

המרכז הבינתחומי הרצלייה

בית הספר לפסיכולוגיה

תכנית תואר מוסמך בפסיכולוגיה חברתית

משדרים על אותו הגל: תפקידו של סנכרון בין אישי בחוויה של אינטימיות בין בני זוג במערכת יחסים

רומנטית

הילה שרון

עבודה זו מוגשת כחלק מהדרישות לשם קבלת תואר מוסמך

בפסיכולוגיה חברתית בבית ספר ברוך איבצ'ר לפסיכולוגיה של המרכז הבינתחומי, הרצלייה

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עבודה זו נכתבה תחת הנחייתן המשותפת של פרופ' גורית בירנבוים וד"ר יוליה גולנד מתכנית לתואר שני בפסיכולוגיה חברתית, בית הספר לפסיכולוגיה, המרכז הבינתחומי הרצלייה.

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סנכרון בינאישי מוטורי, הנטייה של שני אנשים ויותר לתאם את תנועותיהם בזמן ובמרחב, ידוע כמנגנון חיוני ליצירת קרבה וחיבור חברתי. למרות שסנכרון מוטורי בין שותפים לאינטראקציה זוהה בספרות הקלינית כמרכיב באינטראקציה, אשר מעיד על מערכת יחסים קרובה ומוצלחת, תפקידו בהקשר של חוויית האינטימיות טרם נבחן באופן אמפירי. סדרת ארבעת המחקרים הנוכחית בחנה האם סנכרון בינאישי עשוי לתרום לתחושה של אינטימיות הן בין שותפים זרים לאינטראקציה והן בקרב בני זוג במערכת יחסים רומנטית. במחקר 1 שלושים זוגות של משתתפות ללא היכרות מוקדמת ביניהן שוחחו על אירוע חיובי (רגשי) או ניטראלי ודיווחו לאחר מכן על תחושות האינטימיות שהן חוו. מידת הסנכרון המוטורי ביניהן נמדדה בזמן השיחה. במחקר 2 עשרים ושש זוגות משתתפות ללא היכרות מוקדמת ביניהן דיווחו על אופניים באופן מסונכרן (דיווח באותו הקצב) או לא מסונכרן (דיווח במקצבים שונים), בעודן משוחחות על אירוע אישי. לאחר מכן הן דיווחו על מידת האינטימיות שחשו במהלך האינטראקציה. במחקרים 3 ו-4 נבחנה ההשפעה של אינטראקציה מסונכרנת לעומת אינטראקציה לא מסונכרנת על תפישות של אינטימיות ותשוקה בקרב משתתפים המעורבים במערכת יחסים רומנטית. התוצאות הצביעו על כך שהיבטים שונים של אינטימיות בין שותפים לאינטראקציה היו גבוהים יותר באופן מובהק לאחר אינטראקציה מסונכרנת לעומת אינטראקציה לא מסונכרנת. ממצאים אלו מדגישים את החשיבות של סנכרון בין אישי כמרכיב לא-מילולי, אשר עשוי לתרום להיבטי ליבה במערכת היחסים הרומנטית, בפרט ליצירת קרבה ואינטימיות, החיוניים לשימור מערכות יחסים לאורך זמן.

**Abstract**

Motor interpersonal synchronization, the natural phenomenon of temporal alignment of simple motor periodic behaviors between partners, is recognized as an essential mechanism contributing for feelings of closeness and connectedness during social interactions. People tend to synchronize with each other during ordinary activities, such as breathing, walking, and cycling. Although motor synchrony between partners has been considered in the clinical literature as an indication of successful close relationships, its influence on the experience of intimacy has not been established yet. Four studies examined whether motor synchrony instilled a sense of intimacy in both strangers and romantically involved individuals. In Study 1, same-sex strangers discussed positive or neutral events while their motion synchrony and closeness were measured. In Study 2, same-sex strangers pedaled bicycles either in synchronous or in asynchronous rhythms while discussing a personal event, and then rated how intimate they felt. In Studies 3 and 4, the effect of synchronized versus unsynchronized interactions on perceptions of intimacy and desire was assessed among romantically involved participants. Results showed that varied aspects of intimacy between dyad members were higher following synchronized versus unsynchronized interactions, suggesting that synchrony serves as a non-verbal mechanism that promotes closeness in intimate situations. Overall, our research suggests that synchrony plays a role in attachment formation and maintenance through boosting perception of intimacy.

Being on the Same Wavelength: Behavioral Synchrony between Partners and its Influence on  
the Experience of Intimacy

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Abstract

Although synchrony between partners has been considered in the clinical literature as an indication of successful close relationships, its influence on the experience of intimacy has not been established yet. Four studies examined whether synchrony, temporal alignment of simple motor periodic behaviors between partners, might instill a sense of intimacy. In Study 1, same-sex strangers discussed positive or neutral events while their motion synchrony and closeness were measured. In Study 2, same-sex strangers pedaled bicycles either in synchronous or in asynchronous rhythms while discussing a personal event, and then rated how intimate they felt. In Studies 3 and 4, the effect of synchronized versus unsynchronized interactions on perceptions of intimacy and desire was assessed among romantically involved participants. Results showed that varied aspects of intimacy between dyad members were higher following synchronized versus unsynchronized interactions, suggesting that synchrony serves as a non-verbal mechanism that promotes closeness in intimate situations. (149 words)

*Key words:* behavioral coordination; desire; interpersonal synchrony; intimacy; romantic relationships

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Influence on Perceptions of Intimacy

During social interactions, people tend to coordinate their movements and become synchronized (Schmidt & Richardson, 2008). For example, individuals spontaneously synchronize their footsteps when walking side-by-side (Mottet, Guiard, Ferrand, & Bootsma, 2001), orchestrate the swing of their postures when conversing (Shockley, Santana, & Fowler, 2003), and fall into synchronous patterns when tapping together (Kelso, 1981). Such interpersonal motor synchrony is grounded in continuous sensory-motor coupling of the interacting individuals (Knoblich, Butterfill, & Sebanz, 2011; Konvalinka, Vuust, Roepstorff, & Frith, 2010; Noy, Levit-Binun, & Golland, 2015; Semin & Smith, 2013), leading to representational overlap between the self and the other (Paladino, Mazzurega, Pavani, & Schubert, 2010).

Within this context, synchrony may create a sense of “oneness” that fulfills both partners' inherent need for closeness (Smith, 2008; Vacharkulksemsuk & Fredrickson, 2012). Moreover, it has been shown to elicit meaningful social consequences, boosting connectedness and rapport (e.g., Hove & Risen, 2009; Noy et al., 2015). As such, it may contribute to relationship maintenance (Burgoon, Stern, & Dillman, 2007; Smith, 2008) and be particularly beneficial for attachment formation and maintenance in romantic relationships. Indeed, synchrony between romantically involved individuals has long been considered in the clinical literature as an indication of successful close relationships (Cappella, 1997; Gottman, Markman, & Notarius, 1977). Surprisingly, however, the influence of motor synchrony on the experience of intimacy has not been experimentally established yet. The present research attempts to fill this void by examining whether interactional motor synchrony instills perceptions of intimacy among both strangers and romantic partners.

### **Synchrony and its Contribution to Perceptions of Intimacy**

People have an automatic tendency to synchronize with others, anticipating their behaviors and coordinating movement in time during various types of social interactions

(Riley, Richardson, Shockley, & Ramenzoni, 2011; Sebanz, Bekkering, & Knoblich, 2006; Schmidt & Richardson, 2008). Although interpersonal synchrony is an automatic behavioral tendency that has no explicit intention or affective content (Oullier, De Guzman, Jantzen, & Kelso, 2003; Schmidt, Fitzpatrick, Caron, & Mergeche, 2011), it may serve the social function of binding individuals together into a larger whole (e.g., Wilson, Van Vugt, & O’Gorman, 2008). This notion has gained support from research showing that individuals who engage in motor synchrony experience an elevated sense of joint identity and exhibit more cooperation and compassion, possibly because they experience a greater overlap between self and other (Hove & Risen, 2009; Valdesolo & DeSteno, 2011; Valdesolo, Ouyang, & DeSteno, 2010; Wiltermuth & Heath, 2009). Indeed, during interpersonal synchrony, when self- and other-produced actions are highly aligned in time and in form, the neural processes associated with perceptions of self and others closely overlap (Hasson, Ghazanfar, Galantucci, Garrod, & Keysers, 2012). This overlap may hinder the ability to discriminate self- versus other-produced movement, thereby obscuring the self-other distinction (Georgieff & Jeannerod, 1998) and inducing feelings of closeness (Galinsky, Martorana, & Ku, 2003).

The spontaneous capacity for time-sensitive interpersonal synchrony apparently has its roots in early childhood. Studies have indicated that mothers' and their infants' rhythmic cycles naturally synchronize with each other (e.g., Bernieri, Reznick, & Rosenthal, 1988; Feldman, 2006; Isabella & Belsky, 1991; Isabella, Belsky, & van Eye, 1989; Reyna & Pickler, 2009). The early rise of interpersonal motor synchrony, along with its prevalence and robust social consequences, suggest that it facilitates social interactions with caregivers by satisfying the need for connection, physical safety, and affection (Cappella, 1991; Condon, 1980; Condon & Sander, 1974).



A similar view is offered by the coordination-rapport hypothesis, postulating that the extent of coordination enacted by partners is associated with meaningful relationship outcomes, such as rapport, attraction, and connectedness (Tickle-Degnen & Rosenthal, 1987). Past research has provided supportive, but inconclusive, evidence for this contention. For example, in mock student-teacher interactions, as well as among stranger dyad members, partners' ratings of rapport correlated with outside observers' ratings of motion synchrony (Bernieri, 1988; Bernieri, Davis, Rosenthal, & Knee, 1994). Critics contend, however, that observers' ratings might indicate the positivity of the interaction rather than its synchrony *per se* (Capella, 1990; Hove & Risen, 2009). Furthermore, the correlational design of these studies precludes conclusions about causal connections between synchrony and liking (but see Hove & Risen, 2009).

Additional evidence for the coordination-rapport hypothesis comes from studies that have demonstrated the contribution of other forms of interpersonal coordination, such as behavioral mimicry, to social connectedness and rapport (e.g., Chartrand & Bargh, 1999; Lakin, Jefferis, Cheng, & Chartrand, 2003). However, although mimicry and synchrony involve matching of behaviors between two people, they are not isomorphic, and may thus affect perceptions of rapport for different reasons. For example, responding to an individual's action with another equivalent action may indicate affiliative intent. Simple motor synchrony, in contrast, has no intention or affective content, but requires continuous matching in time, which may engender a sense of overlap between perceptions of self and the other (Georgieff & Jeannerod, 1998; Paladino et al., 2010). In addition to focusing on different constructs, none of these studies has examined the coordination-intimacy link within the context of ongoing romantic relationships, in which intimacy-related processes may be especially pronounced.

Previous studies that did focus on romantic relationships have revealed, for example, that happily married couples exhibit more responsive body language than dissatisfied couples do during marital problem-solving discussions (e.g., Julien, Brault, Chartrand, & Begin, 2000). Based on these findings, it has been suggested that synchrony regulates levels of intimacy in close relationships (Julien et al., 2000). Unfortunately, these studies suffer from similar methodological problems as research on synchrony in non-romantic dyads (e.g., correlational designs, failure to assess various expressions of intimacy between partners). In addition, these studies could not rule out a sentiment override explanation, as they assessed behavior coordination by couples' behavioral reciprocity (e.g., responding to a smile with a smile), which may signify approach motivation.

### **The Present Research**

The present research sought to deepen the current understanding of the effects of interpersonal motor synchrony on the experience of intimacy among both strangers and romantic partners, while addressing the limitations of past research. In the first two studies, we examined the effect of interpersonal motor synchrony on various aspects of intimacy (e.g. perceived responsiveness, closeness, empathy) during interaction embedded in an affective context (i.e., situations that involve self-disclosure; Jourard, 1959). Within such a context, people are particularly likely to strive for a sense of “connectedness” both psychologically and behaviorally and to monitor for non-verbal cues of such connectedness (Vacharkulksemsuk & Fredrickson, 2012).

In Study 1, we assessed the association between spontaneous motor synchrony and reported intimacy in same-sex dyads of strangers who were pedaling on two stationary bicycles, while one of the dyad members was disclosing either a positive (affective) or a neutral event. In Study 2, we assessed the causal effect of motor synchrony on reported intimacy in same-sex strangers who pedaled bicycles either in synchronous or in

asynchronous rhythms while one of them was disclosing a personal event. We hypothesized that the previously documented associations between synchrony and rapport (Bernieri et al., 1988; Bernieri et al., 1994; Bernieri, Gillis, Davis, & Grahe, 1996; Hove & Risen, 2009; Noy et al., 2015) would be extended to other aspects of intimacy and would be more pronounced in an affective context than in a neutral, non-affective context. We also hypothesized that levels of felt intimacy would be higher following synchronized interactions than following unsynchronized interactions. Importantly, unlike studies on behavioral reciprocity (e.g., Julien et al., 2000; Margolin & Wampold, 1981), the spontaneous (Study 1) and induced (Study 2) motor synchrony in the present study was irrelevant to the interaction (i.e., within this context, biking does not convey "contact readiness"), allowing to avoid a sentiment override explanation.

In the next two studies, we investigated the effect of motor synchrony on intimacy within romantic relationships. In Study 3, partnered participants rated how intimate they felt with their partners following an imagery task that involved either a synchronized or an unsynchronized walking interaction with them. In Study 4, we manipulated synchrony using a different methodology. Specifically, partnered participants engaged in a simulated synchronized or unsynchronized breathing interaction with their partner. Then, they rated how intimate they felt with their partner and described a sexual fantasy in a narrative form, which was coded for closeness and desire themes. Sexual fantasies were used because they provide a window through which hidden desires and feelings might be tracked (Birnbaum, 2007; Birnbaum, Mikulincer, & Gillath, 2011) and may thus serve as a more implicit measure of intimacy between partners. We hypothesized that engaging in synchronized non-affective behavior (i.e. walking or breathing in sync) would boost intimacy and desire within romantic relationships.

### **Study 1**

Study 1 was designed to examine whether interpersonal synchrony was associated with perceiving an interaction as more intimate in an affective but not in a neutral context. To test this hypothesis, dyads of same-sex unacquainted individuals were pedaling, facing each other, on two stationary bicycles with a shared front wheel, while one of the dyad members ("the discloser") was disclosing either an affective or a neutral personal event. The other member ("the responder") was asked to listen attentively to the disclosure. Spontaneous motor synchrony was measured by the synchrony between dyad members' pedaling velocities. Following this procedure, both participants rated how close they felt to each other. In addition, the disclosing participants rated their perception of the responders' responsiveness, whereas the responding participants rated how empathetic they felt toward the disclosers.

Sample size was determined via a priori power analysis using G\*Power software package (Faul, Erdfelder, Buchner, & Lang, 2009) to ensure 80% power to detect effect size,  $f$ , of 0.40 at  $p < .05$ . This hypothesized effect size was based on the findings of previous research examining the effect of interpersonal synchrony on empathy and judgments of rapport (Koehne, Hatri, Cacioppo, & Dziobek, 2016; Miles, Nind, & Macrae, 2009). In this study, as well as in Studies 2, 3, and 4, all data were collected before any analyses were conducted; all data exclusions, manipulations, and variables analyzed are reported.

## Method

**Participants.** Sixty undergraduate female students from a university in central Israel participated in the study for course credit. Participants were paired with another participant whom they did not know. One member of each pair was randomly designated as "discloser" and the other member was designated as "responder." Disclosers ranged in age from 18 to 62 years of age ( $M = 25.20$ ,  $SD = 7.18$ ). Responders ranged in age from 17 to 54 years ( $M = 24.47$ ,  $SD = 5.95$ ). No significant differences were found between the experimental conditions for any of the socio-demographic variables.

**Measures and procedure.** Participants who agreed to participate in a study on mutual activities were randomly paired with another unfamiliar same-sex participant and were scheduled for a single 15-minute laboratory session. Prior to each session, dyads were randomly assigned to one of the two experimental conditions: affective versus neutral event disclosure. When each dyad arrived at the lab, they were greeted by a research assistant who asked them to mount the dual-bicycle experimental setup. At the practice phase, the participants were asked to ride the bicycles freely for 120 seconds. Following this practice, the research assistant explained that the study involved a disclosure of a recent personal event while riding the bicycles, and randomly assigned participants to the role of discloser or responder by flipping a coin. The research assistant then asked disclosers to disclose a recent personal positive or neutral event. The responders were instructed to listen attentively to the disclosure without interrupting it.

Instructions for the positive event disclosures followed procedures for studying supportive responses to personal event disclosures (Gable, Gonzaga, & Strachman, 2006) and were as follows: "*We would like you to choose some recent positive event from your life. This positive event may be something that happened to you recently or in the past that continues to make you happy, something going on now, or something you anticipate will happen in the future. Some examples could be receiving a good grade in a class, a work promotion, or a financial windfall. Please pick something that has been on your mind recently, no matter how big or small you may think it is. While you are interacting, please feel free to talk about anything related to the personal event. Some suggestions would be to discuss the circumstances surrounding the event, how you feel and what you think about it, and any other details or issues that you think are important, such as the implications of this event for your life.*"

Instructions for the neutral event disclosures were adapted from Birnbaum and her colleagues (Birnbaum, Svitelman, Bar-Shalom, & Porat, 2008; Birnbaum, Weisberg, & Simpson, 2011) and were as follows: *"Please think about the last time you went to the grocery store and try to relive this experience in your mind as much as you can. While you are interacting, please feel free to talk about anything related to this event and describe it in detail and comprehensively. Describe the route you took to the grocery store, what you bought and why, what you noticed during the shopping experience, the store itself, and the way back home."*

The disclosers then talked about the event for three minutes, while both disclosers and responders rode on the experimental bicycles. Motion synchrony was measured using an experimental setup of dual semi-bicycles. The setup was composed of two stationary bicycles that were fitted with a shared front wheel, such that the riders were facing each other as they were pedaling (at a distance of 1 meter). The back wheels were heightened to allow pedaling in a stationary manner. Each participant's leg strokes activated only the back wheel, so that each could ride at her own pace. The wheels were connected to a measuring device that sampled the stroke velocity at 2HZ.

To assess motion synchrony, a zero-order correlation was computed between the two individual velocity time series. Synchrony scores were computed for the first two minutes of the riding, after excluding the initial 15 seconds in order to adjust for initial acceleration period. This exclusion was done both for the first practice session (spontaneous synchrony) and for the second interaction session. To assess interaction synchrony while controlling for spontaneous synchrony between dyad members, the synchrony scores during practice were subtracted from the synchrony scores during the interaction for each dyad.

Following the biking session, both partners reported on the level of closeness they felt toward each other by rating six items (e.g., "I would like to get closer to the other

participant”; "I would like to get to know the other participant better"; "I would like to be the other participant's friend"). The six items were internally reliable ( $\alpha = .94$ ) and were thus averaged to form a global rapport index. Higher scores indicated greater rapport. The disclosers also completed four items from the Hebrew version of the Perceived Responsiveness Scale (e.g., “The other participant was aware of what I am thinking and feeling”; “The other participant really listened to me”) to assess perceptions of how understood, validated, and cared for they felt while interacting with the responder (Reis, Maniaci, Caprariello, Eastwick, & Finkel, 2011). This scale was translated into Hebrew by Birnbaum and Reis (2012), who also validated its structure on an Israeli sample. The scale was factorially unidimensional and internally consistent ( $\alpha = .78$ ) in our sample. Higher scores indicated greater perceived partner responsiveness.

The responders rated the extent to which the disclosure was touching ("I found the disclosure touching"). This affectivity measure served as a manipulation check. The responders also completed two items developed by Davis (1983) to assess how empathetic they felt to the disclosers (e.g., "I identified with the discloser during the interaction"; "I could place myself in the discloser's shoes";  $r = .34, p = .06$ ). All items were rated on a seven-point Likert scale, ranging from 1 (*not at all*) to 7 (*very much*). Finally, both partners provided demographic information (age, years of education) and were then carefully debriefed.

## Results and Brief Discussion

**Manipulation check.** A t-test on the affectivity measure yielded the expected effect,  $t(28) = 4.17, p < .001, Cohen's d = 1.52, 95\% CI for Cohen's d [0.69, 2.33]$ : Affectivity levels were higher in the affective event condition ( $M = 5.00, SD = .85$ ) than in the neutral event condition ( $M = 2.80, SD = 1.85$ ).

**Preliminary analysis.** Zero-order correlations and additional descriptive statistics for each of the experimental conditions are presented in Table 1. As hypothesized, synchrony was

significantly associated with perceived responsiveness and empathy only in the affective event condition. No significant correlations were found between synchrony and any of the intimacy-related variables in the neutral event condition.

**Primary analysis.** A series of multiple regression analyses was conducted to examine whether event type (affective, neutral) moderated the associations of synchrony with intimacy-related variables. Using the PROCESS macro in IBM SPSS (Hayes, 2013), a two-way design was modeled (i.e., Synchrony  $\times$  Event Type). All predictors were mean-centered prior to the analysis. Specifically, three separate regression analyses were conducted, one for each of the intimacy variables (rapport, empathy, and perceived partner responsiveness). Following Kenny, Kashy, and Bolger's (1998) recommendation for samples of less than 36 dyads, we used dyad averages to assess whether the experimental manipulations interacted with synchrony to predict levels of dyads' experienced rapport.

As can be seen in Table 2, the first analysis revealed a significant interaction between synchrony and event type for empathy, such that synchrony predicted higher levels of empathy in the affective event condition,  $B = 3.34$ ,  $SE = 1.76$ ,  $t = 1.91$ ,  $p < .07$ ,  $95\% CI = [-1.28, 7.92]$ , but not in the neutral event condition,  $B = -2.3$ ,  $SE = 1.55$ ,  $t = -1.5$ ,  $p = .15$  (see Figure 1). The second analysis revealed that the interaction between synchrony and event type was not significant for perceived partner responsiveness. However, the simple effect of synchrony on perceived responsiveness approached significance in the affective event condition,  $B = 2.83$ ,  $SE = 1.49$ ,  $t = 1.90$ ,  $p = .07$  (but not in the neutral condition,  $B = .64$ ,  $SE = 1.31$ ,  $t = .49$ ,  $p = .63$ ). The third analysis revealed that the interaction between synchrony and event type was not significant for rapport; however, the simple effect of synchrony on rapport was marginally significant in the affective event condition,  $B = 2.42$ ,  $SE = 1.33$ ,  $t = 1.82$ ,  $p = .08$  (but not in the neutral condition,  $B = .41$ ,  $SE = 1.17$ ,  $t = .35$ ,  $p = .73$ ).



Table 1

*Descriptive Statistics and Zero-Order Correlations between Interpersonal Synchronization, Rapport, Empathy, and Perceived Partner Responsiveness in the Experimental Conditions (Study 1)*

Variables	Positive Affective Event						Neutral Event					
	M	SD	1	2	3	4	M	SD	1	2	3	4
1. Synchrony	.001	.21	-				.066	.24	-			
2. Rapport	5.38	1.06	.48	-			5.87	1.07	.09	-		
3. Empathy	4.60	.80	.62*	.41	-		3.87	1.42	-.25	.36	-	
4. Perceived Responsiveness	5.15	.94	.63*	.55*	.62*	-	5.12	1.41	.11	.63*	.02	-

*Note.* N = 30 dyads. \*  $p < .05$ . All items were rated on a 7-point Likert scale.

Table 2  
*Predicting Empathy, Perceived Partner Responsiveness, and Rapport from Interpersonal Synchronization and Event Type (Study 1)*

	Empathy				Perceived Responsiveness				Rapport			
	B	SE	95% CI	$\beta$	B	SE	95% CI	$\beta$	B	SE	95% CI	$\beta$
Synchrony	.52	1.17	[-1.89, 2.93]	.08	1.74	.99	[-.31, 3.78]	.33	1.41	.89	[-.41, 3.24]	.29
Event Type	.04	.51	[-1.01, 1.08]	.01	.15	.43	[-.73, 1.03]	.07	-.40	.38	[-1.19, .39]	-.19
Sync * Event Type	5.65*	2.34	[.84, 10.47]	.44	2.19	1.99	[-1.90, 6.27]	.21	2.01	1.77	[-1.63, 5.66]	.21

Note.  $N = 30$  dyads. \*  $p < .05$ .

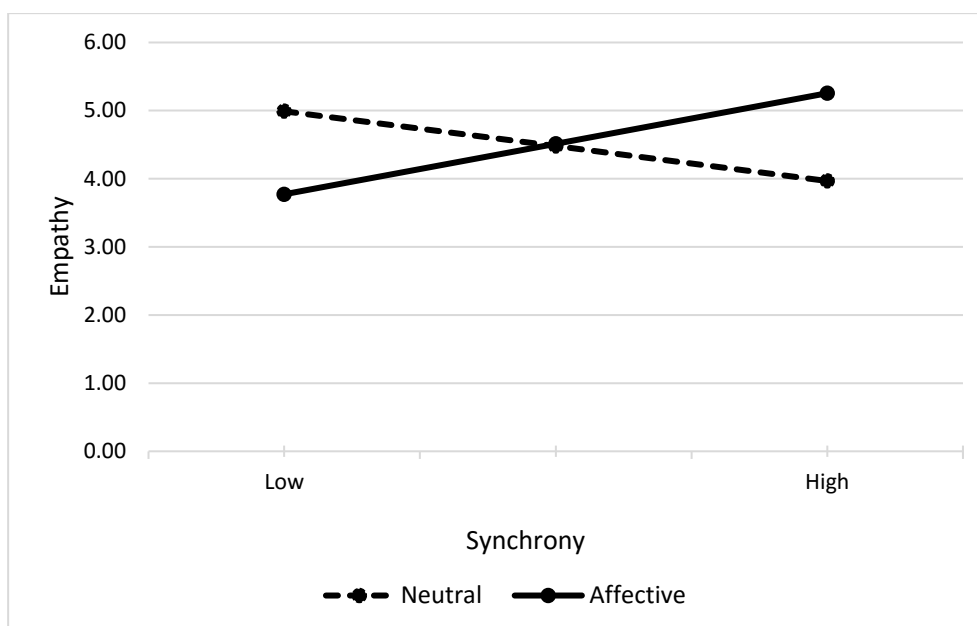


Figure 1. The association between synchrony and empathy in neutral and affective event disclosures (low and high refer to values  $-1$  and  $+1$  standard deviations from the mean, respectively).

Overall, the findings of Study 1 were in line with our predictions. Synchrony was associated with higher levels of intimacy during an affective interaction, but not during a neutral interaction. These findings support and extend previous research by indicating under which conditions motor synchrony is more likely to predict the experience of intimacy. Specifically, the findings suggest that synchrony is likely to instill a sense of intimacy when interpersonal goals aimed at forming close relationships are relatively salient. In such cases, people's heightened need for responsiveness may lead them to rely on the primal, non-verbal cues that signify others' interest in closeness. Still, one limitation of Study 1 is that it could not establish the causal connection between synchrony and the experience of intimacy. For example, it could be claimed that individuals who are more responsive tend to exhibit higher levels of spontaneous synchrony. Study 2 addressed this limitation.

## Study 2

In Study 2, we sought to establish a causal link between synchrony and intimacy during an affective interaction. To do so, we experimentally manipulated the synchrony between dyad members while they were pedaling on two stationary bicycles. Specifically, one member of each dyad was asked to disclose a recent positive event, and the other member listened to the story attentively, while riding bicycles either synchronously (in the in-sync condition) or non-synchronously (in the out-of-sync condition). Following the disclosure, the participants rated their perceptions of rapport, partner responsiveness (disclosers), and empathy (responders).

### Method

**Participants.** Fifty-two undergraduate female students from a university in central Israel participated in the study for course credit or in exchange for 30 NIS (about \$8.00 U.S.). Sample size was determined via a priori power analysis using G\*Power software package (Faul et al., 2009) to ensure 95% power to detect effect size,  $f$ , of 0.40 at  $p < .05$ . Participants were paired with another participant whom they did not know. One member of each pair was randomly designated as “discloser,” and the other member was designated as “responder.” Disclosers ranged in age from 18 to 48 years of age ( $M = 24.88$ ,  $SD = 5.15$ ). Responders ranged in age from 18 to 35 years ( $M = 23.33$ ,  $SD = 2.86$ ). No significant differences were found between the experimental conditions for any of the socio-demographic variables.

**Measures and procedure.** Participants followed the same initial procedure as in Study 1, with the exception that dyads were randomly assigned to participate in one of the two experimental conditions: out-of-sync versus in-sync bicycle riding. In the out-of-sync condition, dyads rode the bicycles simultaneously by cycling to different sound rhythms that were transmitted to each participant via headphones. In the in-sync condition, dyads rode the bicycles simultaneously by cycling to an identical sound rhythm, which led to a synchronized

riding session. To equate the riding rhythms across conditions, same number of participants in each condition rode in tune with either 70 or 90 bpm rhythm. Critically, the responder and discloser's rhythms matched in the in-sync condition and did not match in the out-of-sync condition. Pre-experimental pilots validated that the riding speeds were comfortable and that it was possible to concurrently listen to an audio tempo and disclose a personal event (or attend to it).

The participants were asked to practice riding the bicycles in tune with audio rhythm for 5 minutes. Then, a research assistant randomly assigned participants to the role of discloser or responder by flipping a coin. The disclosers then talked about the event for three minutes, while both disclosers and responders were riding the experimental bicycles either to the in-sync or out-of-sync sound rhythms. After dismounting the bicycles, participants completed the same measures described in Study 1: Both partners completed items assessing their perceptions of rapport ( $\alpha = .78$ ), the disclosers completed items assessing their perceptions of the responder's responsiveness ( $\alpha = .78$ ), and the responders completed items assessing their empathy toward the discloser ( $r = .45, p < .001$ ). Finally, both partners provided demographic information and were then carefully debriefed.

## **Results and Brief Discussion**

**Manipulation check.** A t-test on the synchrony between dyad members yielded the expected effect,  $t(50) = 3.87, p < .001, Cohen's d = 1.07, 95\% CI for Cohen's d [.49, 1.65]$ : Dyad members in the in-sync condition were more synchronized with each other ( $M = .27, SD = .17$ ) than dyad members in the out-of-sync condition ( $M = .10, SD = .12$ ).

**Primary Analysis.** To determine whether differences existed between the in-sync and out-of-sync conditions in rapport, empathy, and perceived partner responsiveness, a one-way multivariate analysis of variance (MANOVA) for synchrony conditions was performed on these three measures. This MANOVA yielded a significant difference between synchrony

conditions, *Hotelling's Trace* = 0.22,  $F(3,48) = 3.45$ ,  $p = .024$ ,  $\eta^2 = .18$ , 95% CI for  $\eta^2$  [0, .33]. The univariate analysis indicated that this effect was significant for all intimacy-related measures, such that synchronized cycling led to higher levels of rapport, empathy, and perceived partner responsiveness than unsynchronized cycling (see Table 3 for means, standard deviations, and statistics).

Table 3

*Means, Standard Deviations, Statistics, and Effect Sizes of Rapport, Empathy, and Perceived Partner Responsiveness for the In-Sync and Out-of-Sync Conditions (Study 2)*

	In-sync		Out-of-sync		$F_{(1, 48)}$	$\eta^2$	95% CI for $\eta^2$
	M	SD	M	SD			
Rapport	5.43	.98	4.40	1.6	8.06**	.14	[.01, .32]
Empathy	5.84	.82	5.04	1.31	7.00*	.13	[.01, .30]
Perceived Responsiveness	5.34	1.17	4.61	1.39	4.24*	.08	[0, .25]

*Note.*  $N = 26$  dyads. \*  $p < .05$ , \*\*  $p < .01$ . All measures were rated on a 7-point Likert scale.

These findings replicated and extended the findings of Study 1 by showing causal links between motor synchrony and expressions of intimacy. The only study that manipulated synchrony and examined its effect on rapport focused on how much participants liked the interactional partner following the synchronization session (Hove & Risen, 2009). Here we significantly extended the scope of synchrony-driven effects on the experience of intimacy and showed that beyond rapport, motor synchrony enhanced empathy and perceptions of responsiveness between previously unacquainted individuals. Particularly notable is the

finding that in the synchronized condition, disclosers perceived their partners to be more responsive than in the out-of-sync condition. Past research has already demonstrated the central role of perceived partner responsiveness in intimate relationships, signifying the partner's specific awareness of who one is and what one truly wants (Birnbaum & Reis, 2012; Reis & Clark, 2013), thus powerfully facilitating emotional bonding (Birnbaum, Reis, Mizrahi, Kanat-Maymon, Sass, & Granovski-Milner, 2016). To the best of our knowledge, this is the first study to investigate and show the positive effects of non-verbal motor coordination on perceived responsiveness in a social context, suggesting that synchrony can induce a deep sense of closeness even in a brief affective interaction between two strangers.

### **Study 3**

Study 3 was designed to examine whether the findings of Studies 1 and 2 would generalize to romantic relationships. The effect of simple motor synchrony on the perception of intimacy within the context of romantic relationship has not been studied yet. Previous studies have mainly focused on emotional coordination between romantic partners (e.g., Julien et al., 2000; Margolin & Wampold, 1981; Pike & Sillars, 1985), showing that satisfied couples are more likely than dissatisfied couples to reciprocate positive behaviors (Julien et al., 2000). However, because positive affective behaviors, as well as their reciprocity, may serve as powerful social signals of approach motivation, one cannot rule out the possibility that the resulting positive reaction to such behaviors spills over to affect satisfaction with the relationship. Here we aimed to study the direct casual effect of non-affective motor synchrony on intimacy in romantic relationships. To do so, romantically involved participants heard the sound of either coordinated or uncoordinated footfalls and were asked to imagine themselves walking side-by-side with their partner. Following this imagery task, participants rated how intimate they felt with their partner.

### **Method**

**Participants.** One hundred twenty-four undergraduate students (60 women, 64 men) from a university in central Israel participated in the study for course credit or volunteered for the study without compensation. Sample size was determined via a priori power analysis using G\*Power software package (Faul et al., 2009) to ensure 80% power to detect effect size,  $d$ , of 0.50 at  $p < .05$ . Participants ranged in age from 20 to 59 years of age ( $M = 27.37$ ,  $SD = 6.96$ ). All participants were currently involved in a romantic relationship. No significant differences were found between the experimental conditions for any of the socio-demographic variables.

**Measures and procedure.** Participants who agreed to participate in a study on mutual activities were scheduled for a single 15-minute laboratory session. Prior to each session, participants were randomly assigned to one of the two experimental conditions: imagining walking side-by-side with their partner either in-sync or out-of-sync. When participants arrived at the lab, they were greeted by a research assistant who asked them to listen through headphones to a guided imagery recording and imagine themselves in the described scenario. In both conditions, the first part of the recording verbally described the participants walking side-by-side with their partner on an esplanade.

After 120 seconds, the participants were told that they were going to hear the sounds of their and their partner's footsteps. Following the procedure of Miles et al. (2009), for the next 60 seconds, the participants heard either the sound of coordinated footfalls (in-sync condition) or uncoordinated footfalls (out-of-sync condition). Specifically, they heard a stereo audio recording of the footsteps of an adult male walking in hard-soled shoes and of an adult female walking in high-heel shoes on a firm surface at a comfortable pace (i.e., 100 steps per minute). To create the impression of two individuals walking together (i.e., two sets of footsteps), one channel of the recording was time-shifted, producing a delay between channels in terms of the onset of each step. In the out-of-sync condition, the relative phase relationship



between the footsteps was manipulated by randomly varying the amount of delay (50–600 ms) between the two channels.

Following the audio session, participant completed five items, which served as a manipulation check, and assessed how well they succeeded in following the instructions and imagining themselves walking side-by-side with their partners (e.g., “I could easily follow the recorded rate of my and my partner's footsteps”; “I could easily imagine me and my partner walking side-by-side”). These items, as well as other items used in Study 3, were rated on a 7-point scale from 1 (*not at all*) to 7 (*very much*). The imagination performance scale was internally consistent ( $\alpha = .88$ ). Higher scores indicated greater success in imagining the recorded scenario.

Participants also completed a single item assessing the rapport they felt with their partner (“I feel close to my partner now”) and 24 items of the Personal Assessment of Intimacy in Relationships (PAIR) questionnaire (Schaefer & Olson, 1981). The PAIR assesses the actual levels of intimacy in relationships on four dimensions: (a) Emotional Intimacy (e.g., “My partner listens to me when I need someone to talk to”;  $\alpha = .90$ ); (b) Social Intimacy (e.g., “Having time together with friends is an important part of our shared activities”;  $\alpha = .71$ ); (c) Intellectual Intimacy (e.g., “We have an endless number of things to talk about”;  $\alpha = .80$ ); and (e) Recreational Intimacy (e.g., “We enjoy the same recreational activities”;  $\alpha = .88$ ). The PAIR items were internally reliable ( $\alpha = .90$ ) and were thus averaged to form a global intimacy index, with higher scores indicating greater felt intimacy with one's partner. Measures of perceived partner responsiveness and empathy were not used in this study because the study did not involve an actual exchange between partners. Finally, participants provided demographic information and were debriefed.

## **Results and Brief Discussion**

**Manipulation check.** To determine whether differences existed between the in-sync and out-of-sync conditions in how well participants succeeded in imagining themselves walking side-by-side with their partner, an independent samples t-test was performed. As expected, the t-test indicated that imagery performance was not significantly different between the in-sync ( $M = 5.21$ ,  $SD = 1.19$ ) and out-of-sync ( $M = 5.02$ ,  $SD = 1.54$ ) conditions,  $t(122) = 0.74$ ,  $p = .47$ , *Cohen's d* = .13, 95% CI for *Cohen's d* [-.22, .49], suggesting that difficulty in imagining the task did not interfere with participants' reactions to the experimental instructions.

**Interpersonal synchronization and intimacy.** To determine whether differences existed between the in-sync and out-of-sync conditions in rapport and perceived intimacy, a one-way multivariate analysis of variance (MANOVA) for synchrony conditions was performed on these two measures. This MANOVA yielded a significant difference between synchrony conditions, *Hotelling's Trace* = .11,  $F(2,121) = 6.72$ ,  $p = .002$ ,  $\eta^2 = .10$ , 95% CI for  $\eta^2$  [.02, .20]. The univariate analysis indicated that this effect was significant for both measures, such that synchronized imaginary walking led to higher levels of rapport and intimacy than unsynchronized imaginary walking (see Table 4 for means, standard deviations, and statistics).

Table 4

*Means, Standard Deviations, Statistics, and Effect Sizes of Rapport and Intimacy for the In-Sync and Out-of-Sync Conditions (Study 3)*

	In-sync		Out-of-sync		$F_{(1, 122)}$	$\eta^2$	95% CI for $\eta^2$
	M	SD	M	SD			
Rapport	5.52	1.33	4.55	2.02	10.02**	.08	[.01, .18]

Intimacy	5.70	.75	5.01	1.41	11.72***	.09	[.02, .19]
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*Note.*  $N = 124$ . \*\*  $p < .01$ , \*\*\*  $p < .001$ . All measures were rated on a 7-point Likert scale.

Consistent with our hypothesis, the findings showed that imagined synchronized interactions with one's partner led to higher levels of felt intimacy with this partner as compared with out-of-sync interactions. Hence, not only synchrony can affect the development of closeness between strangers, but it may also boost levels of intimacy in ongoing romantic relationships. Within this context, synchrony can signify unity between partners, thereby generating an atmosphere ripe for reciprocal exchanges of intimacy that may further intensify the emotional bond between them. This conclusion, however, should be viewed with caution, as it is not clear whether the findings reflect the beneficial effect of synchrony on intimacy or the detrimental effect of a lack of synchrony. Study 4 addressed this limitation.

#### Study 4

Study 4 sought to replicate and extend the findings of Study 3 in several ways. First, to examine whether the findings of Study 3 would generalize to a more realistic setting, we used a different methodology to manipulate synchrony. Specifically, similarly to Study 3, the interaction with one's partner was simulated, but it involved breathing instead of walking with one's partner. To increase the authenticity of the simulation, we added a visual cue in the form of partner's photograph, such that participants were asked to breathe in-sync or out-of-sync with a recorded breathing sound they imagined to be their partner's while looking at their partner's photo. This addition was based on studies indicating that visual cues are powerful tools in simulating real-world situations as they can serve as a framing agent that heightens

the ability to imagine oneself in the designated scenario (Corbu & Iorgoveanu, 2012; Wilson-Pauwels, 1996).

Second, in an attempt to clarify whether the difference in felt intimacy between in-sync and out-of-sync conditions reflects the positive influence of synchrony or the negative influence of a lack of synchrony, we included a control condition in which participants engaged in the synchronized activity without a photo of their partner. Instead, participants breathed in sync while looking at a picture of a neutral object (a koala). The inclusion of this control condition also allowed us to rule out the possibility that breathing in sync activates feelings of intimacy regardless of the interactional partner's identity. Third, we added an open measure of sexual fantasy to assess varied aspects of intimacy between partners more implicitly and to explore whether the effect of synchrony would extend to the most intimate interactions between romantic partners and be manifested in closeness and desire themes.

Participants were assigned to one of three synchrony conditions: breathing in-sync with their partner, breathing out-of-sync with their partner, and breathing in-sync with a koala. Following the breathing interaction, participants rated how intimate they felt with their partner and described a sexual fantasy narratively. Independent judges coded these narratives for closeness and desire themes. We hypothesized that engaging in synchronized interactions would boost intimacy and desire more than the other conditions.

## **Method**

**Participants.** One hundred and seventeen undergraduate students (58 women, 59 men) from a university in central Israel participated in the study for course credit or volunteered for the study without compensation. Sample size was determined via a priori power analysis using G\*Power software package (Faul et al., 2009) to ensure 95% power to detect effect size,  $f$ , of 0.40 at  $p < .05$ . Participants ranged in age from 19 to 47 years of age ( $M = 26.20$ ,  $SD = 3.11$ ). All participants were currently involved in a romantic relationship.

Relationship length ranged from 3 to 176 months ( $M = 47.80$ ,  $SD = 35.30$ ). No significant differences were found between the experimental conditions for any of the socio-demographic variables.

**Measures and Procedure.** Participants who agreed to participate in a study on mutual intimate activities were scheduled for a single 30-minute laboratory session and were asked to provide demographic information and to email a passport photo of their partner to the research assistant. Prior to each session, participants were randomly assigned to one of the three experimental conditions: breathing in-sync with their partner (in-sync), breathing out-of-sync with their partner (out-of-sync), and breathing in-sync with a koala (control). When participants arrived at the lab, they were greeted by a research assistant who seated them in front of a computer screen that displayed a photo of either their partner (in-sync and out-of-sync conditions) or a koala (control condition). Participants in all conditions were asked to look at the photo while following the breathing instructions.

Participants in the in-sync condition were asked to breath synchronously with the background-breathing recording, which they imagined to arrive from their partner. Participants in the control condition were asked to breath synchronously with the background-breathing recording, which they imagined to arrive from a koala. Participants in the out-of-sync condition were asked to ignore the background-breathing recording, which they imagined to be their partner's. Instead, they were instructed to coordinate their breathing with a breathing tempo bar, which appeared next to their partner's photo, and matched the breathing rate used in the in-sync condition. The breathing rate in all conditions was set to about 17 inhale/exhale breath cycles per minute. This rate is within the normal breathing range at rest (Barrett, Barman, & Boitano, 2010) and is easy to follow, based on a pre-experimental pilot. In the out-of-sync condition, the (ignored) background-breathing rate was

set to be vividly different (one inhale every two exhales 32 times per minute). The breathing interaction lasted for two minutes.

Following the breathing interaction, participants completed two measures that served as a manipulation check: A single item assessing difficulties in performing the task (“To what extent did you find the breathing interaction difficult?”) and three items assessing perceived synchronization (e.g., “I was able to coordinate my breathing rhythm with the background breathing rhythm”; “I felt that I breathed in sync with my partner/the koala”;  $\alpha = .93$ ). These items were averaged to form a global perceived synchronization index. Higher scores indicated greater perceived success in coordinated breathing with either one's partner or the koala. Participants also completed the single item assessing rapport, described in Study 3. All items were assessed on a seven-point Likert scale ranging from 1 (*not at all*) to 7 (*very much*).

Finally, participants were given the following definition of the term *sexual fantasy*, adapted from Leitenberg and Henning (1995, p. 470): “*Sexual fantasies refer to any mental imagery that is sexually arousing or erotic to the individual. A sexual fantasy can be an elaborate story, or it can be a fleeting thought of some romantic or sexual activity. It can involve bizarre imagery, or it can be quite realistic. It can involve memories of past events, or it can be a completely imaginary experience.*”

Then, participants were given instructions, which were adapted from Birnbaum (2007) to reflect a dyadic fantasy: “*Please think of a sexual fantasy about your current relationship partner and write about the first one that comes to mind in the space below. Please describe in detail the specific scene, series of events, the figures, wishes, sensations, feelings, and thoughts that are experienced by you and the other figures in your fantasy. At this point, we wish to note that you are writing anonymously, so feel free to write anything you like.*” After describing their fantasy in narrative form, participants were debriefed.

**Coding sexual fantasies.** Participants' written descriptions of sexual fantasies were coded by a team of two trained independent judges (psychology students) who were blind to the hypotheses and to participants' condition and self-report data. Each judge read the descriptions and rated each participant's expressions of closeness (the extent to which the participants represented themselves and their partner as affectionate, responsive, and pleasing) and desire for one's partner (the extent to which the participants expressed desire for their partner and experienced positive and arousing aspects of sexual activity, such as pleasure, passion, and excitement). Ratings were made on a 5-point scale ranging from 1 (*not at all*) to 5 (*very much*). Inter-rater reliability was adequate for both closeness (ICC = 0.87) and desire (ICC = 0.76). We therefore averaged the two judges' scores to create measures of closeness and desire.

## **Results and Brief Discussion**

**Manipulation check.** A one-way analysis of variance (ANOVA) on difficulty in performing the task indicated that performance difficulties were not significantly different between conditions, suggesting that difficulty in performing the task did not interfere with participants' reactions to the experimental instructions. In addition, a one-way ANOVA on perceived synchrony yielded a significant effect, such that levels of perceived synchrony were lowest in the out-of-sync condition. As expected, levels of perceived synchrony were not significantly different between the in-sync and the control conditions (see Table 5 for means, standard deviations, and statistics).

**Synchrony, rapport, and expressions of closeness and desire in fantasies.** A series of one-way ANOVAs was conducted to determine whether differences existed between experimental conditions in rapport and fantasy themes (closeness and desire). The analysis yielded a significant effect for rapport, such that participants experienced higher levels of





Closeness	3.92	.96	3.88	1.21	3.67	1.20	.49	.01	[.00, .06]
Desire	3.62	.94	3.60	1.09	3.91	.85	1.14	.02	[.00, .08]

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*Note.*  $N = 117$ . \*\*  $p < .01$ , \*\*\*  $p < .001$ ; Perceived synchrony, task difficulty, and rapport were rated on a 7-point Likert scale; Fantasy measures (closeness and desire) were coded using a 5-point Likert scale.

Table 6

*Zero-Order Correlations between Perceived Synchrony, Rapport, and Fantasy Measures for the Experimental vs. Control Conditions (Study 4)*

Variables	In-sync and Out-of-sync Conditions			Control		
	1	2	3	1	2	3
1. Synchrony	-			-		
2. Rapport	.28*	-		.05	-	
3. Closeness	.32**	.25*	-	.16	-.08	-
4. Desire	.25*	.27*	.58***	.20	-.09	.14

*Note.*  $N = 117$ . \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$

Study 4 replicated the findings of Study 3 with a different methodology and extended them by indicating that synchrony could do more than just increase rapport; it could heighten desire between romantic partners. Research has already shown that sexual desire is fueled by cues of rising intimacy (e.g., displays of affection and understanding; Birnbaum et al., 2016; Rubin & Campbell, 2012). Our findings suggest that the primal, non-verbal display of synchrony can also serve as such a cue, further inducing feelings of closeness and generating an ambience conducive to increasing desire between partners. This conclusion should be considered cautiously, however, as only the subjective perceptions of synchrony (and not the manipulation of it) predicted the experience of closeness and desire themes. In addition, given the strong tendency to fall into synchronous behavioral patterns, demonstrated in previous studies (Mottet et al., 2001; Schmidt & Richardson, 2008), future research should include a measurement of respiratory behavior to ensure that participants in the out-of-sync condition indeed succeed in avoiding breathing in sync with their partners.

## General Discussion

People tend to synchronize with each other during ordinary activities, such as breathing, walking, and cycling (Schmidt & Richardson, 2008; Sebanz et al., 2006; Shockley et al., 2003). Past research has indicated that such simple motor synchrony may inspire a sense of unity even between previously unacquainted interactional partners (Hove & Risen, 2009) and have vast social consequences, such as heightened feelings of connectedness (Miles et al., 2009; Noy et al., 2015) as well as increased cooperation and compassion (Valdesolo & DeSteno, 2011; Valdesolo et al., 2010; Wiltermuth & Heath, 2009). Our research adds to this literature by demonstrating that synchrony plays a role in attachment formation and maintenance through boosting perception of intimacy.

In four studies, we show that motor synchrony during varied activities (pedaling, walking, and breathing) and across two modalities (visual and auditory) instills a deep sense of closeness among both strangers and romantic partners. Study 1 examined the synchrony-intimacy link in dyads of strangers in relatively naturalistic conditions (live face-to-face, spontaneous interactions), revealing that synchrony was associated with higher levels of intimacy during an affective interaction, but not during a neutral interaction. Study 2 experimentally manipulated synchrony, establishing the causal link between synchrony and intimacy during an affective interaction. In doing so, it demonstrated that motor synchrony enhanced not only rapport between previously unacquainted individuals but also empathy and perceptions of responsiveness. Study 3 indicated that these findings generalized to romantic relationships, such that simulated synchronized interactions (imaginary walking in sync) with one's partner led to higher levels of felt intimacy with this partner as compared with out-of-sync interactions. Study 4 replicated the findings of Study 3 with a different methodology (breathing rather than walking with one's partner) and extended them to the sexual realm,

showing that perceptions of synchrony predicted themes of closeness and desire in sexual fantasies about one's partner.

These findings extend previous results in several ways. First, past research has not dealt with the conditions under which synchrony is more likely to foster intimacy between interactional partners. Second, previous studies have focused on limited aspects of intimacy, using, for example, a vague operational definition of rapport (e.g., liking rather than feelings of connectedness; Hove & Risen, 2009). To be sure, none of these studies has examined whether the effect of synchrony on intimacy generalizes to the sexual arena. Third, most past studies employed correlational designs that do not allow for causal conclusions about the link between synchrony and intimacy (e.g., Bernieri, 1988; Bernieri et al., 1994). Finally, no prior research has examined the effect of simple motor synchrony on the perception of intimacy within the context of romantic relationship. Studies on behavioral coordination between romantic partners have focused on affective behaviors (e.g., behavioral reciprocity; Gottman et al., 1977; Julien et al., 2000; Margolin & Wampold, 1981) and thus could not rule out the possibility of positive-spillover effect from these behaviors to general satisfaction with the relationship.

Overall, our findings firm up a causal connection between motor synchrony and feelings of intimacy in both strangers and romantic partners, highlighting the importance of synchrony to experiencing profound feelings of closeness during interaction embedded in an affective context. In such a context, attachments needs are especially salient, motivating newly acquainted individuals and long-term intimates to seek cues of contact readiness and partner responsiveness (Mikulincer & Shaver, 2007). Our findings suggest that synchrony may satisfy these needs, functioning as a non-verbal cue for interest in connectedness that inspires the atmosphere that allows people to become closer to each other. Recent imaging studies, characterizing the neural correlates of interpersonal synchrony, strongly support this

interpretation. Specifically, interpersonal synchrony has been shown to elicit activation of the brain's reward circuitry (Atzil, Hendler, & Feldman, 2014; Kokal, Engel, Kirschner, & Keysers, 2011), intricately involved in a vast array of attachment-related behaviors, such as romantic and maternal love (Aron et al., 2005; Strathear, Fonagy, Amico, & Montague, 2009).

These results should be interpreted in the context of several limitations. For one, although the simulated couple interactions employed in Studies 3 and 4 seemed realistic, it remains to be seen whether the findings will replicate in an actual dyadic context and generalize to everyday life. In addition, questions arise when it comes to the mechanisms by which synchrony promotes intimacy between interactional partners. Previous research has indicated that intimacy is experienced when self and other representations overlap (e.g., Galinsky et al., 2003). Similar mechanism may underlie the intimacy-building effect of synchrony. In particular, in synchronized interactions, the neural processes in one brain may be coupled to the neural processes in another brain (Hasson et al., 2012), creating a spatiotemporal context that provides a common ground for the interacting partners and induces synergy between them (Marsh, Richardson, Baron, & Schmidt, 2006). Of course, just as synchronized interactions may generate synergy and promote intimacy, so can out-of-sync interactions lead to corresponding disruptions of interactional synergy and attachment processes. Both possibilities should be explored in future studies.

Notwithstanding these limitations, our research is the first to establish a causal link between synchrony and various expressions of intimacy, indicating that synchrony may serve as a basic intimacy-promoting strategy needed for both relationship initiation and development. Previous research has underscored the importance of participating in novel and arousing activities to maintaining passionate and satisfying relationships (e.g., Aron, Norman, Aron, McKenna, & Heyman, 2000). Our research suggests that even primal, non-verbal

displays of synchrony during ordinary activities in everyday lives can deepen the experience of closeness and desire between partners. Further research should explore whether synchronized interactions may be particularly beneficial for the relationships of unhappy couples. For these couples, the intimacy induced by synchrony may offer a compensatory route for satisfying the otherwise unmet needs for merger and love.

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### **Abstract**

Motor interpersonal synchronization, the natural phenomenon of temporal alignment of simple motor periodic behaviors between partners, is recognized as an essential mechanism contributing for feelings of closeness and connectedness during social interactions. People tend to synchronize with each other during ordinary activities, such as breathing, walking, and cycling. Although motor synchrony between partners has been considered in the clinical literature as an indication of successful close relationships, its influence on the experience of intimacy has not been established yet. Four studies examined whether motor synchrony instilled a sense of intimacy in both strangers and romantically involved individuals. In Study 1, same-sex strangers discussed positive or neutral events while their motion synchrony and closeness were measured. In Study 2, same-sex strangers pedaled bicycles either in synchronous or in asynchronous rhythms while discussing a personal event, and then rated how intimate they felt. In Studies 3 and 4, the effect of synchronized versus unsynchronized interactions on perceptions of intimacy and desire was assessed among romantically involved participants. Results showed that varied aspects of intimacy between dyad members were higher following synchronized versus unsynchronized interactions, suggesting that synchrony serves as a non-verbal mechanism that promotes closeness in intimate situations. Overall, our research suggests that synchrony plays a role in attachment formation and maintenance through boosting perception of intimacy.

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School of Psychology

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Being on the Same Wavelength: Behavioral Synchrony between Partners and its Influence on  
the Experience of Intimacy

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