Personality, Counterfactual Thinking, and Negative Emotional Reactivity

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Abstract

Objectives. People differ substantially in their emotional responses to negative stimuli. Separate lines of research have reported that individual differences and mental simulations contribute to emotional symptoms. Here, we explore the independent and interrelated contribution of personality traits and counterfactual thoughts to the intensity, duration, and overproduction of negative emotions. **Method.** A sample of mixed-level athletes (n = 243) completed questionnaire assessments in relation to their most recent unsuccessful competition. **Results.** We found that personality dimensions (extraversion, neuroticism, and openness) relate to the direction and magnitude of person counterfactuals. We also found that personality dimensions (neuroticism, extraversion, openness, and agreeableness) and the direction of counterfactual thoughts (upward or downward) relate to the intensity, duration, and/or overproduction of negative emotions. Lastly, we found that personality and counterfactual thoughts had independent rather than interrelated contributions to the experience of unpleasant emotions. **Conclusions.** These findings carry important theoretical and practical implications with regard to identifying individuals susceptible to experiencing elevated emotional symptoms in response to short-term stressors.

Keywords: mental simulation; negative emotion; five-factor model; emotional overproduction

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

Personality and Acute Emotional Reactivity

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

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

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

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

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

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

Personality and Counterfactual Thinking

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

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

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

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

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

Counterfactual Thinking and Acute Emotional Reactivity

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

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

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

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

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

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

The Current Study

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

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

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

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

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

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

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

Method

Participants

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

Measures

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

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

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

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

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

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

Procedure

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

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

Data Transformation and Analysis

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

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

Results

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

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

Personality and Counterfactual Thinking

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

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

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

Personality and Emotions

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

Emotions and Counterfactual Thinking

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

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

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

Moderation

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

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

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

Mediation

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

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

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

Discussion

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

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

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

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

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

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

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

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

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

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

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Table 1: Descriptive data and correlations for all measured variables

	M	*SD*	*Skew*	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
Personality																
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	-								
Counterfactual thoughts																
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**	-		
Emotions																
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)