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The Effects of Counterfactual Thinking on Exercise Intentions and Behaviour

by

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Honors Thesis

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### Abstract

Counterfactual thinking has been shown to both cause negative affect as well as result from negative mood, leading to motivation for change, or intention to act. However, research is lacking on the impact counterfactuals have specifically on exercise and how the impact of counterfactuals on motivation may be moderated by personality. This study consisted of 116 undergraduate students and residents of London, Ontario. Participants filled out demographics, generated upward or downward counterfactuals (or neither in the control condition), and filled out scales measuring motivational drive, intrinsic and extrinsic motivation, personality, and exercise intentions. Results showed no significant differences between conditions for yoga participation, exercise intentions or motivational drive, but there were gender differences and interaction effects for neuroticism, extrinsic motivation and amotivation found. Practical implications and limitations are further discussed.

*This work is in dedication to my Grandfather Jack McLeod or “Grandpa Jack” who passed prior to its completion. One of my strongest supporters in all academic endeavors. Always loved, never forgotten.*

### The Effects of Counterfactual Thinking on Exercise Intentions and Behaviour

Exercise brings well-established psychological and physical benefits (Pool, Matheson, & Cox, 2012), yet whether due to changing work demands, increasing technology, or strictly becoming a lethargic society, the levels of exercise and physical activity can vary considerably. Alongside this lack of activity, individuals might feel more poorly about their current habits, or to have no specific change in thought regarding their lifestyle. Depending on the manner in which a person is swayed to think or respond to their actions in a certain way, this positive or negative response can be evaluated. When individuals think about how it is possible that they could have performed better at a particular task, or how they could have acted differently in a situation, it is often seen that a sense of ‘what could have been’ is evoked, known as a counterfactual thought. When these thoughts focus on what could have been done better, this is known as an upward counterfactual thought, which is often accompanied by a feeling of negative affect, and thus a sheer desire to correct this behaviour (Epstude & Roese, 2008). Once an individual realizes that they would like to correct this behaviour, they often become motivated to change the previous course of events for a similar future situation, and thus intend to make these modifications. This has implications for exercise in that if an individual is prompted to consider how they could have performed better in terms of their own exercise, they may be more motivated, and therefore more likely to intend to exercise and actually do so. However, it could be that these thoughts of ‘what could have been’ are more beneficial for some people over others.

The present research examines the relationship between counterfactuals (thoughts of what could have been), motivation, and exercise intentions and how the relationships are moderated by personality factors and individual dispositions. This research brings a novel view to previous

research, mainly because research is lacking on the links between counterfactual thoughts and exercise. Furthermore, general research that has been done on topic of counterfactuals and intention have not explored the moderating role of individual differences such as personality traits. The present research will fill this gap and shed new light on cognitive influences on exercise and for whom these influences might have the greatest effects.

### **Counterfactuals**

Counterfactual thinking, thoughts about events could have turned differently, can take on many different forms; however, two are most common. An *upward counterfactual* occurs when an individual thinks about how a personal outcome could have turned out better for, for example, if they think about how they could have done better to receive a better grade on a test. On the other hand, a *downward counterfactual* is when an individual thinks about how they could have performed worse, for example, even though their grade may not have been ideal on a test, they think about how it could have been worse than the outcome (Epstude & Roese, 2008). Each of these counterfactual categories result in opposing feelings, with upward counterfactuals ultimately leading to negative affect, and downward counterfactuals allowing an ease of mind. When an individual begins thinking of past events, and questioning whether an alternative scenario to that particular event could have been better or worse, this person is engaging in one of these types of counterfactual thought. These types of statements or thoughts often fall under “if-then” conditional propositions, leading someone to believe that “if” they acted differently, “then” the consequential situation also would have been altered (Smallman & Roese, 2009).

### **Counterfactuals and Motivation**

The primary idea behind functional accounts of upward counterfactual thinking (e.g., Epstude & Roese, 2008) is that such thoughts ultimately lead an individual to feel motivated. According to the functional theory of counterfactual thinking, counterfactual thoughts focus on the managing of behaviour, and encourages an individual to improve their current or past performance (Epstude & Roese, 2008). Specifically, when an individual engages in an upward counterfactual thought, they are forced to contemplate how they could have performed in a superior manner. This often triggers a sense of negative affect rather than accomplishment, and allows the individual to see that their behaviour could have been improved. In most cases, the negative feeling and perception that one could have performed in a more ideal way is enough to think of ways for them to correct this behaviour and act upon these intentions in future circumstances, mainly because it creates motivation for congruence between their cognitions and behaviours (Epstude & Roese, 2008). Considering downward counterfactuals tend to result in more positive mood states, and upward counterfactuals, on the contrary, often result in more negative moods, it is the negative mood states that are often the source of such motivation. This is due to the idea that negative moods have the capability to produce self-improvement motives following a counterfactual thought of an upward direction (Meier, 2002).

Several studies have shown that negative mood states work interchangeably with upward counterfactuals and self-improvement. An upward counterfactual can result in a negative mood state, and thus motivation for self-improvement, and there is also evidence that suggests a negative mood state leads individuals to have more upward counterfactual thoughts, again leading to thoughts of self-improvement (Sanna, Chang, & Meier, 2001). In a study conducted by Epstude & Roese (2011), participants were given a counterfactual mindset priming task where

they considered an alternative to a scenario, and were then given a second, unrelated task. Across studies using this technique, the individuals showed better performance in forming creative associations, but worse performance on novel idea generations. This illustrates that when an individual is primed with counterfactual thinking, they are motivated to simply alter or 'correct' their methodology for the second task. This finding can be further supported by Markman, McMullen, and Elizaga's (2008) findings that individuals were seen to improve on an anagram task parallel to shifts in affect initiated by counterfactual thinking. When negative affect was induced through either an upward or downward counterfactual thought, participants were then more motivated to try harder on the anagram task that followed. In summary, this shows that counterfactual thought can lead to negative affect, which in turn, can ultimately lead someone to be more motivated.

### **Counterfactuals and Intentions**

Once an individual has engaged in upward counterfactual thinking, it can subsequently lead to an increase in motivation for self-improvement, which in many cases also facilitates an increase in intentions to take corrective action. This is ultimately because within each counterfactual thought is a causal insight that provides the foundation for a behavioural intention (Epstude & Roese, 2008). A study by Roese (1994) was performed that had participants focus on a recent academic performance that was considered disappointing to them. Subjects were then asked to provide three ways in which they could have performed better (upward counterfactual) and three ways they could have performed worse (downward counterfactual). The experiment demonstrated that those who generated upward counterfactuals reported an increase in their intention to perform future success-facilitating behaviours. These upward counterfactuals also serve a preparative function, in terms of unexpected failures, they prepare



the individual for possible future outcomes (Smallman & Roese, 2009; Epstude & Roese, 2011). An example of counterfactuals leading to behavioural intentions is used by Epstude and Roese (2011), in which an individual misses their friend's birthday. This leads the individual to think something like "if only I had noted it in my calendar, I would not have missed it", with the following behavioural intention "I will note it in my calendar for next year". Thus, counterfactuals and behavioural intentions appear to have an automatic connection, and therefore prepare the individual for similar future situations (Epstude & Roese, 2011).

### **Counterfactuals and Exercise**

The simple feeling of regret (the painful feeling that occurs upon an outcome that turned out differently than what was desired) is enough to produce negative affect in an individual, as well as motivate them to perform more ideally in a similar future situation. This motivation is consequently often enough for an individual to intend to perform a particular action. Therefore, if an individual happens to think their level of exercise could have been better in the past events, we would expect that this negative affect would potentiate the increased intention to raise their exercise levels in the future. If the thought of anticipated regret is enough for an individual to alter their behavioural intentions, simply because they would like to avoid regret later, this could further increase the likelihood that regret in the form of an upward counterfactual would cause them to alter their behavioural intention as well (Abraham & Sheeran, 2003). Abraham & Sheeran (2003) found that individuals who were primed with a feeling of anticipated regret saw their behavioural intentions to exercise increase. This would suggest that if an individual were to regret their exercise behaviour, they would take action in order to make a greater effort to increase their exercise in the future (Abraham & Sheeran, 2004). However, not all individuals may be similarly motivated by upward counterfactuals about exercise, depending on their personality traits.

### **Personality and Exercise**

In regards to personality, certain personality traits correspond to various behavioural traits that are displayed by an individual. With regard to exercise, two of the more important personality traits when coinciding with motivation are neuroticism and extraversion, although extraversion has been seen to have some mixed results (Wilson & Dishman, 2015). A study was conducted that looked at the multiple relationships between exercise, anxiety, depression, and most importantly, personality. The study found that the individuals who exercise more are less neurotic, and are also more extraverted (de Moor, Beem, Stubbe, Boomsma, & de Geus, 2006). Another study performed by Rhodes et al. (2002) also supports these findings, as it concluded that there is a positive correlation between exercise and extraversion, as well as a negative correlation between exercise and neuroticism. This logically makes sense, as extraverted individuals are thought to be more outgoing and engage in more social interaction, whereas neurotic individuals are known to experience negative affect, as well as disturbed thoughts and actions (Rhodes, Courneya, & Jones, 2002). These findings, however, were said to be mediated by the factors in the Theory of Planned Behaviour (attitudes, subjective norms and perceived behavioural control), so the subsequent study by Rhodes, Courneya, & Jones (2002) went on to control those factors. The study then found that extraversion had a direct effect on exercise behaviour, without the influence of the Theory of Planned Behaviour, and explained variance beyond intention (Rhodes, Courneya, & Jones, 2002).

There also seems to be a correlation between the motivation one has to exercise, as well as aspects of their personality. A study conducted by Huang, Lee, and Chang (2007) found that increased physical and psychological motivation is positively correlated with scores of extraversion. They go on to conclude that individuals with high scores on extraversion are

motivated to attend fitness centres, ultimately due to the idea they are outgoing and energetic (Lewis & Sutton, 2011). We might then expect that such individuals would see a greater impact from upward counterfactuals on their intentions to exercise and actual exercise activities.

### **Present Study**

The present study examines the role of upward counterfactuals as well as downward counterfactuals regarding exercise behaviour, how this influences motivation and exercise along with how these relationships are moderated by individual differences. Based on past research illustrating how upward counterfactuals facilitate self-improvement motives and intentions (Epstude & Roese, 2008; Meier, 2002; Roese, 1994, Sanna, Chang, & Meier, 2001), production of upward counterfactuals should increase an individual's general level of motivational drive (Hypothesis 1)

If the individual is then more motivated, it is likely they will have an increased intention to act, thus showing they intend to exercise more in the future. The overall increase in intention to exercise; however, stems back to the initial production of the upward counterfactual. This can be seen in the study performed by Roese (1994), which demonstrates that when given two blocks of anagrams, their performance was significantly increased for the second anagram. Also, performance was facilitated through the use of counterfactuals that were particularly upward, and these benefits were also linked to their performance-enhancing strategies within the counterfactual thoughts. Therefore, we can predict that upward counterfactuals should increase intention to exercise and actual participation in exercise activities (a yoga class in the present study) (Hypothesis 2).

In addition to motivation, the present study looks into the impact of personality, such that the relationship between counterfactual thoughts and intention to exercise is possibly regulated

by various aspects of an individual's personality. It has been shown that those who are seen to be more sociable and energetic, in other words extraverted, tend toward increased levels of exercise compared to those who are introverted (de Moor, et al., 2006). Also, it has been illustrated that the individuals who are more anxiety-prone or worry-prone, described as neurotic, have also been seen to exercise more frequently (Rhodes, Courneya, & Jones, 2002). Based on such past work, in the study at hand the relationship between counterfactuals and exercise intentions should be moderated by both intrinsic motivation (motivation based on internal desires and needs) (Hypothesis 3a), extrinsic motivation (motivation based off external rewards and benefits for others) (Hypothesis 3b), and amotivation (lack of motivation) (Hypothesis 3c), as well as personality factors such as neuroticism and extraversion (Hypothesis 4a and Hypothesis 4b). Specifically, it is expected that the generation of upward counterfactuals (relative to the generation of downward counterfactuals or generation of no counterfactuals) will facilitate greater exercise intentions among those higher in extraversion, intrinsic motivation and extrinsic motivation and those lower in neuroticism and amotivation.

The present study assesses what has not previously been analyzed, which is the direct relationship between counterfactual thoughts and exercise. More specifically, the influence of counterfactual thinking on the intention to exercise was assessed by having participants either provide an upward or downward counterfactual in terms of their past exercise. Participants also completed the Global Motivation scale (Guay, 2003) to measure intrinsic and extrinsic motivation as well as motivation and the Big Five Inventory of Personality to measure the personality traits of neuroticism, extraversion, openness to experience, conscientiousness, and agreeableness (John & Srivastava, 1999). These measures of motivation and personality have not been included together in research on the impacts of counterfactuals on intentions and

behaviour. To measure exercise intentions specifically, participants were asked to rate their exercise intentions over the next month and be given an opportunity to sign up for a yoga class being offered on main campus of Western University upon filling out the surveys previously mentioned. This the present study adds to knowledge regarding how counterfactual thoughts influence intention, and ultimately behaviour in a self-enhancing manner and how the effects are further moderated by individual difference factors.

## **Methods**

### **Participants**

The participants in this experiment consisted of 116 residents of London (females = 75, males = 41), recruited from King's University College and from social media. The age range of the participants was 18 to 56 ( $M = 21.4$ ,  $SD = 5.95$ ). An advertisement on the King's SONA system was used to recruit Psychology 1000 students as well as Second Year Psychology students for this study. These students were offered up to 2.5% course credit towards their Psychology 1000 or Second Year Psychology course for participating in this study and completing an assignment related to the study. Individuals were also recruited through social media, with criteria being that they reside in London, Ontario. Individuals were randomly assigned to one of the three conditions of the experiment using an online generator.

### **Materials**

*Demographics.* Participants were asked their age and gender.

*Reflection on Exercise Behaviour.* The next material contained three conditions in which participants open-endedly generated either an upward counterfactual or a downward counterfactual, or neither in the control condition which involved neither. The upward counterfactual condition contained the question "looking back on your exercise activity over the

past month, how would you say you could have done better?” The downward counterfactual condition contained the question “looking back on your exercise activity over the past month, how would you say you could have done worse?” The control condition skipped this section altogether.

***Motivational Drive.*** An individual’s drive to achieve their goal was measured through the drive subscale for the Behavioural Inhibition System/Behavioral Approach System (BIS/BAS) (Carver & White, 1994). The BIS/BAS scale includes a series of statements which participants rated how much the statement corresponds to them. The scale for each item ranges from 1 which represents “very true of me” to 4 which represents “very false of me”. The drive subscale from this measure utilized for this study includes 4 items including “I will go out of my way to get the things I want”, “when I want something I will usually go all-out to get it”, “when I go after something I will use a ‘no holds barred’ approach”, and “If I see a chance to get something I will move on it right away.” These items are slightly modified from the original items to refer to future intentions as opposed to general tendencies. The BIS/BAS scale has been used in a wide variety of studies and the drive subscale has shown acceptable reliability of above .70 in diverse samples (Leone, Perugini, Bagozzi, Pierro, & Mannetti, 2001; Poythress et al., 2008; Smits & De Boeck, 2006), as well as the present study ( $\alpha = .69$ ).

***Global Motivation Scale.*** An individual’s different motivations underlying their behaviour was measured using the Global Motivation Scale (Guay, 2003), which contains 28 items that measure three types of intrinsic motivation ( $\alpha = .89$ ), three types of extrinsic motivation ( $\alpha = .83$ ), and amotivation ( $\alpha = .78$ ), showing acceptable reliability throughout. This scale has also showed acceptable reliability (Cronbach’s  $\alpha = .75-.91$ ) throughout several previous studies (Guay, 2003). The Global Motivation Scale uses a seven point Likert scale with

responses ranging from 1 which represents “does not correspond accordingly” to 7 which represents “corresponds completely”. This measure uses questions such as “in general I do things because I do not want to disappoint certain people” and “in general I do things because I chose them as means to attain my objectives”.

***The Big Five Inventory of Personality.*** 44 questions were used in the Big Five Personality Inventory to tap into participant’s personality traits including: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism. This measure uses a five point Likert scale with the responses ranging from 1 which represents “Strongly disagree” to 5 which represents “Strongly agree”. An example question targeting extraversion is “I see myself as someone who is talkative”. An example question targeting neuroticism is “I see myself as someone who is depressed, blue”. An example question targeting agreeableness is “I see myself as someone who is helpful and unselfish with others”. An example question targeting openness is “I see myself as someone who is original, comes up with new ideas”. Lastly, an example question targeting conscientiousness is “I see myself as someone who does a thorough job” (John & Srivastava, 1999). The subscales for this measure have previously shown acceptable reliability of above .70 (John & Srivastava, 1999), as well as the current study for all variables including extraversion ( $\alpha = .85$ ), agreeableness ( $\alpha = .68$ ), conscientiousness ( $\alpha = .79$ ), neuroticism ( $\alpha = .82$ ), and openness to experience ( $\alpha = .75$ ).

***Exercise Intentions and Behaviour.*** In order to measure exercise intentions and future behaviour, participants were told “There is a free yoga class that happens every Wednesday night from 7-8 PM at 1537 Adelaide St near our campus. The research investigator can pass on your contact info to the yoga instructor so you can receive more information.” Participants were asked “would you be interested in participating in this class?” and “Would you be willing to provide

your email and phone number to the research investigator after you have concluded this survey so that the yoga instructor can follow up with more information?” Finally, participants were asked to state their level of agreement with the item “I intend to exercise more in the next month than I did in the previous month” on a 5 point scale ranging from 1 which represents “Strongly disagree” to 5 which represents “Strongly agree”.

### **Procedure**

Participants were recruited online through the SONA system and social media, where they could find a link to the current study which was conducted strictly online through the use of Qualtrics, a survey software that has been adapted through a license with Western University. They then completed the study online, which took approximately 15-20 minutes to complete. The first page the participant filled out was a letter of informed consent. Upon providing consent the individual was then able to continue on to the rest of the survey. Participants provided demographic information (i.e. age and gender), then they were randomly selected by Qualtrics to complete the upward counterfactual condition, the downward counterfactual condition, or the control condition (see Appendix A). Then the participant completed the Motivational Drive BIS/BAS subscale (see Appendix B), Global Motivation Scale (see Appendix C) and the Big Five Inventory of Personality (see Appendix D). Participants were then told that there was a free yoga class occurring on Adelaide Street in London on Wednesdays, and further asked if they would be interested in participating (see Appendix E). Finally, participants were asked to state their level of agreement with the item “I intend to exercise more in the next month than I have in the past month” (see Appendix F). The participant was then debriefed and thanked for their participation.



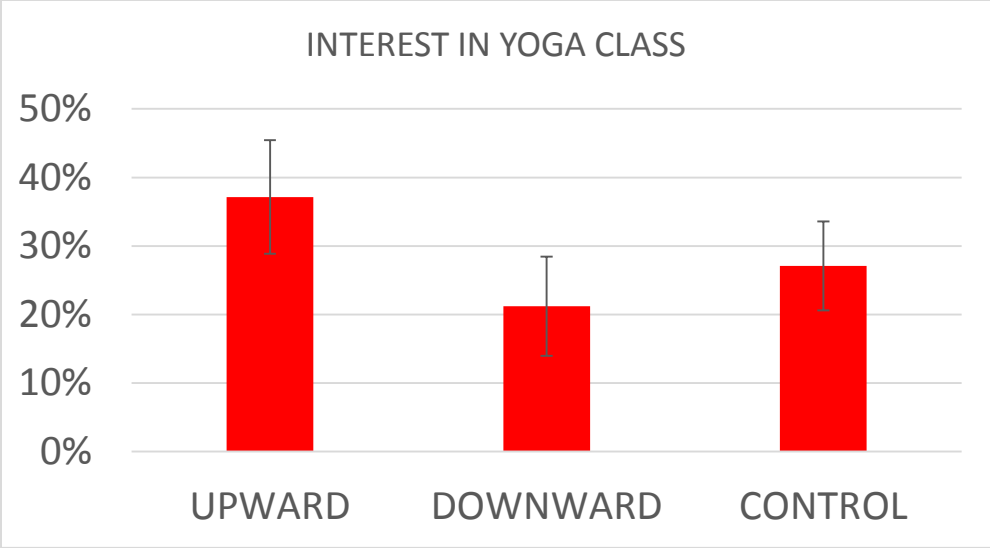
## Results

Analyses began with an examination of the effects of generating an upward, downward, or no counterfactual on intention to exercise over the following month, desire to participate in a yoga class, and motivational drive via One-Way between subjects ANOVA tests. There was no significant difference between conditions for participation in the yoga class (Upward:  $M = 37.1\%$ ,  $SD = 49.0\%$ , Downward:  $M = 21.0\%$ ,  $SD = 41.5\%$ , Control:  $M = 27.0\%$ ,  $SD = 44.9\%$ ),  $F(2, 113) = 1.09$ ,  $p = .34$  (see Figure 1), exercise intentions (Upward:  $M = 4.34$ ,  $SD = 1.06$ , Downward:  $M = 3.94$ ,  $SD = 1.12$ , Control:  $M = 4.04$ ,  $SD = .98$ ),  $F(2, 112) = 1.41$ ,  $p = .25$  (see Figure 2), and motivational drive (Upward:  $M = 1.79$ ,  $SD = .47$ , Downward:  $M = 1.83$ ,  $SD = .41$ , Control:  $M = 1.91$ ,  $SD = .41$ ),  $F(2, 113) = 1.00$ ,  $p = .37$  (see Table 1).

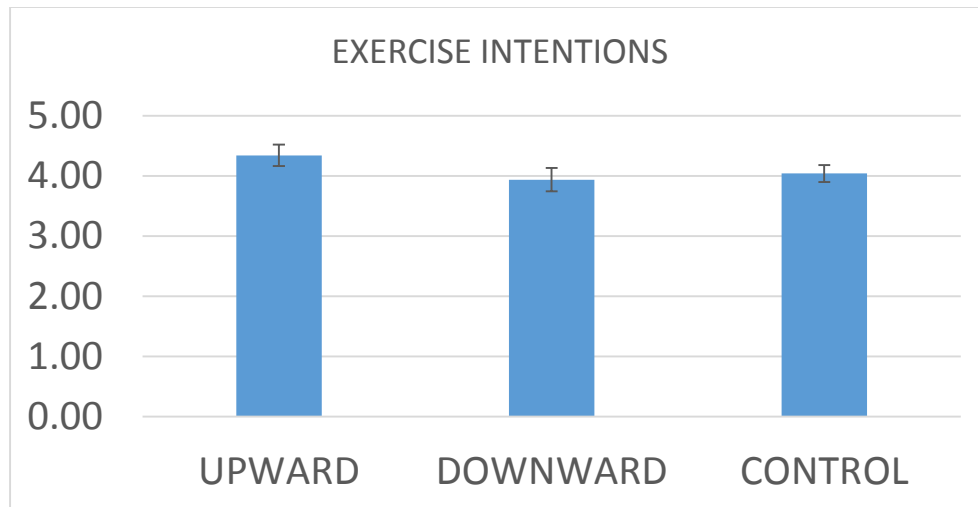
Table 1

*Means and Standard Deviations of Motivational Drive, Intrinsic Motivation, and Extrinsic Motivation By Experimental Condition.*

Dependent Variables	Condition					
	Upward		Downward		Control	
	Mean	SD	Mean	SD	Mean	SD
Motivational Drive	1.79	.47	1.83	.41	1.92	.41
Intrinsic Motivation	5.00	.97	4.98	.81	5.30	.80
Extrinsic Motivation	4.91	.81	4.77	.92	5.12	.78



*Figure 1.* Interest in yoga participation among participants who generated an upward counterfactual, downward counterfactual, or no counterfactual. Error bars represent 95% confidence intervals.



*Figure 2.* Exercise intentions among participants who generated an upward counterfactual, downward counterfactual, or no counterfactual. Error bars represent 95% confidence intervals.

*Gender Differences.* A Two-Way between subjects ANOVA was conducted in order to see possible main effects and interaction effects with gender, and it revealed that females ( $M = 37.3\%$ ,  $SD = 48.7\%$ ) were significantly more likely to want to participate in the yoga class than males ( $M = 12.2\%$ ,  $SD = 33.1\%$ ),  $F(1, 110) = 7.72, p < .01$ . It also demonstrated that generating upward counterfactuals predicted marginally higher exercise intentions for men (Upward:  $M = 4.58$ ,  $SD = .67$ , Downward:  $M = 3.46$ ,  $SD = 1.20$ , Control:  $M = 3.88$ ,  $SD = 1.15$ ) compared to women (Upward:  $M = 4.22$ ,  $SD = 1.20$ , Downward:  $M = 4.25$ ,  $SD = .97$ , Control:  $M = 4.13$ ,  $SD = .89$ ),  $F(1, 109) = 2.50, p = .09$ .

Regression analyses (logistic regression for predicting interest in the yoga class, linear regression for predicting the other dependent variables) were performed in order to explore other possible interaction effects of the types of intrinsic or extrinsic motivation or amotivation, as well as the five personality variables including: extraversion, agreeableness, conscientiousness, neuroticism, and openness. These regression analyses were conducted with counterfactual type (upward vs downward or upward vs control), the potential moderating variable and the interaction term entered as predictors of the dependent measures of exercise intentions as well as motivational drive. The results below report only those findings that were of statistical significance or approaching significance, all other effects were not found to be significant.

*Neuroticism.* When controlling for neuroticism, upward counterfactuals were more likely to predict interest in the yoga class when compared to the control,  $\beta^i = 2.59, p = .02$ . We also found an interaction effect, such that upward counterfactuals were more predictive of wanting to participate in the yoga class versus the control group among those lower in neuroticism, interaction  $\beta = -2.50, p = .03$ . In comparing against those in the downward counterfactual

condition, when you control for neuroticism, the difference between those who generated upward counterfactuals and downward counterfactuals was approaching significance,  $\beta = 1.73, p = .11$ .

*Extrinsic Motivation.* Upward counterfactuals were more likely to predict exercise intentions for those higher on extrinsic motivation relative to the control group, interaction  $\beta = 1.38, t(81) = 1.95, p = .05$ . This effect was marginally significant in comparing those in the upward counterfactual group against those in the downward counterfactual group. However, we found no other significant main effects or interactions, interaction  $\beta = 1.24, t(67) = 1.76, p = .08$ .

*Amotivation.* When controlling for amotivation, upward counterfactuals better predicted increased motivational drive relative to the downward counterfactual group,  $\beta = .72, t(67) = 2.01, p < .05$ . There was also an interaction such that upward counterfactuals predicted increased motivational drive for those who are lower in amotivation relative to the downward counterfactual group, interaction  $\beta = -.88, t(67) = -2.26, p = .03^{ii}$ .

### **Discussion**

The present study examined whether or not individuals who were prompted to generate an upward counterfactual were more likely to participate in a yoga class, intend to exercise more over the following month, and have an increase in motivational drive compared to those generating a downward counterfactual or no counterfactual. This study also looked to discover whether or not these relationships were moderated by personality (extraversion and neuroticism) or intrinsic or extrinsic motivation or amotivation. There were no significant differences between the conditions for all aspects including yoga participation, exercise intentions, or motivational drive. There was also only slight evidence of moderation of neuroticism and extrinsic motivation, with no support that extraversion is a moderator of any of these relationships. There were also gender differences found within some relationships.

Those providing an upward counterfactual were not more likely to intend to exercise over the following month, participate in a yoga class, or have an increase in motivational drive in comparison to the downward counterfactual or control groups, which does not support hypotheses 1 and 2. Also, extraversion did not moderate the relationship between upward counterfactuals and any of the three dependent variables which is not consistent with hypothesis 4b, but is consistent with findings by Ekkekakis, Hall, and Petruzzello (2005) that there is no relationship between extraversion and exercise participation.

The relationship between generating an upward counterfactual and participating in a yoga class was, however, moderated by neuroticism, such that those who were lower in neuroticism, (otherwise known as those who are more emotionally stable) were more likely to participate in the yoga class if they described how they could have performed better over the previous month. This is in support of hypothesis 4a, and can somewhat be explained by the idea that those who are higher in neuroticism have higher anxiety and vulnerability, which may reduce their opportunity and exposure to physical activity (Wilson & Dishman, 2015). Furthermore, it appears as though neuroticism may be suppressing the relationship between upward counterfactuals and yoga class participation, such that the individuals were more likely to participate in the yoga class if they generated an upward counterfactual, when neuroticism was statistically controlled for. This occurred when comparing the upward counterfactual group to both the control condition which was significant, as well as the downward counterfactual group which was approaching significance.

When looking at motivation, those providing an upward counterfactual were more likely to intend to exercise over the following month, if they were higher in extrinsic motivation. This is evidence for hypothesis 3b, but only for this particular relationship, and reasoning that

motivation may not be a significant moderator of other relationships is the idea that particular motives vary in meaning across individuals and situations, therefore altering their intrinsic or extrinsic motivation toward participation (Ingledeew, Markland, & Sheppard, 2004). Additionally there is rationalization of the idea that only extrinsic motivation moderates this relationship, because more extrinsic factors are involved when looking at motivation to exercise (Kilpatrick, Hebert, & Bartholomew, 2005).

When comparing the upward counterfactual group to the downward counterfactual group, it was found that those who generated an upward counterfactual had higher motivational drive if they were less amotivated. Similarly, upward counterfactuals predicted increased motivational drive when amotivation is statistically controlled for. This is supportive evidence of Epstude & Roese (2008), which posits that upward counterfactuals can lead to negative mood states, and thus motivation to correct this and maintain congruence. Those who are more motivated (lower in amotivation) may therefore be most likely to benefit from upward counterfactuals.

The present study also looked at gender differences to determine whether or not males and females differ in exercise intentions. It was found that women were significantly more likely to agree to participate in a yoga class in comparison to men, which is supported by a study that found women to be much more likely to have participated in yoga in the past year (Cramer et al., 2016). It was also found that men benefited more from generating upward counterfactuals compared to women, such that men were more likely than women to intend to exercise over the following month if they were prompted to generate an upward counterfactual as opposed to downward or control, with marginal significance. This finding is supported by a study performed by Roese et al. (2006) which found that men emphasize regrets of inaction over action, whereas women consider them equally. This points to the possibility that men are more



motivated than women to intend to exercise if they believe there is a manner in which they could have performed better or even at all when they did not.

Overall, these findings show that the impact of counterfactual thinking was moderated by levels of neuroticism, as seen by de Moor, et al. (2006), extrinsic motivation and amotivation. The results also show that producing upward counterfactuals did not have an overall effect on general level of motivational drive, exercise intentions or interest in yoga class participation. Furthermore, gender differences displayed females as more likely to participate in yoga than men, and men were marginally more likely to have increased exercise intentions after generating upward counterfactuals. This illustrates that counterfactual thinking may not work for every individual in all contexts, but that there are particular individuals who may benefit more from this type of thinking. In other words, the roles of personality and gender seem to be a large factor, such that having certain personality traits or being of a particular gender may be crucial in order to reap the benefits of counterfactual thinking.

### **Implications and Limitations**

The present study has several practical implications. The findings show that there are particular situations and types of people that will be positively impacted by upward counterfactual thinking, as well as individuals who will not derive such benefits. There are also practical implications when looking at health promotion campaigns as well as interventions regarding exercise behaviours, because these are areas in which it is important to take the perspective and characteristics of the audience into perspective, as these individual differences must be taken into account. It is especially important to be aware that differences in personality styles can have an impact on whether or not counterfactual thinking is advantageous or not. This is because on one hand, there are particular personality profiles that benefit from counterfactual

thinking, however, on the other hand, counterfactual thinking can be rather detrimental within other personality profiles.

Although there are many aspects of this study that were carefully and properly performed, there are a few limitations that should be pointed out. The main issue involved in this study was the sample size. The sample size was relatively small, especially when performing a study with such a large number of variables. In order to have a well-conducted study of this nature, it is important to have a well-proportioned number of participants relative to the number of variables being examined. In terms of these participants, a limitation would also be that the sample consisted of a disparity between a larger number of undergraduate students compared to the smaller number of members of the general London population, and the study did not look at the potential differences between these two populations.

Continuing off of this issue with participants, there was also a very large gender disparity. The number of females (75) far exceeded the number of males (41), therefore the study did not have an equal distribution of males and females throughout which would be more ideal. This relates to the limitation of using yoga as a measure for exercise, due to the idea that many individuals simply do not enjoy yoga, and as seen in the results, women are more likely than men to participate in yoga. Lastly, another aspect of measurement that contains a limitation is the generating of counterfactuals themselves, and not conducting a manipulation check in order to determine whether or not they had an overall effect, as it is possible that participants did not follow the instructions appropriately and generate the if-then thoughts (“If I did X, Y would have happened) thought to have the most direct impacts on motivation.

### **Future Directions**

The present study and findings provides a sound base for conducting future research. Future research could look at other domains of health and how they are impacted by counterfactual thinking, such as healthy eating behaviours, or other aspects of physical activity such as sport participation. This would give research a different take on counterfactual thought, and could begin to determine if there are effects on all aspects of health, or only specific domains.

In addition to exploring these dependent variables more thoroughly, future research could also look more closely into the moderating variables of these relationships, for example, personality, and gain further evidence that these are influential. Further investigation on extraversion, for example, may show significant moderation, even though the present study failed to conclude this. Moreover, this was a study with a rather short timeline, therefore, it would be interesting to see if there would be a long term effect of generating counterfactuals if the a study was to be done with a longitudinal design. Future studies in this area could include a manipulation check to better verify what kinds of thoughts are being generated when individuals are asked to reflect on what they had done better.

Ultimately, the benefits of generating an upward counterfactual on yoga participation, exercise intentions, and motivational drive are inconclusive and definitely requires more research and investigation. Although the main hypotheses (1 and 2) were not supported, there was evidence of a relationship between counterfactuals and yoga participation when controlling for neuroticism (in support of hypothesis 4a). There was also a relationship discovered between upward counterfactuals and exercise intentions when controlling for extrinsic motivation (in support of hypothesis 3b). Lastly, there was a relationship between upward counterfactuals and

motivational drive when controlling for amotivation (in support of hypothesis 3c). This demonstrates that some of the predictions made were validated, and that there are implications for the present work performed. In all, our findings raise questions about when and among which individuals upward counterfactuals will either aid or hinder. Future research will absolutely contribute to our understanding of counterfactuals and their impact on health behaviours and quality of life.

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**Appendix A**

**REFLECTION ON EXERCISE BEHAVIOUR (NOT COMPLETED BY THOSE IN CONTROL GROUP)**

*Upward Counterfactual Condition:*

Looking back on your exercise activity over the past month, how would you say you could have done better?

*Downward Counterfactual Condition:*

Looking back on your exercise activity over the past month, how would you say you could have done worse?

### Appendix B

Each item below is a statement that a person may either agree with or disagree with. For each item, indicate how much you agree or disagree with what the item says. Please respond to all the items; do not leave any blank.

Choose only one response to each statement. Please be as accurate and honest as you can be. Respond to each item as if it were the only item. That is, don't worry about being "consistent" in your responses. Choose from the following four response options:

- 1 = very true for me
- 2 = somewhat true for me
- 3 = somewhat false for me
- 4 = very false for me

1. I will go out of my way to get the things I want

Very true of me      Somewhat true of me      Somewhat false of me      Very false of me

2. When I want something I will go all-out to get it.

Very true of me      Somewhat true of me      Somewhat false of me      Very false of me

3. If I see a chance to get something I will move on it right away.

Very true of me      Somewhat true of me      Somewhat false of me      Very false of me

4. When I go after something I will use a "no holds barred" approach.

Very true of me      Somewhat true of me      Somewhat false of me      Very false of me

**Appendix C**

**GENERAL ATTITUDES**

*Indicate to what extent each of the following statements corresponds generally to the reasons why you do different things.*

	Does not correspond accordingly		Corresponds moderately					Corresponds completely	
	1	2	3	4	5	6	7		
<b>IN GENERAL, I DO THINGS . . .</b>									
1. ... in order to feel pleasant emotions.	1	2	3	4	5	6	7		
2. ... because I do not want to disappoint certain people.	1	2	3	4	5	6	7		
3. ... in order to help myself become the person I aim to be.	1	2	3	4	5	6	7		
4. ... because I like making interesting discoveries.	1	2	3	4	5	6	7		
5. ... because I would beat myself up for not doing them.	1	2	3	4	5	6	7		
6. ... because of the pleasure I feel as I become more and more skilled.	1	2	3	4	5	6	7		
7. ... although I do not see the benefit in what I am doing.	1	2	3	4	5	6	7		
8. ... because of the sense of well-being I feel while I am doing them.	1	2	3	4	5	6	7		
9. ... because I want to be viewed more positively by certain people.	1	2	3	4	5	6	7		
10. ... because I chose them as means to attain my objectives.	1	2	3	4	5	6	7		
11. ... for the pleasure of acquiring new knowledge.	1	2	3	4	5	6	7		
12. ... because otherwise I would feel guilty for not doing them.	1	2	3	4	5	6	7		
13. ... for the pleasure I feel mastering what I am doing.	1	2	3	4	5	6	7		
14. ... although it does not make a difference whether I do them or not.	1	2	3	4	5	6	7		
15. ... for the pleasant sensations I feel while I am doing them.	1	2	3	4	5	6	7		
16. ... in order to show others what I am capable of.	1	2	3	4	5	6	7		
17. ... because I chose them in order to attain what I desire.	1	2	3	4	5	6	7		
18. ... for the pleasure of learning new, interesting things.	1	2	3	4	5	6	7		
19. ... because I force myself to do them.	1	2	3	4	5	6	7		
20. ... because of the satisfaction I feel in trying to excel in what I do.	1	2	3	4	5	6	7		
21. ... even though I do not have a good reason for doing them.	1	2	3	4	5	6	7		
22. ... for the enjoyable feelings I experience.	1	2	3	4	5	6	7		

Does not correspond accordingly	Corresponds moderately					Corresponds completely	
1	2	3	4	5	6	7	

**IN GENERAL, I DO THINGS . . .**

---

- |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 23. ... in order to attain prestige.                                  | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 24. ... because I choose to invest myself in what is important to me. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 25. ... for the pleasure of learning different interesting facts.     | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 26. ... because I would feel bad if I do not do them.                 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 27. ... because of the pleasure I feel outdoing myself.               | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 28. ... even though I believe they are not worth the trouble.         | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

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**SCORING KEYS**

**GMS-28**

- |                        |   |
|------------------------|---|
| <b># 4, 11, 18, 25</b> | <b>Intrinsic motivation - to know</b>                   |
| <b># 6, 13, 20, 27</b> | <b>Intrinsic motivation - toward accomplishment</b>     |
| <b># 1, 8, 15, 22</b>  | <b>Intrinsic motivation - to experience stimulation</b> |
| <b># 3, 10, 17, 24</b> | <b>Extrinsic motivation - identified</b>                |
| <b># 5, 12, 19, 26</b> | <b>Extrinsic motivation - introjected</b>               |
| <b># 2, 9, 16, 23</b>  | <b>Extrinsic motivation - external regulation</b>       |
| <b># 7, 14, 21, 28</b> | <b>Amotivation</b>                                      |

## Appendix D

### The Big Five Inventory (BFI) (John & Srivastava, 1999)

Here are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who likes to spend time with others? Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement.

1 = Disagree strongly

2 = Disagree a little

3 = Neither agree nor disagree

4 = Agree a little

5 = Agree Strongly

I see Myself as Someone Who...

- |   |  |
|---|--|
| <p>___ 1. Is talkative</p> <p>___ 2. Tends to find fault with others</p> <p>___ 3. Does a thorough job</p> <p>___ 4. Is depressed, blue</p> <p>___ 5. Is original, comes up with new ideas</p> <p>___ 6. Is reserved</p> <p>___ 7. Is helpful and unselfish with others</p> <p>___ 8. Can be somewhat careless</p> <p>___ 9. Is relaxed, handles stress well</p> <p>___ 10. Is curious about many different things</p> <p>___ 11. Is full of energy</p> <p>___ 12. Starts quarrels with others</p> <p>___ 13. Is a reliable worker</p> <p>___ 14. Can be tense</p> <p>___ 15. Is ingenious, a deep thinker</p> <p>___ 16. Generates a lot of enthusiasm</p> <p>___ 17. Has a forgiving nature</p> <p>___ 18. Tends to be disorganized</p> <p>___ 19. Worries a lot</p> <p>___ 20. Has an active imagination</p> <p>___ 21. Tends to be quiet</p> <p>___ 22. Is generally trusting</p> | <p>___ 23. Tends to be lazy</p> <p>___ 24. Is emotionally stable, not easily upset</p> <p>___ 25. Is inventive</p> <p>___ 26. Has an assertive personality</p> <p>___ 27. Can be cold and aloof</p> <p>___ 28. Perseveres until the task is finished</p> <p>___ 29. Can be moody</p> <p>___ 30. Values artistic, aesthetic experiences</p> <p>___ 31. Is sometimes shy, inhibited</p> <p>___ 32. Is considerate and kind to almost everyone</p> <p>___ 33. Does things efficiently</p> <p>___ 34. Remains calm in tense situations</p> <p>___ 35. Prefers work that is routine</p> <p>___ 36. Is outgoing, sociable</p> <p>___ 37. Is sometimes rude to others</p> <p>___ 38. Makes plans and follows through with them</p> <p>___ 39. Gets nervous easily</p> <p>___ 40. Likes to reflect, play with ideas</p> <p>___ 41. Has few artistic interests</p> <p>___ 42. Likes to cooperate with others</p> <p>___ 43. Is easily distracted</p> <p>___ 44. Is sophisticated in art, music, or literature</p> |
|---|--|

#### **Scoring:**

BFI scale scoring (“R” denotes reverse-scored items):

Extraversion: 1, 6R, 11, 16, 21R, 26, 31R, 36

Agreeableness: 2R, 7, 12R, 17, 22, 27R, 32, 37R, 42

Conscientiousness: 3, 8R, 13, 18R, 23R, 28, 33, 38, 43R

Neuroticism: 4, 9R, 14, 19, 24R, 29, 34R, 39

Openness: 5, 10, 15, 20, 25, 30, 35R, 40, 41R, 44

**Appendix E****Yoga Class**

There is a free yoga class that happens every Wednesday night from 7-8 PM at 1537 Adelaide St near our campus. The research investigator can pass on your contact info to the yoga instructor so you can receive more information.

Would you be interested in participating in this class?

Yes \_\_\_\_

No \_\_\_\_

Would you be willing to provide your email and phone number to the research investigator after this study concludes so that the yoga instructor can follow up with more information?

**Appendix F**

Please state your level of agreement with the following statement:

I intend to exercise more in the next month than I did in the previous month

Disagree strongly      Disagree a little      Deither agree nor disagree      Agree a little      Agree strongly

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**NOTES**

<sup>i</sup> All beta values cited are standardized beta values

<sup>ii</sup> It was further tested whether the effects reported here replicate when taking a random subset of 50% of the sample. The effects were reduced in all cases and ranged from  $p = .06$  to  $p = .19$  for effects reported relating to neuroticism and amotivation, but were eliminated entirely for extrinsic motivation, all  $ps > .66$ . Given the small sample size, reducing the sample by 50% further reduced statistical power, thus further inquiry with a larger sample would still be advised to have greater faith in the reliability of the findings.