Touch as an interpersonal emotion regulation process in couples' daily lives: The mediating role of psychological intimacy

Anik Debrot, Dominik Schoebi, and Meinrad Perrez,

University of Fribourg, Switzerland

Andrea B. Horn

University of Zürich, Switzerland

Authors Note

Anik Debrot, Dominik Schoebi, and Meinrad Perrez, Department of Psychology, University of Fribourg, Switzerland; Andrea B. Horn, Psychological Institute, University of Zürich, Switzerland.

Correspondence concerning this article should be addressed to Anik Debrot, Rue de Faucigny 2, 1700 Fribourg, Switzerland. E-mail: anik.debrot@unifr.ch or to Andrea B. Horn, University of Zürich, Binzmühlestr. 14/17, Bin.3.E.11 Switzerland. E-mail: a.horn@psychologie.uzh.ch

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Abstract

Interpersonal touch seems to promote health through its effects on physiological stress-sensitive parameters. However, less is known about its psychological effects. The present study investigates associations between touch and romantic partners' affective state in daily life. We hypothesized that this association is established by promoting the recipient's experience of intimacy. Both partners of 102 dating couples completed an electronic diary four times a day during one week. Multilevel analyses revealed that touch was associated with enhanced affect in the partner. This association was mediated by the partner's psychological intimacy. Touch was also associated with intimacy and positive affect in the actor. Finally, participants who were touched more often by their partner during the diary study week reported better psychological well-being six months later. This study provides evidence that intimate partners benefit from touch on a psychological level, conveying a sense of strengthened bonds between them and enhancing affect and well-being.

Keywords: emotion regulation, touch, intimacy, e-diary, couples.

Nonverbal interaction plays an important role in human relationships, and particularly so regarding the communication of emotional content (Schachner, Shaver, & Mikulincer, 2005). Touching an interaction partner is an important way of communicating affection throughout the life-span (Gallace & Spence, 2010; Hertenstein, Verkamp, Kerestes, & Holmes, 2006), and particularly so in romantic relationships (Hanzal, Segrin, & Dorros, 2008). Recent research suggests that nonsexual touch is positively related to the health of the touch receiver, a linkage that is likely established via physiological stress-sensitive parameters. For example, in premenopausal women, the reported frequency of received hugs by the husband was found to be linked to lower blood pressure and higher oxytocin levels (Light, Grewen, & Amico, 2005). Moreover, Holt-Lunstad, Birmingham, and Light (2008) have shown that a relatively simple and brief four week "warm-touch" intervention that involved the partners learning to display agreeable and responsive touch to each other, had a beneficial effect on several stress-sensitive parameters (blood pressure, alpha-amylase and salivary oxytocin). Finally, simply holding the hand of the romantic partner seems sufficient to attenuate the neural stress response, reflecting stress-buffering effects of touch (Coan, Schaefer, & Davidson, 2006).

Partner Touch as an Interpersonal Emotion Regulation Process

Apart from physiological mechanisms, little is known about how interpersonal touch is connected with better health outcomes, particularly regarding the *psychological* processes involved. Social baseline theory (Coan, 2008, 2010) maintains that social proximity is used as an affect regulation strategy. Social proximity is considered to signal security, in that the need to invest one's own regulatory resources in the case of threat is reduced. Similarly, Sbarra and Hazan (2008) propose that in adult romantic relationships, positive rewards and felt security contribute to a stable state of coregulation. Once the adult attachment figure is permanently lost, a state of severe dysregulation follows that involves both psychological and physiological components.

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In both models, romantic relationships operate as regulatory systems that contribute to the maintenance of positive affect and to the downregulation of negative affect. Supporting this view, being touched in a responsive way has been shown to enhance mood. For example, Burleson, Trevathan, and Todd (2007) reported that women who received nonsexual physical signs of affection from the romantic partner experienced reduced negative affect and more positive affect on the same day. Touching one's partner in a positive, caring manner can thus be considered a strategy to improve the partner's affect (Hertenstein & Campos, 2001; Niven, Totterdell, & Holman, 2009), and represents an important extrinsic emotion regulation strategy. Emotion regulation is a term commonly used referring to processes that alter latency, rise time, magnitude, duration, and offset of affective dynamics on the behavioral, experiential, and physiological domain (Gross & Thompson, 2007, p. 8). .

The current study adopts this perspective and seeks to extend prior research by examining momentary associations between touch and concurrent or subsequent affective experience in romantic couples. We take advantage of having both partners of dating couples' reports to investigate the effect of touch on the recipient's affective state. By affective state (Gross & Thompson, 2007; Larsen & Prizmic, 2004), we mean the momentary valence of the emotional tone, which is to consider as a broad aspect of the emotional experience including the valence of the mood and/or discrete emotions (i.e. Frijda & Scherer, 2009). In contrast to discrete emotions that are relatively rare in daily life (Scherer, Wranik, Sangsue, Tran, & Scherer, 2004), affective state lends itself particularly well for assessing fluctuations and thus regulation of the affective experience in daily life. Indeed, it is a subjective state that can steadily be assessed and that is readily changed by social, psychological, and environmental contexts (Cranford et al., 2006). We expect that participants whose partner reports having touched them in a responsive manner will experience an increased affective state (Figure 1: Path 1a).

Intimacy as a mediating variable

Additionally, we investigated the experience of intimate feelings toward the partner as a putative mediator of the emotion-regulation effects of touch displayed in couples' everyday interactions. Touching the partner is a behavior that signals affection, care and concern through physical contact (i.e. Dainton, Stafford, & Canary, 1994). When displayed in a benevolent way and in a meaningful situation, touch can be considered a nonverbal form of responsiveness. Being responsive is a critical factor in building and maintaining trust and intimacy in romantic relationships (Reis & Patrick, 1996, Lemay & Clark, 2008). It communicates that the welfare of the partner is important to oneself and conveys empathy, respect and appreciation as a response to one's partner's action or disclosure (Reis, 1998). Responsiveness fosters the experience of intimacy, that is, the extent to which one feels understood, validated and cared for by the partner (Reis & Patrick, 1996; Debrot, Cook, Perrez, & Horn, 2012)[1]. Accordingly, we propose that, as a benevolent gesture in response to the partner's affective state, touch will foster feelings of intimacy.

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[1] Reis and Patrick (1996) consider that "intimacy refers to an interactive process in which, as a result of a partner's response, individuals come to feel understood, validated and cared for" (p. 536). Some authors have considered these feelings as reflecting "perceived partner responsiveness", i.e. an earlier step in the interactive process of intimacy (e.g. Laurenceau, Barrett, and Rovine, 2005). However, in this study we consider these feelings in combination with the report of felt closeness as constitutive of psychological intimacy. Accordingly, in a previous study, a CFA showed that our items measuring intimacy are reliably assessing the same construct (Debrot, Cook, Perrez, and Horn, 2012). Moreover, this study revealed that perceived responsiveness and intimacy are related but distinct aspects in couple's daily lives. This corresponds to the definition of perceived responsiveness by Reis, Clark, and Holmes (2004) "[…]a process by which individuals come to believe that relationship partners both attend to and react supportively to central, core defining features of the self. […] This definition does not equate perceived partner responsiveness with intimacy or closeness; rather we see this process as one path (albeit a key one) by which people become intimate or close" (p. 203).

In other studies (i.e. Stadler, Snyder, Horn, Shrout, & Bolger, 2012, physical proximity between romantic partners has been labeled "physical intimacy". In our study, we clearly differentiate touch as a responsive *behavior* toward the partner, from intimacy as a *feeling* toward the partner that is characterized by a subjective, that is psychological experience. However, in order to ensure empirically that these are two different aspects of the participant's experience, we want to test whether a) touch at the previous report predicts intimacy at the consecutive report, and b) conversely, whether intimacy at the previous report predicts consecutive touch.

The experience of intimate feelings toward the partner involves a sense of the quality and strength of one's bonds with the partner, thereby strengthening mental health and enhancing positive affect (Reis & Franks, 1994; Prager & Roberts, 2004). Intimacy experiences conveyed by the partner's touch should therefore be a key mediator of the effects of touch on the partner's affective states (Figure 1: Path 1b followed by Path 3).

Benefits for the Touch Giver

Prosocial behaviors can also be beneficial to the health and well-being of the person performing them (i.e., the actor; Post, 2005; Kogan et al., 2010; Lemay & Clark, 2008). Some evidence suggests that these benefits extend to behaviors involving touch. Field, Hernandez-Reif, Quintino, Schanberg, and Kuhn (1998) found that elderly benefit from giving a massage to children; their anxiety, depression and stress hormone levels were reduced, even more than in the condition where they received a massage. Although based on a small sample (N=10), these results are consistent with attachment related models of interpersonal coregulation (e.g., Coan, 2010; Sbarra & Hazan, 2008), which suggest benefits for both partners to the extent that the responsive behavior leads to a shared perception of security.

Accordingly, touching one's partner should also foster the affective state in the actor (Figure 1: path 2a). Moreover, we expect this association to be mediated by one's own experience of intimacy (Figure 1: Path 2b followed by Path 3).

Long-Term Consequences of Responsive Touch

Being able to effectively regulate one's affect has important implications for mental and physical health (e.g., Cohen, Alper, Doyle, Treanor, & Turner, 2006; Kring & Werner, 2004; John & Gross, 2004). Interpersonal processes are likely to contribute to emotion regulation in important ways. We therefore explore whether individuals who experience greater amounts of touch in their relationship, as assessed during a week in daily life, report better psychological functioning six months later (Ryff 1989; see Figure 2).

In sum, the present study investigates the intra- and interpersonal effects of touch in romantic couples. We examined the self-reported touch, assessed four times per day over a period of seven consecutive days using an electronic diary procedure. We assume that the experience of being touched by the partner is associated with more positive affect states, and that this association is accounted for by feelings of psychological intimacy toward the partner. Similarly, we assume that the act of touching one's partner also foster one's own experiences of intimacy, which in turn improve one's affective state. Finally, we turn to longer-term implications of touch and examine whether the frequency of reported responsive touch during the diary week is predictive of the psychological well-being of the partners six months later.

Method

Participants and Procedure

Participants were recruited by means of e-mails, posters, and flyers distributed in colleges and universities. One hundred and two couples met the inclusion criteria (being aged between 18 and 40 years, speaking the assessment language, dating for at least 3 months and

not being married) and agreed to participate in the study. All of them supplied sufficient data to be included in the analyses. Participants were between 18 and 40 years old ($M = 25.40$, $SD = 5.08$). Couples had been dating between 4 months and 15 years ($M = 35.48$ months, $SD = 32,31$); less than half of the couples were cohabitating (43,3%). Most participants had finished high school or higher education (89.8%) and 27 % had a master's degree. More than half of the participants (54,4%) were students and the remaining participants were employed. Mean relationship satisfaction (measured with a German version of the Relationship Assessment Scale, Hendrick, Dicke, & Hendrick, 1998; Sander & Böcker, 1993) was 23.99 ($SD = 1.87$, *min.* = 17, *max.* = 29). This corresponds to a score between fairly satisfied and very satisfied (*min.* = 7 *unsatisfied*; *max.* = 35 *completely satisfied*—suggesting a rather high level of relationship satisfaction in this sample.

At a first laboratory session, both partners filled in a computerized questionnaire package (Time 1 assessment). Each couple then participated in a standardized training for completing the e-diary and received a manual. Participants were asked to fill in the e-diary during a week that they judged representative of their daily lives (i.e. where no special events were expected). The e-diary was implemented on handheld computers. Participants were prompted to report by an acoustic signal four times a day. Simultaneously for both partners, reports were prompted randomly within a 30 min. time window around nine a.m., one p.m., five p.m. and nine p.m. Reporting was possible within a two hour time interval after the signal. Participants were instructed to complete their diaries in private and not to discuss their answers with the partner. Participants responded at 91.4% of the scheduled reports. The mean response time after the signal was 9:03 min. As we were interested in the momentary effect of responsive touch, we only utilized the reports where a direct contact with the partner was reported, and thus, touching the partner was possible (62.0% of the reports). Six months after the e-diary assessment week, participants were e-mailed a follow-up questionnaire package (Time 2). 182 questionnaires were completed and sent back (89.22%).

Measures

Affective state. At each report, participants rated the valence of their present affective state by responding to the question "*How do you feel at this moment?*". Answers were given by means of two bipolar 9-point scales, ranging from 1 =*unwell to* 9 =*well*, and from 1 =*discontent* to 9 =*content*. The two reports were averaged to obtain a variable reflecting one's general affective state in the particular situation. Participants' average affective states over the e-diary week ranged from 3.74 to 8.61 ($M = 6.55$, $SD = .87$; after centering the data around the individual mean: $M = .16$, $SD = 1.52$, *min.* = -6.61, *max.* = 4.26) and did not differ significantly between men and women (paired $t(101) = 1.08$, $p=.28$).

Responsive touch. When participants reported the partner's presence, the device presented a list of sixteen statements reflecting different ways to deal with the partner's affective state. Following Gross and Thompson's (2007) definition of emotion regulation, we instructed participants that one can respond to the partner's affect in many different ways (actively, passively, deliberately, automatically, etc.), no matter how the partner feels (good or bad, intensive emotion or less intensive mood, etc.). The list included the item: "*Since the last report, I have hugged or physically caressed my partner as a response to his/her affective state.*"[2] The item was rated on a 5-point scale (0 = *does not apply* to 4 = *applies very strongly*). Participants' average ratings over the week ranged from .29 to 4.00 ($M = 2.55$, $SD = .88$, reflecting a frequent use of responsive touch toward the partner. Women scored significantly higher than men on this item (paired $t(101) = 2.81$, $p < .01$).

Psychological Intimacy. At all reports, participants answered questions concerning how they felt toward their partner since the last report. Intimacy was assessed by four items: *[I felt] close to, secure with, cared for, and understood.* Items were rated on 5-point scales (0 = *does*

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[2] No explicit distinction was made between sexual and nonsexual touch. However, the example points toward nonsexual aspects of touch.

not apply to 4 = *applies very strongly*). A confirmatory factor analysis indicated that these items reliably assess the same construct for men and women (Debrot et al., 2012). The four items were averaged to provide an intimacy score for each report. Mean scores over the assessment period ranged from .80 to 4.00 ($M = 3.05$, $SD = .60$). They did not differ significantly between men and women (paired $t(101) = .072$, $p = .94$).

  Psychological Well-Being. We used the average of six subscales from the psychological well-being (PWB) scale by Ryff (1989; see also Springer & Hauser, 2006) to measure psychological well-being. Each subscale was measured with 9 items. The six scales included Self-Acceptance, Environmental Mastery, Positive Relations With Others, Personal Growth, Purpose in Life, and Autonomy. The measure was administered immediately prior to the diary week (Time 1) and six months later (Time 2). It was reported to have good psychometric qualities (Risch, Taeger, Morina, & Stangier, 2011). Participants indicated their thoughts and feelings on scales ranging from 1= *disagree strongly* to 6 = *agree strongly*. The mean score over all scales was moderately high (Time 1: $M = 4.91$. $SD = .47$; Time 2: $M = 4.76$. $SD = .54$). In the current sample, the Cronbach's alpha suggested high consistency ($\alpha_{\text{Time 1}} = .90$; $\alpha_{\text{Time 2}} = .88$). We found no gender differences at Time 1 (paired $t(100) = 1.025$, $p = .31$), but higher scores for men than for women at Time 2 (paired $t(85) = 2.706$, $p < .01$).

Data Analytic Strategy

  The current data feature dependencies due to repeated measurements within each participant, and due to the fact that participants were nested within couples, and this clustering lead to similarity of data stemming from the same person and from the same couple (Laurenceau & Bolger, 2012). To adjust for these dependencies, we used a multilevel modeling approach for dyads. We computed a two-level adaptation of the Actor-Partner Interdependence Mediation Model (APIMeM; Ledermann & Bodenmann, 2006, an extension of the Actor-Partner Interdependence Model, APIM; Cook & Kenny, 2005) with two sets of parameters per

couple (one for the female and one for the male partner; Kenny, Kashy, & Cook, 2006). With this procedure, participants' multiple daily reports (Level 1) are considered as nested within couples (Level 2; see also Laurenceau & Bolger, 2005). Intercepts were allowed to vary randomly across persons and reports, and residual terms were allowed to be correlated between partners.

The present hypotheses concern associations at the within-subject level (Level 1). Thus, in order to remove the effects of individual differences at Level 2 (i.e. mean over the assessment period), all predictors were centered at the person's mean on that variable. Moreover, we adjusted for the score of the dependent variable from the prior report, so that the outcome represents residualized change that occurred since the preceding report. We estimated random variation of parameter estimates at Level 2 (variation across husbands and wives), except for the autoregressive parameter (b_1).

Equation 1 shows the Level 1 model for the effects of responsive touch and intimacy on changes in affective state.

$$\textit{Affective state}_{ij} = b_{0j} + b_1 (\text{previous affective state}) + b_{2j}(\text{partner responsive touch}) + b_{3j}(\text{own responsive touch}) + b_{4j}(\text{own intimacy}) + e_{ij} \tag{1}$$

Affective state$_{ij}$ is the current self-reported valence of the affective state of a partner from couple j at time i. The estimate for b_{0j} is the average of the participant's affective state, adjusted for all predictors in the model. The estimate for b_1 reflects the effect of the actor's affective state at the previous report (i.e., the autocorrelation of the affective state variable). The estimate for b_{2j} captures the unique effect of partner responsive touch on the affective state change since the previous report (Figure 1, path 1a). The estimate for b_{3j} represents the unique effect of the own responsive touch on one's change in affective state (Figure 1, path 2a). The estimate for b_{4j} captures the effect of the own intimacy on one's changes in affective state (Figure 1, path 3). The parameter for e_{ij} is the Level 1 error term.

Equation 2 represents a model for the prediction of the partner's intimacy changes by both partners' responsive touch:

$$Intimacy_{ij} = b_{0j} + b_1 \text{ (previous intimacy)} + b_{2j}\text{(partner responsive touch)} + b_{3j}\text{(own responsive touch)} + e_{ij} \tag{2}$$

Intimacy_{ij} represents the intimacy toward one's partner felt by the male or female partner of couple *j* at time *i*. The estimate for b_{0j} is the average of the participant's intimacy, adjusted for all predictors in the model. The estimate for b_1 reflects the effect for the actor's intimacy at the previous report (i.e., the autocorrelation of intimacy reports). The estimate for b_{2j} captures the effect of the partner's responsive touch on the own intimacy change since the prior report (Figure 1, path 1b). The estimate for b_{3j} represents the effect of own responsive touch on one's intimacy changes (Figure 1, path 2b). [3]

To test the indirect effects of a touch experience on one's affective state via intimacy (mediation at level 1), we used a procedure recommended by Bauer, Preacher, and Gil (2006) for assessing lower level mediation. This approach tests the two equations of the indirect path simultaneously. The procedure allows obtaining estimates of a possible correlation between the individual's parameters (touch predicting intimacy, and intimacy predicting affective state), and to adjust for this correlation in the tests of the mediational paths. We implemented the proposed model using the multivariate extension of the MLwiN software (Rabash, Charlton, Brown, Healy, & Cameron, 2009). The equation for the independent variable (Equation 1) and the equation for the mediator variable as the outcome (Equation 2) were computed

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[3] Relationship duration and relationship satisfaction could have an influence on the studied processes. They were therefore included it in the model. Relationship duration showed no association with the outcomes. Relationship satisfaction was positively and significantly related to daily affective state and daily intimacy. However, the inclusion of these variables in the model did not affect the hypothesized effects in a significant way, and we therefore excluded them from our models.

simultaneously. For the formal estimation of the indirect paths, we utilized the Monte Carlo Method for Assessing Multilevel Mediation (MCMAM; Selig & Preacher, 2009).

As we were not expecting any particular overall gender differences (e.g., Burleson & Kunkel, 2006), we tested whether assuming equality in the actor and partner effects and the size of their variance terms lead to a models that performed equally well. A model comparison between the original model and a model with gender constrained suggested no significant difference (χ^2_{diff} (11) = 13.52, p = .26), This provided us with the empirical grounds to retain a more parsimonious model with equal parameters and variances for husbands and wives, while men and women can still be considered to be distinguishable members of the dyad on the gender variable (Olsen & Kenny, 2006).

We ran additional analyses for the exploration of the temporal unfolding of the effects of responsive touch and psychological intimacy. To this end, we ran two slightly modified models, now testing prospective change rather than concurrent change. In the first one, responsive touch at the prior report was tested as a predictor of intimacy. In the second one, intimacy at the prior report was tested as the predictor of responsive touch. In both models, we adjusted for the dependent variable at the prior report and for the predictor at the concurrent report.

To investigate the long-term effect of responsive touch on psychological well-being, we regressed partner's psychological well-being at Time 2 (six months follow-up) on the mean scores of responsive touch over the e-diary period, adjusting for psychological well-being at Time 1(Ledermann & Bodenmann, 2006; see Figure 2). We estimated all actor and partner associations, using a Structural Equation Modeling approach (using AMOS, Arbuckle, 2009).

Results

Preliminary Analyses

Table 1 presents the means, standard deviations and Pearson product moment correlations[4] between variables aggregated across all reports for each person.

To obtain estimates of the intercorrelations of variables at within and between subjects, we examined the variance-covariance matrices of a multivariate analysis with empty models (including random intercepts and no further predictors) for all investigated variables. The results suggested that all variables covaried significantly between partners at both levels. For affective state, the correlation at Level 2 was $r = .27$, $p < .05$ and at Level 1 $r = .32$, $p < .001$; for responsive touch, correlation at Level 2 was $r = .67$, $p < .001$ and at Level 1 $r = .24$, $p < .001$; for intimacy, correlation at Level 2 was $r = .67$, $p < .001$ and at Level 1 $r = .41$, $p < .001$.

Daily associations between touch, intimacy and affective state

Unstandardized parameters estimates, standard errors and variances of the investigated associations are displayed in Table 2. The average affective state over the assessment period of both partners, controlled for all other parameters in the multivariate model, was $b = 5.697$, $SE = .141$, $p < .001$; the corresponding average intimacy level was $b = 2.38$, $SE = .060$, $p < .001$. The affective state at the previous report predicted the concurrent affective state significantly, $b = .124$, $SE = .018$, $p < .001$. Intimacy at the previous report also predicted concurrent intimacy, $b = .209$, $SE = .015$, $p < .001$.

Turning to our main hypotheses, we first tested our prediction that partner responsive touch was positively associated with own affective state (Figure 1: path 1a). The results showed that daily responsive touch was associated with a concurrent increase in the partner's affective state, thus confirming our first hypothesis ($b = .070$, $SE = .023$, $p < .01$). Computing

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[4] Prior centering at the person's mean.

the effect size (ES) r^5 yielded a medium estimate of ES $r = .29$. Moreover, we expected that responsive touch would be positively associated with the touch provider's own affective state (path 2a on Figure 1). We found a significant and large actor effect ($b = .156$, $SE = .024$, $p < .001$; ES $r = .55$), lending support to our hypothesis.

Next, we turned to examine the mediational paths via psychological intimacy. We expected that responsive touch should be positively associated with increases in the partner's intimacy (Figure 1: path 1b), and also with increases in the provider's own intimacy (Figure 1: path 2b). The results confirmed this expectation for the partner's intimacy ($b = .067$, $SE = .008$, $p < .001$; ES $r = .65$), and also with respect to the actor's own intimacy ($b = .163$, $SE = .012$, $p < .001$; ES $r = .81$). Finally, we proposed that experienced intimacy is positively associated with increases in the own affective state (path 3 on Figure 1). Results confirmed our assumption, showing a significant positive association between intimacy and affective state in participants' daily lives ($b = .662$, $SE = .076$, $p < .001$; ES $r = .67$).

Prospective association between touch and intimacy

To obtain estimates that allow for more valid interpretations of the direction of pathways, we also examined moment to moment lagged effects of touch on intimacy, and vice versa.

Intimacy at the previous report predicted consecutive intimacy significantly ($b = .562$, $SE = .021$, $p < .001$; ES $r = .93$). Concurrent responsive touch predicted intimacy significantly ($b = .148$, $SE = .011$, $p < .001$; ES $r = .80$). Responsive touch at the previous report did not predict intimacy significantly (a marginally significant effect was negative, $b = -.017$, $SE = .009$, $p =$

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[5] Determining effect sizes in multilevel models is an issue of ongoing debate. We computed effect sizes r, (e.g., Rosenthal, Rosnow & Rubin, 2000) based on the Wald test and the degrees of freedom for coefficients with random variation. These effect sizes should be interpreted with caution, and might overestimate the true size of the effects.

.06; ES $r = .19$). These results suggest that, adjusting for for previous intimacy and concurrent touch, prior responsive touch is not related to changes in intimacy.

We also examined the prediction of touch by intimacy at the previous report, above and beyond concurrent associations. Responsive touch at the prior report significantly predicted changes in responsive touch ($b = .442$, $SE = .02$, $p < .001$; ES $r = .73$). Concurrent intimacy significantly predicted responsive touch, ($b = .565$, $SE = .046$, $p < .001$; ES $r = .78$). Prior intimacy, however, did not predict prospective change in responsive touch, ($b = .038$, $SE = .041$, $p = .35$; ES $r = .09$). These results suggest that, when controlled for previous touch and concurrent intimate feelings, previous intimate feelings were not associated with changes in touching behaviors.

To sum up, the association between touch and intimacy seems to be bidirectional and concurrent. It appears to emerges within a relatively narrow time window and dissipate over a span of about four hours.

Testing Mediational Paths

The results of our main model (Figure 1) showed that all hypothesized paths were significant. As mentioned, we estimated the significance of the full mediational paths in a multivariate framework, following the procedure proposed by Bauer and colleagues (2006).

Before beginning with the actual test of the mediational path, in order to test the value of adding the mediator to the model, we compared a fixed model without the mediator (direct partner path 1a, $b = .112$, $SE = .023$, $p < .001$; direct actor path 2a, $b = .253$, $SE = .023$, $p < .001$) to a fixed model with the mediator (direct partner path 1a, $b = .069$, $SE = .023$, $p < .01$; direct actor path 2a, $b = .154$, $SE = .024$, $p < .001$). The models differed significantly, χ^2_{diff} (10) $= 1080.3$, $p < .001$, showing the relevant contribution of the mediator.

We first tested an indirect path between partner responsive touch and own affective state via the own intimacy. Because we only constrained the variances but not the covariances to be

equal across gender, we conducted one MCMAM-analysis (Selig & Preacher, 2008) with 20,000 repetitions for the effect on men's affective state and one for the effect on women's affective state. Results revealed that the hypothesized indirect effect (path 1b × path 3) differed significantly from zero in both partners (men: 95% CI [.027, .076]; women: 95% CI [.005, .055]). This confirms our second hypothesis according to which the effect of partner responsive touch on own affective state is mediated by the own increased intimacy feelings toward the touch displaying partner. Second, we tested whether intimacy mediated the association between own responsive touch and own affective state (path 2b × path 3). This indirect path was significant for both partners (men: 95% CI [.070, 1.431]; women: 95% CI [.074, 1.459]). Note that both actor and partner direct effects remained significant when controlled for the indirect effects, indicating partial rather than full mediation.

Long-Term Effects of Responsive Touch

In order to examine whether the mean amount of responsive touch displayed in couple's daily lives had a long-term association with a trait-oriented well-being measure, we conducted an APIM structural equation model controlling for concurrent well-being. Again, all effects were set equal across genders. The constrained model did not perform worse than the unconstrained model, χ^2_{diff} (6) =8.21. The resulting model fitted the data well, $\chi^2(6) = 8.21$, $p = .22$, $pclose = .37$, $CFI = .99$. The results of the whole model are displayed in Table 3 and illustrated in Figure 2. They revealed a significant partner effect of mean responsive touch at Time 1 on Time 2 Psychological Well-Being ($b = .094$, $SE = .035$, $p < .01$), while adjusting for correlation in the two partners' predictors and outcomes and for psychological well-being at Time 1. This shows that experiencing more touch from one's romantic partner is positively associated with a broad measure of well-being on the long-term. The corresponding actor effect, that is, the effect of the mean responsive touch at Time 1 on the own psychological

well-being six months later, was not significant ($b = -.053$, $SE = .034$, $p = .12$), indicating that actors did not benefit from touching their partner

Discussion

The main aim of the study was to investigate the effects of responsive touch on the romantic partner's affective state as it occurs in daily life. We used electronic diary reports of both partners of dating couples to test the idea that touching one's partner represents an interpersonal strategy to improve their emotional experience, and that this regulatory effect is established by conveying a feeling of intimacy. The results confirmed that displaying responsive touch toward one's partner was positively associated with changes in momentary affect, in the touched individual as well as in the partner. This association was partially mediated by fluctuations of intimacy felt toward the partner. Moreover, exploring the possible long-term implications of touch in close relationships, between person differences in the overall amount of daily responsive touch, as assessed during the diary week, were found to be predictive of the partner's psychological well-being six month later.

Responsive Touch as Interpersonal Emotion Regulation

The display of responsive touch toward a partner in response to their affective state was associated with increases in the latter. This highly reliable association of touch with a more positive affective valence in a moment-to-moment perspective suggests that the enactment of responsive touching gestures toward the partner may serve as a nonverbal means to improve the partner's emotional experience, supporting the view that responsive touch may be used as an interpersonal emotion regulation strategy, not only in mother-child relationships (Hertenstein & Campos, 2001) but also in adult romantic relationships.

The effects in this study on momentary affect are subtle and immediate. Considering that affect has the function of responding to changing demands of the environment (Robinson & Clore, 2002), there is multitude of influences on its daily fluctuations. The fact that partner's

reports of responsive touch explain positive changes in affect above and beyond the previous affective state, self-reports of touch and controlled for the averaged couple level of touch seems remarkable, even if the effect size was moderate. Accumulated measures of momentary affect have been shown to be meaningful for health and wellbeing (Cohen et al., 2006); this shows that even subtle changes in daily affective experience might be seen as relevant for these outcomes.

Few studies have investigated genuine interpersonal emotion regulation (Butler & Gross, 2009), and particularly few studies have examined naturally occurring behaviors. A possible explanation of the association may be that responsive touch is relatively easy to identify as such when displayed by the partner. Previous studies have shown that the provision of support—not only instrumental, but also emotional—can be ineffective or can even exacerbate emotional reactivity when it is visible, i.e perceived by the target. The deleterious effect seems to be more pronounced when support communicates a sense of inefficacy in the recipient (e.g. Bolger & Amarel, 2007). Gestures showing responsiveness, such as touch, are less likely to communicate negative information, as may be the case for other enactments of social support. Touch, enacted as a response to the partner's affective state, conveys a sense of responsiveness toward the partner, which is a key ingredient in supportive transactions that renders social support most beneficial for the target (Maisel & Gable, 2009).

Moreover, touch was shown to have specific stress-reducing (Holt-Lunstad et al., 2008) or stress preemptive properties (Ditzen et al., 2007), both on a physiological as on a subjective level (Coan et al., 2006). The combined stress reducing and security increasing (through the communication of responsiveness) quality of touch may be a further explanation of the positive effect on the partner's affective state.

In the current study, participants indicated having touched their partner in response to his/her affective state. Because we controlled for the previous affective state, we can conclude that responsive touch is associated with a positive change in the latter. Dimensional assessment

of the affective experience is regarded as the method of choice for assessing short-term fluctuations in daily life (Cranford et al., 2006; Schwarz, Kahnemann, & Xu, 2009). As a consequence, results assessing affective valence cannot be interpreted with respect to the ebb and flow or the occurrence of specific emotion categories. Rather, conclusions can only be drawn with respect to the daily fluctuations of the overall valence of momentary reported affective state.

Some evidence points to the possibility that touch is beneficial even if not displayed exactly during the stressful moment. In an experimental study, Ditzen and colleagues (2007) have shown that a positive partner contact was associated with significantly reduced salivary free cortisol response and with reduced heart rate increase in response to a stressor, even if the partner was no longer present during the stress exposure. This suggests that touch can have effects that endure at least a few minutes or hours after the display. The present results on prospective effects of touch and intimacy suggest that the positive impact of touch does not hold over the four hours lag between the scheduled reports. Designs with a more narrow spacing between reports, or controlled designs in a laboratory would be appropriate to examine the effect of touch and its dissipation over time.

Similarly, it would be important to investigate whether the effects of touch differ depending on the partner's initial affective state. Also, distinguishing between different kinds of touch may provide further insight in the psychological mechanisms underlying the effects on partner's affect. For example, both sexual and non-sexual touch seem to have positive effects on mood (Burleson et al., 2007). We can hypothesize that the effects vary across conditions (i.e. private vs. public setting) and populations (i.e. as a function of relational stage; Emmers & Dindia, 1995, marital status; Hanzal et al., 2008, or some trait variables such as attachment style; Schachner et al., 2005). It is important to note that differences in relationship satisfaction did not alter the observed results, albeit in a rather homogeneous sample to this regard. More

research is needed in order to examine possible influences of relationship satisfaction in this process Possibly, certain associations might alter if couples are in discord.

Touch Brings Us Together: The Mediating Role of Intimacy

The second main result of this study is that the positive effect of responsive touch on the partner's affective state was partially but significantly mediated by increased intimacy experienced by the receiving partner. In other words, when we are touched by our partner, we experience an increased sense of being close and intimate with him/her; this in turn improves our affective state. Thus, a significant part of the emotion regulative function of touch seems to be established via the experience of intimate bonds to the romantic partner.

A further issue concerning the conceptualization of intimacy concerns the fact that physical closeness has been considered as an indicator of intimacy (i.e. Stadler et al., 2012). In our study, we differentiate between touch as a *behavior* enacted toward the partner from intimacy as a subjective *feeling*. Additional analyses on the temporal unfolding of the association between touch and intimacy show that this association only holds within the time frame of one report (i.e., about four hours). Touch and intimacy seem to be closely associated cross-sectionnally, but our data did not indicated that one direction of this association was stronger than the other. Thus, one can assume that the concurrent association may be bidirectional and that a virtuous cycle may take place between touch and intimate feelings (Canevello & Crocker, 2010). Moreover, the fact that touch can communicate several emotions (among them love and sympathy; Hertenstein, Holmes, McCullough, & Keltner, 2009) further supports the possible influence of touch on intimacy. The exact temporal association of touch and intimacy should be investigated into more details in further research, for example using a live observational setting of couples' interactions or experimental manipulation.

The reported data suggest that the health benefits of responsive touch are likely to also involve psychological pathways. Massage has been found to have favorable effects on mood

and to reduce depression and anxiety symptoms (Field, Diego, & Hernandez-Reif, 2007; Moyer, Rounds, & Hannum, 2004). Beyond the physical effects of massage in a professional context, touch displayed within romantic relationships has the potential to convey a message of responsiveness in addition to the mere physiological effects of the physical contact. Responsive touch represents a reaction to the partner's state and is a way to express care and affection. This responsiveness may probably be perceived as such by the target (Debrot et al., 2012; Lemay & Clark, 2008). Coan and colleagues (2006) reported that the positive effects of touching a hand while exposed to a stressor were stronger when it was the spouse's hand, as compared to a strangers' hand. Moreover, this effect was stronger the more satisfied the individuals were with the relationship with the hand-holding partner. The present data suggest that intimacy accounted for much, but not all of the association between responsive touch and enhanced affective state. Physical closeness can increase psychological closeness, and can therefore become associated with a broader variety of positive outcomes (e.g. Stadler, et al., 2012).

Touch represents a way to show one's partner one's care and attachment. Based on Sbarra and Hazan (2008)'s adult attachment perspective, one could argue that the positive effect of touch on affective state is a conditioned response of reward, related to experiences to the attachment figure, whereby the repeated contact with the partner is associated to a state of psychological security and physiological calm (Depue & Morrone-Strupinsky, 2005). This conditioned association may explain the positive impact on a moment to moment basis, but also in the long term. Physiological and psychological positive effects are likely to be closely tight and may reinforce each other. Investigation of interactions between physiological and psychological responses to interpersonal touch will be a promising avenue to increase our understanding of the effects of touch.

Positive Effects on the Touch Displayer

Accumulating evidence supports the notion that doing good to others is also beneficial for the self (Kogan et al., 2010; Lemay & Clark, 2008; Post, 2005). The present study showed that displaying responsive touch is beneficial for the displayer in the context of romantic relationships, as it also increases his/her affective state. Moreover, we could show that this effect was partially mediated by an increase in the displayer's intimacy toward the touched partner. Thus, touch—as displayed in couples' daily lives—seems to be a way to bring both partners together, to increase their mutual feelings of connectedness and in turn, to positively affect both partners' affective state. In the context of romantic relationships—as opposed to a professional setting of massage—, it is probably often not clear which partner is the touch displayer and which the receiver. Rather, caring touch appears as a genuine exchange between both partners, as indicated by the high correlation between both partner's responsive touch at the person's level.

Long-Term Effects of Partner Responsive Touch

The total amount of responsive touch displayed in daily life was associated with an enhanced psychological well-being in the partner in the long term. Meaning that above and beyond the common level of touch in couples, individuals with partners who report to responsively touching them more experience higher levels of wellbeing six months later. As the mean level of PWB was high in our sample and even higher at Time 1 than at Time 2, it may be that partner touch prevents a decrease in PWB rather than promoting increases. This association further underscores the health enhancing effects of positive relationships (Berkman, Glass, Brissette, & Seeman, 2000; Holt-Lunstad, Smith, Layton, & Brayne, 2010). Interestingly enough, this effect is not observable in concurrent associations between habitual responsive touch and wellbeing, showing that this association seems to be delayed.

To better understand the possible mechanisms behind these effects, it would be important to identify mediators, both on a psychological and physiological level. Leaning on Sbarra and Hazan's model (2008), it seems plausible to assume that factors such as relationship quality, perceived proximity of social resources (Coan et al., 2006) or a positive or idealized perception of the partner (Murray, Holmes, & Griffin, 1996) mediate the long-term benefits of touch.

Strengths, Limitations and Future Directions

The present study relied on an electronic diary method to investigate interpersonal emotion regulation in daily life. We can therefore assume ecological validity for the present results (Fahrenberg, Myrtek, Pawlik, & Perrez, 2007; Reis, 2012). The sample included mostly young, well educated, and relatively satisfied partners. The results may therefore not generalize adequately to the broader population and may not characterize distressed or clinical populations.

In most effects found in this study, significant variability at the person level remained to be explained. To this regard, it would be worth investigating whether the beneficial effects of touch are also found in avoidantly attached individuals. They are known for distrusting relationship partners' goodwill (Schachner et al., 2005). Therefore, one might expect that their reaction to responsive touch will not be always positive and might rather be negative. A similar pattern can be expected in distressed couples, where conflict history might affect the perception of the goodwill of a partner's touching behavior (Gottman, 1993). Relationship length or relational stage (Emmers & Dindia, 1995; Guerrero & Andersen, 1991), socio-economical level or cultural background may also moderate the effect of touch.

The study relies entirely on self-reported data. This leaves us with some doubt about inflated coefficients due to reporting bias. Another limitation is that although responsive touch was reportedly displayed as reaction to the partner's affective state, we do not know to which

(discrete) emotion exactly the touch was related. The conferred meaning and therefore the associations might differ according to which emotion or situation the partners are experiencing.

Finally, the current results are correlational and do not allow the identification of causal relationships. Rather, as the lagged analyses showed, it is possible that the associations found in this study are also likely to be valid in other configurations. For example, being in a good mood could promote more responsive touch toward the partner, as it could also encourage the partner to approach responsively. However, as we controlled for the outcome at the previous report, we can conclude that the present association found here indicate precedence, a necessary but insufficient condition of causality (Conner & Lehman, 2012).

Conclusion

Our results complement and extend previous research on the health benefits of a positive physical contact to a close partner. The study shows that the display of responsive touch has not only direct short-time effects on the affective state of the target of the touch, but also for the touch enacting partner. These positive effects on affective state were partially but significantly mediated by increased intimacy felt toward the partner and suggest that the benefits of a positive partner contact are not limited to the physiological effects and that quality of the bonds or the relationship is also an important vector. Furthermore, the amount of responsive touch displayed by the partner appears to be long-lasting, as reflected by increased psychological well-being of the target—an indicator of positive functioning. The route of physical closeness leading to psychological closeness and thereby enhancing positive affect may be an important pathway through which the health enhancing function of positive relationships can be explained (Berkman et al.,2000; Reis, Collins, & Berscheid, 2000).

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Tables

Table 1

Mean and Standard Deviation of and Intercorrelations (Pearson's r) between Men and Women's Average Scores over the Assessment Period

	Mean	SD	1	2	3	4	5
1. Valence of mood W	6.67	0.86					
2. Valence of mood M	6.56	0.91	**0.22***				
3. Responsive touch W	2.7	0.79	0.13	**0.30****			
4. Responsive touch M	2.48	0.94	**0.17$^+$**	0.47***	**0.61****		
5. Intimacy W	3.05	0.60	0.49***	**0.37****	0.37***	**0.31****	
6. Intimacy M	3.05	0.61	**0.26****	0.48***	**0.30****	0.41***	**0.63****

Note. N = 102 men and 102 women. The correlations between the dyad members are in bold.

M = men, W = women. $^+$ p < .1, * *p* < .05, ** *p* < .01, *** p < .001 (two tailed).

Table 2.

Betas, Standard Errors and Variances of the Multivariate Multilevel Model.

Predictor	Predicting mood		Predicting intimacy	
	β	*Variance of the effect at Level 1*	β	*Variance of the effect at Level 1*
Intercept	5.697 (.141)***	.510 (.071)***	2.38 (.060)***	.170 (.020)***
Previous outcome	.124 (.018)***	-	.209 (.015)***	-
Actor responsive touch	.156 (.024)***	.001 (.011) *n.s.*	.163 (.012)***	.015 (.003)***
Partner responsive touch	.070 (.023)**	.001 (.001) *n.s.*	.067 (.008)***	.003 (.008) *n.s.*
Actor intimacy	.662 (.076)***	.295 (.076)***	-	-

Note. N = 102 men and 102 women. Standard errors are shown in brackets.

** $p < .01$, *** $p < .001$, *n.s.*: non significant. Effects were set equal between genders.

Table 3.

Responsive touch as a predictor of Psychological Well-Being over six months

Predictor	Actor's PWB at Time 1		Partner's PWB at Time 1		Actor's PWB at Time 2		Partner's PWB at Time 2	
	β	*Stand. β*	β	*Stand. β*	β	*Stand. β*	β	*Stand. β*
Mean daily responsive touch	.075 (043)[+]	W: .133/M: .160	.022 (.043) *n.s.*	W: .040/ M: .047	-.053 (.034) *n.s.*	W: -.094/ M: -.071	**.094 (.035)**[**]	W: **.140/**
PWB at Time 1	-		-		.999 (.055)[***]	W: .758/ M: .828	.000 (.055) *n.s.*	W: .000/

Note. N = 102 men and 102 women. In brackets is the standard error. PWB = Psychological Well-Being, M = men, W = women.

[+] p < .1, ** *p* < .01, *** p < .001, *n.s.*: non significant. *Stand.* = standardized. Effects were set equal between genders.
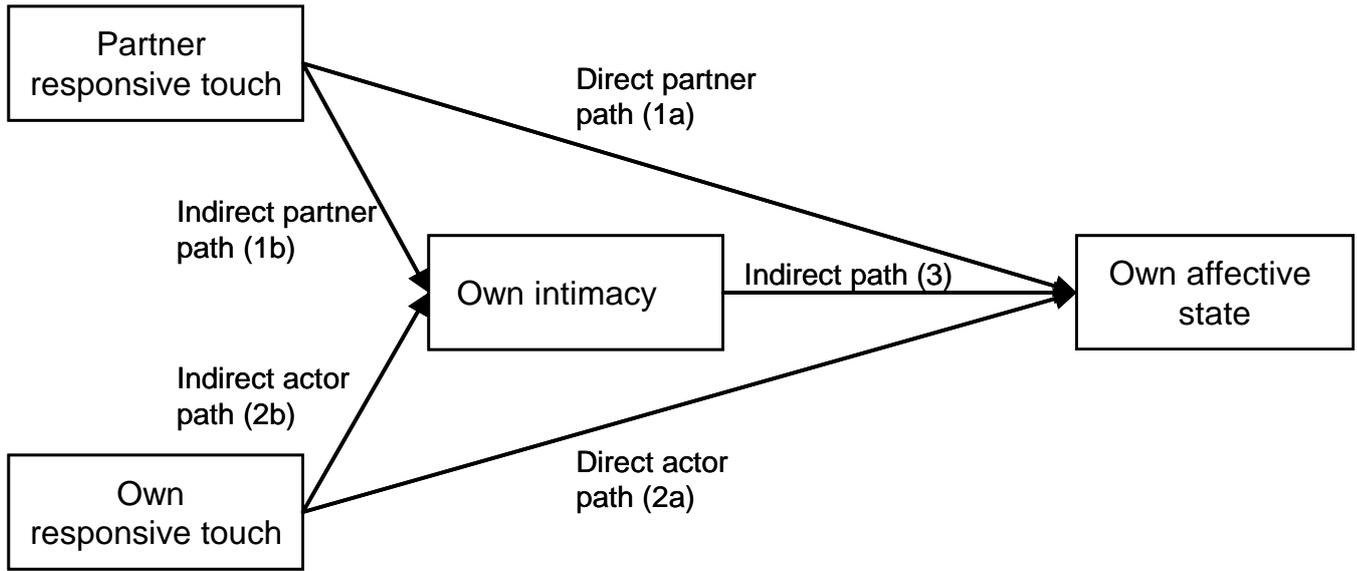
Figure 1. Daily mediation model.

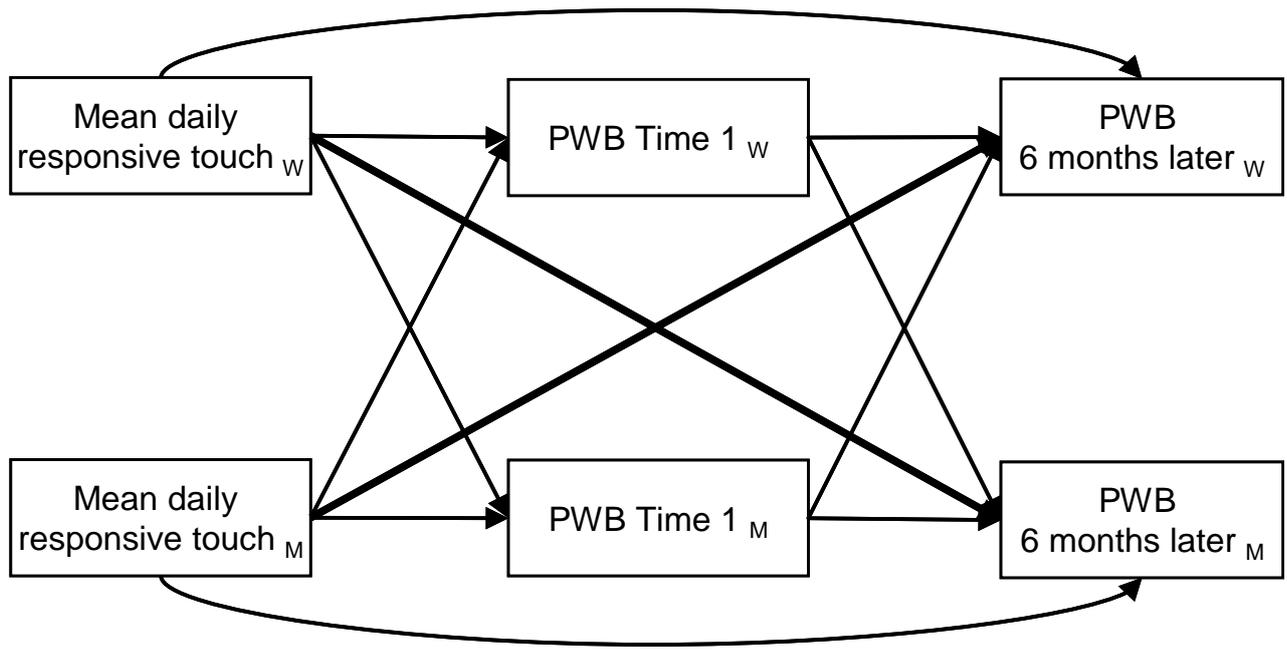*Figure 2*. *Responsive touch as a predictor of Psychological Well-Being over 6 months*

W = woman; M = man.