conducted a regression analysis replacing the implementation intention and counterfactual thought terms with these dummy variables. The decomposed Counterfactual x Implementation intention interactions were not included, as preliminary analyses revealed no significant effects of these terms. The resulting model can be seen in Table 3.

Neither the time-related counterfactual vs. control nor its interaction with negative mood significantly predicted persistence. Only the interaction of Unrelated counterfactual vs. control x Negative mood interaction predicted persistence. Specifically, counterfactuals unrelated to time led to increased persistence when individuals reported more negative mood, simple-slope = 3.18,  $t(74) = 3.20$ ,  $p < .01$ , 95% CI: 1.20 to 5.15. Counterfactuals unrelated to time did not predict persistence when individuals reported less negative mood, simple-slope = -1.06,  $t(74) = 1.03$ ,  $p = .31$ , 95% CI: -3.10 to 0.99.

In addition, the Time-related implementation intentions vs. control x Negative mood interaction was significant. Among those high in negative mood, time-related implementation intentions predicted nonsignificantly greater persistence relative to the control condition, simple-slope = 1.30,  $t(74) = 1.17$ ,  $p = .25$ , 95% CI: -.91 to 3.52. Among those low in negative mood,

time-related implementation intentions predicted nonsignificantly less persistence relative to the control condition, simple-slope = -0.93,  $t(74) = 0.88$ ,  $p = .38$ , 95% CI: -3.02 to 1.17

In summary, the results of Study 2 supported hypothesis 1. Even when participants were able to generate their own thoughts, counterfactuals appeared to influence effort in a content-neutral manner, and only when accompanied by more negative affect. Hypothesis 2 was partially supported. Only implementation intentions concerning time predicted time spent on the task. However, this effect was moderated by affect, such that implementation intentions tended to predict subsequent behavior only when accompanied by more negative mood. This finding suggests that implementation intentions may also be subject to motivational consideration. More importantly for our purposes, the benefits of forming implementation intentions did appear to be tied to their content. Only when controlling for thought content did any implementation intention effect emerge. Finally, forming an implementation intention had benefits for task persistence over and above generating a counterfactual thought.

### **Study 3 – Mood Discounting**

Thus far, we have observed that counterfactuals influence subsequent performance and persistence only when accompanied by relatively more negative affect. According to the REM (Markman & McMullen, 2003), negative affect resulting from counterfactual thinking is a signal of insufficient goal progress and the need to increase effort. Study 3 was designed to test this explanation for our findings. One way to test the mood-as-input hypothesis is to manipulate the validity of mood as a cue to goal progress (Gendolla & Krüskén, 2002; Schwarz & Clore, 1983). In other words, if mood can be attributed to other sources in the environment (e.g., pills, lighting, or an intervening task) then individuals should discount current feelings as an indicator of goal progress. We therefore used a misattribution paradigm (see also Gendolla & Krüskén, 2002;

Schwarz & Clore, 1983) to determine whether the mood moderation effects we observed in Studies 1 and 2 were due to participants using mood-as-input into judgments of goal progress. We therefore introduced an additional task that supposedly primed neutral or negative feelings. We predicted a three-way interaction of counterfactual condition, negative mood, and this misattribution cue. In the control cue (neutral prime) condition, we expected to replicate the Counterfactual thought x Negative mood interaction observed in previous studies. That is, counterfactuals should increase performance relative to a control thought only among individuals reporting more negative affect. In the misattribution cue (negative prime) condition, we expected that the Counterfactual thought x Negative mood interaction would be eliminated, because individuals would assume their negative mood was due to the influence of the subliminal primes rather than their task performance.

## Method

### Participants and Design

Participants were 87 (58 female) students at a German university, 88.5% of whom were age 25 or younger. They received 4€ as compensation, regardless of performance on the tasks. One male participant was excluded from the analyses as an outlier on the mood, effort, and understanding measures. Participants were randomly assigned to conditions in a 2 (counterfactual vs. no counterfactual) x 2 (misattribution cue vs. control cue) between-subjects design.

### Materials

**Anagram task.** The anagram task consisted of two blocks of twenty trials. On each trial, participants could choose whether to solve a six-letter anagram or skip the item. Participants

were told that they would receive one point for every correct answer, and would receive 0.50€ for every ten points.

**Lexical decision task.** Participants were told the task was a pretest for a future study. On each trial, a fixation cross was presented for 250ms. Next, a letter-string was presented for 70ms, followed by a mask. Participants were asked to identify the letter-string as a word ('D'-key) or non-word ('K'-key). There were a total of 50 trials, including 25 words and 25 non-words. The words included eight positive (e.g., friend, sunshine), eight negative (e.g., danger, cockroach), and nine neutral (e.g., table, pencil) words.

### **Procedure**

Participants were told the study involved problem-solving under time pressure, and that they would complete two versions of an anagram task, receiving feedback after each part. After providing demographic information, the anagram task was explained. Participants were given the goal "I want to earn as many points as possible!" and asked to write this goal three times. They completed the measures of motivation, willingness to put forth effort, and understanding of the task as in Study 2. They then completed the first block of 20 anagrams. All participants were then given accurate feedback concerning the number of items correctly solved, number of items skipped, and total number of points earned.

Next, participants were asked to complete the lexical decision task. Following this task, participants were randomly assigned to one of two cue conditions. Those in the misattribution cue condition were told that, during the lexical decision task, negative words had been presented between the fixation cross and the target letter-string. These primes were supposedly presented so briefly as to be subliminal. Participants were told the purpose of the study was to examine whether these subliminal primes would facilitate the identification of negative target words

presented on the screen. As a result, participants were warned that they may notice that their mood became more negative as a result of the task, but that this effect usually dissipates after ten minutes. Those assigned to the control cue condition were not given any information about the effects of the task on their mood.

Next, participants were randomly assigned to one of two thought conditions. Those assigned to the counterfactual condition were asked to consider the thought “if only I had concentrated during the anagram task, I would have done better“. They were asked to write this thought three times. Those assigned to the control thought condition were asked to consider the thought “I would like to know how my friends would have done on this task“. They were asked to write this thought three times. Following this task, they again wrote the goal “I want to earn as many points as possible!” three times. The second set of items thus represented a task of unfixed difficulty. Participants next completed the 17-item measure of mood as in Study 2. They again rated their motivation, willingness to put forth effort, and understanding of the task. They then completed the second block of the anagram task.

### **Results and Discussion**

Participants indicated that they were motivated to perform well ( $M_{\text{set1}} = 5.76$ ,  $M_{\text{set2}} = 5.36$ ), were willing to put forth effort ( $M_{\text{set1}} = 5.77$ ,  $M_{\text{set2}} = 5.51$ ), and that they understood what to do on the task ( $M_{\text{set1}} = 5.05$ ,  $M_{\text{set2}} = 4.43$ ). Effect coding was used for the thought (counterfactual = 1, no counterfactual = -1) and cue (control = 1, misattribution = -1) variables. Negative mood scores ( $M = 14.14$ ,  $SD = 5.45$ , Cronbach’s  $\alpha = .85$ ) were positively skewed, and so scores on this measure were log-transformed ( $M = 2.59$ ,  $SD = 0.34$ ). A 2 (counterfactual vs. no counterfactual) x 2 (misattribution cue vs. control cue) ANOVA on negative mood scores did not reveal any

significant differences,  $F_s < 2.22$ ,  $p_s > .14$ . Preliminary analyses revealed an order effect on performance, and so this variable was included as a covariate in the analysis.

We examined accuracy in set 2 ( $M = 6.19$ ,  $SD = 4.02$ ) controlling for accuracy in set 1 ( $M = 5.42$ ,  $SD = 4.03$ ). These scores were then regressed onto the following model: order, negative mood scores, counterfactual condition, and cue condition were entered in the first step, all two-way interactions of negative mood scores, thought condition, and cue condition were entered in the second step, and the three-way interaction of negative mood scores, thought condition, and cue condition was entered in the final step.<sup>7</sup> The results of this analysis are presented in Table 5. In addition to effects of order and negative mood, the predicted Counterfactual x Negative mood x Cue interaction was significant, see Figures 5a and 5b. The Counterfactual x Negative mood interaction was calculated within each cue condition in order to decompose this significant three-way interaction.

Within the control cue condition, the Counterfactual x Negative mood interaction observed in previous studies was replicated,  $\beta = .453$ ,  $t(76) = 2.23$ ,  $p = .03$ . Performance was marginally better in the counterfactual condition relative to the control condition among participants reporting more negative mood, simple-slope = 1.65,  $t(76) = 1.92$ ,  $p = .06$ , 95% CI = -0.06 to 3.37. Counterfactual thought had no effect among those reporting less negative mood, simple-slope = -0.93,  $t(76) = 1.32$ ,  $p = .19$ , 95% CI = -2.33 to 0.47.

This pattern was eliminated in the misattribution cue condition,  $\beta = -.314$ ,  $t(76) = 1.64$ ,  $p = .11$ . When told their negative mood may be due to the lexical decision task, counterfactual thoughts did not improve performance relative to the control condition among those low in negative mood, simple-slope = 1.12,  $t(76) = 1.46$ ,  $p = .15$ , 95% CI = -0.41 to 2.65, or among those high in negative mood, simple-slope = -0.67,  $t(76) = 0.90$ ,  $p = .37$ , 95% CI = -2.14 to 0.81.

The results of Study 3 strongly supported the mood-as-input (Cervone et al., 1994; Gendolla & Brinkman, 2005; Martin et al., 1993) and REM (Markman & McMullen, 2003) perspectives on the role of affect in determining the behavioral consequences of counterfactual thoughts. As in prior studies, counterfactual thoughts led to better performance only when accompanied by negative affect. However, when negative affect was said to be the result of an intervening task, it could no longer be used to inform judgments of goal progress (Gendolla & Krüsken, 2002; Schwarz & Clore, 1983). As a result, the counterfactual no longer improved performance.

### **General Discussion**

The present work sought to examine two differing explanations of the benefits of counterfactual thinking for subsequent performance. The content-specific view holds that counterfactuals are translated into an intention to engage in a specific behavior in the future (Smallman & Roese, 2009). Thus, the benefits of counterfactual thinking should be quite comparable to those of forming a plan (Epstude & Roese, 2008). According to the REM (Markman & McMullen, 2003), counterfactuals indirectly influence judgments of progress toward a goal, particularly when no objective information exists. When individuals experience more negative affect as a result of counterfactual thinking, they should judge their performance as inadequate (Carver & Scheier, 1990; Cervone et al., 1994; Gendolla & Brinkman, 2005; Martin et al., 1993). Effort on the task is increased, leading to more broad improvement (Markman et al., 2008). Based on the REM and Action-Phase Theory (Heckhausen, 2003; Heckhausen & Gollwitzer, 1987), we argued that any content-specific benefits should be dependent on subjective evaluations of goal progress. The present studies therefore had two aims: determining the specificity of counterfactual benefits for performance relative to those of

forming a plan, and examining the role of mood in moderating these effects. The design of the studies allowed us to directly compare the explanatory power of these two accounts.

The findings of three studies were largely supportive of the REM (Markman & McMullen, 2003) and Action-Phase Theory (Heckhausen, 2003; Heckhausen & Gollwitzer, 1987). First, we observed benefits of counterfactual thinking only when these thoughts were accompanied by more negative affect. Second, the effects of counterfactual thinking were eliminated when negative affect could be misattributed to an unrelated task. Third, the benefits of counterfactual thought for performance were largely unrelated to their strategic content. That is, we found that counterfactuals significantly improved performance even in the absence of significant changes in the specified behavior (Study 1), and that counterfactuals with unrelated strategic content significantly influenced behavior (Study 2). Finally, the effects of counterfactual thinking were unique and additive to the benefits of forming a corresponding plan in the form of an implementation intention. These results held for a variety of tasks, specified strategies, and manipulations of counterfactual thinking. Counterfactual thoughts seem to have broad benefits for performance, but only when individuals are dissatisfied with their prior efforts. We discuss the implications of these findings below.

### **Role of Mood in Moderating Benefits of Counterfactual Thinking**

Consistent with the REM (Markman et al., 2008) and mood-as-input (see also Gendolla & Brinkman, 2005; Martin et al., 1993) views, we found that counterfactual thoughts only led to corrective action and performance improvement when accompanied by negative affect. Moreover, when affect could be (mis)attributed to the context rather than one's performance, these benefits were eliminated. These findings are consistent with past work showing that counterfactuals that result in negative affect are most likely to increase intentions to improve



(Markman et al., 2008), as well as with work showing that counterfactuals used to excuse poor performance reduce subsequent effort (McCrea, 2008; Tyser et al., 2012). Future work should continue to test the mood-as-input explanation for the role of affect in determining the consequences of counterfactual thinking. For example, the tasks in our studies featured “do your best” goals (i.e., tasks of unfixed difficulty), which are inherently subjective. The role of affect may be minimized in tasks with more objective standards (e.g., a percentile ranking or point total that must be reached).

In addition, it should be noted that individuals in our studies held conscious goals and affect was likely used to inform decisions about whether and how to pursue these goals. In other work, the co-activation of negative affect and nonconscious (i.e., subliminally primed) goals has been shown to undermine motivation (Aarts, Custers, & Holland, 2007). The impact of counterfactual thinking when pursuing goals nonconsciously thus remains an interesting area for exploration.

### **Breadth of Benefits of Counterfactual Thinking**

The REM (Markman & McMullen, 2003) proposes that counterfactuals increase persistence as a result of judgments (informed by negative affect) of insufficient goal progress. Consistent with this view, we found that counterfactual thinking influenced persistence and performance independent of the strategic content of the thought. These effects were in sharp contrast to the consequences of forming an implementation intention. Replicating past work (Parks-Stamm et al., 2007), implementation intentions benefitted the specified behavior, but did not affect other goal-relevant behaviors. Thus, counterfactual thinking had effects quite different from those of forming an if-then plan.

Smallman and colleagues (Smallman & McCulloch, 2012; Smallman & Roese, 2009) previously demonstrated that counterfactual thinking increases the accessibility of intentions to

engage in the specified behavior (i.e., “In the future, I will do X”). One may then ask why we did not more consistently observe content-specific benefits of counterfactual thought. Although we expected counterfactuals would have benefits to performance beyond those specified in the thought, this does not preclude engaging in the specified behavior at all. We suggest several possible reasons for this finding.

As discussed earlier, individuals in our studies could have formed additional intentions not suggested by the counterfactual thought. In the short timeframes (i.e., a few seconds) assessed in previous studies (Smallman & McCulloch, 2012; Smallman & Roese, 2009), counterfactual thoughts might increase the accessibility of corresponding intentions. However, when individuals have the opportunity to deliberate they could spontaneously consider other strategies to improve. Consistent with this view, we found in Study 2 that the opportunity to generate a counterfactual thought did not significantly affect the content of subsequently generated implementation intentions (replicating Myers, 2009). Thus, given a few moments to form an implementation intention, individuals may form the same plan regardless of the content of prior counterfactual thoughts.

A second possibility is that counterfactual thinking does not result in well-encoded future intentions. In a recent study by McCrea, Penningroth, and Tyser (2012), it was observed that implementation intentions forged a strong cue-response link in memory and improved prospective memory performance on a go/no-go task. Participants who formed a counterfactual or a plan that did not take an “if-then” format did not significantly differ from a control group on these measures. Thus, it is possible that counterfactuals facilitate intentions that are poorly encoded or that occasionally fail to take the “if-then” format of an implementation intention.

### **An Important Role for Thought Content?**

Even if the specified strategy is not enacted, the content of a counterfactual thought is still important in determining its consequences for behavior. In addition to influencing mood and thereby the perceived need for additional effort, upward counterfactuals also affect self-efficacy and feelings of control for subsequent performance (Nasco & Marsh, 1999; Tal-Or, Boninger, & Gleicher, 2004). That is, the corrective actions suggested by the counterfactual may be helpful in so far as they help the individual feel as if he or she is capable of completing the task. Thus, another critical feature of upward counterfactuals may be that they tend to focus on controllable actions (Markman, Gavanski, Sherman, & McMullen, 1995). Thoughts that specify external (e.g., “If only I was luckier”) or uncontrollable (e.g., “If only I was smarter”) causes for poor performance may not have the same benefits for the mobilization of effort as do those specifying controllable actions. The combination of dissatisfaction with prior performance and feelings of control should be highly motivating. We are currently examining this question in our laboratory.

### **Implications for Behavior Change and Effective Self-Regulation**

Implementation intentions have been shown to improve goal striving in a variety of domains (Gollwitzer & Sheeran, 2006) and therefore are of great interest to applied researchers. The finding that counterfactual thinking can have additional beneficial effects beyond planning is therefore exciting and should be investigated in other research contexts. Specifically, upward counterfactual thinking seems to more broadly increase performance, whereas implementation intentions promote specific behaviors. In similar work examining simulations of future events, Oettingen and colleagues (2001; Stadler, Oettingen, & Gollwitzer, 2009) have found that mentally contrasting a desired outcome with a current state of reality increases the mobilization of effort, and that doing so also enhances the impact of subsequently-formed implementation intentions. Thus, much like mental contrasting can increase motivation prior to a task,

counterfactual thinking can increase motivation upon receiving feedback (see also Gollwitzer, Wieber, Myers, & McCrea, 2010). Implementation intentions can then direct this energy into productive behavior.

### **Conclusion**

Counterfactuals are ubiquitous and powerful thoughts that not only determine our affective reactions to events, but also our subsequent behaviors. Particularly after negative events, we often think about what went wrong and try to learn from our mistakes. The present research indicates that these kinds of thoughts may often be beneficial because we become committed to improvement more generally, rather than because of any one particular “lesson learned.” Certainly, such flexibility points to the functionality of these thoughts and the need for more research into how they are translated into subsequent action.

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## Footnotes

- <sup>1</sup>. We report all data exclusions, conditions, and hypothesis-relevant measures. Data collection proceeded until the end of the semester or a predetermined cell size was reached.
- <sup>2</sup>. Our hypotheses centered on the effects of negative mood. Principle-components analysis was utilized to identify mood dimensions. Preliminary analyses revealed no interactions of positive mood or self-esteem with either condition variable ( $ps > .07$ ). Thus, we do not discuss these other variables further.
- <sup>3</sup>. Analyzing change scores did not alter the pattern of results in any of the three studies.
- <sup>4</sup>. When examining selection of clues at all other time points (prior to 50 sec. or after 70 sec.), there was only an effect of implementation intention condition,  $\beta = -.227$ ,  $t(85) = 2.64$ ,  $p = .01$ . Those in the implementation intention condition were actually *less* likely to select clues at these times, consistent with the notion that they carried out the specified behavior only at the specified time. There were no effects of counterfactual thought condition (all  $ts < 1$ ,  $ps > .70$ ).
- <sup>5</sup>. Preliminary analyses revealed no effects of positive mood ( $ps > .20$ ), and so we do not discuss this variable further.
- <sup>6</sup>. For the primary analyses, the condition index was  $< 12$  and variance inflation factor (VIF)  $< 1.22$ . For the mediation analysis, the condition index was  $< 9$  and VIF  $< 2.39$ . A condition index  $< 30$  and VIF  $< 5$  is considered acceptable (see Tabachnik & Fidell, 1996). Moreover, the results remained stable when dropping the negative mood term or the Counterfactual x Implementation intention term from the analysis.
- <sup>7</sup>. Preliminary analyses revealed no effects of positive mood ( $ps > .52$ ), and so we do not discuss this variable further.

Table 1

*Strategy use and performance in set 2 (Study 1)*

Clue use (50-70 sec)	$\beta$	$t$	$p$	$f^2$
Clue use (50-70 sec) in set 1	.097	0.95	.35	.01
Negative mood	.209	1.93	.06	.04
Counterfactual	-.005	0.05	.96	<.01
Implementation intention	.296	2.93	<.01	.10
Counterfactual x Negative mood	.108	1.01	.32	.01
Implementation intention x Negative mood	.093	0.92	.36	<.01
Counterfactual x Implementation-intention	-.073	0.72	.47	<.01
Accuracy	$\beta$	$t$	$p$	$f^2$
Accuracy in set 1	.138	1.24	.22	.02
Negative mood	.038	0.33	.75	<.01
Counterfactual	.169	1.61	.11	.03
Implementation intention	.047	0.44	.66	<.01
Counterfactual x Negative mood	.230	2.02	<.05	.05
Implementation intention x Negative mood	.058	0.55	.59	<.01
Counterfactual x Implementation-intention	.026	0.24	.81	<.01

Table 2

*Reported effort and time spent on set 2 (Study 2)*

Willingness to put forth effort in set 2	$\beta$	$t$	$p$	$f^2$
Willingness to put forth effort in set 1	.344	3.11	<.01	.14
Negative mood	.115	1.03	.31	.02
Counterfactual	.050	0.46	.65	<.01
Implementation intention	.155	1.37	.18	.03
Counterfactual x Negative mood	.202	1.76	.08	.04
Implementation intention x Negative mood	.135	1.17	.24	.02
Counterfactual x Implementation-intention	.130	1.18	.24	.02
Time spent on set 2	$\beta$	$t$	$p$	$f^2$
Time spent on set 1	.545	5.81	<.001	.48
Negative mood	-.132	1.38	.17	.03
Counterfactual	.149	1.56	.12	.03
Implementation intention	.027	0.28	.78	<.01
Counterfactual x Negative mood	.228	2.29	.03	.07
Implementation intention x Negative mood	.164	1.63	.11	.04
Counterfactual x Implementation-intention	.017	0.18	.86	<.01

Table 3

*Decomposed model predicting time spent in set 2*

Time spent on set 2	$\beta$	$t$	$p$	$f^2$
Time spent on set 1	.532	5.87	<.001	.51
Negative mood	.046	0.43	.67	<.01
Time-related counterfactual vs. control	-.068	0.56	.58	<.01
Unrelated counterfactual vs. control	.213	1.85	.07	.05
Time-related implementation intention vs. control	.158	1.33	.19	.03
Unrelated implementation intention vs. control	-.123	1.07	.29	.02
Time-related counterfactual vs. control x Negative mood	-.180	1.36	.18	.03
Unrelated counterfactual vs. control x Negative mood	.424	3.20	<.01	.15
Time-related implementation intention vs. control x Negative mood	.262	2.14	.04	.07
Unrelated implementation intention vs. control x Negative mood	-.103	0.84	.40	<.01

Table 4

*Accuracy in set 2 (Study 3)*

Accuracy in set 2	$\beta$	$t$	$p$	$f^2$
Accuracy in set 1	.601	6.18	<.001	.50
Order	.285	3.00	<.01	.12
Negative mood	.083	0.82	.42	<.01
Counterfactual	.074	0.80	.43	<.01
Cue	-.059	0.64	.53	<.01
Counterfactual x Negative mood	.049	0.50	.62	<.01
Counterfactual x Cue	.017	0.18	.86	<.01
Negative mood x Cue	-.035	0.37	.72	<.01
Counterfactual x Negative mood x Cue	.266	2.78	<.01	.10



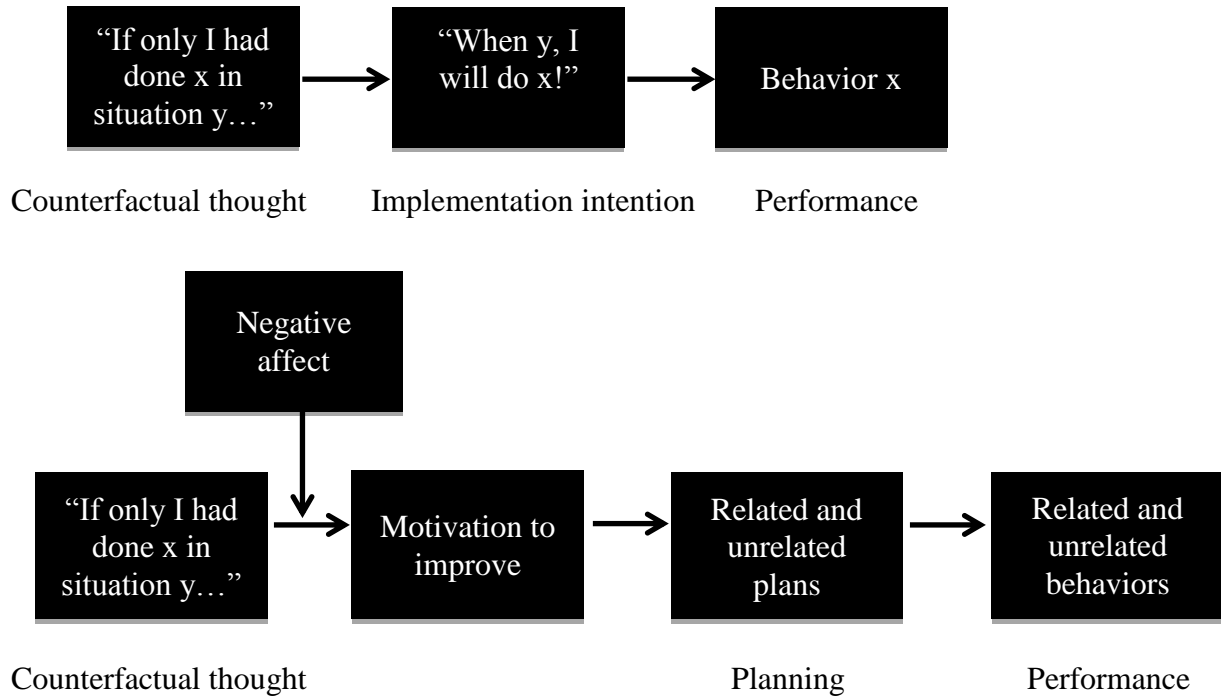


Figure 1. Content-specific pathway (top panel) and content-neutral pathways (bottom panel) to performance improvement (adapted from Epstude & Roese, 2008; Markman & McMullen, 2003).

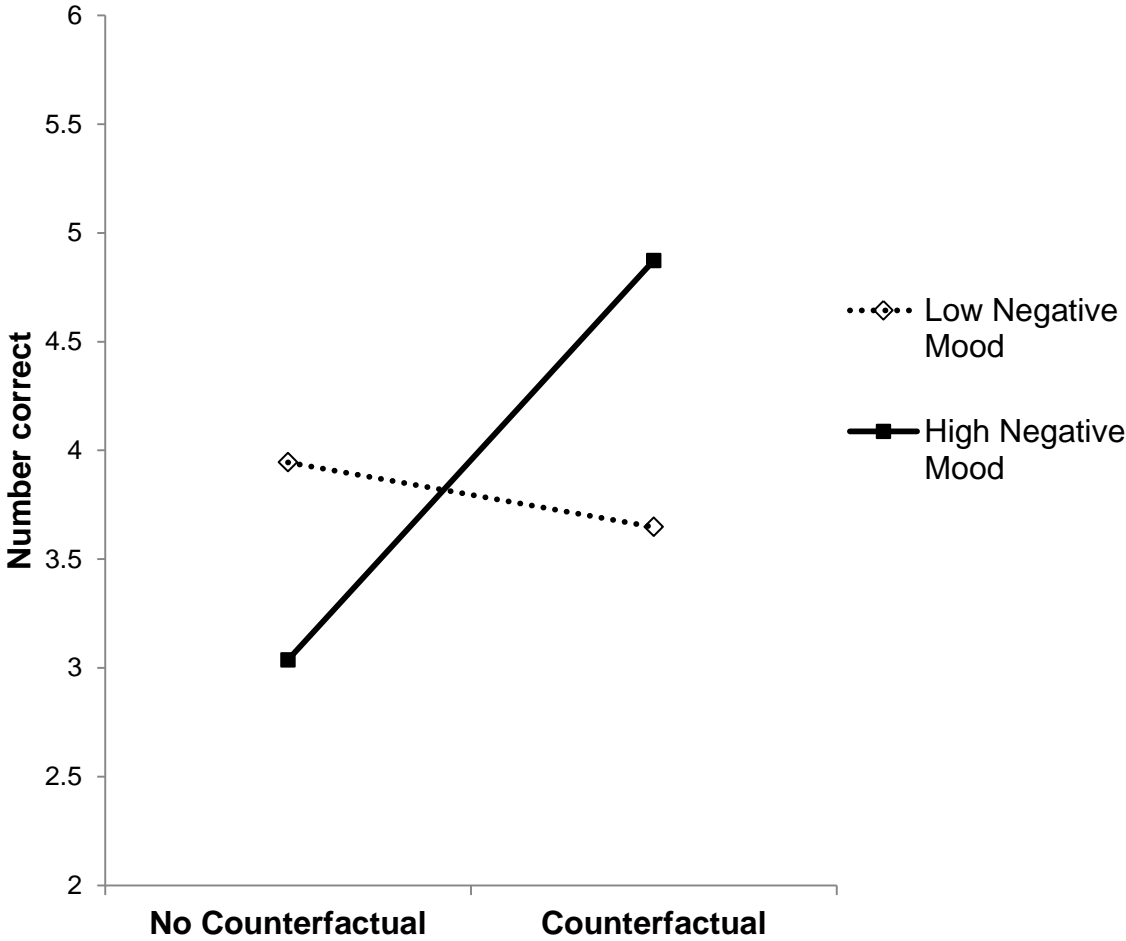


Figure 2. Counterfactual x Negative mood interaction on set 2 accuracy (Study 1).

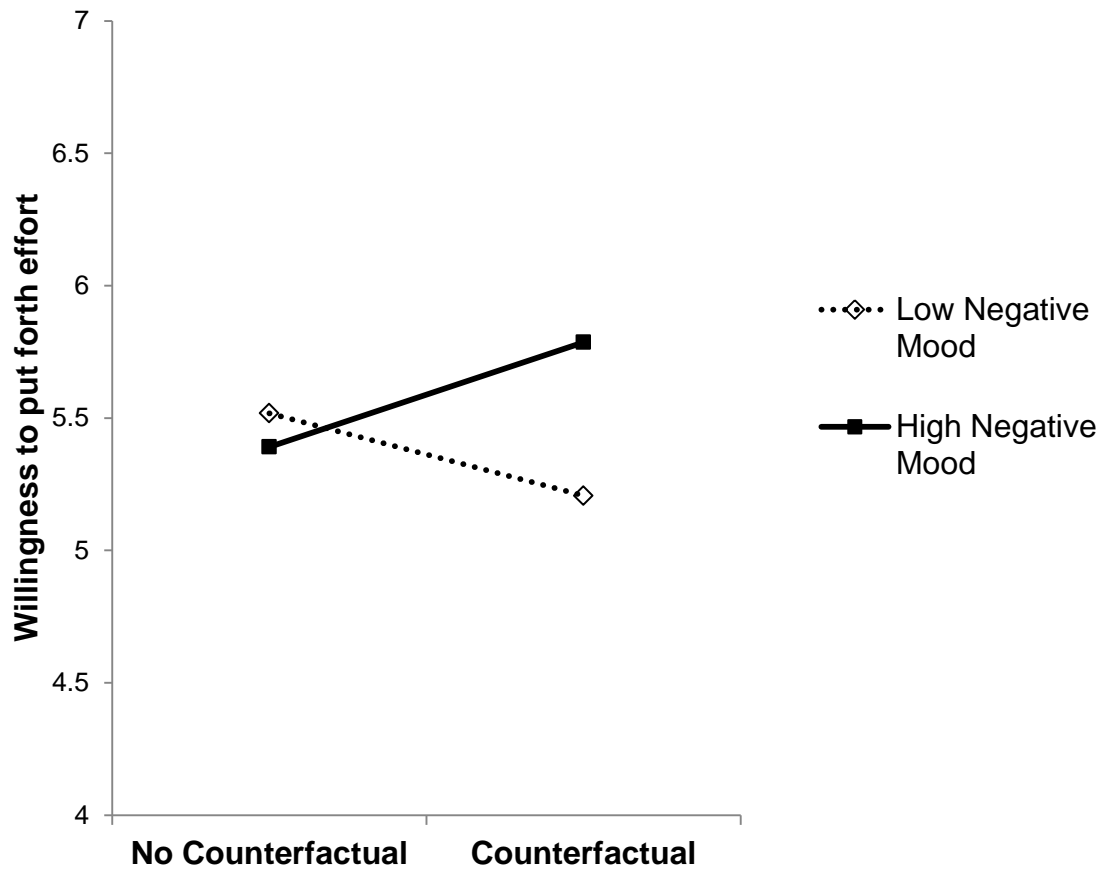


Figure 3. Counterfactual x Negative mood interaction on willingness to put forth effort in set 2 (Study 2).

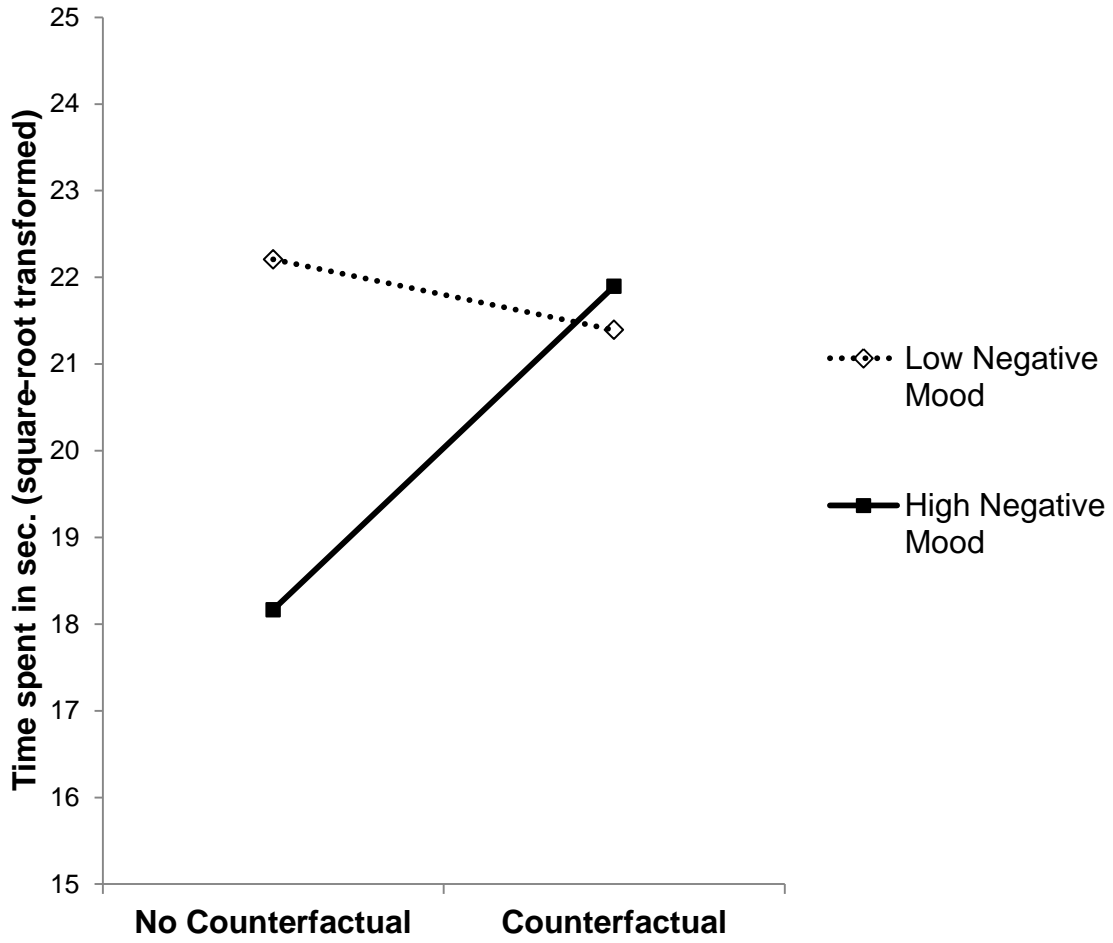


Figure 4. Counterfactual x Negative mood interaction on time spent in set 2 (Study 2).

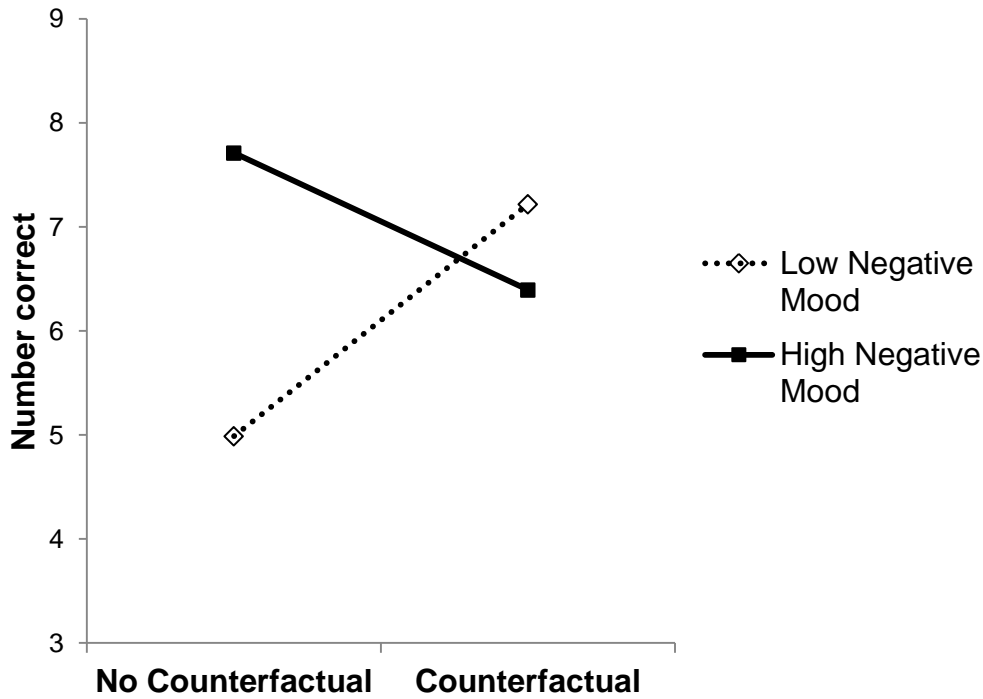
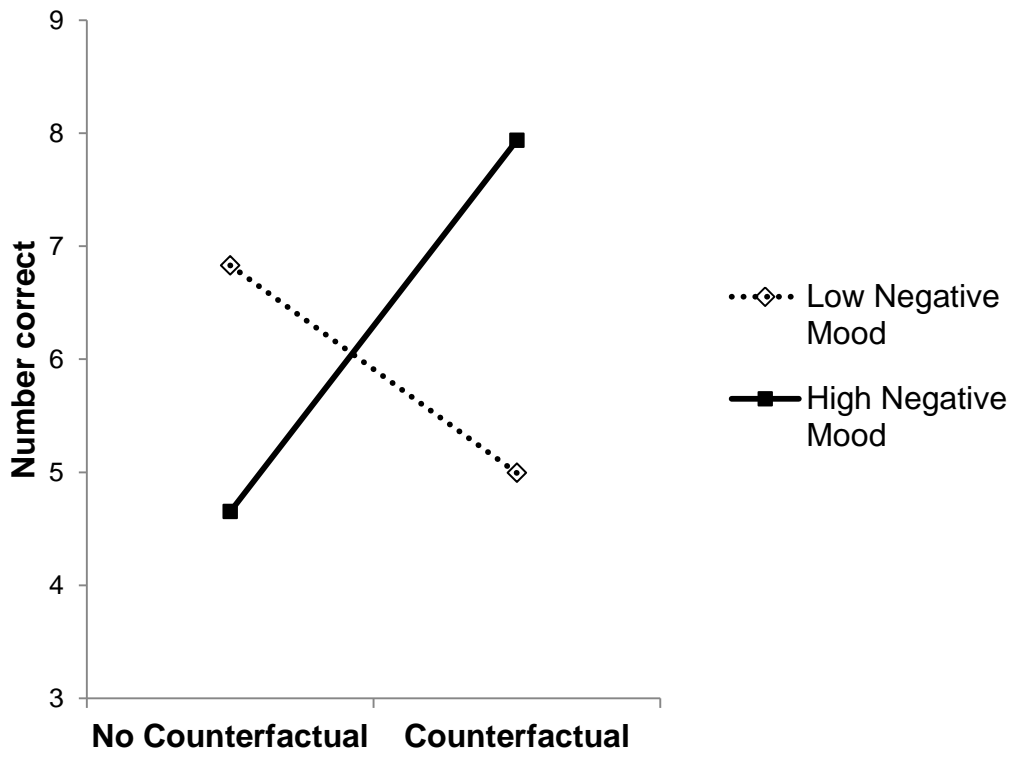


Figure 5a and 5b. Counterfactual x Negative mood interaction on difference in number correct within the (a) control cue condition and (b) the misattribution cue condition (Study 3).