Clustering by Well-Being in Workplace Social Networks: Homophily and Social Contagion

Joseph Chancellor

Kristin Layous

Seth Margolis

Sonja Lyubomirsky

University of California, Riverside

in press, *Emotion*

s

Author Note

Kristin Layous is now at the Department of Psychology, California State University, East Bay.

Correspondence should be addressed to Seth Margolis (seth.margolis@email.ucr.edu).

Abstract

Social interaction among employees is crucial at both an organizational and individual level. Demonstrating the value of recent methodological advances, two studies conducted in two workplaces and two countries sought to answer the following questions: 1) Do coworkers interact more with coworkers who have similar well-being?; and, if yes, 2) what are the processes by which such affiliation occurs? Affiliation was assessed via two methodologies: a commonly used self-report measure (i.e., mutual nominations by coworkers) complemented by a behavioral measure (i.e., sociometric badges that track physical proximity and social interaction). We found that individuals who share similar levels of well-being (e.g., positive affect, life satisfaction, need satisfaction, and job satisfaction) were more likely to socialize with one another. Furthermore, time-lagged analyses suggested that clustering in need satisfaction arises from mutual attraction (homophily), whereas clustering in job satisfaction and organizational prosocial behavior results from emotional contagion.

Keywords: subjective well-being, homophily, emotional contagion, sociometric badges

Clustering by Well-Being in Workplace Social Networks: Homophily and Social Contagion

Social interaction is not just a human desire; it is a necessity (Baumeister & Leary, 1995). People deprived of social interaction have greater levels of stress (Cohen & Wills, 1985), weaker immune systems (Kiecolt-Glaser et al., 1984), and higher risk of mental illness (Barnett & Gotlib, 1988). Hence, it is not surprising that social scientists have studied social networks for over 80 years (e.g., Freeman, 2004; Moreno, 1934). In 1934, Moreno introduced sociograms, which depict social networks. A striking feature of most sociograms is clustering—that is, the tendency for people to group together socially.

Social clustering is especially important in workplace settings, where frequent interactions are often necessary for productivity and creativity (Bennett, Owers, Pitt, & Tucker, 2010; Perry-Smith, 2006). Within business organizations, social clusters can result from institutional properties such as organizational structure and office positioning (Reskin, McBrier, & Kmec, 1999). However, social clustering may also stem from individual characteristics. Interestingly, research demonstrates that over and above simple demographics (e.g., age, social class), shared behaviors (e.g., Latin dancing, skateboarding), or external attributes (e.g., hair styles, body modification), social clustering can be based on inward psychological states (e.g., personal values, happiness, depression; Huston & Levinger, 1978). The current study explores whether people cluster by one such category of internal states—namely, well-being levels—and how this clustering arises in two different workplaces.

Of course, companies aim to have a maximally productive workforce. In most organizations, communication among employees is essential. Employees—as well as their work product—typically benefit when they are aware of events and developments within the organization (Kraul, Fish, Root, & Chalfonte, 1990). Employees also benefit from their colleagues' assistance in a variety of forms, including collaboration, guidance, reinforcement, cooperation, and emotional support (Bolino, Turnley, & Bloodgood, 2002). Furthermore, a workplace environment characterized by frequent social interaction is likely to be motivating and inspiring (Van Yperen & Hagedoom, 2003). People working on parallel projects motivate each other, and witnessing the success of colleagues can be inspiring. Social interaction also breeds well-being, which is associated with productivity (Boehm & Lyubomirsky, 2008). Indeed, most organizations desire fairly frequent social interaction amongst employees (Berman, West, & Richter Jr., 2002).

To boost social interaction, scientists need to understand how it operates. A wealth of previous research demonstrates that social interaction tends to occur in clusters, but what mechanisms drive clustering? Our two studies examine whether similarities in well-being (e.g., resemble each other in job satisfaction or feelings of connectedness) can explain clustering, and, if this is the case, the process by which such clustering arises.

Psychological theory and research suggest that individuals can cluster via at least two distinct processes: homophily and social contagion. That is, people seek out or attract similar others (homophily; e.g., I spend time with Bill because we both smoke) or, alternatively, converge with others over time as a result of their interaction (social contagion; e.g., after spending time with Bill, I started smoking). If clustering by well-being is occurring, is it due to one or both of these processes?

By knowing the answer to this question, companies can better design their workplace structures, both physically and socially. For example, if our data suggest that clustering occurs via social contagion, managers may consider grouping employee workspaces by which employees they wish to influence each other, as well as strategically positioning role models (e.g., employees high on connectedness) into low-performing groups to maximize impact. On the other hand, if clustering occurs via homophily, businesses seeking social interaction among employees should hire or create workgroups with employees who are similar in well-being, or take measures to boost interaction among dissimilar coworkers via team-building exercises.

Homophily

Homophily—the process in which similar people seek each other to a greater extent than do dissimilar people—is one mechanism that can explain clustering. Originally articulated by Aristotle and Plato, homophily has been examined empirically in the social sciences through much of the last century (McPherson, Smith-Lovin, & Cook, 2001). People have been found to express preference for or attraction to similar others based on a wide range of attributes, including age, race, sex, political attitudes, personality, and emotional states (Byrne, 1961; Morell, Twillman, & Sullaway, 1989; Nahemow & Lawton, 1975; Rosenblatt & Greenberg, 1988; Tenney, Turkheimer, & Oltmanns, 2009). A meta-analysis of 460 effect sizes concluded that the relationship between attraction and both actual and perceived similarity was large and significant (Montoya, Horton, & Kirchner, 2008)). So, the old adage, “birds of a feather flock together,” pervades relationships across diverse contexts and personal characteristics.

What are the causes of homophily? The most prominent cause is physical proximity. Individuals who are similar tend to live, work, and socialize together (Lieberson, 1980), and this close proximity breeds social interaction. Thus, physical proximity can cause similar people to interact more frequently. Another leading cause of homophily is organizational structure. In workplace settings (or settings like schools or volunteer organizations), workers of similar sex and education level tend to be placed in similar positions (Marsden, 1990). Because, the organizational structure of a company affects social ties (Reskin et al., 1999), workers with similar demographic characteristics tend to group together. Lastly, workplace homophily may develop as a result of both employees and organizations selecting one another when there is good fit (and exiting when there is poor fit; Goldstein & Smith, 1995; Schneider, 1987). Homophily based on race, sex, education, and status has been widely studied in the workplace (McPherson, Smith-Lovin, & Cook, 2001). In addition, researchers have noted similarities among workers in both negative and positive affect at the workgroup level (i.e., among those working under the same manager; George, 1990) and at the organizational level (i.e., among those working at the same organization, but not necessarily in the same workgroup) (Goldstein & Smith, 1995; Schneider, 1987; Schneider, Smith, Taylor, & Fleenor, 1998). Less is known, however, about actual patterns of social interaction within the workplace. Specifically, do people with similar levels of affect interact more frequently? In other words, does emotional homophily occur? The present research seeks to extend what we know about emotional homophily to affiliative patterns within the workplace.

Understanding emotional homophily and affiliative patterns might be particularly important in intact work groups—that is, work groups that work closely with one another over time. For example, one study followed senior-level managers through a 4-week training program and found that similarity in personal values (e.g., happiness, achievement, social recognition) failed to predict initial liking of co-workers, but did predict liking 3 weeks later (Glaman, Jones, & Rozelle, 1996). By contrast, demographic similarity predicted liking initially, but not 3 weeks later, suggesting that people’s internal states might be more predictive of affiliation and liking in intact work groups than demographics.

Social Contagion

Social contagion—a second explanation for clustering—holds that over time, two individuals may become more similar as a direct consequence of their social interaction (or “socialization”). Within the domain of emotions, researchers have demonstrated how emotional states can propagate automatically and unconsciously from person-to-person through facial expressions, speech, body postures, and behavior (Chartrand & Bargh, 1999; Hatfield, Cacioppo, & Rapson, 1992). Also, both depression and happiness can propagate through social networks, influencing others as far away as three degrees of separation (Fowler & Christakis, 2008; Rosenquist, Fowler, & Christakis, 2011).

Emotional contagion (i.e., the social contagion of emotions) is an important topic in organizational research as it explains one pathway by which leaders motivate and influence followers in the workplace (Sy, Côté, & Saavedra, 2005). Researchers have experimentally manipulated emotional expression via trained confederates and measured how these emotions “spread” to others in the workgroup (Barsade, 2002). The present studies tracked workers longitudinally in actual workplaces. Our aim was to observe emotional contagion naturalistically and use time-lagged analyses to explore homophily and contagion as potential causes of well-being clustering. However, there may be other causes that we do not explore in our studies. For example, socially proximate employees may have similar experiences, which could lead to them to have similar levels of well-being.

Well-Being

We define well-being broadly, including constructs that reflect both hedonic well-being (life satisfaction, positive affect, job satisfaction, and the absence of depression) and eudaimonic well-being (i.e., psychological need satisfaction, or the sense that one is competent, autonomous, and connected to close others, as well as organizational prosocial behavior).

Accumulating evidence demonstrates that all of these characteristics, which we measure in our studies, predict positive outcomes in the workplace (Boehm & Lyubomirsky, 2008; Wright, 2010). For example, happiness and positive affect (i.e., hedonic well-being) predict better job performance as rated by supervisors (Cropanzano & Wright, 1999; Wright & Cropanzano, 2000) and constituents (DeLuga & Masson, 2000), higher job satisfaction (Connolly & Viswesvaran, 2000), and lower absenteeism (Pelled & Xin, 1999). In addition, people with higher job satisfaction have better work performance as indicated by supervisors, peers, subordinates, and objective ratings (Judge, Thoresen, Bono, & Patton, 2001).

Like hedonic well-being, eudaimonic well-being is also related to better work performance. For example, employees' psychological need satisfaction is associated with higher performance evaluations (Baard, Deci, & Ryan, 2004), more energy while at work (Van den Broeck, Vansteenkiste, De Witte, & Lens, 2008), and less job-related exhaustion (Van den Broeck et al., 2008). Additionally, organizational prosocial behavior predicts better performance evaluations and lower turnover intentions, actual turnover, and absenteeism at the individual level and increased productivity, efficiency, and customer satisfaction at the organizational level (Podsakoff, Whiting, Podsakoff, & Blume, 2009).

Although research has shown that one's well-being is in part determined by one's personality (Costa & McCrae, 1980), evidence also suggests that well-being can be affected by one's environment (e.g., how autonomy-supportive it is; Baard, Deci, & Ryan, 2004) and by the behaviors one chooses to engage in (e.g., whether one expresses gratitude or performs kind acts; Lyubomirsky, Sheldon, & Schkade, 2005; Lyubomirsky & Layous, 2013). Because coworkers make up a large portion of one's work environment throughout the week, and because well-being is an important predictor of work outcomes, understanding the interplay between coworkers' well-being is important to understanding workplace dynamics.

The Current Studies

We sought to answer two overarching exploratory questions: 1) Is there evidence for clustering by well-being in workplaces? and, 2) if yes, does mutual attraction or social contagion explain why co-workers cluster on their well-being? To answer these research questions, we employed two sociometric technologies that track physical proximity and face-to-face social interaction in a precise, unobtrusive, and unbiased manner, with the aim to demonstrate how these new technologies complement social network measurement via self-report.

Radio frequency identification (RFID) badges, which hang from a lanyard around one's neck, provide spatial location within 1-2 meters and are well-suited for assessing social networks indoors and throughout multi-story buildings. RFID badges allow social networks to be assessed in a relatively objective, easy, and rapid fashion. A slightly different type of badge—an infrared badge—can assess face-to-face interaction because it scans for other badges in front of it. Due to the advantages of RFID and infrared badges, social network researchers have begun to implement them in their investigations (Barrat et al., 2008; Cattuto et al., 2010; Yano, Lyubomirsky, & Chancellor, 2012). Because such devices can be worn unobtrusively, researchers can monitor participants in naturalistic locations, such as schools or workplaces, rather than confining them to artificial laboratory environments.

Although badges have many advantages, they still have drawbacks. Most important, badges do not indicate much about the specific interactions between people. For example, data from badges can suggest that two people interact often, when they are simply frequently in the same room without communicating. However, coupling badges with self-reports, as we did in the current studies, mitigates this issue.

Because the location of an organization and the type of business it conducts largely determines that organization's culture, we aimed to examine real-time social interaction patterns in two separate workplaces housed in different countries and industries. Thus, we sought results that generalize across business cultures.

In Study 1, social interaction was measured both via self-reports and via sociometric (Purelink active RFID) monitoring badges that provided a measure of the physical distance between coworkers within the office over 2 weeks. In Study 2, infrared badges were used to track time spent in social interaction (Hitachi's Business Microscope; Yano & Lyubomirsky, 2012).

Both technologies afford the use of continuous predictors of sociality (e.g., physical proximity over time in Study 1 and time spent in face-to-face interaction in Study 2) as opposed to peer nominations, which are common measures in many social network studies. In both studies, we tested for clustering by well-being within the workplace by using indices of well-being to predict social interaction patterns. Notably, in Study 2, we also use time-lagged models to determine whether homophily explains well-being clustering (i.e., people with similar levels of well-being are attracted to one another) or whether sociality prompts convergence on well-being (i.e., well-being is contagious).

Study 1

In Study 1, we examined whether individuals in workplace settings cluster by well-being.

Method

Participants. Employees of Coca-Cola Iberia in Madrid, Spain (*N* = 94, 72% female) participated in this study. Their ages ranged from 22 to 61 (*M* = 35.60, *SD* = 8.99), and they worked in a variety of departments, including Marketing, Accounting, Information Technology, and Customer Care, but were all located within the same multi-story building. Because our sample size was limited, our results should be interpreted with caution.

Procedure. We recruited participants in their workplace and offered them a small prize of university merchandise, as well as a donation to a charitable organization based on study enrollment. All employees were eligible to participate. Participants logged into the study website for 18 weeks as part of a longer, ongoing investigation. We used participants' baseline well-being measures and their corresponding badge monitoring data (see below).

Active RFID badges. A subset of study participants ($n = 22$) worked within the viewable range of our RFID equipment and elected to wear active RFID badges (see Figure 1, top left) for the first 2 weeks of the study. We placed RFID receivers (see Figure 1, top right) around the office to report the signal strength of each badge within its field of view to a computer server. The server uses two or more observations to triangulate and record the spatial location of each badge relative to an office floor plan. The badges are tracked multiple times per second.

To calculate spatial proximity between any two badges, we calculated the spatial distance between each dyad during any 5-second interval and aggregated the inverse of this distance (i.e., $\frac{1}{d}$) across all observations. So, if participant 1 and 2 were standing within 1 meter of each other during a 5-second value, the value for this dyad would be recorded as a 1. However, if they were standing within 5 meters of each other during this time window, the value for this dyad would be recorded as 1/5. Thus, aggregated proximity is higher when a dyad is located in close proximity over longer periods of time (up to a maximum duration of 2 weeks). Conversely, aggregated proximity is lower when dyads are often far apart or infrequently within close proximity. Computing reliability by comparing Week 1 to Week 2 proximity yielded an α of .77.

Materials. In Week 2, participants were asked to list up to 10 individuals with whom they "interact with the most at work." They nominated other coworkers in the office, whether or not these coworkers were also participating in the research study. No other questions about these individuals were asked. We used mutual ties (i.e., instances in which two coworkers nominated one another) to construct the social network that was used for all analyses.

Participants completed the Satisfaction With Life Scale (Diener, Emmons, Larsen, & Griffin, 1985)—a 5-item measure of global life satisfaction (e.g., "In most ways my life is close to ideal"; α = .88).

Participants also completed the Quick Inventory of Depressive Symptomatology Self-Report (QIDS-SR; Rush et al., 2003), which is a 16-item measure of depressive symptom severity (e.g., sleep problems, sadness, lethargy, restlessness).

Participants reported three types of need satisfaction (connectedness ["I felt a sense of contact with people who care for me, and whom I care for"], autonomy ["I was free to do things my own way"], and competence ["I was successfully completing difficult tasks and projects"]; Deci & Ryan, 2000; Sheldon, Elliot, Kim, & Kasser, 2001). The questionnaire contained three sets of 3-item measures, with reliabilities of .73, .74, .and 83, for connectedness, autonomy, and competence, respectively.

Participants completed the 3-item Overall Job Satisfaction Scale (Cammann, Fichman, Jenkins, & Klesh, 1983), which assesses employees' liking and satisfaction with their jobs (e.g., "I like working here"; α = .86).

Correlations between all self-report variables from Studies 1 and 2 are included in Tables 1, 2, and 3.

Results

Social network analytic approach. To test for clustering in the self-report data, we used mixed-effects (i.e., multi-level) modeling (estimated using the lme4 library in R), as observations were nested within participants. We predicted the presence or absence of a mutual tie between two participants (using the binomial family with a log link). The composite equation of the model used for affiliation effects, where EGO and ALTER denote the survey values for each member of the dyad and SIMILARITY is calculated as $(-1)\left(abs\left(EGO - ALTER\right)\right)$, is the following:

$$Tie_{ij} = \gamma_{00} + \gamma_{01}EGO + \gamma_{02}ALTER + \gamma_{03}\,SIMILARITY + (\zeta_{ij} + \zeta_{EGO} + \zeta_{ALTER})$$

We calculated random intercepts for each member of the dyad. The key coefficient that tests our clustering hypothesis in this model is γ_{03} (see gray column in Table 4), which, if positive, indicates that similar individuals are more likely to form mutual ties. A negative coefficient indicates that dissimilar individuals are more likely to form ties. The coefficients γ_{01} and γ_{02} carry the main effects of individuals' levels on the variable of interest—that is, whether or not an individual's level on that variable increased the likelihood of forming ties. Although these two main effects are not the focus of our paper, we include them in the model so that the coefficient for ego-alter similarity carries only the "pure" interaction effect.

To examine proximity between two individuals as measured by RFID badges, we also used mixed-effects modeling. However, instead of predicting the presence or absence of a tie, we predicted aggregated proximity between two badges over time, using the Poisson family with a log link, and added an additional random-effects term to control for over- or under-dispersion (i.e., quasi-Poisson). Otherwise, the equations are identical to those used for self-reports above.

$$Proximity_{ij} = \gamma_{00} + \gamma_{01}EGO + \gamma_{02}ALTER + \gamma_{03}SIMILARITY + (\zeta_{ij} + \zeta_{EGO} + \zeta_{ALTER} + \zeta_{OD})$$

Just as in the earlier model, our interest lies only in the "pure" ego-alter interaction coefficient γ_{03}. The other terms (γ_{01}, γ_{02}) will carry the main effect of how much an individual's level of that variable influences the outcome

Social networks. Self-report data indicated that the workplace network contained 451 ties (i.e., nominations from one employee to another), of which 325 (72.1%) were made to other participants in the study. Of all ties, 122 (35%) were mutual, (i.e., both employees were participants in the study and nominated each other). On average, the workplace network contained 2.83 ties per employee (1.06 mutual ties per employee), and overall, the network density (i.e., proportion of actual ties to possible ties) was relatively sparse (δ = .002 out of 1.000).

The RFID badges recorded a total number of 705,681 spatial observations over 14 days. The network density is also relative sparse (δ = 0.0009).

Clustering. All estimates from self-report data are reported in Table 4 (see Study 1, self-report rows). Similarity in life satisfaction, connectedness, and job satisfaction (γ_{03}) predicted social nominations (see Figure 2). Controlling for individual differences, mutual nominations were more likely among those more similar in life satisfaction, connectedness, and job satisfaction. Specifically, a 1 standard deviation increase in similarity in job satisfaction led to a 37% increase in the likelihood of a mutual nomination, and this likelihood of a mutual nomination rose to 71% for life satisfaction and 92% for connectedness.

All estimates from RFID badges are reported in Table 4 (see Study 1, RFID Badge rows). Similarity in connectedness predicted aggregated spatial proximity (see Figure 3, top). Dissimilarity in competence and depressive symptoms (γ_{03}; similarity column) also predicted proximity (see bottom graphs in Figure 3). Controlling for individual differences, 1 standard deviation increases in similarity in connectedness, competence, and autonomy were associated with a 0.19 increase, 0.14 decrease, and 0.47 decrease, respectively, in the log of the proximity score.

Brief Discussion

We analyzed self-reports and two measures of sociality to examine whether individuals who share similar levels of well-being are more likely to socialize. Mutual self-reported nominations between dyads were more likely when similarity in life satisfaction, connectedness, and job satisfaction was high rather than low.

Using RFID badges, we found that dyads relatively similar in connectedness spent more time in physical proximity to one another than dissimilar dyads. Conversely, we also found that dyads dissimilar in competence and depressive symptoms spent more time in close physical proximity than similar dyads.

Notably, both the self-reported social interactions and badge proximity analyses revealed that co-workers cluster based on similarity in connectedness. This finding suggests that our novel technological approach to measuring sociality is capturing what we intend—namely, actual social behavior as indicated by physical proximity.

Although the subset of participants wearing badges was only a quarter of the full sample, it revealed important effects that were not evident from participants' recollections of their social patterns. Notably, the proximity analyses indicated that individuals may be seeking out people who differ in feelings of competence and depressive symptoms, or conversely, that social interaction causes divergence in these measures. However, this pattern of divergence did not appear in self-reported nominations, perhaps because highly dissimilar individuals did not remember to nominate each other (as we only used mutual ties) or because such dyads did not like one other, even though they did in fact spend time together. Thus, unlike self-reported sociality, our sociometric badges are immune to recollection biases by their nature.

Finally, although both sets of results demonstrated that emotional clustering is occurring, because the data are correlational, we can only speculate whether homophily or contagion is driving the effect. We conducted Study 2 (using a complementary sociometric technology) to begin to address these limitations.

Study 2

In Study 2, we aimed to replicate the well-being clustering we observed in Study 1. In addition, Study 2 examined two potential causes of well-being clustering: homophily and social contagion.

Method

Participants. Thirty-two Japanese employees of an engineering firm in Tokyo (27 male, 5 female), who ranged in age from 24 to 50 years (*M* = 35.31, *SD* = 6.65), participated in this study. We recruited from a pool of employees who were already wearing sociometric badges daily at the company, and participants completed our online measures in addition to their usual work-related activities. Again, our sample size was limited, but each participant's sociometric data include interactions with 145 other badge-wearing employees. Altogether, employees who contributed data to the study came from 36 different work groups, but were located at the same worksite.

Procedure. The study was conducted entirely online in Japanese using a secure website. Participants completed weekly surveys for 6 weeks, as well as a 1-month follow-up.

Materials. Participants completed the same measures of life satisfaction (αs from .84 to .94), need satisfaction (αs from .83 to .96), and job satisfaction (αs from .79 to .86) as administered in Study 1. Additionally, positive affect was measured with 2 items: "How have you felt this week?" (-10 = *extremely negative*, 10 = *extremely positive*) and "How satisfied are you with your life this week?" (-10 = *extremely satisfied*, 10 = *extremely dissatisfied*; αs from .94 to .96). Participants also completed the 4-item Organizational Citizenship Behavior (OCB) Scale (Lee & Allen, 2002), which measures the frequency of performing behaviors that indicate employees' commitment and dedication to their work duties, coworkers, and employer over and above what is strictly required by their jobs (αs from .81 to .93). We considered OCB an important construct of interest because it is both important to businesses (due to its association with a host of positive work outcomes) and taps behavior (in contrast to our cognitive and emotional outcomes). Participants did not complete a measure of depressive symptoms. All measures asked participants about their feelings over the past week. Correlations between all of the self-report measures are included in Table 2 (cross-sectionally) and Table 3 (over time).

Because our participants wore sociometric badges (see Figure 1, bottom) as part of their work, behavioral monitoring data were available throughout the study. The badges—worn on a lanyard in the middle of the chest area facing out—contain embedded infrared sensors with the ability to measure social interactions. (Technically, this measure is time spent facing other individuals at a distance no more than 2 meters.) The infrared sensors, which have a $60°$ conic viewing space extending from one's chest and a range of up to 2 meters, are able to track minutes of face-to-face communication between two or more individuals. Several times per minute, each badge scans the viewable area for other badges and records the devices it has identified in 1-min intervals. Thus, we were able to calculate from the raw sociometric data the total number of minutes each week that dyads of participants spent in face-to-face proximity, where social interactions are highly likely to occur. To determine reliability, we split measures by week, which yielded an α of .92.

Results

Analytic approach. We used mixed-effects (i.e., multi-level) modeling (estimated using the lme4 library in R) to test for clustering. Because the number of minutes of face-to-face contact between any two participants is zero or slightly above zero (i.e., not Gaussian distributed), we used the Poisson family with a log link and included a random-effects term to control for over-dispersion (ζ_{OD}). The composite equation of the model used to analyze clustering is the following:

$$MINUTES_{ij} = \gamma_{00} + \gamma_{01}EGO + \gamma_{02}ALTER + \gamma_{03}SIMILARITY + (\zeta_{ij} + \zeta_{EGO} + \zeta_{ALTER} + \zeta_{OD})$$

We included no other covariates in either time-lagged model, as none of our occupational variables were significant predictors of minutes in conversation. Our models are similar to those used in Study 1, where γ_{03} indicates the “pure” ego-alter interaction effect (i.e., similarity on a variable), γ_{01} and γ_{02} carry the main effect of individuals’ levels on the variable of interest.

For time-lagged analyses, we tested two models. First, we tested whether changes in sociality from week to week predict similarity using the following composite equation (i.e., contagion):

$$SIMILARITY_{ij} = \gamma_{00} + \gamma_{01}MINUTES_{current} + \gamma_{02}MINUTES_{previous} + \gamma_{03}EGO_{current} + \gamma_{04}ALTER_{current} + (\zeta_{ij} + \zeta_{EGO} + \zeta_{ALTER})$$

Using this model, estimates of coefficient γ_{01} indicate whether more time in social interaction this week (i.e., current week's social interaction [γ_{01}] controlling for the previous week's social interaction [γ_{02}]) predicts individuals' similarity on the variable of interest. Likewise, the previous week's social interaction [γ_{02}] might also predict similarity in the future, controlling for the current level of social interaction [γ_{01}], which is a stronger test of the social contagion hypothesis as it is further apart in time from the outcome. As in earlier models, we control for individuals' current levels of each variable (γ_{03} and γ_{04}). Unlike in previous models, however, because the outcome is different, these coefficients indicate how individuals' levels of a variable predict their similarities to others on the same variable (rather than how similarity to others predicts social interaction).

Likewise, we tested whether changes in similarity from one week to the next predict sociality (i.e., homophily). The composite equation is the following:

$$\begin{aligned} MINUTES_{ij} &= \gamma_{00} + \gamma_{01}EGO_{current} + \gamma_{02}ALTER_{current} + \gamma_{03}SIMILARITY_{current} \\ &+ \gamma_{04}EGO_{previous} + \gamma_{05}ALTER_{previous} + \gamma_{06}SIMILARITY_{previous} \\ &+ (\zeta_{ij} + \zeta_{EGO} + \zeta_{ALTER} + \zeta_{OD}) \end{aligned}$$

Social network. As most participants had at least one face-to-face interaction during the study, the network is almost perfectly dense (δ = .96). A density graph of minutes in social interaction is displayed in Figure 3 (bottom). Notably, we examined how the subset of participants in our study differed from all badge-wearing employees whose social network data were used in our sociometric analyses. We found no differences between these two groups in the number of leaders, department membership, or type of position (all *p*s > .25). The correlations between self-report variables for the subset of participants in our study are included in Table 2.

Clustering. Estimates for our analysis of clustering are reported in Table 4 (see Study 2 rows). Our results indicate that similar levels of life satisfaction, positive affect, autonomy, connectedness, competence, and job satisfaction (γ_{03} ; similarity column) predicted more time in face-to-face interaction (see Figure 4). Thus, the log of minutes in conversation changed with a 1 standard deviation increase in similarity in life satisfaction (0.36 increase), positive affect (0.19 increase), autonomy (0.55 increase), connectedness (0.26 increase), competence (0.43 increase), and job satisfaction (0.34 increase).

Additionally, similar levels of OCB marginally predicted less time in social interaction. (A -0.16 decrease in the log of minutes of conversation was associated with a 1 standard deviation increase in similarity.) However, this finding may reflect managers with relatively high OCB interacting with employees with relatively lower OCB.

Time-lagged analysis. Our first time-lagged model can shed light on whether changes in social interaction precede changes in well-being similarity (i.e., contagion; see Table 5). Controlling for prior time in social interaction, we found that current time in social interaction (γ_{01}; social interaction minutes [current] column highlighted in gray) significantly predicted similarity in OCB and job satisfaction. Thus, as individuals spend more time interacting, they become more similar in OCB and job satisfaction. In a stronger test of the contagion hypothesis, social interaction from the prior week (γ_{02}; social interaction minutes [previous] column in gray) controlling for the current week predicted similarity in autonomy (significantly) and competence (marginally). Thus, the prior week's social interaction time predicted later convergence in autonomy and competence.

To determine whether well-being similarity precedes sociality in time, we predicted sociality from weekly changes in similarity (i.e., mutual attraction or homophily; see Table 6).

Controlling for the prior week, shared levels of autonomy, connectedness (marginally), and competence (γ_{03}; similarity [current] column in gray) significantly predicted time spent in social interaction. Thus, as individuals become more similar in their feelings of autonomy, connectedness, and competence, they spend more time engaging in social interaction.

Furthermore, as a stronger test of the homophily hypothesis, similarity in connectedness and autonomy from the prior week (γ_{06}; similarity [previous] column in gray) controlling for the current week significantly predicted minutes in social interaction 1 week later. Thus individuals who previously similar in autonomy and connectedness would go on to spend more time in social interaction 1 week later.

Brief Discussion

Study 2 examined well-being clustering in a workplace environment using minutes of social interaction (as measured by sociometric badges) and self-reported measures of well-being. We found that dyads with similar levels of need satisfaction (i.e., autonomy, connectedness, and competence), life satisfaction, positive affect, and job satisfaction spent more minutes in face-to-face interaction than did dissimilar dyads. We also found a marginal tendency for dyads to match based on their dissimilarity in OCB rather than their similarity. Notably, the fixed effects found in Study 2 were smaller than those found in Study 1, likely due to the use of different technologies in each study.

We used two complementary time-lagged analyses that would implicate either contagion (that individuals become more similar as they interact) or homophily (that individuals will interact more as they become more similar) to explain this clustering. We found that similarity in job satisfaction and OCB converges as social interaction increases. These findings suggest that job satisfaction and OCB are subject to contagion—individuals influence one another as they interact. Using the second time-lagged model, we found that increases in dyads' similarity of need satisfaction (autonomy, competence, and connectedness) predicted the number of minutes they spend in social interaction. Thus, individuals appear to be attracted to others who are having their needs similarly met or are similarly engaged in their work (i.e., homophily).

General Discussion

In *The Odyssey*, the second oldest piece of Western literature, Homer wrote that the gods were always "bringing like and like together." Thus, socializing with similar others is perhaps one of the most ancient and reliable observations of human behavior. Although researchers have documented how individuals cluster based on shared external attributes, such as gender or age, our studies examined the links between socialization and shared internal psychological characteristics—namely, several constructs related to well-being. In two studies using two workplace samples in Spain and Japan, we related various measures of well-being to sociality as assessed by self-reports of interaction patterns and two relatively novel technologies: RFID badges (tracking workers' physical proximity), and infrared sociometric badges (tracking minutes of face-to-face social interaction). Notably, we discovered that well-being clustering occurred in both workplaces, using all three measures of sociality and both types of sociometric technologies.

We found broad agreement that individuals cluster based on shared levels of connectedness in both samples across all three measures of sociality. Dyads that report similar levels of connectedness tend to nominate each other, stand physically closer together, and spend more time in face-to-face interaction than dissimilar dyads. It is worth noting that people who are high in connectedness are also likely to be well-adjusted and extraverted, having sufficient social support and strong relationships (Andreassen, Hetland, & Pallesen, 2010; Sheldon &

Elliot, 1999). Thus, connectedness may serve as a general marker of positive mental health. Paralleling the pattern for connectedness, dyads that report similar levels of job and life satisfaction tend to nominate each other (Study 1) and engage in more minutes of social interaction (Study 2).

Although we only measured depressive symptoms in Study 1, our RFID badge analysis suggests that individuals cluster based on dissimilar levels of depressive symptoms (i.e., misery does not love company). We can only speculate that heterophily might explain this effect. This could occur in two ways. First, individuals with relatively high levels of depressive symptoms may be seeking out others to lift their mood or for general emotional support. Second, those with relatively low levels of depressive symptoms could be identifying and purposefully spending time with those who need an emotional boost. Alternatively, a work-related interaction (e.g., receiving negative feedback) might cause two individuals' scores to diverge.

Our time-lagged analyses in Study 2 attempted to shed light on the direction of change between sociality and similarity. These analyses suggest that homophily may be driving individuals' clustering on shared levels of need satisfaction: We found that changes in need satisfaction similarity predict sociality (i.e., homophily), but changes in sociality do not predict similarity in need satisfaction (i.e., contagion). Prior research on homophily suggests at least three possible explanations for these findings. First, individuals may be seeking out similar others, either consciously or unconsciously (Huston & Levinger, 1978). Alternatively, similarity may not drive the initial interaction, but once a social interaction has begun, it may be more likely to persist between individuals who are more similar (Popielarz & McPherson, 1995). Third, the apparent matching of individuals could be an artifact of everyone being attracted to those high on some characteristic (e.g., autonomy), but having to settle for interactions with only those who reciprocate their overtures (i.e., homophily through nonreciprocity; Schaefer, 2012).

As a contrast to how clustering in need satisfaction may operate through homophily, our time-lagged analyses showed that changes in social interaction patterns predict similarity in OCB and job satisfaction (i.e., contagion). Thus, sociality may drive convergence: As individuals converse at work, they may be sharing experiences, stories, or complaints about their jobs—and may be modeling positive behaviors to one another—that make them converge in job satisfaction or their tendency to go above and beyond their work responsibilities (OCB).

Our findings that clustering on OCB and job satisfaction results from social contagion have implications for how business organizations might consider organizing their workplaces. For example, companies may want to reorganize workspaces so that employees high in OCB or job satisfaction are spread evenly throughout the organization. In addition, based on our result that clustering by need satisfaction occurs via homophily, businesses that desire social interaction among employees should consider hiring people similar in need satisfaction (i.e., connectedness, autonomy, and competence). Alternatively, businesses could create workgroups with employees who are similar in need satisfaction, or organize team-building activities for employees dissimilar in need satisfaction.

Our findings on the clustering of individuals based on reported competence were mixed: We found dissimilar matching in Study 1 and similar matching in Study 2. Such differences could have arisen because of the heterogeneity of our Study 1 workplace (a corporate office may have more occupational diversity) or the homogeneity of our Study 2 workplace (engineers may perform similar job duties). According to this explanation, engineers might be more likely to shun those whom they judge as being relatively less competent, whereas corporate workers may be more willing to seek help from others or offer their assistance. Alternatively, East-West cultural differences could result in differences in how competence is perceived and affects social interactions. Likewise, these differences could be a consequence of disparity in gender composition between studies, as Study 1 featured predominantly female employees, while Study 2 featured predominantly male employees.

Importantly, our results demonstrate the value of using badges to assess social networks. In Study 1, continuous data from badges (i.e., physical distance between individuals over time) extended data obtained from one-time dichotomous nominations from self-reports regarding clustering by connectedness. Notably, we also found effects with badge data that we did not find with self-reports—namely, individuals dissimilar in competence and depressive symptoms clustered. It is possible that those who dislike each other because of dissimilarities (or who are obliged to interact due to their work duties) will not nominate each other via self-report, but may nonetheless interact with one another often. A badge methodology may allow such effects to be revealed due to its lack of bias in comparison with self-report. A badge methodology was quite beneficial in Study 2 as well, as the badges provided a measure of social interaction that was continuous over time, which was essential for time-lagged analyses.

Limitations and Future Directions

Our studies' primary shortcoming was that we did not experimentally assign social interaction or well-being similarity: Thus, other unmeasured variables could be causing any or all of the effects we found. Similar dyads could have more in common than just their well-being (i.e., multiplex ties), and these other similarities may be driving well-being clustering. For example, people with similar incomes might also be similarly satisfied with their jobs. Our time-lagged analyses show how changes over time affect our outcomes, but do not necessarily mean that we have identified the mechanisms at work. Thus, we cannot definitively know whether social contagion or homophily is causing the clustering we observed. In fact, we did not find homophily or contagion effects for all of our variables (and when we did, effect sizes were small), suggesting that other processes may be operating. To make causal conclusions, researchers could promote sociality with specific individuals (to observe contagion) or manipulate individuals' awareness of their similarity to others (to observe homophily).

We phrased our interpretations primarily as similarity drawing people together. However, it is also possible that dissimilarity drives people apart. For example, differences in well-being may be repulsive—an alternative explanation fully consistent with our results and prior research on the primacy of the negative over the positive (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001).

Due to the limited range of our RFID receivers, the subsample of participants who wore badges in Study 1 was small, and these analyses were low in statistical power. When results are inconsistent between studies and samples, it is unclear whether statistical power is too low or whether the effect is actually nonexistent. To partially address this limitation, we focused our attention on positive findings, and especially highly significant ones, rather than over-interpreting negative findings. Nevertheless, we still found two significant dissimilarity effects in our behavioral data from the smaller sample in Study 1 that were not evident in the larger sample using self-reported nominations. Our badges may have captured these patterns because when recalling social interactions, people may forget to list dissimilar individuals with whom they often interact. Alternatively, participants may only be thinking of a particular type of social interaction (i.e., work-related conversations only) when nominating others and not the totality of their interactions. Where recall biases exist, sociometric technology can capture differences that might not otherwise be apparent. However, sociometric technologies do not guarantee that social interactions have taken place, nor do they capture interactions that may be occurring between distant individuals, such as messaging or telephone calls (although such interactions could be added to analyses should data become available).

The number of variables analyzed in our studies inflates our risk of making Type I errors. This concern is especially relevant for results with *p*-values between .10 and .01. Thus, we urge readers to direct the bulk of their attention to our more significant results (i.e., $p < .001$) when replicating or extending the results presented here. Relatedly, our effect sizes are also small. Large effect sizes are not expected in this area of research, but it is important to note that clustering processes may be slow in nature once initial social ties have formed.

We collected data in two locations with pronounced cultural differences (Western and Eastern) and in companies in dissimilar industries (engineering and beverage). Although our approach greatly boosts generalizability, the confounding of culture and industry precludes cross-cultural or cross-industry comparisons. Culture plays an important role in how individuals express well-being, value well-being, and socialize (Kitayama, Markus, & Kurokawa, 2000). Likewise, well-being clustering could differ by workplace, industry, or the nature of one’s job responsibilities. For example, business students who work together have been found to prefer similar coworkers when performing noncompetitive tasks, but dissimilar coworkers on competitive tasks (Glaman, Jones, & Rozelle, 2002). Researchers interested in cross-cultural or cross-industry comparisons could benefit from using diverse samples and holding industry or culture constant.

Our study employed a number of variables that are conceptually related to well-being and job satisfaction. An alternative approach to analyzing our data would have been to group related constructs as latent variables (e.g., need satisfaction, occupational well-being). However, when we did so, the results were very similar to those reported in the present study. Moreover, aggregating all variables into a single latent factor would gloss over a consider amount of heterogeneity, and our time-lagged analyses strongly suggest that different mechanisms or causal directions are at work even in conceptually-related constructs. For example, need satisfaction variables such as autonomy and competence (but not positive affect or life satisfaction) performed best in time-lagged models of homophily. Likewise, job-related variables, such as OCB and job satisfaction (but not most need satisfaction variables), showed small, but significant effects in time-lagged models of social contagion. Thus, keeping these variables separate allowed us to gain insight into the processes underlying the interplay of homophily and contagion in social interaction patterns.

Because our studies were conducted within business organizations, social interactions may have been the result of forced (rather than chosen) contact, which could serve as a source of bias. For example, clustering by well-being could stem from the structure of the organization. Perhaps employees with similar levels of well-being were assigned to work together. However, our detection of effects based on homophily and social contagion suggests that people chose, at least to some extent, with whom they interacted. Furthermore, the presence of situationally forced interactions would only reduce our power to detect homophily and social contagion effects. Another possibility is that employees in social clusters had similar experiences in the workplace, and this caused them to have similar levels of well-being. Again, however, the presence of homophily and social contagion effects suggests that this possibility cannot explain all of the clustering that we observed and should only reduce our power.

Final Words

Our research highlights the surprising role that individuals' well-being plays in the formation and influence of workplace relationships: Emotions can bring people together and ripple out from person to person. Specifically, our results imply that job satisfaction and going above and beyond one's work duties may be particularly contagious, and thus managers seeking to improve morale might consider placing personnel strategically, knowing that in these particular dimensions, they may influence others. However, because some aspects of well-being may be prone to attraction rather than being particularly contagious, if communication is a high priority, then managers would do well to assemble teams of individuals similar in those aspects of well-being who will naturally communicate better. Consequently, understanding these complementary processes can help leaders cultivate cohesive teams and satisfied employees.

References

Andreassen, C. S., Hetland, J., & Pallesen, S. (2010). The relationship between ‘workaholism’, basic needs satisfaction at work and personality. *European Journal of Personality*, *24*, 3-17.

Baard, P. P., Deci, E. L., & Ryan, R. M. (2004). Intrinsic need satisfaction: A motivational basis of performance and well-being in two work settings. *Journal of Applied Social Psychology, 34*, 2045-2068.

Barnett, P. A., & Gotlib, I. H. (1988). Psychosocial functioning and depression: Distinguishing among antecedents, concomitants, and consequences. *Psychological Bulletin*, *104*, 97-126.

Barrat, A., Cattuto, C., Colizza, V., Pinton, J. F., Broeck, W. V. D., & Vespignani, A. (2008). High resolution dynamical mapping of social interactions with active RFID. *arXiv preprint arXiv:0811.4170*.

Barsade, S. G. (2002). The ripple effect: Emotional contagion and its influence on group behavior. *Administrative Science Quarterly*, *47*, 644-675.

Baumeister, R. F., Bratslavsky, E., Finkenauer, C., & Vohs, K. D. (2001). Bad is stronger than good. *Review of General Psychology*, 5, 323-370.

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, *117*, 497-529.

Bennett, J., Owers, M., Pitt, M., & Tucker, M. (2010). Workplace impact of social networking. *Property Management, 28,* 138-148.

Berman, E. M., West, J. P., & Richter Jr., M. N. (2002). Workplace relations: Friendship patterns and consequences (according to managers). *Public Administration Review, 62,* 217-230.

Boehm, J. K., & Lyubomirsky, S. (2008). Does happiness promote career success? *Journal of Career Assessment*, *16*, 101-116.

Bolino, M. C., Turnley, W. H., & Bloodgood, J. M. (2002). Citizenship behavior and the creation of social capital in organizations. *Academy of Management Review, 27*, 505-522.

Byrne, D. (1961). Interpersonal attraction and attitude similarity. *The Journal of Abnormal and Social Psychology*, *62*, 713-715.

Cammann, C., Fichman, M., Jenkins, D. A., & Klesh, J. R. (1983). The Michigan Organizational Assessment Questionnaire. In S. E. Seashore (Ed.), *Assessing organizational change: A guide to methods, measures, and practices* (pp. 71-138). New York: Wiley.

Cattuto, C., Van den Broeck, W., Barrat, A., Colizza, V., Pinton, J. F., & Vespignani, A. (2010). Dynamics of person-to-person interactions from distributed RFID sensor networks. *PLOS ONE*, *5*, e11596.

Chartrand, T. L., & Bargh, J. A. (1999). The chameleon effect: The perception–behavior link and social interaction. *Journal of Personality and Social Psychology, 76*, 893-910.

Cohen, S., & Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin*, *98*, 310-357.

Connolly, J. J., & Viswesvaran, C. (2000). The role of affectivity in job satisfaction: A meta-analysis. *Personality and Individual Differences*, *29*, 265-281.

Costa, P. T., & McCrae, R. R. (1980). Influence of extraversion and neuroticism on subjective well-being: Happy and unhappy people. *Journal of Personality and Social Psychology, 38*, 668-678.

Cropanzano, R., & Wright, T. A. (1999). A 5-year study of change in the relationship between well being and job performance. *Consulting Psychology Journal: Practice and Research, 51*, 252–265.

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, *11*, 227-268.

DeLuga, R. J., & Mason, S. (2000). Relationship of resident assistant conscientiousness, extraversion, and positive affect with rated performance. *Journal of Research in Personality, 34*, 225–235.

Diener, E. D., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The Satisfaction with Life Scale. *Journal of Personality Assessment, 49,* 71-75.

Fowler, J. H., & Christakis, N. A. (2008). The dynamic spread of happiness in a large social network. *British Medical Journal*, *337*, a2338: 1-9.

Freeman, L. C. (2004). *The development of social network analysis: A study in the sociology of science.* Vancouver, CA: Empirical Press.

George, J. M. (1990). Personality, affect, and behavior in groups. *Journal of Applied Psychology, 75*, 107-116.

Glaman, J. M., Jones, A. P., & Rozelle, R. M. (1996). The effects of co-worker similarity on the emergence of affect in work teams. *Group & Organization Management*, *21*, 192-215.

Glaman, J. M., Jones, A. P., & Rozelle, R. M. (2002). Competitiveness and the similarity of preferred coworkers. *Journal of Applied Social Psychology, 32*, 142-158.

Hatfield, E., Cacioppo, J., & Rapson, R. (1992). Primitive emotional contagion. In M. S. Clark (Ed.), *Review of Personality and Social Psychology*. Newbury Park, CA: Sage.

Huston, T. L., & Levinger, G. (1978). Interpersonal attraction and relationships. *Annual Review of Psychology*, *29*, 115-156.

Judge, T. A., Thoresen, C. J., Bono, J. E., & Patton, G. K. (2001). The job satisfaction-job performance relationship: A qualitative and quantitative review. *Psychological Bulletin*, *127*, 376-407.

Kiecolt-Glaser, J. K., Ricker, D., George, J., Messick, G., Speicher, C. E., Garner, W., & Glaser, R. (1984). Urinary cortisol levels, cellular immunocompetency, and loneliness in psychiatric inpatients. *Psychosomatic Medicine*, *46*, 15-23.

Kitayama, S., Markus, H. R., & Kurokawa, M. (2000). Culture, emotion, and well-being: Good feelings in Japan and the United States. *Cognition and Emotion*, *14*, 93–124.

Kraut, R. E., Fish, R. S., Root, R. W., & Chalfonte, B. L. (1990). Informal communication in organizations: Form, function, and technology. In S. Oskamp & S. Spacapan (Eds.), *Human reactions to technology: Claremont symposium on applied social psychology* (pp. 145-199). Beverly Hills, CA: Sage Publications.

Lee, K., & Allen, N. J. (2002). Organizational citizenship behavior and workplace deviance: The role of affect and cognitions. *Journal of Applied Psychology*, *87*, 131.

Lieberson, S. (1980). *A piece of the pie: Blacks and white immigrants since 1880*. Berkeley, CA: University of California Press.

Lyubomirsky, S., & Layous, K. (2013). How do simple positive activities increase well-being?. *Current Directions in Psychological Science*, *22*, 57-62.

Lyubomirsky, S., Sheldon, K. M., & Schkade, D. (2005). Pursuing happiness: The architecture of sustainable change. *Review of General Psychology*, *9*, 111-131.

Marsden, P. V. (1990). Network diversity, substructures, and opportunities for contact. In C. Calhoun, M. Meyer, & R. S. Scott (Eds.), *Structures of power and constraint: Papers in honor of Peter Blau* (pp. 397-410). New York: Cambridge.

McPherson, M., Smith-Lovin, L., & Cook, J. M. (2001). Birds of a feather: Homophily in social networks. *Annual Review of Sociology*, 415-444.

Montoya, R. M., Horton, R. S., & Kirchner, J. (2008). Is actual similarity necessary for attraction? A meta-analysis of actual and perceived similarity. *Journal of Social and Personal Relationships*, *25*, 889-922.

Morell, M. A., Twillman, R. K., & Sullaway, M. E. (1989). Would a Type A date another Type A?: Influence of behavior type and personal attributes in the selection of dating partners. *Journal of Applied Social Psychology*, *19,* 918-931.

Moreno, J. L. (1934). *Who shall survive? A new approach to the problem of human interrelations*. Beacon, NY: Beacon House.

Nahemow, L., & Lawton, M. P. (1975). Similarity and propinquity in friendship formation. *Journal of Personality and Social Psychology*, *32*(2), 205.

Pelled, L. H., & Xin, K. R. (1999). Down and out: An investigation of the relationship between mood and employee withdrawal behavior. *Journal of Management*, *25,* 875–895.

Perry-Smith, J. E. (2006). Social yet creative: The role of social relationships in facilitating individual creativity. *Academy of Management Journal*, *49,* 85-101.

Podsakoff, N. P., Whiting, S. W., Podsakoff, P. M., & Blume, B. D. (2009). Individual- and organizational-level consequences of organizational citizenship behavior: A meta-analysis. *Journal of Applied Psychology, 94*, 122-141.

Popielarz, P. A., & McPherson, J. M. (1995). On the edge or in between: Niche position, niche overlap, and the duration of voluntary association memberships. *American Journal of Sociology, 101,* 698-720.

Reskin, B. F., McBrier, D. B., & Kmec, J. A. (1999). The determinants and consequences of workplace sex and race composition. *Annual Review of Sociology, 25,* 335-361.

Rosenblatt, A., & Greenberg, J. (1988). Depression and interpersonal attraction: The role of perceived similarity. *Journal of Personality and Social Psychology*, *55*, 112-119.

Rosenquist, J. N., Fowler, J. H., & Christakis, N. A. (2010). Social network determinants of depression. *Molecular Psychiatry, 16,* 273-281.

Rush, A. J., Trivedi, M. H., Ibrahim, H. M., Carmody, T. J., Arnow, B., Klein, D. N., ... & Thase, M. E. (2003). The 16-Item Quick Inventory of Depressive Symptomatology (QIDS), clinician rating (QIDS-C), and self-report (QIDS-SR): a psychometric evaluation in patients with chronic major depression. *Biological Psychiatry, 54*, 573-583.

Tenney, E. R., Turkheimer, E., & Oltmanns, T. F. (2009). Being liked is more than having a good personality: The role of matching. *Journal of Research in Personality*, *43*, 579-585.

Schaefer, D. R. (2012). Homophily through nonreciprocity: Results of an experiment. *Social Forces*, *90*, 1271-1295.

Schneider, B. (1987). The people make the place. *Personnel Psychology*, *40*, 437-453.

Schneider, B., Goldstein, H. W., & Smith, D. B. (1995). The ASA framework: An update. *Personnel Psychology*, *48*, 747-773.

Schneider, B., Smith, D. B., Taylor, S., & Fleenor, J. (1998). Personality and organizations: A test of the homogeneity of personality hypothesis. *Journal of Applied Psychology*, *83*, 462-470.

Sheldon, K. M., & Elliot, A. J. (1999). Goal striving, need satisfaction, and longitudinal well-being: The self-concordance model. *Journal of Personality and Social Psychology*, *76*, 482-497.

Sheldon, K. M., Elliot, A. J., Kim, Y., & Kasser, T. (2001). What is satisfying about satisfying events? Testing 10 candidate psychological needs. *Journal of Personality and Social Psychology, 80*, 325-339.

Sy, T., Côté, S., & Saavedra, R. (2005). The contagious leader: Impact of the leader's mood on the mood of group members, group affective tone, and group processes. *Journal of Applied Psychology, 90*, 295-305.

Tenney, E. R., Turkheimer, E., & Oltmanns, T. F. (2009). Being liked is more than having a good personality: The role of matching. *Journal of Research in Personality, 43*, 579-585.

Van den Broeck, A., Vansteenkiste, M., De Witte, H., & Lens, W. (2008). Explaining the relationship between job characteristics, burnout, and engagement: The role of basic psychological need satisfaction. *Work & Stress, 22*, 277-294.

Van Yperen, N. W., & Hagedoorn, M. (2003). Do high job demands increase intrinsic motivation or fatigue or both? The role of job control and job social support. *Academy of Management Journal, 46*, 339-348.

Wright, T. A. (2010). Much more than meets the eye: The role of psychological well-being in job performance, employee retention and cardiovascular health. *Organizational Dynamics, 39*, 13-23.

Wright, T. A., & Cropanzano, R. (2000). Psychological well-being and job satisfaction as predictors of job performance. *Journal of Occupational Health Psychology, 5,* 84–94.

Yano, K., Lyubomirsky, S., & Chancellor, J. (2012). Sensing happiness. *IEEE Spectrum*, *49*, 32-37.

Table 1

Correlations Among Outcome Variables in Study 1

Full Sample	Life Satisfaction	Depressive Symptoms	Connectedness	Autonomy	Competence	Job Satisfaction
Life Satisfaction						
Depressive Symptoms	-0.31**					
Connectedness	0.26*	-0.16				
Autonomy	0.48***	-0.39***	0.54***			
Competence	0.49***	-0.39***	0.36***	0.66***		
Job Satisfaction	0.45***	-0.30**	0.28**	0.44***	0.50***	

Sub-Sample (Badge Only)	Life Satisfaction	Depressive Symptoms	Connectedness	Autonomy	Competence	Job Satisfaction
Life Satisfaction						
Depressive Symptoms	-0.09					
Connectedness	0.45*	0.03				
Autonomy	0.73***	-0.36	0.57**			
Competence	0.58**	-0.11	0.25	0.67**		
Job Satisfaction	0.47*	-0.22	0.32	0.65**	0.74***	

†*p* < .10. **p* < .05. ***p* < .01. ****p* < .001.

Table 2

Correlations Among Outcome Variables in Study 2

	Life Satisfaction	Positive Emotions	Autonomy	Connectedness	Competence	OCB	Job Satisfaction
Life Satisfaction							
Positive Affect	0.75***						
Autonomy	0.73***	0.81***					
Connectedness	0.67***	0.79***	0.84***				
Competence	0.63***	0.72***	0.89***	0.82***			
OCB	0.32	0.40*	0.35*	0.40*	0.39*		
Job Satisfaction	0.61***	0.62***	0.58***	0.63***	0.64***	0.48**	

†p < .10. *p < .05. **p < .01. ***p < .001. All time points were averaged within individuals before correlating.

Table 3

Correlations Among Outcome Variables Over Time in Study 2

	T_1-T_3	T_1-T_4	T_1-T_5	T_1-T_6	T_1-T_7
Job Satisfaction	0.74***	-	-	0.57***	-0.13
OCB	0.69***	-	-	0.54**	0.17
Life Satisfaction	0.78***	-	-	0.85***	0.61***
Positive Affect	0.68***	-	-	0.57***	0.82***
Autonomy	0.90***	0.81***	0.69***	0.85***	-
Connectedness	0.76***	0.63***	0.74***	0.84***	-
Competence	0.89***	0.81***	0.73***	0.71***	-

T_x-T_y = correlation between time point *x* and time point *y*. – denotes that variable was not measured at that time point. †p < .10. *p < .05. **p < .01. ***p < .001.

Table 4

Concurrent Analyses Predicting Clustering by Well-Being (Studies 1 and 2)

					Fixed Effects				*Random Effects*			
		Network Method		Obs	Intercept	Ego	Alter	Similarity	Residuals	Ego	Alter	Dispersion
Study	Distribution	(Outcome)	DV	Level 1 (Level 2)	γ_{00}	γ_{01}	γ_{02}	γ_{03}	σ_{ε}^2	σ_0^2	σ_1^2	σ_2^2
Study 1	Binomial	Self-Report (Nominations)	Life Satisfaction	7832 (89)	-5.878*** (1.258)	0.173 (0.171)	0.173 (0.171)	0.689*** (0.188)	0.644	0.39	0.39	-
			Connectedness	7656 (88)	-3.422*** (0.836)	-0.072 (0.211)	-0.072 (0.211)	1.088*** (0.229)	0.707	0.420	0.420	-
			Job Satisfaction	7140 (85)	-5.787*** (0.758)	0.233 (0.143)	0.233 (0.143)	0.312* (0.142)	0.716	0.32	0.32	-
Study 1	Quasi-Poisson	RFID Badge (Aggregated Proximity)	Connectedness	204 (20)	3.719 (2.494)	0.086 (0.557)	-0.002 (0.622)	0.303* (0.133)	0.048	3.42	3.83	0.685
			Competence	204 (20)	6.405* (2.777)	-0.497 (0.637)	-0.533 (0.711)	-0.247* (0.126)	0.049	3.35	3.72	0.688
			Depressive Symptoms	204 (20)	4.126*** (0.911)	-1.962 (2.03)	-1.915 (2.212)	-2.252*** (0.557)	0.050	3.14	3.51	0.651
Study 2	Quasi-Poisson	Sociometric Badge (Minutes in Social Interaction)	Life Satisfaction	224 (32)	-2.068* (0.89)	0.165 (0.138)	0.004 (0.137)	0.338*** (0.088)	0.042	3.242	3.101	12.13
			Positive Emotions	2924 (32)	-1.894** (0.713)	0.150 (0.124)	-0.053 (0.124)	0.180* (0.086)	0.043	3.093	2.994	12.06
			Autonomy	3028 (32)	-2.124** (0.769)	0.169 (0.106)	0.172 (0.105)	0.451*** (0.068)	0.048	2.422	2.35	10.92
			Connectedness	2984 (32)	-2.554*** (0.748)	0.115 (0.106)	0.238* (0.105)	0.212** (0.066)	0.048	2.32	2.247	11.02
			Competence	3066 (32)	-2.17** (0.672)	0.139 (0.100)	0.212* (0.099)	0.344*** (0.067)	0.048	2.404	2.322	10.98
			OCB	3066 (32)	-1.430† (0.848)	-0.065 (0.101)	-0.099 (0.101)	-0.151† (0.088)	0.042	3.257	3.256	12.26
			Job Satisfaction	3066 (32)	0.380 (0.797)	-0.23* (0.099)	-0.176† (0.099)	0.344*** (0.088)	0.042	3.48	3.358	12.09

†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 5

Time-Lagged Analyses Modeling the Contagion Hypothesis: Sociality Precedes Well-Being Similarity (Study 2)

			Fixed					*Random*		
		Obs	Intercept	Social Interaction Minutes (Current)	Social Interaction Minutes (Previous)	Ego	Alter	Residuals	Ego	Alter
DV	Measure	Level 1 (Level 2)	γ_{00}	γ_{01}	γ_{02}	γ_{03}	γ_{04}	σ_{ε}^{2}	σ_{0}^{2}	σ_{1}^{2}
Similarity	Life Satisfaction	2054 (32)	-2.05*** (0.269)	0.000633 (0.000573)	-0.00069 (0.000619)	0.0828† (0.0433)	0.0836† (0.0434)	0.663	0.25	0.25
	Positive Emotions	2054 (32)	-1.99*** (0.188)	-0.000142 (0.000604)	0.000751 (0.000707)	0.0875** (0.0337)	0.0873** (0.0337)	0.704	0.20	0.20
	Autonomy	3066 (32)	-2.98*** (0.221)	0.000399 (0.000516)	0.001390** (0.00053)	0.1610*** (0.0281)	0.1610*** (0.0281)	0.975	0.31	0.31
	Connectedness	3066 (32)	-1.91*** (0.214)	0.000693 (0.000542)	-0.00032 (0.000556)	0.0315 (0.0294)	0.0319 (0.0294)	1.080	0.24	0.24
	Competence	3066 (32)	-1.59*** (0.203)	0,0000958 (0.000534)	0.001060† (0.000548)	-0.0128 (0.0278)	-0.0128 (0.0278)	1.040	0.29	0.29
	OCB	2098 (32)	-3.85*** (0.181)	0.001230* (0.00061)	-0.000729 (0.00064)	0.2670*** (0.0228)	0.2670*** (0.0228)	0.749	0.16	0.16
	Job Satisfaction	2050 (32)	-0.898*** (0.179)	0.00139* (0.000615)	-0.000542 (0.000641)	-0.0557* (0.0229)	-0.0568* (0.0228)	0.746	0.14	0.14

†p < .10. *p < .05. **p < .01. ***p < .001.

Table 6

Time-Lagged Analyses Modeling the Homophily Hypothesis: Well-Being Similarity Precedes Sociality (Study 2)

		Fixed								*Random*			
		Obs	Intercept	Ego (Current)	Alter (Current)	Similarity (Current)	Ego (Previous)	Alter (Previous)	Similarity (Previous)	Residuals	Ego	Alter	Dispersion
DV	IV	Level 1 (Level 2)	γ_{00}	γ_{01}	γ_{02}	γ_{03}	γ_{04}	γ_{05}	γ_{06}	σ_ε^2	σ_0^2	σ_1^2	σ_2^2
Minutes In Social Interaction	Life Satisfaction	342 (19)	-5.14* (2.3)	0.0345 (0.94)	0.135 (0.943)	-0.348 (0.761)	0.0305 (0.987)	-0.131 (0.989)	0.232 (0.788)	0.00513	0	0	39.16
	Positive Emotions	342 (19)	-5.41** (2.09)	-0.159 (0.575)	-0.163 (0.576)	-0.360 (0.616)	0.411 (0.605)	0.304 (0.595)	0.562 (0.615)	0.00629	0	~ 0	35.29
	Autonomy	1652 (29)	0.39 (1.21)	0.272 (0.173)	0.452** (0.174)	0.570*** (0.108)	-0.305† (0.169)	-0.475** (0.17)	0.228* (0.115)	0.0509	3.08	3.03	9.58
	Connectedness	1652 (29)	-0.985 (1.16)	0.268 (0.184)	0.557** (0.185)	0.194† (0.106)	-0.22 (0.164)	-0.444** (0.168)	0.404*** (0.114)	0.0514	2.83	2.82	9.72
	Competence	1652 (29)	-1.2 (1.02)	0.0867 (0.15)	0.373* (0.151)	0.638*** (0.106)	0.096 (0.161)	-0.292† (0.165)	-0.0617 (0.115)	0.051	2.73	2.84	9.70
	OCB	306 (18)	-9.54* (4.69)	-0.038 (0.503)	-0.0467 (0.502)	-0.379 (0.589)	0.454 (0.544)	0.431 (0.543)	-0.200 (0.586)	0.00424	0	0	41.74
	Job Satisfaction	306 (18)	-6.3 (5.21)	0.0313 (0.544)	0.0725 (0.545)	-0.151 (0.672)	0.0506 (0.546)	-0.00629 (0.542)	0.00689 (0.649)	0.003	0	~ 0	49.12

†p < .10. *p < .05. **p < .01. ***p < .001.

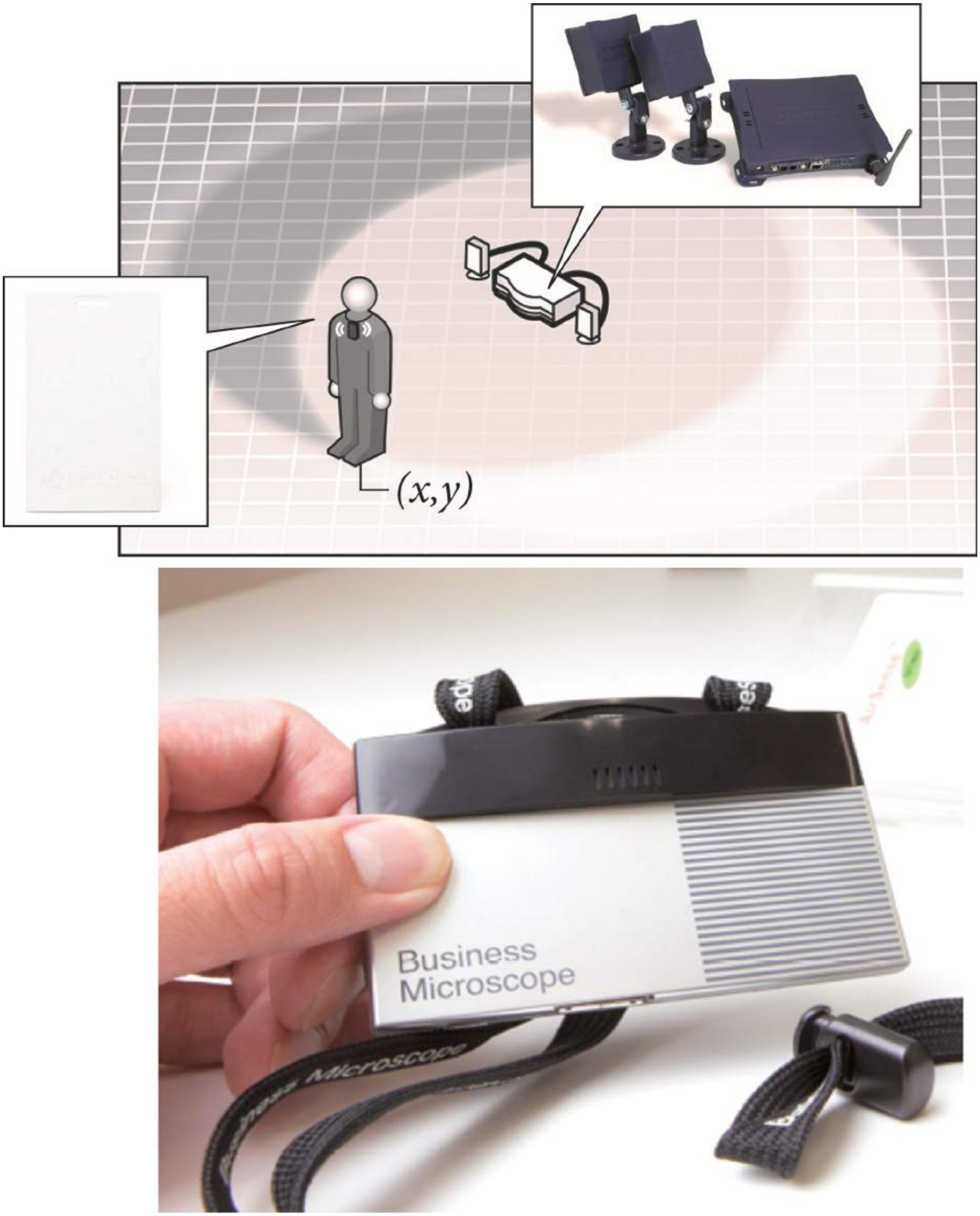

Figure 1. Active RFID badges from PureLink were used in Study 1 (top) and from the Hitachi Research Lab in Study 2 (bottom).

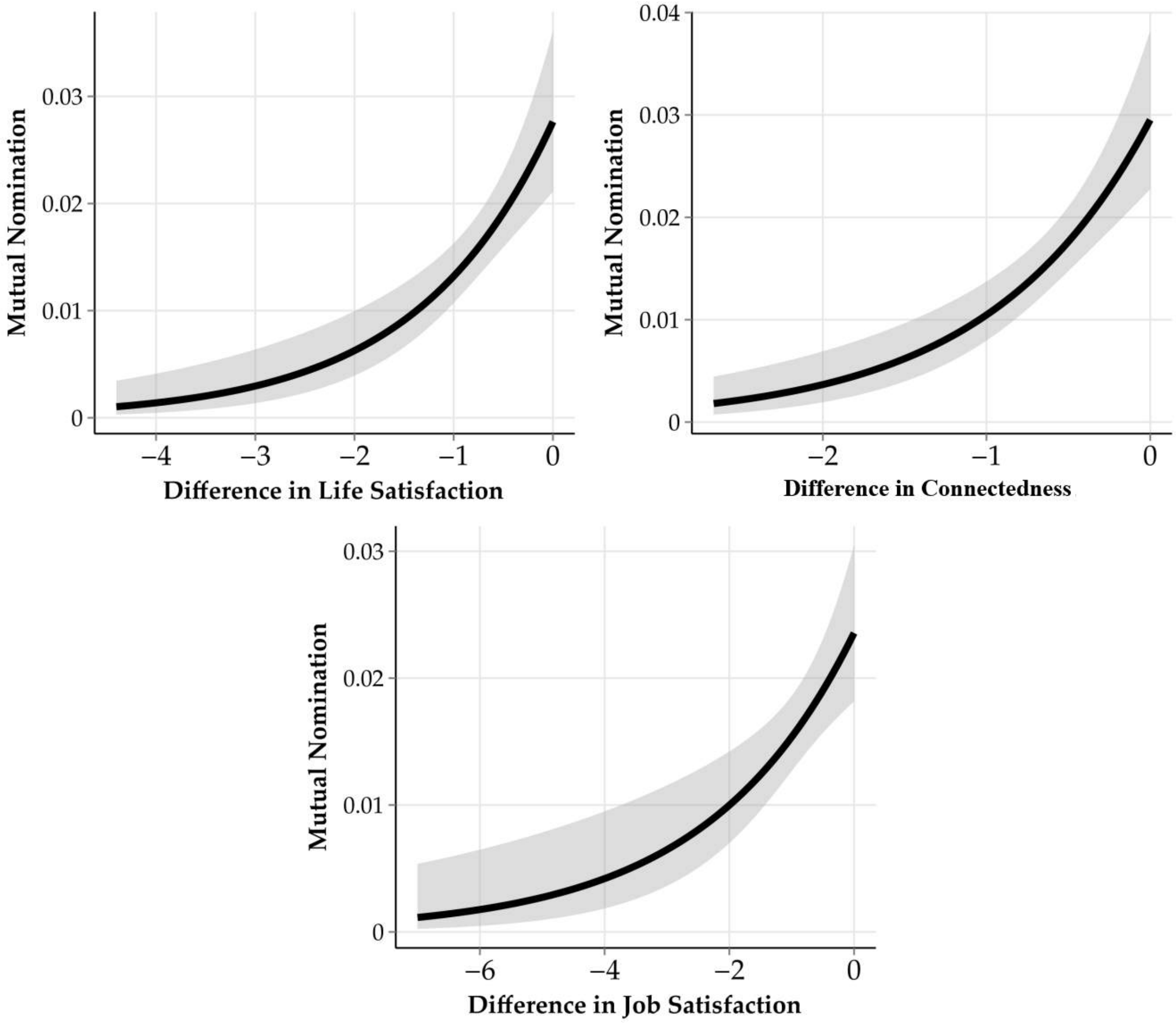

Figure 2. Relation of dyad differences in life satisfaction, connectedness, and job satisfaction to mutual social nominations (0 = no mutual nomination, 1 = mutual nomination) in Study 1.

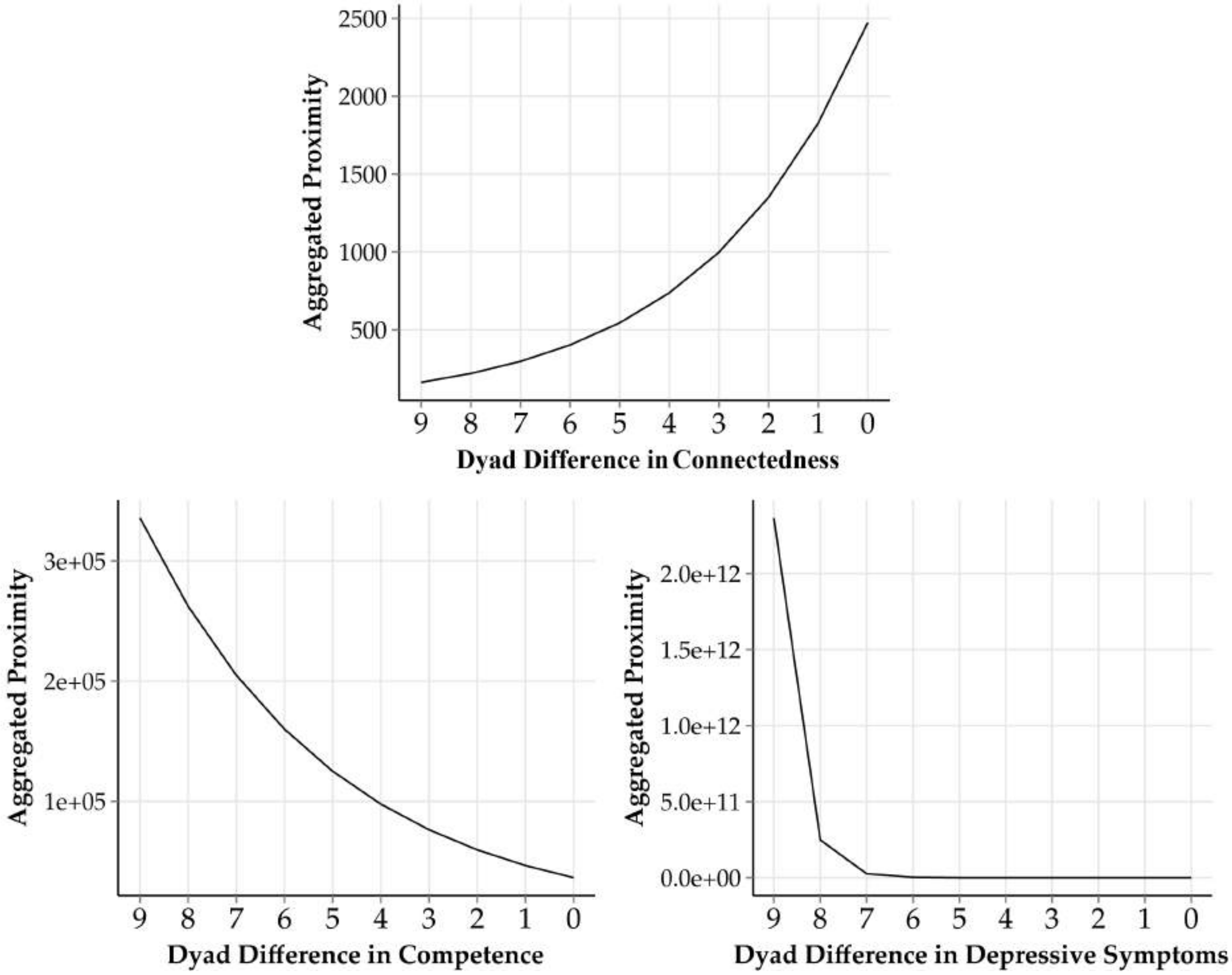

Figure 3. Relation of dyad differences in connectedness, competence, and depressive symptoms to aggregated physical proximity as measured by RFID badges in Study 1.

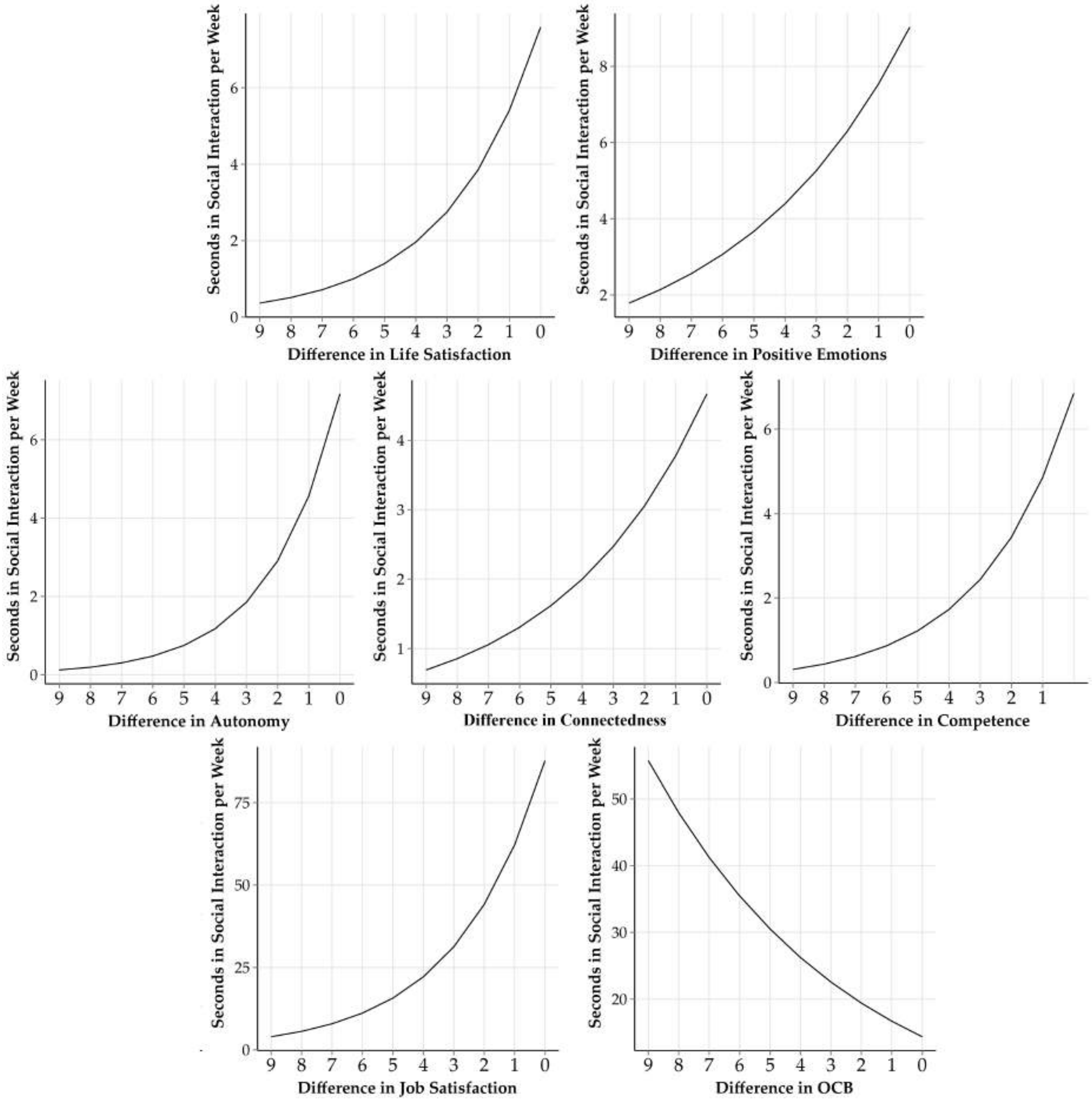

Figure 4. Relationship between dyad differences in life satisfaction, OCB, positive emotions, autonomy, connectedness, competence, and job satisfaction, to seconds in social interaction as measured by Hitachi's sociometric badges in Study 2.