How does rejection induce social anxiety? A test of hurt feelings as a mechanism.

by

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Abstract

Research suggests that victims of negative social events such as bullying, criticism, and rejection develop the tendency to experience social anxiety. Two studies were conducted to examine hurt feelings as a potential mechanism underlying this relation. In Study 1, undergraduate participants were exposed to an artificial social situation in which they were either rejected (experimental condition) or included (control condition) by one group of peers, and exposed to a second situation with another group. Results showed that participants who were initially rejected reported higher anxiety before and during their second interaction and that this effect was fully mediated by hurt feelings from the initial interaction. In Study 2, all participants were initially rejected by one group of peers and were then exposed to a second situation with another group. Half of the participants were randomly assigned to ingest acetaminophen in order to alleviate rejection-induced hurt feelings, and half were assigned sugar placebo. The acetaminophen group reported lower anxiety before and during their second interaction, and approximately half of this effect could be attributed to hurt feelings reduction. In sum, results from both studies provided preliminary support for the hypothesis. Findings were discussed in the context of social pain literature and its potential clinical applications.

Preface

The thesis was based on work conducted in Professor Lynn Alden's laboratory at the UBC Department of Psychology. I was responsible for the study design, preparation, performance, and data analysis.

Preliminary results were presented as part of a symposium. Fung, K. (2014). Why Do Negative Social Events Cause Social Anxiety? Hurt Feelings as a Mechanism. Symposium Presentation. Canadian Psychological Association Annual Convention, Vancouver, BC.

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Introduction

Research suggests that negative social events are one factor that contributes to the development of social anxiety. Specifically, victims of events such as bullying, criticism, and rejection have been shown to be more likely to develop high social anxiety later in life. However, the psychological mechanism for this phenomenon has yet to be examined. Research from various psychological disciplines suggests that hurt feelings—the aversive feeling that arises from being rejected—may motivate victims to become more cautious, and in extreme cases, anxious about similar situations in the future in order to avoid feeling hurt again. Two studies were conducted to test this hypothesis.

Social Anxiety

Social anxiety is discomfort or fear experienced during social interactions that arises from fear of scrutiny and negative evaluation by others. The experience of anxiety often occurs with a set of cognitive (e.g., worry), physical (e.g., sweating), and behavioural symptoms (e.g., avoidance). Individuals can experience anticipatory anxiety before they enter social situations, during which they ruminate about the probability and social cost of behaving ineptly in the pending situation, and state social anxiety during the situation itself (Clark & Wells, 1995). In addition to the phenomenological experience, the phrase *social anxiety* can be used to describe individual trait differences. For the purpose of clarity, the word *state social anxiety* (SSA) will be used to describe the phenomenological experience and the phrase *social anxiety* (SA) will be used to describe trait tendencies. Individuals with *low SA* tend to experience mild to no SSA across situations, whereas those who have *high SA* tend to experience intense SSA across a wide range of situations. In cases where SA is extreme and causes significant disruption to quality of life and functioning, a diagnosis of social anxiety disorder (SAD) can be applied (American Psychiatric Association, 2013).

SSA is a common experience that is proposed to arise from doubt that one could make a desired impression on others (Schlenker & Leary, 1982). Much research has focused on why some individuals experience SSA more intensely and frequently than others, in other words, factors that maintain high SA. According to cognitive conceptualizations, inaccurate, negatively-biased self-beliefs and expectations about social situations are the primary maintaining mechanisms (e.g., Clark & Wells, 1995; Rapee & Heimberg, 1997). That is, individuals with high SA commonly describe themselves as being inadequate or socially deviant (e.g., worthless, boring, weird). In addition, these individuals often report holding conditional assumptions that their social acceptance hinges on their own or others' behaviours, for example, "if I show emotions, I am weak", or "if someone disapproves of my behaviour, they must be right" (e.g., Wong & Moulds, 2011).

Before and during social situations, individuals who carry such beliefs would unsurprisingly doubt their ability to make a good impression on others and worry about negative outcomes such as rejection or criticism from others. To prevent such outcomes, high SA individuals attempt to engage in avoidance to alleviate SSA. When escape is not a viable option, they engage in in-situation safety behaviours (e.g., talk excessively) to prevent exposing selfattributes they perceive as deficient (e.g., boring) for others' scrutiny. By doing so, they believe would minimize the probability of negative outcomes (e.g., Clark, 1999; Hirsch, Meynen & Clark, 2004). Although avoidance and safety behaviours temporarily alleviate SSA, these behavioural tendencies consolidate high SA individuals' negative beliefs and expectations through intrapersonal and interpersonal means. Individuals with high SA can attribute the absence of social dangers, such as rejection, to their use of safety behaviours. Such attributions can prevent disconfirmation of inaccurate negative self-beliefs and impede learning that social

situations are often more innocuous than they think (Clark & Wells, 1995). Moreover, avoidance and safety behaviours can be seen as signs of elusiveness and aloofness by others, and therefore increase the likelihood of negative social events such as rejection (Alden & Taylor, 2004; Plasencia, Alden & Taylor, 2011). Negative social outcomes would then confirm high SA individuals' pre-existing self-beliefs and expectations and perpetuate this negative interpersonal cycle.

Other cognitive processes that maintain high SA levels have also been identified, for example, self-focused attention (e.g., Woody, 1996). In addition, they have been found to pay inordinate attention to internal images of how they may appear to others (e.g., Hirsch, Clark, Matthews, & Williams, 2003; Hirsch et al., 2004). Such images are distorted and negativelybiased compared to how they actually appear because they are based on their distorted selfbeliefs, prior negative social experiences, as well as physical symptoms of anxiety they are experiencing at the moment (e.g., sweating). Focusing on negative self-images can impair their actual social performance and prevent them from noticing the likely absence of social disapproval from the audience that may disconfirm their expectations.

Rejection and social anxiety

While contemporary clinical models focus on the cognitive and behavioural processes that maintain SA, another body of research addresses the etiology of those beliefs and behaviors. Etiological contributors to SA include biological factors (e.g., genetics) and environmental factors (e.g., overprotective parenting; see Rapee & Spence, 2004 for a review). Aversive social experiences, such as rejection, humiliation, abuse and criticism, is one type of environmental factor that has received much research attention. The effect of such experiences is the focus of the current research. Investigations of aversive experiences and SA were initially based on retrospective selfreports. These studies indicated that the majority of individuals with high SA and shyness attributed their condition to early negative social events (Hugdahl & Ost, 1985; Ishiyama, 1984). In addition, individuals with high SA reported experiencing frequent, intrusive images of themselves failing in social situations (e.g., being humiliated by others), which they thought derived from an aversive personal memory (Hackmann, Clark & McManus, 2000). Later studies found that the number of self-reported negative social events, such as childhood emotional abuse and neglect, rather than one single traumatic event (Stemberger, Turner, Beidel, & Calhoun, 1995), predicted individuals' SA levels (Kuo, Goldin, Werner, Heimberg and Gross, 2011), which suggests that multiple negative events or a general negative environment likely causes long-lasting elevations in SA. However, one limitation of retrospective studies is that results may be contaminated by memory biases.

Cross-sectional and prospective research studies provide more direct support for the hypothesis that rejection increases SA in victims, especially in those who already have elevated SA levels at the time of the negative social event. Cross-sectional investigations found that children and adolescents' SA levels were associated with self-reported peer victimization (La Greca & Lopez, 1994) and poorer quality peer relationships (Slee, 1994). A five-year longitudinal study with kindergarten children revealed a reciprocal relation between active peer exclusion and anxious solitude, defined as solitary behaviour due to anxiety (Gazelle & Ladd, 2003). Specifically, being actively or passively excluded from peer relationships in kindergarten predicted concurrent and subsequent anxious solitude, and anxious solitude predicted concurrent and subsequent anxious solitude, and anxious solitude predicted concurrent and subsequent active peer exclusion. Third graders, whose friend apparently declined their invitation to participate in the study with them, were less likely to nominate

another friend to participate (Gazelle & Druhen, 2009). The children's reluctance to name a second friend was interpreted as a sign of social helplessness, the belief that one cannot influence interpersonal events, a belief that is proposed to be a central feature of high SA (Clark & Wells, 1995). Children's tendency to develop social helplessness was especially prominent in those who displayed anxious solitude tendencies. Research in young adults has shown a similar pattern. Sensitivity to peer exclusion and self-reported teasing frequency predicted increased high SA levels in an undergraduate sample two months later (Levinson, Langer & Rodebaugh, 2013).

Aversive social experiences have also been examined in classical conditioning studies. These studies revealed that individuals with high SA developed fear towards neutral faces that were paired with hostile facial expressions and insults (Lissek et al, 2008; Pejic, Hermann, Vaitl & Stark, 2013). Some researchers propose that the conditioning effect of negative social events may cumulate synergistically such that individuals develop increasingly intense fear responses (Beidel & Turner, 2007; Mineka & Zinbarg, 1995), that is, individuals who have acquired a mild fear response from a minor negative social event would be primed to develop more fearful responses when exposed to subsequent social trauma. One implication of this proposal is that individuals with high SA would be particularly vulnerable to rejection, and would develop even more anxiety compared to those with low SA when exposed to such events.

In sum, extant research suggests that negative social events cause increases in subsequent SA levels in children and young adults. Furthermore, conditioning experiments suggest that SA may be acquired through learning, specifically motivated by the aversive emotions arising from social disapproval. In line with this proposal, children's affective response mediated the relation between rejection and subsequent social helplessness (Gazelle & Druhen, 2009). This finding raises the question as to what specific affect or emotion motivates excluded people to display

subsequent SA. Current research suggests that *hurt feelings* may be a critical factor that contributes to learning SA.

Hurt feelings

Hurt feelings is an emotion that is commonly elicited in response to negative interpersonal events such as rejection, neglect, criticism and personal affront, betrayal, illconceived humour, humiliation, unappreciative gestures, and lying (Feeney, 2004; Leary, Springer, Negel, Ansell & Evans, 1998; Vangelisti, Young, Carpenter-Theune & Alexander, 2005). Researchers hypothesize that the precise cause for hurt feelings is that victims perceive others' behaviours and reactions to mean that they are less interpersonally connected than they desire. MacDonald (2009), for example, proposed that individuals feel hurt when they perceive a decrease in future social support and that hurt feelings may be especially intense when the hurtful event is perceived as having negative implications across many relationships. Feeney (2004) proposed that individuals experience hurt feelings when events cause them to believe that they are less worthy of love.

Findings from empirical studies support this idea. Leary and Leder (2009) found that the intensity of feeling hurt is associated with a discrepancy between how much participants want the perpetrator to value their relationship, and how much they think others actually value the relationship. In addition, raters judged the majority of self-reported hurtful events as having negative implications for the victims' social desirability (Leary et al., 1998). Finally, studies have consistently shown that hurtful events worsen victims' self-esteem (e.g., Feeny, 2004; Leary et al., 1998; Vangelisti et al., 2005), with self-esteem being a reflection of how much individuals perceive themselves as being social accepted (Leary, Tambor, Terdal & Downs,

1995). Given that negative self-perception is a central component of high SA, this finding suggests that hurt feelings during negative social events may be involved in the development of high SA.

Eisenberger and Lieberman (2004) proposed that a neural alarm system underlies the experience hurt feelings. The neural alarm system consists of two components: A pain detector that identifies threats in the environment, for example, rejection; and an unpleasant alarm (i.e., hurt feelings) that notifies the organism of errors or threats and motivates it to think and behave in such a way the threat is reduced. An important anatomical structure in this system is the anterior cingulate cortex, which is consistently activated when errors for self-performance are detected and when negative affect is experienced (Spunt, Lieberman, Cohen & Eisenberger, 2012). In fact, activity in the anterior cingulate cortex has been shown to be associated with negative changes in self-esteem and self-perceived social standing (Eisenberger, Inagaki, Muscatelli, Haltom & Leary, 2011). Because negative self-perception is a central feature of high SA, this finding suggests that activity in the neural alarm system, or hurt feelings, may be involved in its development. The neural alarm system is activated not only during hurt feelings, but also during physical pain (Eisenberger & Lieberman, 2004; Panksepp, 2003; Rainville, Duncan, Price, Carrier & Bushnell, 1997). In support of this pain overlap hypothesis, individuals who are sensitive to hurt feelings also tend to be sensitive to the physical pain and vice versa (Eisenberger, Jarcho, Lieberman & Naliboff, 2006; MacDonald, Kingsbury & Shaw, 2005). In addition, active ingredients in physical painkillers, opiates and acetaminophen, have been shown to reduce hurt feelings (DeWall et al., 2010; Panksepp, 1998). Finally, research has shown comparable psychological consequences of hurt feeling and physical pain (MacDonald & Leary, 2005). For example, both experiences lower mood and self-esteem, induce aggression (Riva,

Wirth & Williams, 2011), and physical and emotional numbness (Borsook & MacDonald, 2010; DeWall & Baumeister, 2006; Riva et al., 2011). One important consequence that was explored in the current studies was whether hurt feelings, like physical pain, also motivates individuals to develop fear and anxiety.

The phenomenological and neural overlap for hurt feelings and physical pain reflects a more general principle. Research in cognitive neuroscience has shown that similar areas in the neo-cortex are activated in response to a wide range of sensory-motor, affective and cognitive experiences, and that this pattern seems to be the rule rather than the exception. Recently, multiple researchers have proposed that during evolutionary brain development, neural circuits for basic sensory-motor functions (e.g., spatial awareness) may be reused in other circuits for more complex functions (e.g., mathematics) without losing its original sensory-motor functions (see Anderson, 2010 for a review). Such proposals are in contrast with hypotheses that postulate that new brain structures are developed specifically for new functions (e.g., Maclean, 1993), which was highly unlikely during the course of evolution. Instead, it is more likely that more connections were formed between different areas of the cortex, which then formed new circuits suited for functioning in more complex environments, thus increasing adaptive fitness. As a result of this pattern of reusing neural circuits, many sensory-motor, affective, cognitive, and behavioural experiences that are apparently unrelated seem to influence each other. For example, moving marbles upwards and downwards induced the retrieval of more positive and negative memories respectively, and the retrieval of positive and negative memories facilitated the behaviour of moving marbles upwards and downwards respectively (Casasanto & Dijkstra, 2010). Under the same neural reuse principle, the neural circuit for monitoring rejection and

inducing hurt feelings (i.e., the neural alarm system) has been proposed to have "piggy-packed" onto the circuit for physical pain during evolution (Eisenberger & Lieberman, 2004).

Physical pain is adaptive because it alerts organisms to life-threatening stimuli and situations that require immediate caution and withdrawal, and its overwhelmingly unpleasant experience seems to induce this response instinctively and effectively. Similarly, hurt feelings is proposed to be adaptive because it alerts people of immediate, negative changes in their social connection, as well as situations and behaviour that potentially lead to this change (MacDonald & Leary, 2005). Some researchers underscore the importance of self-perceived social connection because negative changes in this domain might have been life-threatening during pre-modern times when there was high selection pressure for social inclusion (e.g. Eisenberger & Lieberman, 2004). Humans who could not experience hurt feelings would be less motivated to engage in prosocial behaviour to promote social acceptance in response to social exclusion. The environment was extremely dangerous for humans, and excluded people who did not receive protection from others were almost certain to die without offspring. Indeed, the experience of hurt feelings is ubiquitous amongst humans. Leary & Springer (2001) found that every one of their undergraduate sample was able to recall an instance where their feelings were hurt. In addition, 60% of these individuals indicated that they experienced hurt feelings more than once a month, and 20% reported feeling hurt at least once a week. The identity of hurt feelings perpetrators was not limited by type of social relationship (Leary et al., 1998). Evolutionary perspectives on SSA parallel that on hurt feelings, namely that SSA is an adaptive experience that prevents exclusion and increase fitness. Unlike hurt feelings, in which perceiving oneself as being less socially connected motivates reconnection, SSA has been proposed to prevent this loss of social connectedness from ever happening (Gilbert, 2001). This line of evidence suggests that

anxiety may be a secondary response that prevents both hurt feelings and physical pain, which again highlights the similarities between the two *painful* experiences.

Animals readily associate environmental stimuli and behaviours with aversive feelings such as physical pain. As conditioning studies have repeatedly shown, animals that have experienced physical pain, or more specifically the unpleasant alarm in the neural alarm system known as pain affect (as discussed above), learn to avoid exposing themselves to situations or engage in behaviours that are perceived to lead to this aversive feeling. When avoidance is not possible, they experience anxiety and cautiously engage in such situations and behaviours. Similarly, hurt feelings may result in fear and avoidance of situations and behaviours associated with negative social outcomes to prevent further damage to one's social connectedness. As a result, victims of hurt feelings may become vigilant in detecting social cues that signal potential disapproval while ignoring safety cues (Veljaca & Rapee, 1998). Some propose that hurt feelings may also alert people to aspects of their behaviour and more global self-characteristics that attract painful rejection or heighten awareness of their lower social status (e.g., Eisenberger et al., 2011; Goetz & Dweck, 1980; Moscovitch, 2009). Therefore, victims may engage in selfmonitoring (Spurr & Stopa, 2002) and to adopt behaviours, such as self-concealment, that are intended to protect themselves from scrutiny and disapproval (i.e., *safety behaviours*; e.g., Clark & Wells, 1995; Leary & Allen, 2011; Rapee & Heimberg, 1997). It is notable that low selfesteem, a reflection of self-perceived low social status (Leary et al., 1995), has been shown to precede and contribute to the onset of SAD (Acarturk et al, 2009). From the evidence presented, it seems that hurt feelings motivates individuals to feel SSA in previously hurtful situations.

Current Investigation

In response to the question "how does rejection cause social anxiety?", findings from various psychological disciplines suggest that hurt feelings motivates people to recognize social danger and induces anxiety in similar situations. However, this hypothesis has not been empirically examined. This hypothesis yields two predictions, which was tested over two studies. First, rejection was expected to result in increased SSA in a similar situation, and this relation was predicted to be mediated by hurt feelings (Study 1). Second, rejection was predicted to cause less SSA if hurt feelings was diminished (Study 2).

Study 1: Does rejection induce subsequent anxiety and is this effect mediated by hurt feelings?

As an initial step to test hurt feelings as a mechanism towards developing SA, Study 1 examined whether hurt feelings mediated the relation between rejection and SSA. Some researchers propose that rejected individuals who already have high SA are especially prone to developing even higher levels (e.g., Beidel & Turner, 2007). Findings from in-vivo studies investigating kindergarten children, as well as studies in a controlled laboratory environment investigating conditioning in adults, have supported this proposal (Gazelle & Druhen, 2009; Lissek et al, 2008; Pejic et al., 2013). Thus, another goal of Study 1 was to examine whether this pattern would extend to rejection in an online environment for young adults (Cyberball). Specifically, the current study examined whether high SA individuals reported more SSA than their low SA counterparts in response to rejection, and if so, whether this vulnerability to develop SA could be explained by hurt feelings.

In Study 1, undergraduate participants were exposed to two artificial social interactions two days apart in which they were initially rejected (experimental condition) or included (control condition) by a group of peers and rated hurt feelings. Then, participants rated anxiety before (anticipatory anxiety) and after (SSA) the second interaction with another group of more inclusive peers. Based on the logic described above, participants who were initially rejected were expected to report higher Round 2 anticipatory anxiety and Round 2 SSA, and hurt feelings was predicted to mediate these relations. Based on findings from conditioning studies, high SA participants were expected to report higher Round 2 anticipatory anxiety and Round 2 SSA, and that these effects, if present, would be accounted for by hurt feelings.

Method

Participants

Eighty-eight undergraduate participants were recruited from Human Subject Pool at the University of British Columbia. As a token of appreciation, participants were awarded partial course credit. The mean age for the sample was 19.99 (SD = 2.05). The sample consisted of 66% females. Of the sample, 36% self-identified as North American or European, 46% self-identified as East Asian or East Asian Canadian, and 18% self-identified with other cultures

Materials

Cyberball 4.0 (Williams, Yeager, Cheung & Choi, 2012). Cyberball is a computer program that is commonly used as a manipulation for rejection and has reliably elicited hurt feelings (e.g., Eisenberger, Lieberman & Williams, 2003). For participants in the current study, the game was presented as a medium to examine "how people with same or different personalities interact". During the game, participants were instructed to toss a ball around with two other players (one female and one male). The name and photo of each player, including the participant, appeared beside their ball-tossing avatar. The two players seemed as if they are other participants, but in fact, their passes are controlled by a preset computer script. Participants were able to pass the ball to any player of their choice, and they believed that other players would be able to do the same. The entire game lasted forty ball tosses. Rejected participants were only passed the ball three times for the entire game and included participants were passed the ball as many times as other players. Participants in the current study were exposed to two groups of peers, and the order to which they were exposed was randomly assigned. Websites for Cyberball are listed in *Appendix A*.

Measures

Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998). The SIAS was used as a trait measure of individuals' SA levels, that is, the tendency to experience social anxiety across situations. The scale consists of 20 self-report items that measure anxiety during a range of everyday social interactions (*Appendix B*). Participants rated how much they endorse each item on a five-point scale ranging from 0 (*not at all*) to 4 (*very much*). The mean was 29.84 (*SD* = 15.11). The scale demonstrated high internal consistency (α = .94).

Round 1 hurt feelings. Three items were used to measure how hurt participants felt after the first round of Cyberball (i.e., "I was bothered by how the game went.", "My feelings were hurt from not being involved in the game.", "I felt bad being left out by other players."). Participants rated the degree to which each of the three statements reflect their experience with Cyberball on a nine-point scale ranging from 0 (*not at all*) to 8 (*very much so*). The three items had good reliability ($\alpha = .93$).

Round 2 anticipatory anxiety. Three items were used to measure anticipatory anxiety before the second round of Cyberball (i.e., "I wonder if I will get along with the players in the coming game.", "I feel self-conscious about how I will appear to others in the coming game.", "I feel nervous about how the coming game will go."). Participants rated the degree to which each of the three statements reflect their experience on a nine-point scale ranging from 0 (*not at all*) to 8 (*very much so*). The three items had adequate reliability ($\alpha = .79$).

Round 2 state social anxiety (SSA). A global composite measure for cognitive and physical symptoms of SSA was created by summing the standardized scores of Round 2 cognitive anxiety and Round 2 BSAM (described below). The two scales were inter-correlated

but not isomorphic (r = .57, p < .001). Reliability for the composite score calculated using the formula provided by Nunnally & Bernstein (1994, p. 268) was .90.

Cognitive anxiety. Three items were used to measure cognitive symptoms of SSA during the second round of Cyberball (i.e., "I felt uneasy throughout the game.", "I was concerned that others thought poorly of me.", "I felt self-conscious."). Immediately after the second round of Cyberball, participants rated the degree to which each of the three statements reflect their experience on a nine-point scale ranging from 0 (*not at all*) to 8 (*very much so*). The three items had good reliability ($\alpha = .84$).

Brief State Anxiety Measure (BSAM; Berg, Shapiro, Chambless & Ahrens, 1998). The BSAM measures physical symptoms of SSA and was used to supplement the three cognitive symptom items. Immediately after the second round of Cyberball, participants indicated the degree to which they experienced each item (e.g., "I felt relaxed/steady/strained/comfortable/ worried/ tense.") on a four-point scale ranging 1 (Not at all) to 4 (Very much so). The scale demonstrated high internal consistency ($\alpha = .84$).

Procedure

The study took place over two sessions two days apart. During the first session, participants completed the trait SA scale, SIAS, and played the computer social interaction game Cyberball apparently with two other players (one male and one female). Participants were randomly assigned to be either rejected by being passed the ball few times (rejection condition; n= 44) or included by being passed the ball as many times as other players (inclusion control condition; n = 44). Immediately after the game, all participants rated Round 1 hurt feelings. Two days later, all participants rated Round 2 anticipatory anxiety and played Cyberball again apparently with two other players, who were inclusive and passed participants the ball as many times as they did to each other. Immediately after, participants reported Round 2 SSA and were debriefed.

Personnel. Three female senior undergraduate research assistants were trained to follow an instructional script (See Appendix C). Research assistants were blind to participants' conditions (i.e., rejection/control) unless participants reported about their Cyberball experiences after Round 1. Research assistants were specifically instructed to remain neutral if participants reported being excluded (e.g., not sympathize).

Results

Correlation matrix

A correlation matrix with Round 1 hurt feelings, Round 2 anticipatory anxiety, Round 2 cognitive anxiety, Round 2 BSAM, and SIAS are presented in Table 1.

Table 1

	1	2	3	4	5
1. Round 1 hurt	_				
feelings					
2. Round 2	.60**	-			
anticipatory					
anxiety					
3. Round 2	.55**	.66**	_		
cognitive					
anxiety					
4. Round 2	.37**	.30*	.57**	_	
BSAM					
5. SIAS	.28*	.55**	.43**	.41**	_

Correlation matrix for Study 1.

Note. **p* < .01, ***p* < .001.

Data analytic strategy

Traditional perspectives posit that four requirements be met for mediation (Baron & Kenny, 1986). First, the independent variable (IV) must predict the dependent variable (DV; cf.

Hayes, 2009). Second, the IV must predict the mediator (Me). Third, the Me must predict the DV. Finally, the IV-DV relation must be diminished when the Me is held constant.

Using the SPSS macro PROCESS (Hayes, 2012), two separate mediation analyses were conducted to examine whether rejection caused Round 2 anticipatory anxiety and Round 2 SSA during Cyberball, and if so, how much of the effect could be explained by Round 1 hurt feelings. Dummied-coded condition variable (rejection = 1, control = -1) was entered as the IV, hurt feelings as the Me, and Round 2 anticipatory anxiety and Round 2 SSA were entered respectively as the DVs for the two analyses. Bootstrapping procedures was used to examine indirect effects, that is, the effect of the IV condition on the DVs Round 2 anticipatory anxiety and Round 2 SSA through Me Round 1 hurt feelings (Preacher & Hayes, 2008). Point estimates and accelerated bias-corrected confidence intervals with 5000 resamples are reported below.

Cohen's *d*s for condition's effects on Round 1 hurt feelings, Round 2 anticipatory anxiety, and Round 2 SSA are also reported to provide more meaningful indices of effect size estimates. Cohen's *d* is calculated using the following formula: $2b/SD_y$ based on logic described below. Raw regression coefficients for condition indicate the amount of increase in Round 1 hurt feelings/Round 2 anticipatory anxiety/Round 2 SSA associated with one unit of increase in condition. Because there are two units of differences in the conditions (i.e., 1 - (-1) = 2), the raw difference in Round 1 hurt feelings/Round 2 anticipatory anxiety/Round 2 anticipatory anxiety/Round 2 SSA between conditions is twice the magnitude of the regression coefficients. Cohen's *d* is the between-condition raw difference, standardized in terms of the variable that was predicted, that is, Round 1 hurt feelings, Round 2 anticipatory anxiety, and Round 2 SSA.

Mediation 1: Condition \rightarrow Round 1 hurt feelings \rightarrow Round 2 anticipatory anxiety

The overall model, shown in Figure 1, was significant, $R^2 = .37$, F(2, 85) = 37.71, p < .001. All four mediation requirements were established. First, rejection significantly predicted more Round 2anticipatory anxiety, b = 1.25 (SE = .55), t(86) = 2.27, p = .026, d = .74. Second, rejection predicted more Round 1 hurt feelings, b = 3.32 (SE = .55), t(86) = 6.03, p < .001, d = 1.30. Third, Round 1 hurt feelings predicted Round 2 anticipatory anxiety when condition was held constant, b = .59 (SE = .07), t(85) = 8.60, p < .001. Finally, rejection's effect on Round 2 anticipatory anxiety was diminished and insignificant when hurt feelings was held constant, b' = -.69 (SE = .54), t(85) = -1.28, p = .20, $d' = -.26^{1}$. The partially standardized indirect effect was significant and estimated to be .37 (CI.95 = .25 - .48), which indicates a difference of .74 standard deviations for Round 2 anticipatory anxiety (CI.95 = .50 - .96) between the conditions due to Round 1 hurt feelings.

¹ As readers may have noticed, the direct effect for the mediation model is slightly negative with an insignificant but considerable effect size. This negative effect is likely due to other variables that mediate rejection's effect on anxiety (see Hayes, 2009 for a contemporary perspective on mediation). One such mediator may be the degree to which participants were deceived of the presence of other participants. Specifically, many rejected participants reported that they were less convinced of the presence of other participants in the study because not being passed the ball in that situation was not within social norms. Then, rejected participants may feel less anticipatory anxiety and SSA under the knowledge that they were not interacting with real participants. At the end of the study, participants rated how much they thought there were actually other "participants on a scale of 0 (no participants at all) to 8 (completely thought that there were participants). Indeed, rejected participants reported being less deceived (M = 3.62; SD = 2.43) compared to control participants (M = 5.05; SD = 2.81), t(83) = 2.50, p = .014. When deception was entered as a Me simultaneously into the mediation model, the indirect effect for Me deception was significant, b = .40 (SE = .17), p = .03, d = -.11, and the negative *direct* effect was reduced, b = -.35 (SE = .56), p = .54, t(83) = -.62, d = -.14, suggesting that deception partially accounted for the negative direct effect and that rejection caused more anticipatory anxiety despite that rejected participants thought that there was less of a chance they were interacting with real participants.

Figure 1

Mediation model for rejection (IV), Round 1 hurt feelings (Me), and Round 2anticipatory anxiety (DV).

Partially standardized indirect effect = $.37 (CI_{.95} = .25 - .48)$

Indirect effect d = .74 (CI_{.95} = .50 - .96)



Note. Unstandardized regression coefficients and standard errors (parenthesis) are presented. *p < .05, **p < .01, ***p < .001.

Mediation 2: Condition \rightarrow Round 1 hurt feelings \rightarrow Round 2 SSA

The overall model is shown in Figure 2 and was significant, $R^2 = .27$, F(2, 85) = 15.92, p < .001. Again, all four mediation requirements were met. Rejection significantly predicted more Round 2 SSA, b = .44 (SE = .18), t(85) = 2.37, p = .020, d = .50; and more Round 1 hurt feelings, b = 3.32 (SE = .54), t(85) = 6.10, p < .001, d = 1.30. Round 1 hurt feelings predicted Round 2 SSA when condition was held constant, b = .16 (SE = .03), t(86) = 4.97, p < .001. Rejection did not significantly predict Round 2 SSA when hurt feelings was held constant, b' = -.10 (SE = .19), t(85) = -.50, p = .62, d' = -.11 (see footnote 1). The partially standardized indirect effect was significant and estimated to be .30 (CI_{.95} = .14 - .48), which indicates a difference of .74 standard deviations for SSA (CI_{.95} = .50 - .96) between the conditions due to hurt feelings.

Figure 2

Mediation model for rejection (IV), Round 1 hurt feelings (Me), and Round 2 SSA (DV).

Partially standardized indirect effect = .30 (CI_{.95} = .14 - .48)

Indirect effect d = .60 (CI_{.95} = .28 - .96)



Note. Unstandardized regression coefficients and standard errors (parenthesis) are presented. *p < .05, **p < .01, ***p < .001.

Secondary-hypothesis: Were high SA participants more prone to developing anxiety from rejection, and if so, could this effect be explained by hurt feelings?

To examine whether high SA reported more anticipatory and SSA after experiencing rejection, two hierarchical regression analyses were run entering dummied-coded condition (rejection = 1, control = -1) and centred SIAS scores as IV in step 1, and interaction variable Condition \times SIAS in step 2. Round 2 anticipatory anxiety and Round 2 SSA were entered as DVs in two separate analyses.

Results showed that high SA participants were not especially prone to developing either anticipatory anxiety or SSA from rejection. As expected, Step 1 was significant for both analyses; for anticipatory anxiety, $R^2 = .35$, F(2, 85) = 22.62, p < .001, for SSA, $R^2 = .28$, F(2, 85) = 16.33, p < .001. However, Step 2 Condition × SIAS interaction did not contribute to additional variance above Step 1 predictors for Round 2 anticipatory anxiety, $\Delta R^2 < .01$, $\Delta F(1,84) = .49$, p = .48, or Round 2 SSA, $\Delta R^2 < .01$, $\Delta F(1,84) = .28$, p = .60. Because Step 2 interaction effects did not contribute to the model, Step 1 regression variables were retained and their coefficients are reported below. The rejection condition and SIAS predicted the dependent variables independently; for Round 2 anticipatory anxiety predictor rejection, b = 1.12 (SE = .46), t(84) =2.43, p = .017, for Round 2 anticipatory anxiety predictor SIAS, b = .19 (SE = .03), t(84) = 6.15, p < .001; for Round 2 SSA predictor rejection, b = .40 (SE = .16), t(84) = 2.44, p = .017, for Round 2 SSA predictor SIAS, b = .06 (SE = .01), t(84) = 5.05, p < .001.

Discussion

As predicted, rejection caused participants to report higher anticipatory anxiety and SSA two days later in a similar context compared to the control condition. It is interesting to note that

rejected participants reported higher anticipatory anxiety (partially standardized indirect effect = .37) and SSA (partially standardized indirect effect = .30) due to hurt feelings even when they were exposed to a different group of peers, after they were included by the second group, and suspected that they were not interacting with real participants (see footnote 1). Importantly, these effects were null when hurt feelings was held constant, which suggests that rejection's effect on SSA could be fully explained by hurt feelings. This result supports the hypothesis that hurt feelings is a mechanism that contributes to the development of high SA. However, mediation is often insufficient to show that the mediator is a mechanistic variable. For example, in the context of Study 1, an alternative interpretation of the results may be that hurt feelings is a by-product of rejection and not a central mechanism involved in subsequent anxiety. That is, the results could be interpreted as rejection causing hurt feelings as well as anxiety at a later time, instead of supporting the prediction that rejection causes hurt feelings, which then causes future anxiety. To rule out this alternative, Study 2 will directly manipulate the proposed mechanism, hurt feelings, and examine changes in the dependent variables, anticipatory anxiety and SSA, to put the hypothesis to a more rigorous test.

A side-objective of the current study was to examine whether individuals with high SA were likely to report more anxiety after rejection, and if so, whether this effect could be explained by hurt feelings. Results showed that rejection caused all participants to report higher anticipatory and SSA regardless of SA levels, which was apparently contrary to past studies on SA-learning (e.g., Gazelle & Druhen, 2009; Lissek et al, 2008; Pejic et al., 2013). However, there are important differences in method between past studies and Study 1. First, whereas rejection and exposure to the same situation took place over one session in past studies, in the current study, the two events took place over two days, two days apart in Study 1. Participants'

behaviour between the two sessions was not controlled, which may have accounted for the discrepancy. Second, rejection in past studies may have been more intense and hurtful compared to Study 1. Specifically, past participants were exposed to hostile faces and insults in conditioning studies, and children were made to believe that their friend actually refused their invitation (Gazelle & Druhen, 2009; Lissek et al, 2008; Pejic et al., 2013). Such rejection manipulations were arguably more severe compared to Cyberball rejection, which has been shown to be only mildly hurtful (Berstein & Claypool, 2012).

Study 2: Does reducing hurt feelings reduce subsequent anxiety?

Consistent with the hypothesis, results in Study 1 showed that rejection induced SSA in a subsequent similar situation and that the effect was fully mediated by hurt feelings. In order to convincingly demonstrate that hurt feelings is the underlying mechanism, however, manipulating hurt feelings should be shown to change subsequent SSA. In Study 2, hurt feelings intensity was directly manipulated and changes in subsequent SSA was assessed. If hurt feelings is truly the underlying mechanism, then reducing hurt feelings in rejected individuals should also reduce subsequent SSA. In other words, individuals who are manipulated to experience rejection as less hurtful should report lower levels of SSA in similar subsequent situations.

Ingesting acetaminophen, the active ingredient in many over-the-counter painkillers, would be a subtle means of reducing hurt feelings. As noted above, hurt feelings and physical pain involve a common phenomenological component represented by activity in the neural alarm system (Eisenberger & Lieberman, 2004; Panksepp, 1998; Rainville et al., 1997). In addition to alleviating physical pain, acetaminophen has been shown to reduce hurt feelings by virtue of dampening the neural alarm system (DeWall et al., 2010). DeWall et al. randomly assigned undergraduate participants to take daily doses of either 500mg acetaminophen or placebo for three weeks. Participants who consumed acetaminophen reported lower levels of hurt feelings on a daily basis compared to those who were administered placebo, and this difference increased with time. After three weeks, a subset of the participants played Cyberball, in which they were apparently rejected by other players. Compared to the placebo group, participants who took acetaminophen displayed less neural activity associated with hurt feelings, as measured by an fMRI scanner (d = .89 - 1.37). Unlike DeWall et al.'s study (2010), one single dose of 1000mg acetaminophen was administered in Study 2. Past research has shown that this dose was also

effective at dampening the neural alarm system, albeit to a smaller extent (d = .43 - .52; Randles et al., 2013).

In Study 2, undergraduate participants played Cyberball on two occasions. They were rejected by a group of peers in the first game and then included in the second game. Participants were randomly assigned to either acetaminophen, in order to alleviate hurt feelings, or to a sugar placebo. If the hypothesis that hurt feelings is a mechanism towards developing anxiety is true, then reducing hurt feelings with acetaminophen would also be expected to reduce anxiety. In addition, the hypothesis posits that reduction in anxiety would be explained by reductions in hurt feelings. Hence, mediation analysis was conducted to examine whether acetaminophen reduced anxiety, and if so, whether this effect could be explained by reduction in hurt feelings.

Method

Participants

One hundred and forty-four undergraduate participants were recruited from Human Subject Pool at the University of British Columbia. As a token of appreciation, participants were awarded partial course credit. The mean age for the sample was 20.60 (SD = 4.44). The sample consisted of 54% females. Of the sample, 38% self-identified as North American or European, 44% self-identified as East Asian or East Asian Canadian, and 17 % self-identified as other cultures.

Materials

Cyberball 4.0 (Williams et al., 2012). Most Cyberball procedures remained the same as in Study 1. Unlike Study 1, participants played Cyberball twice with two groups of three players

(one male, two females) instead of two groups of two (one male, one female). The order to which participants played with the two groups of was randomly assigned. Websites for Cyberball are listed in *Appendix A*.

Measures

Round 1 hurt feelings. Four items were used to measure how hurt participants felt after the first round of Cyberball (i.e., "Other players were hurtful", "Other players made me feel bad/upset/hurt."). Participants rated the degree to which each of the four statements reflect their experience with Cyberball on a nine-point scale ranging from 0 (*not at all*) to 8 (*very much so*). The four items had good reliability ($\alpha = .90$).

Round 1 and 2 anticipatory anxiety. Six items were used to measure anticipatory anxiety before Cyberball (i.e., "I feel worried/stressed/nervous/uneasy about meeting other participants.", "Other participants will judge me.", "Meeting other participants makes me self-conscious."). Participants rated the degree to which each of the six statements reflect their experience on a nine-point scale ranging from 0 (*not at all*) to 8 (*very much so*). The six items showed adequate reliability for both Round 1 and Round 2 ($\alpha_1 = .91$; $\alpha_2 = .94$).

Round 2 SSA. As in Study 1, a global composite measure for cognitive and physical symptoms of SSA was created summing the standardized scores of Round 2 cognitive anxiety and Round 2 BSAM (described below). The two scales were inter-correlated but not isomorphic (r = .56, p < .001). Reliability for the composite score calculated using the formula provided by Nunnally & Bernstein (1994, p. 268) was .92.

Cognitive anxiety. Six items were used to measure cognitive symptoms of SSA during the second round of Cyberball (i.e., "Other participants made me feel

worried/stressed/nervous/uneasy/self-conscious/judged."). Immediately after the second round of Cyberball, participants rated the degree to which each of the six statements reflect their experience on a nine-point scale ranging from 0 (*not at all*) to 8 (*very much so*). The six items had good reliability ($\alpha = .92$).

Round 2 Brief State Anxiety Measure (BSAM; Berg, Shapiro, Chambless & Ahrens,

1998). As in Study 1, the BSAM measures physical symptoms of SSA and was used to supplement the six cognitive symptom items. Immediately after the second round of Cyberball, participants indicated the degree to which they experienced each item (e.g., "I feel relaxed/steady/strained/comfortable/worried/tense.") on a four-point scale ranging 1 (Not at all) to 4 (Very much so). The scale demonstrated good reliability ($\alpha = .82$).

Procedure

The purpose of the study was advertised as to examine how Tylenol affects personality, cognition, and behaviour. First, participants were randomly assigned to consume either two pills of Extra Strength Tylenol (1000mg acetaminophen; experimental condition; n = 72) or sugar placebo (control condition; n = 72). Participants and research assistants were blind to the condition. Then, all participants completed personality questionnaires (e.g., the Big Five Inventory; John & Srivastava, 1999) and sample questions from the Graduate Record Examination as filler tasks for 45 minutes, which was the maximum time required for acetaminophen to take effect according to the manufacturer.

Next, the apparent purpose and procedure for the computer social interaction game (Cyberball) was described, and participants rated their Round 1 anticipatory anxiety. They then played the game apparently with three other players (one male, two female). All participants were rejected, that is, passed the ball few times, and then they rated Round 1 hurt feelings. After the initial rejection, research assistants asked participants to play Cyberball again because they were not passed the ball. Participants then rated their Round 2 anticipatory anxiety, played Cyberball apparently with another group of three peers (one male, two female). In this round, all participants were accepted, that is, passed the ball as often as the others. Finally, they rated their Round 2 SSA.

Personnel. Two female senior undergraduate research assistants were trained to follow an instructional script (See Appendix D) and were blind to participants' conditions. As noted above, the experimenters, as well as the participants, were blind to condition. This is done by using pill capsules that contained either sugar and acetaminophen, or sugar only. The inclusion of sugar in the acetaminophen capsule ensured that this capsule more closely looked and tasted like the placebo capsule. In addition, research assistants only knew of acetaminophen and sugar placebo pills as meaningless letters and numbers (e.g., 1/2, N/L).

Results

Correlation matrix

A correlation matrix with Round 1 hurt feelings, Round 2 anticipatory anxiety, Round 2 cognitive anxiety, and Round 2 BSAM are presented in Table 2.

Table 2

Correlation matrix for Study 2.

	1	2	3	4
1. Round 1 hurt	_			
feelings				
2. Round 2	.52	-		
anticipatory				
anxiety				
3. Round 2	.50	.59	_	
cognitive anxiety				
4. Round 2	.33	.44	.56	_
BSAM				

Note. All correlations were significant, p < .001.

Preliminary Analyses and data analytic strategy

At the end of the study, participants were asked to guess whether they ingested acetaminophen or placebo even if they claimed that they did not know. Fifty-six percent of the participants correctly guessed their condition, which was not significantly different from random guessing (p = .18).

Round 1 anticipatory anxiety for the acetaminophen group was not significantly lower than that of the placebo group, which suggests that acetaminophen did not reduce anxiety directly in the absence of rejection and hurt feelings, t(142) = .69, p = .49, d = -.12.

Requirements for mediation according to traditional perspectives were listed in the results section in Study 1 above. Using the SPSS macro PROCESS (Hayes, 2012), two separate mediation analyses were conducted to examine whether acetaminophen reduced Round 2 anticipatory anxiety and Round 2 SSA during Cyberball, and if so, how much of the effect could be explained by Round 1 hurt feelings. Dummied-coded condition variable (acetaminophen = 1; placebo = -1) was entered as the IV, hurt feelings as the Me, and Round 2 anticipatory anxiety and Round 2 SSA were respectively entered as the DVs for the two analyses. As in Study 1, bootstrapping procedures were used to examine the indirect effects of the IV condition on DVs Round 2 anticipatory anxiety and Round 2 SSA through the proposed Me Round 1 hurt feelings (Preacher & Hayes, 2008). Point estimates and accelerated bias-corrected confidence intervals with 5000 resamples are reported. As in Study 1, Cohen's *ds* for condition's effects on Round 1 Hurt Feelings, Round 2 anticipatory anxiety, and Round 2 SSA are reported to provide more meaningful indices of effect size estimates using the following formula: $2b/SD_y$.

Mediation 1: Condition \rightarrow Round 1 hurt feelings \rightarrow Round 2 anticipatory anxiety.

The overall model, shown in Figure 3 below, was significant, $R^2 = .37$, F(2, 85) = 37.71, p < .001. All four mediation requirements were established. First, acetaminophen significantly predicted lower Round 2anticipatory anxiety, b = -1.90 (SE = .79), t(142) = -2.41, p = .017, d = -.40. Second, acetaminophen also predicted lower Round 1 hurt feelings, b = -1.54 (SE = .57), t(142) = -2.71, p = .008, d = -.45. Third, Round 1 hurt feelings predicted Round 2 anticipatory

anxiety when condition was held constant, b = .69 (SE = .10), t(141) = 6.87, p < .001. Finally, rejection's effect on Round 2 anticipatory anxiety was diminished when Round 1 hurt feelings was held constant, b' = -.83 (SE = .70), t(141) = -1.18, p = .24, d' = -.20. The partially standardized indirect effect was significant and estimated to be -.11 (CI_{.95} = -.19 - -.03), which indicates a between-condition difference of -.22 (CI_{.95} = -.19 - -.02) standard deviations of anticipatory anxiety due to hurt feelings.

Figure 3

Mediation model for acetaminophen (IV), Round 1hurt feelings (Me), and Round 2 anticipatory anxiety (DV).

Partially standardized indirect effect = -.11 (CI_{.95} = -.19 - -.03)





Note. Unstandardized regression coefficients and standard errors (parenthesis) are presented. *p < .05, **p < .01, ***p < .001.

Mediation 2: Condition \rightarrow Round 1 Hurt Feelings \rightarrow Round 2 SSA. The overall model, shown in Figure 4, was significant, $R^2 = .27$, F(2, 85) = 15.92, p < .001. Again, all four mediation requirements were met. Acetaminophen significantly predicted lower Round 2 SSA, b = -.30 (SE = .15), t(142) = -2.07, p = .041, d = -.34; and lower Round 1 hurt feelings, b = -1.54 (SE = .57), t(142) = -2.71, p = .008, d = -.45. Round 1 hurt feelings predicted Round 2 SSA when condition was held constant, b = .12 (SE = .02), t(141) = 5.97, p < .001. Acetaminophen was not significantly associated with lower Round SSA, when Round 1 hurt feelings was held constant, b = -.12 (SE = .13), t(141) = -.92, p = .36, d = -.15. The partially standardized indirect effect was significant and estimated to be -.10 (CI_{.95} = -.19 - .02), which suggests a between-condition difference of .20 (CI_{.95} = -.19 - .02) standard deviations of SSA due to hurt feelings.

Figure 4

Mediation model for acetaminophen (IV), Round 1hurt feelings (Me), and Round 2 SSA (DV).

Partially standardized indirect effect = -.10 (CI_{.95} = -.19 - -.02).

Indirect effect = -.20 (CI_{.95} = -.38 - -.04)



Note. Unstandardized regression coefficients and standard errors (parenthesis) are presented. *p < .05, **p < .01, ***p < .001.

Discussion

Results from Study 2 replicated past research and showed that acetaminophen reduced hurt feelings with a similar effect size, that is, .45 standard deviations (DeWall et al., 2010). More importantly, compared to sugar placebo, acetaminophen was also shown to significantly reduce subsequent anticipatory anxiety (Indirect effect d = -.22) and SSA (Indirect effect d = -.20) through hurt feelings. The findings support the hypothesis that hurt feelings is a mechanism towards developing SA. Some might argue that the results of Study 2 were due to acetaminophen exerting direct effects on SSA before and after the second social situation, not via reductions in hurt feelings. If acetaminophen directly reduced SSA, however, then Round 1anticipatory anxiety (before the initial rejection) would have been lower for the acetaminophen group than the placebo group. On the contrary, results from Study 2 showed that the acetaminophen group reported comparable anticipatory anxiety to the placebo group before rejection had taken place (d = -.12, p = .49). In addition, at the time the current study was being conducted, research was published on the effects of acetaminophen negated existential anxiety in the presence, but not in the absence of existential threats (e.g., surrealist films). The current results are consistent with Randels et al.'s findings and suggest that the neural alarm system does not directly influence anxiety levels in the absence of threat.

General Discussion

Victims of negative social events such as rejection, criticism, and bullying have been shown to develop high SA. Research from various fields in psychology suggests that hurt feelings may be a mechanism that may leads individuals to develop SA tendencies. This hypothesis was tested over two studies with young adults in the context of controlled, artificial social interactions. In Study 1, undergraduate participants were exposed to two situations in which they were initially rejected by one group of peers and subsequently included by another group, or included both times by two groups of peers. Results showed that participants who were initially rejected reported higher SSA before and during the second interaction compared to participants who were included. Moreover, this effect could be fully explained by the proposed mediator, hurt feelings. A side-objective of Study 1 was to examine whether high SA individuals were especially vulnerable to developing even more SSA from negative social events, and if so, whether this vulnerability was due to hurt feelings. Results showed that rejection caused higher SSA indiscriminately regardless of pre-existing SA levels.

Study 2 was conducted to follow-up on the mediation found in Study 1. If hurt feelings is a mechanism that underlies the link between aversive social events and subsequent SA and not a co-phenomenon, then manipulating hurt feelings should cause changes in SSA. In Study 2, all participants were initially rejected by a group of peers, and were then exposed to another group in a similar task. Half of the participants were randomly assigned acetaminophen to reduce hurt feelings and half were assigned placebo. Results again supported the hypothesis: Participants who ingested acetaminophen reported lower SSA before and after the second social interaction, and approximately half of the effect could be explained by hurt feelings after initial rejection. Group differences in SSA only emerged after rejection, and subsequent hurt feelings, took place,

which suggests that the alternative explanation, that is, acetaminophen directly reducing hurt feelings, is unlikely.

In sum, the hypothesis that hurt feelings is a mechanism linking negative social events and SA was supported over two studies, which is consistent with current research on hurt feelings and social pain. First, current results showed that hurt feelings motivated SA-learning, which is consistent with proposals that highlight the evolutionary importance of those experiences in avoiding social exclusion. In addition, the current study indicates that SSA may be a secondary response that prevents loss of status and hurt feelings from occurring, much like anxiety's function in preventing physical pain. Second, the current findings are consistent with research on the neural alarm system, which has been shown to be activated in response to perceived environmental threats (e.g., injury, rejection, existential threats, and self-performance errors) and to promote changes in cognition and behaviour through negative affect (Eisenberger & Lieberman, 2004; Randles et al., 2013; Spunt et al., 2012). The current studies extend our knowledge by identifying another function of the neural alarm system, that is, SA-learning. The findings contribute to an emerging picture showing that the system may be involved in a wide range of common experiences. The ubiquity of the system suggests that it can potentially be considered a fundamental motivation. Understanding the structure and function of this system may be fruitful in generating a conceptual framework that predicts and explains a wide range of human experiences and behaviours.

Limitations and future directions

There are several factors that limit the findings' implications and generalizability. First, young adults receiving higher education were recruited in the current studies and may not be representative of individuals who have been proposed to be vulnerable to developing high SA levels, such as children, whose plastic neural circuits may make them susceptible to long-lasting changes due to aversive events (Leonardo & Hen, 2008), and adolescents, a group associated with the onset for SAD (Rapee & Spence, 2004). Second, Cyberball was chosen for the artificial social interactions because it is a controlled task and because ethical considerations for participants' well-being precluded more extreme forms of rejection. However, it does not mimic real-life scenarios closely, which may be the reason that Cyberball rejection only induces mild hurt feelings (Berstein & Claypool, 2012). Participants may think and behave differently in response to more severe, realistic rejections. For example, high SA individuals may develop higher SSA than their low SA counterparts in response to severe rejections (e.g., Gazelle & Druhen, 2009; Lissek et al, 2008; Pejic et al., 2013). Third, participants reported anxiety when they were exposed to the same situation (i.e., Cyberball) where they experienced rejection. It is unclear how much learned anxiety would generalize to other social situations, which is an important step for development of high SA.

Implications

The current studies identified hurt feelings as one important consequence of rejection that may contribute to the development of high SA. This finding suggests that developing strategies that specifically reduce hurt feelings may be beneficial for prevention and treatment of SAD. Consistent with this idea, research has shown that sensitivity to exclusion predicted increased

social anxiety (Levinson et al., 2013) and that treatment that decreased the emotional cost of negative outcomes (i.e., how bad people predicted they would feel) mediated social anxiety disorder symptom reduction (Hofmann, 2004). Alleviating the impact (emotional cost) of rejection and decreasing rejection sensitivity have been identified as important strategies for prevention and treatment,

There is strong evidence that social support from peers, attachment figures, or even merely seeing images of romantic partners, reduces hurt feelings (e.g., Eisenberger et al., 2011; Masten, Telzer, Fuligni, Lieberman & Eisenberger, 2012; Master et al., 2009; Onada et al., 2009; Shaver, Mikulincer, Lavy & Cassidy, 2009). One implication of these findings may be to advise high-risk and clinical populations to seek out social support when hurt feelings arises. Another implication may be for schools to implement programs that facilitate friendship development to provide such individuals with a source of social support.

The current findings suggest that teaching high-risk and clinical populations modified emotion regulation strategies that specifically target for hurt feelings may be useful for prevention and treatment. For example, affect labeling, in which one's emotional experiences are described and put into words, has been shown to an effective strategy to reduce the intensity of emotion and emotionally-charged images (e.g., Lieberman et al., 2007); and has been proposed as the mechanism for mindfulness based treatments (Creswell, Way, Eisenberger & Lieberman, 2007). In fact, recent evidence suggests that labeling negative images in words may prevent the development of fear and anxiety (Tabibnia, Lieberman & Craske, 2006). Another technique that could be introduced for prevention and treatment is cognitive distancing, whereby one views images from the perspective from a distant outsider (Ochsner et al., 2004). This strategy has recently been shown to work specifically for negative social cues and events (e.g., Koenigsberg

et al., 2010). Parallel research on SAD suggests that cognitive distancing from retrospective traumatic social events may be beneficial for symptom reduction. Given that emotion regulation techniques (e.g., affect labeling, cognitive distancing) are similar to maladaptive features of high SA (e.g., negative imagery, self-focused attention; Rachman, Gruter-Andrew & Shafran, 2000; Spurr & Stopa, 2002), however, more research on their differences are needed before such techniques could be reliably integrated into treatment.

Another approach is to implement treatment strategies designed to directly reduce the likelihood of rejection and subsequent hurt feelings. For example, high SA individuals and patients with SAD often use avoidance and safety behaviours as anxiety-reduction strategies, but such behaviours may simultaneously present them as being aloof or elusive and attract rejection (Alden & Taylor, 2004). Research indicates that reducing safety behaviours can reduce the likelihood of negative social outcomes (e.g., Taylor & Alden, 2011). Social skills procedures may similarly reduce the frequency of social rejection. Future research is needed to determine whether such strategies might also reduce hurt feelings.

Summary

The current research made a novel contribution to the literature by examining hurt feelings as a mediator of the link between rejection and social anxiety in a controlled laboratory setting. Another novel feature was to use the pain medication acetaminophen to manipulate hurt feelings, thereby demonstrating a causal effect of social pain reduction on SSA. The findings are consistent with the proposed nomonological network for social pain and SA and suggest that introducing hurt feelings reduction techniques to a clinical setting may be effective for SAD prevention and treatment.

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Appendices

Appendix A: Cyberball Websites

Study 1

Rejection

http://kfung.psych.ubc.ca/cyberball.htm?userid=klint&settings=3plos&pics=true&p2name=Parti cipant

Name&pic2=images/woman.jpg&p1name=Greg&pic1=images/tom.jpg&p3name=Alicia&pic3=images/siba.jpg&&chat=false&spectate=false

Inclusion (control)

http://kfung.psych.ubc.ca/cyberball.htm?userid=klint&settings=3plall&pics=true&p2name=Participant

Name&pic2=images/woman.jpg&p1name=Rui&pic1=images/mary.jpeg&p3name=Tom&pic3=i mages/noyan.jpg&&chat=false&spectate=false

Study 2

Rejection

http://kfung.psych.ubc.ca/cyberball.htm?userid=klint&settings=4plos&pics=true&p2name= Participant Name &pic2=images/

woman.jpg&p1name=Greg&pic1=images/tomw.jpg&p3name=Alicia&pic3=images/sibag.jpg&p4name=Francesca&pic4=images/sarac.jpg&chat=false&spectate=false

Inclusion (control)

http://kfung.psych.ubc.ca/cyberball.htm?userid=klint&settings=4plall&pics=true&p2name= Participant Name &pic2=images/

woman.jpg&p1name=Rui&pic1=images/mary.jpeg&p3name=Tom&pic3=images/noyan.jpg&pi c1=images/mary.jpeg&p4name=Charlotte&pic4=images/chelseae.jpg&chat=false&spectate=fals e

Please indicate the degree to which you feel the statement is characteristic or true for you.					
	Not at all	Slightly	Moderately	Very	Extremely
1. I get nervous if I have to speak with someone in authority (teacher, boss).	0	1	2	3	4
2. I have difficulty making eye contact with others.	0	1	2	3	4
3. I become tense if I have to talk about myself or my feelings.	0	1	2	3	4
4. I find it difficult to mix comfortably with the people I work with.	0	1	2	3	4
5. I find it easy to make friends my own age.	0	1	2	3	4
6. I tense up if I meet an acquaintance in the street.	0	1	2	3	4
7. When mixing socially, I am uncomfortable.	0	1	2	3	4
8. I feel tense when I am alone with just one person.	0	1	2	3	4
9. I am at ease meeting people at parties, etc.	0	1	2	3	4
10. I have difficulty talking with other people.	0	1	2	3	4
11. I find it easy to think of things to talk about.	0	1	2	3	4
12. I worry about expressing myself in case I appear awkward.	0	1	2	3	4
13. I find it difficult to disagree with another's point of view.	0	1	2	3	4
14. I have difficulty talking to attractive persons of the opposite sex.	0	1	2	3	4
15. I find myself worrying that I won't know what to say in social situations.	0	1	2	3	4
 I am nervous mixing with people I don't know well. 	0	1	2	3	4
17. I feel I'll say something embarrassing when talking.	0	1	2	3	4
 When mixing in a group, I find myself worrying I will be ignored. 	0	1	2	3	4
19. I am tense mixing in a group.	0	1	2	3	4
20. I am unsure whether to greet someone I know only slightly.	0	1	2	3	4

Appendix B: SIAS

Appendix C: Study 1 script

Set-up

- Round 1 Questionnaires
 - Consent form
 - Round 1 Pre-Questionnaire
 - Post-Questionnaire
- Round 2 Questionnaires
 - Round 2 Pre-Questionnaire
 - Post-Questionnaire
 - Debriefing form
 - Debriefing consent
 - Sign-up sheet
 - Debrief worksheet
- Login to myVPN
 - Click arrow pointing up at the bottom right corner (beside speaker volume)
 - Click Cisco AnyConnect Secure Mobility Client VPN (globe and lock icon)
 - Login to WinSCP (desktop\WinSCP)
- 1) <u>Study overview</u>
 - a) If Round 1...
 - i) Explain purpose: How people with same or different personalities interact
 - ii) Explain procedure: Personality questionnaires → Computer game → Questionnaires about experience
 - iii) Consent form
 - b) If Round 2...
 - i) Explain procedure: Personality questionnaires → Computer game → Questionnaires about experience
- 2) <u>Pre-Cyberball</u>
 - a) Take picture of participant with webcam
 - i) desktop\simple tap\Camera preview
 - ii) Let participant take a snapshot
 - iii) start\pictures
 - iv) Name new photo with assigned number in the email (e.g., 101.jpg, 102.jpg)
 - v) Drag photo (e.g., 101.jpg) into WinSCP window, images folder
 - b) Hand out Round 1/ Round 2 Pre- Questionnaire
 - c) Open desktop\Cyberball, tell participant to go ahead and read the instructions when they're done the questionnaire

- d) Tell participant **NOT TO START**, that you'll come back to check on them before they start, leave room until participant is finished with the pre-questionnaire and instructions
- 3) Cyberball
 - a) Questions about game?
 - b) Hand out Post-Questionnaire and ask participant to fill in questionnaire immediately after they're done
 - c) Tell participant you're going to make sure everyone's ready so everyone can start at the same time. Tell them to wait for your signal.
 - d) Make your cell phone ring and tell participant to start.
- 4) End (when participant comes to Room 1809, move back to Room 1803)
 - a) If Round 1...
 - i) Thank participant
 - ii) Remind participant of being scheduled the next day
 - iii) Don't talk to other participants if they see them in person because it might affect results
 - iv) Others...
 - (1) Might be better if you don't let them ask you any questions
 - (2) If participants tell you they were left out, don't sympathize with them
 - b) If Round 2...
 - i) Probes
 - (1) "What did you think of the games?"
 - (2) "What did you think is the purpose of the study?"
 - (a) If participant complains about other players, something related to the cover story (e.g., how social interactions happen between people with same and different personalities), or something that's not related, or if they have trouble coming up with it, move on
 - (b) If they say anything that resembles to the purpose of the study (e.g., acceptance, rejection), probe "What do you mean?"
 - (c) If participant suspects there aren't other players or if they are confederates or if they had exposure to Cyberball, mark on questionnaires.
 - (3) "Have you played Cyberball before, or have you heard of Cyberball from class or your friends?" Mark down on questionnaire if participant had previous exposure to Cyberball.
 - c) Debrief
 - i) Thank and debrief (i.e., explain purpose and method, hand out debriefing form) participant
 - (1) No other participants

- (2) Rate how much they believe they were playing a game with other participants on a scale of 0 (definitely not playing with other players) to 8 (definitely playing with other players), mark at the end of the Post-Questionnaire
- (3) Purpose: To examine how high and low acceptance would affect subsequent social interactions, and how this is affected by people's social anxiety levels
- (4) Method: May be initially included or excluded, then included, measured anxiety
- (5) Contacts
- ii) Participant fills out
 - (1) Debrief consent
 - (2) Sign-up sheet
 - (3) Debrief worksheet
- iii) Give participants' cell phones back!!!

5) Afterwards

- a) For Round 1...
 - i) Staple Pre- and Post- Questionnaires together
 - ii) Mark participant number (number in email with web addresses) on questionnaires
- b) For Round 2...
 - i) Staple Questionnaires with Round 1 questionnaires in order, that is, Round 1 Pre-Questionnaire→Round 1 Post-Questionnaire→Round 2 Pre-Questionnaire→Round 2 Post-Questionnaire
 - ii) Mark participant number (number in email with web addresses) on sign-up sheet

Appendix D: Study 2 script

Set-up

- Pills 1 and 2
- Schedule Sheet
- Questionnaires (Mark down participant number beforehand)
 - o Consent
 - Personality questionnaire
 - Cognition questionnaire
 - Social interaction questionnaire
 - Debriefing form
 - Debrief consent
 - HSP feedback sheet
 - Sign-up sheet
- How to log in...
 - Login to myVPN
 - Click arrow pointing up at the bottom right corner (beside speaker volume)
 - o Click Cisco AnyConnect Secure Mobility Client VPN (globe and lock icon)
 - Login to WinSCP (desktop\WinSCP)
- How to change pictures...
 - Open desktop\pictures
 - Name photo as indicated on the schedule sheet
 - Drag photo into WINSCP\images
 - 1.
- 6) Study overview and Tylenol
 - a) Explain purpose: If Tylenol changes how people think and behave?
 - b) Explain procedure
 - i) Take Tylenol/Placebo
 - ii) Do cognitive, personality and social tests
 - c) Consent and screen for medical conditions (in consent form)
 - d) Give pills 1 or 2 (according to the schedule sheet)
- 7) Trait questionnaires and filler tasks

Personality and cognitive questionnaire for 45minutes

- 8) Social task
 - a) Explain procedure
 - i) Interacting with other participants through a social exercise
 - b) Round 1
 - i) Take picture, drop off picture in WINSCP folder

- ii) Drop off and go through pre-questionnaire, open the appropriate file
- iii) Go back in 5 minutes and see if participant is ready and drop off post-questionnaire, make your cell phone ring and tell participant to start
- c) Round 2 (Don't need to take picture again)
 - i) After 10-15 minutes, go back and tell participant we hooked them up with another group because they didn't get passed the ball the first round
 - ii) Drop off and go through pre-questionnaire, open the appropriate file
 - iii) Go back in 5-10 minutes and see if participant is ready and drop off postquestionnaire
 - iv) Go back in 5 minutes and see if participant is ready and drop off post-questionnaire, make your cell phone ring and tell participant to start
- 9) End (when participant comes to Room 1809, move back to Room 1803)
 - a) Probes and questions
 - (1) Ask participant to help you grade the cognition questionnaire (each would take around 5 minutes; no credits). Mark on questionnaire.
 - (2) Ask participant which condition they think they are in. Mark on questionnaire
 - (3) "What did you think is the purpose of the study?"
 - (4) "Do you know what the social exercise is?" Mark down on questionnaire if participant had previous exposure to Cyberball.
 - b) Debrief
 - i) Thank and debrief (i.e., explain purpose and method, hand out debriefing form) participant
 - (1) Purpose: Hurt feelings \rightarrow Future social anxiety (e.g., people who were bullied would be more socially anxious)
 - (2) Method: Everything was planned, played two rounds of ball-tossing where they were not passed the ball the first round.
 - (3) Hypothesis: Everyone is excluded, those who feel less hurt from taking painkillers would feel less social anxiety in Round 2.
 - (4) Rate how much they believe they were playing a game with other participants on a scale of 0 (definitely not playing with other players) to 8 (definitely playing with other players). Mark on questionnaire.
 - c) Wrap up
 - i) Participant fills out
 - (1) Debrief consent
 - (2) Sign-up sheet
 - (3) Debrief worksheet
 - ii) Staple useful questionnaires together