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Co-workers who telework and the impact on those in the office: Understanding the implications of virtual work for co-worker satisfaction and turnover intentions

Timothy Golden

ABSTRACT

Telework and other forms of virtual work have experienced dramatic growth over the last decade. While research is beginning to understand its impacts on teleworkers themselves, studies to date have not looked at its effect on those who remain in the office. This study therefore shifts the focus to non-teleworkers in offices where telework is present, to investigate if the prevalence of teleworkers in an office impacts the work outcomes of non-teleworkers. Using a sample of 240 professional employees, results suggest teleworker prevalence is negatively associated with co-worker satisfaction, and that this relationship is influenced by the amount of time co-workers telework, the extent of face-to-face interactions, and job autonomy. Moreover, a non-teleworker's satisfaction with co-workers was also found to be negatively associated with turnover intentions. Together, results suggest the need to consider the full range of telework's impacts including the potential adverse consequences for non-teleworkers.

KEYWORDS

co-worker satisfaction ▪ telecommuting ▪ telework ▪ turnover intentions ▪ virtual work

As an increasing number of employees telework from remote locations away from the office, individuals who are in their office but do not telework are apt to be impacted as well. Telework, a form of virtual work also known as telecommuting, generally entails working some portion of the work week away from the conventional workplace, typically from home, and communicating by way of computer-based technology (Nilles, 1994). As a global trend, estimates indicate that telework is increasingly popular, more than doubling in popularity in eight years in the UK to 2.4 million workers (Office of National Statistics, 2005), and growing between 11 percent to 20 percent per year in the USA (SHRM, 2001; WorldatWork, 2007) with over 20 million workers (Bureau of Transportation Statistics, 2003). Despite telework's tremendous growth, researchers to date understand very little about this work arrangement, and even less about its impact on those in the teleworker's office (Bailey & Kurland, 2002). This is surprising, since the work activities of other employees are often altered by the teleworker's absence (Duxbury & Neufeld, 1999; Watson-Fritz et al., 1998), and studies report upwards of 75 percent of non-teleworkers have concerns about co-workers who telework (Cooper & Kurland, 2002). Indeed, the impact of teleworking on others in the office may be especially important not only because of its growing prevalence, even within organizations with already established telework programs (Bednarz, 2005; Roitz & Jackson, 2006), but also because of its potential to affect collaboration and the willingness of workers to share crucial job knowledge (Cramton, 2001; Straus & McGrath, 1994).

Existing research on telework however has focused nearly exclusively on teleworkers themselves, tending to investigate how this new form of virtual work alters work outcomes such as the teleworker's work–family conflict (Golden et al., 2006; Hill et al., 1998), organizational identification (Thatcher & Zhu, 2006; Wiesenfeld et al., 2001), work exhaustion (Golden, 2006a), or isolation (Cooper & Kurland, 2002). Research has also tended to consider teleworkers independently from non-teleworkers, and as noted by several scholars, has made only broad comparisons irrespective of how the behaviors of teleworkers might influence others (Bailey & Kurland, 2002; Baruch, 2000; Igbaria & Guimaraes, 1999). Although existing literature has recently begun to look at the periphery of telework's impact on others by investigating the teleworker's relationships (Golden, 2006b), or suggesting that teleworking may be dysfunctional thereby hindering job satisfaction (Chapman et al., 1995; Golden & Veiga, 2005; McCloskey & Igbaria, 1998), research has not yet investigated it from the perspective of the non-teleworker, nor how telework's prevalence in a work unit impacts even fundamental work outcomes.

In this study the research lens is therefore shifted to the non-teleworker, to investigate if telework by co-workers in the office impacts satisfaction with

co-workers and turnover intentions. Since work units vary in the degree to which teleworking is practiced (Wiesenfeld et al., 1999), and the literature has expressed concern over the unbounded adoption of this work mode and called for research examining the impact of varying levels of telework (Bailey & Kurland, 2002; Cooper & Kurland, 2002; Ruppel & Harrington, 1995), this study further extends the literature by investigating if the varying prevalence of teleworkers in a work unit plays a role in determining the non-teleworkers' work outcomes. Drawing from existing research, it is suggested that the prevalence of teleworkers in a work unit alters the flexibility and workload of non-teleworking colleagues, thereby impacting their satisfaction with co-workers and turnover intentions. In order to more fully understand differences due to the nature of the non-teleworker's altered work interactions, this study also examines how telework's impact on co-worker satisfaction may be influenced by the amount of time co-workers telework, the extent of face-to-face interactions, and job autonomy. After these influences are examined, the linkage to turnover intentions is investigated.

The altered work environment for non-teleworkers

In a traditional office, workers typically share physical proximity and in addition to formal meetings interact due to chance encounters in hallways, in break rooms by the coffee or tea dispenser, or in other common areas (Zahn, 1991). Such close yet unplanned encounters tend to encourage affinity, trust, and camaraderie as individuals discover mutual interests and share both professional and personal aspects of their lives (Sarbaugh-Thompson & Feldman, 1998). Yet as the prevalence of teleworkers increases within a work unit, these interactions are apt to become less common, along with informal conversations over shared mutual experiences and information (Caldwell, 1997). With more teleworkers absent from the office, such interactions in which co-workers regularly coordinate tasks and work products, tend to be more deliberate and must be scheduled or structured to compensate for the absence of chance encounters (Cooper & Kurland, 2002; Zack, 1993). Interactions are therefore likely to be less informal and more task oriented as individuals strive to complete work objectives (Bailey & Kurland, 2002) and compensate for decreased accessibility (Guimaraes & Dallow, 1999), changing with it the social fabric of those interacting and the reactions of employees to their teleworking co-workers.

This altered social milieu is likely to be reflected in a number of implications for non-teleworkers as they go about conducting work activities. First, non-teleworkers are apt to have decreased flexibility in conducting their work activities, since greater restrictions are placed upon them when

coordinating and adjusting their own tasks and schedules (Allen & Renn, 2003). This can involve more restrictive scheduling of meetings to when teleworkers are in the office (Ruppel & Harrington, 1995), holding off on sensitive or complex discussions until face-to-face discussions can be held (Guimaraes & Dallow, 1999; Kugelmass, 1995), or forgoing important feedback sessions on performance or client information (Feldman & Gainey, 1997; Hartman et al., 1992). Such decreased flexibility may also involve greater difficulty in obtaining answers to pressing questions, or simply forcing the individual to proceed with work tasks without the full advice and consent of others, thereby introducing greater risk of suboptimal decisions or creating potential strife or misunderstandings (Cooper & Kurland, 2002; Cramton, 2001).

Additionally, telework is also apt to change the scope and amount of workload experienced by those remaining in the office, since non-teleworking individuals must often assume additional responsibilities which might otherwise be handled by a teleworker but which are not due to their absence (Kugelmass, 1995). Expanded responsibilities may include taking messages for teleworkers who are absent (Gordon, 2005; Reinsch, 1997), directing clients to alternative ways in which their needs can be met in the absence of the teleworker (Gordon, 2005; Gupta et al., 1995), or taking on additional tasks that are best handled by those consistently in the office (Chapman et al., 1995; Harrington & Ruppel, 1999). Non-teleworkers may also be more pressured to respond to unanticipated requests from others, such as managers, who stop by the office (Yap & Tng, 1990), or they might simply choose to handle job tasks themselves since they cannot 'see' if they are disrupting their teleworking colleague from other important tasks (Cooper & Kurland, 2002). Together, the additional restrictions and workload experienced by non-teleworkers are likely to alter affective reactions toward teleworking co-workers, with implications for both co-worker satisfaction and turnover intentions.

Linking teleworker prevalence to co-worker satisfaction

Satisfaction with co-workers involves an individual's overall cognitive evaluation and affective response toward co-workers (Liao et al., 2004; Smith et al., 1969). In traditional office work as with telework, co-worker satisfaction has become crucial to organizational success, whereby an individual's affective reactions may in part determine how well they respond to others in the workplace (Liao et al., 2004) as well as individual and organizational performance (Fried, 1991). Although satisfaction with co-workers has been studied in traditional work modes (e.g. Donovan et al., 2000; Liao et al.,

2004), its absence from the telework literature is notable, given human need for interpersonal attachment (Baumeister & Leary, 1995) and the integral role co-worker satisfaction plays in the success of the burgeoning collaborative and team-based work environments (Cramton, 2001; Guzzo & Shea, 1992; Marks et al., 2001). Lower co-worker satisfaction has been associated with feelings of tension or annoyance toward co-workers (Ducharme & Martin, 2000), and with less social integration and peer support (Hitlan et al., 2006).

An individual's satisfaction with co-workers is likely to be altered by the inherent changes that teleworking imposes in flexibility and workload, which are apt to become more frustrating with a greater prevalence of teleworkers in the office. With a greater number of teleworking co-workers, non-teleworkers are likely to encounter restrictions more often when coordinating tasks and activities (Allen & Renn, 2003). This decreases their ability to adjust work tasks to meet their own individual needs and desires and adversely affects reactions to co-workers (Baltes et al., 1999; Pierce et al., 1989). Additionally, due to the necessity to cover for teleworkers and thereby assume additional duties that broaden the scope and amount of work, non-teleworkers are more apt to feel tension and inequity in their work, or even jealousy (Furnas, 2000; Harrington & Ruppel, 1999). These impositions are likely to decrease satisfaction levels with those whom they hold responsible (Salancik & Pfeffer, 1978), generating feelings of irritation and even resentment toward teleworkers (Kugelmass, 1995), particularly since teleworkers may derive personal work–family benefits while they themselves do not (Hill et al., 1998).

With a greater prevalence of teleworkers, non-teleworkers are also apt to find it less personally fulfilling to conduct their work, due to increased obstacles to building and maintaining effective and rewarding co-worker relationships. These obstacles restrict the relational quality associated with interactions with co-workers, such as when non-teleworkers are forced to be more reliant upon technologies like e-mail and teleconferences to interact with others in their office. These media are less rich and lower in social presence than face-to-face interactions (Daft & Lengel, 1986; Short et al., 1976), making it more cumbersome and time-consuming to conduct work activities or to interact effectively especially over complex tasks (Straus & McGrath, 1994). Moreover, in addition to technological constraints, interactions through these media are less personally gratifying because of the limited contact and decreased feelings of involvement (Short et al., 1976), and they are considered by many to be socially restricting (Rice & Gattiker, 2001). Put simply, when teleworkers are prevalent in a work unit, there is less opportunity to easily engage in informal interactions in the workplace, some of which may be useful to maintaining healthy and fulfilling relationships with

co-workers, and without these the level of positive regard characteristic of high satisfaction with co-workers is apt to suffer.

Taken together, with greater teleworker prevalence, non-teleworkers experience less flexibility and greater workloads and are forced to rely more extensively upon media with less interactivity, which incurs a greater risk of damaging work relationships and extracts a greater toll on satisfaction with co-workers (Ruppel & Harrington, 1995). Thus, the literature and available evidence suggest a negative association between teleworker prevalence and co-worker satisfaction.

> *H1*: Teleworker prevalence is negatively related to satisfaction with co-workers.

The moderating nature of interactions with co-workers

Although the first hypothesis suggests that the prevalence of teleworkers is likely to negatively impact satisfaction with co-workers, whether non-teleworkers experience the full impact is likely to be influenced by the nature and extent of interactions they have with co-workers (Kugelmass, 1995). The characteristics of such interactions may help determine an individual's experiences with co-workers and ensuing cognitive assessment of them, further exacerbating or helping to alleviate the flexibility and workload implications discussed earlier. Toward this end, the moderating role of three characteristics of an individual's interactions with co-workers is investigated, namely the amount of time co-workers telework, the extent of face-to-face interactions with co-workers who telework, and the degree of job autonomy. These three characteristics capture aspects inherent to coordinating and carrying out work activities within work units where co-workers telework (Kugelmass, 1995), and they are likely to influence reactions to teleworkers and attitudes towards working with them (Stephens & Szajna, 1998). As an initial study into the broader impact of teleworking beyond the teleworkers themselves, these characteristics therefore encompass key behavioral implications associated with having co-workers who telework, which are likely to influence telework's impact on attitudinal changes inherent in co-worker satisfaction and turnover intentions.

Time co-workers telework

The time co-workers telework refers to the amount of time co-workers telework in a typical week (Golden & Veiga, 2005; Wiesenfeld et al., 1999).

Individuals with co-workers who telework extensively are apt to experience comparatively less flexibility and greater frustration in their interactions with co-workers than do those in work units whose co-workers telework less extensively. Having co-workers who telework a larger amount of time is apt to make it more difficult and cumbersome to adjust work demands to meet individual needs and desires (Pierce & Newstrom, 1980, 1983). Specifically, with a higher prevalence of teleworkers in the work unit, in-office workers are likely to be locked into more restrictive periods for scheduling team or client meetings (Watson-Fritz et al., 1998), and they must carry out a greater number of interactions through less rich and comparatively impoverished electronic media that are likely to increase ambiguity and frustration (Daft & Lengel, 1986; Workman et al., 2003). With co-workers teleworking more of the time, non-teleworkers are also likely to assume a larger portion of in-office tasks and additional duties in order to compensate for their absent co-workers (Cooper & Kurland, 2002), thereby generating even resentment toward them (Furnas, 2000). Due to decreased flexibility, higher workload, and the ensuing greater frustration that comes with coordinating in an environment with more extensive co-worker telework, satisfaction with co-workers is likely to be less than when co-workers telework a smaller amount of time. Therefore it follows that the negative effect of teleworker prevalence on co-worker satisfaction is likely to be greatest when the amount of time teleworking is extensive. Formally stated,

> *H2*: Time co-workers telework moderates the relationship between teleworker prevalence and satisfaction with co-workers, such that the more time co-workers spend teleworking, the more negative the impact of teleworker prevalence on co-worker satisfaction.

Extent of face-to-face interactions

The extent of face-to-face interactions, or the degree to which individuals interact directly with co-workers who telework in their work unit as part of their job activities, involves interpersonal contact that is not computer mediated and stems from participation in the individual's job tasks (Green & Taber, 1980; Yoo & Alavi, 2001). Compared to individuals with less extensive face-to-face interactions, those with more are likely to have enhanced coordination and cooperation with co-workers (Andres, 2002), deeper shared understandings and trust (Leenders et al., 2003), and more informal communication (Shapiro et al., 2002). All of these are apt to build socio-emotional bonding and satisfaction with co-workers (Burgoon et al., 2002; Shapiro et al., 2002). Although extensive interaction can generate

increased conflict as more differences are brought to the surface (Jehn & Mannix, 2001), it is more likely that such interactions enable issues to be identified and resolved before they escalate (Hinds & Mortensen, 2005; Kiesler & Cummings, 2002). Hence, rather than experiencing typical restrictions in flexibility or frustration due to a high prevalence of teleworkers, individuals with more extensive face-to-face interactions know co-workers better and are better equipped to bridge periods when co-workers telework than are those with less interaction. For example, whereas an earnest and open exchange with others is less likely via e-mail or phone, particularly in key activities like informal mentoring or feedback (Cooper & Kurland, 2002), extensive face-to-face interactions build commonalities which overcome some of the difficulties associated with a high preponderance of teleworking (Hinds & Mortensen, 2005). In this way an individual's willingness to endure less flexibility and incur additional work is enhanced in comparison to individuals with less extensive face-to-face interactions, leading to higher satisfaction with co-workers. Compared to those with less face-to-face interaction, in which the impact of teleworker prevalence may be exacerbated due to the reduced informal communication and diminished shared trust and understanding (Harrington & Ruppel, 1999), more extensive face-to-face interactions are likely to attenuate the negative impact of teleworker prevalence on satisfaction with co-workers. Formally stated,

> *H3*: Extent of face-to-face interactions moderates the relationship between teleworker prevalence and satisfaction with co-workers, such that the more extensively individuals have face-to-face interactions with co-workers, the less negative the impact of teleworker prevalence on co-worker satisfaction.

Job autonomy

Job autonomy is the amount of discretion and control individuals have over how tasks are accomplished (Langfred, 2000). An individual with greater autonomy has more freedom and influence and can exert more discretion over the manner and sequence of interactions with co-workers (Langfred, 2000), which is likely to enhance feelings about work (Pierce & Newstrom, 1980, 1983). In the teleworking context as with others, individuals coordinating job activities who lack control are prone to experience greater frustration (Norman et al., 1995), particularly when they perceive some of the difficulties are due to co-workers who choose to telework instead of remaining more easily accessible in the office (Vega, 2003). Paralleling the

previous argument, the lack of control as individuals seek information from co-workers who telework is more apt to be frustrating and less satisfying when teleworkers are prevalent in the work unit and there is a greater need to rely upon less rich media that introduce ambiguities (Daft & Lengel, 1986; Guimaraes & Dallow, 1999). And in similar fashion, while greater autonomy could potentially attenuate the effect of teleworker prevalence on co-worker satisfaction, when teleworking is highly prevalent in the work unit, these effects are likely to be the most pronounced. Conversely, individuals with less autonomy and less control over the manner and sequence of interactions with co-workers should be more prone to experience the full impact of co-workers who are absent from the office environment (Norman et al., 1995), and are therefore more apt to be frustrated and less satisfied with their co-workers. Formally stated,

> *H4*: Extent of job autonomy moderates the relationship between teleworker prevalence and satisfaction with co-workers, such that the more individuals have autonomy from co-workers, the less negative the impact of teleworker prevalence on co-worker satisfaction.

Linking co-worker satisfaction to turnover intentions

While an individual's satisfaction with co-workers is likely to be negatively impacted by the prevalence of teleworkers in his or her work unit and to be influenced by factors associated with the nature and extent of interactions with co-workers, it is also likely that decreased co-worker satisfaction will be associated with higher turnover intentions. Research suggests that individuals who are less satisfied with co-workers are apt to find the workplace less enjoyable (Sherony & Green, 2002), have fewer and weaker emotional ties to co-workers (Reinsch, 1997), and generally feel less obligated to the organization (Burt, 2001). Moreover, whereas co-workers who telework enjoy numerous personal advantages, such as greater freedom (Guimaraes & Dallow, 1999; Kurland & Egan, 1999), and an enhanced ability to handle family demands (Duxbury et al., 1998), these same benefits are not enjoyed by their in-office colleagues. Indeed, the non-teleworker may feel marginalized, deriving neither the advantages of telework nor the managerial attention or resources which teleworkers receive (Vega, 2003), thereby garnering feelings of inequity and disenfranchisement from the organization.

Non-teleworking individuals with lower co-worker satisfaction are therefore more likely to leave the organization, feeling less attached to individuals within it and deriving less personal advantage than their peers. Since

relationships with co-workers tend to serve emotional needs in addition to task requirements (Kahn, 1998), and feelings of attachment to others in the organization have been identified as motivational factors dissuading voluntary turnover (Maertz & Griffeth, 2004), individuals with less satisfaction with co-workers are apt to lack sufficient interpersonal ties that might otherwise keep them from leaving (Mitchell et al., 2001; Mossholder et al., 2005). The literature has also found consistent negative relationships between co-worker satisfaction and turnover (Cotton & Tuttle, 1986), and recent meta-analytic findings support a negative association between satisfaction with co-workers and turnover intentions (Griffeth et al., 2000), suggesting this relationship is both important and durable across a range of contexts and conditions. Thus, for individuals who work with teleworkers the literature and available evidence suggests a negative association between co-worker satisfaction and turnover intentions.

H5: Co-worker satisfaction is negatively related to turnover intentions.

Methods

Sample and procedure

Respondents were 240 educated professional employees at a large high-technology company. The company had an on-going telework program that had been growing in recent years, and managers wanted to understand how the program affected the rest of the company's workforce. As is common in telework programs, the option to telework was a voluntary initiative offered to nearly all employees as a means of improving quality of life and alleviating conflicts between work and family (Hill et al., 1998). The cross-sectional sample was constructed by the company's human resources department as part of a larger annual employee survey that was strongly endorsed by senior management. All participants were assured confidentiality. Drawing randomly from workers across the company, only employees in professional level positions were included. The final sample represented completed responses from 42 percent of those contacted, and were all co-workers of teleworkers but did not telework themselves. All respondents had at least a bachelor's degree, 55 percent were female, and the average age was 37. Although respondents filled a variety of positions in work units specializing in marketing, systems analysis, and financial reporting, due to the highly technical nature of the company and its culture respondents generally shared technical backgrounds even if they were not in these positions at the time of

the study. Performance assessments were based primarily upon the achievement of individual milestones set out between the employee and manager, rather than through a team-based reward system.

Measures

Satisfaction with co-workers

Respondent's satisfaction with co-workers was assessed using the widely used co-worker satisfaction scale of the Job Diagnostic Survey (Hackman & Oldham, 1975, 1980). A variety of studies have shown this three-item scale to possess sound psychometric properties, with reliability coefficients of .70 to .91 (Fried, 1991; Makinen et al., 2003; Sachau et al., 1999). Respondents were asked to assess how satisfied they were with their teleworking co-workers, ranging from 1 (very little) to 5 (very much). Items were averaged to create the final score (alpha = .83).

Turnover intentions

To assess turnover intentions the three-item scale developed by Schaubroeck et al. (1989) was used. This measure has been shown to have sound psychometric properties with prior reported reliability coefficients ranging from .70 to .89 (Clugston, 2000; Schaubroeck et al., 1989). Items were averaged to create the final score (alpha = .87).

Teleworker prevalence

To assess teleworker prevalence respondents were asked to indicate the proportion of co-workers in their work unit who teleworked away from the office. As verification of the reliability of this index, responses were compared to those from a prior corporate study within the firm. Responses were highly comparable, with little difference in the means (28% in this study, compared to 33% in the corporate study), supporting the appropriateness of the measure.

Time co-workers telework

Based on prior research (e.g. Golden & Veiga, 2005; Wiesenfeld et al., 1999), the amount of time co-workers teleworked was assessed by asking respondents to indicate the average number of hours per week their co-workers spent teleworking away from the office. For additional confidence, responses

were compared to a small sample of teleworkers from the same work units in the company. Results were highly similar (e.g. 15 hours versus 14 hours), further supporting the use of this measure.

Face-to-face interactions

Building on prior research (Green & Taber, 1980; Yoo & Alavi, 2001), the extent of face-to-face interactions with co-workers who telework was assessed by asking respondents to indicate the percentage of their work week that they spent working face-to-face with co-workers who telework in their work unit on job related activities. This measure has greater precision than prior assessments (e.g. Watson-Fritz et al., 1998), and focuses on face-to-face interactions during coordination with co-workers in the office place.

Job autonomy

A four-item measure developed by Langfred (2000) was used to assess job autonomy. Respondents were asked to assess the amount of discretion and control they have in the implementation of assigned tasks. Reponses were recorded on a scale ranging from 1 (very little) to 5 (very much), with prior reported reliabilities ranging from .71 to .90. Items were averaged to create the final score (alpha = .80).

Control variables

In order to minimize the possibility of unintended effects and to present conservative findings, a number of control variables were included in all analyses. First, since gender may have disproportionately influenced earlier telework research (Bailey & Kurland, 2002) it was controlled in the analysis (1 = male, 2 = female). Age (in years) may also influence reactions to telework and was therefore controlled (Belanger, 1999). Company tenure and unit tenure (in years) were controlled, since reactions to individuals and to one's work may differ depending on the length of time needed to adjust to work modes (Bailey & Kurland, 2002). Finally, although participants in this sample were all educated professional level workers in occupationally similar positions, functional specialization was controlled by creating dummy codes for each specialization (system analyst, marketing associate, engineer, accountant, programmer, and other specialties, with sales associate as the omitted category). These steps were taken to ensure the robustness of the findings.

Results

Table 1 presents means, standard deviations, and correlations for each of the measures. To test each hypothesis, hierarchical regression analysis was used following the procedures outlined by Aiken and West (1991) and Baron and Kenny (1986). Each predictor was entered after the control variables, with the changes in R-squared (ΔR^2) at each step and the standardized regression coefficients presented in Table 2. Hypothesis 1, which predicted that teleworker prevalence was negatively related to satisfaction with co-workers, was supported. As shown in Table 2 (model 1, step 2), a higher prevalence of telework was associated with less co-worker satisfaction ($\beta = -.24$, $p < .001$).

To test the moderator hypotheses, terms were entered together as a block into the regression analysis in order to follow a conservative and realistic approach (Kohler & Mathieu, 1993). Hypothesis 2 predicted that the amount of time co-workers telework would moderate the relationship between teleworker prevalence and satisfaction with co-workers. As shown in Table 2 (model 1, step 4), support for the amount of time co-workers telework as a moderator was found ($\beta = -.17$, $p < .05$), and the overall variance explained was significant ($\Delta R^2 = .08$, $p < .001$). To facilitate interpretation, the interaction effect was graphed following procedures prescribed by Cohen and colleagues (2003) and Aiken and West (1991). Co-worker satisfaction for those with co-workers who spent little and extensive time teleworking was graphed for +1/–1 standard deviations of teleworker prevalence. In Figure 1, 'little' and 'extensive' time teleworking refer to values of one standard deviation below and above the mean on this variable, respectively. As shown in Figure 1, the more extensively co-workers telework, the greater the toll of teleworker prevalence on satisfaction with co-workers. Conversely, when co-workers spent little time teleworking, the negative impact of increasing teleworker prevalence was relatively small.

Hypothesis 3 predicted that the extent of face-to-face interactions with co-workers would moderate the relationship between teleworker prevalence and satisfaction with co-workers. As shown in Table 2 (model 1, step 4), support for extent of face-to-face interactions as a moderator was found ($\beta = -.15$, $p < .05$), and as reported above the overall variance explained was significant ($\Delta R^2 = .08$, $p < .001$). To facilitate interpretation, the interaction effect was graphed for those with little and extensive face-to-face interactions (defined as one standard deviation below and above the mean, respectively). As shown in Figure 2, those with more extensive face-to-face interactions had a higher satisfaction with co-workers across nearly all levels of teleworker prevalence, while those with little interaction were less satisfied. This

Table 1 Descriptive statistics and correlations

Variables	*Mean*	*SD*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
1. Gender	1.57	.50															
2. Age	37.50	11.35	–.03														
3. Company tenure	6.76	2.85	–.07	–.04													
4. Unit tenure	4.46	2.42	–.06	–.04	.57**												
5. System analysts	.21	.41	–.04	.12	–.01	.01											
6. Marketing associates	.11	.31	.07	.06	–.14*	–.11	–.18**										
7. Engineers	.01	.09	.08	–.06	–.06	–.06	–.05	–.03									
8. Accountants	.23	.42	.10	.01	–.16*	–.11	–.29**	–.20**	–.05								
9. Programmers	.07	.27	–.06	–.08	.33**	.26**	–.15*	–.10	–.03	–.16*							
10. Other specialties	.17	.37	.02	–.08	–.01	–.04	–.24**	–.16*	–.04	–.25**	–.13*						
11. Prevalence of teleworkers	28.64	22.08	.04	–.22**	.25**	.24**	–.05	–.06	–.06	.03	.08	.00					
12. Time co-workers telework	15.99	14.48	.01	–.17**	–.06	–.01	.02	–.06	.09	.09	–.08	.04	.05				
13. FTF interactions	47.54	7.45	.01	.10	.04	.18**	.12	–.17**	–.04	–.03	.07	.00	–.01	.10			
14. Job autonomy	3.28	1.04	.03	.12	.03	.08	.10	–.01	–.03	–.09	–.02	.03	–.05	.14*	.03		
15. Satisfaction with co-workers	3.69	.94	.06	.07	.01	.03	.03	.02	.01	–.02	.03	–.05	–.19**	.03	.13*	.22**	
16. Turnover intentions	3.14	.48	.06	–.17**	–.12	.02	–.03	.01	.01	.01	.01	–.04	.23**	–.12	–.13*	–.15*	–.39**

$N = 240$; * $p < .05$; ** $p < .01$.

Table 2 Hierarchical regression analysis

Variables	*Satisfaction with co-workers*		*Turnover intentions*	
	Model 1		*Model 2*	
	β	ΔR^2	β	ΔR^2
Step 1: Controls		.02		.02
Age	.15*		.09	
Gender	.02		–.02	
Company tenure	.01		–.12	
Unit tenure	.01		.07	
Systems analysts	–.09		–.08	
Marketing associates	.01		–.03	
Engineers	–.04		–.02	
Accountants	–.02		–.04	
Programmers	–.01		.04	
Other specialties	–.04		–.07	
Step 2:		.06***		.15***
Prevalence of teleworkers	–.24***			
Co-worker satisfaction			–.39***	
Step 3:		.09***		
Time co-workers telework	.06			
FTF interactions	.23***			
Job autonomy	.13*			
Step 4:		.08***		
Prevalence × time co-workers telework	–.17*			
Prevalence × FTF interactions	–.15*			
Prevalence × job autonomy	.22**			
R^2		.25		.17
Adjusted R^2		.18		.12
F		3.54***		3.51***

N = 240; * $p < .05$; ** $p < .01$; *** $p < .001$.

suggests that in terms of co-worker satisfaction, greater face-to-face interaction helps attenuate some of the negative impact of teleworker prevalence.

Hypothesis 4 predicted that the extent of job autonomy would moderate the relationship between teleworker prevalence and satisfaction with co-workers, and as shown in Table 2 (model 1, step 4) this was also supported ($\beta = .22$, $p < .01$; $\Delta R^2 = .08$, $p < .001$). Again, to facilitate interpretation, the interaction term was graphed for those with low and high autonomy (one standard deviation below and above the mean). As shown in

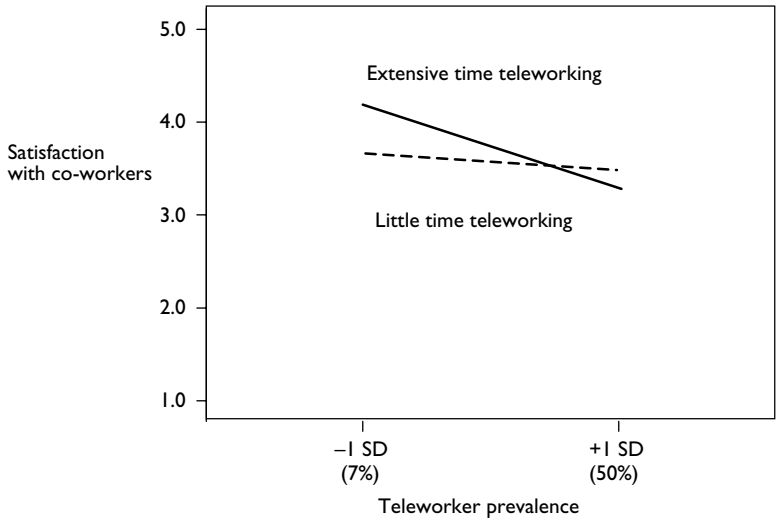

Figure 1 The moderating role of time co-workers telework on the teleworker prevalence–co-worker satisfaction relationship

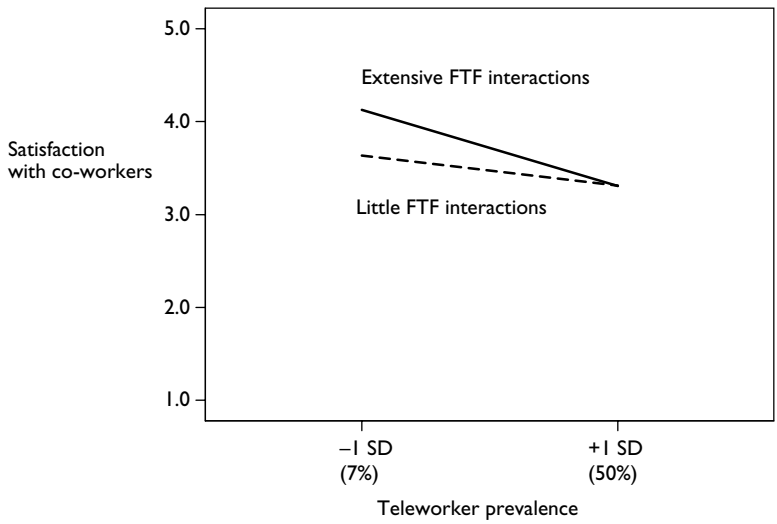

Figure 2 The moderating role of face-to-face interactions on the teleworker prevalence–co-worker satisfaction relationship

Figure 3, the higher the job autonomy the less negative the impact of teleworker prevalence on co-worker satisfaction. Stated differently, when workers had little autonomy in their jobs, they were more vulnerable to the negative impact of teleworker prevalence on satisfaction with co-workers.

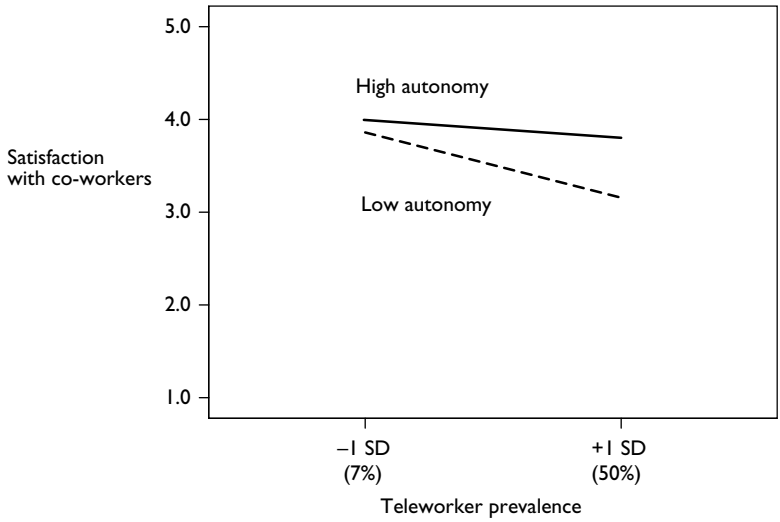

Figure 3 The moderating role of job autonomy on the teleworker prevalence–co-worker satisfaction relationship

Hypothesis 5, which predicted that co-worker satisfaction would be negatively related to turnover intentions, was supported. As shown in Table 2 (model 2, step 2), lower satisfaction with co-workers was associated with higher turnover intentions ($\beta = -.39$, $p < .001$; $\Delta R^2 = .15$, $p < .001$), suggesting that non-teleworkers with lower satisfaction were more apt to leave the organization.

Discussion

As an initial step towards understanding the full impact of telework on others in the office, this study examines if the prevalence of teleworkers in a work unit impacts a non-teleworker's satisfaction with co-workers, and if co-worker satisfaction is associated with turnover intentions. By answering the calls of other researchers and readjusting the research lens to focus on in-office colleagues rather than the teleworkers themselves (e.g. Bailey & Kurland, 2002), this study begins to encapsulate the broader implications of this work mode on the experiences of co-workers with whom the teleworker interacts. Consistent with predictions, a higher prevalence of teleworkers was found to be negatively associated with satisfaction with co-workers, suggesting that telework by others in the office may adversely impact how non-teleworkers view their co-workers. Moreover, satisfaction with co-workers was found to be negatively associated with turnover intentions, indicating

that decreased co-worker satisfaction may lead to higher turnover intentions. Together, these results indicate that telework may have important detrimental consequences beyond any for the teleworkers themselves, which have not been previously studied in the literature. By accounting for the varied occurrences of telework among co-workers, this study begins to unravel how telework's popularity in an organizational setting impacts an individual's view toward such co-workers and attitudes toward working with them, as well as possible consequences of these attitudes in terms of turnover. Given the increasing importance and reliance upon collaborative work in many organizations (Guzzo & Shea, 1992; Marks et al., 2001), especially in knowledge generation and transfer (Nonanka & Takeuchi, 1995; Raghuram, 1996), unraveling these linkages further may be key to enhancing our understanding of this work mode.

By studying co-workers of teleworkers rather than teleworkers themselves, this study expands our view of the potential range of impacts produced by this work mode, and in so doing opens up many avenues for research. For example, perceptions of injustice may be especially strong among co-workers of teleworkers, considering the decreased flexibility and increased workload implications discussed earlier. The findings in this study, considered in combination with those by Kurland and Egan (1999) who found that organizational justice perceptions may be altered by telework, suggest that even larger negative impacts to distributive, procedural, and interactional justice may be experienced by co-workers of teleworkers rather than merely teleworkers themselves. Similarly, findings from this study add support to Thatcher and Zhu's recent theorizing that teleworkers need to 'make conscious efforts to communicate to managers and co-workers' (2006: 1080), since it appears co-workers may hold teleworkers accountable for impositions they experience as reflected in decreased satisfaction with teleworkers. In this regard, future studies investigating social exclusion (e.g. Williams, 2007) and anti-social behaviors in the workplace (e.g. Robinson & O'Leary-Kelly, 1998), may be particularly insightful. As another avenue of research, given initial findings regarding the altered organizational identification of teleworkers (e.g. Wiesenfeld et al., 1999, 2001), researchers might find it useful to investigate if having a greater prevalence of teleworkers in one's work unit adversely impacts identification-related constructs. While in-office colleagues may still reside in the same physical location, the absence of teleworking co-workers and associated decrements in socio-emotional bonding (e.g. Shapiro et al., 2002) may cause their identification with the organization to suffer. This may be especially important since it is likely that more in-office colleagues than teleworkers may suffer identification-related impacts, considering that telework is typically practiced by a minority of employees in a work unit

(in this study it is 29%). As these examples illustrate, there are many future lines of inquiry suggested by this new focus on co-workers of teleworkers, and accounting for the dynamic interplay between teleworkers and non-teleworkers may bear fruitful insights important for telework's success.

Beyond expanding our view of telework, these findings also suggest the need to gain more in-depth understandings by examining telework through the refinement of theories developed in traditional work contexts. As noted by other telework researchers (e.g. Bailey & Kurland, 2002), the development of new or expanded theoretical perspectives that accommodate the study of telework is likely to add needed depth which will enable greater insights into this important area of inquiry. For instance, in this study the negative impact of teleworker prevalence on co-worker satisfaction is consistent with work adjustment theory (Baltes et al., 1999; Dawis et al., 1968; Pierce & Newstrom, 1980, 1983; Pierce et al., 1989), yet this theoretical perspective provides only a partial explanation. According to this perspective, a close correspondence between an individual's abilities and needs, and the satisfaction of those needs by the work environment, is apt to lead to positive work outcomes. Following this logic, an individual's flexibility, through which they can adjust their own needs and abilities within the work environment, will likely alter work attitudes. For non-teleworkers with teleworking colleagues, however, this seems only partially able to explain their experiences. While the non-teleworker experiences decreased flexibility in order to accommodate absent co-workers (which is consistent with work adjustment theory), he or she is also likely to incur additional workload, an aspect which is lacking in current adjustment literature. Therefore, although this theory may explain some impacts of telework by contending individuals who are less able to adjust work activities to satisfy individual desires are apt to view their work experiences less positively, it does not account for telework's other consequences. Future researchers might therefore consider refining this literature to accommodate these and other potential impacts. Extending theory in this way will likely add valuable richness and clarity.

Findings from this research also support predictions that teleworker prevalence and its impact on co-worker satisfaction may be influenced by differences stemming from the nature of interactions with others, as reflected in the amount of time co-workers telework, the extent of face-to-face interactions, and job autonomy. More specifically, as shown in Figure 1, results suggest that the amount of time co-workers telework moderates the impact of teleworker prevalence on satisfaction with co-workers. It appears that individuals with co-workers who spent extensive time teleworking experienced large reductions in co-worker satisfaction as teleworker prevalence increased in the work unit. However, individuals whose co-workers spent

little time teleworking experienced little drop in co-worker satisfaction, regardless of the prevalence of teleworkers. Consistent with theorizing presented earlier, non-teleworkers may experience more frustration and additional workload due to the reduced availability and accessibility of a large proportion of their co-workers who telework extensively, especially when attempting detailed or sensitive discussions, and the restrictions this places on them is associated with decreased satisfaction with co-workers (Baruch, 2000; Guimaraes & Dallow, 1999). With greater burdens and less flexibility, the constraining effect of enduring extensive time in which co-workers telework appears to extract a toll on co-worker satisfaction. This finding showing the importance of time spent teleworking adds to the growing body of evidence suggesting this aspect of telework is pivotal, and it therefore seems likely to help explain prior conflicting results in earlier literature (Bailey & Kurland, 2002; Golden, 2006a, 2006b).

Results were also supportive of a moderating effect exhibited by the extent of face-to-face interactions with co-workers, suggesting that more extensive face-to-face interaction helps ameliorate the detrimental impact of teleworker prevalence on satisfaction with co-workers. As shown in Figure 2, extensive face-to-face interaction is associated with higher co-worker satisfaction across nearly all levels of teleworker prevalence, although this effect is less pronounced in situations where teleworkers are more prevalent in a work unit. It appears that more opportunities to relate to co-workers in person may help offset the negative impact of telework unless teleworkers are highly prevalent in a work unit. This may be due to the comparatively richer exchanges with co-workers that occur during such interactions (Daft & Lengel, 1986), within which greater socio-emotional bonding and warm affective exchanges are apt to take place (Sarbaugh-Thompson & Feldman, 1998). Consistent with earlier research that suggests telework may strain trust (Harrington & Ruppel, 1999) and that interpersonal contact reinforces connectedness and trust (Kiesler & Cummings, 2002), the extent of face-to-face interactions with teleworkers appears to play a highly influential role. Therefore, building upon research which has found a negative relationship between telework and co-worker relationships in terms of team-member exchange quality (Golden, 2006b), future researchers may find it insightful to investigate issues pertaining to interpersonal trust between teleworkers and in-office colleagues. This may shed more nuanced insights into telework's impact on relational quality between those in the office and those who telework.

Consistent with predictions, job autonomy exerted a conditioning role on telework's impact, substantiating earlier claims by scholars that self-regulation (Allen & Renn, 2003) and control (Kossek et al., 2006) are

influential mechanisms associated with telework that may determine individual reactions. As shown in Figure 3, a greater prevalence of teleworkers is especially detrimental to satisfaction with co-workers when individuals have low job autonomy, whereas those with higher autonomy were less adversely impacted. As asserted in the literature on job characteristics (e.g. Hackman & Oldham, 1975), it seems likely that individuals with less autonomy in their jobs are unable to adjust work activities as readily to accommodate their teleworking co-workers, resulting in greater frustration and decreased satisfaction with them. In this regard it would be interesting for future researchers to investigate other aspects of control over work interactions with teleworkers, such as task interdependence (Kiggundu, 1983). This would enable researchers to understand if it is the required interaction with others during task activities characteristic of task interdependence that is frustrating, or if it is the lack of control over when and how interactions occur associated with job autonomy, that is of greater concern. By investigating these types of job characteristics and associated interactions between teleworkers and in-office colleagues, future researchers may be able to further unravel attributions formed between teleworkers and their co-workers (e.g. Festinger et al., 1950), since both types of workers develop perceptions and expectations about the role of telework (Stephens & Szajna, 1998).

While the insights offered by this study contribute to the telework literature, causality cannot be inferred from cross-sectional data, as noted by Bobko and Stone-Romero (1998). Given the cross-sectional nature of studies of this type, the possibility of alternative explanations clearly exists. Moreover, although the findings in this study are well grounded in research literature, the potential for feedback loops could further complicate the conclusions drawn. For example, an increased prevalence of teleworkers might decrease co-worker satisfaction, but the potential for decreased satisfaction by co-workers could also prevent teleworking due to the fear of negative reactions and other similar feedback from co-workers (Guimaraes & Dallow, 1999). Such possibilities do not seem likely however based on existing literature and available research evidence, such as studies highlighting the positive effects of telework on work–family conflict (e.g. Hill et al., 1998). These studies suggest other considerations beyond those from co-workers may drive telework adoption. Nonetheless, despite such indicators to the contrary, future research is needed to fully address this possibility. Finally, another potential limitation of this study involves the possibility of common method variance (Spector, 1987). Although some cross-checks of the data were available from a prior corporate study at the firm, this possibility cannot be ruled out since the data used here were taken from a single source. However, these results are consistent with other research that has

concluded that while bias may be present, it may not always significantly affect results or conclusions (Doty & Glick, 1998; Spector & Brannick, 1995). Nevertheless, future researchers should bear this in mind when interpreting the findings presented here.

While certainly of interest to researchers, the implications of teleworking in terms of its impact on others in the office is also especially noteworthy for managers and professionals seeking to make decisions about this work arrangement. Since results of this study indicate that a higher prevalence of teleworkers is associated with decreased co-worker satisfaction among those remaining in the office, organizational decision makers need to exercise caution when implementing or expanding this work practice based purely on individual desires to telework. Managers who take into account the broader impact of telework on other employees may help alleviate important adverse consequences. While such decisions should clearly be made using all available information, this study suggests that as more employees are permitted to telework, and the more extensively they do so, the less others in their office are satisfied with co-workers. Results also suggest that managers may be able to help mitigate some of this adverse impact by ensuring greater face-to-face contact between co-workers when employees are in the office, and granting greater job autonomy to accomplish work activities as employees see fit. The consequences of failing to do so appears to be an increased tendency for individuals to leave the organization due to a lower level of satisfaction with teleworking colleagues. While these suggestions remain tentative pending additional research, given the growth and continued importance of telework and its associated benefits for teleworkers, an increased emphasis appears needed to account for telework's broader impacts on non-teleworkers left in the office.

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Timothy Golden, PhD, is an Assistant Professor of Management in the Lally School of Management and Technology at Rensselaer Polytechnic Institute (RPI). His research interests focus on telework and other forms of virtual work, work–family conflict, work exhaustion, dispersed leadership, and managerial ethics. His research has appeared in leading academic journals, including the *Journal of Applied Psychology*, *Journal of Vocational Behavior*, *Journal of Management*, *Academy of Management Executive*, and *Journal of Organizational Behavior*, among others.

[E-mail: goldent@rpi.edu]