

# The Crossover of Daily Work Engagement: Test of an Actor–Partner Interdependence Model

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This study of 62 dyads of employees ( $N = 124$ ) examined the crossover of work engagement—a positive, fulfilling, work-related state of mind that is characterized by vigor, dedication, and absorption. We hypothesized that work engagement crosses over from an employee (the *actor*) to his or her colleague (the *partner*) on a daily basis. The frequency of daily communication was expected to moderate the crossover of daily work engagement, which in turn would relate to colleagues' daily performance. Participants first filled in a general questionnaire and then completed a diary study over 5 consecutive workdays. The hypotheses were tested with multilevel analyses, using an actor–partner interdependence model. Results confirmed the crossover of daily work engagement, but only on days when employees within a dyad interacted more frequently than usual. Moreover, we found that actor's work engagement (particularly vigor), when frequently communicated, had a positive indirect relationship with partner's performance through partner's work engagement. Finally, results showed that actor's vigor was negatively related to partner's performance when communication was low. However, this negative effect was counteracted when mediated by the vigor of the partner.

*Keywords:* actor–partner interdependence model, communication, crossover, diary study, work engagement

Since Seligman and Csikszentmihalyi's (2000) call for "positive psychology," the field of organizational psychology has witnessed a sharp increase in the number of studies devoted to positive organizational behavior (Bakker & Schaufeli, 2008). One concept that has received special research attention is *work engagement* (Bakker, Schaufeli, Leiter, & Taris, 2008; Macey & Schneider, 2008). Engaged employees are fully involved in and enthusiastic about their work (May, Gilson, & Harter, 2004; Schaufeli & Bakker, in press). Moreover, research suggests that engaged workers are a source of inspiration; they radiate energy and keep up the spirit in their team (Engelbrecht, 2006). Quantitative studies have confirmed that work engagement is contagious within work teams (Bakker, Van Emmerik, & Euwema, 2006) and may be communicated from one partner to the other in a close relationship (Bakker, Demerouti, & Schaufeli, 2005; Westman, Etzion, & Chen, 2009). Although these studies made a strong case for the crossover of work engagement, they have treated engagement as a static phenomenon, thus failing to capture possible daily variations in its crossover. The present study examines the crossover of daily engagement from one employee to another.

## Work Engagement

A recent review by Macey and Schneider (2008) documented the proliferation of various definitions of engagement. These authors conceptualized employee engagement as an "aggregate multidimensional construct" (p. 18) that contains different types of engagement (i.e., trait, state, and behavioral engagement), each of which entails various conceptualizations. Several authors have argued against this approach by emphasizing that such an umbrella term may only create conceptual confusion (e.g., Griffin, Parker, & Neal, 2008; Saks, 2008).

We follow Schaufeli and Bakker's (2004, in press) operationalization of work engagement. Accordingly, work engagement is a positive, fulfilling, and work-related state of mind that consists of vigor, dedication, and absorption. Vigor is characterized by high levels of energy while working, and the willingness to invest effort in one's work. Dedication refers to being strongly involved in one's work, and experiencing a sense of significance and enthusiasm. Finally, absorption is characterized by being fully concentrated and happily engrossed in one's work (Schaufeli & Bakker, in press). Recent studies have shown that engagement can be discriminated from related concepts like job embeddedness (Halbesleben & Wheeler, 2008), workaholism (Schaufeli, Taris, & Bakker, 2006), and organizational commitment (Hallberg & Schaufeli, 2006).

## Antecedents and Relationship With Performance

One reason why engagement has become such a popular topic is its positive relationship with various performance indicators. For example, Bakker, Demerouti, and Verbeke (2004) showed that engaged employees received higher ratings from their colleagues

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on in-role and extra-role performance. Similarly, Salanova, Agut, and Peiró (2005) showed that customers of hotels and restaurants were more loyal and gave higher performance ratings to highly engaged employees. These studies have also emphasized the role of job resources as main antecedents of work engagement, and subsequently of performance.

Diary research has further confirmed the positive relationship between job and personal resources, engagement, and performance on a daily level. Sonnentag (2003) found that day-level recovery was positively related to engagement and personal initiative during the subsequent work day. Results of the study by Xanthopoulou, Bakker, Heuven, Demerouti, and Schaufeli (2008) among flight attendants showed that the social support built up with the crew during the outbound flight had a positive impact on flight attendants' sense of self-efficacy before the inbound flight. Self-efficacy, in turn, determined flight attendants' performance during the inbound flight through work engagement. In another study conducted in fast-food restaurants, Xanthopoulou, Bakker, Demerouti, and Schaufeli (2009b) showed that employees were more engaged on days that job resources were higher than usual. Consequently, on days that employees were more engaged, the restaurants' financial returns were higher.

### Crossover of Daily Engagement

The process that occurs when the psychological well-being experienced by one person affects the level of well-being of another person is referred to as *crossover* (Westman, 2001). Crossover is a dyadic, interindividual transmission of well-being between closely related individuals that occurs within a particular domain (e.g., workplace or family). Most previous studies have provided evidence for the crossover of "un-well-being" (e.g., job burnout; Westman & Bakker, 2008). Only a few studies have examined and supported the crossover of positive well-being, including flow at work (Bakker, 2005), and work engagement (Bakker et al., 2005, 2006). It is important to note that although work engagement has been found to fluctuate from one day to another (Sonnentag, 2003; Xanthopoulou et al., 2008, 2009b), previous studies treated its crossover as a static phenomenon. Confirming the crossover of work engagement on a day-to-day level expands previous between-person studies. According to Chen, Bliese, and Mathieu (2005), supporting the homology of the hypothesized crossover effect across levels of analysis adds to the parsimony and breadth of the underlying processes, because it assumes similarity across the levels of analysis. Rejection of homology calls for the refinement of theories to explain how processes operate at each distinct level. Evidence supporting daily crossover would indicate that even when its levels change, work engagement is a positive state that may be transferred from one employee (the actor) to a colleague (the partner).

Employees are considered engaged if they score high on each of the three work engagement subdimensions (Schaufeli & Bakker, in press). Therefore, we examine engagement as an overall construct, and we expect that all its subdimensions are likely to cross over. This is in line with the study by Bakker et al. (2006), in which team-level engagement was found to enhance individual team members' vigor, dedication, and absorption. Nevertheless, each dimension of work engagement crosses over for a somewhat different reason. The crossover of vigor and absorption may be the

result of an unconscious modeling process in which employees imitate each other's behavior. An employee may become unconsciously more energetic when working with a vigorous colleague. Similarly, an employee who works closely with a colleague who is often immersed in his or her work is likely to model such behavior. Research has indeed shown that people automatically mimic the facial expressions, postures, and behaviors of others (Bavelas, Black, Lemery, & Mullett, 1987; Bernieri, Reznick, & Rosenthal, 1988). Dedication may be the result of a more conscious cognitive process, where employees "tune in" to the emotions and attitudes of their colleagues. This is the case when an employee tries to imagine how he or she would feel in the position of a colleague and, as a consequence, experiences the same feelings and attitudes. Thus, dedication expressed by one employee may fuel his or her colleagues' dedication, because their thoughts are focused on those aspects of work that make them enthusiastic (Bakker & Demerouti, 2009; Hsee, Hatfield, Carlson, & Chemtob, 1990).

### Explaining Crossover

In an attempt to understand which factors facilitate the daily crossover of work engagement from one colleague to another, the regulating role of frequent daily communication has been examined. Expressiveness manifested through frequent daily communication may increase the chances for work engagement to cross over. Indeed, experimental studies suggest that people who are high in expressiveness are better able to transmit their emotions to others. For example, Wild, Erb, and Bartels (2001) presented photos on a PC, varying the affective content (happy and sad), the expressive strength, and the duration of presentation. After each photo, participants rated the strength of experienced emotions. Wild et al. found that stronger expressions evoked more emotion. In another experiment, Towler and Dipboye (2001) investigated the effects of trainer expressiveness, lecture organization, and trainee goal orientation on training outcomes, and showed that participants had the highest recall after an expressive and organized lecture. Totterdell, Wall, Holman, Diamond, and Epitropaki (2004) argued and found that the extent to which affect converges between individuals in work groups depends on their level of communication, because interactions are the channels of the affect sharing processes. On the basis of this literature, we formulated our first hypothesis:

*Hypothesis 1:* The positive crossover of daily work engagement is moderated by the frequency of employees' daily communication. Actor engagement is positively related to partner (i.e., colleague) engagement, particularly on days that they frequently interact.

Because extraversion is the disposition of sociability, cheerfulness, and high activation, and extraverts are inclined to interact more frequently and with a higher intensity than nonextraverts (Costa & McCrae, 1992), we controlled for participants' extraversion when testing the hypothesized relationships.

### Crossover of Engagement and Performance

Considering the positive relationship between work engagement and performance both at the between-person and the within-person

level (Demerouti & Cropanzano, in press), it is conceivable that the crossover of work engagement will also affect employee self-reported performance. When the actor frequently communicates his or her work engagement to his or her partner, it is likely that the partner will also become highly engaged. As a result, he or she will exhibit high levels of intrinsic motivation to fulfill the work tasks and, in turn, will perform better. Evidence for such a process has been found in various occupations (Totterdell, Kellett, Teuchmann, & Briner, 1998). For example, in Totterdell’s (2000) study, players from two professional cricket teams used pocket computers to rate their moods and performances three times a day for 4 days during a competitive match between the teams. Analyses revealed significant positive associations between the average of teammates’ happy moods and the players’ own moods and subjective performances. In short, it is likely that the actor’s engagement will have a positive relationship with the partner’s self-rated performance through partner’s engagement. Taking into account that frequency of communication is the moderator of the daily crossover of work engagement, we formulated our second hypothesis (see Figure 1 for an overview):

*Hypothesis 2:* The interaction between (frequent) daily communication and actor’s work engagement relates to partner’s (i.e., colleague’s) self-reported performance through the mediation of partner’s work engagement. Thus, actor engagement is positively related to partner performance, particularly on days that they frequently interact, and this effect is mediated by partner engagement.

Method

Procedure and Participants

We approached 80 employees working in different organizations in the Netherlands. The 65 employees who agreed to participate (response rate = 81%) were requested to ask one of their colleagues with whom they worked closely on a daily basis to take part in the study simultaneously. Because the only prerequisite for sample selection was that employees within each dyad worked

closely together, and we were not interested in specific partner relationships (e.g., male vs. female), the members of the dyad were treated as nondistinguishable. As such, each member could be considered either as the actor or as the partner in the hypothesized relationships. Participants had to first fill in a general questionnaire (measuring extraversion and demographics), followed by a diary survey (measuring frequency of daily communication, daily work engagement, and daily task performance) over 5 consecutive workdays. They were requested to fill in the diary surveys at the end of each workday. Data from 62 dyads of colleagues (*N* = 124 participants and *N* = 620 occasions) were used in the analyses. The final study sample consisted of 62 men (50%) and 61 women (49.2%); information on the gender of 1 participant was missing. Participants’ mean age was 35 years (*SD* = 10.5), and their mean organizational tenure was 12.4 years (*SD* = 9.9). Most participants were employed in the service (37%) and health (14%) sectors. Finally, the majority (70%) lived with their partners and had finished higher education (62%).

Measures

*Extraversion* was assessed with a subscale from Goldberg’s (1992) bipolar rating scale of the Big Five factors (Van Heck, Perugini, Caprara, & Froeger, 1994). Participants had to react to 12 pairs of adjectives (e.g., *introvert–extravert*, *not social–social*), wherein they described themselves along the extremes of 9-point scales (1 = *strongly introvert*, 9 = *strongly extravert*). The internal consistency of the scale was satisfactory (Cronbach’s  $\alpha$  = .85).

*Frequency of daily communication* was measured with the following item: “How much time did you spend today on business and informal contacts (phone, e-mail, face-to-face) with your colleague?” Employees could choose one of five answering categories: 1 = 0–15 min., 2 = 15–30 min., 3 = 30–60 min., 4 = 1–2 hr, 5 = more than 2 hr. Preliminary analyses revealed high interrater agreement within each dyad, as the intraclass correlation coefficient (ICC3; Shrout & Fleiss, 1979) was high for each of the 5 workdays: .72, .87, .74, .66, .75. Thus, we used a composite frequency of daily communication score referring to the dyad for each of the five study occasions.

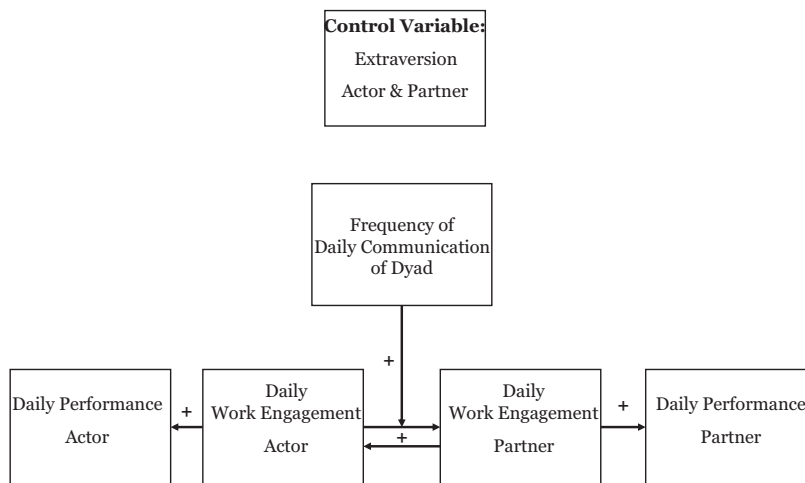


Figure 1. Study design and hypotheses.

*Daily work engagement* was measured with six adapted items of the Utrecht Work Engagement Scale (Schaufeli, Bakker, & Salanova, 2006). We included two items for vigor (e.g., “Today, I felt strong and vigorous while working”), two items for dedication (e.g., “Today, I was enthusiastic about my work”), and two items for absorption (e.g., “Today, I was completely immersed in my work”). Answering categories ranged from 1 = *totally disagree* to 5 = *totally agree*. Following Schaufeli, Bakker, and Salanova (2006), we computed an overall work engagement index for each of the 5 days. This decision was further supported by item-level principal axis factoring analyses for each of the five occasions that the study took place, which resulted in one engagement factor that explained 59%, 53%, 58%, 62%, and 56% of the variance, respectively. The mean of Cronbach’s alphas across the five occasions was .89.

*Daily task performance* was assessed with two modified items (“Today, I fulfilled all the requirements of my job” and “Today, I performed well”) from Goodman and Svyantek’s (1999) scale. The items were rated on a 5-point scale (1 = *totally disagree*, 5 = *totally agree*). The mean of Cronbach’s alphas across the five occasions was .64, and interitem correlations ranged from .31 to .64.

Confirmatory factor analyses supported the superiority of the four-factor solution (i.e., extraversion, frequency of daily communication, daily work engagement and daily performance) in comparison to alternative one-, two- or three-factor models for all five study occasions. These results are available from Despoina Xanthopoulou upon request.

### Strategy of Analysis

The central proposition of the present study is that the work engagement of the one colleague (the actor) reflects the work engagement of the other colleague (the partner) within the dyad. It is well perceived that such dyadic data are nonindependent (Kenny, 1996), because both partners are exposed to a common outside influence (i.e., the same work environment; Cook & Snyder, 2005). Therefore, we analyzed our data with the actor–partner interdependence model (APIM; Kenny & Cook, 1999). This model includes the dyad as the highest unit of analysis, with individuals nested within the dyad. By applying APIM it is possible to calculate how a person’s independent variable has an effect on his or her own dependent variable (i.e., an *actor effect*), as well as on his or her partner’s dependent variable (i.e., a *partner effect*; Campbell & Kashy, 2002). In the present study, we were mainly interested in

partner effects. It should be noted that the partner effect in APIM models the mutual (i.e., reciprocal) influence that may occur between the members of the dyad. In our case, the crossover from the actor to the partner is tested simultaneously with the crossover from the partner to the actor (see Figure 1). For details on how data sets are structured in APIM, we refer the reader to Campbell and Kashy (2002) and to Cook and Kenny (2005).

In our study, employees are nested within dyads and repeated measurements (days) are nested within employees. This leads to a three-level model with the series of repeated measures at the first (within-person) level, individual persons at the second (between-person) level, and the dyad at the third (between-dyad) level. To test our hypotheses, we performed multilevel analyses with the MLwiN program (Rasbash, Browne, Healy, Cameron, & Charlton, 2000) with three levels: day (Level 1;  $N = 620$  study occasions), person (Level 2;  $N = 124$  participants), and dyad (Level 3;  $N = 62$  dyads). Power analyses for three-level models with the optimal design program (Spybrook, Raudenbush, Liu, Congdon, & Martínez, 2008) resulted in values higher than .80, suggesting adequate power. Day-level variables were frequency of communication, work engagement, and task performance, whereas at the person level we measured extraversion. To gain unbiased estimates of the hypothesized relationships, it is advisable to use centered scores for the *predictor* variables in multilevel analysis (Hofmann & Gavin, 1998). In the present study, extraversion scores were centered to the grand mean, frequency of communication scores were centered to each dyad’s mean across the five occasions, and work engagement scores were centered to each person’s mean across the five occasions. Centered scores were used only when variables were functioning as predictors and not as outcomes in our analyses.

## Results

### Descriptive Statistics

Table 1 presents the mean scores, standard deviations, and correlations among the study variables. Demographic variables were inconsistently related or nonrelated to the study variables. Only participants’ age was positively related to their work engagement ( $r = .35, p < .01$  for actor;  $r = .31, p < .05$  for partner).

### Supporting the Use of Multilevel Modeling

To provide statistical evidence for the use of a three-level (dyads, persons, days) model, we examined whether our variables

Table 1  
Means, Standard Deviations, and Correlations Between the Study Variables ( $N = 62$  Dyads,  $N = 124$  Individuals)

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7
1. Extraversion, actor	6.69	0.76	—						
2. Extraversion, partner	6.61	0.83	.14	—					
3. Frequency of Daily Communication	3.20	1.02	.08	.13	—				
4. Daily Work Engagement, actor	3.70	0.60	.44**	.32*	.04	—			
5. Daily Work Engagement, partner	3.61	0.53	.14	.49**	.02	.44**	—		
6. Daily Task Performance, actor	3.59	0.43	.35**	.12	.24	.55**	.21	—	
7. Daily Task Performance, partner	3.55	0.43	.12	.37**	.05	.35*	.48**	.28*	—

Note. Day-level data were averaged across 5 days.  
\*  $p < .05$ . \*\*  $p < .01$ .

exhibit sufficient variability at all levels of analysis. For each day-level variable, we conducted a deviance ( $-2 \times \log$ ) difference test comparing the intercept-only model with one level (i.e., days) with the intercept-only model with two levels (i.e., persons), and the latter with the intercept-only model with three-levels (i.e., dyads). Results showed that in all cases the three-level models fit significantly better to the data than the two-level and one-level models.

Specifically, regarding frequency of daily communication, the two-level model fit significantly better to the data than the one-level model,  $\Delta - 2 \times \log(1) = 221.76$ ,  $p < .001$ , and the three-level model fit significantly better than the two-level model,  $\Delta - 2 \times \log(1) = 138.62$ ,  $p < .001$ . On the basis of the three-level intercept-only model, we calculated the intraclass correlations ( $\rho_{\text{dyads}} = .62$ ;  $\rho_{\text{persons}} = .00$ ). These results suggest that 62% of the variance may be attributed to between-dyad fluctuations, and 38% of the variance may be attributed to daily, within-person fluctuations. Although the variance attributed to the person level was zero, we decided to use three levels for this variable on the basis of the results of the deviance difference tests. Results concerning daily work engagement also showed that the two-level intercept-only model fit significantly better than the one-level model,  $\Delta - 2 \times \log(1) = 250.62$ ,  $p < .001$ , and the three-level model fit significantly better than the two-level model,  $\Delta - 2 \times \log(1) = 15.05$ ,  $p < .001$ ;  $\rho_{\text{dyads}} = .30$ ;  $\rho_{\text{persons}} = .26$ . These results show that 30% of the variance was attributable to between-dyad variations, 26% of the variance was attributable to between-person variations, and 44% of variance was attributable to within-person variations. Finally, calculations regarding daily task performance also supported the use of a three-level model. The two-level intercept-only model fit better than the one-level model,  $\Delta - 2 \times \log(1) = 119.07$ ,  $p < .001$ , and the three-level model fit significantly better than the two-level model,  $\Delta - 2 \times \log(1) = 6.59$ ,  $p < .01$ ;  $\rho_{\text{dyads}} = .16$ ;  $\rho_{\text{persons}} = .22$ . Sixteen percent of the variance was attributable to between-dyad variations, 22% to between-person variation, and 62% to daily, within-person fluctuations. These results clearly support the use of multilevel modeling.

### Hypothesis Testing

To test whether frequency of daily communication moderates the crossover of daily work engagement (Hypothesis 1), we examined four nested models: (a) the null (intercept-only) model; (b) Model 1, in which the control variables (extraversion of actor and partner) were added; (c) Model 2, where the predictor and the moderator were added (daily engagement and frequency of daily communication); and (d) Model 3, in which their interaction (i.e., multiplicative) term was added. Table 2 presents unstandardized estimates, standard errors, and  $t$  values for all predictors of the best-fitting model to the data (Model 3).

Results of APIM analyses did not support the bidirectional crossover of work engagement (no main effect;  $t = 0.16$ ,  $ns$ ; see Table 2). Frequency of daily communication did not have a direct effect on work engagement either. However, the interaction between the daily work engagement of the actor and the frequency of daily communication within the dyad on the work engagement of the partner was significant ( $t = 2.65$ ,  $p < .001$ ). This significant interaction was probed with Preacher, Curran, and Bauer's (2006)

Table 2

*Actor-Partner Interdependence Model of the Crossover of Daily Work Engagement: Frequency of Daily Communication as Moderator (N = 62 Dyads, N = 124 Individuals, N = 620 Observations)*

Variables	Model 3		
	Estimate	SE	$t$
Intercept	3.664	.052	70.462***
Actor effects			
Extraversion	.310	.059	5.254***
Partner effects			
Extraversion	.121	.059	2.051*
Daily Work Engagement	.008	.049	0.163
Frequency of Daily Communication	-.024	.028	-0.857
Daily Work Engagement $\times$ Frequency of Daily Communication	.191	.072	2.653**
$-2 \times \log$			855.79
$\Delta - 2 \times \log$			7.03**
$df$			1
			<hr/> $R^2$ <hr/>
Variance			
Level 1	.218	.015	1%
Level 2	.112	.030	15%
Level 3	.077	.033	50%

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

approach. We used values at 1  $SD$  above and below the mean of frequency of communication to assess the crossover effect. Plotting procedures fully supported Hypothesis 1. Figure 2 shows that as frequency of communication increases, the slope relating the engagement of the actor to the engagement of the partner becomes more strongly positive. Probing results revealed that the simple slope was significant only at +1  $SD$  of frequency of communication (estimate = .15;  $t = 2.09$ ,  $p < .05$ ), and not at -1  $SD$  (estimate = -.13;  $t = -1.84$ ,  $p = .07$ ). These results suggest that the crossover of daily work engagement among dyads of colleagues takes place *only* on days that colleagues communicate more frequently than usual. Results did not change significantly when we controlled for participants' age in the analyses.

Additional analyses for each subdimension of work engagement supported the interaction effect of Hypothesis 1 only for vigor ( $\gamma = .163$ ,  $SE = 0.064$ ,  $t = 2.55$ ,  $p < .01$ ), and not for dedication ( $\gamma = .049$ ,  $SE = 0.078$ ,  $t = 0.63$ ,  $ns$ ) or absorption ( $\gamma = .068$ ,  $SE = 0.072$ ,  $t = 0.94$ ,  $ns$ ). Probing results were again in line with predictions. Figure 3 shows that daily vigor crosses over from one colleague to the other only on days that communication is frequent. Again, the simple slope was significant at +1  $SD$  of frequency of communication (estimate = .16;  $t = 2.60$ ,  $p < .01$ ), and not at -1  $SD$  (estimate = -.08;  $t = -1.24$ ,  $p = .21$ ).

Hypothesis 2 suggests that the interaction between frequent daily communication of the dyad and the work engagement of the actor will lead to partner's performance through the mediation of partner's work engagement. According to Mathieu and Taylor (2006), this is a case of *mediated moderation*. To test mediated moderation the standard analytic approach for the test of mediation is followed, although the interaction effect is also taken into account. The three conditions that should be met in order to

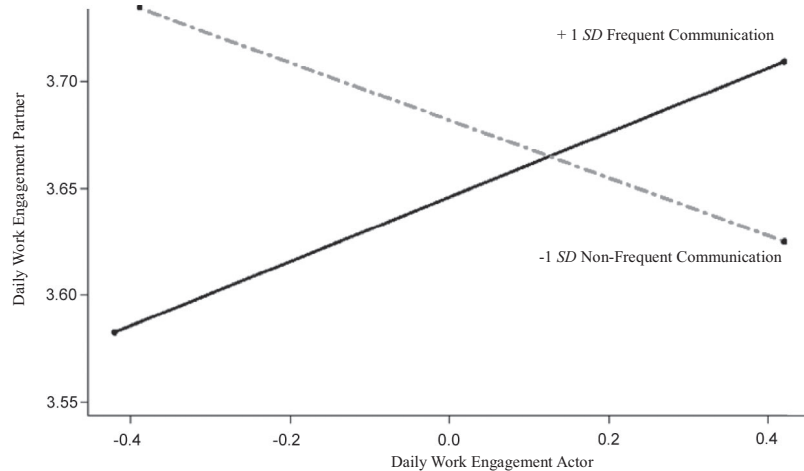


Figure 2. Interaction effect of daily work engagement of the actor and frequency of daily communication within the dyad on the work engagement of the partner. Solid line = 1 standard deviation (*SD*) above the mean on frequency of communication; dotted line = 1 *SD* under the mean on frequency of communication.

support Hypothesis 2 are (a) the interaction between daily work engagement of the actor and frequency of daily communication should be positively related to the daily work engagement of the partner; (b) daily work engagement of the partner should be positively related to the daily performance of the partner; and (c) after the inclusion of the mediator (i.e., daily work engagement of the partner), the previously significant relationship between the interaction term and daily performance of the partner either turns into nonsignificance (full mediation) or becomes significantly weaker (partial mediation; Mathieu & Taylor, 2006; Muller, Judd, & Yzerbyt, 2005).

The test of Hypothesis 1 already supported the first condition. Preliminary analyses also supported the second condition for mediation by showing that daily work engagement of the partner was positively related to the daily performance of the partner ( $\gamma =$

.446,  $SE = 0.041$ ,  $t = 10.88$ ,  $p < .001$ ). However, the direct effect of the work engagement of the Actor  $\times$  Frequency of Communication interaction on the task performance of the partner was nonsignificant ( $\gamma = .101$ ,  $SE = 0.080$ ,  $t = 1.26$ , *ns*), thus rejecting the hypothesized mediation effect. In cases where mediation hypotheses are rejected, Mathieu and Taylor (2006) suggested that the alternative hypothesis of indirect effects should be considered. *Indirect effects* are a special form of intervening effects whereby the predictor and the dependent variable are not related directly, only indirectly through a significant relationship with a linking mechanism (Mathieu & Taylor, 2006). The magnitude of the indirect effect was tested with the Sobel (1982)  $z$  test. Although the interaction effect was not significant, we added the work engagement of the partner in the model. Results of the Sobel test ( $t_a = 2.65$ ,  $t_b = 11.96$ ,  $z = 2.59$ ,  $p = .01$ ) showed that the work

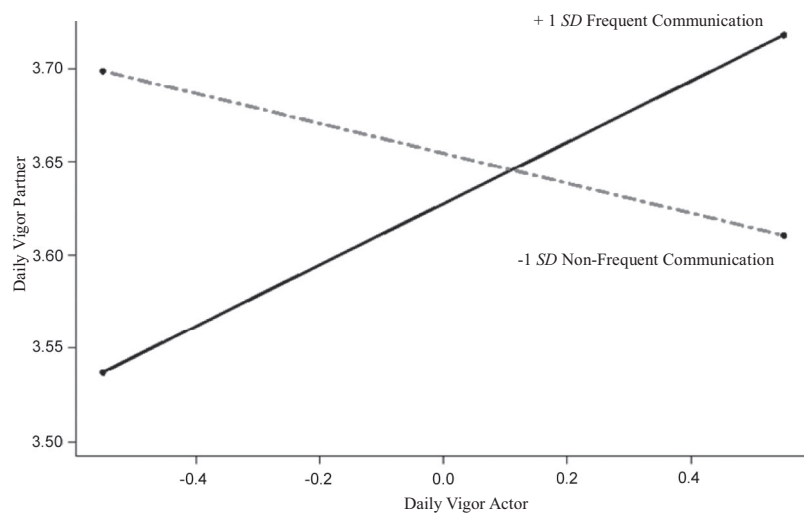


Figure 3. Interaction effect of daily vigor of the actor and frequency of daily communication within the dyad on the vigor of the partner. Solid line = 1 standard deviation (*SD*) above the mean on frequency of communication; dotted line = 1 *SD* under the mean on frequency of communication.

engagement of the Actor  $\times$  Frequency of Communication interaction indirectly positively relates to the task performance of the partner via partner's work engagement.

Although APIM analyses did not support the mediation effect of Hypothesis 2 for overall work engagement, results were in line with predictions for vigor (the only subdimension of work engagement for which the first condition of Hypothesis 2 was confirmed; see results for Hypothesis 1). To test Hypothesis 2 for vigor, we examined the nested models presented in Table 3. As can be seen, the inclusion of daily vigor of the partner into the equation turned the relationship between the interaction term (daily vigor of the Actor  $\times$  Frequency Of Daily Communication) and daily performance of the partner from significance ( $t = 2.20, p < .05$ ) to nonsignificance ( $t = 1.72, ns$ ; Sobel  $z = 2.33, p < .01$ ), thus supporting a full mediation effect. These results suggest that when the actor's vigor is frequently communicated, it relates positively to the vigor of the partner, which in turn enhances his or her self-reported performance. Probing results showed that the simple slope at +1 *SD* of frequency of communication was not significant (estimate = .05;  $t = 0.90, p = .37$ ). However, the simple slope at -1 *SD* of frequency of communication was significant (estimate = -.13;  $t = -2.12, p < .05$ ). As depicted in Figure 4, the effect of the vigor of the actor on the performance of the partner becomes more strongly negative in conditions of infrequent communication. Put differently, the vigor of the actor is negatively related to the performance of the partner when they hardly communicate. However, this negative effect disappears when mediated by the vigor of the partner.

Discussion

In the present study, we examined the daily crossover of engagement in the workplace. The results clearly show that engage-

ment (and especially vigor) crosses over from one employee to another, particularly on days when colleagues frequently interact and talk through e-mail, by telephone, or face to face. In turn, this positive crossover may have beneficial effects for colleagues' self-rated performance.

Frequent Communication

One of the most significant findings of the study was that frequency of communication moderated the crossover of daily work engagement in a way that work engagement crossed over when employees communicated frequently with an engaged colleague. Thus, the crossover of work engagement (and particularly of vigor) takes place only on days when colleagues interact more frequently than usual. In line with Daniels (2006), it is clear that what happens at work on a daily basis (e.g., daily communication), due to its proximity, constitutes the most crucial determinant of daily psychological states (engagement). Consistent with Totterdell et al. (2004), the nonsignificant slope for the low frequency of communication condition implied that when communication is infrequent, there is no trigger (i.e., communication channel) for crossover. The pattern of the interaction effect offers evidence for the crossover of work engagement and excludes possible alternative explanations for a relationship between actor and partner engagement, such as common job characteristics (cf. Cook & Snyder, 2005; Westman, 2001). These findings are also in line with a recent study on mood crossover in 50 couples (Song, Foo, & Uy, 2008). The couples used their cell phones to report their momentary moods over 8 consecutive days. Crossover of mood was observed particularly when spouses were physically together. Our findings expand this study by showing that in addition to mood, work engagement crosses over from one colleague to another under conditions of frequent communication.

Table 3  
Actor-Partner Interdependence Model: Explaining Daily Task Performance of the Partner ( $N = 62$  Dyads,  $N = 124$  Individuals,  $N = 620$  Observations)

Variable	Model											
	Null			1			2			3		
	Estimate	SE	t	Estimate	SE	t	Estimate	SE	t	Estimate	SE	t
Intercept	3.957	.048	82.44***	3.957	.045	87.93***	3.952	.045	87.82***	3.953	.045	87.84***
Extraversion, actor				.060	.052	1.15	.044	.053	0.83	.048	.053	0.91
Extraversion, partner				.202	.052	3.88***	.207	.053	3.91***	.205	.053	3.87***
Daily Vigor, actor							-.038	.043	-0.88	-.048	.041	-1.17
Frequency of Daily Communication							-.002	.031	-0.07	.002	.030	0.07
Daily Vigor, Actor $\times$ Frequency of Daily Communication							.121	.055	2.20*	.091	.053	1.72
Daily Vigor, partner										.238	.041	5.80***
-2 $\times$ log $\Delta - 2 \times$ log <i>df</i>			1,078.30			1,019.23			946.99			914.00
						59.07***			72.24***			32.99***
						2			3			1
						R <sup>2</sup>			R <sup>2</sup>			R <sup>2</sup>
Variance												
Level 1	.263	.017		.275	.018	0%	.279	.019	0%	.257	.018	2.3%
Level 2	.094	.027		.085	.026	10%	.084	.028	11%	.090	.028	4%
Level 3	.069	.029		.048	.026	30%	.044	.026	36%	.044	.026	36%

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

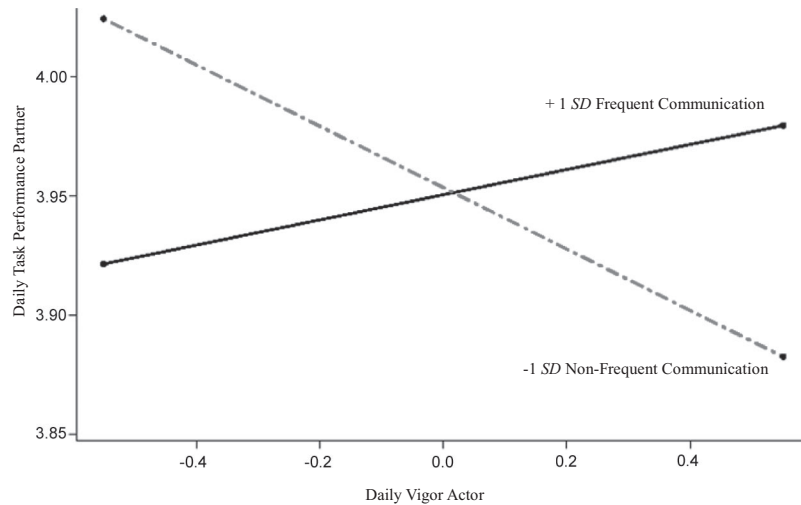


Figure 4. Interaction effect of daily vigor of the actor and frequency of daily communication within the dyad on the task performance of the partner. Solid line = 1 standard deviation (SD) above the mean on frequency of communication; dotted line = 1 SD under the mean on frequency of communication.

Further, in line with previous between-person research (Mostert & Rothmann, 2006), our findings showed that actor's extraversion was positively related to actor's daily engagement, perhaps because extraverts focus on the positive side of their experiences and they are good at mobilizing their social resources (Watson & Hubbard, 1996). It is interesting that we also found a positive relationship between actor's extraversion and partner's daily work engagement. This finding may be attributed to the fact that extraverts are active nonverbal communicators (Riggio & Riggio, 2002) who may not even need to discuss work to transmit their enthusiasm to their direct colleagues.

#### Crossover of Daily Work Engagement and Performance

Another aim of our study was to investigate whether the crossover of work engagement determines employees' self-reported task performance. We found that the interaction between daily communication and actor's work engagement had an indirect effect on partner's performance via partner's work engagement. In other words, results showed that actor's engagement crosses over to the partner when they communicate frequently and in turn enhances partner's performance. Although our results did not support the hypothesized mediation effect, evidence for an indirect effect confirms the suggested sequence of effects (Mathieu & Taylor, 2006). The hypothesized mediation effect was supported only for the vigor dimension of work engagement. The findings imply that the actor's vigor, when communicated, enhances partner's vigor, which in turn is responsible for the partner's high performance. For example, when an employee interacts frequently with a colleague who is more vigorous than usual, he or she is likely to become energetic and perform well. Engaged employees are intrinsically motivated to fulfill their work goals. As a result, they deal with their work tasks successfully and, in turn, exhibit high levels of performance (Demerouti & Cropanzano, in press).

In addition, when communication between colleagues was less frequent than usual, the vigor of the actor had a negative relation-

ship with the performance of the partner. Combining these findings with the results regarding Hypothesis 1, it seems that when communication is low, the crossover of vigor is unlikely to take place. If the partner does not interact with the actor, it is unlikely that he or she shares the energy of the actor. Consequently, the partner will not have the energy and the strength to invest the required effort in the job, which may lead to low levels of performance (Demerouti & Cropanzano, in press). Only if positive states are communicated can they elicit beneficial results for colleagues as well. Indeed, our analyses showed that the vigor of the partner fully mediates the direct effect of the Vigor of Actor  $\times$  Communication interaction on the partner's performance. This means that the crossover of vigor (when communication is frequent), has a positive effect on partners' performance.

#### Limitations, Strengths, and Avenues for Future Research

Some limitations of our study must be noticed. First, our study was solely focused on task performance, whereas future studies should look at other performance dimensions like organizational citizenship behavior. Next, the fact that frequency of communication was assessed with only one item raises concerns regarding the reliability of this measure. However, results suggested substantial agreement between the members of each dyad, which counteracts these concerns. Another limitation of the study is the use of self-reports only, which implies a risk of common method variance. However, results of Harman's single factor tests (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003) suggested that common method bias is not a threat in our study, because item-level factor analyses for each day resulted in the expected factors, whereas the first factor never explained most of the total amount of variance. The use of self-ratings of performance may be considered particularly problematic because, due to their subjectivity, they may be biased. However, the means (which were not extremely high) and standard deviations (which were not low) of the performance measure suggest that unrealistically positive estimations of task performance were not observed in the study. It is important to



note that our findings are in line with previous between-person and diary studies that supported the positive link between engagement and objective indicators of performance (e.g., Bakker & Bal, 2009; Xanthopoulou et al., 2009b). Nonetheless, future research should include other-ratings of performance (e.g., colleagues, supervisors, or clients).

A final limitation of the present study is that participants chose the other member of the dyad themselves, implying that they may have asked a colleague they liked to coparticipate in the study. Mutual liking was not measured in the present study, and thus it is possible neither to rule out its potential effect on our findings nor to conclude that our findings hold only for those employees who like each other. The role of mutual liking in the crossover of work engagement should be taken into account in future studies.

A clear advantage of a diary research design is that response bias is reduced, because self-reports are collected in close proximity to the actual experiences and behaviors (Bolger, Davis, & Rafaeli, 2003). Also, the design of this study provided the opportunity to examine the phenomenon of bidirectional crossover while taking into account daily fluctuations in work engagement. Our results clearly suggest that it is mainly on days when employees feel more engaged and communicate more frequently with their colleagues than usual that crossover takes place. More research is needed on daily crossover, because it offers the opportunity to examine proximal moderators of the daily crossover effect. For instance, although the present study focused solely on the role of frequency of communication, it is likely that the type of communication may also determine the magnitude of the crossover. It is conceivable that frequent face-to-face communication may have a stronger impact on the daily crossover of work engagement than frequent e-mail communication.

### Practical Implications

Our findings have two important implications for organizations that aim at flourishing workforces. First, organizations should facilitate daily engagement among their employees, because this spreads around and may have a beneficial impact on performance. Previous studies have consistently shown that daily work engagement may be built (a) through the allocation of sufficient job resources (e.g., feedback, coaching) to employees; and (b) through the enhancement of employees' positive self-beliefs (e.g., self-efficacy or optimism; Xanthopoulou et al., 2008, 2009a, 2009b). Considering that engagement crosses over on a daily basis, the second implication of this study is that organizations may facilitate and cultivate frequent exchange between engaged colleagues, because engaged employees have a positive impact on others with whom they collaborate.

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