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The Effects of Attachment Priming on Depressed and Anxious Mood

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### Abstract

Correlational evidence links attachment insecurity (attachment anxiety and attachment avoidance) to depression and anxiety (Carnelley, Pietromonaco, & Jaffe, 1994; Eng et al., 2001), but the causal directions of these relationships remain unspecified. Our aim (Study 1, *N* = 144) was to prime attachment anxiety and avoidance and test causal relationships between these attachment patterns and depressed and anxious mood. Attachment anxious-primed participants reported higher depressed mood than secure-primed participants. Furthermore, avoidant-primed and anxious-primed participants reported higher anxious mood compared to secure-primed participants. In Study 2 (*N*=81) we tested the effectiveness of repeatedly priming attachment security (versus a neutral prime), in the laboratory and via texts, on improving depressed and anxious mood. Secure-primed (compared to neutral-primed) participants reported less anxious mood post-prime and one day later. Repeated secure-primed (compared to neutral) participants reported marginally less depressed mood post-prime and one day later. Discussion considers possible clinical implications for repeated security priming.

*Keywords*: attachment, depression, anxiety, priming, security

**The Effects of Attachment Priming on Depressed and Anxious Mood**

According to attachment theory (Bowlby, 1973) the quality of interactions with primary carers becomes internalized over time in the form of attachment orientations. An individual’s attachment orientation guides their perceptions of the social world (Baldwin, Keelan, Fehr, Enns, & Koh-Rangarajoo, 1996; Collins & Read, 1990; Rowe & Carnelley, 2003). Attachment orientations are conceptualized along two dimensions: anxiety regarding abandonment and avoidance of intimacy (Brennan, Clark, & Shaver, 1998). Secure individuals (low on both dimensions) are effective at regulating affect in response to threat. Avoidance is associated with orienting away from threat cues, while anxiety is associated with exaggerated appraisals of and hypervigilance towards threat cues (Mikulincer & Shaver, 2006). Both insecure attachment dimensions (attachment anxiety and avoidance) have been linked to anxiety and depression (Carnelley et al., 1994; Doi & Thelan, 1993), but the causal role of attachment on depression and anxiety has yet to be examined and is the aim of the current studies.

The quality of care received from attachment figures determines individuals’ attachment patterns such that reliable, sensitive care leads to attachment security, inconsistent or overprotective care leads to attachment anxiety and neglect or rejection leads to attachment avoidance (Ainsworth, Blehar, Waters, & Wall, 1978).

Attachment dimensions are associated with affect regulation strategies (Bowlby, 1973; Kobak & Sceery, 1988). Those high in attachment anxiety engage in the hyperactivation of the attachment behavioral system and are hypervigilant for signs of rejection. Those high in avoidance engage in deactivation of the attachment system to defend the self from pain of rejection; they turn attention away from relational information and avoid emotional expression. Secure individuals can regulate negative affect so that when the attachment system is activated in times of threat, it can be downregulated when comfort is received.

Correlational studies with both clinical and non-clinical samples suggest a link between attachment insecurity and depression and anxiety. Some non-clinical studies of the relationship between attachment dimensions and depression indicate that both attachment anxiety and attachment avoidance are linked with depressive symptoms (e.g., Davila, 2001; Whiffen et al., 2001; Williams & Riskind, 2004), while others report associations only between attachment anxiety (but not attachment avoidance) and depressive symptoms (e.g., Besser & Priel, 2005; Shaver, Schachner, & Mikulincer, 2005). Correlational evidence for an association between attachment dimensions and anxiety from non-clinical samples indicate that both attachment avoidance and attachment anxiety are positively related to anxiety (e.g., Doi & Thelan, 1993; Hankin, Kassel, & Abela, 2005; Irons & Gilbert, 2005), while other studies report a positive relationship exclusively between attachment anxiety (but not attachment avoidance) and anxiety symptoms (e.g., Sonnby-Borgstrom & Jonsson, 2004; Strodl & Noller, 2003).

Studies with clinically depressed samples suggest that both high attachment anxiety and high attachment avoidance are related to depression symptoms (e.g., Carnelley et al., 1994; Reinecke & Rogers, 2001; Reis & Greyner, 2004). Furthermore, evidence from clinical samples suggest that social anxiety disorder is associated with both attachment anxiety and avoidance (Eng, Heimberg, Hart, Schneier, & Liebowitz, 2001) and adolescents with a diagnosed anxiety disorder are more likely to be categorised as insecure in attachment, compared to adolescents without anxiety disorders (Brumario, Obsuth, & Lyons-Ruth, 2013).

Taken together, these correlational findings suggest that attachment insecurity in general is associated with depression and anxiety. However, it appears that the relationship between attachment anxiety and both anxiety and depression is more reliable than the relationship between attachment avoidance and anxiety and depression (see Mikulincer & Shaver, 2007a for a review).

 Causal relationships between attachment insecurity and depression and anxiety are yet to be reported, but theoretical models make a strong case for attachment insecurity serving as a vulnerability factor for depression. Bowlby (1973) proposed a path by which attachment insecurity could lead to the development of anxiety disorders. For insecure individuals the attachment system has failed to achieve its protective function and the child (and later, adult) will therefore feel unsafe when entering new and/or challenging situations. Indeed, insecurely attached individuals, particularly those high in attachment anxiety, tend to doubt their own ability to cope with stressful events and challenges. These feelings of inadequacy combined with fearful reactions to challenges are likely to leave insecurely attached individuals vulnerable to anxiety and depressive disorders. Several mediating variables have been suggested to explain the links between anxiety or avoidance and depression. For example, research shows that excessive reassurance seeking mediates the link between attachment anxiety and depression (Brennan & Carnelley, 1999; Shaver et al., 2005). In contrast, low emotional disclosure (Shaver & Mikulincer, 2009) and perfectionism (Wei et al., 2006) may be vulnerability factors for mood disorders for those high in attachment avoidance. Finally, the role of perceived support has been explored with regard to women’s depression in the transition to parenthood (Rholes et al., 2011), a challenging life event. Women high in attachment anxiety reported higher levels of depression throughout the transition if they perceived less partner support. These studies (and others) suggest that attachment insecurity has a causal role in determining depression and anxiety, but have not tested causality.

 It is possible that depression erodes attachment security. However, evidence demonstrates that inducing depressed (versus elated) mood with music in non-depressed adults does not negatively affect reports of attachment insecurity (Haaga et al., 2002). All things considered theory and research point to insecure attachment patterns as vulnerability factors for depression.

We here test the causal relationship between attachment insecurity and depression and anxiety using a semantic priming methodology. By adulthood individuals have multiple relationship-specific cognitive representations of attachment alongside their more dominant and chronically activated dispositional model. Relationship-specific attachment orientations develop on the basis of long-term attachment relationships with others (Collins & Read, 1990). Relationship-specific attachment orientations can be experimentally and temporarily activated by priming (Baldwin et al., 1996; Mikulincer & Arad, 1999; Rowe & Carnelley, 2003), either supraliminally or subliminally. Much past research shows that temporarily activating a specific attachment style leads individuals to think, feel and behave in ways consistent with the ways a person with that dispositional attachment style would think, feel, and behave, albeit temporarily (see Mikulincer & Shaver, 2007b for a review). Past research reports that attachment security priming can increase positive mood and decrease negative mood compared to neutral primes (Mikulincer & Arad, 1999; Mikulincer & Shaver, 2001). However none of the studies have assessed depressed mood or anxious mood directly.

Furthermore researchers have shown that secure (versus neutral) priming can reduce personal distress empathy reactions to a fictional person’s plight (Mikulincer, Gillath, Halevy, Avihou, Avidan, & Eshkoli, 2001), and can help people to feel less negative affect after thinking about an upsetting memory or when their feelings have been hurt (Cassidy, Shaver, Mikulincer, & Lavy, 2009; Selcuk, Zayas, Gunaydin, Hazan, & Kross, 2012). Although these priming studies point to the role that secure relationships may have in buffering individuals from depression and anxiety, they do not assess depressed and anxious mood. In the current studies, we extend past research by directly assessing depressed and anxious mood with multi-item measures, whilst taking into account prior depressed and anxious mood.

In the current studies we examine state depressed and anxious mood rather than clinical depression and anxiety disorders. State levels temporarily mimic chronic effects. Depression induction procedures have been shown to mimic the effects of naturally occurring depressed mood on a wide range of variables, producing a state which is a good analogue of mild, naturally occurring retarded depression (Clark, 1983). Depressed and anxious mood are core symptoms of clinical depression and anxiety disorder, respectively. Furthermore, recent evidence using Meehl’s (1995) taxometric procedures to reveal latent structures supports the view that depression (Hankin, Fraley, Lahey, & Waldman, 2005) and anxiety (A. M. Ruscio, Borkovec, & Ruscio, 2001) are best viewed as continuums, suggesting some of the same psychological processes may be involved in understanding both state and clinical levels of depression and anxiety.

**Study 1**

The novel aim of Study 1 was to explore whether priming participants with secure, anxious, avoidant attachment styles or a neutral (control) prime leads to differences in post-prime self-reported depressed mood and anxious mood. We hypothesized that participants in the secure condition, compared to those in the anxious, avoidant or neutral conditions, would report lower levels of post-prime depressed mood and anxiety. Furthermore, we predicted higher levels of post-prime depressed mood and anxiety to be reported by those in the attachment anxious condition, compared to those in the avoidant condition, in line with research findings documenting a more consistent link between attachment anxiety with depression and anxiety. In addition, we predicted that those in the neutral condition would report less depressed and anxious mood than those in the anxious and avoidant conditions. We hypothesized that participants in the secure attachment prime condition would report higher levels of post-prime felt security (our manipulation check), compared to those in the anxious and avoidant attachment prime conditions and the control (neutral prime) condition. Furthermore, we hypothesized that participants in the neutral condition would report higher levels of felt security, compared to those in the anxious and avoidant conditions (who should report similar levels).

The attachment primes should temporarily override an individual’s dispositional level of attachment security, as has been found in previous security priming research (Rowe & Carnelley, 2003). We therefore predicted that dispositional attachment anxiety and avoidance would not affect felt security or depressed and anxious mood, for those in the secure, anxious or avoidant conditions. However, we did expect dispositional attachment dimensions to affect felt security and depressed and anxious mood for those in the neutral (control) condition, with those higher in attachment anxiety or avoidance reporting less felt security and more depressed and anxious mood post-prime, compared to those low in dispositional attachment anxiety and avoidance.

## Method

### Participants

We recruited 154 undergraduates (135 female), from a British university to participate for course credits (8 participants were excluded due to a technical error resulting in large amounts of missing data, 2 participants were excluded because they were unable to complete the visualisation task in the anxious prime condition as they had never experienced that type of relationship). Analyses included 144 participants (127 female) with a mean age of 20.1 (range 18-50); the majority (125) described themselves as Caucasian, 12 as Asian, 3 as Indian, 1 as African, and 3 did not state or chose “other”.

In order to detect a medium or large effect, in Analysis of Variance (ANOVA) with 4 groups (*f* = .25) and *p* = .05, a sample size of 180 or 72, respectively, is necessary (Cohen, 1992). Ours was somewhat below that for a medium effect.

### Procedure

The protocols for both studies received ethical approval from the Psychology Department Ethics committee and the University Research Governance office and were carried out in accordance with American Psychological Association and British Psychological Society Guidelines. Immediately after booking a slot participants were sent an email with a link to the first (online) part of the study, with instructions to complete it immediately (Time 1). After providing informed consent, participants completed demographics and measures of dispositional attachment and baseline depression and anxiety symptoms (over the last week). At Time 2 (a few days to a week later), participants attended the laboratory in groups of 1 to 6, were seated in separate cubicles at a computer and were randomly assigned to either a secure (*N =* 38), anxious (*N* = 35), avoidant (*N* = 33) or neutral (*N* = 38) priming condition. After the priming task participants completed felt security, depressed and anxious mood measures followed by a mood repair task, before being debriefed and thanked.

### Materials

**Adult attachment.** Attachment avoidance and anxiety were measured using an adapted version of the Experiences in Close Relationships inventory (ECR: Brennan et al., 1998), which consists of 36 items, 18 for each dimension. It was adapted to measure dispositional attachment orientation to close others as opposed to romantic partners (Carnelley & Rowe, 2007). An example avoidance item is “I prefer not to show others how I feel deep down”. An example anxiety item is “I worry about being rejected or abandoned”. Participants rated items on a 7-point scale (1 = *strongly disagree,* 7 = *strongly agree*). The ECR shows high reliability, with alpha coefficients close to or above .90 and test-retest reliability ranging between .50 and .75 (Mikulincer & Shaver, 2007a). In the current study, attachment anxiety ( = .92) and attachment avoidance ( = .95) were weakly correlated (see Table 1).

**Baseline depression and anxiety.** Baseline depression (15 items,  = .93) was measured using the depression-dejection items (e.g., miserable) from the Profile of Mood States (POMS: McNair, Lorr, & Droppleman, 1992). Baseline anxiety (9 items,  = .81) was measured using the tension-anxiety items (e.g., shaky) from the POMS. Participants rated on a 5-point Likert scale (0 = *not at all*, 4 = *extremely*) the extent to which they were experiencing various mood states over the last week, including that day.

**Experimental Manipulation**

We used an adaptation of Bartz and Lydon’s (2004) attachment style priming method. Participants wrote for 10 minutes about a relationship that made them feel either secure, anxious, or avoidant; participants were asked to visualize the person and how they feel when with her/him. The neutral prime was identical to the one used by Rowe and Carnelley (2003), which was adapted from Mikulincer and Shaver (2001); participants wrote for 10 minutes about a weekly supermarket shop, visualizing taking items from the shelves and moving around the shop.

**Post Prime Materials**

**Felt security.** To find out whether the experimental manipulation was successful, participants completed a 10-item measure ( = .96) of felt security (Luke, Sedikides, & Carnelley, 2012). Participants rated the extent to which the person or scenario in the visualisation task made them feel each item (e.g., loved, protected) on a 6-point Likert scale (1 = *not at all*, 6 = *very much*).

**Depressed mood.** Participants rated POMS depression-dejection items ( = .92) based on how they were feeling “right now”.

**Anxious mood**. Participants rated POMS tension-anxiety items ( = .85) based on how they were feeling “right now”.

**Mood repair.** Participants wrote about the 5 best things in their life to counteract any negative affect participants in the anxious or avoidant prime conditions may have experienced.

## Results and Discussion

### Preliminary Analyses

There was 1 missing value for attachment avoidance and attachment anxiety which were dealt with using Expectation-Maximization in SPSS. One univariate outlier (z-score > 3.29) for post-prime depressed mood and two outliers for post-prime anxious mood were replaced with the mean plus two standard deviations (Field, 2005). Table 1 shows correlations among variables.

Table 2 indicates whether the following four baseline variables met criteria to be included as covariates in the Analyses of Covariance (ANCOVA) reported below for each dependent variable (DV): attachment anxiety, attachment avoidance, baseline anxiety and baseline depression. To be used as covariates the variables must correlate with the DV, be independent from the experimental effect (prime condition), and must not violate the homogeneity of regression slopes assumption (Field, 2005).

### Felt Security Analyses

As a manipulation check, we examined whether post-prime felt security was higher for people in the secure prime condition compared to the other prime conditions. Table 2 shows that none of the variables met the criteria to serve as covariates. We conducted an ANOVA, with prime condition (4 levels: secure, anxious, avoidant and neutral) as the independent variable and post-prime felt security as the dependent variable (DV). Figure 1 displays the means and standard errors for felt security in each condition. Levene’s test indicated equal variances across experimental groups (*p* = .46). The effect of condition on felt security was significant, *F*(3,140) = 35.13, *p* < .001. Tukey-Kramer post hoc analyses revealed that participants in the secure condition (*M* = 4.77, *SE* = .17) reported significantly more felt security than those in the anxious (*M* = 2.85, *SE* = .18), *p* < .001, avoidant (*M* = 2.42, *SE* = .18), *p* < .001, and neutral (*M* = 3.05, *SE* = .17) conditions, *p* < .001, in support of hypotheses. Also, as expected, participants in the avoidant condition reporting marginally lower felt security compared to those in the neutral condition, *p* = .06, and there were no significant differences between the avoidant and anxious condition, *p* = .34. In contrast to hypotheses, those in the neutral condition did not report higher felt security than those in the anxious condition, *p* = .34. Effect size was calculated using ηprime condition accounted for 43% of the variance in felt security scores. These findings suggest that the secure prime was more successful at inducing security than the anxious prime was at inducing a sense of attachment insecurity and may reflect the ambivalent nature of the anxious attachment style in terms of views of others (Mikulincer, Shaver, Bar-On, & Ein-Dor, 2010). (Attachment dimensions did not moderate the effects of the primes.)1,2

### Depressed Mood: Preliminary Analyses

Table 2 shows that attachment avoidance, baseline anxiety, and baseline depression fulfilled the criteria of covariates. Analyses showed that the standardised residuals for depressed mood were non-normal in distribution (*p* < .01) and Levene’s test (*p* < .001) indicated that the error variance was not equal across experimental conditions. When we used a log transformation, the standardised residuals were normally distributed (*p* = .06) and Levene’s test was nonsignificant, *p* = .99 indicating that the error variance was equal across experimental conditions and the transformation was a success. Results below use transformed post-prime depressed mood.

### Depressed Mood: Main Analyses

We conducted an ANCOVA on post-prime depressed mood by prime condition (4 levels: secure, anxious, avoidance and neutral) with attachment avoidance, baseline anxiety, and baseline depression as covariates. Figure 2 (Panel A) displays the estimated marginal means for depressed mood in each prime condition. Higher baseline depression and attachment avoidance (*F*(1,137) = 5.79, *p* < .05, *B* = .01, Partial η2 = .04; *F*(1,137) = 7.65, *p* < .01, *B* = .09, Partial η2 = .05, respectively) predicted higher post-prime depressed mood. The effect of prime condition was significant, *F*(3,137) = 12.21, *p* < .001, Partial η2  = .21. Post hoc analyses (pairwise comparisons of the estimated marginal means, with Bonferroni correction) revealed that as hypothesized, participants in the secure prime condition (*M* = .54, *SE* = .06) reported less depressed mood than those in the anxious condition (*M* = 1.00, *SE* = .06), *p* < .001. Although the means were in the predicted direction, those in the secure prime condition did not differ from those in the avoidant prime condition (*M* = .74, *SE* = .07) (*p* = .149). Furthermore, those in the secure condition did not differ from those in the neutral (*M* = .53, *SE* = .06) condition, *p =* 1.00. Consistent with our hypotheses, those in the neutral condition reported significantly less depressed mood than those in the anxious condition, *p* < .001, but not the avoidant condition, *p* = .126. Finally, those in the anxious prime condition reported more depressed mood than those in the avoidant, *p* < .05, consistent with hypotheses. (Attachment dimensions did not moderate the effects of the primes.)3,4 These findings suggest a causal relationship between attachment anxiety and depression.

### Anxious Mood: Preliminary Analyses

Table 2 shows that attachment avoidance and Baseline anxiety were suitable covariates. Analyses demonstrated that the standardised residuals were non-normal in distribution (*p* < .01) and Levene’s test (*p* < .05) indicated that the error variance was not equal across experimental conditions. When we used square root transformation for anxious mood the standardised residuals were normally distributed (*p* = .20) and Levene’s test was nonsignificant, *p* = .44 indicating that the error variance was equal across experimental conditions and transformation a success. Results below use transformed post-prime anxious mood.

### Anxious Mood: Main Analyses

We conducted an ANCOVA on anxious mood by prime with attachment avoidance, baseline depression and baseline anxiety as covariates. Figure 2 (Panel B) displays the estimated marginal means for anxious mood in each prime condition. Higher levels of baseline anxiety, *F*(1, 137) = 4.42, *p* < .05, *B* = .04, Partial η2 = 3%, predicted higher levels of post-prime anxious mood. Baseline depression, *F*(1,137) = .11, *p* = .75, *B* = -.00, did not significantly predict post-prime anxious mood. Higher levels of attachment avoidance predicted higher levels of post-prime anxious mood, *F*(1,137) = 11.58, *p* < .01, *B* = .23, Partial η2 = .08. The effect of prime condition, *F*(3,137) = 12.78, *p* < .001, Partial η2 = .22, was significant. Post-hoc analyses (pairwise comparisons of the estimated marginal means, with Bonferroni correction), revealed that as predicted, participants in the secure condition (*M* = 1.74, *SE* = .13) reported less anxious mood than those in the anxious (*M* = 2.71, *SE* = .14), *p* < .001, and avoidant (*M* = 2.64, *SE* = .24) conditions, *p* < .001. Furthermore, as expected, those in the neutral condition reported less anxious mood than those in the anxious and avoidant conditions, *p* < .01 (who did not differ from each other, *p* = 1.00). This finding is encouraging as it suggests that security priming is likely to reduce the symptoms of anxiety. Moreover, these findings suggest a causal relationship between attachment anxiety and anxious mood and between attachment avoidance and anxious mood, consistent with previous research (e.g., Eng et al., 2004). However, those in the secure condition did not report significantly less anxious mood than those in the neutral (*M* = 2.02, *SE* = .13) prime condition, *p =* .83. (Attachment dimensions did not moderate the effects of the primes.)5, 6, 7

### Linguistic and Word Count Analyses

We hypothesised and found that those in the secure condition reported higher felt security than those in the neutral condition. However, we also predicted that those in the secure condition would report less depressed and anxious mood post-prime compared to those in the neutral condition, which was not supported. These findings might imply that it is possible to increase depression and anxiety by priming attachment insecurity (which for ethical reasons researchers would not wish to do) but that it is more difficult to decrease depression or anxiety by priming attachment security. However, an alternative explanation is that the unintended interpersonal nature of our neutral prime might have led to these results.

We noticed while reading participants’ text from the prime task that many in the neutral condition wrote about grocery shopping with family or friends and wondered whether this could have boosted their mood post-prime, causing the prime to be less “neutral” than intended. Using the Linguistic Inquiry and Word Count (LIWC) program (Pennebaker et al., 2007), we explored word count differences (using t-tests) between the secure and neutral conditions in social, ‘we’, family and friend words. Participants in the secure condition (*M* = 13.06, *SE* = .47) used more social words than those in the neutral (*M* = 5.01, *SE* = 5.01) condition, *t*(78) = 10.85, *p* < .001. However, there were no significant differences in the number of family words used between the secure (*M* = .20, *SE* = .51) or neutral (*M* = .32, *SE* = .69) conditions, *t*(78) = -.92, *p* = .36, or in the number of friend words used in the secure (*M* = .47, *SE* = .09) and neutral (*M* = .32, *SE* = .32) conditions, *t*(78) = 1.31, *p* = .20. Furthermore, there was no difference in the number of “we” words used by participants in the secure (*M* = 2.22, *SE* = .26) and neutral (*M* = 1.98, *SE* = .38) conditions, *t*(70.69) = .47, *p* = .64. These findings show that the secure and neutral conditions triggered similar levels of reference to close others. Perhaps neutral visualisation tasks that were less likely to involve a person’s attachment figures (doing laundry) might have produced the expected differences between the secure and neutral conditions in depressed and anxious mood.

 We also noticed that some participants in the secure condition were sad about no longer having the secure attachment figure they had visualised in their life (e.g., an ex-romantic partner) so we explored differences in use of negative and positive emotion words between conditions. Participants in the secure condition (*M* = 1.20, *SE* = .15) used more negative emotion words than those in the neutral (*M* = .29, *SE* = .06) condition, *t*(51) = 5.79, *p <* .001. However, those in the secure condition (*M* = 5.16, *SE* = .27) also used more positive emotion words than those in the neutral (*M* = 1.11, *SE* = .11) condition, *t*(51.50) = 14.02, *p* < .001. These findings indicate that the secure prime triggers both negative and positive emotions, as opposed to just positive emotions, as we might have expected. Furthermore, the neutral condition triggers relatively low levels of both negative and positive emotions, as we would expect of a neutral task. Finally, although participants in both conditions reported more positive than negative emotions words, this was much more pronounced for the secure primed participants (*F*(1,79)=98.80, *p* < .001).

It is possible that participants chose to write about relational figures who were no longer in their lives or those who they miss due to seeing them infrequently. It is likely that many of our undergraduate participants have moved away from their family home and long-term friends relatively recently and if these relational figures were focused on in the secure prime task, it may have evoked negative emotions such as homesickness. These limitations may help to explain why no significant differences in depressed or anxious mood were observed between the secure and neutral prime conditions. Future security priming studies should control for the quality of the relational figure selected (by asking participants to list their closest others, characterise them by attachment style and indicate the frequency of their contact with that person); we do this in Study 2.

The findings that participants in the secure prime condition used more positive and negative emotion words than those in the neutral condition may not be as surprising as they initially appear. Zayas and Shoda (in press) provide evidence that suggests that mental representations of attachment figures simultaneously trigger both positive and negative automatic reactions. Their participants were primed with names of significant others that they liked or disliked and those in a control condition were primed with names of objects they liked or disliked. They assessed the extent to which the primes facilitated the processing of positively or negatively valenced target words and found that the object primes had a univalent priming effect; liked object primes facilitated the classification of positively valenced targets (and inhibited the classification of negative targets) and disliked object primes facilitated the classification of negative targets (and inhibited the classification of positive targets). By contrast, the significant other primes had a bivalent-priming effect; they facilitated the classification of both positive and negative targets. Furthermore, participants were not consciously aware of possessing both positive and negative responses to a significant other. Therefore, our finding that the secure prime triggered both positive and negative emotions may be normative.

## Study 2

##  The aim of Study 2 was to examine whether repeated security priming would lead to less depressed and anxious mood. We focus here exclusively on the positive effects of security priming that we identified in Study 1, on the basis that such effects might have implications for the development of interventions designed to ameliorate symptoms of depression and anxiety. We were particularly interested in whether the effects of security priming we identified in Study 1 would be strengthened across priming sessions. In addition to the lab priming methodology used in Study 1, we here also primed via text message, a method we have found successfully boosts felt security (Otway, Carnelley, & Rowe, 2014). Participants provided information regarding their 10 closest relational figures. For the security priming manipulation we exclusively selected attachment figures (from the list of 10) reported to be strong secure attachment figures. We could be sure, therefore, that the relationships with which participants were primed induced security and that participants were currently in contact with these attachment figures.

We hypothesised that participants in the repeated secure prime condition would report higher levels of felt security and lower levels of depressed and anxious mood, at all post-prime time-points in the study, compared to participants in the repeated neutral prime condition. We predicted that felt security would decrease between Time 4 (immediately after the last secure text prime) and Time 5 (one day later) for those in the repeated security prime condition.

## Method

### Participants

Participants (*n* = 81, 70 female) from a British university participated for course credits. They ranged in age from 18 to 33 (*M* = 20.32); 65 identified as Caucasian, 6 as Asian, 3 as Indian, 3 as Mixed, 2 as African, and 2 as “other ethnicity”. In order to detect a medium or large effect in an ANOVA with 2 groups (*f* = .25, *p* = .05), a sample size of 128 or 52, respectively is necessary (Cohen, 1992). Our sample size (N = 81) was sufficient to detect a large effect.

### Procedure

Participants signed up to an online study which purported to examine people’s ability to use their imagination and memory skills during and after visualisation tasks, some of which would be received via text message. At an introductory session (Baseline), participants completed baseline measures of attachment anxiety and avoidance, information about attachment figures, baseline depression and anxiety and filler items about creativity, to support the cover story.

Participants were randomly assigned to either a secure (*N* = 43) or neutral (*N* = 38) priming condition. A week later, participants came to the laboratory (Time 1) and wrote for 10 minutes about either a security-inducing attachment figure (selected ahead of time by the experimenter) or a supermarket shopping trip on a computer (control condition). Participants then completed measures of felt security, depressed and anxious mood and filler items. At Time 2 (1 day later) participants received a text containing a 3 minute visualisation task; they were asked to text “Done” to the experimenter once they had completed the task, along with any words concerning their thoughts and feelings during the task. One day later (Time 3), participants received another 3-minute visualisation text and the same procedure as at Time 2 was followed. One day later (Time 4), participants received another 3-minute visualisation text. After sending their “done” response, participants were instructed (by text) to complete the online questionnaire (felt security, depressed and anxious mood and filler items) immediately and were given a url and password. Finally, one day later (Time 5), participants received a text instructing them to complete an online questionnaire immediately (felt security, depressed and anxious mood and filler items).

### Materials

**Attachment figure information.** We used an adaptation of the procedure developed by Baldwin et al. (1996) to obtain information about participants’ attachment relationships and select secure attachment figures for participants in the secure condition. At Baseline, we asked participants to indicate the names of up to 10 of their ‘‘closest significant others’’. Next, we provided them with Bartholomew and Horowitz’s (1991) single paragraph descriptions of four attachment categories (secure, preoccupied, dismissing, and fearful) and asked them to select which relationship description best described their feelings in each relationship; participants could indicate ‘‘none of the above’’ if necessary. Participants rated from 1 (*not very representative*) to 5 (*very representative*) the extent to which the description chosen was representative of how they felt in that relationship. Then they reported how frequently they contacted each person and the length of time they had known them. Secure attachment figures were selected from those participants categorised as secure. If more than one was listed, we selected one based on how representative the attachment figure was of security, followed by frequency of contact and length of time known. All participants listed at least one secure attachment figure. Participants frequency of contact with secure attachment figures was on average 1.28 (where 1=daily and 2=at least once a week) and length of time known was 10.83 years.

**Attachment avoidance and anxiety.** Attachment anxiety and avoidance were measured using the Experiences in Close Relationships Short form (ECR-S) developed by Wei, Russell, Mallinckrodt and Vogel (2007) which consists of 12 items; evidence suggests that it has psychometric properties similar to the ECR (Wei et al., 2007). An example avoidance item is “I try to avoid getting too close to my partner”. An example anxiety item is “My desire to be very close sometimes scares people away”. Participants rated items on a 7-point Likert scale (1=*disagree strongly,* 7=*agree strongly*). Attachment anxiety ( = .83) and attachment avoidance ( = .79) were moderately correlated (*r* = .29, *p* < .01).

**Baseline depression.** The baseline depression measure was the same as in Study 1 ( = .94).

**Baseline anxiety.** The baseline anxiety measure was the same as in Study 1 ( = .90).

**Filler items.** Participants rated 13 filler items (e.g., imaginative) to fit the cover story on a 5-point scale (0 = *Not at all*, 4 = *Extremely*) regarding how they felt over the last week.

**Primes**. The security and neutral primes used in the laboratory at Time 1 were the same as in Study 1. The text primes used in this experiment were developed by the researchers (Otway et al., 2014). An example secure text was: “Please spend 3 minutes thinking about the person you visualised and how they make you feel safe, secure and comforted”. An example neutral text was: “Please spend 3 minutes thinking about the route you take from your home to the supermarket”. Participants were asked to reply ‘Done’ along with any words or thoughts that came to mind during the task.

**Post-Prime Measures**

**Felt security.** Participants indicated the extent to which thinking about the person or scenario in the visualisation task made them feel by rating 16 items (e.g., loved) on a 6-point scale (1 = *not at all*, 6 = *very much*) (Luke et al., 2012; Time 1 α = .98, Time 4 α = .98, Time 5 α = .98).

**Depressed mood.** Depressed mood was measured using the POMS depression-dejection items. At Time 1, 4 and 5 participants rated items based on how they felt “right now” (Time 1  = .96, Time 4 α = .94, Time 5 α = .95).

**Anxious mood.** Anxious mood was measured using the POMS tension-anxiety items. At Time 1, 4 and 5 participants rated items based on how they felt “right now” (Time 1  = .90, Time 4 α = .87, Time 5 α = .88).

**Filler items.** Participants completed the same filler items as at Baseline regarding how they felt “right now”.

## Results

### Preliminary Analyses

Missing data were dealt with using Expectation-Maximization in SPSS. Nine univariate outliers were replaced with the mean plus two standard deviations (Field, 2005). Table 3 shows the correlations between variables.

### Felt Security: Preliminary Analyses

Table 4 demonstrates that attachment avoidance met criteria to be used as a covariate. We found that the standardised residuals for Time 1 and 5 felt security were normally distributed (*p*s = .20), but not Time 4 (*p* < .05). Levene’s tests showed that the error variance was equal for Time 4 and 5 (*p*s > .13) but not Time 1, *p* < .05. Various methods of transforming the data failed to rectify problems with non-normal data, therefore subsequent analyses were performed on the original data.

### Felt Security: Main Analyses

 We conducted a mixed-design ANCOVA on felt security with time as a within-subjects factor (3 levels: Time 1, 4 and 5) and prime condition (2 levels: secure versus neutral) as a between-subjects factor, with attachment avoidance as a covariate. The effect of prime was significant, *F*(1,78) = 109.14, *p* < .001, accounting for 58% of the variance. Those in the secure prime condition (M = 4.97, *SE* = .13) reported higher felt security than those in the neutral prime condition (M = 2.97, *SE* = .14), as hypothesised (see Figure 3).8 Attachment avoidance did not significantly affect felt security, *F*(1, 78) = 2.60, *p* = .11.

 Mauchly’s test indicated that the assumption of sphericity was violated, (2) = 28.92, *p* < .001, therefore degrees of freedom were corrected using the Greenhouse-Geisser estimates of sphericity ( The effect of time was significant, *F*(1.52,118.81) = 3.79, *p* < .05, η*p* There was no significant difference between felt security at Time 1 (*M* = 4.08, *SE* = .10) and Time 4 (*M* = 4.02, *SE* = .10, *p* = 1.00), however, felt security marginally decreased between Time 4 and 5 (*M* = 3.90, *SE* = .11, *p* = .06). There were no significant differences between felt security at Time 1 and Time 5, *p* = .08. The interaction between condition and time on felt security was not significant, *F*(1.52,118.81) = .49, *p* = .56.9, 10

### Depressed Mood: Preliminary Analyses

Table 4 shows that Baseline anxiety met criteria for a covariate. The standardised residuals for Time 1, 4 and 5 depressed mood were non-normal in distribution, *p*s < .001. Levene’s tests showed that the error variance was equal across experimental conditions at all time-points, *p*s > .73. We used square root transformation on depressed mood which fixed the non-normal distribution (*p*s > .13) problem; ANCOVA results reported below use the transformed variables.

### Depressed Mood: Main analysis

We conducted a mixed-design ANCOVA on depressed mood with time (3 levels: Time 1, 4 and 5) as a within-subjects factor and prime condition (2 levels: secure versus neutral) as a between-subjects factor, with Baseline anxiety as a covariate. The effect of prime was not significant, *F*(1,78) = 2.38, *p* = .13 (see Figure 4, Panel A for the means). Baseline anxiety predicted depressed mood, *F*(1,78) = 18.41, *p* < .001. Higher levels of baseline anxiety predicted higher levels of depressed mood at Time 1, *B* = .08, *t*(1,78) = 3.60, *p* < .001, Time 4, *B* = .08, *t*(1,78) = .42, *p* < .001, and Time 5, *B* = .09, *t*(1,78) = 4.32, *p* < .001.

The effect of time on depressed mood was not significant, *F*(2,156) = .38, *p* = .69, η*p*Although the interaction between condition and time on depressed mood was not statistically significant (*F*(1.52, 118.81) = 2.38, *p* = .10), the pattern of results were in the predicted direction. Furthermore, simple effects test revealed that differences in depressed mood between the secure and neutral conditions became more pronounced over time. At Time 1, there were no significant differences between the secure *(M* = 2.70, *SE* = .21) and neutral (*M* = 2.72, *SE* = .22) conditions, *F*(1,78) = .01*, p* = .95. However at Times 4 and 5, the differences between the secure (T4: *M* = 2.52, *SE* = .23; T5: *M* = 2.46, *SE* = .22) and neutral (T4: *M* = 3.14, *SE* = .25; T5: *M* = 3.06, *SE* = .25) conditions were marginally significant (*F*(1,78) = 3.36, *p* = .07 and *F*(1,78) = 3.62, *p* = .06, respectively) with secure-primed participants showing lower depressed mood, compared to neutral-primed participants.11,12

### Anxious Mood: Preliminary Analyses

Table 4 shows that Baseline depression met criteria for a covariate. The standardised residuals for Time 1, 4 and 5 anxious mood were non-normal in distribution, *p*s < .001. Levene’s tests showed that the error variance was equal across experimental conditions at Time 1 and 4 (*p*s > .14), but not Time 5, *p <* .05. We used square root transformation on anxious mood which fixed the non-normal distribution (*p*s > .20) problem and the Levene test for Time 5 (*p* = .39); ANCOVA results reported below, therefore, use the transformed variables.

### Anxious Mood: Main Analyses

We conducted a mixed-design ANCOVA on anxious mood with time (3 levels: Time 1, 4 and 5) as a within-subjects factor and condition (2 levels: secure versus neutral) as a between-subjects factor, with Baseline depression as a covariate. As hypothesized, participants in the secure prime condition (*M* = 1.94, *SE* = .12) reported less anxious mood than participants in the neutral condition (*M* = 2.52, *SE* = .13, *F*(1,78) = 10.11, *p* = .01); condition accounted for 11% of the variance in anxious mood (see Figure 4, Panel B for means). Importantly, the effect of prime held across time points (i.e., it was not moderated by time, *F*(1.69, 131.55) = .35, *p* = .67). Baseline depression had a significant effect on anxious mood, *F*(1,78) = 20.03, *p* < .001. Higher levels of baseline depression predicted higher levels of anxious mood at Time 1, *B* = .04, *t*(1,78) = 3.22, *p* < .01, Time 4, *B* = .04, *t*(1,78) = 4.07, *p* < .001, and Time 5, *B* = .03, *t*(1,78) = 3.58, *p* < .001.

Mauchly’s test indicated that the assumption of sphericity was violated, (2) = 15.83, *p* < .001, therefore degrees of freedom were corrected using the Greenhouse-Geisser estimates of sphericity ( The effect of time on anxious mood (*F*(1.69, 131.55) = 2.67, *p* = .08, η*p*was nonsignificant.13,14,15

**Linguistic Analyses**

We explored the text participants typed during the Time 1 priming session to further understand the results using LIWC (Pennebaker et al., 2007). Participants in the secure (*M* = 1.53, *SE* = .29) condition used more negative emotion words than those in the neutral (*M* =.34, *SE* = .06) condition, *t*(80) = 3.67, *p* < .001. Participants in the secure (*M* = 6.35, *SE* = .52) condition used more positive emotion words than those in the neutral (*M* = 1.54, *SE* = .17) condition, *t*(80) = 8.33, *p* < .001. Finally, participants in the neutral (*t*(34) = 7.71, *p* < .001) and secure condition used more positive emotion words than negative emotion words, *t*(43) = 7.24, *p* < .001.

## Discussion

The results for anxious mood supported our hypotheses. Participants in the secure (versus neutral) repeated prime condition reported lower levels of anxious mood post-prime. Time did not moderate the effects of the primes suggesting that the secure laboratory prime led to low levels of anxious mood and that the secure text primes extended the anxiety-reducing effect for a number of days. These results add to the small number of studies that have demonstrated effects of repeated security priming between one day and one week after the final priming session on various dependent measures that focus on views of self and others and felt security (Carnelley & Rowe, 2007; Gillath, Selcuk, & Shaver, 2008; Otway et al., 2014). The fact that security primes can have lasting effects is impressive given that other types of primes typically do not last very long. Future research should examine what the daily processes are that drive these effects, for example, do participants spontaneously bring to mind working models of secure attachment figures more often in-between priming sessions? Do the results of security priming (lowered negative mood, more positive views of self and others, higher felt security) affect individuals’ interpersonal behaviour in ways that bring about more support and positivity from others, that in turn leads to more felt security in a virtuous circle?

Our hypothesis that participants in the secure (versus neutral) condition would report less depressed mood at each time point was not supported. However, the means for depressed mood were in the expected direction, with a trend towards participants in the secure condition reporting less depressed mood than those in the neutral condition. Moreover, participants in the repeated security prime condition reported marginally less depressed mood immediately after the last text prime and one day after the last text prime, compared to participants in the neutral condition. Because these differences were only marginally significant they should be interpreted with caution, but they suggest that although one single laboratory prime does not result in a significant shift in depressed mood (a finding also evident in Study 1), repeated security priming is likely to be effective in decreasing depressed mood.

There is a growing use of technology in the treatment of mental health, including text messages (Barak & Grohol, 2011). Evidence suggests that patients receiving Cognitive Behavioural Therapy (CBT) for depression respond positively to text-messages inquiring about their mood, thoughts and activities; the majority of participants reported that the text messages made them feel closer to their therapist and increased their attendance to sessions (Aguilera & Munoz, 2011). Moreover, evidence suggests that text messages that encourage self-monitoring and provide supportive feedback may enhance the success of CBT for bulimia nervosa (Shapiro et al., 2010). Finally, Agyapong, Ahern, McLoughlin, and Farren (2012) show that a supportive text message intervention decreased depression and improved global functioning in patients with comorbid major depression and alcohol use disorder.These findings represent a potential way forward for attachment-focused interventions to be developed for use in clinical samples of people with anxiety disorders, perhaps by combining text security priming with other forms of psychological interventions, such as CBT. Security priming may increase individuals’ openness to, and engagement with, therapeutic interventions by reducing defensive processes and improving negative attachment models of self and others. The effects of security priming should be replicated in a clinical sample to better inform such interventions and to demonstrate that the current findings do not simply reflect mood changes.

It is interesting that the secure primes led to a reduction in anxious mood (compared to the neutral condition) but not a significant reduction in depressed mood. These findings raise the possibility that security priming may be more effective for those suffering from anxiety disorders, than those suffering from depression. Bowlby (1988) argued that insecurely attached individuals, particularly those high in attachment anxiety, tend to doubt their own ability to cope with stressful events and challenges. Avoidance of events that provoke anxiety is a key feature of many anxiety disorders (Dymond & Roche, 1999). Williams and Riskind (2004) argue that a looming maladaptive style (LMS) is a cognitive vulnerability for anxiety that leads a person to formulate rapid and excessive mental representations concerning threats or danger. Moreover, Williams and Riskind (2004) found that LMS partially mediates the relationship between attachment insecurity and anxiety symptoms.

 Perhaps security priming is particularly effective for reducing anxiety as it bolsters the individuals’ belief in their ability to cope with stressful situations, thus reducing anxiety and potentially avoidance behaviours. Slade (2008) argues for the “privileging of fear in the development of psychopathology” (p. 775) because the attachment system is activated in times of threat. When attachment needs are not met reliably and sensitively, fear can be maintained and will be the cause of defensive processes and other emotions such as anger (Slade, 2008) and anxiety. It is possible that in the same way that proximity to an attachment figure can reduce a child’s anxiety concerning threats in the environment (Ainsworth, 1967), activating secure attachment representations in adults can reduce an adult’s sense of anxiety regarding threat. Such threats may be psychological rather than physical in nature (financial worries, work pressures or relationship difficulties). In this sense, attachment security priming could be seen as reducing the LMS that partially mediates the relationship between attachment insecurity and anxiety (Williams & Riskind, 2004). This is a direction for future research.

It is possible that a pessimistic explanatory style (PES), the cognitive vulnerability that has been found to partially mediate the relationship between attachment insecurity and depression (Williams & Riskind, 2004), is more resistant to change through security priming. PES leads individuals to attribute negative past events to internal, stable, and global causes (Abramson et al., 1989; Alloy et al., 1997). Depression is related to negative views of oneself and the environment and the future. These negative views may not be so easily reduced or revised through attachment security priming, compared to the feelings of fear associated with anxiety. However, our results are modest but promising in that they suggest that over time, repeated security priming is likely to reduce depressed mood. Future research should increase the number of security priming trials to see if this is the case. Further research might also examine whether repeated security priming affects PES and depression in a clinical sample.

Results demonstrate that security priming (in comparison to neutral) increased participants’ felt security immediately after the laboratory prime. Furthermore, security (versus neutral) priming led to increased felt security after 3 days of text priming and 1 day after the last text prime, consistent with hypotheses. These findings indicate that the secure text primes kept the initial sense of felt security active for several days. In line with hypotheses, participants’ felt security decreased between receiving their last text message and the final felt security measure, one day later. Nonetheless, there was still a significant difference between the secure and neutral conditions, with secure-primed participants reporting higher levels of felt security, even one day after the last text prime. These results replicate our earlier work (Otway et al., 2014) demonstrating that text messages are effective at inducing felt security. The decrease in felt security between the last text message prime and the final felt security measures, one day later, was only marginally significant suggesting that secure text primes may need to be delivered over a longer time period for long-lasting changes in felt security to be observed. This is unsurprising given the evidence suggesting that people’s levels of attachment security are relatively stable over time (Zhang & Labouvie-Vief, 2004).

**General Discussion**

Theory (Bowlby, 1973) and research (Mikulincer & Shaver, 2007) point strongly to a causal relationship between insecure attachment and depression and anxiety, but to date, this relationship has not been directly tested, despite important clinical implications. We here make a novel contribution to the literature by examining the influence of attachment dimensions on depressed and anxious mood experimentally using semantic priming in the lab and via text messages (a method used previously in only one study, Otway et al., 2013). In Study 1, participants primed with attachment anxiety reported higher depressed mood than those primed with security, consistent with prior correlational research highlighting the role of negative attachment self-models in depression. Furthermore, those primed with avoidance or attachment anxiety reported higher anxious mood compared to those primed with security. In Study 2 we tested the effectiveness of repeatedly priming attachment security (versus a neutral prime), in the laboratory and via text messages, on improving depressed and anxious mood. Results showed that those who repeatedly received the secure prime (compared to neutral) reported less anxious mood. Depression may be somewhat more impervious to the benefits of security priming, but the pattern of our marginally significant findings suggest that an increased number of secure primes might significantly improve depressed mood, an avenue for future research.

Our findings from Study 1 suggest a causal link between insecure attachment and depression and anxiety, as well as the possibility that those high in attachment anxiety may be vulnerable to co-morbid depression and anxiety. These findings may have implications for clinical research concerned with vulnerability factors for the development of affective disorders. One might wonder if our findings are due to a simple effect of valence rather than of attachment security per se. Past research shows that the effects of primed attachment security can be distinguished from the effects of positive affect primes (thinking about a funny TV or film character) on various dependent measures, including empathy (Mikulincer, Gillath, Halevy, Avihou, Avidan, & Eshkoli, 2001), and less negative evaluations to outgroups (Mikulincer & Shaver, 2001). Similarly, where positive mood is controlled for, security priming still produces significant effects on various dependent measures, including energy and willingness to explore (Luke et al., 2012), cognitive openness (Mikulincer & Arad, 1999), and positive relationship expectations (Rowe & Carnelley, 2003). In a textual analysis using LIWC of the content of responses during prime tasks, Carnelley and Rowe (2010) found that those primed with security used more positive emotion words and fewer negative emotion words than those in a positive affect prime condition. Taken together this research suggests that our results are not due to a simple effect of valence; future research should include a positive or negative non-attachment-relevant prime to directly test this.

We were initially surprised to note that participants in the secure prime condition did not report lower depressed or anxious mood than participants in the neutral prime condition. In the discussion of Study 1 we put forward in explanation the possibility that secure-primed participants used more positive and negative emotion words in the priming session (compared to neutral-primed participants) because they were focusing on attachment figures with whom they no longer had contact, which brought to mind sad thoughts. In Study 2, we guarded against the possibility that participants might focus on no-longer-available attachment figures by selecting attachment figures for participants in the secure condition who served as secure attachment figures that they were currently in regular contact.

 In the discussion of Study 1 we also put forward the alternative possibility that the triggering of negative and positive emotions may be a normative response to thinking about a significant other (Zayas & Shoda, in press). We know that priming security induces thoughts related to felt security, positive care, a sense of merging with another, positive emotion, and communion (Carnelley & Rowe, 2010), but it would also appear to induce some negative emotions. The findings from Study 2 support the hypothesis that the triggering of both positive and negative emotions while thinking about attachment figures is normative. The effects of secure versus neutral priming on depressed and anxious mood were more in line with hypotheses in Study 2 compared to Study 1, with participants in the secure condition in Study 2 reporting less anxious mood compared to participants in the neutral condition (and participants in the secure condition reporting marginally less depressed mood immediately after the last text prime and one day after the last text prime). However, the linguistic analysis results in Study 2 were similar to Study 1; participants in the secure (versus neutral) condition used more negative and positive emotions during the laboratory priming tasks. This suggests that even after ensuring the attachment figure was security inducing and frequently contacted, the secure laboratory prime still triggered both positive and negative emotions, compared to the neutral prime. It seems that even secure relationships are likely to have good and bad qualities. However, security priming is likely to lead to a reduction in anxious mood post-prime, as the participant feels secure after visualising their secure attachment figure. In addition, our results suggest that security priming is likely to reduce depressed mood, if security priming sessions are repeated more frequently over time.

A limitation of Study 2 was low statistical power. This experiment should be replicated with a larger sample in order to better determine whether security priming via laboratory primes and secure text primes has a beneficial effect on depressed mood (compared to a neutral condition). Furthermore, the majority of the participants in Studies 1 and 2 were young, female undergraduates; it is possible that these results do not generalise to a wider population.

Moreover, our study focused on depressed and anxious mood leaving open the possibility that the findings may not generalize to clinical depression and anxiety disorders. We examined the effects of security priming in non-clinical samples as a starting point for further research into the effects of security priming on clinical depression and anxiety. It makes sense (from an ethical point of view especially) to explore whether security priming has an effect on depressed/anxious mood in relatively healthy participants before subjecting participants with clinical disorders to a study that requires a lot of investment and time on their part. In addition, clinical populations can show high levels of co-morbidity and additional problems. By looking at these factors in a non-clinical population we avoid some of these potential confounds and can more easily isolate causality. This experiment should be replicated in a clinical sample in order to explore what effect secure (laboratory and text) primes have on clinical anxiety and depression.

As stated earlier, anxious and depressed mood states are a core aspect of clinical depression and anxiety. Research that examines the link between major depressive disorder (MDD) and daily reports of state negative mood speaks to the issue of generalizability of our results. Peeters, Nicolson, Berkhof, Delespaul, and de Vries (2003) compared individuals with MDD to healthy participants in an experience sampling procedure to examine their positive and negative affect following positive and negative daily events. Following negative events both healthy participants and participants with MDD showed more negative and less positive affect; these effects were more pronounced for healthy participants. Moreover, the negative affect following negative events persisted longer for participants with MDD than healthy participants. In contrast, following positive events both healthy and participants with MDD showed more positive affect, but this was more pronounced for participants with MDD than healthy participants; and following positive events only participants with MDD showed lower negative affect. These findings suggest that there are similarities between MDD and healthy participants in that they both react with negative affect to negative events (and with positive affect to positive events), and differences in that negative events affect healthy participants more and have a more persistent effect on negative affect for MDD participants, whereas positive events affect MDD participants more. Understanding how to lessen feelings of depression and anxiety (albeit temporarily) should apply to both healthy individuals and those with clinical depression and anxiety. Furthermore, given the stronger reaction to positive events by those with MDD, we might expect the security prime (a positive experience) to have stronger effects on those with MDD, suggesting it might be beneficial in interventions.

### Conclusions

Our research is the first to explore causal relationships between attachment patterns and depressed and anxious mood. The findings indicate that attachment anxiety causes an increase in depressed mood. In addition, both attachment anxiety and avoidance cause an increase in anxious mood. Moreover, the research replicates Otway et al. (2014) and further establishes the effectiveness of a novel, practical and location-independent method of delivering attachment security primes, through text messages. Our research is the first to demonstrate that repeated attachment security priming (in the laboratory and via text message) has a beneficial effect on anxious mood. To conclude, the research findings make a useful and novel contribution to understanding the role that attachment patterns play in anxious and depressed mood. Moreover, the evidence may have implications for the development of attachment-focused interventions designed to reduce the symptoms of anxiety and depression.

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**Footnotes**

 In order to test whether dispositional attachment dimensions moderated the effects of prime on post-prime felt security, we created three dummy attachment prime variables (secure, anxious and avoidant). The neutral condition was the comparison (excluded) condition, coded 0. We regressed post-prime felt security on the secure, anxious and avoidant dummy variables and centred attachment anxiety and avoidance (Step 1), and interactions between each of the 3 dummy variables and each attachment dimension (Step 2) in a hierarchical regression. Steps 1 and 2 were significant (*R2*= .44, *F*(5,138) = 21.49, *p* < .001, *R2*= .50, *F*(11,132) = 11.94, *p* < .001, respectively), as was Step 2 *R2*change = .06, *p* < .05. The interaction between attachment avoidance and the anxious prime dummy variable and between attachment avoidance and the secure dummy variable were significant. We attempted to follow up these interactions with simple slopes analyses using PROCESS (Hayes, 2013a), however PROCESS generated an error (code #12417) that was most likely due to multicollinearity of the predictors and the relatively small sample size. Indeed, the average VIF of the predictor values was 2.54. Bowerman and O’Connell (1990) argue that an average VIF higher than 1 indicates multicollinearity.

2 We explored whether the effects of the primes on post-prime felt security differed for people with different levels of baseline depression or anxiety. The three attachment dummy prime variables and baseline depression and baseline anxiety (centred) were entered at Step 1. The interaction between each of the dummy prime variables and baseline depression and each of the dummy variables and baseline anxiety was entered at Step 2. No significant interactions were found indicating that the effect of the primes was equally effective regardless of baseline levels of anxiety or depression.

3 In order to explore whether baseline depression moderated the effects of prime we regressed post-prime depressed mood on the attachment dummy variables, attachment avoidance, baseline anxiety and baseline depression (Step 1), and the interactions between each dummy variable and baseline depression (Step 2) in a hierarchical regression. (Attachment avoidance and baseline anxiety were entered at Step 1 as they were covariates in the ANCOVA). The change in *R*2 from Step 1 to Step 2 was not significant, suggesting that baseline depression did not moderate the effects of the primes on depressed mood.

4 We explored whether the effects of the primes on post-prime depressed mood differed for people with different levels of attachment anxiety or avoidance. The three attachment dummy prime variables, attachment anxiety, attachment avoidance, and baseline anxiety and depression were entered at Step 1. (Baseline anxiety and depression were included at Step 1 as they were covariates in the ANCOVA). The interaction between each of the dummy prime variables and attachment avoidance and each of the dummy variables and attachment anxiety were entered at Step 2. The interaction terms did not significantly add to the prediction of depressed mood, indicating that the primes were equally effective regardless of a person’s dispositional levels of attachment anxiety or avoidance.

5 In order to explore whether baseline anxiety moderated the effects of prime condition on anxious mood, we regressed post-prime anxious mood on the prime dummy variables, attachment avoidance, baseline depression and baseline anxiety (Step 1), and the interactions between the 3 dummy variables and baseline anxiety (Step 2) in a hierarchical regression. (Avoidance and baseline depression were included at Step 1 because they were covariates in the ANCOVA). Results indicated that baseline anxiety did not moderate the effects of the primes on anxious mood.

6 We explored whether the effects of the primes on post-prime anxious mood differed for people with different levels of attachment anxiety or avoidance. The attachment dummy prime variables, attachment anxiety, attachment avoidance, baseline anxiety and baseline depression were entered at Step 1. (Baseline anxiety and depression were included as they were covariates in the ANCOVA). The interaction between each dummy prime variable and attachment avoidance and each dummy variable and attachment anxiety were entered at Step 2. No significant interactions were found indicating that the primes were equally effective regardless of a person’s dispositional level of attachment anxiety or avoidance.

7 For the sake of transparency (Simmons, Nelson, & Simonsohn, 2011), we re-ran analyses without the covariates. The pattern of results for Study 1 was the same as with covariates, however the difference between the anxious prime condition and the avoidant prime condition for depressed mood was now marginally significant (*p* = .089 rather than *p* < .05).

8  We conducted nonparametric tests for felt security at each time point by prime condition. Results indicated that the distributions of felt security were not the same across conditions at all 3 time points, consistent with the main analyses.

9 We examined whether the effect of prime on Time 1 felt security differed for people with different levels of dispositional attachment anxiety or avoidance in a regression. (We examined felt security at Time 1 only to reduce the number of tests). Attachment anxiety, attachment avoidance and condition were entered at Step 1. The interactions between condition and attachment anxiety and condition and attachment avoidance were entered at Step 2. Neither interaction was significant suggesting that the prime was equally effective, regardless of participants’ levels of attachment anxiety or avoidance.

10 We examined whether the effect of prime on Time 1 felt security differed for people with different levels of baseline anxiety or baseline depression in a regression. Baseline depression, baseline anxiety, attachment avoidance and condition were entered at Step 1. (Attachment avoidance was included at Step 1 because it was a covariate in the ANCOVA). The interactions between condition and baseline anxiety and condition and baseline depression were entered at Step 2. Neither interaction was significant suggesting that the prime was equally effective, regardless of participants’ baseline levels of anxiety or depression.

11 We examined whether the effect of prime on Time 1 depressed mood differed for people with different levels of dispositional attachment anxiety or attachment avoidance in a regression. Attachment anxiety and avoidance, baseline anxiety and condition were entered at Step 1. (Baseline anxiety was included because it was a covariate in the ANCOVA). The interaction between condition and attachment anxiety and condition and attachment avoidance were entered at Step 2. Neither interaction was significant, suggesting that attachment anxiety or avoidance levels did not alter the effectiveness of the prime.

12 We examined whether the effect of the primes on Time 1 depressed mood differed for people with different levels of baseline anxiety or baseline depression in a regression. Baseline depression and baseline anxiety and condition were entered at Step 1. The interactions between condition and baseline anxiety and condition and baseline depression were entered at Step 2. Neither interaction was significant, suggesting that the prime was equally effective, regardless of baseline levels of anxiety or depression.

13 We examined whether the effect of prime on Time 1 anxious mood differed in individuals with different levels of dispositional attachment anxiety or avoidance in a regression. Attachment anxiety and avoidance, baseline depression and condition were entered at Step 1. (Baseline depression was included as it was a covariate in the ANCOVA). The interaction between condition and attachment anxiety and condition and attachment avoidance were entered at Step 2. Neither interaction was significant suggesting that the prime was equally effective, regardless of dispositional levels of attachment anxiety and avoidance.

14 We examined whether the effect of prime on Time 1 anxious mood differed in people with differing levels of baseline anxiety or baseline depression in a regression. Baseline depression, baseline anxiety and condition were entered at Step 1. The interactions between condition and baseline anxiety and condition and baseline depression were entered at Step 2. Neither interaction was significant, suggesting that the prime was equally effective, regardless of dispositional levels of baseline anxiety or baseline depression.

15 We re-ran analyses without the covariates. The pattern of results for Study 2 was the same as with covariates with one exception, the effect of time was significant for anxious mood (*F*(1.69, 133.33)= 5.01, *p* = .012, T1 Mean = 2.07, T4 Mean = 2.20, T5 Mean = 2.43).

Table 1

*Study 1: Descriptive Statistics and Correlations between All Variables*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Mean | SD | ANX | AVO | BD | BA | DM | AM | FS |
| ANX | 3.97 | 1.00 | - | .15 | .40\* | .44\* | .13 | .05 | .12 |
| AVO | 3.04 | 1.05 |  | - | .35\* | .33\* | .30\* |  .33\* |  -.02 |
| BD | 11.17 | 9.73 |  |  | - | .80\* | .41\* |  .26\* | .11 |
| BA | 10.66 | 7.78 |  |  |  | - | .40\* |  .32\* | .10 |
| DM | 7.32 | 7.95 |  |  |  |  | - |  .73\* |  -.25\* |
| AM  | 6.00 | 4.50 |  |  |  |  |  | - |  -.32\* |
| FS | 3.31 | 1.38 |  |  |  |  |  |  | - |

*Note. N* = 144. \**p* < .001. ANX = Attachment anxiety. AVO = Attachment avoidance. BD = Baseline Depression. BA = Baseline Anxiety. DM = Depressed Mood. AM = Anxious Mood. FS = Felt Security. The means in this table were calculated using the original, untransformed data.



Table 3

*Study 2: Descriptive Statistics and Correlations between all Variables*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Mean | SD | ANX | AVO | FT1 | FT4 | FT5 | BD | DT1 | DT4 | DT5 | BA | AT1 | AT4 | AT5 |
| ANX | 3.41 | 1.22 | - | .29\*\* |  -.09 | -.06 |  -.03 |  .42\*\* |  .28\* |  .34\*\* |  .33\*\* | .26\* |  .19 | .17 |  .17 |
| AVO | 2.68 | 1.07 |  | - |  -.31\*\* | -.23\* |  -.21 | .25\* |  -.09 |  .02 |  .07 |  .29\*\* |  .09 | .08 |  -.04 |
| FT1 | 4.14 | 1.37 |  |  | - |  .88\* |  .86\*\* |  -.07 |  .02 | -.06 | -.11 |  .05 |  -.26\* |  -.31\*\* |  -.27\* |
| FT4 | 4.07 | 1.38 |  |  |  | - |  .96\* |  -.12 |  -.02 | -.12 | -.15 |  .03 |  -.23\* |  -.31\*\* |  -.27\* |
| FT5 | 3.96 | 1.42 |  |  |  |  | - |  -.05 |  -.02 | -.10 | -.14 |  .10 |  -.22\* | -.25\* |  -.23\* |
| BD | 12.48 | 12.43 |  |  |  |  |  | - |  .36\*\* |  .46\*\* |  .62\*\* |  .69\*\* |  .32\*\* |  .37\*\* |  .33\*\* |
| DT1 | 5.56 | 8.83 |  |  |  |  |  |  | - |  .70\*\* |  .61\*\* |  .41\*\* |  .74\*\* |  .43\*\* |  .41\*\* |
| DT4 | 6.11 | 8.65 |  |  |  |  |  |  |  | - |  .79\*\* |  .39\*\* |  .51\*\* |  .66\*\* |  .50\*\* |
| DT5 | 5.96 | 8.48 |  |  |  |  |  |  |  |  | - |  .46\*\* |  .50\*\* |  .58\*\* |  .66\*\* |
| BA | 11.22 | 7.57 |  |  |  |  |  |  |  |  |  | - |  .49\*\* |  .40\*\* |  .33\*\* |
| AT1 | 5.74 | 5.68 |  |  |  |  |  |  |  |  |  |  | - |  .49\*\* |  .50\*\* |
| AT4 | 5.87 | 5.13 |  |  |  |  |  |  |  |  |  |  |  | - |  .75\*\* |
| AT5 | 6.96 | 5.63 |  |  |  |  |  |  |  |  |  |  |  |  | - |

*Note. N =* 81. \**p* < .05. \*\**p* < .01. ANX = Attachment anxiety. AVO = Attachment avoidance. FT1 = Felt Security at Time 1. FT4= Felt Security at Time 4. FT5 = Felt Security at Time 5. T5 = Time 5. BD = Baseline Depression. DT1 = Depressed Mood at Time 1. DT4 = Depressed Mood at Tim4. DT5 = Depressed Mood at Time 5. BA = Baseline Anxiety. AT1 = Anxious Mood at Time 1. AT4 = Anxious Mood at Time 4. AT5 = Anxious Mood at Time 5. The mean figures in this table were calculated using the original, untransformed data.



*Figure 1.* Estimated marginal means for felt security in each experimental condition in Study 1.

*Figure 2.* Estimated marginal means for depressed mood (Panel A) and anxious mood (Panel B) in each experimental condition in Study 1.

*Figure 3.* Means for felt security in each of the prime conditions in Study 2.

*Figure 4.*  Means for depressed mood (Panel A) and anxious mood (Panel B) in each of the prime conditions in Study 2.