


RESEARCH ARTICLE

Fluctuations in proximity seeking and paranoia

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Abstract

Objectives: This study aimed to investigate associations between proximity seeking, stress and paranoia in the context of daily life, and whether these relationships are moderated by trait attachment styles.

Methods: Sixty non-clinical participants completed 3423 assessments of state stress, proximity seeking and paranoia over a 6-day period using an experience sampling method. Multilevel linear regression was performed to evaluate relationships between variables.

Results: The post-hoc analysis showed antecedent events subjectively appraised as very unpleasant or very pleasant predicted greater levels of momentary proximity seeking at the subsequent timepoint. Greater stress predicted greater subsequent shifts or variability in proximity seeking. Changes in proximity seeking were not associated with momentary paranoia. However, for individuals with an avoidant attachment style, greater shifts in proximity seeking resulted in greater subsequent reports of paranoia.

Conclusions: These findings suggest that, in daily life, the attachment system may become active in response to stress. For those with an avoidant attachment style, an active attachment system may exacerbate paranoid thoughts possibly due to the activation of attachment-related beliefs that one should be fearful of unavailable others and instead rely on

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one's autonomy to regulate affect. These findings highlight the need to consider attachment in the assessment and formulation of paranoia.

KEYWORDS

attachment, experience sampling methodology, paranoia, proximity seeking, stress

Practitioner points

- Antecedent events subjectively appraised as very unpleasant or very pleasant were associated with greater proximity seeking and aligns with Bowlby's conceptualization that attachment is a dynamic system activated in response to novel situations, whether positive or negative
- Greater momentary stress was associated with greater shifts or disturbances in proximity seeking, which may serve as a behavioural indicator of the attachment system coming 'on-line' in daily life
- For those with an avoidant attachment style, greater shifts in proximity seeking were positively associated with momentary reports of paranoia
- The study had a relatively small sample size, which may have resulted in insufficient power to detect interaction effects of trait attachment
- The study design is observational and correlational in. We cannot determine whether causal relationships exist between variables examined.

INTRODUCTION

Paranoia is defined as a mistrust or suspicion of others with a corresponding tendency to interpret the actions of others as deliberately threatening (DeRosse & Karlsgodt, 2015). Continuum models of psychosis suggest paranoia is experienced in varying levels of severity in the general population (Verdoux & van Os, 2002). Research has sought to elucidate how psychological mechanisms contribute to paranoid thinking so that psychological interventions can be more specifically tailored (Brown et al., 2019). One such mechanism is attachment. Specifically, there is evidence that insecure attachment may facilitate a paranoid attributional style in the presence of other contributing factors (e.g., reasoning biases, impairments in Theory of Mind and low self-esteem; Bental & Fernyhough, 2008; Lavin et al., 2020; MacBeth et al., 2008).

Attachment theory posits that infants form emotional bonds with their primary caregiver through proximity seeking and maintaining behaviours. Bowlby (1973) conceptualized proximity seeking as an innate affect regulation process in which primary caregivers function as a 'safe haven' from which infants can seek comfort, reassurance and security during times of distress. Infants internalize their experience of interactions with their primary caregiver, which enables them to develop internal working models about the self and others. Ainsworth et al. (1978) were the first to describe individual differences in attachment working models or styles in infants and this taxonomy was later applied to understand different attachment styles in adulthood (Hazan & Shaver, 1987). A secure attachment style is developed when caregivers' responses to the infant's bid for proximity are consistent, responsive, sensitive and emotionally available. Insecure attachment can be understood within this framework of affect regulation. When primary caregivers do not provide responsive care or predictable responses to the child's proximity seeking behaviour and distress, the child develops negative working models about the self and others. These negative working models are thought to result in the development of

behavioural orientations towards attachment figures such as withdrawal (avoidant attachment) or excessive proximity seeking (anxious attachment) to regulate one's affect (Bowlby, 1978). Negative working models continue to guide behaviour in future attachment-related interactions throughout the lifespan and can increase sensitivity to future stress, criticism and negative responses from others. Research has consistently shown associations between insecure attachment and paranoia in non-clinical (Wickham et al., 2015), subclinical (Pickering et al., 2008) and clinical (Wickham et al., 2015) samples. Previous research has largely been cross-sectional in nature examining trait models of attachment at a single timepoint. However, there are limitations to treating attachment as a trait variable. It is known that attachment is a dynamic system that can be 'on-or offline' at any given time (Pierce & Lydon, 2001), as attachment representations (currently activated internal working models about the self and others) have been shown to fluctuate over short periods of time (Scharfe & Bartholomew, 1994; Waters et al., 2000). Studies conducted to date have not captured these momentary shifts or variability in the attachment system, which are meaningfully impacted by contextual cues (Baldwin & Fehr, 1995). To this end, measuring changes in proximity seeking, which serve as a behavioural indicator of the attachment system, could provide one way to map whether the attachment system is 'online or not' in the flow of daily life; permitting a more dynamic understanding of the attachment system.

Experiencing sampling methodology (ESM) captures the frequency, intensity and patterns of momentary mental processes and behaviour (Csikszentmihalyi & Larson, 2014). ESM utilizes a more intensive assessment schedule than traditional approaches, involving multiple assessments per day, allowing for a more fine-grained analysis of patterns of attachment fluctuations in everyday life. A study by Sitko et al. (2016) employed ESM to examine associations between state attachment and paranoia in a mixed sample of clinical participants ($n = 20$) with schizophrenia spectrum diagnoses and healthy controls ($n = 20$) with no history of mental health difficulties. Elevated stress predicted an increase in attachment insecurity, which in turn predicted a subsequent increase in paranoia; findings remained significant when covarying self-esteem and auditory hallucinations. One limitation was that only emotional items of state attachment were used; the attachment-linked behavioural strategies used to regulate affect were not measured. Secondly, the authors treated attachment as a binary (secure-vs.-insecure) variable, preventing investigation of differences between forms of insecure attachment (i.e., avoidant vs. anxious; Hesse, 2008).

Monitoring and appraisal of stressful events leads to activation of proximity seeking as part of the attachment system's attempt to regulate affect (Mikulincer & Shaver, 2003; Mikulincer & Shaver, 2010). The current study seeks to measure proximity seeking behaviour based on the idea that different insecure attachment styles will manifest via differences in proximity seeking behaviour in everyday life. We expect that an anxious attachment style may lead to over-activation of proximity seeking in response to stress, as the attachment system comes 'online'. An avoidant attachment style, on the other hand, may result in the suppression of proximity seeking in response to stress. In this study, we use proximity seeking as a proxy measure of assessing attachment activation because the primary function of the attachment system is to seek help/protection/support when distressed (in the case of secure attachment). Momentary activation of the attachment system may in turn explain momentary experiences of paranoia. We expect that individuals with an anxious attachment style will activate a negative self-model and cognitions about others as unreliable, following the attachment system coming 'online', resulting in anxiously attached individuals attempting to seek proximity to regulate negative affect. This over-activation of proximity seeking fails to alleviate distress and instead results in increased monitoring of threats to the self and signs of attachment-figure unavailability and possible rejection, reinforcing the sense of oneself as vulnerable, which may lead to increases in paranoia (DeRosse & Karlsgodt, 2015). Conversely, individuals with an avoidant attachment style who rely on their own autonomy and socially withdraw to keep maximum distance from others during times of stress may generate a greater sense of disconnection from others, which in turn provides less corrective feedback resulting in increased mistrust of others (Freeman & Garety, 2014; Mikulincer & Shaver, 2010). Subsequently, this sense of disconnect may contribute to perceptions that one is at risk of harm or maltreatment from others which characterizes paranoid ideation.

This study builds on existing literature by providing a moment-by-moment analysis of stress, proximity seeking and paranoia and also examines the moderating role of different types of insecure attachment on this process.

Aims of the study

Our first objective was to examine the relationship between state stress and level of proximity seeking and explore if this relationship is moderated by trait attachment style.

We hypothesized that

- (i) greater stress will be associated with greater proximity seeking;
- (ii) high attachment anxiety will positively moderate this relationship (i.e., a stronger positive relationship between stress and proximity seeking in those higher in attachment anxiety); and
- (iii) high attachment avoidance will negatively moderate this relationship (i.e., a weaker positive relationship, or even increasingly inverse relationship, between stress and proximity seeking in those higher in avoidant attachment).

Our second objective was to examine whether elevated stress is associated with the magnitude of change in proximity seeking over time (as a proxy for the attachment system coming online), and whether this relationship is moderated by trait attachment. We hypothesized that:

- (i) greater stress will be associated with a greater shift or change in proximity seeking from the previous timepoint; and
- (ii) insecure attachment will positively moderate this relationship (i.e., greater stress is associated with a greater change in proximity seeking from the previous timepoint for individuals with high attachment anxiety or high attachment avoidance).

Our third objective was to test whether change in proximity seeking is associated with state paranoia. We hypothesized that:

- (i) greater change in proximity seeking will be associated with greater paranoia; and
- (ii) insecure attachment will positively moderate this relationship (i.e., greater change in proximity seeking is associated with greater paranoia for individuals with high attachment anxiety or high attachment avoidance).

We control for the confounding effects of negative affect, social comparison and gender (paranoia analyses only), which have been shown to be associated with experiences of paranoia (Freeman et al., 2018; Kramer et al., 2014).

DESIGN AND PARTICIPANTS

Ethical approval was granted by the relevant research ethics committee. Participants were University students recruited through posters placed around campus, emails and the university participation credit scheme. Eligibility criteria included as follows: students aged 18 or above and command of the English language sufficient to complete questionnaires and ESM assessments. Potential participants were excluded if they did not have regular access to a smartphone (to complete ESM notifications) and if they had never had at least one romantic relationship due to the Experience in Closeness Relationship Scale-Short form (Wei et al., 2007), utilized to measure trait attachment, assessing a person's feelings in romantic relationships.

Measures

Questionnaires

Baseline questionnaire measures were administered before the ESM assessment period to ascertain trait-level measures of attachment, paranoia, mood and self-perceptions of social rank.

Demographic information

Age, gender and ethnicity were recorded.

Attachment figure

Participants were asked to select an attachment figure to whom their proximity seeking behaviour would be measured. They received the following instructions:

Please list three significant people in your life. These people should be people that you currently 'feel a strong emotional tie to, regardless of whether this is positive negative or mixed' and whom you would like to go to for help or support when something bad happens to you, or you feel upset, whether or not you actually go to them. Please pick one person from this list who you are most likely to seek support from over the next 2 weeks. Our definition of an attachment figure was taken from Trinke and Bartholomew's Attachment Network Questionnaire (Trinke & Bartholomew, 1997), which is a commonly used measure of adult attachment relationships and attachment hierarchies. Detailed instructions were given to participants to help them identify an appropriate attachment figure in line with this definition (e.g., a person to whom they feel a strong emotional connection and they would like to approach for support).

Experience in Close Relationship Scale-Short Form (ECR-S)

The ECR-S is a self-report measure of trait attachment (Wei et al., 2007). Participants are asked to rate 12-items on a seven-point Likert Scale ranging from 1 (strongly disagree) to 7 (strongly agree). The ECR-S returns a continuous score for two subscales: attachment anxiety and attachment avoidance. This scale has good internal consistency and construct validity (Wei et al., 2007). In this study, the internal consistency of the ECR-S avoidant subscale was acceptable ($\alpha = .76$) and the anxiety subscale had questionable internal consistency ($\alpha = .62$).

Paranoia Scale

This 20-item self-report scale measures paranoia in non-clinical samples (Fenigstein & Venable, 1992). Items are rated on a five-point Likert Scale ranging from 1 (not at all applicable to me) to 5 (extremely applicable to me). Previous research has demonstrated good internal reliability and adequate convergent and discriminant validity (Fenigstein & Venable, 1992). Good internal consistency for the Paranoia Scale was demonstrated in this study ($\alpha = .88$).

Depression Anxiety Stress Scale-21 (DASS-21)

The DASS-21 is a widely used self-report measure of trait depression, anxiety and stress (Lovibond & Lovibond, 1995). Items are scored on a four-point scale ranging from 0 (did not apply to me at all) to 3 (applied to me very much or most of the time). The scale has good internal reliability and validity. In the current study, the DASS-21 anxiety subscale had good internal consistency ($\alpha = .80$) and the depression and stress subscales had good internal consistency ($\alpha = .87$ and $\alpha = .84$, respectively).

Social Comparison Scale (SCS)

The SCS measures self-perceptions of social rank and relative social standing (Allan & Gilbert, 1995). Respondents are required to make a global comparison of themselves in relation to others and rate themselves on 11 items on a 10-point Likert Scale from 1 (incompetent) to 10 (competent). The scale points in between were not labelled. Lower scores relate to feelings of inferiority and low rank perceptions of oneself. The SCS in this study had good internal consistency ($\alpha = .88$).

Experience sampling method

Item development

The ESM items used in the present study were taken from previous research (Palmier-Claus et al., 2012; Palmier-Claus et al., 2013; Thewissen et al., 2008) or produced based on literature exploring key facets of the constructs of interest. Internal consistency was computed for the first assessment point (day 1, assessment 1).

ESM items

The items listed below were used to capture moment-to-moment variation in participants' experiences of paranoia, stress and proximity seeking in the flow of daily life.

State Paranoia: was defined as the total score of four statements rated on seven-point Likert scales from 1 (not at all) to 7 (very much). The statements assessed suspiciousness and paranoid ideation: 'I feel that others dislike me,' 'I feel that others might hurt me,' 'I feel suspicious,' and 'I feel safe' (reversed scale). Based on the first ESM data point, this scale had acceptable internal consistency in the current study ($\alpha = .74$).

State Stress: at every ESM assessment point, participants were instructed to rate the extent to which they felt stressed immediately before the text prompt. The item 'I feel stressed' was rated on a seven-point Likert scale (1 = not at all to 7 = very much). An item of 'event-related stress' was also utilized so that participants could state and rate the most important event to occur since the last beep from 'very unpleasant' (-3) to 'very pleasant' (3). Lower scores represent a greater degree of dislike for the event and are indicative of greater event-related stress. The individual score for each of these two items were used in the analyses.

Proximity seeking: at every ESM assessment point, participants were required to rate the number of times since the last beep they had attempted to contact their attachment figure across five modes of communication: face-to-face contact, telephone call, text messaging, email messaging and social networking sites. Items were rated 0 times, 1–2 times, 3–4 times, 5–6 times, 7–8 times, 9–10 times and 10+ times. A total score was calculated by summing the number of contact attempts across these five modes of communication. This total proximity seeking score was used in the analysis. Cronbach's alpha was not calculated as proximity seeking items were not expected to inter-correlate because some participants may choose to stick to a preferred mode of communication.

ESM software and sampling procedure

Participants completed the ESM diary via an online survey platform they could access remotely from their phones/other device. Participants were prompted to complete the diary questions in response to receiving a text message to their own mobile phone. Prompts were delivered at pseudo-random times (one prompt within each 2-h period), six times per day (between 10 AM and 10 PM) over a period of 14 days. This assessment period was sufficiently adequate to capture momentary changes in state stress. ESM reports were considered valid if items were completed within a 15-min window of the beep.

Procedure

Informed consent was taken at a face-to-face meeting with the researcher. Baseline measures were completed the measures were completed independently at face-to-face meetings. During the same meeting, participants were briefed about the ESM procedure. The researcher contacted each participant on the first and seventh day of the ESM alert schedule to confirm the functionality of the procedure.

Statistical analysis

Power calculation for multilevel linear models relies on a potentially large number of parameters and the number of level-1 units nested within each level-2 unit (Tom & Bosker, 1999); $n \geq 30$ is adequate for

non-biased significance tests of fixed effects. Similarly, 30 level-2 units with 30 level-1 units per cluster has also been suggested; although, fewer level-1 units per cluster may be necessary Kwok et al., (2008). The sample size target of $n = 60$, with 84 timepoints within each level-2 unit was, therefore, sought.

A change in proximity seeking variable was computed using the absolute change value between two succeeding reports: the current timepoint (t) minus the proximity seeking score on the previous timepoint ($t - 1$). The absolute change score gives higher values when there are larger differences between the scores of two consecutive timepoints but ignores the direction of change, which is appropriate when conducting analyses regarding the magnitude of shift in proximity seeking. Change scores were only calculated for consecutive beeps within a day as the gap between beeps across days is considered too large to be a valid measure of momentary experience Carter & Emsley, (2019); Palmier-Claus et al., (2011).

All analyses were performed on STATA version 14 StataCorp L. (2015). ESM scale scores were calculated as an average of items. This was done with available items where some were missing, so a scale score could still be calculated. ESM data typically have a three-level hierarchical structure (observations nested within days, nested within participants), which violates the assumption of independence of observations. Multilevel linear regression can account for the clustering in outcomes and also use cases with incomplete data. Effect sizes are reported as standardized regression coefficients (β).

Multilevel regression analyses were conducted using the MIXED command with maximum likelihood estimation. Participant number and day were included as random effects for all analyses to control for the nested structure of the data. A series of multilevel regression models were estimated as follows:

1. Estimating the relationship between stress ('I feel stressed') and the level of proximity seeking at the subsequent timepoint. Stress was lagged such that it reflected stress at the previous beep ($t - 1$). Event-related stress was not lagged as the wording of the item ('Since the last beep') already refers to the period between the previous beep and the current beep (i.e., between $t - 1$ and t). A quadratic relationship was suspected between event-related stress and proximity seeking based on visual inspection of responses. Thus, *post hoc* likelihood ratio tests were performed to determine whether the inclusion of a quadratic term for event-related stress benefited model fit. Analyses also investigated whether the relationships between stress or event-related stress, and proximity seeking, were moderated by attachment.
2. Estimating the relationship between stress at the previous timepoint ($t - 1$), or event-related stress, and the magnitude of change in proximity seeking, from that previous timepoint to the current timepoint. Models were also estimated to investigate whether attachment moderated the relationship between (i) stress ($t - 1$) and change in proximity seeking and (ii) event-related stress and change in proximity seeking.
3. Estimating the relationship between change in proximity seeking and paranoia, and investigating if attachment moderates the effect of change in proximity seeking on paranoia.

For all analyses, person-level attachment variables (attachment anxiety and attachment avoidance) were grand mean centred. Due to the increased risk of a false-positive finding (Type-1 error) when running multiple analyses, the Bonferroni correction was applied to all models with either stress variable entered as a predictor by employing the adjusted alpha level of .025. Sensitivity analyses were performed to determine whether any of the associations were substantively reduced when trait depression, trait anxiety, trait social comparison and gender.

RESULTS

Sample characteristics

Eleven potential participants were excluded at the screening phase as they did not report experiencing a romantic relationship. Sixty-two participants consented to take part in the study. Two participants did not complete the ESM phase; the final sample for analysis comprised 60 participants. Participants

were predominately White British and female. 'Boyfriend' was the most commonly reported attachment figure, followed by 'mother'. Table 1 presents the characteristics of the sample.

Retention and adherence

Of the 62 participants who started the ESM phase, 60 completed the full ESM schedule and completed more entries than the traditionally accepted one third of assessment points Palmier-Claus et al., (2011). Of a possible 5040 assessment points, 3423 were completed by participants within 15min of each prompt (67.9% overall response rate).

Proximity seeking behaviours

Though participants could choose multiple models of communication over the course of the study (and at each timepoint), overall, 49 people (82%) chose to communicate via telephone, 54 people (90%) communicated via text and 50 people (83%) communicated face-to-face at least once over the course of the study. Social networking was less common (40 people, 67%), and very few people used email (five people, 8%).

Does stress predict the level of proximity seeking?

A multilevel linear regression analysis was conducted with proximity seeking total score as the dependent variable and stress lagged ($t - 1$) as the independent variable. Results indicated that stress at the previous timepoint did not predict levels of proximity seeking even when trait depression, trait anxiety and trait social comparison were entered as co-variates in the model (see Table 2; Models 1 and 2).

A similar model was estimated using proximity seeking total score as the dependent variable and event-related stress as the independent variable. The *post hoc* likelihood ratio test provided evidence that inclusion of the quadratic terms improved model fit ($\chi^2 [1] = 42.15, p < .001$); therefore, the multilevel regression analysis was run with event-related stress and event-related stress squared entered as independent variables in the model. A significant quadratic trend in event-related stress was observed with a turning point of .33 suggesting that as event-related stress decreased, proximity seeking reduced. However, after the turning point of .33 as event-pleasantness increased so did participants level of proximity seeking. This finding should be interpreted with caution as when applying the Bonferroni adjusted alpha level of .025, only the quadratic relationship between event-related stress and proximity seeking remained significant. Therefore, there was no significant quadratic effect at the adjusted alpha. The size of the association between event-related stress and proximity seeking was unchanged when covarying trait depression, trait anxiety and trait social comparison (see Table 2; Models 3 and 4).

Does attachment moderate the relationship between stress and the level of proximity seeking?

Attachment style did not moderate the relationship between stress and proximity seeking, regardless of the type of stress variable used in the model or whether the linear or non-linear effects of event-related stress were investigated. This remained unchanged when trait depression, trait anxiety or trait social comparison were adjusted for within the models (see Table 2; Models 5 to 16).

TABLE 1 Participant demographics and scores on baseline measures

Demographics/variables	<i>n</i>	%	<i>M</i> (SD)	Range
<i>Demographics</i>				
Age (years)	60	–	19.6 (1.5)	18–26
Gender				
Male	9	15	–	–
Female	51	85	–	–
Ethnicity				
White British	41	68.3	–	–
White other	7	11.7	–	–
Indian	1	1.7	–	–
Pakistani	1	1.7	–	–
Chinese	7	11.7	–	–
Other Asian	2	3.3	–	–
Mixed	1	1.7	–	–
Named attachment figure				
Mother	14	23.3	–	–
Father	1	1.7	–	–
Grandmother	1	1.7	–	–
Girlfriend	5	8.3	–	–
Boyfriend	27	45	–	–
Sister	4	6.7	–	–
Friend	8	13.3	–	–
<i>Variables</i>				
ECR-S				
Attachment avoidance	60	–	14.4 (5.6)	6–27
Attachment anxiety	60	–	23.4 (5.5)	11–36
Paranoia Scale Total	60	–	43.6 (12.1)	26–80
DASS-21				
Stress	60	–	8.4 (4.4)	1–20
Depression	60	–	4.6 (3.9)	0–20
Anxiety	60	–	4.7 (4.0)	0–17
SCS total	60	–	58.8 (13.9)	26–85

Abbreviations: DASS-21, depression anxiety stress Scale-21; ECR-S, experience in close relationship scale-short form; *M*, mean; SCS, social comparison scale; SD, standard deviation.

Does stress predict the magnitude of change in proximity seeking?

Multilevel regression models were estimated with change in proximity seeking as the dependent variable and stress lagged ($t-1$) as the independent variable. Results showed that preceding stress was positively associated with the magnitude of change in proximity seeking. That is, a greater level of stress predicted a larger change in proximity seeking between two consecutive timepoints. This relationship remained significant when covarying trait depression, trait anxiety and trait social comparison (see Table 3; Models 1 and 2).

A similar model was estimated using proximity seeking total score as the dependent variable and event-related stress as the independent variable. The *post hoc* likelihood ratio tests showed that adding

TABLE 2 Effect of stress on level of proximity seeking and moderation effects of person-level attachment style

Independent variables	β	<i>p</i> -value	95% CI
Model 1			
Stress lagged $t-1$	-.020	.623	-.099 to .060
Model 2			
Stress lagged $t-1$	-.021	.606	-.100 to .059
Trait depression	-.073	.351	-.226 to .080
Trait anxiety	.074	.317	-.071 to .219
Trait social comparison	-.030	.108	-.067 to .007
Model 3			
Event-related stress	-.056	.040*	-.110 to -.002
Event-related stress squared	.089	<.001**	.062 to .116
Model 4			
Event-related stress	-.056	.040*	-.110 to -.002
Event-related stress squared	.089	<.001**	.062 to .116
Trait depression	-.090	.291	-.256 to .077
Trait anxiety	.078	.334	-.080 to .235
Trait social comparison	-.024	.249	-.064 to .017
Model 5			
Stress lagged $t-1$	-.020	.625	-.099 to .060
Trait anxious attachment	.016	.758	-.085 to .116
Stress lagged $t-1 \times$ trait anxious attachment	.007	.317	-.007 to .020
Model 6			
Stress lagged $t-1$	-.020	.618	-.100 to .059
Trait anxious attachment	.033	.559	-.077 to .142
Stress lagged $t-1 \times$ trait anxious attachment	.007	.319	-.007 to .020
Trait depression	-.100	.223	-.260 to .061
Trait anxiety	.056	.457	-.091 to .203
Trait social comparison	-.031	.095	-.068 to .005
Model 7			
Stress lagged $t-1$	-.018	.666	-.097 to .062
Trait avoidant attachment	-.090	.076	-.189 to .009
Stress lagged $t-1 \times$ trait avoidant attachment	.008	.262	-.006 to .023
Model 8			
Stress lagged $t-1$	-.019	.640	-.099 to .061
Trait avoidant attachment	-.098	.050	-.196 to .000
Stress lagged $t-1 \times$ trait avoidant attachment	.008	.270	-.006 to .023
Trait depression	-.061	.429	-.211 to .090
Trait anxiety	.083	.254	-.059 to .224
Trait social comparison	-.032	.080	-.069 to .004
Model 9			
Event-related stress	-.056	.042*	-.109 to -.002
Event-related stress squared	.089	<.001**	.063 to .116
Trait anxious attachment	.036	.484	-.065 to .138
Event-related stress \times trait anxious attachment	.003	.561	-.006 to .011

TABLE 2 (Continued)

Independent variables	β	<i>p</i> -value	95% CI
Event-related stress squared \times trait anxious attachment	.001	.583	-.003 to .006
Model 10			
Event-related stress	-.056	.041*	-.110 to -.002
Event-related stress squared	.090	<.001**	.063 to .116
Trait anxious attachment	.059	.312	-.055 to .172
Event-related stress \times trait anxious attachment	.003	.567	-.006 to .011
Event-related stress squared \times trait anxious attachment	.001	.580	-.003 to .006
Trait depression	-.122	.168	-.296 to .052
Trait anxiety	.059	.465	-.100 to .218
Trait social comparison	-.025	.217	-.065 to .015
Model 11			
Event-related stress	-.054	.049*	-.108 to -.000
Event-related stress squared	.089	<.001**	.062 to .116
Trait avoidant attachment	-.076	.131	-.176 to .023
Event-related stress \times trait avoidant attachment	-.001	.804	-.011 to .008
Event-related stress squared \times trait avoidant attachment	.002	.357	-.002 to .007
Model 12			
Event-related stress	-.054	.049*	-.108 to -.000
Event-related stress squared	.089	<.001**	.062 to .116
Trait avoidant attachment	-.082	.107	-.181 to .018
Event-related stress \times trait avoidant attachment	-.001	.809	-.011 to .008
Event-related stress squared \times trait avoidant attachment	.002	.366	-.003 to .007
Trait depression	-.075	.374	-.239 to .090
Trait anxiety	.083	.290	-.071 to .238
Trait social comparison	-.026	.194	-.066 to .013

β = unstandardized coefficient values; SE, standard error of the coefficient; 95% CI, 95% confidence interval for the coefficient.

* < .05; ** < .025.

a quadratic term to the model did not make a substantive improvement to model fit ($\chi^2 [1] = 2.12, p = .146$); therefore, the model was run with the linear event-related stress variable only. Results showed that as event-related stress decreases, there is a reduction in the magnitude of change in proximity seeking. In other words, greater event-related stress predicted a larger change in proximity seeking between two succeeding timepoints. This relationship remained significant when trait attachment, trait depression and trait social comparison were inserted in the model as co-variates. All findings were significant when applying the adjusted alpha level of .025 (see Table 3; Models 3 and 4).

Does attachment moderate the relationship between stress and the magnitude of change in proximity seeking?

No moderating effects of attachment style were found, regardless of whether stress lagged, or event-related stress were inserted as the predictor in the model. Person-level attachment style continued

TABLE 3 Effect of stress on change in proximity seeking and moderation effects of person-level attachment style

Independent variables	β	<i>p</i> -value	95% CI
Model 1			
Stress lagged $t-1$	.089	.017**	.016 to .162
Model 2			
Stress lagged $t-1$	.087	.020**	.013 to .160
Trait depression	-.003	.940	-.083 to .077
Trait anxiety	.032	.404	-.044 to .108
Trait social comparison	-.005	.620	-.024 to .014
Model 3			
Event-related stress	-.066	.022**	-.122 to -.010
Model 4			
Event-related stress	-.065	.024**	-.121 to -.009
Trait depression	-.004	.924	-.085 to .077
Trait anxiety	.035	.370	-.042 to .112
Trait social comparison	-.005	.598	-.025 to .014
Model 5			
Stress lagged $t-1$	.089	.017**	.016 to .162
Trait anxious attachment	-.006	.833	-.065 to .053
Stress lagged $t-1 \times$ trait anxious attachment	.007	.284	-.006 to .019
Model 6			
Stress lagged $t-1$	.087	.019**	.014 to .160
Trait anxious attachment	-.010	.753	-.073 to .053
Stress lagged $t-1 \times$ trait anxious attachment	.006	.319	-.006 to .019
Trait depression	-.008	.853	-.092 to .076
Trait anxiety	.027	.491	-.050 to .105
Trait social comparison	-.005	.619	-.024 to .014
Model 7			
Stress lagged $t-1$	.091	.014**	.018 to .164
Trait avoidant attachment	-.041	.182	-.100 to .019
Stress lagged $t-1 \times$ trait avoidant attachment	.009	.198	-.005 to .022
Model 8			
Stress lagged $t-1$	.089	.017**	.016 to .162
Trait avoidant attachment	-.045	.142	-.104 to .015
Stress lagged $t-1 \times$ trait avoidant attachment	.009	.205	-.005 to .022
Trait depression	-.001	.971	-.081 to .078
Trait anxiety	.036	.353	-.040 to .111
Trait social comparison	-.005	.609	-.024 to .014
Model 9			
Event-related stress	-.085	.007**	-.147 to -.023
Trait anxious attachment	.010	.713	-.042 to .061
Event-related stress \times trait anxious attachment	-.002	.660	-.012 to .008
Model 10			
Event-related stress	-.085	.007**	-.146 to -.023

TABLE 3 (Continued)

Independent variables	β	<i>p</i> -value	95% CI
Trait anxious attachment	.003	.927	-.055 to .061
Event-related stress \times trait anxious attachment	-.002	.680	-.012 to .008
Trait depression	-.008	.856	-.093 to .077
Trait anxiety	.033	.406	-.045 to .112
Trait social comparison	-.005	.588	-.025 to .014
Model 11			
Event-related stress	-.085	.007**	-.147 to -.023
Trait avoidant attachment	-.025	.332	-.075 to .025
Event-related stress \times trait avoidant attachment	-.008	.169	-.019 to .003
Model 12			
Event-related stress	-.084	.008**	-.146 to -.022
Trait avoidant attachment	-.029	.254	-.080 to .021
Event-related stress \times trait avoidant attachment	-.008	.175	-.019 to .003
Trait depression	.001	.987	-.080 to .081
Trait anxiety	.035	.363	-.041 to .111
Trait social comparison	-.006	.555	-.025 to .013

β , unstandardized coefficient values; SE, standard error of the coefficient; 95% CI, 95% confidence interval for the coefficient.
 * < .05; ** < .025.

to not moderate the path between stress and change in proximity seeking when controlling for the confounding effect of trait depression, trait anxiety and trait social comparison (see Table 3; Models 5 to 16).

Does the magnitude of change in proximity seeking predict the level of paranoia?

Multilevel regression models were estimated with state paranoia as the dependent variable and change in proximity seeking as the independent variable. Change in proximity seeking did not predict paranoia. This relationship remained non-significant when covarying trait depression, trait anxiety, trait social comparison and gender (see Table 4; Models 1 and 2).

Does the attachment moderate the relationship between the magnitude of change in proximity seeking and the level of paranoia?

The above multilevel regression analysis was re-run with either anxious attachment or avoidant attachment included as a potential moderator variable. For anxious attachment, no moderating effects were identified. This remained the case when trait depression, trait anxiety, trait social comparison and gender were entered as co-variables in the model (see Table 4; Models 3 to 6).

Attachment avoidance moderated the relationship between change in proximity seeking and level of paranoia. Figure 1 illustrates the moderating effect of attachment avoidance on the relationship between change in proximity seeking and level of paranoia. As attachment avoidance increases, the relationship between change in proximity seeking and paranoia is greater. That is, change in proximity seeking is associated with greater subsequent paranoia for participants who are higher on attachment avoidance. Conversely, for participants who score lower on the attachment avoidance subscale, change in proximity seeking is associated with lower paranoia. The moderating effect of attachment avoidance

on the relationship between change in proximity seeking and level of paranoia remained significant when controlling for the confounding effect of trait depression, trait anxiety, trait social comparison and gender (see Table 4).

DISCUSSION

This study investigated the association with proximity seeking, stress and paranoia in the context of daily life, and whether these relationships are moderated by trait attachment style. Findings on the relationship between preceding levels of stress and participants' level of proximity seeking partially supported our hypothesis. However, only event-related stress, but not general stress (i.e., reported stress not linked to a specific event), was predictive of participants' level of proximity seeking. This suggests that participants' subjective appraisals of the stressfulness of daily events may play a more important role in the activation of the proximity seeking than their momentary levels of general stress (Mikulincer et al., 2003). There was a non-linear, quadratic relationship between event-related stress and level of proximity seeking, as participants' level of proximity seeking was highest for events, which participants subjectively appraised as either very unpleasant or very pleasant. Individuals may seek greater proximity to their attachment figure at times of stress but also in response to positive events. The finding that participants' level of proximity seeking was highest for events rated as either very unpleasant or very pleasant aligns with Bowlby's conceptualization of the attachment system as a dynamic, innate affect regulation system, which is activated in response to novel situations or stimuli, whether positive or negative (Bowlby, 1978). This finding, therefore, supports utilizing proximity seeking, which Bowlby posited as the primary attachment strategy to regulate affect (Bowlby, 1978; Mikulincer et al., 2003) as a meaningful indicator of the attachment system coming 'online' in the flow of daily life. Focusing on proximity seeking potentially provides a more dynamic understanding of attachment. This understanding of attachment is more in line with Bowlby's original model and the proposed regulatory functions and consequences of maintaining proximity to attachment figures (Mikulincer et al., 2003) than the 'appraisal' version of attachment theory often referred to in the cognitive literature (Main et al., 1985; Mikulincer & Shaver, 2005).

The hypothesis that different insecure attachment subtypes would be associated with different patterns of proximity seeking responses was not supported; momentary levels of proximity seeking in response to stress did not vary by trait attachment style. This finding is inconsistent with attachment theory and may be attributed to either problem in how we assessed attachment styles (e.g., the use of self-report measures, which rely on conscious awareness of attachment processes), or our use of proximity seeking as a proxy measure of attachment behaviour.

In line with our hypothesis, there was a positive relationship between stress and the magnitude of change in proximity seeking, as elevated stress was associated with a larger change in proximity seeking between successive timepoints. This significant positive relationship was found for both event-related stress and general stress (i.e., reported stress not linked to a specific event). This finding could be interpreted as the attachment system becoming active or disturbed during times of stress, creating a shift in levels of proximity seeking, in line with attachment theory (Bowlby, 1978; Mikulincer et al., 2003).

The hypothesis that trait insecure attachment would positively moderate the relationship between preceding stress and magnitude of change in proximity seeking, or in other words that elevated stress would lead to a greater shift in proximity seeking for more insecure individuals was not supported, suggesting that the size of shift in proximity seeking in response to stress are comparable across individuals regardless of their level of trait attachment insecurity. The non-significant finding for insecure anxious attachment is particularly surprising because research shows that help-seeking behaviours of people with anxious attachment styles are inconsistent compared to those with secure and avoidant attachment styles Shaver et al., 2016). This is likely to be because anxiously attached individuals often want to be protected by others, but simultaneously fear that they will be rejected.

TABLE 4 Effect of change in proximity seeking on level of paranoia and moderation effects of person-level attachment style

Independent variables	β	<i>p</i> -value	95% CI
Model 1			
Change in proximity seeking	-.009	.629	-.047 to .029
Model 2			
Change in proximity seeking	-.009	.650	-.047 to .029
Trait depression	.368	<.001*	.188 to .547
Trait anxiety	.114	.192	-.057 to .285
Trait social comparison	-.012	.576	-.056 to .031
Gender	.277	.741	-1.368 to 1.923
Model 3			
Change in proximity seeking	-.009	.627	-.047 to .029
Trait anxious attachment	.180	<.001*	.054 to .306
Change in proximity seeking \times trait anxious attachment	.001	.789	-.006 to .008
Model 4			
Change in proximity seeking	-.009	.646	-.047 to .029
Trait anxious attachment	.056	.398	-.073 to .184
Change in proximity seeking \times trait anxious attachment	.001	.829	-.006 to .008
Trait depression	.341	<.001*	.153 to .529
Trait anxiety	.931	.300	-.083 to .269
Trait social comparison	-.013	.554	-.056 to .030
Gender	.523	.553	-1.205 to 2.251
Model 5			
Change in proximity seeking	-.002	.913	-.041 to .036
Trait avoidant attachment	.073	.273	-.057 to .203
Change in proximity seeking \times trait avoidant attachment	.007	.042	.000 to .144
Model 6			
Change in proximity seeking	-.002	.930	-.040 to .037
Trait avoidant attachment	.015	.779	-.092 to .123
Change in proximity seeking \times trait avoidant attachment	.007	.044*	.000 to .144
Trait depression	.363	<.001*	.184 to .542
Trait anxiety	.107	.217	-.063 to .277
Trait social comparison	-.012	.598	-.055 to .032
Gender	.287	.732	-1.353 to 1.926

β , unstandardized coefficient values; SE, standard error of the coefficient; 95% CI, 95% confidence interval for the coefficient.

*<.05.

The hypothesis that changes in proximity seeking between two successive timepoints would be positively associated with levels of paranoid thinking was not supported. However, findings showed that attachment avoidance moderated the relationship between changes in proximity seeking behaviour and paranoia, supporting our hypothesis that trait attachment would positively moderate the relationship between magnitude of change in proximity seeking (our proxy for the attachment system coming online) and levels of paranoid thinking. Individuals high on attachment avoidance experienced greater

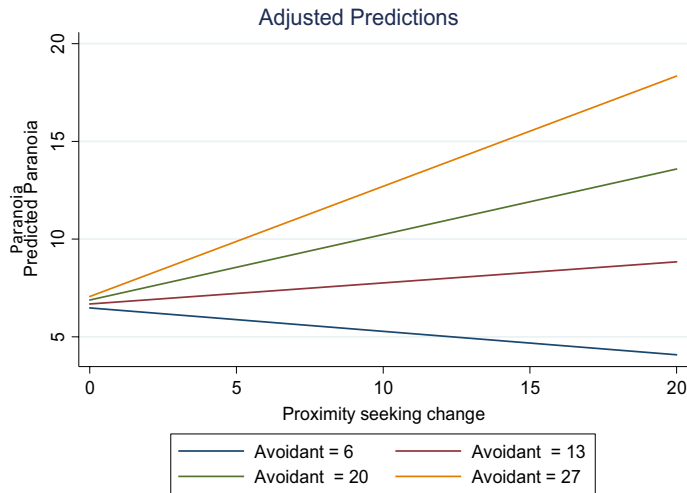


FIGURE 1 Margin plot illustrating the moderating effect of avoidant attachment on the relationship between change in proximity seeking and level of paranoia. The coloured lines represent the relationship at different levels of avoidant attachment score (from minimum value to maximum value).

levels of paranoia in response to shifts in proximity seeking compared to individuals lower on attachment avoidance. For individuals lower on attachment avoidance, change or shift in proximity seeking resulted in less paranoia. Collectively, these findings are consistent with the idea that stress leads to shifts/disturbances in proximity seeking, which serves an indicator of the attachment system coming ‘online’. Whether the attachment system being ‘online’ is a problem, in terms of the occurrence of paranoia, is dependent on an individual’s overall attachment style. For those low in attachment avoidance, an ‘online’ attachment system may lead to a soothing of threat-related cognitions like paranoia. This would be in line with theory that a healthy attachment system serves to adaptively regulate affect⁴. For those with an avoidant attachment style, however, an ‘online’ attachment system may exacerbate paranoid thoughts, due to the activation of attachment-related beliefs that one should be fearful of unavailable or untrustworthy of others and instead rely on one’s autonomy to regulate affect (Mikulincer & Shaver, 2010; Mikulincer & Shaver, 2012; Mikulincer et al., 2003), resulting in paranoid thinking that one is vulnerable to intentional harm from others (Freeman & Garety, 2014).

There are some limitations. First, the reliance on a self-report measure of attachment may not adequately tap covert attachment dynamics, as self-report measures of attachment have been found to not correlate well with more process-focused tools (e.g., Adult Attachment Interview; George et al., 1985). Furthermore, we used proximity seeking as a proxy measure of attachment activation because the primary function of the attachment system is to seek help/protection/support when distressed (in the case of secure attachment). However, we recognize that the activation of the attachment system may not always be explicit. For example, attachment-avoidant individuals typically suppress attachment-related needs and emotions when they are stressed and typically do not seek help when they might need it. Moreover, proximity seeking is likely to overlap with the concept of help-seeking. However, as we did not measure people’s intention behind proximity seeking, we cannot determine whether or not its function was to seek help. Second, the ECR-S measure of trait attachment measures attachment in romantic relationships. Participants were asked to select their own attachment figure and the named attachment figure for the momentary measures may not have been the same person considered for the ECR-S. Whilst romantic partners were the most commonly selected attachment figure, they were not chosen by a substantial proportion of participants (53.3% of the sample). Even if there was a mismatch in attachment figure, the attachment patterns identified by the ECR-S might be expected to generalize to other individuals, including the individual the ESM data was based on. For example, there is evidence

of overlap between general attachment working models and attachment models in relationships with specific individuals (Collins & Read, 1994). Nonetheless, future research should consider explicitly matching the attachment figure referred to in trait and state (i.e., proximity seeking) measures. Third, our sample size was small, which may have resulted in insufficient power to detect interaction effects and affected the ability to detect moderator effects within the analyses. Additionally, running a large number of models may result in spurious associations, and results should be interpreted with caution. Fourth, The ECR-S anxious subscale had poor internal consistency, which may have resulted in the attenuation of associations between variables. Fifth, this study was observational and correlational in nature, which prevents causal inferences being drawn. Sixth, the study did not measure other important concepts relevant to both attachment processes and paranoia such as affect regulation processes. In this respect, future studies might include a measure of intrapersonal emotional regulation. Finally, the generalizability of the findings is limited by the fact that our participants were students who had access to a smart phone and at least some experience in romantic relationships. They were also predominately female and White British.

Bearing in mind the non-clinical nature of this study, there are several clinical and theoretical implications to consider. The findings provide preliminary support for the notion that attachment is a dynamic, affect regulation system that can be ‘on-or-offline’ at any given time in the presence of relevant contextual cues (i.e., stress; Pierce & Lydon, 2001), and changes in proximity seeking may serve as a behavioural indicator of the attachment system coming ‘online’ in the flow of daily life. For individuals with high avoidant attachment, an online attachment system may exacerbate paranoid ideation due to activation of attachment-related beliefs that one should be fearful of unavailable others and rely on one's own autonomy (Mikulincer et al., 2003). Clinicians may benefit from viewing the attachment system in this dynamic way when formulating a client's difficulties, considering, for example, when the system might be most active for that person, and the consequences of this. *In this study, event-related stress predicts proximity seeking. This suggests that it is important to inquire about the impact of everyday events on stress levels as opposed to global ratings of stress. When developing formulations, it would be useful to explore the impact of specific stressful events on how that impacts on proximity seeking. In the case of anxious attachment, it is also important to recognize that it might not be associated with simple increases in proximity seeking – there might be a fear underlying that proximity seeking, which can lead to inconsistent responding to attachment figures. This study also highlights the importance of the potential of positive events, suggesting that we should pay attention to the impact of positive psychological events on people's emotional relationships. Although clinicians may not have electronic-based systems at their disposal to collate moment-by-moment information about attachment-processes, it may be possible to ask clients to collect information through paper-based diaries.* Therapeutic interventions, which focus on attachment could be helpful in reducing paranoia. Adopting an attachment-based approach may allow interventions such as cognitive behavioural therapy to be better focused around cognitions about others that may follow the activation of the attachment system such as seeing others as unreliable or hostile, and attempting to reduce behaviours that may maintain paranoid thinking (e.g., withdrawal, avoidance of others; Bucci et al., 2015; Berry et al., 2017; Berry et al., 2019). Although the added-value of attachment-informed approaches for people with paranoia has yet to be demonstrated through rigorous randomized controlled trials, there is preliminary evidence from clinical case studies that secure attachment imagery may be helpful in reducing paranoia (Pitfield et al., 2020).

AUTHOR CONTRIBUTIONS

SB, PT and KB conceived of the study. KL carried out the study, collected and analysed the data and wrote the full paper. LC supported data analysis and gave critically intellectual input to data interpretation. SB and KB managed paper revisions and revised the paper for critically important intellectual content.

ACKNOWLEDGEMENTS

The authors would like to thank all the service users who took part in the study. There was no funding associated with this study.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Research data are not shared.

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How to cite this article: Lawrence, K., Bucci, S., Berry, K., Carter, L-A & Taylor, P. (2022). Fluctuations in proximity seeking and paranoia. *British Journal of Clinical Psychology*, 61, 1019–1037. <https://doi.org/10.1111/bjc.12372>