

Perspective-taking influences autonomic attunement between partners during discussion of conflict

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Abstract

This study investigated the effects of dispositional and experimentally induced perspective-taking (PT) on physiological attunement between romantic partners during a conflict resolution task. Young adult couples ($N = 103$ dyads) rated their trait PT 1 week prior to participating in a conflict resolution session with their romantic partner. Immediately before the conflict task, participants were given one of the following three instructions: to take their partner's perspective (PT condition), to approach the conflict mindfully (mindfulness condition), or to focus on their own perspective regarding the conflict (control condition). Participants provided four saliva samples over the course of the laboratory session, and the samples were assayed for alpha-amylase to measure autonomic nervous system activity. Multilevel modeling results revealed that couples in the PT condition displayed greater autonomic attunement over the course of the conflict session compared to those in the other conditions. In addition, female partners' dispositional PT enhanced the effect of the PT induction on couples' attunement. Furthermore, secondary analyses provided support for the beneficial role of autonomic attunement. Specifically, attunement was decreased by negative conflict behaviors and predicted increased post-conflict negative affect in females. Implications for dyadic functioning and intervention are discussed.

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Keywords

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The ability to connect to others profoundly affects relational quality and satisfaction (Brennan & Shaver, 1995; Simpson, 1990), as well as mental and physical well-being (Blackburn & Epel, 2012; LeMoult, Chen, Foland-Ross, Burley, & Gotlib, 2015; Mikulincer & Shaver, 2012; Pietromonaco, Uchino, & Schetter, 2013). Social relationships play a key role in resiliency, life expectancy, and health, making it important to understand the factors that foster healthy close relationships (e.g., Holt-Lunstad, Smith, & Layton, 2010; Uchino, Cacioppo, & Kiecolt-Glaser, 1996; Umberson & Montez, 2010). One mechanism likely involved in connecting in-the-moment relational experiences and positive relationship outcomes is attunement or the bidirectional linkage of emotional, behavioral, and/or physiological responses between two or more individuals over time (Butler & Randall, 2012; Feldman, 2012). The attunement of partners' stress-responsive physiology during important relationship interactions such as conflict is thought to play a critical role in relationship-related risk and resilience processes (Brooks et al., 2014; Pietromonaco et al., 2013; Saxbe & Repetti, 2010) and understanding the psychological factors that influence this process may be key to promoting relational and individual partner health. However, very little empirical research is available to establish either the psychological basis for or relational implications of couples' physiological attunement during such interactions. The current investigation takes an important step in this direction as the first study to our knowledge to investigate perspective-taking (PT)—both as a trait and as an experimentally induced state—as a predictor of romantic partners' autonomic attunement during conflict stress and how this relates to conflict-related and broader relationship outcomes.

Attunement and relational outcomes

Attunement refers to the bidirectional synchronization, co-regulation, concordance, or linkage of the dynamic fluctuations in psychological, behavioral, and/or biological systems between two or more individuals across time (Butler & Randall, 2012; Feldman, 2012). As Sbarra and Hazan (2008) describe, attunement can be thought of “as the reciprocal maintenance of psychophysiological homeostatis within a relationship” (p. 143) such that each member of the dyad varies his/her behaviors, affect, and/or physiology to accommodate to the needs of the dyad. This process influences the temporal patterning (duration and occurrence), intensity, and expression of biobehavioral systems to shape psychological, physical, and relational health (Butler & Randall, 2012; Feldman, 2012; Sbarra & Hazan, 2008). Several processes, both automatic and voluntary, may contribute to this phenomenon.

One theoretical model, social entrainment theory, describes the way in which signals become linked across individuals through “spatiotemporal coordination” (Phillips-Silver, Aktipis, & Bryant, 2010). Over the course of repeated interactions, proximity to a romantic partner may cue the synchronization of mental and physical responses

(Hazan, Campa, & Gur-Yaish, 2006; Hofer, 1984; Phillips-Silver et al., 2010). Such synchrony has in turn been shown to be essential for close relationships, such as those between mother and infant (Feldman, 2007, 2012), by helping individuals to understand and empathize with the other's behaviors (Carr, Iacoboni, Dubeau, Mazziotta, & Lenzi, 2003; Gallese, Keysers, & Rizzolatti, 2004). Another relevant framework in explaining human attunement processes is communication accommodation theory, which posits that each member of a dyad can adjust his/her verbal and nonverbal expressions in response to communicative behaviors of his/her partner, furthering either convergence or divergence within the interaction (Giles, Coupland, & Coupland, 1991). In this framework, convergence refers to relational situations in which individuals adjust their own verbal and nonverbal communication (e.g., speech, eye contact, gestures, and postures) to match that of their partner in an attempt to decrease communicative and relational differences, while divergence refers to relational situations in which individuals emphasize their own verbal and nonverbal tendencies to increase communicative and relational differences. Within the context of close relationships, greater accommodation of partners' signals has been associated with interdependence and psychological femininity, as well as with partner PT (Rusbult, Verette, Whitney, Slovik, & Lipkus, 1991). Together, these theories help to understand how attunement of psychophysiological processes might come about in close relationships, while suggesting that individual differences (i.e., sensitivity to the partner's point of view) might facilitate the conditions for attunement to occur.

Some aspects of attunement have received greater attention than others. Behavioral attunement, as characterized by nonverbal synchronization or mimicry, is understood to be a form of interpersonal coordination or accommodation that supports positive relationships (for a review, see Chartrand & Lakin, 2013). Behavioral attunement has also been associated with affect in dyadic interactions (Tschacher, Rees, & Ramseyer, 2014). Affective attunement has been shown to occur between romantic partners but is associated with heterogeneous outcomes that are likely context dependent (Butler & Randall, 2012; Butner, Diamond, & Hicks, 2007; Saxbe & Repetti, 2010; Schoebi, 2008). For example, both daily positive and negative affect have been shown to covary over time in romantic couples (Butner et al., 2007), with female affect influencing male affect, but not the other way around (Schoebi, 2008). Affective attunement has also been shown to vary according to psychological characteristics, such as interpersonal orientation and sensitivity, suggesting individual differences in attunement processes that can be explained by psychological variables. Of relevance to the current study, husbands higher in PT have shown greater affective crossover with their wives (Schoebi, 2008).

Although the literature on behavioral and emotional attunement is well established, there is a paucity of research investigating the role physiological attunement plays in relational dynamics. The impacts of behavioral and affective attunement may derive, at least in part, from linkages at the physiological level, with partner emotion states giving rise to and/or fostered by matched physiological activity (Tschacher et al., 2014; van Bakel & Riksen-Walraven, 2008). To fully understand the value of attunement processes for couples' adjustment, the conditions for and outcomes associated with physiological attunement must be clarified.

Attunement of stress-responsive physiology

Physiological attunement has been described as the synchrony of physiological responses between members of a dyad, such that these trajectories are more or less related to each other temporally (Laurent, Ablow, & Measelle, 2011). Physiological attunement occurs throughout the life span and across numerous systems including neural activation coupling (Anders, Heinzle, Weiskopf, Ethofer, & Haynes, 2011; Hasson, Ghazanfar, Galantucci, Garrod, & Keysers, 2012; Nummenmaa et al., 2012; Stephens, Silbert, & Hasson, 2010), thermal signature mirroring (Manini et al., 2013), and concordance of autonomic (heart rate/respiratory sinus arrhythmia synchrony) and neuroendocrine salivary stress markers (e.g., Feldman, Magori-Cohen, Galili, Singer, & Louzoun, 2011; Gordis, Granger, Susman, & Trickett, 2008; Helm, Sbarra, & Ferrer, 2014; Konvalinka et al., 2011; Papp, Pendry, & Adam, 2009; Saxbe et al., 2014; Saxbe & Repetti, 2010). Although emotional and behavioral attunement between dyad members is thought to indicate positive relational functioning, as discussed above, important questions remain about the value of attunement at the physiological level.

Indeed, extant research has demonstrated associations between physiological attunement and both positive and distressed interpersonal functioning (for a recent review, see Timmons, Margolin, & Saxbe, 2015). For example, some marital research has demonstrated greater daily and/or conflict-related attunement among unhappy couples relative to happy couples (Levenson & Gottman, 1983; Saxbe & Repetti, 2010). In addition, increased cortisol attunement during stress reactivity is associated with punitive and restrictive parenting styles, parent-child situational challenge (compared to non-challenge situations), increased parental depressive symptomatology, negative affect, and intimate partner violence (Hibel, Granger, Blair, & Cox, 2009; Laurent et al., 2011; LeMoult et al., 2015; Papp et al., 2009; Ruttle, Serbin, Stack, Schwartzman, & Shirlcliff, 2011). Similarly, couples displaying high levels of relational strain and disagreement have greater cortisol awakening response synchrony than couples with lower strain and disagreement (Liu, Rovine, Klein, & Almeida, 2013). At the same time, there is evidence for lower (mother-adolescent) cortisol attunement in families with high interparental aggression (Gordis, Margolin, Spies, Susman, & Granger, 2010), and autonomic attunement has been associated with greater empathy and enhanced understanding of an interaction partner's emotion states (Chatel-Goldman, Congedo, Jutten, & Schwartz, 2014; Levenson & Ruef, 1992). A parsimonious explanation of these mixed effects is that physiological attunement may arise both to reinforce or entrain positive relational processes and to support survival in adverse relational conditions. Further investigation of partners' physiology during relationship-relevant situations will be needed to shed light on these issues.

An important context for investigating physiological attunement is romantic conflict. Conflict processes are critical to understanding relational adjustment; negative conflict styles and unresolved conflict have been shown to predict the degradation of relationship satisfaction and/or the termination of relationships (Cramer, 2000). Although attunement is generally thought to support mutual regulation of affect/arousal, during conflict, this may manifest as over-coupling or contagion of (negative) responses, leading to emotional and physiological overload and mutual dysregulation (Timmons et al., 2015). In line with this reasoning, research in married couples reporting relationship difficulties has shown that

strong sympathetic nervous system attunement (heart rate and skin conductance) during a conflict related to decreased relational satisfaction (Levenson & Gottman, 1983). Similarly, greater cross-partner linkage of daily cortisol and negative mood reciprocity in middle-class married couples has been associated with decreased relationship satisfaction (Saxbe & Repetti, 2010). In contrast, research in a community sample of couples demonstrated that parasympathetic nervous system attunement during both positive and negative relationship discussions related to increased relationship satisfaction (Helm et al., 2014). These studies indicate that the implications of attunement for relationship adjustment are complex and may depend not only on the communicative context (conflict or non-conflict) but also on the physiological system under investigation and the type of couples studied (i.e., married couples already experiencing distress vs. couples who have not developed difficulties). Over time, the communication and entrainment patterns couples develop during conflict likely work through multiple routes including the hypothalamic–pituitary–adrenal (HPA) axis and autonomic nervous system (ANS) activation to impact relational health for better or worse. Although questions about the factors shaping beneficial versus harmful attunement remain, the foregoing research establishes that what occurs during conflict impacts ongoing relational health and that physiological attunement of stress-responsive systems likely plays a role in this association.

The Autonomic Nervous System

A major branch of the human stress response involves the ANS, which is composed of both the energy-expending sympathetic nervous system and the energy-conserving parasympathetic nervous system. ANS components are activated when an organism faces a variety of challenges, from environmental threats and physical exertion to psychosocial stress. Unlike survival threat and physical exertion, which are often transient and acute in nature, ongoing psychosocial stress, particularly when it occurs in the context of close relationships, may have more chronic impacts on health over time. Salivary alpha-amylase (sAA) is an indirect and noninvasive biological marker of ANS activation that has been shown to respond to psychological stress (Bosch, Veerman, de Geus, & Proctor, 2011; Granger, Kivlighan, El-Sheikh, Gordis, & Stroud, 2007; Nater et al., 2005, 2006; Nater & Rohleder, 2009; Rohleder, Nater, Wolf, Ehlert, & Kirschbaum, 2004).

Early findings indicate that sAA response profiles are associated with psychosocial adjustment. For example, blunted sAA stress responses are associated with increased suicide risk, depression, antisocial and disruptive behavior, rule breaking, and borderline personality disorder (De Vries-Bouw et al., 2012; McGirr et al., 2010; Susman et al., 2010). There is also emerging evidence that sAA responsiveness during dyadic stress relates to interpersonal adjustment; dynamic sAA reactivity and quick recovery to baseline levels were associated with a higher ratio of positive/negative behaviors and less perceived negativity during couples conflict, as well as positive anticipation of a conflict discussion (Ditzen et al., 2013; Laurent, Powers, & Granger, 2013). In such interpersonal contexts, sAA reactivity may be influenced by attunement processes, making it important to discern what fosters dyadic sAA attunement and how this translates into relational outcomes. One psychological factor that may influence a person's ability to physiologically attune to another is the ability to take their partner's perspective.

Perspective Taking and Attunement

PT is the act of imagining another person's psychological experience or imagining oneself "as" the other (e.g., Batson, Early, & Salvarani, 1997; Myers, Laurent, & Hodges, 2014) and can be induced through experimental manipulations or conceptualized as a chronic tendency toward adopting others' psychological perspectives (i.e., trait PT; Davis, 1983). Although PT typically provokes an affective response characterized by warmth, concern, and sympathy toward the person whose perspective has been taken (often labeled "empathy"; e.g., Batson et al., 1997), empathy itself is a multifaceted construct (Davis, 1983) that has both cognitive and affective aspects. In the present analysis, we focus on PT (i.e., a cognitive aspect of empathy) because of how it may impact attunement by strengthening social relationships and/or directly influencing stress physiology (Chatel-Goldman et al., 2014).

Over three decades of research have established PT as an important contributor to relational health (e.g., Davis, 1983) and interpersonal closeness (Cialdini, Brown, Lewis, Luce, & Neuberg, 1997). This ability to put oneself figuratively into "another person's shoes" has been associated with a wide array of social benefits, including increased empathic concern toward others, a greater willingness to engage in altruistic and helping behavior, more leniency for social transgressions, and better theory of mind (Davis, 1983; Harwood & Farrar, 2006; Lamm, Batson, & Decety, 2007; Maner et al., 2002; Oswald, 1996; Skorinko, Laurent, Bountress, Nyein, & Kuckuck, 2014). PT has also been linked to behavioral attunement between individuals in the form of behavioral mimicry and taking on the beliefs and attitudes of a social target (Galinsky, Ku, & Wang, 2005; Laurent & Myers, 2011), which in turn is highly related to liking, cohesion, and inhibition of aggressive responding (e.g., Lakin, Jefferies, Cheng, & Chartrand, 2003; Richardson, Green, & Lago, 1998).

Within the context of romantic relationships, those who take the perspective of their partner are more likely to display relationship satisfaction, confidence, and compromise during conflict, while those who fail to take their partner's perspective show discomfort with closeness and more dominating characteristics during conflict (Corcoran & Mallinckrodt, 2000; Long & Andrews, 1990). Furthermore, individuals who take their partner's perspective are better able to inhibit negative affective reactions (Arriaga & Rusbult, 1998), which could improve the quality of difficult or conflictual interactions. Similarly, PT appears to limit the distancing effects of harmful relationship orientations such as attachment avoidance (e.g., Bernstein, Laurent, Nelson, & Laurent, 2015). On the other side, those who lack PT ability experience greater social dysfunction (i.e., social anxiety, verbal aggression, arrogance, and shyness; Davis, 1983). The inability to take another person's point of view may lead to unintended relational transgressions and make it more difficult to reach a state of attunement. That is, deficits in PT could indirectly influence physiological attunement by inhibiting emotional understanding and closeness, particularly during periods of conflict.

PT has also been found to directly impact biological systems involved in stress reactivity. For example, imagining that *another person* is in pain activates similar neural patterns as those that are activated when we imagine *ourselves* in pain (Jackson, Brunet, Meltzoff, & Decety, 2006; Lamm et al., 2007). PT also is associated with peripheral physiological changes. Paraphrasing a narrator's perspective has been associated with increased autonomic activity in the form of increased heart rate and skin conductance response and decreased blood volume pulse amplitude, while also downregulating

negative emotion (Seehausen, Kazzer, Bajbouj, & Prehn, 2012). Observers with higher levels of empathy and PT have also shown stronger autonomic activation in response to speaker stress (Buchanan, Bagley, Stansfield, & Preston, 2012).

The above research provides evidence that both dispositional tendencies to take another person's perspective and acute PT inductions in the laboratory can impact stress physiology, specifically the ANS and attunement. However, it is also reasonable that manipulations of PT may have the strongest effects for those individuals who chronically adopt others' perspectives, suggesting that a full understanding of PT could require attention to the interaction of trait and induced PT. For instance, previous work in the current study sample indicates that the effect of a brief mindfulness induction on partners' stress physiology depends on their levels of trait mindfulness, with beneficial effects of the mindfulness condition only evident for partners possessing higher levels of dispositional mindfulness (Laurent, Laurent, Nelson, Wright, & Sanchez, 2014). One reason for this may be that brief interventions designed to elicit interpersonal stress-regulation strategies are most effective for partners who already possess a certain degree of these qualities. In other words, the effects of a brief intervention on subsequent outcomes may emerge most clearly when they consider the psychological qualities that people already possess. Thus, a brief PT induction may only yield effects for partners with moderate to high levels of dispositional PT ability.

Finally, PT effects may further depend on partner gender. Prior couples research has demonstrated that female (as opposed to male) partner characteristics tend to play a predominant role in driving relational dynamics (e.g., Laurent, Kim, & Capaldi, 2008, 2009). Women are often socialized to take more responsibility for relationship caretaking, and research indicates that females display greater PT and empathic concern than do their male peers (Long & Andrews, 1990; Van der Graaff et al., 2014). Women also tend to report higher empathy and communion (e.g., Eisenberg & Lennon, 1983; Laurent & Hodges, 2009), show greater ability to infer others' thoughts and feelings (Klein & Hodges, 2001; Laurent & Hodges, 2009), and tend to contribute more than husbands to relationship maintenance (Ragsdale, 1996). This gender role asymmetry in relationship caretaking expectations and abilities may contribute to variation in the effects on PT based on partner gender. Thus, it is important to consider gender as a contextual factor that could shape dispositional PT-attunement associations.

As outlined above, dispositional PT tendencies, induced PT, and the interaction of the two might provide ways for romantic partners to engage with and understand each other's mental states, thereby influencing stress reactivity and regulation. However, PT has not (to our knowledge) been examined as a predictor of dyadic attunement during conflict stress.

Current study

The current study was designed to investigate whether PT—an experimental induction of PT, one's own and/or partner's dispositional levels of PT, or their interaction—would predict autonomic attunement between romantic partners, as indexed by the covariation of their sAA trajectories during a conflict resolution task. Based on communication accommodation theory, we would expect that partners who are higher in PT are able to engage with one another in a more harmonious way that fosters psychophysiological

convergence or attunement. Similarly, social entrainment theory would suggest that repeated couple interactions cue attuned physiological responses that both foster and are fostered by PT, resulting in a positive PT-attunement association. On the basis of these theoretical frames and prior empirical evidence reviewed above, we hypothesized that both experimental induction of PT and partners' dispositional PT would be associated with greater sAA attunement between partners. We also hypothesized that dispositional PT would interact with an experimental induction of PT, such that being asked to take the partner's perspective would relate most strongly to physiological attunement for participants reporting higher levels of this psychological orientation. In addition, we were interested in the potential role gender plays in the effects of dispositional PT, and we predicted that one partner's PT qualities (most likely female partners' PT) could show stronger relations with ANS attunement. Finally, we investigated associations between partner attunement and a set of conflict-specific and longer term relational outcomes (i.e., conflict behaviors, post-conflict affect, and global relationship satisfaction) to provide a preliminary sense of whether ANS attunement should be interpreted as helpful or harmful in this sample. Identifying these associations will fill important gaps in our understanding of the conditions for and implications of partner attunement during conflict resolution.

Method

Participants

Participants were heterosexual couples ($N = 114$ dyads) recruited from a departmental human subjects pool and community fliers in a small college town in the Mountain West of the U.S. The host university's institutional review board approved the study, and all participants gave informed consent prior to participating in the study. Inclusion criteria required that participants be at least 18 years of age ($M = 21.31$, $SD = 6.11$) and in a romantic relationship for a minimum of 2 months ($M = 1.93$ years, $SD = 4.91$, range = 1 month to 47 years)¹. On average, couples spent 58.5 hr/week together, and the majority of couples reported being in an exclusive relationship or living together (80%). Most participants were Caucasian (84%) and moderately satisfied with their relationship ($M = 106.31$, $SD = 19.41$ on the Dyadic Adjustment Scale [DAS]; Spanier, 1976). After excluding participants with incomplete PT data, the final sample consisted of 103 dyads. This subset did not differ significantly from the full sample on demographic or current study variables.

Procedures

The study consisted of two laboratory sessions. The first laboratory session lasted approximately 1 hour, during which participants completed questionnaire measures of dispositional constructs including trait-level PT. The second laboratory session was scheduled 1 week later and lasted approximately 2 hours. In this session, partners discussed an unresolved conflict in their relationship, nominated by one of the two partners (randomly selected by coin toss). Example topics varied widely across and within couples, including topics such as "my unemployment," "politics," "the fact we have not been on a date for a month," "how we spend money," "what church to go to,"

“(he/she) won’t talk to me about things bothering (him/her),” “my jealousy,” “how serious our relationship is,” and “(forgetting to) shut the fridge.” This paradigm is well validated as a psychosocial stressor that elicits both subjective and physiological stress responses related to individual differences in adjustment (e.g., Heffner, Kiecolt-Glaser, Loving, Glaser, & Malarkey, 2004; Kiecolt-Glaser, Glaser, Cacioppo, & Malarkey, 1998; Powers, Pietromonaco, Gunlicks, & Sayer, 2006).

Participants provided four saliva samples throughout the laboratory procedure to index physiological stress trajectories. Samples were always collected under research assistant supervision, and sample start/stop times were recorded ($M = 2.43$ min, $SD = 1.25$ min). To control for diurnal variation (i.e., expected change in stress markers over the course of the day), all laboratory sessions began at 4:00 p.m. When participants arrived to the second session, they filled out questionnaires to assess study condition compliance (i.e., no smoking or drug use within the past 24 hr, no teeth brushing or intense exercise in the past 3 hr, no eating or drinking in the past hour, and no current illness). Next, participants were asked to rinse their mouths with water to clear potential contaminants, after which the initial saliva sample was collected (baseline stress). Participants were given instructions for the passive drool technique (i.e., to swallow existing saliva in the mouth, then deposit fresh saliva into the collection vial using a short straw), including tips on how to generate spit if they were having difficulty. Saliva sample 2 (anticipatory stress) was collected 20 min after research assistants informed participants of the session’s agenda, providing a vivid description of the conflict resolution task (participants entered the session knowing they would complete an interactive task but not that this would involve conflict). At this time, each partner nominated a topic of unresolved conflict, one of which was chosen for discussion via a coin toss.

Prior to the conflict task, couples were sequentially assigned to one of three experimental conditions (i.e., Couple 1 to first condition, Couple 2 to second condition, Couple 3 to third condition, etc.). Instructions included both written material and an audio-guided exercise on how to approach the conflict resolution task: to take the perspective of your partner (PT condition), to attend mindfully to whatever arises (mindfulness condition; instructions based on Erisman & Roemer, 2010), or to focus on your own thoughts/feelings about the conflict (control condition). Conditions varied between couples, but not within couples, such that both partners of the couple were always in the same condition. These conditions were selected to compare different stress-regulation strategies and to foster particular psychological states—i.e., PT and mindfulness, which can be conceptualized as strategies for staying open to a partner’s or to one’s own experience, respectively—against the narrowly self-focused view that typically accompanies conflict (control condition). Following the condition-specific preparation period, participants were instructed to discuss and attempt to resolve the selected conflict for 15 min.² Saliva samples 3 (conflict stress) and 4 (recovery) were collected 10 and 25 min following the discussion, respectively. No saliva samples were taken during the actual conflict itself in order to allow the conflict process to unfold as naturally as possible without researcher intervention. In the interim periods between Samples 1 and 2 and Samples 3 and 4, partners completed questionnaires in separate rooms. All samples were collected by passive drool and then immediately stored at -20°C until they were shipped to Salimetrics (State College, Pennsylvania, USA) for assay on dry ice.

Primary measures

Trait PT—Interpersonal Reactivity Index for Couples (IRIC). The 13-item IRIC assesses dispositional PT in the context of a romantic relationship (Péloquin & Lafontaine, 2010). PT was measured using the 6-item subscale of this index, which assesses individuals' tendency to take their partner's psychological point of view. Sample items include, "I sometimes try to understand my partner better by imagining how things look from his/her perspective" and "When I'm upset with my partner, I usually try to 'put myself in his/her shoes' for a while." Responses are given on a 5-point Likert-type scale ranging from 0 (*does not describe me well*) to 4 (*describes me very well*). This measure has been shown to be both valid and stable over 18 months (Péloquin & Lafontaine, 2010). Internal reliability was good ($\alpha = .83$).

Stress physiology—sAA. Saliva samples were assayed by Salimetrics using kinetic reaction assays. The assay employs a chromagenic substrate, 2-chloro-4-nitrophenol, linked to maltotriose. The enzymatic action of sAA on this substrate yields 2-chloro-*p*-nitrophenol, which can be spectrophotometrically measured at 405 nm using a standard laboratory plate reader. The amount of sAA activity present in the sample is directly proportional to the increase (over a 2 min period) in absorbance at 405 nm. Results are computed in units per milliliter of sAA. Intra-assay variation computed for the mean of 30 replicate tests was <7.5%. Inter-assay variation computed for the mean of average duplicates for 16 separate runs was <6%. The impact of salivary flow rate was tested and found to be nonsignificant in this sample, so it was not included in further analyses. Figure 1 shows mean sAA values for both males and females at each sample.

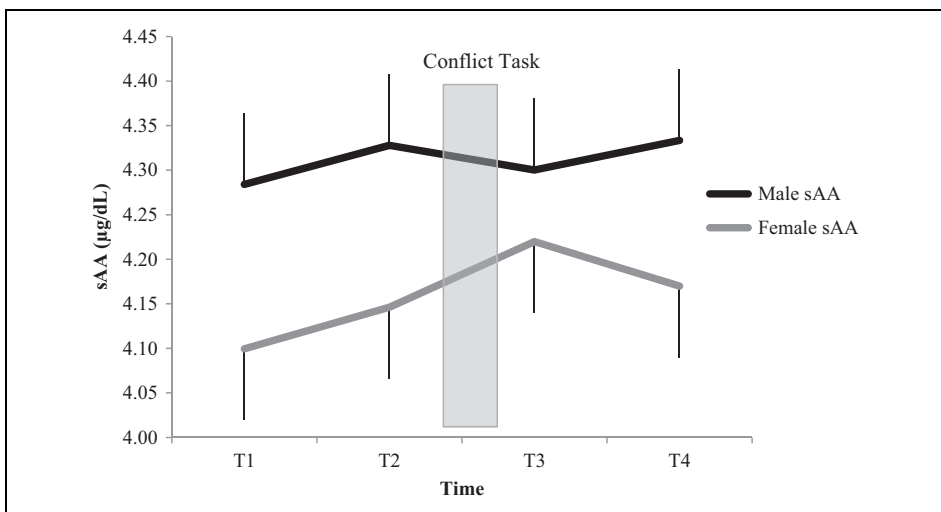


Figure 1. Average men's and women's sAA levels across the session (x-axis shows samples; bars represent standard errors). sAA: salivary alpha-amylase.

Secondary measures

Conflict behaviors—*The System for Coding Interactions in Dyads (SCID)*. The SCID was used to assess partner positive (support) and negative (attempts to control, coerciveness, negativity and conflict, verbal aggression, and pursuit/withdrawal) behaviors during the conflict discussion (Malik & Lindahl, 2004). This coding scheme was developed to measure couples' affective and communicative functioning and has been validated for use with couples from various ethnic groups and with varying levels of adjustment (from violent/distressed to satisfied). A natural log transformation was adequate to correct positive skew for attempts to control, negativity and conflict, and pursuit/withdrawal. Coerciveness and verbal aggression were still highly skewed following transformation; therefore, these variables were dichotomized to indicate presence versus absence of the behavior.

Post-conflict affect—*Positive and Negative Affective Schedule (PANAS)*. The 20-item PANAS was used to assess positive and negative affect post-conflict (10 items for each subscale; Watson, Clark, & Tellegen, 1988). Sample items include “interested,” “distressed,” “irritable,” and “proud.” Responses are given on a 5-point Likert-type scale ranging from 1 (*very slightly or not at all*) to 5 (*extremely*). Internal reliability was good for both positive affect ($\alpha = .89$) and negative affect ($\alpha = .88$).

Relationship satisfaction—*Dyadic Adjustment Scale (DAS)*. The 32-item DAS was used to assess overall relationship satisfaction (Spanier, 1976). Sample items include “handling of family finances,” “philosophy of life,” and “making major decisions.” Responses are given on a 6-point Likert-type scale ranging from 0 (*Always disagree*) to 5 (*Always agree*). Internal reliability was good ($\alpha = .86$).

Analytic strategy

Hierarchical linear modeling was used to examine partner attunement or the covariation of male and female partner sAA levels across the session (Raudenbush & Bryk, 2002).³ Dyadic models were fit with dummy-coded terms to simultaneously specify male and female partner parameters as described by Saxbe and Repetti (2010). Specifically, partners' sAA levels (Samples 1 to 4) served as the Level 1 outcome, modeled with partner-specific intercepts (representing mean male and female sAA across samples) and attunement terms (female and male partner sAA as time-varying covariates). At Level 2, experimental condition, own dispositional PT (Model 1) or partner dispositional PT (Model 2), and their interaction were used to predict variance in these Level 1 parameters, particularly the attunement terms. For illustration, the multilevel explanatory model (two-level equation) for Model 1 is given below:

Level 1 model:

$$\text{sAA} = \beta_1(\text{Male}) + \beta_2(\text{Female}) + \beta_3(\text{Male effect of partner}) \\ + \beta_4(\text{Female effect of partner}) + \text{error}$$

Level 2 model:

$$\beta_1 = \gamma_{10} + \gamma_{11}(\text{PT Induction}) + \gamma_{12}(\text{Male Trait PT}) \\ + \gamma_{13}(\text{PT Induction} \times \text{Male Trait PT})$$

$$\beta_2 = \gamma_{20} + \gamma_{21}(\text{PT Induction}) + \gamma_{22}(\text{Female Trait PT}) \\ + \gamma_{23}(\text{PT Induction} \times \text{Female Trait PT})$$

$$\beta_3 = \gamma_{30} + \gamma_{31}(\text{PT Induction}) + \gamma_{32}(\text{Male Trait PT}) \\ + \gamma_{33}(\text{PT Induction} \times \text{Male Trait PT}) + \text{error}$$

$$\beta_4 = \gamma_{40} + \gamma_{41}(\text{PT Induction}) + \gamma_{42}(\text{Female Trait PT}) \\ + \gamma_{43}(\text{PT Induction} \times \text{Female Trait PT}) + \text{error}$$

Results

Baseline model

First, a baseline model with no predictors was fit to assess cross-partner attunement in the sample as a whole and to determine whether there was significant between-couple variability to justify explanatory model testing. The average attunement terms were not significant ($\gamma = .008$, $p = .90$ for female partner effect on male sAA; $\gamma = -.006$, $p = .92$ for male partner effect on female sAA), indicating that on average, changing sAA levels were not synchronized across partners. In other words, this finding indicates that in the sample as a whole (without considering individual difference factors influencing attunement), changing sAA levels were not synchronized across partners. However, the τ statistics indicated significant variability in attunement across couples ($\tau = .14$, $p < .001$ for male attunement; $\tau = .18$, $p < .001$ for female attunement), suggesting between-couple differences that could be explained by variables such as PT.

Explanatory models

Model 1: Own dispositional PT. The first explanatory model tested (1) participation in the PT experimental induction (vs. other conditions), (2) own dispositional PT, and (3) the interaction of PT Condition \times Own Dispositional PT as Level 2 predictors of men's and women's sAA intercepts and attunement to partner sAA (see Table 1). Participation in the PT induction (relative to the other two conditions, which did not differ from one another) predicted greater sAA attunement to partner. This effect was significant for females and marginally significant for males (see Table 1, line 6).

Table 1. Model 1: Explanatory model for own PT predicting alpha-amylase attunement.

	Males		Females	
	Coefficient	<i>p</i> Value	Coefficient	<i>p</i> Value
1. Mean sAA level (intercept)	4.312	<.001	4.267	<.001
2. PT Condition	−0.273	.498	−0.027	.941
3. Dispositional PT	−0.652	.122	0.696	.090
4. PT Condition × Dispositional PT	1.487	.012*	−1.491	.006*
5. Attunement to partner sAA	−0.051	.532	−0.0105	.230
6. PT Condition	0.208	.073	0.263	.022*
7. Dispositional PT	0.186	.088	−0.090	.487
8. PT Condition × Dispositional PT	−0.195	.184	0.463	.013*

Note. sAA = salivary alpha-amylase; PT = perspective-taking.
 **p* < 0.05: Statistically significant.

The main effect of own dispositional PT on sAA attunement to partner was not significant. However, for females only, the interaction of PT condition and own dispositional PT significantly predicted attunement to her male partner (see Table 1, line 8). This synergistic interaction meant that female partner PT intensified the attunement-enhancing effect of the PT induction. According to the region of significance calculations (Preacher, Curran, & Bauer, 2006), the PT condition had a significant positive effect on females’ autonomic attunement when their own dispositional PT was ≥ -0.12 , or the 45th percentile. At lower values of females’ own dispositional PT, the induction had no effect. Figure 2 plots expected attunement values in the PT and non-PT conditions at this boundary of the region of significance. These results indicate that being instructed to take a partner’s perspective during conflict is associated with an increase in ANS attunement, and this is particularly true for female partners moderate to high in dispositional PT ability. Model 1 resulted in a significantly better model fit compared to baseline $\chi^2(12) = 24.03, p = .02$, explaining 14.17% of the variance in male attunement to female and 11.69% of the variance in female attunement to male sAA.

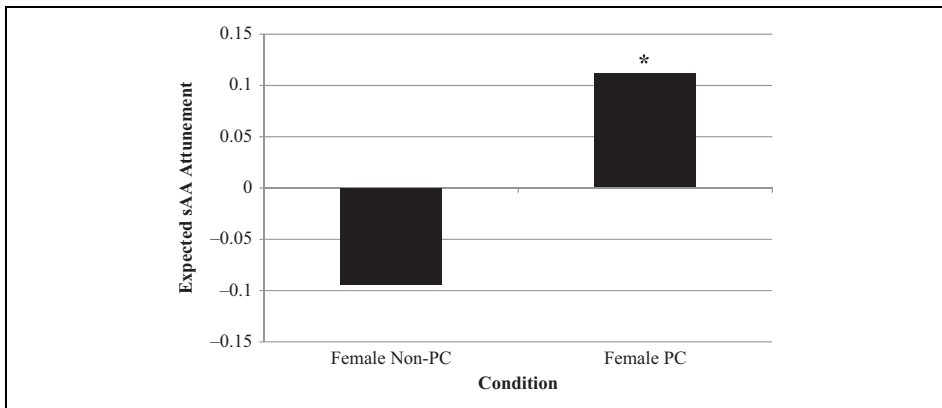


Figure 2. Graphic shows predicted female autonomic attunement to male in the PC versus mindfulness and control conditions (non-PC) at the boundary of the region of significance for female IRI PT. PT: perspective-taking; PC: perspective-taking condition; IRI: Interpersonal Reactivity Index.

Model 2: Partner dispositional PT. The second explanatory model tested (1) participation in the PT experimental induction, (2) the partner's dispositional PT, and (3) the interaction of PT Condition \times Partner Dispositional PT as Level 2 predictors of men's and women's sAA intercepts and attunement to partner sAA (see Table 2). Again, participation in the PT induction (relative to the other two conditions, which did not differ from one another) predicted greater attunement to partner sAA (see Table 2, line 6). In this model, the effect of PT condition was significant for both males and females.

Table 2. Model 2: Explanatory model for partner PT predicting alpha-amylase attunement.

	Males		Females	
	Coefficient	<i>p</i> Value	Coefficient	<i>p</i> Value
1. Mean sAA level (intercept)	4.375	<.001	4.189	<.001
2. PT Condition	-0.356	.367	0.057	.878
3. Partner Dispositional PT	0.831	.061	-0.679	.134
4. PT Condition \times Partner Dispositional PT	-1.228	.019*	1.008	.052
5. Attunement to partner sAA	-0.059	.486	-0.081	.323
6. PT Condition	0.222	.049*	0.235	.036*
7. Partner Dispositional PT	-0.162	.274	0.154	.187
8. PT Condition \times Partner Dispositional PT	0.358	.037*	-0.104	.442

Note. sAA = salivary alpha-amylase; PT = perspective-taking.

**p* < 0.05: Statistically significant.

Partner dispositional PT was not significantly related to autonomic attunement for either males or females. However, the interaction of PT condition and (female) partner dispositional PT significantly predicted male attunement (see Table 2, line 8). This synergistic interaction meant that female partner PT intensified the attunement-enhancing effect of the PT induction. According to the region of significance calculations (Preacher et al., 2006), the PT condition had a significant positive effect on males' autonomic attunement when females' dispositional PT was ≥ -0.004 , or the 47th percentile (nonsignificant effect at lower levels of female partner PT). Figure 3 plots expected male attunement values in the PT and non-PT conditions at the boundary of the region of significance. Echoing the above, these results indicate that being instructed to take a partner's perspective during conflict is associated with an increase in ANS attunement, particularly when the female partner is moderate to high in dispositional PT ability. Model 2 resulted in a marginally better model fit compared to baseline, $\chi^2(12) = 19.88$, *p* = .07, and explained 12.27% of the variance in male attunement to female and 14.93% of the variance in female attunement to male.

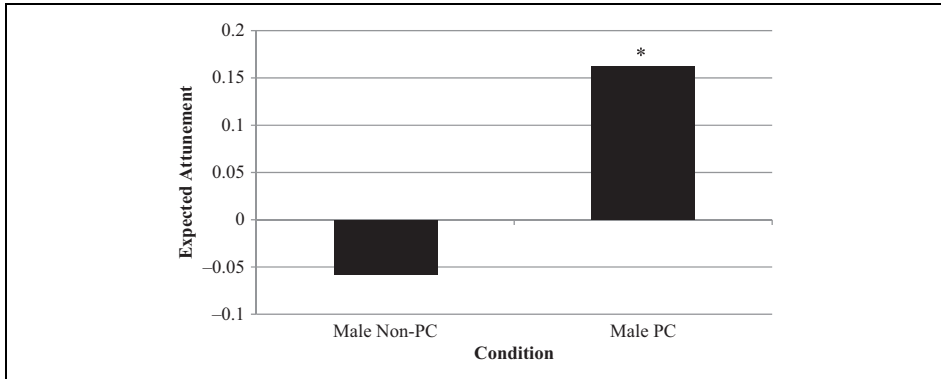


Figure 3. Graphic shows predicted male autonomic attunement to female in the PC versus mindfulness and control conditions (non-PC) at the boundary of the region of significance for female IRI PT. PT: perspective-taking; PC: perspective-taking condition; IRI: Interpersonal Reactivity Index.

Secondary analyses

Secondary explanatory models were run to determine whether attunement related to positive or negative relational outcomes. In particular, these models assessed associations between sAA attunement and partners’ (1) observed conflict behaviors, (2) post-conflict affect, and (3) overall relationship satisfaction.

For males, attempts to control and (at a trend level) pursuit/withdrawal and lower support behaviors related to decreased attunement to female sAA. For females, verbal aggression, negativity and conflict, and pursuit/withdrawal all related to decreased sAA attunement.

Female post-conflict negative affect related to lower female attunement to male sAA (no effect was found for male attunement). Neither female nor male sAA attunement to partner related significantly to post-conflict positive affect or global relationship satisfaction (Table 3).

Table 3. Relational outcomes associated with alpha-amylase attunement.

	Males		Females	
	coefficient	p Value	coefficient	p Value
Attunement to partner sAA				
SCID Variables				
Attempts to control	-0.223	0.039*	-0.015	0.895
Pursuit/withdrawal	-0.318	0.074	-0.241	0.023*
Verbal aggression (dichotomized)	-0.022	0.908	-0.319	0.021*
Negativity and conflict	-0.194	0.280	-0.227	0.045*
Support	0.172	0.094	0.038	0.642
Post-conflict PANAS				
Negative affect	0.047	0.519	-0.221	0.034*
Positive affect	0.090	0.296	0.090	0.261
Dyadic adjustment				
Overall relationship satisfaction	0.0001	0.959	-0.002	0.465

Note. sAA = salivary alpha-amylase; SCID = The System for Coding Interactions in Dyads; PANAS = Positive and Negative Affective Schedule.

*p < 0.05: Statistically significant.

Discussion

This study is the first to our knowledge to investigate a psychological predictor associated with romantic partners' autonomic attunement during a conflict resolution task. The primary findings indicated that participation in a brief PT induction was associated with increased autonomic attunement to partner during conflict, an effect that was heightened by female partners' dispositional PT. Secondary analyses further revealed that negative conflict behaviors and post-conflict negative affect were associated with decreased attunement, particularly for female partners. As outlined above, despite theoretical reasons to expect attunement in well-adjusted dyads, the existing research has been mixed on whether physiological attunement contributes to resilience or risk in relationships. Elucidating characteristics that influence how individuals physiologically attune to one another and what this means for relational adjustment promises to move this field of study forward to address when, how, and for whom physiological attunement may be beneficial.

Overall, this study provided qualified support for the relationship between PT and autonomic attunement. Results showed that dispositional PT for both males and females did not, on its own, predict autonomic attunement to partner during conflict. In contrast, experimentally induced PT was associated with significantly greater autonomic attunement during conflict resolution for both males and females when the effect of partners' dispositional PT was taken into account (this effect was marginal for males when only their own dispositional PT was included in the model). These results are notable, given that the intervention was quite brief—consisting of just 10 min of combined written and auditory instructions. Unlike the dispositional PT measure, which taps self-perceived abilities that may or may not be invoked during periods of conflict, receiving these instructions immediately before the discussion appeared to shift the way couples experienced the task. In particular, the invitation to experience conflict from their partner's perspective was associated with increased autonomic attunement, possibly via more accommodative communication patterns in which couples adjust their verbal and nonverbal behaviors to reduce differences between partners and foster convergence (see Giles et al., 1991). This would be consistent with prior evidence that PT facilitates accommodation and affective attunement in couples' relationships (Rusbult et al., 1991; Schoebi, 2008).

Although dispositional PT did not exert an effect on its own, the effect of the PT manipulation was further intensified by female partners' dispositional PT, such that the strongest attunement was found for couples with a moderate to high PT female who took part in the PT induction. This echoes a previously detected Trait Mindfulness \times Mindfulness Induction effect found in this sample (Laurent et al., 2014), suggesting that brief interventions to elicit interpersonal stress regulation strategies may be most effective for partners who already possess a certain degree of these qualities. The fact that this effect was observed for female, but not male, partners' dispositional PT is also consistent with previous research highlighting an important role for women in driving relational dynamics. In particular, women's behaviors during conflict have been shown to impact both their own and their partner's relationship satisfaction, mood, and affect over time to a greater extent than their male partners (Laurent et al., 2008, 2009; Schoebi, 2008).

Perhaps women who make a habit of taking their partner's perspective are better able, when cued to do so, to engage in the constructive conflict behaviors (i.e., convergence) that promote positive attunement and this in turn explains differences in individual and dyadic adjustment when repeated over long periods of time. This would fit with prior research showing that partners with more feminine characteristics and greater PT ability use accommodation behaviors to counter potentially destructive behaviors with more constructive ones (Rusbult et al., 1991). This finding is important because it could inform couples' intervention approaches; in particular, women with moderate to higher levels of dispositional PT ability may be able to improve conflict outcomes if they try to take the perspective of their partner during conflict situations. At the same time, it is important to note that female partners are not wholly responsible for relationship dynamics and quality of conflict, and attention to male partner characteristics and dyadic patterns built up over time is warranted. Further research into factors beyond PT that shape both partners' contributions to conflict process and related physiology is an important future direction for this research.

Secondary analyses incorporating measures of conflict behaviors, post-conflict affect, and overall relationship satisfaction helped to contextualize the above results. Overall, these analyses provided support for the beneficial role of autonomic attunement during romantic conflict. Specifically, negative conflict behaviors (i.e., female verbal aggression, negativity and conflict, and pursuit/withdrawal, as well as male attempts to control) were associated with decreased autonomic attunement. It is possible that the use of aggressive or withdrawn behaviors interrupted accommodational patterns that foster the behavioral and physiological process of attunement and/or that autonomic attunement fostered greater understanding of and sensitivity to partner states (and thus more positive conflict behaviors). Such divergence in behavioral and physiological processes may become entrained over time, leading to greater and greater mismatches between partners during conflict. Research designs in which effects of dyadic behaviors on physiology can be separated from those of physiological attunement on subsequent behavior will be needed to better understand the causal processes involved. Consideration of conflict behaviors further offers a starting point for understanding how PT may translate into greater attunement; female partners in the PT condition (relative to the other conditions) showed lower negativity and conflict, $t(87) = 1.99, p < .05$. Thus, it may be that attempting to take the partner's perspective helps to maintain a more harmonious tone during conflict, possibly through more accommodating communication patterns, which in turn supports (and/or is supported by) physiological attunement.

These results also pointed to a relation between autonomic attunement and less negative outcomes of the conflict discussion itself; we found that in couples who were less closely attuned, female partners experienced more negative affect once the conflict was resolved. These results corroborate and extend previous research on positive behavioral synchrony, which indicate that such attunement is related to better individual outcomes in therapy and higher positive and lower negative affect during interactions (Ramseyer & Tschacher, 2011, 2014; Tschacher et al., 2014). In contrast, overall relationship satisfaction failed to show a significant association with autonomic attunement. It is possible that the fast-acting ANS has more of an impact on immediate conflict dynamics rather than longer term relationship satisfaction. Another possibility is that the

relatively short length of relationships in this sample did not allow for the accumulation of conflict-related physiological effects (i.e., social entrainment of psychophysiological responses) over time that would influence global relationship satisfaction. Further investigation of different forms of psychobiological attunement in couples studied over longer time scales could help to resolve these questions and answer whether social entrainment over extended periods of time leads to increased physiological attunement, either normatively or in satisfied couples more particularly.

The current results are consistent with research, suggesting that the tendency to attune to a partner's physiology and the implications of such attunement depend on context (e.g., Levenson & Ruef, 1992; Saxbe & Repetti, 2010; Timmons et al., 2015). Whereas attuning to a partner during interactions involving constructive conflict tactics and/or positive affect may arise normatively because it benefits couples, attuning during interactions characterized by aggression and negative affect may be rarer because it promotes harmful contagion. Previous work involving the HPA stress-response system, for example, suggests attunement can arise in dyads both at low and high risk for affective psychopathology (Laurent et al., 2011; LeMoult et al., 2015). We might expect that in the former case, attunement has neutral or positive effects in calibrating HPA axis response to stress, while in the latter case the spreading of dysregulated cortisol responding would increase the partner's risk of symptomatology.

It is also possible that attunement implications are specific to the stress system under investigation; whereas a number of previous studies have demonstrated HPA attunement in adverse relationship situations, research on autonomic attunement has revealed more benefits. Given that the ANS activates to help the organism respond to both positively and negatively valenced challenges, it makes sense that dyadic entrainment of this system would have different correlates than the HPA axis, which tends to activate more specifically in response to negatively valenced threatening situations (Dickerson & Kemeny, 2004). In turn, coactivation of each of these systems is likely to have differential downstream health implications, with HPA axis dysregulation more closely associated with allostatic load sharing and psychopathology (Brooks et al., 2014; LeMoult et al., 2015).

The factors underlying physiological attunement may also be system specific. It is worth noting that we did not find any effects of PT on HPA attunement (indexed by covariation of partners' salivary cortisol levels). One interpretation of these null findings is that the immediacy of PT during the conflict more easily influences the rapidly responding ANS, whereas the slower acting HPA system is more controlled by entrenched dyadic patterns involving threat responding. In line with this, other analyses involving this sample have shown that mutual emotion dysregulation relates to greater cortisol attunement during conflict (Nelson, Laurent, & Laurent, unpublished). Future research should work to systematically identify dispositional and situational factors that influence ANS versus HPA attunement.

These findings begin to shed light on how autonomic attunement may be helpful for couples, particularly during states of conflict stress. Beyond the theoretical implications of this work for understanding how and why couples attune to one another, the current results could be used to inform more sustained psychotherapeutic interventions that elaborate on PT instructions such as those used here and provide psychoeducation about

PT in conflict situations. This type of skills coaching could provide a quick and cost-effective way to improve conflict-related relational outcomes.

Limitations and future directions

Several potential limitations to the present study should be noted. Sample homogeneity in race, age, relationship satisfaction, and length limits the generalizability of these findings to a wider population. Future research should address attunement with a more diverse sample, including couples who have been together for a more sustained time period and those experiencing clinically significant distress. Relatedly, studying couples whose relationship satisfaction ranges from distressed to satisfied would allow the examination of the possible impacts of conflict severity on attunement-related processes; this represents an important contextual variable for future investigation that we were unable to address under the current study design. Furthermore, studying such attunement processes in the face of other challenges (i.e., not conflict related) may elucidate the ways in which contextual factors can influence the process and degree of physiological attunement.

The sequential assignment protocol of this study is another potential limitation to consider. Although secondary analyses indicated there were no significant differences in couples between conditions in measures of personality, dyadic adjustment, empathy, PT, behavioral activation, and behavioral inhibition (ps from .09 to .80, average $p = .39$), it is possible that an unmeasured variable may have been associated with the PT condition. Future studies of this kind should implement random assignment to condition to correct for any potential confounds that were not assessed in this study.

The assessment of attunement and PT was also relatively limited, and next steps in this research should expand these domains. The salivary sampling protocol (four time points before and after the discussion) provided poor temporal resolution of ANS reactivity during the conflict itself. Future studies should use other measures of autonomic functioning that would provide more temporally detailed continuous data about couples' attunement, such as respiratory sinus arrhythmia, pre-ejection period, or heart rate. In addition, temporally sensitive behavioral measures such as mimicry, facial expressions, and eye contact could be used to assess behavioral and affective attunement. Such measures would provide a more detailed model of how (e.g., via microsocial behaviors and facial expressions) and when (i.e. what precedes positive or inverse attunement) couples physiologically attune to one another during the task. In the evaluation of PT effects, we note that a PT manipulation check created by the second and fourth authors did not detect a significant impact of PT condition on this measure in the sample as a whole. This may reflect limitations in the measure itself, because it narrowly focused on participants' awareness of engaging in cognitive aspects of PT, it may not have adequately tapped into whether the manipulation evoked emotional and/or broader cognitive shifts in the ways partners approached conflict. It is also possible that the PT condition enhanced PT only in some participants but that other participants—perhaps focused squarely on their own feelings about the conflict—resisted the prompt to take their partners' perspectives, resulting in less rather than more PT and a nonsignificant total effect. Moderation analyses in a larger sample might yield important information about the conditions under which such instructions result in conscious use of and

perceived success in PT during conflict, and future studies should use more comprehensive measures of conflict-related PT and/or probe-moderated effects to better evaluate how such a laboratory induction operates.

Aside from understanding the attunement process itself, more research is needed to determine its functional value—that is, when physiological attunement predicts positive relational and health outcomes and when it may be deleterious. The fact that attunement was associated with a set of positive psychological/behavioral constructs in this study supports the view that this is beneficial, but further testing of links with long-term adjustment outcomes in more diverse samples will be required to confirm or dispute this. Future studies should address physiological attunement over longer periods of time (i.e., days, weeks, and years) to determine whether there are more durable benefits for relationship satisfaction that accrue over repeated interactions. Furthermore, such studies should examine physiological attunement in relational contexts other than conflict, such as how partners support one another during challenge or interact during periods of low stress or relaxation. Finally, future studies should investigate whether physiological attunement may act as one mechanism that underlies both the positive (stress buffering) and negative (allostatic load sharing) mental and physical health outcomes associated with close relationships (Brooks et al., 2014; Butler & Randall, 2012; Kiecolt-Glaser & Newton, 2001; Pietromonaco, DeBuse, & Powers, 2013; Saxbe & Repetti, 2010; Sbarra & Hazan, 2008).

The present study provides important groundwork for understanding factors that impact physiological attunement between romantic partners during periods of relational stress, particularly the ways in which a brief PT induction may influence this process. Further insight into the basis for and consequences of physiological attunement will help refine our understanding of how relationships are cemented and influence health throughout life.

Declaration of Conflicting Interests

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Notes

1. A comparison of model effects with and without the couple that had been together for 47 years (which was substantially longer than the rest of the sample) confirmed that their inclusion did not influence the current findings.
2. Topic selection (i.e., male nominated or female nominated) was also tested as a predictor of male and female sAA attunement, and no significant effects were found.
3. Analyses were also run in an alternative set of hierarchical linear modeling models that predicted between-couple differences in sAA attunement for males and females separately, and the results were consistent with those reported here. In addition, results using the actor-partner

interdependence approach were consistent with those described in the main text, though the interaction effect was only marginally significant ($p = .06$).

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