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Personality, Counterfactual Thinking, and Negative Emotional Reactivity

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Abstract

1
2 **Objectives.** People differ substantially in their emotional responses to negative
3 stimuli. Separate lines of research have reported that individual differences and mental
4 simulations contribute to emotional symptoms. Here, we explore the independent and
5 interrelated contribution of personality traits and counterfactual thoughts to the intensity,
6 duration, and overproduction of negative emotions. **Method.** A sample of mixed-level
7 athletes ($n = 243$) completed questionnaire assessments in relation to their most recent
8 unsuccessful competition. **Results.** We found that personality dimensions (extraversion,
9 neuroticism, and openness) relate to the direction and magnitude of person counterfactuals.
10 We also found that personality dimensions (neuroticism, extraversion, openness, and
11 agreeableness) and the direction of counterfactual thoughts (upward or downward) relate to
12 the intensity, duration, and/or overproduction of negative emotions. Lastly, we found that
13 personality and counterfactual thoughts had independent rather than interrelated contributions
14 to the experience of unpleasant emotions. **Conclusions.** These findings carry important
15 theoretical and practical implications with regard to identifying individuals susceptible to
16 experiencing elevated emotional symptoms in response to short-term stressors.
17
18 **Keywords:** mental simulation; negative emotion; five-factor model; emotional
19 overproduction

Personality, Counterfactual Thinking, and Negative Emotional Reactivity

1 **Personality, Counterfactual Thinking, and Negative Emotional Reactivity**
2 People differ substantially in the degree to which they develop negative emotional symptoms
3 in response to stressful conditions. For example, following an argument with a colleague, or
4 an unsuccessful competition, some people will experience elevated symptoms of anger or
5 embarrassment while others will show no meaningful changes or even reductions in negative
6 emotions (Osinsky, Lösch, Hennig, Alexander, & MacLeod, 2012). In cases of elevated
7 emotional symptoms people are more susceptible to a variety of adverse mental and physical
8 health outcomes. In particular, emotional stressors can trigger pathophysiological effects
9 including cardiac electrical instability, myocardial ischemia, and in extreme cases can have
10 severe health consequences such as increased myocardial infarction, stroke rate, and
11 mortality (Schwartz et al., 2012; Steptoe & Brydon, 2009). Given the negative correlates and
12 consequences of heightened emotional reactivity, it is important to identify factors that
13 contribute to emotional symptoms. Here, we explore the independent and interrelated
14 contribution of personality traits and counterfactual thoughts to the intensity, duration, and
15 overproduction of negative emotions.

Personality and Acute Emotional Reactivity

17 Over the past two decades researchers have uncovered a great deal of information
18 about the heritability, temporal stability, and structure of human personality. Most
19 researchers now accept that there are five basic dimensions to the structure of personality
20 (John, Naumann, & Soto, 2008). The five dimensions are extraversion, neuroticism,
21 openness, agreeableness, and conscientiousness. Extraversion assesses the quantity and
22 intensity of interpersonal interactions, neuroticism assesses susceptibility to emotional
23 instability, openness assesses the tendency to seek out new and exciting experiences,
24 agreeableness assesses concern for cooperation and social harmony, and conscientiousness
25 assesses organisation and goal-directed behaviour (McCrae & Costa, 2008). These five

1 dimensions predict a variety of health, leisure, and performance outcomes (Ozer & Benet-
2 Martínez, 2006).

3 Multiple lines of research demonstrate that components of personality align with the
4 temperament of positive and negative emotionality (Hampson, 2012). For example, Costa
5 and McCrae (1980) observed that people with low levels of neuroticism and high levels of
6 extraversion are happier than people with high levels of neuroticism and low levels of
7 extraversion. Comprehensive meta-analyses have since demonstrated that all five dimensions
8 of personality are associated with emotional temperament (DeNeve & Cooper, 1998; Steel,
9 Schmidt, & Shultz, 2008). In particular, positive emotionality (a combination of positive
10 affect, happiness and life satisfaction) is negatively correlated with neuroticism, and
11 positively correlated with extraversion, openness, and conscientiousness. Negative
12 emotionality, on the other hand, is positively correlated with neuroticism, and negatively
13 correlated with extraversion, agreeableness, and conscientiousness. In addition to association
14 studies of person temperaments, researchers have also explored the role of personality in
15 emotional reactivity to situational outcomes. Studies have shown that individuals with high
16 levels of extraversion react to positive situations with greater positive emotional responses
17 and individuals with high levels of neuroticism react to negative situations with greater
18 negative emotional responses (see, for example, Howell & Rodzon, 2011; Lucas & Baird,
19 2004).

20 Evidence for a link between personality and emotional reactivity is also available
21 from studies documenting cardiovascular responses to stress. People classified as having
22 Type D personality characteristics (the combination of negative affectivity and social
23 inhibition) show greater cardiac output (Nyklíček, Vorselaars, & Denollet, 2011), blood
24 pressure reactivity (Habra, Linden, Anderson, & Weinberg, 2003), and heart rate reactivity
25 (Martin et al., 2010) during experimentally induced stress. Further, people with high levels

1 of neuroticism or low levels of extraversion show greater cardiac output, blood pressure
2 reactivity, and heart rate reactivity when faced with mental or emotional stressors (Hughes,
3 Howard, James, & Higgins, 2011; Jonassaint et al., 2009). These findings suggest that people
4 with particular personality characteristics are more susceptible to experience stress in
5 response to difficult or challenging environmental circumstances.

6 The research findings linking neuroticism and extraversion to emotional reactivity
7 are robust (Canli, 2004). However, the structure of these relationships is open to further
8 investigation. It is possible that people with particular personality characteristics are more
9 susceptible to experience particular emotions (in response to negative outcomes) irrespective
10 of situation specific thought processes. Indeed, emotional temperament is a central feature of
11 both extraversion and neuroticism (McCrae & Costa, 2008) and the most common observed
12 characteristic of negative emotionality is a greater sensitivity to negative events (Hampson,
13 2012). In this instance, we can expect the same dimensions of personality that predict
14 emotional temperament to predict situational emotional reactivity. On the other hand, people
15 with particular personality characteristics may respond to outcomes with greater emotional
16 reactivity because they engage in cognitive biases in the processing of emotional stimuli
17 (Canli, 2004). Thus, individual differences in emotional reactivity could be due to
18 personality contributions to other (cognitive) processes that influence emotions. This is
19 possible given that personality can affect the way people think about and respond to negative
20 outcomes.

21 **Personality and Counterfactual Thinking**

22 Following negative outcomes it is not uncommon for people to reflect on how things
23 could have been different. Counterfactual thoughts (as they are known) are mental
24 representations of alternatives to past events, actions, or states (Byrne, 2007; Roese, 1997).
25 They can involve thoughts about how things could have gone better (upward counterfactual

1 thinking) or thoughts about how things could have gone worse (downward counterfactual
2 thinking). Counterfactual thoughts may also be understood with respect to their *content*,
3 *structure*, and *object of reference*. Counterfactual thoughts can add elements to a situation
4 (additive), remove elements from a situation (subtractive), or replace elements with different
5 elements (substitutional); counterfactual thoughts can also focus on actions taken by oneself
6 (self-referent), actions taken by others (other-referent), or actions taken by nobody (non-
7 referent). Counterfactual reasoning develops early in childhood (around age 2), is common
8 across nations and cultures, and may be an essential property of human intelligence (Epstude
9 & Roese, 2008). It has been established that people tend to imagine alternatives to actions
10 rather than inactions, events within their control rather than beyond their control, and socially
11 unacceptable events rather than socially acceptable events (Byrne, 2007). Critically,
12 counterfactual thoughts are more common following negative events (than positive events)
13 and tend to focus on how things could have gone better (Epstude & Roese, 2008).

14 The functions that mental simulations might serve suggest several ways that people
15 might differ in their tendency to engage in counterfactual thinking. Counterfactual thoughts
16 are deeply connected to goals and emotions (Epstude & Roese, 2008; Roese, 1997) and
17 personality characteristics that correspond to these functions are likely to have an important
18 role in counterfactual generation. In particular, traits such as optimism and self-esteem are
19 routinely identified as key psychological characteristics of mental simulations over time
20 (Kasimatis & Wells, 1995; Sanna, Carter, & Small, 2006). There is evidence that people with
21 high self-esteem or greater levels of optimism tend to generate more downward
22 counterfactuals, and people with low self-esteem or greater levels of pessimism tend to
23 generate more upward counterfactuals (Roese & Olson, 1993; Sanna, 1996). In addition to
24 optimism and self-esteem effects, other components of personality such as impulsivity
25 (Schmidt & Van der Linden, 2009), depressive symptoms (Markman & Miller, 2006), and

1 perfectionism (Sirois, Monforton, & Simpson, 2010) have each been linked to the direction,
2 magnitude and/or content of counterfactual thoughts. Specifically, more impulsive persons
3 (greater levels of urgency) show a greater occurrence of counterfactual generation,
4 individuals with more severe depressive symptoms show a greater occurrence of upward
5 counterfactuals (in addition to more uncontrollable and less reasonable counterfactuals), and
6 maladaptive perfectionists show a greater occurrence of upward counterfactuals (in addition
7 to more controllable, subtractive and less specific counterfactuals).

8 The available data suggest that components of personality have an important role in
9 mental simulations. However, the exclusive focus on narrow traits makes it difficult to
10 ascertain the overall contribution of cardinal traits to counterfactual thoughts. Sanna (2000)
11 proposed that in addition to narrow traits such as optimism and self-esteem, broad traits that
12 correspond to the experience of positive and negative emotions could also have an important
13 role in counterfactual generation. Since all five dimensions of personality have demonstrated
14 an affective component (Steel et al., 2008) we might expect all five dimensions (and
15 extraversion and neuroticism in particular) to have a role in counterfactual thinking.
16 However, as far as we know, broad dimensions of personality have never been considered in
17 this regard.

18 **Counterfactual Thinking and Acute Emotional Reactivity**

19 Mental simulations are central to human thinking and emotion (Epstude & Roese,
20 2008). Not only do negative emotions trigger the activation of counterfactual thoughts
21 (Roese, 1997), but counterfactual thoughts can amplify emotional responses to positive and
22 negative outcomes (Kahneman & Miller, 1986; Roese, 1997). This has been demonstrated in
23 several research investigations. For example, in a study of the 1992 Summer Olympics,
24 bronze medallists were rated as displaying greater levels of satisfaction than silver medallists
25 (Medvec, Madey, & Gilovich, 1995). The authors report that bronze medallists tend to be

1 happier because the most compelling counterfactual alternative for the silver medal is
2 winning the gold, whereas for the bronze medal the most compelling counterfactual is
3 finishing without a medal. That is, silver medallists were experiencing upward
4 counterfactuals whereas bronze medallists were experiencing downward counterfactuals.

5 Both norm theory (Kahneman & Miller, 1986) and the functional model of
6 counterfactual thinking (Roese, 1997) propose that emotional responses are contrasted away
7 from the direction of the counterfactual – upward counterfactuals amplify negative emotional
8 responses and downward counterfactuals amplify positive (or reduce negative) emotional
9 responses. This proposal has been confirmed in studies of person satisfaction (Markman,
10 Gavanski, Sherman, & McMullen, 1993; Medvec et al., 1995), but the relationship between
11 counterfactual thoughts and other discrete emotions is less straightforward. Mandel (2003)
12 observed that upward counterfactual thinking amplifies negative emotions (guilt, shame,
13 regret, disappointment and sadness), but downward counterfactual thinking was unrelated to
14 emotional responses. The study also showed that *self-focused* upward counterfactuals were
15 related to self-conscious negative emotions (e.g., shame, guilt) but were unrelated to social
16 negative emotions (e.g., anger, frustration). Similar findings have been reported in other
17 studies of emotion and counterfactual thoughts (e.g., Dray & Uphill, 2009; Mandel & Dhami,
18 2005). In short, although upward counterfactuals will, in general, amplify negative affect,
19 relationships with discrete emotions can vary.

20 Of particular relevance to the current study is the role of personality in the activation
21 of counterfactual thinking and negative emotions. There is some evidence that personality
22 and counterfactual thoughts contribute to emotional symptoms in an interrelated manner.
23 Sanna (2000) proposed that people with particular personality characteristics engage in
24 counterfactual reasoning in a direct attempt to regulate/repair negative emotions and moods.
25 In particular, people with high levels of self-esteem (or greater levels of optimism) regulate

1 negative emotions by thinking about how outcomes could have been worse (downward
2 counterfactuals), whereas persons with low self-esteem tend to amplify negative emotions by
3 thinking about how outcomes could have gone better. This is because persons with high self-
4 esteem are governed by acquisitive motives, whereas persons with low self-esteem are
5 governed by self-protective motives (Kasimatis & Wells, 1995; Sanna et al., 2006). Thus,
6 counterfactual thoughts should mediate the relationship between personality and situational
7 emotional reactivity.

8 Although this represents one possible interconnection among study variables, a
9 somewhat different hypothesis was put forward in the research by Roese (1994). This article
10 proposed that the magnitude of the relationship between counterfactual thoughts and negative
11 emotions may be contingent on the personality of the individual. In particular, traits such as
12 self-esteem are proposed to moderate counterfactual thinking effects on emotions in such a
13 way that persons with greater self-esteem experience more positive emotions in response to
14 downward counterfactuals, and experience more negative emotions in response to upward
15 counterfactuals (Roese, 1994). Although the specific mechanism behind this effect was not
16 discussed, it is presumed that people with particular personality characteristics are more
17 capable of regulating their emotional responses to the counterfactual thoughts that are typical
18 of all persons. Thus, personality and counterfactual thoughts may interactively predict
19 emotional symptoms.

20 **The Current Study**

21 The current research sought to build on the evidence reviewed in a number of ways.
22 First, studies of emotional temperament show that all five dimensions of personality are
23 connected to positive and negative emotionality (Steel et al., 2008). However, studies of
24 acute emotional reactivity have centred exclusively on extraversion and neuroticism
25 components (e.g., Howell & Rodzon, 2011). If emotional temperament causes people to

1 respond to particular situations with greater emotional reactivity (Hampson, 2012) than the
2 same dimensions that predict emotional temperament should also predict acute emotional
3 responses. In this study, we build on the research that has explored extraversion and
4 neuroticism contributions to emotional symptoms by considering a greater number of
5 personality dimensions.

6 Second, emotion research has tended to focus on the intensity of emotional symptoms,
7 but has rarely considered how other facets of emotion might be connected to personality or
8 mental simulations. Research has shown that people differ substantially not only in the
9 intensity of their emotional symptoms but also in the number of unpleasant emotions
10 generated (termed ‘emotional overproduction’) (Hervas & Vazquez, 2011) and the duration
11 of such emotions (Revelle & Scherer, 2010). There are good reasons to expect personality to
12 predict emotion duration and overproduction, in addition to emotion intensity, based on the
13 conceptual definitions provided for personality components. For example, people with
14 greater levels of neuroticism “tend to be *emotionally over-responsive* and have *difficulties in*
15 *returning to a normal state* after emotional experiences” (Eysenck & Eysenck, 1968, p. 6,
16 emphasis added). Therefore, individual differences in emotional reactivity may be observed
17 more clearly in the duration of emotions (or the overproduction of emotions) rather than in
18 their immediate magnitude. The present study explores the contribution of personality traits
19 and counterfactual thoughts to the intensity, duration, and overproduction of negative
20 emotions.

21 A further objective was to explore how broad dimensions of personality relate to the
22 direction and magnitude of counterfactual thoughts. Current research has demonstrated that
23 narrow facets of personality such as self-esteem (Roese & Olson, 1993), optimism (Sanna,
24 1996), and perfectionism (Sirois et al., 2010) predict the content, direction, and/or magnitude
25 of counterfactual thoughts. However, any component of personality that relates to the

1 functions of person counterfactuals (i.e., goals and emotions) is presumed to be important for
2 counterfactual thinking (Kasimatis & Wells, 1995; Sanna, 2000). Because broad dimensions
3 of personality have demonstrated important associations with negative emotions (Steel et al.,
4 2008), these dimensions might predict the counterfactual simulations that people fashion in
5 response to negative outcomes.

6 In short, separate lines of research have demonstrated that both personality and
7 counterfactual thoughts contribute to elevated emotional symptoms. However, it remains
8 unclear whether these two factors are having independent effects or whether personality and
9 counterfactual thoughts are making their contributions in an interrelated manner. Personality
10 and counterfactual thoughts could be expected to influence emotions in one of three ways.
11 First, personality and counterfactual thoughts could have separate and independent effects on
12 emotional responses. Indeed, emotional temperament is a central component of human
13 personality (McCrae & Costa, 2008) and this temperament may directly cause some
14 individuals to respond to particular situations with greater emotional reactivity (Howell &
15 Rodzon, 2011). A second possibility is that personality exerts its influence on emotional
16 symptoms partly through its impact on counterfactual thinking. Components of personality
17 are proposed to contribute to the direction and magnitude of counterfactual thoughts (Sanna
18 et al., 2006) and many studies have demonstrated that counterfactual thoughts contribute to
19 elevated emotional symptoms (e.g., Mandel, 2003). Thus, the relationship between
20 personality and emotional reactivity may be mediated by counterfactual thoughts. A third
21 possibility is that personality and counterfactual thoughts interactively predict emotional
22 responses. Indeed, persons with particular personality characteristics are hypothesised to
23 show greater emotional responses to particular types of counterfactual thoughts (Roese,
24 1994). The present research sought to test empirically each of these possibilities.

1 To summarise, we have a limited knowledge of the relation between personality,
2 counterfactual thinking, and acute emotional reactivity. Research has demonstrated that
3 components of personality can predict counterfactual thoughts (Sanna et al., 2006) and that
4 counterfactual thoughts can predict the magnitude of (some) negative emotional symptoms
5 (Mandel & Dhimi, 2005). In this study we shift the focus from narrow personality traits to
6 broad personality dimensions, move beyond the exclusive focus on emotion intensity to
7 consider a more rounded selection of emotion facets, explore personality and counterfactual
8 interactions that might better predict emotional responses (Roese, 1994), and consider
9 personality, emotions, and counterfactual thoughts concurrently in a mediation model (Sanna
10 et al., 2006). These relationships were explored in a sample of currently competing mixed-
11 level athletes. Competitive sport is an ideal sample to explore emotional reactivity and
12 counterfactual thoughts, as athletes typically form strong identities with their teams, mental
13 simulations and emotional symptoms are common, success and failure can be easily
14 determined, and the outcomes are meaningful to the individuals involved.

15 Method

16 Participants

17 Participants were 242 athletes (78 women, 164 men) competing in 36 different sports
18 (mean age = 20.98 ± 2.92 years). The participants had an average of $10.03 (\pm 4.31)$ years
19 experience in their sport and had competed at club ($n = 158$), regional ($n = 43$), national ($n =$
20 19), and international ($n = 8$) levels.

21 Measures

22 **Personality.** Personality was assessed using the *NEO Five Factor Inventory* (NEO-
23 FFI; Costa & McCrae, 1992). This 60-item self-report measure assesses five personality
24 dimensions of neuroticism ($\alpha = .82$), extraversion ($\alpha = .77$), openness ($\alpha = .57$), agreeableness
25 ($\alpha = .67$), and conscientiousness ($\alpha = .80$). For each question participants are required to

1 indicate, on a five point scale (*strongly disagree, disagree, neutral, agree, strongly agree*),
2 whether each statement is true of them. The NEO-FFI is psychometrically sound and has
3 been applied in a wide variety of populations and cultures (John et al., 2008).

4 **Counterfactual thinking.** Two measures of athlete counterfactuals were taken – a
5 state measure and a trait measure. Competition-specific (state) counterfactual thinking was
6 assessed using two single item measures: “after the competition I thought about how much
7 *worse* things could have been” (downward counterfactuals) and “after the competition I
8 thought about how much *better* things could have been” (upward counterfactuals). Both
9 items were assessed on a five-point scale (*not at all, a little, somewhat, quite a bit, very*
10 *much*) and were counterbalanced across participants. General (trait) counterfactual thoughts
11 were assessed using the sixteen-item *Counterfactual Thinking for Negative Events Scale*
12 (CTNES; Rye, Cahoon, Ali, & Daftary, 2008). The stem of the questionnaire was modified
13 to reflect counterfactual thinking occurring in sport competitions only:

14 “Take a few moments to vividly recall your experiences of negative outcomes in sport
15 and what it was like for you. Now think about the types of thoughts you experienced
16 following those undesirable outcomes. Using the following scale, rate the frequency
17 with which you experienced the thoughts described below”.

18 The sixteen items are assessed on a five-point scale (*never, rarely, sometimes, often, very*
19 *often*) and assess four dimensions of counterfactual thought: non-referent downward (e.g., “I
20 think about how much worse things could have been”, $\alpha = .79$), other-referent upward (e.g.,
21 “If only another person had not been so selfish, this could have been avoided I think”, $\alpha =$
22 $.84$), self-referent upward (e.g., “I think about how much better things would have been if I
23 had acted differently”, $\alpha = .58$), and non-referent upward (e.g., “I think about how much
24 better things could have been”, $\alpha = .67$).

25

1 **Emotions.** Emotions were assessed using a measure derived specifically for this
2 study. Single-items were used to assess six negative emotional responses: anger, frustration,
3 disappointment, dejection, shame, and embarrassment. These emotions were chosen as they
4 have been identified as relevant to counterfactual thoughts (see, for example, Mandel, 2003).
5 Participants responded to each emotion with a “yes/no” occurrence response – a greater
6 number of “yes” responses indicative of greater *emotional overproduction*. Responses to
7 “yes” items were also rated on a 3-point scale for *emotion intensity* (low, medium, high) and
8 a 3-point scale for *emotion duration* (minutes, hours, days). Where participants responded
9 with “no” (indicating that they did not experience the emotion) they were given a score of 0
10 for both emotional intensity and emotional duration. Thus, emotion intensity and duration
11 were classified on a 4-point scale and emotional overproduction on a 6-point scale.

12 **Procedure**

13 Ethical approval for the study was granted by a university research ethics committee.
14 Data were collected using a cross-sectional recall design. A recall design was used in
15 preference to experimental methods given the difficulties in generating high intensity
16 emotions and meaningful counterfactuals in unfamiliar laboratory tasks. This assessment
17 method also allowed us to collect data on emotion duration in addition to emotion intensity.
18 Prior to completing questionnaires all participants provided informed consent and were
19 informed that all answers provided would remain anonymous. The athletes were first asked
20 to recall their most recent negative (unsuccessful) competition and to write down two or three
21 sentences detailing the event. This was done to facilitate task engagement and recollection of
22 the competition. Participants then completed the two single-item measures of state
23 counterfactuals (the order of which were counterbalanced across participants) and the
24 measure of emotion (intensity, duration, and overproduction) in relation to the negative event
25 they had described. This was followed by the personality assessment and the trait measure of

1 counterfactual thinking. The questionnaires were completed where no observable
2 distractions were present and participants did not receive any compensation for taking part in
3 the study.

4 **Data Transformation and Analysis**

5 For coherence, data on discrete emotions were combined to create two single *emotion*
6 *intensity* and *emotion duration* scores. Main analyses were run on the combined scores and
7 are presented in the manuscript. In addition, we also explored data on discrete emotions
8 (anger, frustration, disappointment, dejection, shame, and embarrassment) and findings are
9 reported in the supplementary file available for download.

10 Tests of association (correlation and regression) were used to explore
11 interrelationships between study variables. All associations were checked for linearity and
12 homoscedasticity by visual inspection of standard scatterplots. Collinearity diagnostics were
13 also computed to ensure the regression analyses were not affected by high correlations
14 between predictor variables. In all cases, the data appeared linear and homoscedastic with
15 variance inflation factors (and associated tolerance values) within acceptable ranges. The
16 data were also checked for multivariate outliers using Cook's distance. A case was
17 considered a potential outlier if the Cook's distance value was markedly higher than the rest
18 of the cases. Data were explored both with and excluding outliers (a sensitivity analysis) to
19 check on the robustness of results. In most cases the data remained unchanged.
20 Nevertheless, we report our findings both with and excluding outliers.

21 **Results**

22 Table 1 provides descriptive data and correlations among study variables. Consistent
23 with past observations, mean scores on extraversion appeared higher, and conscientiousness
24 somewhat lower, than what is typically observed in normative (non-athletic) populations
25 (Allen, Greenlees, & Jones, 2013). Also consistent with past observations (Roese, 1997)

1 participants reported a greater occurrence of upward counterfactual thoughts ($M = 4.25$, $SD =$
2 1.02) than downward counterfactual thoughts ($M = 2.07$, $SD = 1.07$), $t(240) = 20.40$, $p < .01$,
3 $d = 2.09$.

4 **Personality and Counterfactual Thinking**

5 To explore the contribution of personality to counterfactual thoughts, dimensions of
6 personality were regressed on state and trait dimensions of person counterfactuals. For state
7 measures, there was a significant effect for extraversion ($\beta = .18$, $p < .01$) on upward
8 counterfactuals ($R^2 = .05$, $p < .05$), and for extraversion ($\beta = .16$, $p < .05$) and neuroticism (β
9 $= .20$, $p < .01$) on downward counterfactuals ($R^2 = .06$, $p < .05$). The positive regression
10 coefficients indicate that greater levels of emotional instability were linked to a greater
11 occurrence of thoughts about how things could have gone worse, and greater levels of
12 extraversion were linked to a greater occurrence of thoughts about how things could have
13 gone better or worse. A sensitivity analysis, involving the removal of two and five potential
14 outliers (Cook's values $> .05$) produced a similar pattern of results.

15 For trait measures, there was a significant effect for openness ($\beta = -.26$, $p < .01$) on
16 other-referent upward counterfactuals ($R^2 = .09$, $p < .01$), for openness ($\beta = -.21$, $p < .01$) and
17 neuroticism ($\beta = .20$, $p < .01$) on self-referent upward counterfactuals ($R^2 = .11$, $p < .01$), and
18 for openness ($\beta = -.14$, $p < .05$) and neuroticism ($\beta = .24$, $p < .01$) on non-referent upward
19 counterfactuals ($R^2 = .08$, $p < .01$). The removal of two potential outliers (Cook's values $>$
20 $.05$) also showed a significant effect for conscientiousness ($\beta = -.15$, $p < .05$) on self-referent
21 upward counterfactuals, with openness and neuroticism effects remaining unchanged. The
22 direction of the regression coefficients indicate that greater levels of emotional instability and
23 lower levels of openness were linked to a greater occurrence of thoughts about how others,
24 personal factors, and situational factors could have improved outcomes. Lower levels of

1 conscientiousness also linked to a greater occurrence of thoughts about how personal factors
2 could have improved outcomes when multivariate outliers were removed from the data set.

3 **Personality and Emotions**

4 Similar regression models were used to explore the contribution of personality traits
5 to emotion facets. When dimensions of personality were entered simultaneously, the overall
6 regression models were significant for emotion intensity ($R^2 = .07, p < .01$), emotion
7 overproduction ($R^2 = .06, p < .05$), but not emotion duration ($R^2 = .05, p = .076$). However,
8 observation of individual regression coefficients showed a significant effect for openness on
9 emotion intensity only ($\beta = -.15, p < .05$). Sensitivity analyses produced a similar pattern of
10 results. When explored independently, neuroticism correlated positively with emotion
11 intensity ($r = .15, p < .05$), duration ($r = .15, p < .05$), and overproduction ($r = .18, p < .01$);
12 extraversion correlated negatively with emotion intensity ($r = -.14, p < .05$), duration ($r = -$
13 $.14, p < .05$), and overproduction ($r = -.15, p < .05$); and openness ($r = -.17, p < .05$) and
14 agreeableness ($r = -.14, p < .05$) correlated negatively with emotion intensity (Table 1).

15 **Emotions and Counterfactual Thinking**

16 To explore the contribution of counterfactual thinking to athlete emotions, state and
17 trait counterfactuals were regressed (in independent analyses) on emotion facets. For state
18 measures, there was a significant effect for both upward ($\beta = .19, p < .01$) and downward ($\beta =$
19 $-.14, p < .05$) counterfactuals on emotion intensity ($R^2 = .07, p < .01$), for downward
20 counterfactuals ($\beta = -.15, p < .05$) on emotion duration ($R^2 = .05, p < .01$), and for upward
21 counterfactuals ($\beta = .15, p < .05$) on emotion overproduction ($R^2 = .02, p = .096$). The
22 removal of three potential outliers (Cook's values $> .05$) showed significant effects for both
23 upward ($\beta = .18, p < .01$) and downward ($\beta = -.18, p < .01$) counterfactuals on emotion
24 duration ($R^2 = .08, p < .01$). The removal of two potential outliers (Cook's values $> .05$) for

1 emotion overproduction produced a similar pattern of results, but also produced a significant
 2 overall regression model ($R^2 = .04, p < .05$).

3 For trait measures, there was a significant effect for both non-referent downward ($\beta =$
 4 $-.13, p < .05$) and non-referent upward ($\beta = .34, p < .01$) counterfactuals on emotion intensity
 5 ($R^2 = .23, p < .01$); for non-referent downward ($\beta = -.18, p < .01$), self-referent upward ($\beta =$
 6 $.16, p < .05$) and non-referent upward ($\beta = .27, p < .01$) on emotion duration ($R^2 = .19, p <$
 7 $.01$); and for self-referent upward ($\beta = .22, p < .01$) and non-referent upward ($\beta = .17, p < .05$)
 8 on emotion overproduction ($R^2 = .14, p < .01$). These data patterns indicate that people who
 9 more frequently have thoughts about how personal or situational factors could have improved
 10 outcomes (and less frequently have thoughts about how situational factors could have
 11 worsened outcomes) reported more intense, longer duration, and an overproduction of
 12 negative emotions. The removal of one potential outlier in each analysis produced a similar
 13 pattern of results.

14 **Moderation**

15 To explore potential moderating effects, we computed interaction terms from
 16 standardised data (main effects) and variables were entered into regression models in
 17 sequential steps. Emotions (intensity, duration, and overproduction) were regressed on
 18 upward (state) counterfactual thoughts (Step 1), the five personality dimensions (Step 2), and
 19 the product of these terms (Step 3). For emotion intensity, significant effects were observed
 20 at Step 1 ($R^2 = .05, p < .01$) for upward counterfactuals ($\beta = .23, p < .01$) and at Step 2 ($\Delta R^2 =$
 21 $.08, p < .01$) for extraversion ($\beta = -.14, p < .05$) and openness ($\beta = -.13, p < .05$) with no
 22 significant interaction effects at Step 3 ($\Delta R^2 = .02, p = .49$). For emotion duration, significant
 23 effects were again observed at Step 1 ($R^2 = .03, p < .05$) and at Step 2 ($\Delta R^2 = .05, p < .05$)
 24 with no significant interaction effects at Step 3 ($\Delta R^2 = .01, p = .70$). For emotion
 25 overproduction, significant effects were observed at Step 1 ($R^2 = .02, p < .05$) and at Step 2

1 ($\Delta R^2 = .06, p < .05$) with no significant interaction effects at Step 3 ($\Delta R^2 = .01, p = .72$).
 2 Sensitivity analyses, involving the removal of one, two and two cases respectively (Cook's
 3 values $> .05$) produced a similar pattern of results.

4 These analyses were then re-run with downward (state) counterfactuals in place of
 5 upward counterfactuals. For emotion intensity, significant effects were observed at Step 1
 6 ($R^2 = .04, p < .01$) for downward counterfactuals ($\beta = -.19, p < .01$) and at Step 2 ($\Delta R^2 = .08,$
 7 $p < .01$) for openness ($\beta = -.16, p < .05$) with no significant interaction effects at Step 3 (ΔR^2
 8 $= .01, p = .70$). For emotion duration, significant effects were observed at Step 1 ($R^2 = .03, p$
 9 $< .01$) for downward counterfactuals ($\beta = -.19, p < .01$) and at Step 2 ($\Delta R^2 = .05, p < .05$) for
 10 neuroticism ($\beta = .14, p < .05$) with no significant interaction effects at Step 3 ($\Delta R^2 = .02, p =$
 11 $.44$). For emotion overproduction, a significant effect was shown at Step 2 ($\Delta R^2 = .06, p <$
 12 $.05$) for neuroticism ($\beta = .15, p < .05$), with no significant effects at Step 1 ($R^2 = .00, p = .52$)
 13 or Step 3 ($\Delta R^2 = .01, p = .72$). Sensitivity analyses, involving the removal of zero, four and
 14 four cases respectively (Cook's values $> .05$) produced a similar pattern of results. Taken
 15 together, these findings show that the relationship between counterfactual thoughts and
 16 emotions is not moderated by personality traits.

17 **Mediation**

18 Potential mediating effects were explored for personality dimensions that correlated
 19 with both state counterfactuals and emotions. Only extraversion and neuroticism dimensions
 20 satisfied these criteria. A significant correlation was observed between extraversion and
 21 emotion intensity ($\beta = -.14, p < .05$) and between extraversion and upward counterfactuals (β
 22 $= .21, p < .01$). In a regression model with emotion intensity set as the criterion variable and
 23 upward counterfactuals entered at Step 1 and extraversion at Step 2, we found that upward
 24 counterfactuals (the mediator) correlated with emotion intensity ($\beta = .23, p < .01$) and
 25 remained significant with the inclusion of extraversion ($\beta = .26, p < .01$). However, in this

1 last step the relationship between extraversion and emotion intensity remained unchanged (β
2 = $-.19, p < .01$) indicating no significant mediation effect. When the analysis was re-run for
3 emotion duration and emotion overproduction a similar pattern of results was observed (no
4 significant mediation effect).

5 For downward (state) counterfactuals, significant correlations were observed for both
6 extraversion ($\beta = .13, p < .05$) and neuroticism ($\beta = .15, p < .05$). In a regression model with
7 emotion intensity set as the criterion variable and downward counterfactuals entered at Step 1
8 and extraversion at Step 2, we found that downward counterfactuals (the mediator) correlated
9 with emotion intensity ($\beta = .19, p < .01$) and remained significant with the inclusion of
10 extraversion ($\beta = .18, p < .01$). In this last step the relationship between extraversion and
11 emotion intensity remained unchanged ($\beta = .12, p = .06$) indicating no significant mediation
12 effect. In a similar model, with neuroticism included in place of extraversion, we found that
13 downward counterfactuals correlated with emotion intensity ($\beta = -.19, p < .01$) and remained
14 significant with the inclusion of neuroticism ($\beta = -.22, p < .01$). In this last step the
15 relationship between neuroticism and emotion intensity remained unchanged ($\beta = .18, p <$
16 $.01$) indicating no significant mediation effect. When these analyses were re-run for emotion
17 duration and emotion overproduction a similar pattern of results was observed. Taken
18 together, these findings show that the relationship between personality traits and emotional
19 reactivity is not mediated by counterfactual thinking.

20 **Discussion**

21 This study sought to explore the interrelationships between personality, counterfactual
22 thinking, and negative emotional reactivity. As predicted by Sanna et al. (2006), broad
23 dimensions of personality were connected to person counterfactuals. In particular, openness
24 related negatively to (other-referent, self-referent and non-referent) upward counterfactuals,
25 and neuroticism related positively to (self-referent and non-referent) upward counterfactuals.

1 Further, neuroticism correlated positively, and other dimensions negatively, to the intensity,
2 duration, and/or overproduction of negative emotions. Consistent with predictions outlined
3 in norm theory (Kahneman & Miller, 1986) and the functional model of counterfactual
4 thinking (Roese, 1997), the direction of person counterfactuals were contrasted away from
5 the intensity, duration, and overproduction of negative emotions. Interestingly, the shared
6 variance between personality and emotional reactivity was not explained by counterfactual
7 thoughts (no mediation effects), nor were counterfactual thoughts connected to emotional
8 reactivity exclusively for people with particular personality characteristics (no moderation
9 effects). This suggests that personality and counterfactual thoughts have direct and
10 independent contributions to negative emotional symptoms.

11 These findings appear to support the contention that emotional temperament is a
12 central component of personality that directly causes some individuals to respond to
13 particular situations with greater emotional reactivity (Howell & Rodzon, 2011). To date,
14 researchers have focused almost exclusively on extraversion and neuroticism components
15 when exploring personality contributions to emotional reactivity (rather than emotional
16 temperament) and although larger effects were generally shown on these dimensions, our
17 study identifies openness and agreeableness as important contributors to the experience of
18 unpleasant emotions. Interestingly, when we explored our data further (see supplementary
19 material) there was a suggestion that different dimensions of personality are important for
20 different negative emotions. In short, our findings suggest that people who are more
21 introverted, disagreeable, emotionally unstable, and/or less open to new experiences tend to
22 respond to negative outcomes with a greater number of negative emotions that are more
23 intense and of a longer duration.

24 Sanna and colleagues (2006) proposed that broad dimensions of personality that
25 correspond to the experience of pleasant and unpleasant emotions are likely to be important

1 for counterfactual thoughts. Our study findings support this prediction and show that
2 extraversion, neuroticism and openness relate to the direction and magnitude of person
3 counterfactuals. In particular, people with greater levels of emotional instability reported a
4 greater occurrence of thoughts about how the competition could have gone worse, and people
5 with greater levels of extraversion reported a greater occurrence of thoughts about how the
6 competition could have gone better or worse. The tendency for extraverted persons to report
7 a greater number of upward *and* downward counterfactuals indicate that such persons are
8 more likely to generate mental simulations but not in any one particular direction. In
9 addition, people with greater levels of openness and/or emotional stability reported a general
10 tendency to experience fewer counterfactual thoughts about how others, personal factors, or
11 situational factors could have improved outcomes. These findings highlight the value of
12 using broad trait dimensions to predict the occurrence and direction of counterfactual
13 thoughts.

14 Reported counterfactual thoughts were also connected to the experience of unpleasant
15 emotions. Similar to data patterns observed in other studies (e.g., Dray & Uphill, 2009),
16 upward counterfactuals were connected to the experience of high intensity negative emotions,
17 and downward counterfactuals were connected to the experience of low intensity negative
18 emotions. Our findings also demonstrate that counterfactual thoughts are important for the
19 duration and overproduction of negative emotions. When people experience thoughts about
20 how outcomes could have gone better they tend to experience a greater number of unpleasant
21 emotions that persist for a longer period of time. On the other hand, when people experience
22 thoughts about how outcomes could have been worse they tend to experience less intense
23 emotions and for a shorter period of time. These findings should be considered a general
24 connection between counterfactual thoughts and negative affect, and it is likely that different
25 types of counterfactual thoughts permeate different types of negative emotions. Indeed,

1 Mandel (2003) reported that counterfactual thoughts relate differently to self-conscious
2 emotions (e.g., embarrassment) than they do social emotions (e.g., anger), and these patterns
3 were generally observed in our own data set (see supplementary material file). The positive
4 and negative connections between counterfactual thoughts and negative emotions should
5 therefore be considered a general trend that might not necessarily hold true for all negative
6 emotions.

7 This study provides evidence for the independent contributions of personality traits
8 and counterfactual thoughts to acute emotional symptoms. However, there are a number of
9 methodological shortcomings that should be addressed in order to place the findings firmly in
10 context. First, we measured emotions using a scale derived exclusively for this study and
11 therefore the validity of this scale is unknown. Second, we did not include an assessment of
12 control over the outcome and it is possible that counterfactual thoughts relate differently to
13 emotions in controllable and uncontrollable settings (Markman & Miller, 2006). Third, the
14 use of currently competing athletes and their descriptions of real-world outcomes provide
15 ecological validity to study findings. However, the use of a non-experimental design means
16 that causality cannot be determined from the data. Although variables were entered into
17 regression models in a manner that comply with current psychological theorising, it is
18 possible that relationships are bidirectional, unidirectional, or even non-causal (see, for
19 example, Roese, 1997). Therefore a progressive recommendation is that future research
20 explores the independent and interrelated effects of personality traits and counterfactual
21 thoughts using longitudinal or experimental methods.

22 Despite these potential limitations, our findings may be of value to those working in
23 applied settings. When targeting the expression or suppression of various emotional
24 symptoms it might be worthwhile implementing cognitive restructuring techniques that focus
25 on changing the direction of person counterfactuals. In the context of professional sport, this

1 might involve the reassessment of personal goals or perceptions of outcome control (see
2 Grieve, Houston, Dupuis, & Eddy, 1999). Although there is no guarantee that this will cause
3 changes in emotional states (as our study did not address causality) the directionally
4 hypothesised relationships outlined in psychological theory (e.g., Roese, 1997; Sanna et al.,
5 2006) suggest this may be the case. Further, our findings suggest that such emotional control
6 interventions would be appropriate for persons of all personality types. This is because the
7 relationships between counterfactual thoughts and emotions were unaffected by personality
8 traits. To conclude, this study provides evidence that the emotions athletes experience in
9 response to counterfactual thoughts are largely independent of personality traits, but that both
10 personality traits and counterfactual thoughts are important for emotional symptoms.

11

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Table 1: Descriptive data and correlations for all measured variables

	<i>M</i>	<i>SD</i>	<i>Skew</i>	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
<i>Personality</i>																
1. Neuroticism	21.11	7.78	0.18	-												
2. Extraversion	31.66	5.77	-0.35	-.25**	-											
3. Openness	23.66	5.09	0.24	-.06	-.03	-										
4. Agreeableness	29.68	5.24	-0.23	-.16*	.29**	.07	-									
5. Conscientiousness	30.99	6.04	-0.06	-.24**	.17**	.03	.12	-								
<i>Counterfactual thoughts</i>																
6. Upward (state) counterfactuals	4.25	1.02	-1.59	-.07	.21**	-.07	.13	.05	-							
7. Downward (state) counterfactuals	2.07	1.07	0.81	.15*	.13*	-.04	.05	.05	-.26**	-						
8. Non-referent downward	10.31	3.10	0.20	.09	.08	-.03	.08	.03	-.03	.54**	-					
9. Other-referent upward	10.29	3.37	-0.08	.11	-.09	-.27**	-.11	-.05	.06	-.08	.03	-				
10. Self-referent upward	12.10	2.74	-0.19	.22**	-.04	-.22**	.00	-.16*	.23**	-.07	.10	.24**	-			
11. Non-referent upward	12.89	2.96	-0.12	.24**	-.03	-.16**	-.07	-.05	.36**	-.17**	-.03	.19**	.57**	-		
<i>Emotions</i>																
12. Emotion overproduction	4.09	1.23	-0.12	.18**	-.15*	-.08	-.09	-.11	.15*	-.04	-.04	.17*	.32**	.31**	-	
13. Emotion intensity	9.24	3.52	0.16	.15*	-.14*	-.17*	-.14*	-.11	.23**	-.19**	-.14*	.20**	.33**	.44**	.84**	-
14. Emotion duration	8.10	3.27	0.44	.15*	-.14*	-.09	-.11	-.07	.16*	-.19**	-.18**	.11	.30**	.38**	.77**	.82**

Note: Personality scores could range from zero to 48, state counterfactual scores could range from one to seven, trait counterfactual scores could range from four to 20, emotional

overproduction could range from zero to six, and emotion intensity and duration could range from zero to 24. * $p < .05$, ** $p < .01$ (two-tailed)