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THE EFFECTS OF COUNTERFACTUAL THINKING ON COLLEGE STUDENTS' INTENTIONS TO QUIT SMOKING CIGARETTES

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ABSTRACT

We examined whether inducing cigarette smokers to engage in counterfactual thinking would change their intentions to quit smoking and their short-term smoking behavior. Participants read a hypothetical scenario describing a doctor visit, and then generated either upward or downward, additive or subtractive counterfactuals. A week later, participants reported their smoking behavior and intentions to quit smoking. Participants in the upward/subtractive condition demonstrated increased desire to quit smoking in the long term. Counterfactual direction also had significant effects on self-reported smoking behavior and willingness to take a lung capacity test. We discuss potential mechanisms for these effects.

INTRODUCTION

The dangers of cigarette smoking are well known. Given the severe health risks associated with smoking, researchers have investigated the efficacy of various smoking cessation interventions. Although several pharmacological treatments are successful in increasing long-term smoking cessation rates (Stead et al., 2012), many people who are at risk for the numerous and often severe side effects associated with such treatments may seek alternative services. Self-help programs are attractive, but generally ineffective (Ranney, Melvin, Lux, McClain, & Lohr, 2006). Counseling programs fare better, but can be expensive, limiting their effectiveness among those less motivated to quit smoking (Lancaster & Stead, 2005). Additional research is needed on non-pharmacological interventions to encourage smoking cessation. We examined the efficacy of a brief counterfactual thinking manipulation on college students' immediate smoking behavior and long-term intentions to quit smoking.

Counterfactual Thinking

Counterfactual thinking is a type of mental simulation wherein one considers how an outcome could have been different if antecedent events had been different (Kahneman & Tversky, 1982). These thoughts are conditional; they focus on events that did not occur and often hinge on "If

only…" or "At least…" verbiage. A large research literature documents the conditions under which people generate counterfactuals, the types of factors that comprise counterfactual thoughts, and the construction of such thoughts (for a review, see Epstude & Roese, 2008). For the present purposes, it is useful to distinguish between two dimensions along which counterfactuals can vary, namely *direction* and *structure*.

Direction refers to the evaluative contrast that characterizes a counterfactual thought (Epstude & Roese, 2008). Upward counterfactuals focus on how the present could have been *better* if certain antecedents had been different (e.g., "If I didn't smoke, I'd be in better health"); downward counterfactuals focus on how the present could have been *worse* (e.g., "If I didn't smoke, I'd be more stressed"). Structure refers to the manner in which antecedents are mutated to form counterfactual thoughts. Additive counterfactuals involve imagining how things would be different if events that did not occur had, in fact, occurred (e.g., "If I exercised regularly, I'd be in better health"); subtractive counterfactuals involve imaginging how things would be different if events that did occur, had not (e.g., "If I hadn't started smoking, I'd be in better health"). Direction and structure are orthogonal dimensions of counterfactual thought.

Behavioral Intentions and Smoking Cessation

Counterfactual thinking serves many adaptive functions (e.g., emotional regulation) and is intimately linked to causal inference and decision-making in myriad contexts (Epstude & Roese, 2008). It also serves an important preparative function. The causal insight gained from counterfactual simulation regarding the influence of one's behavior on the quality of one's circumstances provides cues that inform future behavior: based on counterfactual mutations, one can determine the actions one should take to produce the outcomes one desires (Smallman & McCulloch, 2012). Consequently, counterfactual thinking (especially upward counterfactuals following a negative event) can be a particularly strong motivator.

Page and Colby (2003) reasoned that patterns of counterfactual thoughts regarding a negative smoking scenario that are associated with behavioral intentions (specifically upward and additive counterfactuals) would motivate healthy smoking-related behavior (signing up for a lung-capacity test). Three studies showed that upward (vs. downward) counterfactual thinking increased negative affect, but only additive (vs. subtractive) counterfactual thought increased participants' willingness to sign up for a lung-capacity test.

Although these results are promising evidence that counterfactual thinking can influence behavioral intentions regarding smoking behavior, they are limited in one important way: most participants were not smokers. Approximately 70% of participants across the three studies did not smoke cigarettes; the "consumer base" for smoking cessation interventions was inadequately represented. We aimed to replicate Page and Colby's findings among a sample of regular smokers.

METHOD

Participants and Design

Eighty-five undergraduates (50.6% female) who smoke regularly participated in one of four cells of a 2 (Direction: Upward vs. Downward) x 2 (Structure: Additive vs. Subtractive) between-subjects experiment. Participants had an average age of 19.4 years (*SD* = 1.1) and most (87%) self-identified as Caucasian.

Materials

Contemplation Ladder

The Contemplation Ladder (Biener & Abrams, 1991) is a single 11-pt. response scale that assesses participants' readiness to consider quitting smoking. Higher scores correspond to greater readiness to quit smoking.

Modified Powe Fatalism Inventory

The Powe Fatalism Inventory (PFI; Powe, 1995) is a 15-item measure that assesses participants' fatalistic beliefs regarding cancer. Participants respond yes (coded as 1) or no (coded as 0) to various fatalistic statements (e.g., "I think if someone gets cancer, it was meant to be"). Responses are summed, with higher scores corresponding to greater endorsement of fatalistic beliefs. After one item was removed from the measure for zero variability (all participants responded "no"), the 14-item modified PFI demonstrated acceptable reliability (KR-20 = .83).

Self Report Questionnaire

A brief questionnaire assessed participants' self-reported smoking behavior during the study period and attitudes toward smoking cessation. Two questions assessed participants' smoking behavior in the prior week; three questions assessed participants' intentions to quit smoking and their self-efficacy for quitting smoking (see Appendix A for the items).

Procedure

Participants signed up to complete a study on smoking and other health-related behaviors. The experiment took place over two sessions spaced one week apart. In the first session, after granting consent, participants completed a demographic questionnaire and provided the names and contact information of two people who could verify their smoking behavior (a "bogus pipeline"; Roese & Jamieson, 1993). Participants then completed several inventories as randomization checks (e.g., nicotine dependence scales). Analyses indicated randomization was successful, so we do not report those measures here.

Participants read a brief hypothetical scenario in which they imagined that their doctor found evidence of adverse effects of smoking and wanted to conduct further tests (see Appendix B). Participants then wrote down specific behaviors that they *should* (additive) or *should not* (subtractive) have done that would have *improved* (upward) or *worsened* (downward) their hypothetical health condition (see Appendix B for complete instructions).

Upon returning to the lab one week later, participants completed the Contemplation Ladder, the PFI, and the self-report questionnaire. Participants were then offered the opportunity to take a lung-capacity test. The experimenter told participants that the test was offered by the university's Health and Sport Science department, would only take a few minutes, and that the results of the

lung-capacity test would be available immediately. Interested participants wrote their name, email address, and phone number on a "Lung-Capacity Test Sign-up Sheet," purportedly so the department would be able to contact them to schedule the test. The experimenter then debriefed all participants and provided them with contact information for smoking cessation services and support.

RESULTS

Table 1 displays the descriptive statistics for all dependent measures as a function of the manipulations. We used analysis of variance (ANOVA) and logistic regression to analyze continuous and dichotomous dependent variables, respectively. Appendix C displays the correlation tables for all variables entered into the analyses.

Table 1
Means (SDs) and Percentages of Dependent Variables as a Function of Direction and Structure of Counterfactual Thought

	Upward		Downward	
Outcome measure	Additive (n = 21)	Subtractive (n = 19)	Additive (n = 22)	Subtractive (n = 21)
Contemplation Ladder	5.0 (4.6)	5.9 (4.8)	6.3 (3.8)	7.1 (3.4)
PFI	5.1 (2.9)	3.3 (3.0)	3.0 (2.6)	4.5 (3.0)
Percent Who Smoked	57.1	40	47.8	52.3
Num. Cigarettes Smoked/Day	1.6 (1.3)	1.6 (0.7)	2.6 (1.6)	3.7 (4.4)
Percent Quitting (6 months)	66.6	95	77.3	76.2
Percent Quitting (30 days)	47.6	80	68.2	60
Confidence in Quitting	3.8 (0.9)	4.2 (1.2)	3.4 (1.4)	3.3 (1.2)
Percent Lung Test Sign-up	28.6	35	56.5	47.6

Contemplation Ladder and PFI

A 2 (Direction) x 2 (Structure) ANOVA revealed no effects of the manipulations on Contemplation Ladder scores, Fs < 2.1, ps > .05. An ANOVA on PFI scores revealed a significant Direction x Structure interaction, $F(1, 79) = 6.73$, $p = .011$, eta squared = .078. Simple effects analyses revealed that in upward conditions, participants who engaged in subtractive counterfactual thought endorsed fewer fatalistic beliefs than those who engaged in additive counterfactual thought, $F(1, 79) = 4.08$, $p = .047$, $d = .64$, 95% CI [.01, 1.23]. In downward conditions, however, structure of counterfactual thought did not influence endorsement of fatalistic beliefs, $F(1, 79) = 2.69$, $p = .105$, $d = .50$, 95% CI [-.10, 1.10].

Self-Report Questionnaire

Smoking Behavior

A 2 x 2 logistic regression revealed no effects on whether or not participants reported smoking in the week between experimental sessions. However, among participants who reported smoking in the intervening week (N = 42), those who engaged in upward counterfactual thought (M = 1.6, SD = 1.0) reported smoking fewer cigarettes per day on average than those who engaged in

downward counterfactual thought (M = 3.2, SD = 3.2), F(1, 38) = 4.11, p = .050, d = .63, 95% CI [.00, 1.24].

Intentions to Quit Smoking

Participants who engaged in subtractive counterfactual thought (85.4%) were more likely to report that they were considering quitting smoking in the next 6 months than those who engaged in additive counterfactual thought (72.1%), b = 2.25, SE = 1.13, Wald = 4.00, p = .045, odds ratio = 9.50, 95% CI [1.05, 86.86]. This main effect was qualified by a marginally significant Direction x Structure interaction, b = 2.31, SE = 1.33, Wald = 2.99, p = .084, odds ratio = 10.10, 95% CI [.73, 142.86]. In the upward condition, those who engaged in subtractive counterfactual thought were more likely to report they were considering quitting smoking in the next 6 months than those who engaged in additive counterfactual thought, Chi square (1, N = 41) = 5.24, p = .022, phi = .36, 95% CI [.06, .60]. In the downward condition, Structure did not affect participants' intentions to quit within 6 months, Chi square (1, N = 43) = .007, p = .933, phi = .01, 95% CI [-.24, .27].

Similar patterns emerged on participants' self-reported plans to quit smoking in the next 30 days. Participants who engaged in subtractive counterfactual thought (70%) were more likely to report that they were considering quitting smoking in the next 30 days than those who engaged in additive counterfactual thought (58.1%), b = 1.48, SE = .71, Wald = 4.36, p = .037, odds ratio = 4.40, 95% CI [1.10, 17.68]. This main effect was qualified by a marginally significant Direction x Structure interaction, b = 1.84, SE = .96, Wald = 3.67, p = .055, odds ratio = 6.29, 95% CI [.96, 41.67]. In the upward condition, participants who engaged in subtractive counterfactual thought were more likely to report they were considering quitting smoking in the next 30 days than those who engaged in additive counterfactual thought, Chi square (1, N = 41) = 4.63, p = .031, phi = .34, 95% CI [.09, .55]. In the downward condition, Structure did not affect participants' intentions to quit within 30 days, Chi square (1, N = 43) = .007, p = .933, phi = .09, 95% CI [-.17, .34].

An ANOVA on perceived confidence in quitting smoking within the year revealed a significant main effect of Direction; participants in the upward condition (M = 4.0, SD = 1.1) were more confident than those in the downward condition (M = 3.3, SD = 1.3), F(1, 81) = 5.91, p = .017, d = .53, 95% CI [.09, .96].

Lung-capacity Test

Finally, we examined the influence of the manipulations on lung-capacity test sign-up rates. The analysis revealed a marginally significant main effect of Direction, b = 1.18, SE = .64, Wald = 3.39, p = .066, odds ratio = 3.25, 95% CI [.93, 11.41]. Surprisingly, participants who engaged in *downward* counterfactual thought (52.3%) were more likely to sign up for the lung-capacity test than those who engaged in upward counterfactual thought (31.7%).

Exploratory Analyses

Given the pattern of results, we wondered whether fatalistic beliefs (PFI) mediated the effects of the Direction x Structure interaction on intentions to quit smoking in the next 6 months or 30 days. PFI marginally significantly predicted participants' intentions to quit at both points in time, 6 months: r(80) = -.19, p = .095, 95% CI [-.34, .17]; 30 days: r(79) = -.20, p = .074, 95% CI [-

.34, .17]. Subsequent mediation analyses, however, failed to reveal any evidence of mediated moderation.

DISCUSSION

The present study confirms that certain types of counterfactual thoughts can influence smoking cessation-related intentions and behaviors among a sample of regular smokers. The patterns of results we obtained, however, are inconsistent with those of Page and Colby (2003). We summarize our findings, provide some potential reasons for the discrepancies between our findings and prior findings, and discuss potential mechanisms underlying the observed effects.

Counterfactual Thinking and Smoking Cessation

In upward conditions, those who engaged in subtractive counterfactual thought endorsed fewer fatalistic beliefs and expressed greater intentions to quit smoking in the near and distant future (at 30 days and at 6 months) than those who engaged in additive counterfactual thought. In downward conditions, structure did not influence beliefs or intentions. These results are consistent with the general finding that upward (vs. downward) counterfactual thought is associated with motivation and behavior change, but typically, additive, not subtractive, counterfactuals are those associated with similar outcomes (Epstude & Roese, 2008); why did we find the opposite?

In most prior studies, the target behavior is one in which participants have yet to engage (e.g., purchasing a new computer; Smallman & Roese, 2009). In the present study, the target action was the *removal* of a behavior in which participants are currently engaging: smoking. Whereas additive counterfactuals may facilitate behavior change under most circumstances (suggesting what should be done), subtractive counterfactuals may facilitate behavior change when the goal is to eliminate a behavior (suggesting what should *not* be done). Thus, when upward counterfactuals provide the emotional response to motivate smoking cessation, subtractive counterfactuals may produce the desired action due to greater congruence with the ultimate behavioral goal.

Sample differences also may have played a role in these results. Page and Colby (2003) studied primarily non-smokers; we sampled regular smokers, exclusively. Non-smokers do not engage in the behavior targeted for extinction by smoking cessation interventions. Whereas participants in our study had a very salient behavior they could eliminate to improve lung health, most participants in Page and Colby's studies did not. Consequently, participants in those studies may have been relatively insensitive to subtractive (vs. additive) counterfactual thought inductions.

Consistent with prior research, participants who engaged in upward counterfactual thinking were more confident they would meet their long-term behavior goals (quitting smoking in a year) and demonstrated the desired short-term behavior change: they smoked fewer cigarettes between study sessions. Surprisingly, those who engaged in *downward* counterfactual thinking were more likely to sign up for the lung-capacity test. It is possible this effect is the result of differential motivation among upward and downward groups. Perhaps participants in the upward conditions were already sufficiently motivated to change their behavior (see the interaction effects on

behavioral intentions), and so did not require the extra "push" that a lung-capacity test would engender. Participants in downward groups, however, may not yet have been sufficiently motivated to change their smoking behavior, and instead sought additional evidence that behavior change was necessary (e.g., undesirable results from a lung-capacity test). Additional research on this point is needed.

Mechanism of Counterfactual Thought Interventions

Our results fit with the broader literature demonstrating that counterfactual thinking can facilitate behavioral intentions and produce behavior change. It is still unclear, however, exactly how these outcomes are produced. We wondered whether the decreased endorsement of fatalistic beliefs (which often accompany addiction; Büssing, Mattiessen, & Mundle, 2008) might have accounted for the behavioral intentions facilitated by upward/subtractive counterfactual thought. We did not find that fatalistic beliefs mediated these effects, though this may have been due to low power.

Perhaps endorsement of fatalistic beliefs is a proxy for a more fundamental mechanism, namely cognitive dissonance reduction. Indeed, many dissonance-based behavior change paradigms adopt a similar method to that used in the present study: experimenters induce participants to engage in a writing task that heightens inconsistency between attitudes (e.g., health) and actions (e.g., smoking), producing a motivation to reduce the inconsistency (e.g., Rodriguez & Strange, 2015). This motivation can result in numerous dissonance-reduction strategies, including attitude change, rationalization, and behavior change (Festinger, 1957). Perhaps upward (and subtractive) counterfactuals heighten dissonance by making the discrepancy between health attitudes and smoking behavior salient ("My health could be better if I stopped smoking"), whereas downward counterfactuals inherently assuage dissonance via rationalization ("My health could be worse, so there's no real need to stop smoking"). The drop in endorsement of fatalistic beliefs in the upward/subtractive condition in the present study may represent a shift in dissonance-reduction strategy from rationalization or trivialization toward behavior change.

Limitations

Our study does suffer some limitations. First, our sample is small. We had great difficulty recruiting participants, perhaps due to the stigma that often accompanies being labeled as a smoker (Bayer & Stuber, 2006). This may have reduced statistical power to detect small effects. Similarly, our sample may not represent all smokers, though given the advertised description of our study, the types of participants who comprise our sample may still represent the population of motivated smokers who would benefit from such an intervention.

Second, like Page and Colby (2003), our study does not have a true control group. Although downward counterfactual groups may function as de facto control groups insofar as downward counterfactual thought does not usually facilitate behavior change, future research might make use of a non-counterfactual condition to enhance the interpretability of group differences. Third, research has shown that counterfactual referent (self- vs. other- vs. non-referent) can influence behavioral intentions (Epstude & Roese, 2008). We did not manipulate referent in our study, but we suspect that behavior-change would be greatest among those induced to generate self-referent

counterfactual thoughts that highlight their own contribution toward their health outcomes (vs. contributions of uncontrollable factors, e.g., fate).

Lastly, we were not able to assess the effects of counterfactual thinking on long-term behavior change. The modest immediate changes in behavioral intentions observed here may increase the likelihood that smokers will seek out additional treatment options with higher smoking cessation success rates (Volpp et al., 2009). Future research should adopt a more longitudinal design to examine lasting effects of counterfactual thinking.

Conclusion

Counterfactual thinking plays an important role in informing future behavior. Our study showed that a minimal counterfactual thinking manipulation had consistent effects on participants' intentions to quit smoking, as well as on their actual smoking behavior during the study period. Although our effects were rather small, combined with other smoking cessation services, interventions like these may contribute to an overall improvement in the odds of successful smoking cessation.

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APPENDIX A: SELF-REPORT QUESTIONNAIRE ITEMS

1. Have you smoked at all in the past week?
a. yes b. no

2. If yes, approximately how much did you smoke?
Approximately _____ cigarettes per day

3. Are you seriously considering quitting smoking in the next six months?
a. yes b. no

4. Are you planning to quit smoking in the next 30 days?
a. yes b. no

5. How confident are you that you will not be smoking a year from now?
1 = not confident
2 = slightly confident

3 = somewhat confident
4 = very confident
5 = extremely confident

APPENDIX B: PHYSICIAN'S REPORT AND COUNTERFACTUAL THOUGHT INSTRUCTIONS

You have occasionally smoked cigarettes for the past 4 years. You are very confident that because you are young, eat relatively well, and occasionally exercise, your risk of having lung-related problems is extremely low. Upon your last visit to the doctor, you discover that your lung capacity has decreased by 30 percent and that you have an abnormal growth in your lungs. The doctor is concerned that the growth started 2 years ago and has progressively gotten worse. The doctor wants to take a biopsy from your lungs to check for cancer.

Upward Additive

People often have thoughts like "if only . . ." after negative events, in that they can see how things may have turned out better. For example, an Albany woman who recently sustained minor injuries when she was hit by a car told reporters, "If only I had looked down the street a second time, I would've been fine." Often, we wish we had done something to avoid a negative outcome.

Please complete the statement below, listing some *specific actions* that, in retrospect, you could have done to *improve* your current health condition.

If only I had . . .

Upward Subtractive

People often have thoughts like "if only . . ." after negative events, in that they can see how things may have turned out better. For example, an Albany woman who recently sustained minor injuries when she was hit by a car told reporters, "If only I had not been in such a rush, I would've been fine." Often, we wish we hadn't done something that led to a negative outcome.

Please complete the statement below, listing some *specific actions* that, in retrospect, you should not have done, i.e., not having done them would have *improved* your current health condition.

If only I had not . . .

Downward Additive

People often have thoughts like "well at least . . ." after negative events, in that they can see how things may have turned out worse. For example, an Albany woman who recently sustained minor injuries when she was hit by a car told reporters, "At least I didn't try to move around a lot after the accident, or it would have been a lot worse." Often, there are things that could have happened that would have made a negative outcome worse.

Please complete the statement below, listing some *specific actions* that, in retrospect, you could have done that would have made your current health condition *even worse.*

Well, at least I did not . . .

Downward Subtractive

People often have thoughts like "well at least . . ." after negative events, in that they can see how things may have turned out worse. For example, an Albany woman who recently sustained minor injuries when she was hit by a car told reporters, "At least I had my medic-alert bracelet on, or it would have been a lot worse." Often, negative outcomes could have been worse if certain actions had not been taken.

Please complete the statement below, listing some *specific actions* you did that would have made your current health condition *even worse* if you had not done them.

Well, at least I . . .

APPENDIX C: CORRELATION MATRICES

Correlations Among Variables Entered in ANOVAs

	1	2	3	4	5	6
1. Direction	--					
2. Structure	-.01	--				
3. Contemplation Ladder	-.16	-.10	--			
4. PFI	.09	.03	.01	--		
5. Num. Cigarettes Smoked/Day	-.19*	-.05	.10	.23**	--	
6. Confidence in Quitting	.26**	-.05	.04	-.20*	-.19*	--
M	--	--	6.1	4.0	1.2	3.6
SD	--	--	4.2	2.9	2.2	1.2
N	85	85	85	83	85	85

* $p < .10$
** $p < .05$

Correlations Among Variables Entered in Logistic Regressions

	1	2	3	4	5	6
1. Direction	--					
2. Structure	-.01	--				
3. Smoked in the Last Week	-.01	.06	--			
4. Considering Quitting (6 months)	.05	-.16	-.12	--		
5. Plannning on Quitting (30 days)	-.01	-.12	-.21*	.64**	--	
6. Percent Lung Test Sign-up	-.21*	.02	.20*	-.08	.00	--
Overall Percent	--	--	49.2	41.3	48.3	49.7
N	85	85	85	84	83	85

* $p < .10$
** $p < .05$

AUTHOR NOTE

This paper is based on Erika Eavers' Masters thesis.

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