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Romantic partner presence and physiological responses in daily life: Attachment style as a moderator

Sohyun C. Han[a,*], Hannah L. Schacter[b], Adela C. Timmons[c], Yehsong Kim[a], Stassja Sichko[d], Corey Pettit[e], Theodora Chaspari[f], Shrikanth Narayanan[g], Gayla Margolin[a]

[a] University of Southern California, Department of Psychology, 3620 S. McClintock Ave, Los Angeles, CA, 90089, USA
[b] Wayne State University, Department of Psychology, 5057 Woodward Ave, Detroit, MI, 48202, USA
[c] Florida International University, Center for Children and Families, 11200 SW 8th St, Miami, FL, 33199, USA
[d] University of California, Los Angeles, Department of Psychology, 1285 Franz Hall, Los Angeles, CA, 90095, USA
[e] University of Virginia, Department of Psychology, 485 McCormick Road, Charlottesville, VA, 22903, USA
[f] Texas A&M University, Computer Science and Engineering, 710 Ross St, College Station, TX, 77843, USA
[g] University of Southern California, Department of Electrical and Computer Engineering, 3740 McClintock Ave, Los Angeles, CA, 90089, USA

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ABSTRACT

The present study investigated whether the presence of a romantic partner in daily life is associated with attenuated sympathetic nervous system responses. Additionally, romantic attachment style was tested as a moderator. For one day, 106 heterosexual young adult dating couples wore ambulatory sensors that monitored electrodermal activity (EDA) – an index of sympathetic arousal. Couples reported whether they were together or apart for every hour of the data collection day. Men and women exhibited lower EDA during hours in which their partner was present compared to hours in which they were absent. Additionally, romantic attachment style moderated this association; those who had low anxious attachment showed a stronger attenuating effect of partner presence compared to those with higher anxious attachment. Similarly, those who had low avoidant attachment showed heightened effects of partner presence compared to those with higher avoidant attachment. Romantic partner presence may facilitate everyday health-promoting physiological processes.

1. Introduction

Romantic relationships contribute in important ways to health and well-being. Being married or having a high-quality romantic relationship is associated with living longer and having fewer health problems (Coyne et al., 2001; Holt-Lunstad, Smith, & Layton, 2010; Johnson, Backlund, Sorlie, & Loveless, 2000; Robles, Slatcher, Trombello, & McGinn, 2014). One pathway by which romantic relationships are thought to affect long-term health is through attenuating physiological responses to stress (DeVries, Glasper, & Detillion, 2003; Robles, 2014). Notably, research has shown that simply the presence of a romantic partner, beyond any supportive interactions, is associated with reduced physiological and threat-related neural responses when one partner experiences a laboratory-induced stressor (Coan, Schaefer, & Davidson, 2006; Feeney & Kirkpatrick, 1996). Despite these intriguing findings, considerably less is known about the presence of a partner and physiological responses in naturalistic circumstances. By tracking the hourly comings and goings of young adult romantic couples across an entire day, the current study investigates associations between partner presence and electrodermal activity (EDA), an index of the sympathetic nervous system, in both partners. Additionally, in response to calls to identify individual characteristics that account for variation in the health benefits accrued from romantic relationships (Robles, 2014), we investigate adult attachment style as a moderator.

1.1. Theories on relationship regulation

Humans are biologically predisposed to be physiologically regulated by others (Butler, 2011). Attachment theory posits that beginning in infancy, humans have an innate drive to maintain proximity to a

* Corresponding author at: Department of Psychology, University of Southern California, 3620 S. McClintock Ave, SGM 501, Los Angeles, CA, 90089, USA.
E-mail addresses: sohyunha@usc.edu (S.C. Han), Hannah.schacter@wayne.edu (H.L. Schacter), atimmons@fiu.edu (A.C. Timmons), yehsongk@usc.edu (Y. Kim), ssichko@g.ucla.edu (S. Sichko), cp7ze@virginia.edu (C. Pettit), chaspari@tamu.edu (T. Chaspari), shri@ee.usc.edu (S. Narayanan), margolin@usc.edu (G. Margolin).

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caregiver, which helps promote regulation of affect, physiology, and behavior (e.g., Bowlby, 1982). When infants are even briefly separated from their caregivers, they demonstrate heightened behavioral and emotional distress accompanied by increased physiological stress reactivity (Gunnar, Brodersen, Nachmias, Buss, & Rigatuso, 1996). Attachment is theorized to persist across the lifespan, with adult attachment most commonly conceptualized within the context of romantic relationships (Fraley & Shaver, 2000). Similar to attachment figures in childhood, adult romantic partners are thought to help regulate physiological responses, though some studies suggest that individual differences in attachment style influence the extent of physiological regulation (Pietromonaco, DeBuse, & Powers, 2013; Mikulincer & Shaver, 2007; Pietromonaco, Uchino, & Dunkel Schetter, 2013).

Complementing attachment theory, social baseline theory holds that humans evolved within a social context and are predisposed to rely on others to share resources and to maintain vigilance for risks (Beckes & Coan, 2011; Coan & Maresh, 2015). Thus, when others are in close proximity, the brain automatically relaxes vigilance against threats, which helps conserve and regulate one's own resources. In line with this theory, participants who were in the presence of a friend estimated hills to be less steep compared to those who were alone (Schnall, Harber, Stefanucci, & Proffitt, 2008). These findings suggest that sensory perception becomes modified if a friend is sharing the burden. Additionally, this effect was moderated by friendship duration – that is, the longer participants knew their friend, the less steep they perceived the hill to be, indicating that familiarity in relationships strengthened physiological effects.

1.2. Romantic partner presence and physiology

In support of both attachment and social baseline theories, a number of experimental studies show that the presence of a romantic partner is associated with reduced physiological stress responses. In a landmark study (Coan et al., 2006), women were told they were going to receive an electric shock; conditions varied by whether they were in the presence of their partner, a stranger, or alone. Neural responses in brain structures that regulate emotion (e.g., right dorsolateral prefrontal cortex) were most attenuated when women were holding their romantic partner's hand, compared to holding a male stranger's hand or being alone. Notably, among those who held their partner's hand, individuals in higher quality relationships demonstrated the largest neurological threat reductions. In a replication of this study, hand holding by an opposite-gender dating partner or friend also attenuated neural responses to threat cues to the same degree as hand holding by a spouse, indicating that significant others outside of marriage can be similarly effective in attenuating threat (Coan et al., 2017). In a separate lab-based stress-inducing task (i.e., mental arithmetic), women in the presence of their romantic partner demonstrated lower heart rate and blood pressure compared to women who were alone (Feeney & Kirkpatrick, 1996). This effect was moderated by attachment style such that those who were insecurely attached to their partners demonstrated higher heart rate and blood pressure when the partner was absent compared to those with more secure attachment. Yet another experiment found that, in comparison to an active control (e.g., being alone and thinking about their day), the presence of a romantic partner was associated with attenuated blood pressure reactivity during a cold pressor task compared to those who were in an active control (e.g., thought about their day), though significant attenuation was also found for simply thinking about a romantic partner (Bourassa, Ruiz, & Sbarra, 2019).

To our knowledge, no studies have assessed the effects of partner presence on electrodermal activity (EDA), or skin conductance level – an unobtrusive measure of activity in the eccrine sweat glands. Exclusively innervated by the sympathetic nervous system, EDA is one of the best indices of sympathetic arousal and is a sensitive indicator of anxiety (e.g., Boucsein, 2012), though EDA can also increase with other factors such as attention and interest (Di Lascio, Gashi, & Santini, 2018). Repeated activation of the sympathetic nervous system can lead to allostatic load, or wear and tear of physiological systems, increasing risk for morbidity and mortality (McEwen & Seeman, 1999). Thus, identifying how partner presence is associated with attenuations in EDA could identify one pathway by which partner presence helps ameliorate maladaptive physiological processes.

1.3. Partner presence in daily life

Although partner presence has shown time-limited physiological effects in the laboratory, ambulatory physiological assessments are thought to capture a more accurate representation of an individual's physiology (Stone & Shiffman, 1994). Emerging evidence also indicates that physiological responses captured at home (e.g., heart rate reactivity) are statistically larger and correspond more closely to measures of relationship functioning than in-lab physiological responses (Baucom et al., 2018). Thus, identifying physiological patterns in daily life is crucial to understanding the natural progression of health-relevant processes. To our knowledge, only three studies have investigated the effects of romantic partner presence on physiological processes outside of the laboratory. In two studies, married individuals wore an ambulatory blood pressure monitor that assessed blood pressure at regular intervals for several days (Cornelius, Birk, Edmondson, & Schwartz, 2020; Gump, Polk, Kamarck, & Shiffman, 2001). Immediately after each reading, participants rated whether they were interacting with their partner or with others. Results indicated that interactions with a romantic partner were associated with reduced blood pressure relative to interactions with others. Importantly, diastolic blood pressure during romantic partner interactions predicted attenuated blood pressure 6 years later, whereas blood pressure responses during general social interactions did not predict long-term blood pressure (Cornelius et al., 2020).

Another study used daily diary methodology for 21 days among couples who anticipated a 4 to 7-day natural separation from their partner due to work-related travel (Diamond, Hicks, & Otter-Henderson, 2008). On days that partners were separated, couples displayed declines in feelings of closeness and appreciation towards each other and increases in sleeping problems. Further, partners who did not travel provided daily cortisol samples. Compared to those with lower anxious attachment, individuals with high anxious attachment showed heightened diurnal cortisol responses across the day (e.g., increased physiological stress reactivity) during the separation.

Though these daily life findings are informative, further fine-grained investigation of these physiological processes is needed. First, measuring physiology in both members of the couple is crucial to understanding how these processes unfold dyadically. To our knowledge, no studies either in the lab or at home have examined physiological effects of partner presence in both partners. Measuring physiology dyadically is important to account for the possible physiological covariation between partners, as physiological responses can become synchronized or linked (Timmons, Margolin, & Saxbe, 2015). Additionally, monitoring fine-grained physiological processes on a frequent basis can be informative for understanding within-person changes in physiology associated with partner presence versus absence over the course of the day. It may be especially informative to rely on a measure such as EDA that, relative to other measures like cortisol, is quick to respond (i.e., in 2–3 seconds) and can be measured continuously over the course of the day (Boucsein, 2012).

1.4. Partner presence and attachment style

Several studies have found partner presence effects to vary depending on individual attachment style (Diamond et al., 2008; Feeney & Kirkpatrick, 1996). Adult attachment is generally distinguished by secure and insecure attachment (Fraley & Shaver, 2000). Adults who are securely attached believe that their partners will be accessible and responsive (Hazan & Shaver, 1987). On the other hand, those who are insecurely attached are likely to perceive and expect threats in their relationship. Insecure attachment is further characterized by *anxious attachment*, in which individuals tend to fear rejection and abandonment, and *avoidant attachment*, in which individuals may experience discomfort with intimacy and desire independence. Whereas partner presence may have a main effect on physiological responses among all individuals, the extent to which partner presence has an effect is likely to vary depending on individual attachment style.

Specifically, individuals with high anxious attachment who fear abandonment are likely to evidence higher levels of physiological arousal when their partner is absent and show a stronger effect of partner presence compared to those with more secure attachment. On the other hand, those with high avoidant attachment often seek independence from their partner and thus partner presence may show a weaker effect on physiological arousal compared to those with secure attachment.

1.5. The present study

The present study uses ambulatory assessment in young adult couples to investigate the association between romantic partner presence and physiological responses in daily life. Specifically, we examine whether hours in which romantic partners are present versus absent are associated with within-person differences in EDA. Additionally, we test whether the association between partner presence and EDA may differ depending on romantic attachment style. Fig. 1 illustrates our three hypotheses: as shown in Panel A, we first hypothesized a main effect in which partner presence (compared to absence) is concurrently associated with lower EDA during the same hour for both men and women (HO1). Second, as shown in Panel B, we hypothesized that anxious attachment style would moderate the link between partner presence and EDA (HO2). Those with high anxious attachment may show heightened effects such that partner presence has a stronger attenuating effect on EDA compared to those with low anxious attachment. Third, as shown in Panel C, we expected that avoidant attachment style would moderate the association between partner presence and EDA (HO3). Those with high avoidant attachment may not depend as much on their partners for regulation and thus may show weaker effects of partner presence on EDA compared to those with lower avoidant attachment. Though we did not expect gender differences based on findings from prior research, we conduct exploratory tests to assess whether findings differ between men and women.

2. Method

2.1. Participants

Participants were 106 heterosexual couples (*M* Age = 22.68; *SD* = 2.46) participating in a larger study of family-of-origin experiences and couples' functioning (Timmons et al., 2017). Couples reported being in a relationship for an average of 2.5 years (*M* months = 30.49; *SD* = 24.11); 46 couples (43.40 %) cohabitated. Participants were ethnically/racially diverse, with 27.83 % self-identifying as Caucasian, 23.58 % Hispanic/Latinx, 15.57 % Black/African-American, 13.21 % Asian, 16.04 % multiracial, and 3.77 % other race. Most participants (74.58 %) were employed and about half (50.94 %) were students. Given that many young adults are supported financially by their families, participants additionally reported their family income, with 8.3 % indicating an annual income less than $25,000, 24.6 % between $25–50,000, 22.9 % between $50–100,000, 33.2 % over $100,000, and 22.1 % indicating that they did not know. Additionally, the majority of participants reported being relatively happy in their relationship (for women, *M* = 8.4; *SD* = 1.3; for men, *M* = 8.7, *SD* = 1.0) on a scale of 1 (*unhappy*) to 10 (*perfectly happy*).

Most couples were recruited through online and paper postings and qualified for the study if they were between the ages of 18 and 25 and dating for at least 2 months. We focused on the young adult age range to match a smaller subset of participants (*n* = 29) who had previously participated in earlier waves of a longitudinal study that began when they were early adolescents; those who had a dating partner at the time of this study were invited to participate. T-tests found no significant differences in terms of income, age, relationship length, and ethnicity between newly recruited couples and couples from the longitudinal study. However, newly recruited couples were more likely to be

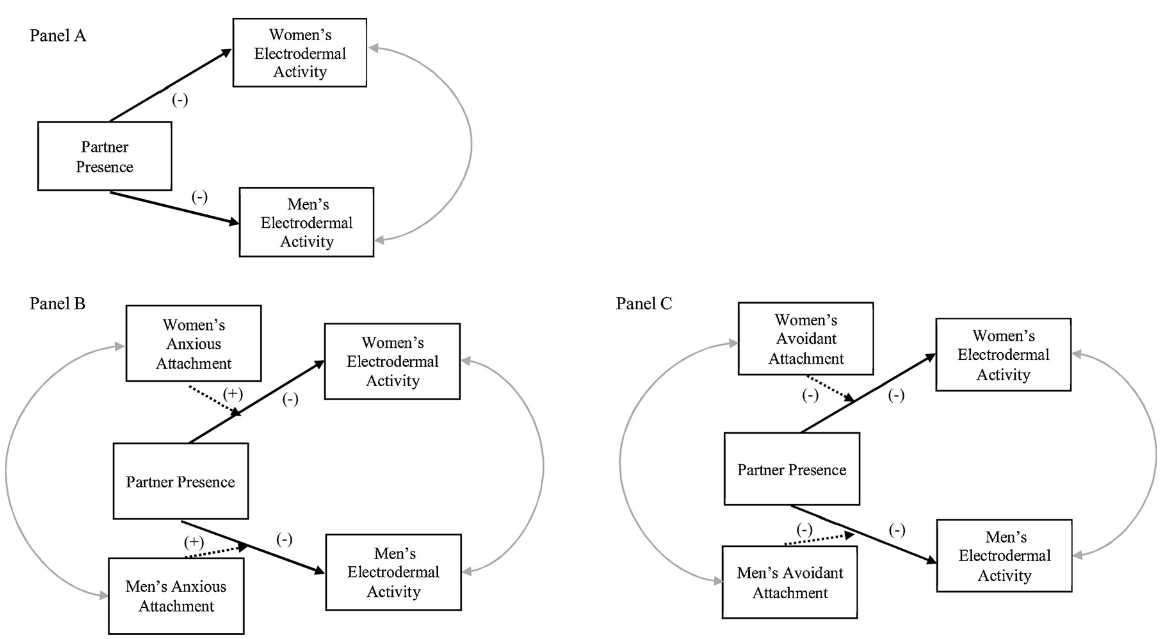

Fig. 1. Hypothesized associations between partner presence and electrodermal activity (EDA). Panel A: Main effect between hourly partner presence and EDA. Panel B: Anxious attachment style as a moderator of the hourly link between partner presence and EDA. Panel C: Avoidant attachment style as a moderator of the hourly link between partner presence and EDA. Dashed lines represent cross-level moderation paths. Grey lines represent the covariation between men's and women's EDA as well as between men's and women's moderators. Covariates are not depicted for parsimony.

cohabitating compared to longitudinal couples. Three same-sex couples were excluded due to the interest in the present study of examining within-couple gender differences.

2.2. Procedures

2.2.1. Home data procedures

Couples participated in home data collection procedures involving physiological measurements and surveys (Timmons et al., 2017). Couples picked a day when they could spend at least five waking hours together and have a meal together in order to ensure that the day included at least a moderate amount of time spent together. The vast majority of couples chose to participate in our study on days in which neither partner worked (only 3.5 % of all hours were reportedly spent on work or study). On day one, couples came to the lab to consent to procedures, receive instructions, and pick up equipment (Timmons et al., 2017). Each participant was outfitted with a wireless wrist monitor that continuously collected EDA. Additionally, they each received a smartphone that alerted them to complete short surveys at the beginning of every hour from 10 AM until 3 AM, or until they turned their phone off at bedtime[1]. The next day, couples came back to the laboratory to return the equipment, participate in a short interview regarding activities they engaged in. Participants were each compensated $100. The university's IRB approved all study procedures.

2.2.2. Intrusiveness and representativeness

The next day, participants individually answered self-reported questions on the intrusiveness and representativeness of the procedures, which were rated on a 5-point scale including *Not at All, A little, Some, A Lot,* and *Extremely.* Most participants (72.2 %) reported that the day was typical of how they usually interact with their romantic partner (either *A Lot* or *Extremely*). Furthermore, most participants (78.7 %) reported that wearing the wrist monitor

generally did not interfere with their daily activities (either *Not at All* or *Slightly*). To assess compliance, participants were also asked whether they took off the wrist monitor at any point. In compliance with study procedures, most participants indicated they briefly took off the wrist monitor to shower whereas others reported taking it off because it was uncomfortable while sleeping. Ten participants additionally reported they removed the monitor briefly because it was itchy or because they needed to readjust the strap. Twelve participants reported they removed the wrist monitor for 1−3 h because it interfered with another activity (e.g., exercise, sports).

2.3. Equipment

2.3.1. Q sensor

The Q sensor is a small, wireless wrist monitor that continuously collects EDA (Poh, Swenson, & Picard, 2010). The Q sensor has shown adequate reliability with EDA collected in the lab and correlates with psychological and physical health constructs in daily life (Timmons et al., 2019). The Q sensor was worn on the inside of the wrist and applied to the non-dominant hand in order to reduce movement artifacts. Consistent with current standards for wearable EDA devices (Poh et al., 2010, 2012), the sampling rate for the Q sensor was set to 8 Hz.

2.3.2. Smartphones

Each participant was given an Android phone, which alerted them to answer hourly surveys on several emotional and behavioral dimensions, including potential confounds of EDA (e.g., caffeine intake).

2.4. Measures

2.4.1. Partner presence

When participants returned to the lab the following day, a trained research assistant interviewed both partners together on the various activities they engaged in during the day of home data collection. Couples came to a consensus when discrepancies arose. For every hour of the day, couples were asked whether they were together or apart, where "together" refers to being in the same room as their partner. They additionally provided information on what activity they each engaged in every hour. If they were together for more than half an hour, it was considered an hour together. Partner presence was coded dichotomously (presence = 1, absence = 0). The following activities were found to be the most commonly reported when couples were together: driving/walking (22.15 %), cooking/eating (15.95 %), using media, i.e., TV, phone, computer (13.74 %), doing errands (9.81 %), and "hanging out" at home (9.45 %).

2.4.2. Hourly covariates

To account for a number of confounding factors related to EDA, participants answered hourly reports on their engagement in physical activity (e.g., exercise), and consumption of caffeine, alcohol, or tobacco. During the interview the next day, they also reported when they napped or were interacting with others (e.g., roommates, family members) for every hour of the day of data collection. All hourly covariates were rated on a dichotomous (yes/no) scale.

2.4.3. Electrodermal activity

EDA data collected on the Q sensors were downloaded onto a computer for processing. We followed procedures by Chaspari, Tsiartas, Stein, Cermak, and Narayanan (2014) to clean and extract EDA data. First, we applied a low-pass filter and then used a computer algorithm to detect movement artifacts. Next, trained research assistants inspected all artifacts and flagged additional artifacts when necessary. Matlab scripts were then used to remove all identified artifacts. Each participant's EDA values, measured in microsiemens, were averaged across each hour to obtain one mean EDA score for each person every hour. The EDA data represented here were collected during the day and not after participants reported going to bed. An average of 14.35 h (SD = 1.47) were captured per couple.

2.4.4. Attachment style

The Experiences in Close Relationships-Revised Questionnaire (ECR-R; Fraley, Waller, & Brennan, 2000) assessed anxious and avoidant attachment style. This measure includes 18 items assessing anxious attachment (e.g., "I am afraid that I will lose my partner's love") and 18 items assessing avoidant attachment (e.g., "I prefer not to show a partner how I feel deep down"). Participants answered items on a 7-point Likert scale ranging from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*). Mean anxious attachment and mean avoidant attachment were calculated for each participant, with higher scores indicating higher levels of anxious or avoidant attachment.

2.5. Overview of analyses

We used multilevel modeling in which observations are nested in people and people are nested in couples. For the main effect model (HO1), we tested hourly partner presence (Level-1) as a predictor of men and women's EDA (Level-1). For the moderation analyses (HO2-HO3), we additionally added between-person moderators as Level-2 predictors of Level-1 slopes between partner presence and EDA. All models accounted for the covariation between men and women's EDA as well as between men and women's moderators (e.g., men's anxious attachment and women's anxious attachment). We used tests of model constraint to: a) determine whether the effects of partner presence on EDA varied by gender; b) determine whether interaction effects varied by gender.

In all our models, we statistically accounted for the following time-varying Level-1 covariates: whether or not they engaged in physical activity, slept, interacted with others, drank alcohol, smoked tobacco, or consumed caffeine. Additionally, we accounted for Level-2 covariates including age, race/ethnicity, relationship length, and whether or not the couple was cohabitating. In accordance with guidelines for cross-level interactions (Enders & Tofighi, 2007), continuous Level-2 variables were grand-mean centered; Level-1 variables were not centered given that they were all dichotomous. Intercepts and slopes were estimated as random. Missing data were handled with Full Information Maximum Likelihood Estimation in Mplus Version 7 (Enders, 2010; Muthén & Muthén, 2017).

3. Results

3.1. Descriptive statistics

Table 1 presents descriptive statistics for the main study variables. Men, on average ($M = 6.83$), had significantly higher levels of EDA than women across the day ($M = 4.64$), $t(105) = -3.47, p < .001$. Women, on average, reported higher anxious attachment ($M = 3.19$) than men ($M = 2.75$), $t(105) = 3.07$, $p < .01$. There were no significant gender differences in avoidant attachment. Significant positive correlations were found between men and women's EDA, men's and women's anxious attachment, and men's and women's avoidant attachment. Additionally, on average, couples spent about 85 % of the day together. Forty-six couples spent the whole day together.

3.2. HO1: partner presence and EDA

First, we conducted tests of model constraint using a Wald Test to determine whether the effect of partner presence on EDA was significantly different for men compared to women. Women's and men's effects did not significantly differ from one another ($\chi^2(1) = .91, p = .34$), thus paths were constrained to equality for parsimony. This effect was constrained in all subsequent analyses.

As shown in Table 2, as hypothesized, both men's and women's EDA levels were significantly lower during hours they were with their partner relative to hours when they were apart. In other words, when partners were present, men and women evidenced a 1.44 unit decline in EDA compared to when partners were absent.

3.3. HO2: anxious attachment style as a moderator between partner presence and EDA

We conducted tests of model constraint using a Wald Test to determine whether the interaction effects were significantly different for men compared to women. Women's and men's effects did not significantly differ from one another ($\chi^2(1) = .12$, $p = .73$), thus paths were constrained to equality for parsimony.

As illustrated in Panel A in Fig. 2, men's anxious attachment significantly moderated the hourly association between partner presence and men's EDA, though this explained a small proportion of the variance in EDA ($b = .31$, $SE = .09$, $p < .001$, 95 % CI [.14, .48], Proportional Reduction in Variance (PRV) = .28 %). Similarly, as illustrated in Panel B in Fig. 2, women's anxious attachment significantly moderated the hourly association between partner presence and women's EDA ($b = .314$, $SE = .09$, $p < .001$, 95 % CI [.14, .48], PRV = .28 %). Contrary to our hypotheses, men and women with high anxious attachment showed less attenuation when partners were present compared to those with average anxious and low anxious attachment.

Table 1
Descriptive Statistics and Bivariate Correlations for Main Study Variables.

	1.	2.	3.	4.	5.	*Mean*	*SD*
1. Women's EDA	–					4.64	5.83
2. Men's EDA	.49**	–				6.83	6.62
3. Women's Anxious Attachment	.02	.01	–			3.19	1.30
4. Men's Anxious Attachment	−.08	.04	.26*	–		2.75	1.24
5. Women's Avoidant Attachment	−.03	.05	.55**	.29*	–	2.23	0.95
6. Men's Avoidant Attachment	−.09	.00	.17	.52**	.21*	2.20	0.96

Note. EDA = electrodermal activity, measured in microsiemens. EDA was averaged across the entire day. * $p < .05$, ** $p < .001$.

Table 2
Association between Hourly Partner Presence and Electrodermal Activity Controlling for Covariates.

	b	*SE*	*p*	Lower CI	Upper CI
Within-Level					
Women's EDA					
Women with others	0.64	0.52	.22	−0.38	1.66
Women's sleep	0.42	0.84	.62	−1.22	2.06
Women's physical activity	0.96	0.36	.01*	0.25	1.66
Women's caffeine	−1.03	0.59	.084	−2.19	0.14
Women's alcohol	0.05	1.20	.97	−2.31	2.41
Women's tobacco	−0.29	0.40	.47	−1.08	0.50
Partner present	−1.44	0.61	02*	−2.63	−0.25
Men's EDA					
Men with others	0.56	0.52	.28	−0.46	1.59
Men's sleep	0.14	0.92	.88	−1.67	1.93
Men's physical activity	1.21	0.42	.004*	0.39	2.04
Men's caffeine	0.32	0.71	.66	−1.07	1.70
Men's alcohol	2.02	0.91	.03*	0.24	3.80
Men's tobacco	−0.10	0.53	.86	−1.13	0.94
Partner present	−1.44	0.61	.02*	−2.63	−0.25
Between-Level					
Women's EDA					
Intercept	2.64	5.46	.63	−8.06	13.34
Relationship length	−0.03	0.02	.16	−0.08	0.01
Cohabitation	0.50	1.11	.65	−1.66	2.67
Women's age	0.12	0.26	.66	−0.40	0.63
Women's ethnicity: White	−0.11	1.38	.44	−3.78	1.63
Women's ethnicity: Latina	1.10	1.60	.49	−2.04	4.24
Women's ethnicity: Black	−2.69	1.16	.02*	−5.00	−0.42
Men's EDA					
Intercept	8.68	3.38	.01*	2.05	15.32
Relationship length	−0.01	0.02	.58	−0.06	0.03
Cohabitation	−0.77	1.30	.55	−3.31	1.77
Men's age	−0.05	0.15	.72	−0.35	0.24
Men's ethnicity: White	0.14	1.78	.94	−3.34	3.62
Men's ethnicity: Latino	0.82	1.58	.60	−2.28	3.92
Men's ethnicity: Black	−1.34	1.34	.32	−0.40	1.20

Note. EDA = electrodermal activity measured in microsiemens. Variables were included simultaneously in one model. Men's and women's paths between partner presence and EDA were constrained to equality. Ethnicity was dummy-coded and compared to "other" ethnicity category comprised of all other ethnic groups. Analyses also accounted for the correlation between men's and women's EDA at both the within and between-level. A 95 % confidence interval was computed. * $p < .05$.

3.4. HO3: avoidant attachment style as a moderator between partner presence and EDA

We conducted tests of model constraint using a Wald Test to determine whether the interaction effects significantly differed between men and women. Women's and men's effects did not significantly differ from one another ($\chi^2(1) = .70$, $p = .40$), thus paths were constrained to equality for parsimony.

As illustrated in Panel A in Fig. 3, men's avoidant attachment significantly moderated the hourly link between partner presence and men's EDA ($b = .19$, $SE = .06$, $p < .001$, 95 % CI [.08, .31], PRV = 1.72 %). Similarly, as illustrated in Panel B in Fig. 3, women's avoidant attachment significantly moderated the hourly association between partner presence and women's EDA ($b = .19$, $SE = .06$, p < .001, 95 % CI [.08, .31], PRV = 1.72 %). As hypothesized, men and women with high avoidant attachment showed less of a dampening effect of partner presence on EDA compared to those with average avoidant and low avoidant attachment.

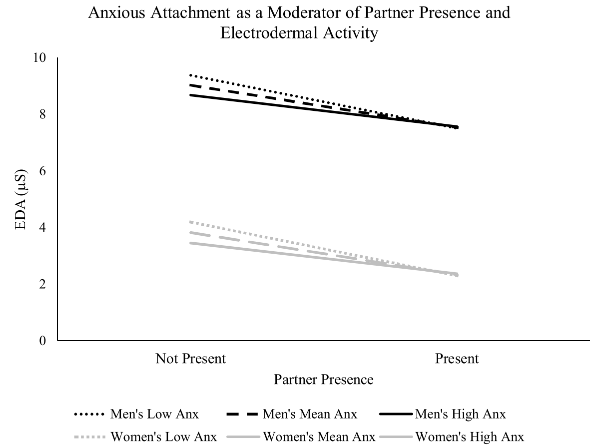

Fig. 2. Partner presence and electrodermal activity (EDA) moderated by men's and women's anxious attachment style. Men's and women's interaction effects were constrained by gender but intercepts were allowed to freely vary by gender. For men, simple slopes were significant at low anxious attachment (−1 *SD* below the mean; $b = -1.88$, $p < .05$, 95 % CI [−3.12, −.65]), mean anxious attachment ($b = -1.49$, $p = .05$, 95 % CI [−2.64, −.34]), and high anxious attachment (+1 *SD* above the mean; $b = -1.105$, $p < .05$, 95 % CI [−2.20, −.01]). Similarly, for women, simple slopes were significant at low anxious attachment (-1 *SD* below the mean; $b = -1.90$, $p < .05$, 95 % CI [−3.14, −.66]) and mean anxious attachment ($b = -1.49$, $p < .05$, 95 % CI [2.64, −.34]), and marginally significant for high levels of anxious attachment (+1 *SD* above the mean; $b = -1.08$, $p = .05$, 95 % CI [−2.18, .01]). µS = microsiemens; Anx = anxious attachment.

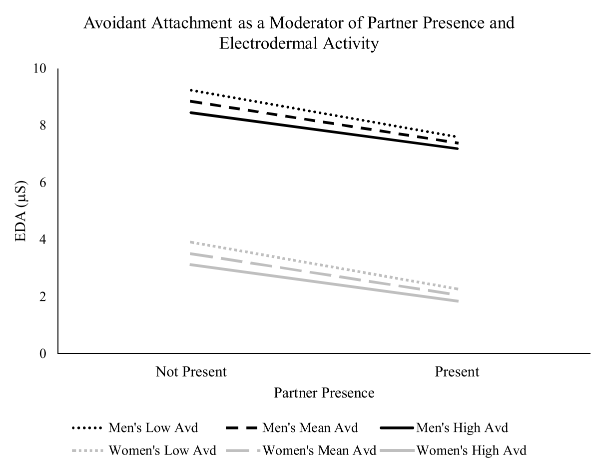

Fig. 3. Partner presence and electrodermal activity moderated by men's and women's anxious attachment style. Men's and women's interaction effects were constrained by gender but intercepts were allowed to freely vary by gender. For men, simple slopes were significant at low avoidant attachment (−1 *SD* below the mean; $b = -1.64$, $p = .01$, 95 % CI [−2.78, −.50]), mean avoidant attachment ($b = -1.45$, $p = .02$, 95 % CI [−2.58, −.32]), and high avoidant attachment (+1 *SD* above the mean; $b = -1.27$, $p = .03$, 95 % CI [−2.42, −.11]). For women, simple slopes were significant at low avoidant attachment (-1 *SD* below the mean; $b = -1.64$, $p = .01$, 95 % CI [−2.78, −.50]), mean avoidant attachment ($b = -1.45$, $p =.01$, 95 % CI [−2.58, −.32]), and high avoidant attachment (+1 *SD* above the mean; b = −1.27, $p = .03$, 95 % CI [−2.42, −.12]). µS = microsiemens; Avd = avoidant attachment.

4. Discussion

The present study investigated naturally-occurring associations between partner presence and physiological arousal among young adult couples in daily life. During hours that romantic partners were physically present, compared to absent, men and women evidenced lower physiological responses as measured via electrodermal activity (EDA). This main effect was moderated by romantic attachment style such that individuals with low anxious attachment showed more of an attenuating effect of partner presence on EDA compared to those with high anxious attachment, which was contrary to our hypotheses. On the other hand, consistent with our expectations, those with low avoidant attachment showed more of a dampening effect of partner presence on EDA compared to those with high avoidant attachment. To our knowledge, this was the first study to examine physiological effects of partner presence in both members of the dyad in a naturalistic setting, allowing for a more comprehensive investigation of health processes in romantic relationships.

Our findings build on prior research showing that the presence of a romantic partner is associated with attenuated physiological and neurological responses to threat in lab-based studies (Bourassa et al., 2019; Coan et al., 2006; Feeney & Kirkpatrick, 1996; Gump et al., 2001). As posited by attachment and social baseline theories, the day-to-day proximity of a significant other is likely to facilitate greater regulation of physiological processes (Gunnar et al., 1996). Our study found that for both men and women, being in the presence of a romantic partner was associated with within-person reductions in EDA compared to when partners were absent, even after controlling for a number potential confounds (e.g., physical activity, interactions with others). Though prior research has focused on how partner presence may attenuate physiology during situations in which stress was intentionally elicited (e.g., Coan et al., 2006), we found that partner presence was associated with reductions in physiological arousal across a reportedly typical day. Our findings point to subtle ways in which romantic partners may help facilitate physiological regulation during the ups and downs of everyday life.

As expected, there was individual variability in the extent to which partner presence was associated with physiological responses. Men and women with low anxious attachment showed a stronger attenuating effect of partner presence on EDA. When partners were absent, individuals with low anxious attachment, compared to those with high anxious attachment, showed higher levels of EDA and larger attenuations in EDA when partners were present. Although other studies found that anxious attachment was related to higher physiological arousal (e.g., higher heart rate and blood pressure) when partners were absent (Diamond et al., 2008; Feeney & Kirkpatrick, 1996), our findings suggest that those with high anxious attachment may continue to perceive threats to their relationship regardless if their partners are physically present or not (Hazan & Shaver, 1987).

Similarly, men and women who were high in avoidant attachment showed weaker effects of partner presence on EDA such that there was less of a decrease in EDA when partners were present. Those with high avoidant attachment are likely to feel discomfort during times of intimacy when their partners are present and thus show higher physiological arousal. Moreover, rather than relying on partners for regulation, those with high avoidance attachment may attempt to modulate stress independently, which may be a less effective strategy (Mikulincer & Shaver, 2007). Interestingly, attachment avoidance and anxiety were positively correlated at moderately high levels (r's > .5); those who are high on both dimensions have previously been characterized as "fearful-avoidant" (Bartholomew & Horowitz, 1991). Such individuals are likely to be fearful of intimacy and socially avoidant, thus, we speculate that they may show the smallest reductions in EDA in response to partner presence.

Despite the unpredictability of collecting data "in the wild," we were able to find significant, albeit, small effects in the hypothesized directions. Though small changes may seem trivial, repeated activation of physiological stress systems can lead to "wear and tear" over time, which can accumulate into long-term health consequences such as chronic diseases (McEwen, 1998; McEwen & Seeman, 1999). Thus, partner presence may represent one such pathway that protects against such wear and tear. Additionally, using EDA to index physiological responses is a strength, as EDA is solely innervated by the sympathetic nervous system and is an approximate measure of autonomic arousal. Furthermore, partner presence had an effect over and above being in the presence of others, such as friends and family members, suggesting that romantic partners may play a particularly important role in regulating physiological responses. Though young adult dating relationships are often less established than marital relationships, our findings indicate that even emerging relationships are linked to physiological processes.

Though the current study has a number of strengths, several limitations must also be noted. First, we did not account for the quality of romantic partner interactions when couples were together. It is well-established that negative, stressful couple interactions can activate physiological stress response systems, particularly in low quality relationships (Robles & Kiecolt-Glaser, 2003); thus, it is possible that partner presence was sometimes associated with greater physiological arousal. Future research may explore whether other relationship variables, such as relationship quality and conflict, moderate the link between partner presence and EDA. Second, there may be "third variables" that account for the link between partner presence and EDA; for instance, the type of activity that couples engaged in together could have attenuated EDA. Though the range in activities was too wide to quantitatively assess the correlation between activity type and EDA, there appeared to be significant variability in the activities couples engaged in. For instance, some couples used shared time to "hang out at home" while others exercised, which may have raised their EDA levels above and beyond anxiety or other psychological variables. While we accounted for a number of covariates, it is possible that EDA levels were influenced by other unforeseen external factors unrelated to the relationship. Additionally, it is possible that the interaction effects may be explained by the "Law of initial values" in which those with low anxious or low avoidant attachment showed greater reductions in EDA with partner presence due to having higher EDA when partners are not present, though EDA was not correlated overall with anxious or avoidant attachment.

Another limitation is that 46 of the couples in our sample chose not to spend any time apart and therefore did not contribute variance to our models. Further, we required couples to be together at least 5 h during the study; thus, these results may not generalize to days when one or both partners have to work or show different patterns across time frames greater than one day. While the focus on naturalistic data collection across one day is a strength of this study, future research should assess couples over multiple days to capture more variability in patterns of partners' presence versus absence and also assess whether the days that couples participate in the study are representative of typical days for the couple. Also, we used retrospective interview reports and segmented couples' activities into hours, which may have placed artificial constraints on their actual time together. While couples typically consulted each other and their calendars to determine the exact time in which they engaged in certain activities, future research using ecological momentary assessments to track the exact time couples were together and apart would be more accurate, although at the cost of significantly increasing participant burden. Moreover, even if partners are not in one another's physical presence, they may be connected virtually through social media, texting, and video or phone calls, which some research suggests is a powerful 'stand-in' for physical proximity (Bourassa et al., 2019; Diamond, 2019; Diamond et al., 2008). Additionally, a potential moderator to include in future studies is the degree to which the partners engaged in physical touch, as prior research has focused on the effects of hand holding as a measure of partner presence (e.g., Coan et al., 2006). Lastly, generalizability to couples in a different life stage cannot be assumed, as partner presence may have different implications at later life stages, such as during retirement.

The current study utilized innovative ambulatory assessment methodology to investigate everyday associations between partner presence and physiological responses among young adult couples. Our findings point to subtle ways in which romantic relationships can facilitate adaptive physiological processes to cumulatively impact long-term health outcomes. Additionally, the presence of a romantic partner may be more or less beneficial depending on individual differences in romantic attachment style. Exploring everyday relationship factors that help mitigate the effects of physiological stress can be key to preventing adverse health problems.

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Declaration of Competing Interest

The authors have no conflicts of interest that might be interpreted as influencing this research. An abbreviated version of this article was published as an abstract for the 2020 meeting of the American Psychosomatic Society.

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