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Mere presence is not enough: Responsive support in a virtual world

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ABSTRACT

When individuals are faced with novel or threatening situations, the presence of a trusted companion should reduce anxiety and promote feelings of security. Attachment theory assumes, however, that mere presence is not sufficient for establishing security; an attachment figure must also be attentive and emotionally responsive. To test this idea, participants came to the lab with their romantic partner and completed a threatening cliff-walking task in a digital immersive virtual environment. The presence and nonverbal support behavior (attentive vs. inattentive) of their partner was experimentally manipulated. Results indicated that participants in the attentive-partner condition experienced the task as less stressful than those who were alone; they also reported feeling more secure during the task and were less vigilant of their partner's behavior compared to those in the inattentive-partner condition. Those in the inattentive-partner condition felt less cared for and kept greater physical distance from their partner on a subsequent task. These findings suggest that human beings are predisposed to monitor their social environment for signs of responsiveness, and that perceived responsiveness, not mere presence, is the key modulator of emotional security.

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Introduction

During times of stress or adversity, people of all ages turn to close others for comfort, assistance, and support. According to attachment theory, the desire for proximity to close others during times of threat is driven by an innate attachment behavioral system that functions to promote safety and survival by keeping individuals in contact with nurturing caregivers (Bowlby, 1969). However, attachment theory assumes that people will be most likely to thrive when close relationship partners are not merely physically present but also emotionally responsive when needed. Attachment theory emphasizes the importance of responsiveness for individual health and well-being and for the development of healthy and satisfying relationships.

The importance of caregiver responsiveness is well-documented in the infant attachment literature, which shows that an infant's ability to cope effectively with novel or threatening environments depends strongly on the degree to which his or her attachment figure is attentive and emotionally attuned during the interaction. Although it is of obvious survival advantage for infants to regulate their security through contact with nurturing caregivers (Ainsworth, Blehar, Waters & Wall, 1978), it is less clear whether, or to what degree, the attachment system operates similarly in adulthood or in intimate relationships, the prototypical attachment bond in adulthood (Hazan & Shaver, 1987, 1994; Zeifman & Hazan, 2008). After all, adults are capable of caring for themselves and are not solely dependent on a romantic partner for survival. During times of threat or uncertainty, what is the impact of partner presence and attentiveness on stress appraisals, felt security, and relationship outcomes? Is the mere presence of a romantic partner enough to reduce threat and establish feelings of comfort, or will adults be aware of, and attuned to, subtle behavioral cues of their partner's attentiveness and emotional availability? To address these questions, the current investigation examines normative attachment processes in romantic couples and explores the impact of partner presence (vs. absence) and attentiveness during a threatening task on stress appraisals, attachment behavior, and relationship outcomes.

Attachment behavior in infants

Although assumed to operate "from the cradle to the grave" (Bowlby, 1979/2005), the normative functions of the attachment behavioral system have been primarily documented in parent–child interactions (Ainsworth et al., 1978; Cassidy, 2008). Infants and young children seek proximity to attachment figures when faced with threatening situations (seeking a *safe haven*) and are more likely to confidently explore novel environments when in the presence of an attachment figure (a *secure base*). However, mere presence is not

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sufficient for establishing a child's sense of emotional security. Indeed, Bowlby (1973) observed that parents are often "physically present but 'emotionally' absent" (p. 23). Thus, attachment theory proposes that a child's sense of security will depend not only on whether an attachment figure is present but also on whether he or she is attentive and emotionally responsive.

Consistent with this idea, experimental work shows that infants and young children are highly attuned to signs of maternal responsiveness and modulate their attachment and exploratory behavior accordingly. For example, Sorce and Emde (1981) placed 15-month-old infants in a novel play environment and manipulated whether their mother was attentive (actively monitoring her child) or inattentive (reading a newspaper). When mothers were *inattentive*, infants were less emotionally comforted by their mother's presence (e.g., smiled less, displayed more negative emotional tone), were more vigilant of their mothers' behavior, and were less likely to venture out and explore the environment. Similarly, Carr, Dabbs, and Carr (1975) found that two-year-old children spent a larger percentage of time looking at their mothers (greater vigilance) when their mothers were inattentive (vs. attentive). Thus, at very early stages in development, human beings are capable not only of monitoring the presence or absence of attachment figures, but also of discerning the degree to which they are willing and able to come to their aid should difficulties arise.

Attachment behavior in adults

Proximity to trusted social partners, especially during times of stress or adversity, should be vital to well-being at all stages in the life span. Thus, attachment theory and other prominent evolutionary perspectives on social bonding assume that adults, like children, will be most likely to thrive when they have close relationship partners who are responsive to their needs and deeply invested in their welfare (Bowlby, 1969; Cacioppo & Patrick, 2008; Coan, 2008, 2010; Tooby & Cosmides, 1996). However, the causal impact of an attachment figure's ongoing signaling of responsiveness on adult attachment behavior is not well understood. One reason for this gap is that prior work on adult attachment has focused on individual differences in adult attachment styles; much less attention has been paid to normative attachment dynamics.

There is some evidence for the normative activation of the attachment system in adult close relationships. For example, correlational studies show that intimate partners rely on one another as a safe haven of comfort when distressed (e.g., Collins & Feeney, 2000; Simpson, Rholes and Nelligan, 1992) and a secure base for exploration and personal growth (e.g., Feeney, 2004). Studies also show that adults turn their attention toward attachment figures when distressed, and that these effects can occur automatically and outside conscious awareness. For example, after being subliminally primed with threat-related words (vs. control words), participants responded more quickly to the names of their attachment figures (Mikulincer, Gillath, & Shaver, 2002).

A small number of experimental studies show that the actual or symbolic presence of a close relationship partner can reduce threat appraisals in adults. For example, holding the hand of an intimate partner attenuated threat-related brain activity in response to mild electric shocks (Coan, Schaefer, & Davidson, 2006) and reduced perceptions of pain in response to heat stimuli (Master et al., 2009). The presence of a trusted companion can also make the physical world appear less daunting (Schnall, Harber, Stefanucci, & Proffitt, 2008); while wearing a heavy backpack, participants judged a hill to be less steep when in the presence of a friend or when thinking about a supportive close relationship partner. These studies provide some causal evidence for the social regulation of security in adults, but they fail to distinguish between partner presence and partner responsiveness. A closer inspection of the findings, however, suggests that responsiveness may have played a key role in shaping these effects. For example, the threat attenuating effects of hand-holding were strongest for those in high quality relationships (Coan et al., 2006). Likewise, the hill was judged to be less steep when participants thought about a significant other who had been a source of support but not when they thought about a significant other who had disappointed or betrayed them (Schnall et al., 2008). These findings suggest that the beneficial effects of social presence depend in large part on the degree to which a partner is likely to be supportive and responsive to one's needs.

In summary, prior research provides initial evidence for the normative activation of the attachment system in adulthood and the safety-regulating function of attachment bonds in intimate relationships. However, it is still unclear how partner presence versus responsiveness modulates the attachment system in adulthood. To our knowledge, no studies have experimentally manipulated partner responsiveness during a stressful episode to examine its causal impact on stress appraisals and behavioral outcomes. Although mere presence can serve as an important safety signal, partner responsiveness should play the key role in shaping attachment behavior and emotional outcomes. That is, a partner must not only be present but must also show signs of being attentive, available, and willing to assist if needed. The presence of a partner whose attention is directed elsewhere should be a less effective safety signal and may even signal a lack of care. Thus, we propose that, when faced with stressful or threatening situations, adults, like children, will be highly sensitive to behavioral cues of their partner's attentiveness and emotional availability. When partners are present and attentive (vs. absent or inattentive), adults should experience lower stress, a greater sense of emotional security, and reduced behavioral vigilance. Conversely, and similar to the infant literature, unresponsive partners may actually interfere with effective coping or successful goal pursuits because adults may become vigilant for signs of responsiveness and preoccupied with fulfilling their attachment needs (e.g., Mikulincer & Shaver, 2008).

In addition to shaping stress-related outcomes, partner attentiveness and sensitivity to needs should have important implications for the development and maintenance of secure and well-functioning relationships. Caregiver responsiveness plays a key role in the development of secure parent–child relationships (Ainsworth et al., 1978), and the same should be true for adult attachment bonds. Many theories in the close relationships literature identify *perceived partner responsiveness to the self* as a key factor in the development of trust and intimacy in close relationships (e.g., Murray, Holmes & Collins, 2006; Reis, Clark, & Holmes, 2004). Perceived responsiveness is typically defined as the degree to which an individual feels understood, validated, and cared for by an interaction partner (Reis & Shaver, 1988). When a partner is behaviorally supportive and emotionally attuned during a stressful event, support-recipients should feel more understood and cared for by their partner. In contrast, when a partner is inattentive or preoccupied with his or her own concerns, support-recipients are likely to feel misunderstood and invalidated, and to question their partner's concern for their welfare.

Finally, social support interactions provide individuals with a critical testing ground for discerning whether their partner will be there for them in good times and bad, and for shaping the broader conclusions they draw about their partner's intrinsic motivation to care for them when they are vulnerable and in need (Collins & Feeney, 2004; Tooby & Cosmides, 1996). Thus, adults should be highly attuned to diagnostic information about their partner's motivation to care for them. Behavioral responsiveness signals a partner's benevolent motives and provides an important cue that a partner is safe to approach. Just as children distance from unresponsive caregivers and seek proximity to responsive caregivers, adults should feel safer to approach a responsive partner compared to an unresponsive partner.

The current study

We investigated normative attachment processes in adult intimate relationships by exploring the impact of both the presence and

responsive support behavior of romantic partners on psychological and behavioral outcomes in an anxiety-provoking situation. We used digital immersive virtual environment technology (IVET) to create an adult analog to the laboratory procedures typically used to study parent–child attachment dynamics. Our goal was to create a *novel* environment that evoked a sense of *threat* to one's safety. We created a virtual world in which participants walked along a path on a steep cliff. We then manipulated the presence or absence of their romantic partner in this world; and when the partner was present, we manipulated his/her nonverbal attentiveness, resulting in three experimental conditions: (a) partner-absent, (b) partner-present and attentive, and (c) partner-present and inattentive. We measured outcomes related to security during the task (stress appraisals, feelings of comfort, behavioral vigilance) and outcomes related to the relationship (perceived partner responsiveness, behavioral approach/distancing). IVET enabled us to create an engaging and threatening environment for adults that would be difficult to create in the real world, to carefully control the partner's behavior, and to obtain precise behavioral measures of vigilance and distancing.

We hypothesized that when placed in a novel and threatening environment, adults would be highly attuned to signals – even *nonverbal signals* – of their partner's attentiveness and emotional availability. When partners are present and attentive (vs. absent or inattentive), participants should experience a greater sense of security as evidenced by lower stress appraisals, greater subjective feelings of safety and comfort, and reduced behavioral vigilance (as measured by their visual attention). When partners are attentive (vs. inattentive), participants should also experience more favorable relationship outcomes; they should feel more understood, validated, and cared for by their partner (greater perceived responsiveness to the self) and should move physically closer to their partner (as opposed to physically distancing) on a subsequent task.

Method

Participants

One-hundred and thirty-one participants (68 women, 63 men) were recruited from the University of California Santa Barbara campus community (mean age = 20.2, *SD* = 2.6). Participants attended the study session with their romantic partners.[1] All couples were heterosexual with the exception of two same-sex female couples. Mean relationship length was 18.8 months (*SD* = 17.2). Nine additional participants were recruited but are not included in the current sample; five were lost due to technical/procedural problems and four due to suspicion. The sample was 66% white/Anglo, 15% Asian/Pacific Islander, 12% Latino/Hispanic, 2% African-American and 5% other.

Design

There were three experimental conditions, two in which the partner was present in the virtual world (*attentive-support,* $n = 43$, and *inattentive-support,* $n = 49$), and one in which the partner was absent (*no support*, $n = 39$).

Procedure

Participants came to the lab with their romantic partners and were informed that the purpose of the study was to examine how couples interact using modern technologies. Couples were told they would be completing various activities (some individually and some together) in a virtual world. Couple members were then escorted to separate rooms, where they completed background questionnaires and remained for the duration of the study. Next, participants were told that they would be completing a cliff-walking activity in a virtual world. In the partner-absent condition, they were told they would be completing this activity alone. In the two partner-present conditions, they were told that their partners would be in the virtual world with them during their task. Participants were informed that they would see a digital representation of their partner and that their partner would be controlling the behavior of this representation. They were also told that they and their partner would be unable to talk to each other but could use physical gestures to communicate. In reality, partners were not actually present in the virtual world. The digital representation of the partner was pre-programmed and controlled by computer algorithms.

Next, participants were fitted with a head mounted display (HMD) and allowed to preview the virtual world. The HMD was then removed and participants completed a measure of pre-task anxiety (described below). To increase participants' comfort with the digital representation (the *agent*) they would see of *their partner* in the virtual world, they were allowed to choose a digital agent to represent their partner from a group of either male or female agents (depending on the sex of their partner) that varied in race and hair color.

Participants then put on the HMD and completed an ostensible "calibration" test with their partner in the virtual world. Part of this test was actually a proxemic task (a behavioral approach task, described below). The rest of the task was used to enhance believability (to allow participants to see their partner controlling his/her digital image in the virtual world). For example, participants and partners were asked to raise their right and left arms in the world. All participants completed this task (even those in the partner-absent condition, who believed they would be doing subsequent tasks with their partner). After the first (ostensible) calibration, participants completed the cliff-walking task (described below). While remaining in the virtual world, they then completed a second proxemic task, identical to the first. The HMD was then removed and participants completed a questionnaire. Finally, participants were fully debriefed and reunited with their partner.

Canyon world design and cliff walking task

The canyon world was designed to be a completely immersive experience. Partner agents were placed at the end of the path near a tree (see Fig. 1). Because the path curved in an "S" shape, participants had to change their head orientation to see their partner at times. Participants were instructed to walk along the path until they heard a bell, at which time they were instructed to turn around and walk back. Perceptual cues were added to create a more enhanced experience. For example, rocks fell off the cliff when participants stepped on or near their location, and localized sound was added (e.g., the sound of wind swooping up from the canyon or rocks falling).

Attentiveness/emotional availability manipulation

In the *attentive*-support condition, digital agents were programmed to wave, clap, nod their heads, and actively orient their bodies toward the participant during the task. In the *inattentive*-support condition, agents were programmed to always be oriented 30° away from participants (at times looking completely away from participants and out over the canyon). These behavioral animations were pilot tested to ensure that they communicated either attentiveness or inattentiveness.

Pre-task questionnaire

Pre-task stress appraisals

After viewing the virtual world, participants completed a 3-item measure of perceived stress ($\alpha = .83$): "How nervous are you about

[1] The recruited participant is the target in this study. Romantic partners attended the study session only as part of the cover story; they did not provide any data. The recruited participant will be referred to as the "participant" and his or her romantic partner as the "partner."

Fig. 1. Participant wearing a head-mounted display (HMD), and a screen shot of the virtual world with an attentive partner shown.

participating in the VR cliff walking task?", "How difficult (emotionally and mentally) do you think the VR cliff-walking task will be for you?" and "Overall, how stressful do you think this task will be?" Items were rated on a scale from 1 'not at all' to 7 'extremely.'

Post-task questionnaire

Post-task stress appraisals

After completing the cliff-walking task, participants responded to the same 3-item stress measure ($\alpha = .83$) used prior to the task but modified to assess perceived stress *during* the task (e.g., "How nervous were you during the cliff-walking task?"). Items were rated on a scale from 1 'not at all' to 7 'extremely.'

Emotional security

To measure subjective feelings of emotional security, participants in the two partner-present conditions were asked to provide an open-ended description of how their partner's presence made them feel during their task. Specifically, they were asked *"In your own words and in as much detail as possible, please describe how your partner's presence in the virtual world made you feel during your cliff walking task."* These written responses were analyzed using a text analysis program called *Linguistic Inquiry Word Count* (LIWC; Pennebaker, Francis, & Booth, 2001). To determine if participants spontaneously mentioned feelings of safety and comfort, we created a custom dictionary that included 25 words associated with emotional comfort (e.g., comfortable, safe, secure, calm, and relaxed). Responses were scored "1" if they included one or more security-related words and "0" if they did not include any such words (see Table 1 for sample responses).

Perceived responsiveness to the self

Participants completed a 6-item measure assessing the degree to which their partner's behavior led them to feel valued, understood, and cared for during their task ($\alpha = .93$). Sample items included: "My partner's behavior during my cliff-walking task made me feel loved and cared for," "…was considerate of my needs," and "…made me feel valued and accepted." Because this measure asked about the partner's behavior during the task, it was only included in the two partner-present conditions. Items were rated on a scale from 1 'not at all' to 5 'extremely.'

Manipulation checks

Participants filled out a behavior check-list to verify that they saw the different behaviors performed by the digital agents in the two partner-present conditions. This list included behaviors that actually occurred (e.g., clapped, nodded, looked out over the canyon) and ones that did not occur (e.g., gave a thumbs-up sign, put hands on hips, smiled). Additionally, to verify that the two groups also differed in their subjective perception of their partner's attentiveness, participants rated four items ($\alpha = .88$) assessing their partner's attentiveness, interest, encouragement, and neglect (reversed).

Behavioral measures

Vigilance (looking) behavior

Vigilance was assessed by measuring participants' visual attention (how much they looked at their partner) during the approach portion

Table 1
Sample open-ended responses. *My partner's presence in the virtual world made me feel…*

LIWC coding	Open-ended response
Comfort words (coded as '1')	Safe. Even if I were to fall down I'm sure he'd be right there to help me back up.
	Comfortable, because she was there. I wasn't worried about falling, I just wanted to get to her. That was my main task.
	Like he was supporting and encouraging me in my task. I watched him clapping while I walked, and this made me feel as though someone cared about my performance and my safety. My partner took a supportive role, which made me feel important.
	At ease. When I got close to the cliff edge and heard rocks falling and the wind whistling, I'd look to her and it helped to settle my nerves quite a bit.
No comfort words (coded as '0')	I don't think her presence was a factor. I focused on the path and not on her.
	It didn't really matter that he was there because I was focusing on the cliff instead of him. The presence of my partner didn't make a difference and it didn't make me feel anything.
	Nothing. I was more focused on getting across the cliff that I did not notice her presence too much. Honestly I was very consumed in the virtual world. After I saw him not noticing me I just took on the task without his guidance. Looking back I realize I never looked at him that much.
	A little sad. I looked up and he wasn't doing anything—just standing there. I expected him to jump up and down. I was disappointed but proud I did it without him.

Note: LIWC = linguistic inquiry word count.

Table 2
Intercorrelations and descriptive statistics for all dependent variables.

Dependent variable	1	2	3	4	5
1. Task-related stress	1.00				
2. Use of comfort words	−.06	1.00			
3. Perceived responsiveness	−.10	.47***	1.00		
4. Visual vigilance	.06	−.11	−.06	1.00	
5. Distance from partner	−.16†	−.08	−.14	.15	1.00
Means	2.97	0.51	2.06	0.06	0.89
Standard deviations	1.33	0.50	1.03	0.11	0.28
Sample size (*N*)	131	90	89	92	131

Note. Samples sizes differ because some of the dependent variables (2–4) were only assessed in the two partner-present conditions and because there was a small number of missing values.
† $p<.10$.
*** $p<.001$.

Table 3
Means by support condition for all dependent variables.

Dependent variable	No support (*N*=39)	Inattentive support (*N*=49)	Attentive support (*N*=43)
Task-related stress	3.31_a	2.99	2.65_b
Use of comfort words (0=no, 1=yes)		0.38_a	0.65_b
Perceived responsiveness		1.71_a	2.46_b
Visual vigilance (proportion of time that the partner was in the visual field)		0.08_a	0.04_b
Distance from partner (meters)	0.86_a	0.97_b	0.84_a

Note. The means for task-related stress, visual vigilance, and distance from partner are adjusted for covariates. Means with different subscripts differ at $p<.05$, with one exception. For distance from partner, the means for the no-support and inattentive-support groups differ from each other at $p=.057$.

of the cliff-walking task (when they were walking toward their partner). The vigilance score represents the proportion of time participants kept their partner within their visual field, including both focal and peripheral field of view. This variable could only be assessed for participants in the two partner-present conditions.

Interpersonal distancing behavior (proxemic task)

To obtain an implicit measure of social approach/avoidance, we used a proxemic task that has been used and validated in prior research (Bailenson, Blascovich, Beall, & Loomis, 2003). Participants were asked to walk toward their partner, look at (and report) a number written on his/her back, and then walk back. This task took place within the virtual cliff world. A precise measure of interpersonal proximity/distance was taken by computing the minimum distance (in meters) that participants assumed between themselves and their partner when in front of (facing) their partner. Higher numbers indicate greater distance. This variable was assessed for all participants.

Results

Descriptive statistics and intercorrelations for all study variables are shown in Table 2. Results for primary dependent variables are shown in Table 3.[2]

Manipulation check

To determine if participants in the two partner-present conditions noticed the different behaviors performed by their partner's agent (the digital animation), we conducted chi-square analyses on the behavior checklist items. Participants in the attentive-support condition were more likely than those in the inattentive-support condition to (correctly) report that their partner clapped (χ^2 (1, $N=91$) = 32.388, $p<.001$, $\eta^2=.36$) and nodded ($\chi^2=10.940$, $p<.01$, $\eta^2=.12$). Participants in the inattentive-support condition were more likely than those in the attentive-support condition to (correctly) report that their partner looked out over the canyon ($\chi^2=14.273$, $p<.001$, $\eta^2=.16$) and looked away from them ($\chi^2=6.793$, $p<.01$, $\eta^2=.07$). There were no differences between groups on behaviors that did not occur, with one exception. Participants in the attentive condition were more likely to (incorrectly) report that their partner smiled at them ($\chi^2=11.72$, $p<.01$, $\eta^2=.13$). These results indicate that our participants were clearly aware of the different behaviors performed by attentive and inattentive partners.

Next we conducted a one-way (two-group) Analysis of Variance (ANOVA) on the partner attentiveness index. Participants in the attentive-support condition rated their partner as significantly more attentive ($M=4.95$, $SD=1.65$) than those in the inattentive-support condition ($M=3.76$, $SD=1.22$), $F(1,88)=15.307$, $p<.001$, $\eta^2=.15$. Thus, our manipulation was clearly effective in creating differences in perceived partner attentiveness.

Task-related stress

Did the presence and attentiveness of a romantic partner lead participants to experience the cliff-walking task as less stressful? To address this question, we conducted a one-way (three-group) Analysis of Covariance (ANCOVA) on post-task stress appraisals. We included two covariates, gender (because men rated the task as significantly less stressful than women, $p<.01$) and pre-task stress appraisals (in order to obtain a more sensitive measure of *changes* in stress appraisals due to support condition). Results revealed a significant effect of support condition, $F(2,126)=3.173$, $p<.05$, $\eta^2=.05$. As shown in Table 3, pairwise comparisons indicated that participants in the attentive-support condition experienced the cliff-walking task as significantly less stressful than those in the no-support (alone) condition. The inattentive-support condition fell in between these two conditions, but did not differ significantly from either one. Thus, as predicted, participants who crossed the cliff in the presence of a behaviorally responsive partner experienced the task as less stressful than those who crossed the cliff alone. The presence of an inattentive partner conferred some small benefit, but was not significantly better than being alone.

In the next series of analyses, we examined the two partner-present conditions more closely to determine how partner attentiveness affected participants' subjective experiences of safety and perceived partner responsiveness to the self during their cliff-walking task.

Emotional security (spontaneous use of comfort words)

To determine if the presence of an attentive (vs. inattentive) partner lead participants to feel safer and more secure during their cliff-walking task, we conducted a chi-square analysis on participants' spontaneous use of comfort words in their open-ended descriptions. This analysis revealed a clear difference between the two groups. Participants in the attentive-support condition were much more likely to spontaneously mention feeling comforted by their partner's presence (65%) compared to those in the inattentive-support condition (38%), χ^2 (1, $N=90$) = 6.46, $p=.01$, $\eta^2=.07$.

Perceived partner responsiveness to the self

To determine if the presence of an attentive (vs. inattentive) partner lead participants to feel more understood, validated, and cared for by their partner, we conducted a one-way (two-group) ANOVA on ratings of perceived partner responsiveness to the self. As shown in Table 3, participants in the attentive-support condition reported greater

[2] The experimental manipulation did not interact with participant sex in predicting any of the dependent variables and will not be discussed further.

perceived responsiveness than those in the inattentive-support condition, $F(1,88) = 13.118$, $p < .001$, $\eta^2 = .13$.

Behavioral measures

The analyses thus far reveal that the support manipulation had a significant impact on self-reported stress appraisals and subjective feelings of comfort and perceived partner responsiveness. But did partner presence and attentiveness influence behavioral outcomes? In the final set of analyses we examined two behavioral outcomes, one that was measured during the cliff-walking task (visual attention/vigilance) and one that was measured after the task (physical approach to partner on a subsequent task).

Vigilance

Did participants in the two partner-present conditions differ in how much they attended to their partners during the cliff-walking task? To address this question, we conducted a one-way (two-group) ANCOVA on the visual attention (vigilance) measure. In this analysis, we controlled for mean *pitch* (which reflects the position of the HMD on each individual) to reduce extraneous noise caused by individual differences in HMD fit. As shown in Table 3, participants in the inattentive-support condition kept their partner in their field of view for a greater proportion of time than those in the attentive-support condition, $F(1,89) = 4.497$, $p = <.05$, $\eta^2 = .05$. Thus, as predicted, participants showed greater vigilance toward inattentive partners.

Interpersonal proximity/distancing

Did partner presence and attentiveness during the cliff-walking task affect participants' willingness to physically approach their partner on a subsequent task? To address this question, we conducted a one-way (three-group) ANCOVA on post-task proximity with two covariates, gender (women moved closer to their partners, $p < .05$) and proximity on the first proxemic task (to control for individual differences in physical proximity prior to the support manipulation). Results revealed a significant effect of support condition, $F(2,126) = 3.532$, $p = .032$, $\eta^2 = .05$. As shown in Table 3, participants in the inattentive-support condition kept greater distance than those in the attentive-support condition ($p = .013$) and those in the alone condition ($p = .057$). The attentive-support condition did not differ significantly from the alone condition. Thus, as predicted, participants who crossed the cliff in the presence of an inattentive partner (vs. an attentive partner or being alone) kept greater distance from their partner on a subsequent task. Contrary to our expectations, participants in the attentive partner condition did not move closer to their partner compared to those in the alone condition.

Discussion

During a novel and anxiety-provoking situation, participants in this study were highly sensitive to cues of their partner's responsiveness. Participants who crossed a virtual cliff in the presence of an attentive partner appraised the task as less stressful than those who crossed the cliff alone, but the presence of an inattentive partner did not significantly attenuate stress relative to being alone. In addition, when romantic partners were present and attentive (vs. present but inattentive), participants reported feeling safer and more secure in the virtual world and more understood, validated, and cared for by their partner. When partners were present but inattentive, participants spent more time monitoring their partner during the cliff-walking task (more vigilance) and kept greater physical distance from their partner on a subsequent task.

This study provides the first experimental evidence that partner responsiveness plays a causal role in shaping attachment dynamics in adulthood, with patterns that were remarkably similar to those observed in parent–child interactions. When romantic partners were present and emotionally responsive, we saw evidence of secure attachment dynamics: calming and feelings of comfort and security. In contrast, when partners were present but unresponsive, we saw evidence of insecure dynamics: discomfort, behavioral vigilance, and behavioral avoidance.

The vigilance and behavioral distancing findings are especially noteworthy, suggesting that the secure base and safe haven dynamics observed in children are also clearly visible in adulthood. When participants were confident that their partners were available if needed, they ventured forth with relative ease (as reflected in open-ended reports) and attended to their cliff-walking task. In contrast, when participants became aware that their partner was not attuned to them, they were less confident in their explorations and continued to monitor the security of their home base (diverting vital resources that could otherwise have been used to cope with their task). These findings are consistent with the idea that attachment security frees up cognitive resources, enabling people to focus on exploration and other important goals (Coan, 2010; Feeney, 2004, 2007; Mikulincer & Shaver, 2008).

It is likely that vigilance and distancing behavior occurred below conscious awareness. Looking behavior and distancing were not correlated with explicit reports of stress, comfort, or perceived partner responsiveness (see Table 2). In addition, many participants in the inattentive-partner condition reported (in open-ended responses) that they did not notice their partner's behavior and that it had no impact on them (see Table 1). However, their behavioral data told a very different story — they actually spent more time looking at their partner during their task and kept greater physical distance on a subsequent task. Although we can only speculate about the underlying psychological dynamics, we suggest that the threat produced by the cliff-walking task automatically activated attachment-relevant goals (such as the desire to seek social support), and these goals in turn shaped vigilance and distancing behavior without conscious awareness or intent (Bargh, Gollwitzer, Lee-Chai, Barndollar & Trotschel, 2001; Shah, 2005).[3]

On a broader level, our findings provide convincing evidence that the normative features of the attachment behavioral system operate similarly in childhood and adulthood. It is by no means obvious that adults – who are capable of caring for themselves and who are likely to possess sophisticated mental representations of their close relationship partners – would be so dramatically affected by subtle differences in their romantic partner's nonverbal responsiveness during a stressful task. By showing that partner attentiveness, and not mere presence, shapes psychological and behavioral outcomes in adults, our study provides evidence that a functional system first observed in infancy is clearly preserved in adulthood. Moreover, although it is widely assumed that the attachment behavioral system is a component of adult pair bonds, this claim is not without controversy (see, for example, Kirkpatrick, 1998). Our findings clearly reveal that the attachment behavioral system is active in adult intimate relationships – often outside conscious awareness – and that it functions to promote safety and well-being in ways that are both subtle and powerful.

[3] One alternative explanation for our vigilance finding is that participants were more attentive to unresponsive partners because their behavior was unexpected (see Johnson, Dweck, & Chen, 2007). If this was the case, it is reasonable to assume that visual attention in the inattentive-partner condition would be positively correlated with participants' general expectations of their partner's supportiveness. That is, participants who expect their partners to be highly supportive should find the inattentive behavior to be more surprising, which should lead to greater vigilance. However, in follow-up analyses, we found no significant correlation between support expectations (which were measured in a background questionnaire) and vigilance in the inattentive-partner condition ($N = 46$, partial r controlling for mean pitch $= -.21$, $p = .16$). Moreover, the direction of the association was opposite of what would be expected – those with high support expectations tended to spend *less* time looking at the unsupportive partner – suggesting that visual attention was not driven simply by failed expectations.

This study also highlights the role of responsive support (or neglect) in shaping the development and deterioration of intimacy and closeness in communal relationships. When romantic partners were attentive and encouraging (vs. inattentive and neglectful), participants felt more loved and cared for by their partner. In contrast, when partners were inattentive, participants felt less cared for (compared to the attentive condition) and kept greater physical distance between themselves and their partner on a subsequent task (compared to both the attentive and alone conditions). This latter finding indicates that participants were clearly moving away from – or avoiding – unresponsive partners. The tendency for participants to physically distance from their unresponsive partners likely reflects a basic safety-regulation process that operates automatically and outside awareness (Christenfeld et al., 1997; Murray et al., 2006; Williams & Bargh, 2008). Interestingly, participants did not move significantly closer to their partners in the attentive-support condition compared to the alone condition. One reason for this finding may be that participants in the alone condition were equally motivated to seek proximity to their partner. After all, they had just completed a stressful and engaging task and were now given an opportunity to be in contact with their partner. Methodological features of the proxemic task may also be important to consider. Specifically, there may have been a ceiling effect such that participants were constrained by norms concerning personal space — they may not have had much latitude in their ability to move closer to their partner without becoming uncomfortably close (recall that we measured the distance between the participant and his or her partner when the participant was face-to-face with the partner's digital image).

It is noteworthy that the effects in this study emerged in response to the partner's *non-verbal* behavior (Ambady, Bernieri, & Richeson, 2000) and within existing (and well-functioning) relationships, suggesting that human beings are predisposed to detect social cues related to responsiveness and to draw broader inferences from these cues (e.g., can this person be trusted, is this person friend or foe). Non-verbal signals of responsiveness may be especially important in conveying information about a partner's concern for one's welfare because human beings first learn about their social world through nonverbal signaling (Schachner, Shaver, & Mikulincer, 2005). That subtle differences in one partner's *nonverbal* attentiveness had such dramatic effects on the other partner's emotional and *behavioral* responses suggests that small acts of kindness or neglect can have important long-term consequences for relationship functioning. Through repeated interactions, the benefits of responsive support, and the costs of unresponsive support, may build up over time to enhance or weaken trust and intimacy in couples (Collins & Feeney, 2000, 2004; Holland, Roeder, van Baaren, Brandte & Bettina, 2004; Reis & Shaver, 1988; Tucker & Anders, 1998).

The current study also has implications for the broader literature on social support. Our data suggests that the stress-buffering role of significant others hinges primarily on their responsiveness to needs and not on their mere presence. In addition, although, it is widely assumed that receiving support facilitates coping and promotes well-being, prior experimental studies have revealed weak and even contradictory evidence for the benefits of receiving support (e.g., Bolger & Amarel, 2007). Most of these studies utilize stress paradigms that involve a high degree of social evaluative threat (e.g., giving a public speech), in which support-providers are also potential evaluators. Moreover, few studies take into account the quality of the support provided. However, recent non-experimental work suggests that support quality and perceived responsiveness are essential to determining if social support will be beneficial (Maisel & Gable, 2009; Rini, Dunkel Schetter, Hobel, Glynn & Sandman, 2006). The current study extends this work by providing causal evidence that responsiveness plays a key role in determining whether the presence of a close other will reduce stress and enhance relationship outcomes.

Finally, this study highlights key methodological strengths of virtual reality technology for studying social psychological processes. IVET allows researchers to create emotionally powerful social environments that would otherwise be difficult or impossible to create in the lab with a high degree of experimental control, a feature that may be especially useful for close relationships research. IVET also allows for the precise measurement of important behavioral outcomes (e.g., visual attention, physical proximity). Although, one potential concern with IVET is whether participants experience the virtual world in the same way that they experience the natural world, prior research indicates that participants treat virtual human representations as if they were humans (Bailenson, Blascovich, Beall & Loomis, 2001; Blascovich & Bailenson, 2011), and participants in the current study clearly did so.

Conclusion

By varying partner presence and responsiveness, this study demonstrates that emotional security in adulthood – as in childhood – hinges primarily on perceived responsiveness and not on the mere presence of a close other. Knowing that an attentive partner "has our back" reduces threat, promotes comfort, and enhances feelings of being cared for. In contrast, inattentiveness fails to attenuate stress and increases behavioral vigilance and distancing, which may interfere with coping and reduce emotional closeness in relationships. Thus, for effective coping and optimal functioning in adulthood, what matters most is not the *physical* presence of others, but their *emotional* presence — a sense of confidence that a trusted companion is concerned about our welfare and willing and able to come to our aid should difficulties arise.

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