THE MAKING OF MIGHT-HAVE-BEENS: EFFECTS OF FREE WILL BELIEF ON COUNTERFACTUAL THINKING

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The Making of Might-Have-Beens:

Effects of Free Will Belief on Counterfactual Thinking

Jessica L. Alquist

Texas Tech University

Sarah E. Ainsworth, Roy F. Baumeister

Florida State University

Michael Daly

Stirling Management School

Tyler F. Stillman

Southern Utah University

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Abstract

Counterfactual thoughts are based on the assumption that one situation could result in multiple possible outcomes. This assumption underlies most theories of free will and contradicts deterministic views that there is only one possible outcome of any situation. Three studies tested the hypothesis that stronger belief in free will would lead to more counterfactual thinking. Experimental manipulations (Studies 1-2) and a measure (Studies 3-4) of belief in free will were linked to increased counterfactual thinking in response to autobiographical (Studies 1, 3 and 4) and hypothetical (Study 2) events. Belief in free will also predicted the kind of counterfactuals generated. Belief in free will was associated with an increase in the generation of self and upward counterfactuals, which have been shown to be particularly useful for learning. These findings fit the view that belief in free will is promoted by societies because it facilitates learning and culturally valued change.

Keywords: Free Will, Counterfactual Thinking, Beliefs, Learning

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People react differently to getting a bad grade, earning a big promotion, or going through a divorce. Some reflect deeply on the way things could have been better than they were, and some do not. People may wonder what would have happened if they had studied more, if they had volunteered for that big project at work, or if they had been willing to go to couples' counseling. Others may not concern themselves with the ways the situation could have been better. People's basic beliefs about the world may influence the extent to which they reflect on the ways things could have gone differently. The present research was designed to test the hypothesis that belief in free will leads to greater counterfactual thinking than a lack of belief in free will.

Free Will

Although some may regard the question of free will as an esoteric philosophical question that is largely irrelevant to everyday life, recent evidence has painted a different and more socially relevant picture. Most people (including children and members of other cultures) have a concept of free will (Monroe & Malle, 2010; Nahmias, Morris, Nadelhoffer, & Turner, 2005; Nichols, 2004; Sarkissian et al., 2010; Stillman, Baumeister, & Mele, 2011). People differ in their views about how much free will people have (Paulhus & Carey, 2011; Stroessner & Green, 1990). Beliefs about free will are not just isolated metaphysical opinions, but rather are deeply intertwined with personality traits, values, political attitudes, and religious beliefs (Baumeister & Brewer, 2012; Carey & Paulhus, 2013). Beliefs about free will have also been shown to be conceptually distinct from and have unique predictive power when controlling for related concepts, such as locus of control (Crescioni et al., 2014; Paulhus & Carey, 2011; Stillman et al.,

2010;Waldman, Viney, Bell, Bennett, & Hess, 1983) and the big five personality traits (Paulhus & Carey, 2011). Moreover, many people's beliefs about free will are somewhat elastic and unstable, which has enabled researchers to increase or decrease those beliefs by experimental manipulations (Baumeister, Masicampo, & DeWall, 2009; Vohs & Schooler, 2008).

What exactly is free will? Some researchers have used highly simplistic and antiscientific definitions, such as the capacity of spiritual souls to control actions (e.g., Montague, 2008). Among philosophers, the concepts have become highly complex (e.g., Dennett, 1984a; Dennett, 1984b; Holton, 2006; Kane, 1996; Mele, 1995, 1999, 2006, 2009; Shepherd, 2012). Recent work on how ordinary people understand the concept of free will has shown that people's view of free will seems to center around the ability to make choices that are in line with their morals and long-term best interest, that do not harm their social group, and are the result of conscious thought (Shepherd, 2012; Stillman et al., 2011; Monroe & Malle, 2010). Some accounts pit deterministic views against free will, and indeed many philosophical treatments of free will focus mainly on whether and how any notion of free will can be reconciled with deterministic causality (Dennett, 1984a; Feltz & Cokely, 2009; Guglielmo, Monroe, & Malle, 2009; Nadelhoffer, Kvaran, & Nahmias, 2009; Nahmias et al., 2005; Nahmias, Morris, Nadelohffer, & Turner, 2006; Nahmias, Coates, & Kvaran, 2007; Nichols, 2006; Nichols & Knobe, 2007). The central tenet of determinism is that each event is causally inevitable. As originally articulated by Pierre-Simon LaPlace (1951/1814), if an extremely powerful mind knew the current position of every particle in the universe and all the causal principles that operate on them, that mind could unerringly predict every future event. Such a belief in relentless, universal inevitability is at odds with counterfactual thinking. Although the statement "if I had acted differently, the outcome would

have been different" can be true even in a deterministic universe (Holton, 2013), the determinist may insist that he or she *could not* have acted differently, so such thoughts are idle speculations.

We doubt that such metaphysical considerations occupy the minds of ordinary people. Instead, we think that inducing disbelief in free will among laypersons amounts to telling them that their conscious sense of choosing and controlling is an illusion. Various recent books and statements aimed at the general public have indeed asserted precisely that (Gazzaniga, 2012; Wegner, 2002; Wilson, 2002; Harris, 2012). Recent neuroscience statements about brain processes may be only the most recent of these effects, and indeed Freudian psychoanalysis was for a long time an influential source of skepticism about conscious control, insisting that unconscious and repressed factors often caused behavior. The effect on laypersons may be not so much a philosophical discrediting of counterfactual thinking as a sense that such thinking is futile. After all, if conscious decisions do not control actions, then what is the point of thinking about how one might have decided differently? Conversely, a manipulation that strengthens or affirms belief in free will should stimulate people to choose carefully and responsibly, and so the deliberate and explicit processes associated with human agency would be intensified.

Counterfactual Thinking

Counterfactual thoughts are reflections on how a different outcome may have occurred if one's behavior or circumstances had been different (Kahneman & Miller, 1986; Markman, Gavanski, Sherman, & McMullen, 1993; Roese, 1994, 1997). A large body of research has shown that some situations invite counterfactual thinking more than others (Gavanski & Wells, 1989; Girotto, Legrenzi, & Rizzo, 1991; Johnson, 1986; Kahneman & Miller, 1986; Kahneman & Varey, 1990; Markman et al., 1995; Meyers-Levy & Maheswaran, 1992; Miller & Gunasegaram, 1990; Roese, 1997; Sanna & Turley, 1996). One feature that predicts whether a

situation generates many or few counterfactuals is the perceived mutability of the situation. High

mutability means that people believe that many different outcomes could have emerged from the

situation, and such situations produce more counterfactual thoughts than situations that seem

inevitable. For example, people are most likely to view aspects of the situation as mutable if

those aspects seem controllable (Girotto et al., 1991; Markman et al., 1995; Markman & Weary,

1996), happened early in the causal chain (Kahneman & Miller, 1986; Wells, Taylor, & Turtle,

1987), happened recently (Byrne et al., 2000; Miller & Gunasegaram, 1990), and deviated from

the norm (Gavanski & Wells, 1989). When people view an action or situation as changeable,

they are more likely to engage in counterfactual thinking.

Situational mutability is one cause of counterfactual thinking: The more the situation

could seemingly be changed, the more counterfactual thoughts the person generates. The present

work sought to extend this pattern by examining people's beliefs about the mutability of human

behavior per se. Concepts of free will assert that people could act in different ways in the same

situation, and therefore alternative scenarios are plausible. Research on children's conceptions of

free will has shown that even young children believe that actors (but not inanimate objects) could

have acted differently than they did (Nichols, 2004). Variations in the degree of belief in free

will should be reflected in counterfactual thinking. Specifically, the more one believes in free

will, the more mutable one perceives one's choices to be, and hence the more counterfactual

thoughts one will generate.

In contrast, determinism and other views that oppose free will generally assert that each

human action is inevitable and that a given person in a given situation could only possibly

perform one particular action. With such a belief, there are no legitimate, plausible

counterfactuals. According to such views, the person could not have acted differently. As Roese

and Olson (1995) observed, "Absurd counterfactuals tend not to arise spontaneously; rather feasibility limits their derivation from reality." (p. 9). To a strict determinist, all counterfactuals are infeasible because nothing could have happened other than what did actually happen (unless perhaps the Big Bang itself had happened differently). People who believe in free will, on the other hand, can assume that they could have acted differently in a particular situation.

We reiterate that there are many subtle variations and complexities in philosophical arguments. To the layperson, however, assertions that there is no free will and of deterministic inevitability may simply eliminate the plausibility of counterfactual thinking: One could not have acted differently. Insofar as counterfactual thinking facilitates social learning and adaptation to human social life, the belief in free will may be socially useful.

<div style="text-align:center">Varieties of Counterfactual Thought</div>

The complexity of human social life enables a diverse array of potential counterfactual simulations. For example, the divorce might have been avoided had the spouse been more considerate, had oneself held lower expectations, had the extramarital affair been avoided, had stresses at work been less, had they had children, had the couple been willing to try marital counseling, had someone been willing to compromise, or had they never married in the first place. One important distinction in the counterfactual literature is between preparative and affective counterfactual thoughts (Roese, 1994). Preparative counterfactual thoughts help people learn. Previous research has shown that upward counterfactuals (imagining the ways things could have been better), additive counterfactuals (imagining how things would be if something were added to the situation) and counterfactuals about one's own behavior are particularly helpful at helping individuals improve their performance (Kray, Galinsky, & Markman, 2009; Markman et al., 1993; Morris and Moore, 2000; Roese, 1994). Other types of counterfactuals serve an

affective rather than a preparative function. In particular, generating downward counterfactuals (thinking about the ways things could have been worse than they are) can help people feel better but often do not have any positive effect on performance (Markman, et al., 1993; Roese, 1994; White & Lehman, 2005).

At the outset of this investigation, we thought it possible that free will beliefs could increase all counterfactual thinking. However, we also came to acknowledge and entertain the possibility that one function of belief in free will may be primarily to generate counterfactuals that may improve future outcomes. Free will beliefs may not lead individuals to randomly generate all the ways things could be different than they are. Instead, free will beliefs may predict people's likelihood of generating preparative counterfactual thoughts, namely upward, additive, and self-related counterfactuals. Free will is presumably understood as a way of deciding how to act, and preparative counterfactuals are most useful for future decisions about how to act. That is, thoughtful reflections on how one could have acted differently to produce better results may help people use their ostensible free will to act more effectively in the future.

Insofar as the focus of counterfactual thoughts is to change one's own future actions, it is generally most useful to consider counterfactuals about the self. We have suggested that believing in free will creates a sense that one can act differently and so it is useful to generate counterfactual thoughts in order to choose the optimal course of action. Hence counterfactual thoughts about the self would likely be increased by belief in free will. Indeed, there is some evidence that people believe themselves to have more free will than other people (Pronin & Kugler, 2010), so again analyzing counterfactuals about one's own actions would be more relevant to high belief in free will than analyzing counterfactuals about external factors beyond one's control.

Present Research

In the present research, participants were asked to reflect on some real or hypothetical situation and were invited to list counterfactual thoughts. We manipulated (Studies 1 and 2) or measured (Study 3) belief in free will and assessed the relationship between those beliefs and the number and nature of counterfactual thoughts. The a priori prediction with which we began this research was that high belief in free will would contribute to more counterfactual thoughts in general than disbelief in free will. Reflecting on one's misdeeds, misadventures, and failures might be somewhat unpleasant but could be beneficial for learning (Epstude & Roese, 2008; Kray, Galinsky, & Markman, 2009; Smallman & Roese, 2009; Roese, 1994, for exceptions see Petrocelli, Seta, & Seta, 2013 and Petrocelli, Seta, Seta, & Prince, 2012). Along the way, we developed ancillary hypotheses that free will beliefs should mainly increase preparative counterfactual thoughts (upward, additive, and counterfactuals about one's own behaviors).

Study 1

Study 1 was designed to test the hypothesis that participants who were encouraged to think affirmatively about having free will would generate more counterfactuals than participants in control or anti-free will belief conditions. It also tested the hypothesis that manipulated free will belief increased only certain types of counterfactual thinking. We predicted that the pro-free will condition would specifically increase preparative counterfactuals (upward, additive, self), as compared to the anti-free will and control conditions.

We manipulated free will beliefs using an adaptation of the Velten induction where participants were asked to re-write pro-free will sentences, anti-free will sentences, or control sentences that were not about free will (Alquist, Ainsworth & Baumeister, 2013; Vohs & Schooler, 2008). Previous research found that reading these sentences had a significant effect on

free will beliefs as measured by the free will and determinism scale (Baumeister, Masicampo, &

DeWall, 2009; Paulhus & Carey, 2011; Vohs & Schooler, 2008). Counterfactual thinking was

measured by asking participants to reflect on a time they had hurt someone and generate ways

that the situation could have gone differently. The number of counterfactual thoughts participants

generated was counted as a measure of counterfactual thinking (Niedenthal, Tangney, &

Gavanski, 1994; Roese & Olson, 1993b).

One alternative explanation for our hypothesized effect of the free will induction on

counterfactual thinking could be that the anti-free will manipulation impaired participants' mood,

which decreased the amount of effort participants were willing to spend on the counterfactual

generation task (regardless of how mutable they perceived the situation to be). We included a

mood measure in order to test for this possibility.

Method

Participants. Ninety-three participants participated for course credit. Participants were

run in groups of 10-20 participants and condition assignment was done at the individual level.

One group of ten participants was excluded from analyses because one participant was disruptive

throughout the session and announced that she/he was lying on all the questions.

Procedure. Participants were told that they would be taking part in two pilot studies on

people's writing styles.

Free will belief manipulation. Participants were given a packet of ten sentences that they

were told to re-write in their own words (Alquist, Ainsworth, & Baumeister, 2013). The

sentences for all three conditions were selected from the procedure used by Vohs and Schooler

(2008) and were designed to bolster belief in free will (e.g. "I am able to override the genetic and

environmental factors that sometimes influence my behavior"), to foster disbelief in free will

(e.g. "Our actions are determined by what we have experienced in the past combined with the specific genetic predispositions that we have."), or to have no effect on free will beliefs (e.g. "Sugar cane and sugar beets are grown in 112 countries"). Participants were given 30 seconds to read each sentence and 30 seconds to re-write it in their own words.

Counterfactual measure. In order to maintain the cover story that the two studies were unrelated, the experimenter asked the participants to sign a separate consent form for the second part of the study. The instructions stated: "Nearly everyone has hurt someone. We are interested in the circumstances surrounding these events, as well as the feelings that are associated with hurting someone. Please think of a time you hurt someone, and respond to the following questions about that time." Participants were then asked to provide a brief description of the person they hurt, and describe what they did to hurt him or her (instructions adapted from Stillman & Baumeister, 2010).

The second page asked, "What could have been different about you, your behavior, or any aspect of the situation so that the situation would have ended differently? Please list any thoughts you have about the way things could have been different. You do not need to fill all the spaces" (emphasis in original packet). This was followed by a series of ten spaces that started with the phrase "If only…" (Niedenthal et al., 1994).

After completing the counterfactual measure, participants were given the Brief Mood Introspection Scale (Mayer & Gaschke, 1988), which asked them to indicate how well various adjectives (e.g. happy, grouchy, content) described their current mood.

Counterfactual Coding. Two trained research assistants who were blind to experimental condition coded each participant's counterfactual statements. Each counterfactual statement was coded as to whether it was upward or downward and additive or subtractive. Statements were

also coded for whether the counterfactual statements were about the person writing the statements or about the person who had been hurt. The total numbers of additive, subtractive, upward, downward, self, and other person counterfactuals were computed for each participant. Because there was strong agreement between coders on all dimensions except downward counterfactuals (All r's>.95, p<.001), only the ratings of the first coder were analyzed. There was no agreement between coders on downward counterfactuals, in part because there were almost no downward counterfactuals generated. The first coder reported that there were no downward counterfactuals and the second coder reported that one participant generated one downward counterfactual. Downward counterfactuals were therefore not analyzed further. The lack of downward counterfactuals was likely due in part to our materials, which prompted participants to list counterfactuals beginning with the phrase, "if only…" This phrase makes it highly unlikely that participants would generate downward counterfactuals. In the remaining studies, the prompt was changed to "if only/what if" to correct for this.

Results

   Counterfactual Thoughts. ANOVA revealed significant variation among conditions in the number of counterfactuals participants generated, $F(2, 81)=3.60$, $p=.03$, $\eta^2=.08$, 90% CI[.004,.174]. A planned comparison demonstrated that participants in the free will condition ($M=4.61$, $SD=2.36$) generated significantly more counterfactuals than participants in the anti-free will condition ($M=3.46$, $SD=1.36$), $F(1,81)=5.22$, p=.03, $\eta^2=.06$, $d=.60$, 95% CI[.9,2.24], and significantly more than those in the control condition ($M=3.47$, $SD=1.63$), $F(1,81)=5.56$, $p=.02$, $\eta^2=.06$, $d=.56$, 95% CI [.08,2.20].

   Counterfactuals for learning: upward, additive, and self. As predicted, a one-way ANOVA showed that there was significant variation among conditions in the number of upward

counterfactual thoughts participants generated, $F(2,81)=3.88$, $p=.03$, $\eta^2=.09$, 90% CI[.006,.18].

(See Figure 1). Participants in the free will condition ($M=4.61$, $SD=2.36$) generated significantly more upward counterfactuals than participants in the control condition ($M=3.43$, $SD=1.61$), $F(1,81)=5.98$, $p=.02$, $\eta^2=.07$, $d=.62$, 95% CI[.13,2.25], and likewise more than participants in the anti-free will condition ($M=3.42$, $SD=1.33$), $F(1,81)=5.66$, $p=.02$, $\eta^2=.07$, $d=.58$, 95% CI[.12,2.24].

Using a one-way ANOVA, we also found that there was also significant variation among conditions in the number of additive counterfactuals participants generated, $F(2,81)=5.05$, $p<.01$, $\eta^2=.11$, 90% CI[.02,.21]. Participants in the free will condition ($M=2.93$, $SD=1.61$) generated significantly more counterfactuals in which a thing or action was added to the situation than participants in the control condition ($M=1.73$, $SD=1.23$), $F(1,81)=9.49$, $p<.01$, $\eta^2=.11$, $d=.82$, 95% CI[.40,1.99], or anti-free will condition ($M=2.04$, $p=1.54$), $F(1,81)=4.90$, $p=.03$, $\eta^2=.06$, $d=.56$, 95% CI[.03,1.75].

Another one-way ANOVA confirmed that there was significant variation among conditions on the number of counterfactuals participants generated about themselves, $F(2,81)=5.07$, $p<.01$, $\eta^2=.11$, 90% CI[.02,.21]. Participants in the free will condition ($M=3.39$, $SD=1.52$) generated significantly more counterfactuals about themselves than participants in the control condition ($M=2.30$, $SD=1.26$), $F(1,81)=9.51$, $p<.01$, $\eta^2=.11$, $d=.78$, CI[.36,1.82], or anti-free will condition ($M=2.58$, $SD=1.24$), $F(1,81)=4.94$, $p=.03$, $\eta^2=.06$, $d=.58$, CI[.05,1.57]. Participants who had their belief in free will bolstered generated a greater number of upward, additive, and self counterfactuals than participants in the anti-free will belief and control conditions.

Downward, subtractive, and other person counterfactuals. Using a one-way ANOVA, we found that there were no significant differences among conditions on subtractive counterfactuals, $F(2,81)=0.26$, $p=.77$ or the number of counterfactuals generated about the person who had been hurt, $F(2,81)=.02$, $p=.98$. There were too few downward counterfactuals (1) to analyze.

Mood. Composite variables for pleasantness and arousal were created following Mayer and Gaschke's instructions (1988). Using a one-way ANOVA, we found that participants did not differ across conditions on the pleasantness-unpleasantness of their emotions, $F(2,81)=0.87$, $p=.42$. Using a one-way ANOVA, we also found no significant differences among conditions on the arousal-calm subscale of the BMIS, $F(2,81)=2.44$, $p=.09$, $\eta^2=.06$, 90% CI[.00,.14].

Discussion

In Study 1, we found that participants who were assigned to re-write statements supporting a belief in free will generated a greater number of counterfactuals than participants who were asked to re-write anti-free will or control sentences. Participants in the free will condition generated a greater total number of counterfactuals, and those differences were concentrated in certain types of counterfactual thoughts.

Specifically, participants in the free will condition generated more upward, additive, and self-related counterfactuals than participants in the anti-free will and control conditions. This suggests that free will belief may not simply haphazardly increase people's likelihood of imagining things being different. Rather, belief in free will may primarily increase people's willingness to think in ways that may facilitate learning and thereby improve future performance.

We did not expect mood to play a role in the effect of free will belief on counterfactual thinking, and we found no significant differences in mood by free will condition. Because Study

1's mood measure came after both the free will manipulation and the counterfactual thought

generation task, it is still not completely clear that the free will manipulation had no effect on

mood. In order to further test the effects of the free will manipulation on mood, Study 2

measured mood immediately after the free will belief manipulation.

Study 2

Study 2 was designed to build on Study 1 in several important ways. Study 2 tested the

hypothesis that participants in a free will condition (as compared to anti-free will or control

conditions) would generate a greater number of counterfactual thoughts in response to both

positive and negative outcomes. In principle, one can learn from both successes and failures, and

counterfactual thinking can facilitate such learning. But other functions of counterfactual thought

may be specific to certain outcomes. For example, if one succeeds, one might savor that success

by imagining the ways that one could have failed.

In Study 1, participants generated counterfactuals based on an experience from their own

lives. Such procedures add external validity by invoking real, nonlaboratory experiences, but

they raise the possibility that results are due not to differential interpretation but to differential

selection of autobiographical incidents. For example, participants in the free will condition might

have chosen incidents that have higher perceived mutability than participants in the other

conditions.

Additionally, because the events participants wrote about in Study 1 had already

happened, participants may have already engaged in counterfactual thinking about the situation.

If that was the case, then the free will manipulation may be increasing participants' memory for

counterfactuals they previously generated, rather than increasing their generation of

counterfactuals. It is worth noting that if free will beliefs did increase memory for

counterfactuals, but not generation of counterfactuals, the effects of free will beliefs on counterfactual thinking would still have value. Memory for counterfactuals likely plays an important role in the relationship between counterfactual thinking and behavior change. Someone who remembers their thoughts about how the car accident could have been avoided will likely drive differently than someone who has already forgotten those counterfactual thoughts. That being said, in Study 2, we sought to test the hypothesis that free will beliefs would increase counterfactual generation by giving participants a hypothetical scenario. Because participants would presumably be reading about this situation for the first time during the study, they couldn't be simply remembering counterfactual thoughts they had previously generated about the situation. Using a hypothetical scenario allowed us to hold the details of the situation constant across participants and test whether free will was affecting the generation of (rather than memory for) counterfactual thoughts.

Study 2 also measured mood directly after the free will belief manipulation (rather than at the end of the Study, as in Study 1) in order to ascertain whether the manipulation caused differences in mood.. A further focus of Study 2 concerned unreasonable counterfactuals. These are extraordinary, unrealistic, and otherwise implausible alternative scenarios. Unreasonable counterfactuals are highly unlikely to be beneficial for learning and they have even been shown to be associated with severe depression (Markman and Miller, 2006). If high free will belief increases all manner of counterfactuals, then it should increase the unreasonable ones also, but if free will beliefs mainly facilitate functional counterfactual thinking, then those beliefs should fail to increase unreasonable counterfactuals.

Method

Participants. 125 undergraduate students (Gender: 85 women, 40 men; Mean age 19.09;

Ethnicity: 25 Hispanic/Latino, 92 Not Hispanic/Latino, 7 Unknown/Choose not to report; Race:

2 Asian, 19 Black or African American, 94 White, 7 More than one race, 1 Unknown/Do not

wish to report, 2 Other) participated for partial course credit.

Procedure. Participants were run in groups of 2-30 participants (depending on how many

signed up for a given time slot) and condition assignment was done at the individual level.

Free will manipulation and mood measure. Free will belief was manipulated using the

same manipulation from Study 1. Following the experimental manipulation, participants

completed the Brief Mood Introspection Scale (*BMIS*; Mayer & Gaschke, 1988).

Counterfactual scenario. Next, participants were randomly assigned to receive one of

two hypothetical scenarios (from Roese & Olson, 1993b) and were asked to imagine how they

would have felt if the scenario had actually happened to them. Both scenarios described a group

project in which grades were assigned based on the joint efforts of two students. The two

students in the scenario were referred to as 'You' (the participants) and Alex (the hypothetical

partner for the group project). Depending on condition, the scenario either ends positively (the

students scored above average and received a grade of an A) or negatively (the students scored

below average and received a grade of a D).

After reading the scenario, participants received the following instructions: "People often

have thoughts like "if only" or "what if" after experiences like this. In the space below, please

list what could have been different about your behavior, Alex's behavior, or the situation that

could have changed the outcome. You do not need to fill all the spaces." The page contained 13

blank lines, which each began with the words: "If only/what if…". The main dependent variable

was the number of counterfactual thoughts participants generated.

Counterfactual coding. In addition to the number of counterfactuals, we also coded

whether the counterfactuals were upward, downward, additive, subtractive, and about the self, or Alex (see Study 1 for more details). As in the previous study, two trained coders who were blind to condition coded the number of counterfactuals of each type generated by each participant. Because the reliability ratings were very high for all ratings (all rs>.88), the first set of ratings was used.

In addition to the coding categories for study 1, coders for study 2 were also asked to rate the reasonableness of each counterfactual on a scale of 1 (completely unreasonable) to 3 (completely reasonable) (Markman & Miller, 2006). To compute the average reasonableness of the counterfactuals generated by each participant, we added together the reasonableness scores for each counterfactual and then divided that number by the total number of counterfactuals generated by the participant.

Results

Counterfactual thoughts. As in Study 1, believing more in free will was linked to generating more counterfactuals. Using a one-way ANOVA, we found a significant effect of condition on the number of counterfactuals participants generated, $F(2,122)=3.33$, $p=.04$, $\eta^2=.05$, 90% CI[.001,.118]. Participants in the free will belief condition (M=5.46, SD=2.36) generated significantly more counterfactuals than participants in the anti-free will belief condition (M=4.43, SD=2.37), $F(1,122)=4.70$, $p=.03$, $\eta^2=.04$, d=.44, 95% CI[.08,1.98], and significantly more counterfactuals than participants in the neutral control condition, (M=4.27, SD=2.18), $F(1,122)=4.87$, $p=.03$, $\eta^2=.04$, d=.52, 95% CI[.11,2.27].

We also tested whether high belief in free will would increase counterfactuals for only good or only bad events — or for both. We ran a 3 (experimental condition: free will belief, anti-free will belief, control) X 2 (scenario outcome valence: positive, negative) ANOVA on the

number of counterfactuals listed by participants. Consistent with the hypothesis that free will belief fosters learning by facilitating counterfactuals for both successes and failures, the only significant effect was a main effect of free will condition, $F(2,119)=3.32$, $p=.04$, $\eta^2=.05$, 90% CI[.001,.12]. There was no significant interaction between free will condition and scenario outcome valence, $F(2,119)=0.02$, $p=.98$, $\eta^2<.01$, 90% CI[.00,.01], indicating that the pattern of results was nearly identical for the positive and negative outcome scenarios. Consistent with previous research manipulating outcome valence (Markman et al., 1993; Roese & Olson, 1993b), there was no main effect of outcome valence on the total number of counterfactuals generated, $F(1,119)=2.04$, $p=.16$, $\eta^2=.02$, 90% CI[.00,.07].

Counterfactual Thought Structure. Because outcome has been shown to have a significant effect on the structure of counterfactual thoughts[1], all analyses for structure included outcome and the interaction between free will condition and outcome in the model.

Reasonableness. One-way ANOVA revealed no significant differences among the free will belief conditions in how reasonable the counterfactuals were judged (by independent raters) to be, $F(2, 119)=.10$, $p=.91$, $\eta^2=.002$, 90% CI[.00,.01] (free will condition $M=2.51$, $SD=0.06$; anti-free will condition $M=2.49$, $SD=0.06$; control condition, $M=2.54$, $SD=0.08$). This suggests that the differences between conditions were not due to participants in the free will belief condition generating more unreasonable counterfactuals. Very few absurd or otherwise highly unreasonable counterfactuals were generated in any condition.

Effect of free will beliefs on counterfactual structure (See Figure 2).

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[1] The results for the main effect of outcome valence on counterfactual structure replicated the previously found effects of outcome valence on counterfactual thinking (Markman et al., 1993; Roese & Olson, 1993b). When the outcome was negative, participants generated significantly more upward and additive and fewer downward and subtractive counterfactuals than when the outcome was positive.

Additive and subtractive counterfactuals. Using an ANOVA, we found that there was no significant overall effect of free will beliefs on the number of additive counterfactuals participants generated, $F(2,119)=3.08$, $p=.05$, $\eta^2=.05$, 90% CI[.00,.12]. Individual contrasts indicate that participants in the free will belief condition generated more additive counterfactuals ($M=3.60$, $SD=2.27$) than participants in the anti-free will belief ($M=2.70$, $SD=1.97$) condition, $F(1,119)=5.50$, $p=.02$, $\eta^2=.04$, $d=.42$, 95% CI[.14,1.68], but not significantly more than participants in the control condition ($M=2.83$, $SD=1.98$), $F(1,119)=3.06$, $p=.08$, $\eta^2=.03$, $d=.21$, 95% CI[-.11,1.65]. Consistent with the findings from Study 1, the free will belief manipulation had no effect on the number of subtractive counterfactuals participants generated, $F(2,119)=0.52$, $p=.59$, $\eta^2=.01$, 90% CI[.00,.04].

Upward and downward counterfactuals. Although using a one-way ANOVA, we found that the overall model predicting upward counterfactuals from free will condition was not significant, $F(2,119)=2.20$, $p=.12$, $\eta^2=.04$, 90% CI[.00,.10], individual contrasts indicate that participants in the free will condition ($M=3.96$, $SD=2.46$) generated more upward counterfactuals than participants in the control condition ($M=3.00$, $SD=2.46$), $F(1,119)=4.20$, $p=.04$, $\eta^2=.03$, $d=.37$, 95% CI[.03,1.89]. Participants in the free will condition did not generate significantly more upward counterfactuals than participants in the anti-free will belief condition ($M=3.45$, $SD=2.37$) , $F(1,119)=1.68$, $p=.20$, $\eta^2=.01$, $d=.20$, 95% CI[-.29,1.35]. Using a one-way ANOVA, we found no differences among free will belief conditions on the number of downward counterfactuals participants generated, $F(2,119)=2.08$, $p=.13$, $\eta^2=.03$, 90% CI[.00,.09].

Self and other counterfactuals. Using a one-way ANOVA, we found that the differences among free will conditions on the number of counterfactuals participants generated about themselves was not significant, $F(2,119)=2.54$, $p=.08$, $\eta^2=.04$, 90% CI[.00,.10]. Descriptively,

participants in the free will condition generated more counterfactuals about themselves (M=2.98, SD=1.64) than participants in the anti-free will condition (M=2.34,SD=1.76), F(1,119)=3.92, p=.05, η^2=.03, d=.38, 95% CI[.00, 1.29]. The difference between the free will condition and the control condition (M=2.30,SD=1.29) in counterfactuals about the self was also not significant, F(1,119)=3.37, p=.07, η^2=.03, d=.46, 95% CI[-.06,1.41].

The one-way ANOVA on the number of counterfactuals participants generated about Alex was not significant, F(2,119)=2.41, p=.09, η^2=.04, 90% CI[.00,.10]. A planned comparison indicated that participants in the free will condition (M=2.65, SD=1.51) generated significantly more counterfactuals about Alex than participants in the control condition (M=1.90, SD=1.42), F(1,119)=4.55, p=.04, η^2=.04, d=.51, 95% CI[.05,1.44]. There were no significant differences between the free will and anti-free will condition (M=2.21, SD=1.52) in the number of counterfactuals generated about Alex, F(1,119)=1.96, p=.16, η^2=.02, d=.29, 95% CI[-.18,1.0].

Mood. Using a one-way ANOVA, we found no significant differences between free will conditions in mood valence, F(2,122)=1.39, p=.25, η^2=.02, 90% CI[.00,.07], or arousal, F(2,122)=0.15, p=.86, η^2<.01, 90% CI[.00,.02]. This suggests that mood was not a factor in producing the differences in counterfactual thoughts.

Discussion

Study 2 largely replicated and greatly extended the findings of Study 1. Participants in the free will condition generated more counterfactual thoughts in response to both positive and negative events than participants in the anti-free will or control conditions. Participants whose belief in free will was bolstered also generated a greater number of upward counterfactuals and counterfactuals about the other person (Alex) than participants in the control condition and a

greater number of additive counterfactuals and counterfactuals about themselves than

participants in the both the anti-free will belief and neutral control conditions.

Methodological aspects of Study 2 enabled us to rule out several possible confounds and

concerns. Unlike Study 1, participants responded to a fixed scenario rather than choosing one

from memory, so the results are not confounded by biased choice (e.g., participants in the free

will condition choosing more mutable incidents) or memory. The effect of free will beliefs on

counterfactual thoughts was not due to mood or arousal, as there were no mood or arousal

differences immediately after the manipulation. The effect was not caused by participants in the

free will belief condition generating unreasonable counterfactuals, because there were very few

of these overall, and they did not vary systematically as a function of free will belief.

Study 3

Study 3 was designed to extend the effects of the previous studies to naturally occurring

individual differences in (rather than manipulated) belief in free will. Although experimental

manipulation of free will beliefs provides the most rigorous test of our causal hypothesis, we also

wanted to assess whether people's pre-existing belief in free will predicted counterfactual

thinking. Some researchers have speculated that anti-free-will manipulations operate less by

actually modifying beliefs than by threatening personally important assumptions about the world

(though Alquist, Ainsworth, & Baumeister, 2013, found substantial differences between

attacking free will beliefs and attacking another important worldview assumption). If

measurement of pre-existing differences in beliefs about free will yield results parallel to

manipulations of those beliefs, then it would be reasonable to assume that the present effects are

not due to having one's beliefs attacked or threatened but rather to the content of the belief.

Convergence in results across measured and manipulated beliefs in free will therefore yields the

highest confidence in conclusions about the impact of such beliefs.

In order to measure free will beliefs, we used the FAD-Plus (Paulhus & Carey, 2011). Previous research using the free will subscale of the FAD-Plus has found that it has unique predictive power even when controlling for locus of control, implicit theories of personality, and the big five (Crescioni et al., 2014; Paulhus & Carey, 2011; Stillman et al., 2010).Previous research led us to suspect that the effect of self-reported belief in free will on counterfactual thinking might be obscured somewhat by self-esteem. Roese and Olson (1993a) found that people with high self-esteem generated *fewer* counterfactuals in response to negative events than people with low self-esteem. Although we could find no published work establishing a relationship between free will belief and self-esteem specifically, it seemed plausible that there might be a positive relationship between self-esteem and belief in free will, given that higher self-esteem is highly correlated with concepts related to belief in free will, such as locus of control and self-efficacy (for a meta-analysis, see Judge, Erez, Bono, & Thoresen, 2002). In order to detect the effect of free will beliefs on counterfactual thinking, we therefore sought to control for individual differences in people's general tendency to perceive themselves positively and any resultant diminishing of counterfactual thinking. We predicted that, holding self-esteem constant, participants with more belief in free will would generate more counterfactuals than participants with less belief in free will.

Study 3 also tested the alternative hypothesis that the relationship between free will belief and counterfactual thinking was mainly due to increased willingness to exert effort on any task. Studies 1 and 2 found that participants in the free will condition generated more counterfactual thoughts than participants in other conditions. We have interpreted that pattern as due to the link between those beliefs and counterfactual thinking. However, some might object that it simply

reflects a willingness to work harder, exert more, and produce more (i.e., respond more thoroughly to the experimental questionnaire). In order to provide a direct measure of effort in generating thoughts that were not counterfactual thoughts, we instructed participants to list as many modes of transportation as they could. This would enable us to test the alternative hypothesis about effort in two ways. First, we could see whether reduced belief in free will did in fact translate into less effort. Second, we could use the effort measure as a covariate in order to ascertain whether there was an effect of free will beliefs on counterfactuals even when controlling for effort.

In Study 3, we changed the structure of the counterfactual thought measure in order to ensure that the findings generalized across different measures of counterfactual thinking. Instead of being given a set of 10 lines beginning with the phrase "if only," participants were given the opportunity to write a paragraph about how the situation could have gone differently.

Method

Participants. Participants consisted of 112 undergraduate students (Gender: 55 women; 57 men; Mean age 18.85; Ethnicity: 20 Hispanic/Latino, 89 Not Hispanic/Latino, 3 Unknown/Choose not to report; Race: 3 Asian, 6 Black or African American, 92 White, 4 More than one race, 2 Unknown/Do not wish to report, 5 Other) who participated in exchange for course credit. One problem that emerged with this sample is that a few participants wrote about highly trivial offenses, such as forgetting plans to go to the grocery store or having a short-lived argument with a friend in elementary school. The issues of remorse, responsibility, learning, and behavior change that stimulated this investigation do not apply very well in cases of trivial offenses. We used participants' ratings of the personal impact of the experiences they described as an index of triviality (this measure was uncorrelated with belief in free will, $r = -.06$, $p = .55$),

and we excluded participants whose ratings were more than two standard deviations below the mean on the self-rated personal impact of the experience. Data from eight participants were excluded on that basis, leaving a final sample of 104 participants (Gender: 53 women, 51 men; Mean age 18.83; Ethnicity: 19 Hispanic/Latino, 83 Not Hispanic/Latino, 2 Unknown/Do Not Wish to Report; Race: 2 Asian, 6 Black or African American, 88 White, 6 More than one race, 7 Unknown/Do not wish to report, 8 Other).

Procedure. Participants were run in groups of 4-68 participants (depending on how many participants signed up for each slot), and condition assignment was done at the individual level. Participants each received two packets at the beginning of the experiment and were told that they would complete two separate experiments.

Free will belief and self-esteem measures. Participants were given the Rosenberg Self-Esteem scale and the Free Will and Determinism Scale Plus and were told these scales would be used as pilot data to design future experiments. The Rosenberg (1965) Self-Esteem scale consists of 10 items designed to assess global self-esteem (e.g., "I feel I have a number of good qualities."). Responses were measured on a 4-point Likert-type scale with higher scores indicating higher self-esteem (a=.85).

The Free Will and Determinism Scale Plus (Paulhus & Carey, 2011) consists of 27 items that create four subscales designed to measure belief in free will (e.g., "People have complete free will."), scientific determinism (e.g., "Your genes determine your future."), fatalistic determinism (e.g., "I believe that the future has already been determined by fate."), and unpredictability (e.g., "What happens to people is a matter of chance."). Responses were recorded on 9-point scales with higher scores corresponding to stronger endorsement of the

statement. Although we included the whole Free Will and Determinism scale in Study 3, our prediction was that the free will subscale specifically would be related to counterfactual thinking.

Counterfactual measure. After participants completed the questionnaires, they were asked to move on to the second packet, which ostensibly constituted a second experiment. The second packet contained the same counterfactual measure from Study 1, with one change. Instead of listing counterfactuals on a set of lines beginning with "If only/what if," the participant was given a simple essay prompt on a lined sheet of paper that asked: "What could have been different about you, your behavior, or any aspect of the situation so that the situation would have ended differently?"

To obtain a measure of the personal impact of the event, participants were asked to rate the stressfulness of the experience, the intensity of the experience, and how much they currently think about the experience on 7-point Likert-type scales. We created an index of the personal impact of the event by averaging these three ratings (a=.84; M=4.62, SD=1.62).

Counterfactual thoughts. The number of counterfactuals generated was our main dependent measure. Coders were given a packet containing descriptions and examples of various types of counterfactual thoughts to help them identify counterfactual thoughts. As in previous studies, we also computed the total number of counterfactual thoughts of each type for each participant (e.g. the total number of upward counterfactuals, the total number of additive counterfactuals). To compute reliabilities, a second judge recoded a portion of the essays (N=40; 38% of narratives). The agreement between judges showed high levels of reliability (Intraclass Correlation Coefficients ranged from .83 to 1.0 with a mean of .93), so the analyses were done using the first codings.

Effort Measure. Participants were asked to list as many modes of transportation as

possible as a measure of effort. We predicted that belief in free will would be associated with the number of counterfactual statements generated, but not with the number of modes of transportation listed.

Results

The main hypothesis was that participants who expressed a greater belief in free will (as indicated by the Free Will subscale of the Free will and Determinism Plus scale) would generate more counterfactuals than participants who expressed less belief in free will. Because the relationship between belief in free will and self-esteem approached significance $r =.17$, $p=.08$, and given prior evidence that counterfactual thinking varies with level of self-esteem (Roese & Olson, 1993a), we report all results controlling for self-esteem (M=3.38, SD=0.44).

Counterfactual thoughts. Using multiple regression, we found that the Free Will subscale (M=6.69, SD=1.07, Skewness=-.04, SE Skewness=.24, Kurtosis=-.79, SE Kurtosis=.47) was related to the total number of counterfactuals (M=2.61, SD=1.58, range: 1-10), β=.19, p=.05, partial r=.19, 95% CI[.00,.57] after controlling for self-esteem (see Table 1). Participants with a stronger belief in free will generated more counterfactual thoughts than participants with a weaker belief in free will. There was no significant effect of self-esteem on the number of counterfactual thoughts participants generated, β=-.17, p=.08, partial r=-.17, though the direction of the effect was the same as has been found previous research on self-esteem and counterfactual thinking (Roese & Olson, 1993a). . The number of counterfactuals generated was unrelated to the Fatalism, Determinism, or Unpredictability subscales of the Free Will and Determinism Scale Plus (p's>.22).

Counterfactual thought structure. Using multiple regression, we found that after controlling for self-esteem, belief in free will was significantly positively related to the number

of upward counterfactual thoughts (M=2.38, SD=1.61), β=.20, p=.04, partial r=.20, 95%

CI[.009,.59]. There was no relationship between belief in free will and the number of additive

counterfactual thoughts (M=1.70, SD=1.35), β=.12, p=.24, partial r=.12, 95% CI[-.10,.40].

Belief in free will was a significant predictor of the number of counterfactuals about the self

(M=1.65, SD=1.70), β=.22, p=.03, partial r=.22, 95% CI[.04,.65].

Using multiple regression, we found a nonsignificant negative correlation between free

will belief and the number of downward counterfactuals, (M=0.17, SD=0.43), β=-.17, p=.09,

partial r=-.17, 95% CI[-.15, .01]. Belief in free will was unrelated to the number of subtractive

counterfactual statements, (M=0.86, SD=1.03), β=.08, p=.40, partial r=.08, 95% CI[-.11,.27], and

to other-related counterfactual statements participants generated, (M=0.74, SD=0.97), β=-.14,

p=.16, partial r=-.14, 95% CI[-.31,.05].

Effort Measure. Using regression, we found that belief in free will was unrelated to the

number of modes of transportation generated (M=15.31, SD=5.32) without controlling for self-

esteem, β=-.13, p=.18, partial r=-.13, 95% CI[-1.6,.31], and also when controlling for self-

esteem, β=-.16, p=.12, partial r=-.16, 95% CI[-1.77,.19]. Furthermore, the relationship between

belief in free will and the number of counterfactual thoughts remained significant when

controlling for self-esteem and the number of modes of transportation generated, β=.21, p=.03,

partial r=.22, 95% CI[.03,.61].

Discussion

Study 3 provided evidence that people with a greater belief in free will generate more

counterfactual thoughts overall. Participants with stronger belief in free will generated

significantly more upward counterfactuals and significantly more self counterfactuals than

participants with weaker belief in free will. Free will belief specifically supports preparative

counterfactual thoughts and may even decrease counterfactual thoughts that are primarily

associated with mood maintenance. This suggests that belief in free will does not simply enhance

the perceived mutability of the past. Instead, it alters the perceived mutability of the past in

specific and functional ways.

The association between belief in free will and counterfactual thinking also cannot be

accounted for simply by the amount of effort participants were willing to put into generating

thoughts as requested by an experimenter. There was no effect of free will beliefs on effort, as

measured by how many modes of transportation people generated, and the main findings

remained significant when controlling for effort. Self-esteem did not account for our results,

which controlled for self-esteem in all analyses.

The convergence of findings between manipulated (Studies 1&2) and measured (Study 3)

beliefs about free will demonstrates that our findings are not limited to a specific method or

procedure. Both procedures linked high belief in free will to high rates of generating

counterfactual thoughts. Additionally, finding that individual differences in free will beliefs

produced the same results as experimentally induced free will beliefs lends ecological validity to

the experimental studies.

Study 4

Although the previous studies provide evidence that free will beliefs are primarily

associated with preparative counterfactual thought structures, an additional study was designed

to test whether free will beliefs predict specific counterfactual thought structures. Participants

were asked to write about a time when someone hurt them and were then asked to indicate their

agreement with upward-self, downward-self, upward-other, and downward-other counterfactual

statements. Due to the difficulty of generating appropriately generic additive and subtractive

counterfactuals that participants would understand, we did not include additive and subtractive

counterfactuals in this study. This study also builds on the previous studies by using a sample of

participants recruited from Mechanical Turk, a sample that is typically more diverse than

samples of college students (Buhrmester, Kwang & Gosling, 2011).

We predicted that participants with greater belief in free will would agree more with

upward counterfactual statements about their own behavior than participants with less belief in

free will. We predicted that free will beliefs would not be significantly related to agreement with

about downward counterfactuals or counterfactual thoughts about the other person's behavior.

Method

Participants. Sixty participants (Gender: 21 women, 39 men; Mean age 29.10; Ethnicity:

14 Hispanic/Latino, 44 Not Hispanic/Latino, 2 No response; Race: 7 American Indian/Alaskan

Native, 35 Asian, 14 White, 1 More than one race, 3 Unknown/Do not wish to report) were

recruited through Amazon's Mechanical Turk. Embedded in the free will questionnaire was a

question asking participants to indicate "Strongly disagree" if they were reading the question.

Ten participants did not answer this question correctly, leaving the final sample at 50 participants

(Gender: 17 women, 33 men; Mean age 29.27; Ethnicity: 11 Hispanic/Latino, 37 Not

Hispanic/Latino, 2 No response; Race: 6 American Indian/Alaskan Native, 29 Asian, 11 White, 1

More than one race, 3 Unknown/Do not wish to report).

Procedure.

Free will belief and self-esteem measures. Participants were given the Rosenberg Self-

Esteem Scale (1965). Participants were also asked to indicate their agreement with the free will

subscale of the FAD-Plus on a scale of 1 (totally disagree) to 5 (totally agree; Paulhus & Carey,

2011). Because only the free will subscale was hypothesized to be related to counterfactual thoughts, the other subscales of the FADPlus were not included in this study.

Counterfactual agreement. Participants were asked to describe a situation in which they hurt someone, as in Studies 1 and 3. Participants were also asked to indicate how long ago the event had happened.

Participants were then asked to indicate their agreement with a series of four counterfactual statements of different structures. Participants were asked to indicate their agreement with an upward-self counterfactual statement ("If I had behaved differently, things could have been better than they were"), a downward-self counterfactual statement ("If I had behaved differently, things could have been worse than they were"), an upward-other counterfactual statement ("If the person I hurt had behaved differently, things could have been better than they were"), and a downward-other counterfactual statement ("If the person I hurt had behaved differently, things could have been worse than they were"). Participants reported their response in qualtrics using a slider with no number labels. The slider recorded participants' response on a scale of 1 to 100.

Results

Because counterfactual thinking varies with level of self-esteem (Roese & Olson, 1993a), self-esteem was again controlled for in Study 4. Previous research has shown that people are more likely to view more recent events as more mutable than less recent events (Byrne et al., 2000; Miller & Gunasegaram, 1990). For this reason, we also controlled for how long ago the event occurred.

Using multiple regression, we found that controlling for self-esteem and how long ago the event occurred, belief in free will (M=3.70, SD=.75, Skewness=-.93, SE Skewness=.34,

Kurtosis=.97, SE Kurtosis=.66) significantly predicted participants' agreement with the upward-self counterfactual statement (M=64.67, SD=27.36), β=.32, p=.04, partial r=.30, 95% CI[.35,25.98]. Participants with a greater belief in free will agreed more that things could have been better if they had behaved differently than participants with less belief in free will. Although we did not predict that free will would be significantly related to downward counterfactuals, participants with greater belief in free will agreed less that things could have been worse if they had behaved differently (M=43.88, SD=27.88) than participants with less belief in free will, β=-.41, p=.007, partial r=-.39, 95% CI[-28.02, -4.70]. Using multiple regression, we found that free will beliefs did not significantly predict upward counterfactual thoughts about the other person in the situation (M=48.90, SD=28.85), β=-.10, p=.56, partial r=-.04, 95% CI[-17.34,9.54], nor downward counterfactual thoughts about the other person in the situation (M=53.38, SD=27.61), β=.04, p=.82, partial r=.04, 95% CI[-11.01,13.93].

Discussion

Study 4 provided evidence that free will belief predicts greater agreement with upward counterfactual thoughts about one's own behavior. People who reported greater belief in free will were more likely to agree that things could have been better if they had behaved differently than people who reported less belief in free will.

Belief in free will was also associated with less agreement with downward counterfactual thoughts about one's own behavior. Although this effect was not predicted, it is consistent with the direction of the nonsignificant (p=.09) negative correlation between free will beliefs and number of counterfactuals in Study 3. If one purpose of free will beliefs is to improve behavior by imagining how things could be different, it is possible that belief in free will may even discourage people from generating counterfactuals that typically do not improve future behavior,

such as downward counterfactuals (Roese, 1994). As predicted, and consistent with Studies 1 and 3, there was no relationship between belief in free will and counterfactual thoughts about the other person's behavior. These results suggest that free will beliefs are specifically associated with preparatory counterfactual thoughts and are either negatively associated with or unrelated to affective counterfactual thoughts.

Meta-analysis

In Experiments 1-3 we found that measured or manipulated belief in free will was associated with increases in the number of counterfactual thoughts. We conducted a meta-analysis (weighting each study by its df) to provide an estimate of the overall effect size and reliability of the main effect of measured or manipulated free will belief. Because Study 4 used a different and more specific measure of counterfactual thoughts, the results from Study 4 were not included in the meta-analysis. The effect of measured or manipulated belief in free will on counterfactual thinking reflected a small to medium sized effect ($r=.23$), and it was highly reliable, $Z=3.49$, $p<.001$.

Meta-analyses were also conducted to provide estimates of the effect size and reliability of the effect of measured or manipulated belief on free will on preparative counterfactuals (upward, additive, and self-referent counterfactuals). The results reflected medium-sized effects and high reliability for upward counterfactuals, ($r=.21$; $Z=3.25$, $p<.01$), additive counterfactuals, ($r=.22$; $Z=3.21$, $p<.01$), and self-referent counterfactuals, ($r=.24$; $Z=3.85$, $p<.001$).

General Discussion

Four studies supported the hypothesis that high belief in free will is associated with greater counterfactual thinking. We found that both higher self-reported belief in free will (Studies 3 and 4) and experimentally manipulated belief in free will (Studies 1 and 2) were

associated with greater counterfactual thinking. The link from high belief in free will to more counterfactual thinking was found in response to both remembered (Studies 1, 3, and 4) and hypothetical situations (Study 2), in response to situations that ended either positively or negatively (Study 2), and regardless of whether participants were asked to make a list of counterfactuals (Studies 1 and 2), write a paragraph about what could have gone differently (Study 3), or rate their agreement with counterfactual statements (Study 4). A meta-analysis confirmed that the effect of free will belief on counterfactual thinking was reliable. Our findings are thus quite robust across a variety of research methods and measures.

Whereas Studies 1 and 2 established causality, Studies 3 and 4 spoke to the question of ecological validity. Manipulations establish causal relationships, but by relying on changing beliefs about free will they risk losing the ability to generalize to people's pre-established beliefs. Fortunately, we found a similar pattern with both manipulated and measured free-will beliefs.

The pattern of findings is consistent with the view that one function of free will beliefs may be to encourage people to learn from the past by contemplating different possibilities. Thinking about the ways things could have gone differently has been shown to help people learn from previous mistakes and form intentions for the future (Boninger, Gleicher, & Strathman, 1994; Landman, Vandewater, Stewart, & Malley, 1995; Smallman & Roese, 2009; Roese, 1994, 1997). Regardless of whether free will exists, believing that things could have been different may give people the ability and motivation to consider various ways they might have brought about a better outcome.

In past research using the same manipulations of free will belief that we employed, the typical pattern has been that the anti-free will condition differs from both the neutral and free will conditions, which have not differed (Baumeister et al, 2009; Vohs & Schooler, 2008). In the

present studies, participants in the free will belief condition generated significantly more counterfactuals than participants in the anti-free will and control conditions, while no differences were obtained between the anti-free will belief and control conditions. Thus, though our work is consistent with prior findings in terms of the difference between free will and anti-free will conditions, it is unusual as to which one of them departed from the neutral control condition.

Two explanations for this departure seem most plausible. One is that believing in free will may particularly attune one to the possibility of multiple different actions in the same situation, which is the essence of counterfactual thinking. Thus, the manipulation that activates beliefs about free will may be more relevant for stimulating counterfactual thoughts than to reduce cheating (Vohs & Schooler, 2008), reduce conformity (Alquist et al., 2013), and many other effects. The other is that thinking about what one did wrong and how one should have responded differently may sometimes require aversive effort and unhappy reflections on one's misbehavior, thereby bringing negative feelings and loss of confidence (Roese, 1994; Sanna, 1999) — so people may not do it unless particularly stimulated. Hence control participants may resemble those induced to disbelieve in free will in the sense that they simply list a couple obvious thoughts but do not push themselves to think of additional ways they might have changed their actions. These two explanations are compatible with each other, and we suspect both are correct.

One open question that remains is how counterfactual thinking affects free will beliefs. Although one might assume that thinking about the way things could have been different might increase free will beliefs, previous research actually suggests otherwise. Research has shown that engaging in counterfactual thinking actually makes the situation seem more inevitable (Kray, George, Liljenquist, Galinsky, Tetlock, & Roese, 2010; Roese & Maniar, 1997; Roese & Olson,

1996). Because of this, it is possible that although free will beliefs may increase counterfactual thinking, counterfactual thinking could decrease belief in free will. Then again, perhaps it is the very sense that things could have turned out differently that makes people think that the actual outcome must have been fated or otherwise dictated by some mysterious power. Although fate seems deterministic, people may invoke it as a special kind of power to explain events that could seemingly have very easily gone differently.

More generally, there is a broad tendency for past events to seem increasingly inevitable in retrospect (Fischhoff, 2011; Byrne et al., 2000; Miller & Gunasegaram, 1990), which is related to the hindsight bias, by which past events seem more predictable and inevitable than future ones (Fischhoff, 1975). Some authors have even referred to this gradual change as "creeping determinism," because seeing events as inevitably determined creeps forward through time, although remaining at some distance behind the present. This may help explain why anti-free will messages failed in this case to depart from the control condition and why belief in scientific determinism did not predict counterfactuals: In general, everyone perceives the past as being largely determined. Our free will manipulation may have stimulated people to break out of this bias toward retrospective inevitability, pushing them to confront again the multiplicity of options available at that time and to think that they might indeed have acted differently in multiple ways.

Counterfactual Structure

In addition to the *number* of counterfactuals, we also assessed the *kinds* of counterfactuals participants generated. We predicted that believing in free will would primarily increase preparative counterfactual thoughts (additive, upward, and self counterfactuals), as compared to counterfactual thinking that was generally unrelated to learning (subtractive,

downward, other person, and unreasonable counterfactuals). Although the full pattern of results

regarding counterfactual structure was not identical across studies, there were some clear and

consistent patterns. The meta-analysis indicated that participants who were induced to believe in

free will (Studies 1 and 2) or who had a greater belief in free will (Study 3) generated more

upward, additive, and self counterfactuals than participants with less belief in free will or

participants in the anti-free will or control conditions.

Alternative Explanations

The present studies sought to test several possible alternative explanations. One was that

the free will belief manipulation may have primed the notion that things could have been

different. If this were the case, the manipulation might temporarily alter people's behavior

without reflecting how free will beliefs affect people's behavior. This is part of the reason we

thought it was important to include studies that measured (rather than manipulated) free will

beliefs. Given that people with a dispositionally high belief in free will generate more

counterfactuals than people with a dispositionally low belief in free will, it seems unlikely that

the relationship between free will belief and counterfactuals is due solely to a unique feature of

the manipulation.

Some critics have proposed that free will belief manipulations could directly change

people's moods and that these changes could drive the main findings. In Study 1, we found that

at the end of the study, participants in the free will belief condition felt somewhat more arousal

(though not significantly and no more positive or negative emotions) than participants in the anti-

free will and control conditions. Although differential arousal might reflect the impact of the

manipulation, its meaning was ambiguous because of the timing of the measure. It is possible

that the combination of the free will belief manipulation and writing about a personal conflict

caused individuals to feel more generally energized to address the situation. To address this, we measured mood immediately after the free will belief manipulation in Study 2. That study found no differences between conditions in either mood valence or arousal.

We also thought it was possible that the free will manipulation might simply increase participants' willingness to expend effort within the immediate situation (i.e., the experiment), which would make them more willing to list anything. Because we wanted to show that free will belief had an effect on counterfactuals that extended beyond willingness to expend effort, we included an additional effort measure where we asked participants to list as many forms of transportation as they could (Study 3). This seemed a promising way to measure effort because the potential list of modes of transport can be quite long (e.g., not just cars and bicycles, but rickshaws, llamas, surfboards, helicopters). We found that the relationship between belief in free will and number of counterfactuals was significant even when controlling for the number of modes of transportation participants generated. Moreover, there was no sign that the free will manipulation increased effort on the transportation measure. In addition to measuring effort in Study 3, we also used a measure of counterfactual thinking that shouldn't rely heavily on effort (agreement with counterfactual statements) in Study 4.

Concluding Remarks

The broader question of why people believe in free will despite the absence of proof is a puzzle. Our findings may suggest one potential resolution. Regardless of whether free will exists, belief in free will seems to foster a highly functional style of thinking. In this way, individuals and society as a whole may have benefitted from free will beliefs and the counterfactual simulations they stimulate.

References

Alquist, J.L., Ainsworth, S.E., & Baumeister, R.F. (2013). Determined to conform: Disbelief in free will increases conformity. *Journal of Experimental Social Psychology, 29*, 80-86.

Baumeister, R.F. & Brewer, L.E. (2012). Believing versus disbelieving in free will: Correlates and consequences. *Social and Personality Psychology Compass, 6*, 736-745.

Baumeister, R.F., Masicampo, E.J., & DeWall, C.N. (2009). Prosocial benefits of feeling free: Disbelief in free will increases aggression and reduces helpfulness. *Personality and Social Psychology Bulletin, 35*, 260-268.

Boninger, D.S., Gleicher, F. & Strathman, A. (1994). Counterfactual thinking: From what might have been to what may be. *Journal of Personality and Social Psychology, 67*, 297-307.

Buhrmester, M., Kwang, T., & Gosling, S.D. (2011). Amazon's mechanical turk: A new source of inexpensive, yet high-quality data? *Perspectives on Psychological Science, 6*, 3-5.

Byrne, R.M.J., Segura, S., Culhane, R., Tasso, A. & Berrocal, P. (2000). The temporality effect in counterfactual thinking about what might have been. *Memory & Cognition, 28*, 264-281.

Carey, J.M. & Paulhus, D.L. (2013). Worldview implications of believing in free will and/or determinism: Politics, morality, and punitiveness. *Journal of Personality, 81*, 130-141.

Crescioni, A.W., Baumeister, R.F., Ainsworth, S.E., Ent, M.R., & Lambert, N.M. (2014). Subjective correlates and consequences of belief in free will. Manuscript submitted for publication.

Dennett, D.C. (1984a). *Elbow room: The varieties of a free will worth wanting*. Cambridge, MA: MIT Press.

Dennett, D.C. (1984b). I could not have done otherwise – so what? *The Journal of Philosophy, 81*, 553-565.

Epstude, K. & Roese, N.J. (2008). The functional theory of counterfactual thinking. *Personality and Social Psychology Review, 12*, 168-192.

Feltz, A. & Cokely, E.T. (2009). Do judgments about freedom and responsibility depend on who you are? Personality differences in intuitions about compatibilism and incompatibilism. *Consciousness and Cognition, 18*, 342-350.

Fischhoff, B. (1975). Hindsight ≠ foresight: The effect of outcome knowledge on judgment under uncertainty. *Journal of Experimental Psychology: Human Perception and Performance, 1*, 288-299.

Fischhoff, B. (2011). *Judgment and decision making.* Oxford: Routledge/Earthscan.

Gavanski, I. & Wells, G.L. (1989). Counterfactual processing of normal and exceptional events. *Journal of Experimental Social Psychology, 25*, 314-325.

Gazzaniga, M.S. (2012). *Who's in charge: Free will and the science of the brain.* New York: Harper Collins Publishers.

Girotto, V., Legrenzi, P. & Rizzo, A. (1991). Event controllability in counterfactual thinking. *Acta Psychologica, 78*, 111-133.

Guglielmo, S., Monroe, A.E., & Malle, B.F. (2009). At the heart of morality lies folk psychology. *Inquiry: An interdisciplinary journal of philosophy, 52*, 449-466.

Harris, S. (2012). *Free will.* New York: Free Press.

Holton, R. (2006). The act of choice. *Philosophers Imprint, 6*, 1-15.

Holton, R. (2013). From determinism to resignation; And how to stop it. In A. Clark, J.

Kiverstein, & I. Vierkant (Eds.), *Decomposing the Will* (87-98). New York: Oxford

University Press.

Johnson, J.T. (1986). The knowledge of what might have been: Affective and attributional

consequences of near outcomes. *Personality and Social Psychology Bulletin, 12*, 51-62.

Judge, T. A., Erez, A., Bono, J.E., & Thoresen, C.J. (2002). Are measures of self-esteem,

neuroticism, locus of control, and generalized self-efficacy indicators of a common core

construct. *Journal of Personality and Social Psychology, 83*, 693-710.

Kahneman, D. & Miller, D.T. (1986). Norm theory: Compsaring reality to its alternatives.

Psychological Review, 93, 136-153.

Kahneman, D. & Varey, C.A. (1990). Propensities and counterfactuals: The loser that almost

won. *Journal of Personality and Social Psychology, 59*, 1101-1110.

Kane, R. (1996). *The significance of free will*. New York: Oxford University Press.

Kray, L.J., Galinsky, A.D., & Markman, K.D. (2009). Counterfactual structure and learning from

experience in negotiations. *Journal of Experimental Social Psychology, 45*, 979-982.

Kray, L.J., George, L.G., Liljenquist, K.A., Galinsky, A.D., Tetlock, P.E., & Roese, N.J. (2010).

From what *might* have been to what *must* have been: *Counterfactual thinking creates

meaning. Journal of Personality and Social Psychology, 98*, 106-118.

Landman, J., Vandewater, E.A., Stewart, A.J., & Malley, J.E. (1995). Missed opportunities:

Psychological ramifications of counterfactual thought in midlife women. *Journal of Adult

Development, 2*, 87-97.

Laplace, P.S. (1951). *A philosophical essay on probabilities*. (F. W. Truscott & F. L. Emory,

Trans.). New York, NY: Dover. (Original work published 1814).

Markman, K.D., Gavanski, I., Sherman, S.J., & McMullen, M.N. (1993). The mental simulation of better and worse possible worlds. *Journal of Experimental Social Psychology, 29*, 87-109.

Markman, K.D., Gavanski, I., Sherman, S.J., & McMullen, M.N. (1995). The impact of perceived control on the imagination of better and worse possible worlds. *Personality and Social Psychology Bulletin, 21*, 588-595.

Markman, K.D. & Miller, A.K. (2006). Depression, control, and counterfactual thinking: Functional for whom? *Journal of Social and Clinical Psychology, 25*, 210-227.

Markman, K.D. & Weary, G. (1996). The influence of chronic control concerns on counterfactual thought. *Social Cognition, 14*, 292-316.

Mayer, J.D. & Gaschke, Y.N. (1988). The experience and meta-experience of mood. *Journal of Personality and Social Psychology, 55*, 102-111.

Mele, A.R. (1995). *Autonomous agents from self-control to autonomy*. New York: Oxford University Press.

Mele, A.R. (1999). Kane, luck, and the significance of free will. *Philosophical Explorations: An International Journal for the Philosophy of Mind and Action, 2*, 96-104.

Mele, A.R. (2006). *Free will and luck*. New York: Oxford University Press.

Mele, A.R. (2009). *Effective Intentions*. New York: Oxford University Press.

Meyers-Levy, J. & Maheswaran, D. (1992). When timing matters: The influence of temporal distance on consumers' affective and persuasive responses. *Journal of Consumer Research, 19,* 424-433.

Miller, D.T. & Gunasegaram, S. (1990). Temporal order and the perceived mutability of events: Implications for blame assignment. *Journal of Personality and Social Psychology, 59*, 1111-1118.

Monroe, A.E. & Malle, B.F. (2010). From uncaused will to conscious choice: The need to study, not speculate about people's folk concept of free will. *Review of Philosophy and Psychology, 1*, 211-224.

Montague, P.R. (2008). Free will. *Current Biology, 18*, 584-585.

Morris, M.W. & Moore, P.C. (2000). The lessons we (don't) learn: Counterfactual thinking and organizational accountability after a close call. *Administrative Science Quarterly, 45*, 737-765.

Nadelhoffer, T., Kvaran, T., & Nahmias, E. (2009). Temperament and intuition: A commentary on Feltz and Cokely. *Consciousness and cognition, 18*, 351-355.

Nahmias, E., Coates, D.J., & Kvaran, T. (2007). Free will, moral responsibility, and mechanism: Experiments on folk intuitions. *Midwest Studies in Philosophy, 31*, 214-242.

Nahmias, E., Morris, S., Nadelhoffer, T., & Turner, J. (2005). Surveying freedom: Folk intuitions about free will and moral responsibility. *Philosophical Psychology, 18*, 561-584.

Nahmias, E., Morris, S., Nadelhoffer, T., & Turner, J. (2006). Is incompatibilism intuitive? *Philosophy and Phenomenological Research, 73*, 28-53.

Nichols, S. (2004). The folk psychology of free will: Fits and starts. *Mind and Language, 19*, 473-502.

Nichols, S. (2006). Folk intuitions on free will. *Journal of Cognitions and Culture, 6*, 57-86.

Nichols, S. & Knobe, J. (2007). Moral responsibility and determinism: The cognitive science of folk intuitions. *Noûs, 41*, 663-685.

Niedenthal, P.M., Tangney, J.P. & Gavanski, I. (1994). "If only I weren't" versus "if only I hadn't": Distinguishing shame and guilt in counterfactual thinking. *Journal of Personality and Social Psychology, 67*, 585-595.

Paulhus, D.L. & Carey, J.M. (2011). The FAD-Plus: Measuring lay beliefs regarding free will and related constructs. *Journal of Personality Assessment, 93*, 96-104.

Petrocelli, J.V., Seta, C.E., & Seta, J.J. (2013). Dysfunctional counterfactual thinking: When simulating alternatives to reality impedes experiential learning. *Thinking & Reasoning, 19*, 205-230.

Petrocelli, J.V., Seta, C.E., Seta, J.J., & Prince, L.B. (2012). "If only I could stop generating counterfactual thoughts": When counterfactual thinking interferes with academic performance. *Journal of Experimental Social Psychology, 48*, 1117-1123.

Pronin, E. & Kugler, M.B. (2010). People believe they have more free will than others. *Proceedings of the National Academy of Sciences of the United States of America, 107*, 22469-22474.

Roese, N.J. (1994). The functional basis of counterfactual thinking. *Journal of Personality and Social Psychology, 66*, 805-818.

Roese, N.J. (1997). Counterfactual thinking. *Psychological Bulletin, 121*, 133-148.

Roese, N.J. & Maniar, S.D. (1997). Perceptions of purple: Counterfactual and hindsight judgments at Northwestern Wildcats football games. *Personality and Social Psychology Bulletin, 23*, 1245-1253.

Roese, N.J. & Olson, J.M. (1993a). Self-esteem and counterfactual thinking. *Journal of Personality and Social Psychology, 65*, 199-206.

Roese, N.J. & Olson, J.M. (1993b). The structure of counterfactual thought. *Personality and Social Psychology Bulletin, 19*, 312-319.

Roese, N.J. & Olson, J.M. (1995). *What might have been: The social psychology of counterfactual thinking.* Hillsdale, NJ, England: Lawrence Erlbaum Associates.

Roese, N.J. & Olson, J.M. (1996). Counterfactuals, causal attributions, and the hindsight bias: A conceptual integration. *Journal of Experimental Social Psychology, 32*, 197-227.

Rosenberg, M. (1965). *Society and the adolescent self-image.* Princeton, NJ: Princeton University Press.

Sanna, L.J. (1999). Mental simulations, affect, and subjective confidence: Timing is everything. *Psychological Science, 10*, 339-345.

Sanna, L.J. & Turley, K.J. (1996). Antecedents to spontaneous counterfactual thinking: Effects of expectancy violation and outcome valence. *Personality and Social Psychology Bulletin, 22*, 906-919.

Sarkissian, H., Chatterjee, A., De Brigard, F., Knobe, J., Nichols, S., & Sirker, S. (2010). Is belief in free will a cultural universal? *Mind and Language, 25*, 346-358.

Shepherd, J. (2012). Free will and consciousness: Experimental studies. *Consciousness and Cognition, 21*, 915-927.

Smallman, R. & Roese, N.J. (2009). Counterfactual thinking facilitates behavioral intentions. *Journal of Experimental Social Psychology, 45*, 845-852.

Stillman, T.F. & Baumeister, R.F. (2010). Guilty, free, and wise: Determinism and psychopathy diminish learning from negative emotions. *Journal of Experimental Social Psychology, 46*, 951-960.

Stillman, T.F., Baumeister, R.F., & Mele, A.R. (2011). Free will in everyday life: Autobiographical accounts of free and unfree actions. *Philosophical Psychology, 24*, 381-394.

Stillman, T.F., Baumeister, R.F., Vohs, K.D., Lambert, N.M., Fincham, F.D., & Brewer, L.E. (2010). Personal philosophy and personnel achievement: Belief in free will predicts better job performance. *Social Psychological and Personality Science, 1*, 43-50.

Stroessner, S.J. & Green, C.W. (1990). Effects of belief in free will or determinism on attitudes toward punishment and locus of control. *The Journal of Social Psychology, 130*, 789-799.

Vohs, K.D. & Schooler, J.W. (2008). The value of believing in free will: Encouraging a belief in determinism increases cheating. *Psychological Science, 19*, 49-54.

Waldman, D. A., Viney, W., Bell, P. A., Bennett, J. B., & Hess, S. (1983). Internal and external locus of control in relation to beliefs in free will and determinism. *Psychological Reports, 53*, 631-634.

Wegner, D.M. (2002). *The illusion of conscious will*. Cambridge: MIT press.

Wells, G.L., Taylor, B.R., & Turtle, J.W. (1987). The undoing of scenarios. *Journal of Personality and Social Psychology, 53*, 421-430.

White, K. & Lehman, D.R. (2005). Counterfactual thinking in response to negative life events. *Personality and Social Psychology Bulletin, 31*, 1413-1424.

Wilson, T.D. (2002). *Strangers to ourselves: Discovering the adaptive unconscious*. Harvard University Press.

Table 1

Regressions using free will belief and self-esteem to predict counterfactual thoughts

| Variable	Free will belief				Self-esteem				Model		
	B	*SE B*	*β*	*p*	*B*	*SE B*	*β*	*p*	R^2	*F*	*p*
Total Number of Counterfactuals	.29	.15	.19	.05	-.62	.36	-.17	.08	.06	2.95	.06
Upward Counterfactuals	.30	.15	.20	.04	-.83	.36	-.23	.02	.07	4.07	.02
Additive Counterfactuals	.15	.13	.12	.24	-.23	.31	-.07	.47	.02	.86	.43
Self Counterfactuals	.34	.15	.22	.03	-1.06	.37	-.27	.01	.08	5.63	.01
Downward Counterfactuals	-.07	.04	-.17	.09	.10	.10	.10	.32	.03	1.75	.18
Subtractive Counterfactuals	.08	.10	.08	.40	-.51	.23	-.22	.03	.05	2.49	.09
Other Person Counterfactuals	-.13	.09	-.14	.22	.22	.22	.10	.31	<.01	1.29	.28
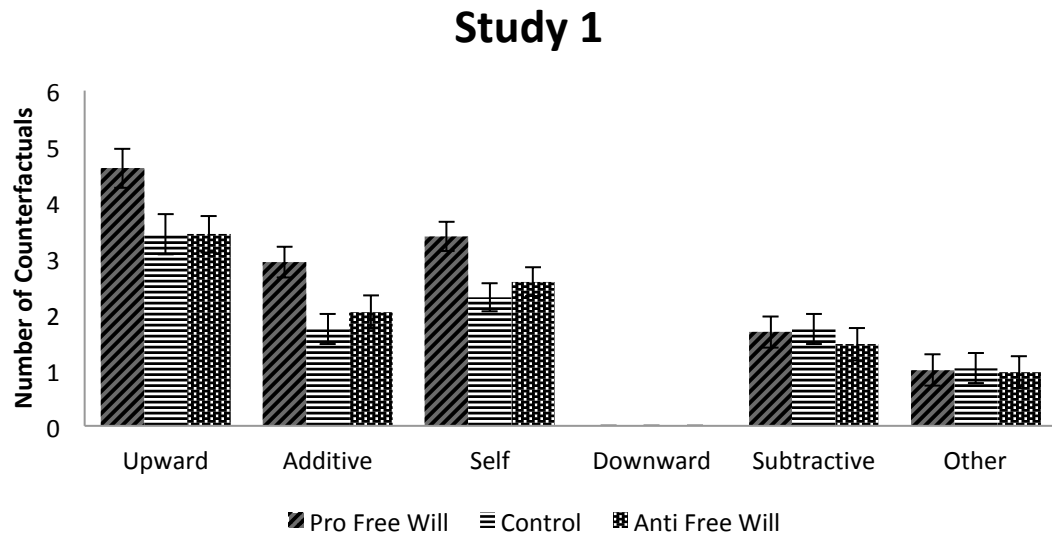
Study 1

Figure 1. Study 1. Average number of counterfactuals by structure and free will condition.
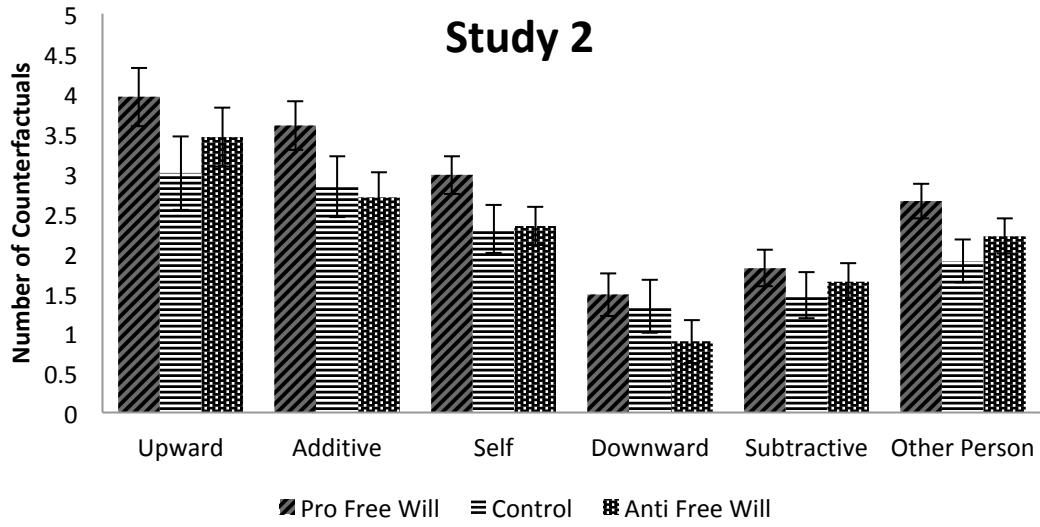
Figure 2. Study 2. Average number of counterfactuals by structure and free will condition.