

The Good, the Bad, and the Unknown About Telecommuting: Meta-Analysis of Psychological Mediators and Individual Consequences

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What are the positive and negative consequences of telecommuting? How do these consequences come about? When are these consequences more or less potent? The authors answer these questions through construction of a theoretical framework and meta-analysis of 46 studies in natural settings involving 12,883 employees. Telecommuting had small but mainly beneficial effects on proximal outcomes, such as perceived autonomy and (lower) work–family conflict. Importantly, telecommuting had no generally detrimental effects on the quality of workplace relationships. Telecommuting also had beneficial effects on more distal outcomes, such as job satisfaction, performance, turnover intent, and role stress. These beneficial consequences appeared to be at least partially mediated by perceived autonomy. Also, high-intensity telecommuting (more than 2.5 days a week) accentuated telecommuting’s beneficial effects on work–family conflict but harmed relationships with coworkers. Results provide building blocks for a more complete theoretical and practical treatment of telecommuting.

Keywords: telecommuting, distributed work, virtual work, meta-analysis

Most current work arrangements still bear the imprint of the Industrial Revolution. Employees mainly transact their time, rather than their products, with employing firms. That time is tightly bound to task and place (Lakoff & Johnson, 1980). In recent decades, however, an information revolution has compelled firms to unbind time and task from place (Harrison, Johns, & Martocchio, 2000). Digital technologies have enabled common, even synchronous activities to be distributed across employees at remote locations (Herschel & Andrews, 1997). These decentralized work arrangements have been publicized as a way for firms to reduce real estate expenses and comply with government regulations (e.g., the Americans With Disabilities Act of 1990, Davenport & Pearlson, 1998; U.S. Equal Employment Opportunity Commission, 2005; Wells, 2001). They are likewise touted as means for employees to adjust their schedule to meet household needs and family demands or to save commuting costs by working from home or satellite offices (HR Focus, 2002; Nickson & Siddons, 2004). That is, through practices that permit flexibility in the “where” of tasks, organizations have adapted work arrangements to fit changing environments and labor needs (Igarria & Guimaraes, 1999).

Investigations of the impact of such flexible work locations began in earnest over 20 years ago (e.g., Ramsower, 1983). More recent studies use the umbrella term *distributed work*: arrangements that allow employees and their tasks to be shared across settings away from a central place of business or physical organizational location (Bélanger & Collins, 1998). The most well-known form of distributed work, telecommuting, which is also known as telework or remote work, has become a widespread practice. It is growing steadily in the United States and abroad (Davis & Polonko, 2001). An estimated 45 million American employees telecommuted in 2006, up from 41 million in 2003 (WorldatWork, 2006). Increasingly, U.S. federal and state governments have encouraged this work arrangement through the introduction of legislation (e.g., Department of Transportation and Related Agencies Appropriations Act of 2000; U.S. Office of Personnel Management, 2005). Outside the United States, a survey of 254 senior-level executives revealed that staff in two thirds of their global firms were involved in distributed work (AT&T, 2004).

Such a sustained rise in popularity suggests a received wisdom of positive outcomes or clear benefits of telecommuting for firms and their employees. Indeed, at the firm level, a number of practitioner articles and company statistics have argued and demonstrated that telecommuting reduces real estate costs (e.g., Apgar, 1998; AT&T, 1997; Dannhauser, 1999). At the individual level as well, the benefits of telecommuting are almost unswervingly claimed by the business press. Improved work–life balance, heightened morale, and increased productivity are widely advertised to practitioners (Apgar, 1998; Brownson, 2004; Tergesen, 1998; Young, 1993). Yet such claims are often criticized by scholars as being based on inconsistent findings, methodologically weak supporting studies, and unconvincing theory regarding why and when those benefits should occur (e.g., Bélanger & Collins, 1998). Moreover, negative consequences for individuals, such as

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social isolation, career stagnation, and family conflict, have also been averred in investigations that sound an opposing drumbeat (Baruch & Nicholson, 1997).

Thus, despite the growing importance and widely spreading practice of telecommuting, reviews of the last 2 decades of research have concluded that it is unknown whether telecommuting is good or bad for employees. Existing evidence is indeterminate and often contradictory (McCloskey & Igarria, 1998). According to one review, "empirical research to date has been largely unsuccessful in explaining what happens" (Bailey & Kurland, 2002, p. 394) after firms and employees adopt distributed work arrangements. A major hurdle in drawing definitive conclusions about telecommuting's impact is that studies of this innovation appear in dispersed literatures (information systems, logistics, industrial relations, psychology, operations, real estate, and management; Bélanger & Collins, 1998), attracting the interest of scholars within multiple disciplines. A key contribution of this article, therefore, is our systematic attempt at locating these studies and summarizing their findings to address what is still unknown despite decades of investigation. We identify studies that address employee outcomes of telecommuting, quantitatively summarize available findings, and provide answers to three fundamental questions for management research. First, is telecommuting or distributed work effective? What are its predictable positive (and negative) consequences for individuals? Second, how do those consequences occur? What psychological mechanisms carry telecommuting's effects? Third, when do those consequences occur? Under what conditions does telecommuting have its strongest effects? In answering these questions, we not only test existing theory, we also forward building blocks and a general framework for future theory development. Specifically, we use meta-analytic cumulation to resolve longstanding debates about the individual costs and benefits of telecommuting and identify circumstances under which those effects are weaker or stronger. We use our findings (and some nonfindings) to propose a research agenda for more nuanced and programmatic investigations of distributed work arrangements.

The Meaning of Telecommuting

We draw on recent reviews and theories to forward a definition of the focal phenomenon that we believe represents an emerging consensus in the literature. Telecommuting is an alternative work arrangement in which employees perform tasks elsewhere that are normally done in a primary or central workplace, for at least some portion of their work schedule, using electronic media to interact with others inside and outside the organization (Bailey & Kurland, 2002; Baruch, 2001; Feldman & Gainey, 1997). There is a substitution of place involved in telecommuting, and a restriction of interactions occurs because of the physical and psychological distance involved in that substitution. Typically, *elsewhere* in the definition above is home, although telework centers and remote offices are alternative locations (Davis & Polonko, 2001; Hill, Miller, Weiner, & Colihan, 1998). Home was the primary location for telecommuting in nearly all the studies included in this meta-analysis.

This definition is broad enough to include most telecommuting forms discussed in academic and practitioner literatures. Yet it deliberately excludes electronic outsourcing, a type of independent contracting in which those who might otherwise be called tele-

commuters are not really members of the contracting organization (Qvortrup, 1998). It also excludes tasks that are normally performed away from a central location of work as part of a conventional work arrangement (e.g., sales trips). Conversely, the definition acknowledges that telecommuting can be practiced by an individual part time (alongside more conventional work arrangements) or full time (exclusively working from home). In a recent review, Bailey and Kurland (2002) suggested that some parts of the literature have implicitly defined telecommuting as full time (always at home, never "at work"), which does not reflect current practice. In fact, fewer than 10% of telecommuting employees are involved in full-time arrangements (Davenport, 2005); part-time arrangements prevail (Qvortrup, 1998; Standen, Daniels, & Lamond, 1999). Our definition also acknowledges that individuals differ in their engagement with telecommuting. Doing so for part of the week (1 or 2 days) represents a less intense form of telecommuting compared to spending the major portion of one's work week away from the central location. We propose that this difference represents a continuum of psychological commitment to the telecommuting arrangement and therefore could have a differential impact on the consequences of telecommuting, an idea we expand on in a later section.

Conceptual Themes in the Telecommuting Literature

Despite a growing consensus on the structural features and importance of telecommuting as an alternative work arrangement, there is no single, overarching theory of its consequences. Most frequently, however, studies have highlighted one or more of the three conceptual themes we detail below (D. G. Allen, Renn, & Griffeth, 2003; Shamir & Salomon, 1985). These themes also constitute statements about the psychological process or intervening mechanisms through which telecommuting has its effects (see the first and second research questions highlighted above).

The first conceptual theme deals with psychological control or perceived autonomy, which is a key feature of any work arrangement. It comprises employees' personal assessments of the extent to which they can "structure and control how and when they do their particular job tasks" (Spector, 1986, p. 1006). Scholars asserting this view see telecommuting as a good thing that is thought to enhance perceived autonomy by providing employees with choice over the location, scheduling (at least for some), and means of work (e.g., DuBrin, 1991; Standen et al., 1999).

The second conceptual theme concerning telecommuting's effects on the work-family interface has been the subject of much scholarly debate. Some scholars view telecommuting as a good thing that leads to greater integration between the work and family roles (e.g., Duxbury, Higgins, & Neufeld, 1998; Raghuram & Wiesenfeld, 2004). Others regard telecommuting as a bad thing that may intensify conflict by increasing the permeability of work and family boundaries (e.g., Igarria & Guimaraes, 1999; Standen et al., 1999). Empirical evidence resolving this debate has been inconclusive (Duxbury et al., 1998; Raghuram & Wiesenfeld, 2004).

The third conceptual theme deals with concerns about telecommuting's potential for relational impoverishment at work. The reduction in face-to-face interactions, the lower frequency and richness of communication between telecommuters and other organization members (Daft & Lengel, 1986), and, thus, the dimin-

ished social presence (Short, Williams, & Christie, 1976) telecommuters have weakened the interpersonal bonds they have with their coworkers or supervisors (Golden, 2006b; Nardi & Whittaker, 2002). These negative consequences are likely to be especially severe for individuals who work away from their central work location for the major portion of their work week.

Taken together, these themes hint at a “telecommuting paradox” of mutually incompatible consequences for employees. If telecommuting were to enhance perceived autonomy and lower work–family conflict, this would, in turn, enhance job-related attitudes, improve performance, and reduce stress. Simultaneously, if telecommuting also were to damage vital work relationships and hamper career advancement, this would imply that outcomes in the work and nonwork domains come at the expense of—or are negatively correlated with—outcomes in the relationship or social domain. The notion that the first two sets of consequences are incompatible with the third, at least in conventional work arrangements, comes from previous meta-analytic research. However, relationship quality with one’s supervisor and coworkers is positively associated with attitudinal outcomes, such as increased job satisfaction, as well as behavioral and physiological outcomes, such as enhanced effectiveness and reduced stress (e.g., Gerstner & Day, 1997; Sousa-Poza & Sousa-Poza, 2000; Viswesvaran, Sanchez, & Fisher, 1999). In the following sections, we examine whether this paradox is sustained by empirical evidence through a quantitative summary and cumulative tests of telecommuting findings.

Theoretical Framework for Telecommuting Meta-Analysis

The three conceptual themes summarized above play a central role as intervening mechanisms in the theoretical framework sum-

marized in Figure 1. That framework guides our meta-analysis. Additional conceptual support for our framework, especially for such a central role of perceived autonomy, work–family conflict, and relationship quality, comes from models developed by D. G. Allen et al. (2003) and Feldman and Gaine (1997). Our choice of individual outcomes of telecommuting is also derived from previous treatments of the consequences of telecommuting (e.g., Shamir & Salomon, 1985). Thus, our framework is a parsimonious collection of important proximal (mediating) and distal consequences of telecommuting, and it also integrates prior theorizing on the topic.

Telecommuting’s Effects on Psychological Mediators

Telecommuters in general are likely to experience increased feelings of freedom and discretion because they are spatially and psychologically removed from direct, face-to-face supervision (DuBrin, 1991). Those employees engaged in part-time telecommuting arrangements are also likely to experience increased autonomy because of the flexibility they are afforded over the location of their work (Shamir & Salomon, 1985). An implicit assumption in the telecommuting literature has been that flexibility in work location is likely to increase self-reliance in scheduling particular tasks and to increase control over the means of completing them: Flexibility equals control (Duxbury et al., 1998; Raghuram, Garud, Wiesenfeld, & Gupta, 2001). This increased flexibility in the timing and execution of tasks enhances employees’ perceptions of autonomy (Hackman & Oldham, 1976). In addition, performing one’s tasks at home allows control over breaks, clothing, layout, decoration, lighting, ventilation, music, and other ambient elements that can contribute to increased feel-

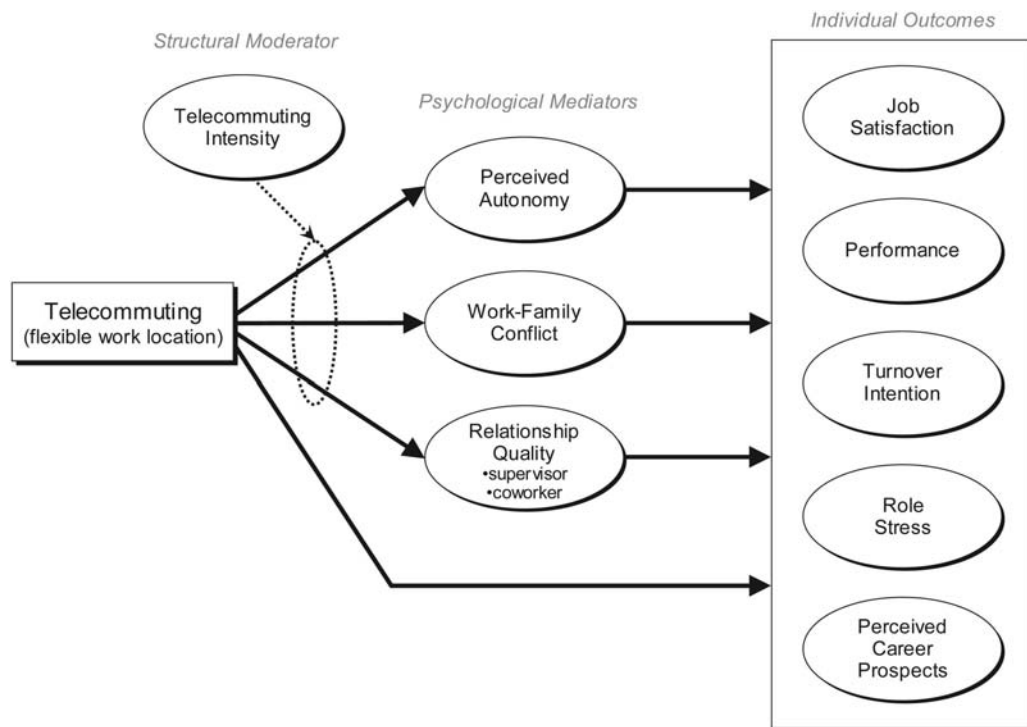


Figure 1. Theoretical framework for the consequences of telecommuting.

ings of autonomy (Elsbach, 2003; Standen, 2000). These arguments lead us to propose the following:

Hypothesis 1: Telecommuting is positively related to perceived autonomy.

As we suggested earlier, debate continues about the work-family consequences of telecommuting. On one hand, telecommuting increases the permeability of boundaries in life domains, making it easier for one domain to intrude on the other, potentially leading to work-family conflict (Standen et al., 1999). Boundary permeability in the context of telecommuting refers to the degree to which either family or work encroaches on the other because they occupy the same place and, potentially, the same time (Ashforth, Kreiner, & Fugate, 2000; Edwards & Rothbard, 2000; Nippert-Eng, 1996). Such permeability could also make psychological disengagement from work more difficult, increasing the likelihood of time-based conflict (Greenhaus & Beutell, 1985). For example, the information and communication technologies supporting telecommuting may encourage employees to continue working at home even after normal work hours (Boswell & Olson-Buchanan, 2004). This may be especially true for individuals with an integrative boundary management strategy who find it difficult to separate activities between home and work (Olson-Buchanan & Boswell, 2006).

On the other hand, increased boundary flexibility from telecommuting can help employees regulate and synchronize demands between work and family and, potentially, reduce work-family conflict (Duxbury et al., 1998; Kirchmeyer, 1995; Raghuram & Wiesenfeld, 2004). Boundary flexibility from telecommuting refers to the degree to which the location (home vs. central location) and timing of work are under the employees' control (Ashforth et al., 2000). Accordingly, the prediction forwarded below emphasizes the boundary flexibility or control offered by most forms of telecommuting (see also L. T. Thomas & Ganster, 1995). This flexibility can also mitigate the negative effects of permeability by allowing employees to schedule work optimally to minimize interference from family. Further, employees can introduce greater segmentation at home through the creation of detached home office spaces that discourage interruptions from family members. Although this could mean that telecommuters work longer hours than when at a central location, they may be able to schedule those hours to mesh with the schedules of family members, reducing time-based conflict. Through the reduction in commuting hours, telecommuting also increases temporal resources that might be available to family activities (rather than the transition to and from work; Greenhaus & Beutell, 1985). Therefore, we expect the following:

Hypothesis 2: Telecommuting is negatively related to work-family conflict.

Telecommuting researchers have adopted many theoretical perspectives to propose that telecommuting leads to detrimental social consequences in the workplace (e.g., D. G. Allen et al., 2003, used social identity theory; Feldman & Gainey, 1997, used social isolation theory). However, scholars have most commonly invoked media richness theory (Daft & Lengel, 1986) and social presence theory (Short et al., 1976) to predict reduced meaningfulness of

relationships between telecommuters and their supervisors and coworkers (e.g., Duxbury & Neufeld, 1999; Harrison, Johns, & Martocchio, 2000; Higa, Sheng, Shin, & Figueredo, 2000; Workman, Kahnweiler, & Bommer, 2003). Face-to-face communication is considered the medium with the highest social presence and media richness. Because telecommuting reduces face-to-face communication, both theories make similar predictions about quality and frequency of interaction, implying mainly negative impacts on interpersonal relationships for telecommuters (see also Hollowell, 1999; Nardi & Whittaker, 2002; Nohria & Eccles, 1992; see updates and expansions of both theories by Carlson & Zmud, 1999; Lombard & Ditton, 1997).

Changing one's workplace from a conventional office to a home or an alternate location is likely to alter the frequency, the quality, and, by definition, the modality of interaction one has with other organization members. Telecommuting therefore has the potential to degrade the quality of the manager-subordinate relationship (Reinsch, 1999). Managers fear reduced control over their subordinates, while employees fear isolation and information impoverishment (Kurland & Cooper, 2002; McCloskey & Igarria, 2003). Reduced face-to-face interaction also makes immediate feedback, as well as affective signals, more difficult to send, sustain, and receive (Hollowell, 1999). Employees who choose to telecommute may also find their loyalty and commitment being questioned by managers (Desrosiers, 2001; McCloskey & Igarria, 2003).

In addition, managers might have to change their strategies for monitoring employees from behavior-based to output-based controls (Kurland & Cooper, 2002), such as management by objectives (Konradt, Hertel, & Schmook, 2003), to adapt to the changes brought on by telecommuting. Behavior-based controls refer to the fairly common practice of supervisors evaluating performance on the basis of employees' observable actions. Output-based controls refer to supervisor's evaluation of the telecommuter's performance on the basis of the evaluation of output, products, or deliverables of work, not on the process or behaviors involved in producing the output. Managers who are unwilling to or who lack the training to change their management and control styles would likely see deterioration in the depth and vitality of their connection with telecommuting subordinates (Shin, El Sawy, Sheng, & Higa, 2000). Altogether, these mechanisms and lines of evidence and logic lead to the following prediction:

Hypothesis 3a: Telecommuting is negatively related to telecommuter-supervisor relationship quality.

Face-to-face interactions with coworkers provide access to informal networks and create opportunities for serendipitous (job-relevant) interactions. Working in the physical proximity of coworkers makes strong, positive, and deep ties easier to develop and maintain (Monge, Rothman, Eisenberg, Miller, & Kirstie, 1985). By decreasing the frequency of such "high bandwidth" interactions, telecommuting could diminish the richness of a focal employee's connection with his or her peers by making it more difficult to transmit the symbolic and nonverbal, personalized cues of everyday encounters (Rice, 1992). Spatial distance from others at work likely translates into psychological distance; for telecommuters this might mean becoming "out of sight, out of mind" (McCloskey & Igarria, 2003). Telecommuters may also face resentment and jealousy from coworkers who do not telecommute

(Roberts, 2001). Because coworkers cannot readily see telecommuters' efforts or their contributions to the unit, they might also perceive telecommuters as parasocial, rather than present and working, and less instrumental to shared goals (Duxbury & Neufeld, 1999; Lombard & Ditton, 1997).

Hypothesis 3b: Telecommuting is negatively related to telecommuter–coworker relationship quality.

Telecommuting's Effects on Individual Outcomes

Telecommuting provides employees with the choice of working away from a central location. It also leads to reduced costs of working, via savings in transportation hassles, time, and money for employees, and (in many cases) formal business dress is not required. By providing the opportunity to telecommute, such an arrangement could also symbolize an employer's willingness to alter the work environment in response to employees' needs. This might also be perceived by employees as reflecting or allowing a greater fit between themselves and their job, which is an aspect of positive work role adjustment (Baltes, Briggs, Huff, Wright, & Neuman, 1999; Dawis, England, & Lofquist, 1968). Altogether, these benefits of telecommuting lead us to assert the following:

Hypothesis 4: Telecommuting is positively related to job satisfaction.

Improved productivity is probably the most widely touted benefit associated with telecommuting (McCloskey & Igarria, 2003; Pinsonneault & Boisvert, 2001). A chief explanation for this proposed advantage in performance is that doing tasks remotely also means fewer disruptions while working (Bailey & Kurland, 2002). Telecommuting is also expected to increase productivity through increased work hours made possible by time saved from not commuting (Apgar, 1998). Finally, telecommuting provides individuals the opportunity to tailor or modify the work environment to better match how and when they do their work most effectively. Baltes et al. (1999) made a similar argument for improved performance in the context of flexible work scheduling. Therefore, we expect the following:

Hypothesis 5: Telecommuting is positively related to job performance.

Another often-cited advantage of telecommuting, especially in the practitioner literature, has been its presumed capability to help retain employees who might otherwise have quit (if such a work arrangement had not been offered; Kraut, 1987; Pinsonneault & Boisvert, 2001). Firms are advised to provide telecommuting to their employees as a form of competitive edge in attracting and keeping the best talent (AT&T, 2004; Vega, 2003). Moreover, Scandura and Lankau (1997) suggested that work arrangements such as telecommuting increase the value of the psychological contract employees have with their organization. These authors proposed that organizations providing employees with the flexibility to work from home are providing a positive signal, visibly demonstrating their trust and support for employees' well-being. This signal from organizations should, in turn, generate greater psychological commitment and a lowered tendency to quit (Rhoades & Eisenberger, 2002). Thus, we anticipate the following:

Hypothesis 6: Telecommuting is negatively related to turnover intent.

Telecommuting reduces the stress associated with getting ready for and commuting to work; commuting itself is a potential work role stressor. Further, Pierce and Newstrom (1980) argued that having to arrive at work, especially at a fixed time every day, causes distress because lateness has negative reputational consequences at the workplace. Similarly, the flexibility provided by the most common forms of telecommuting could allow greater participation in recreational social or sports activities that could mitigate negative physiological consequences of role stress experienced on the job (Konradt et al., 2003). Hence, we expect the following:

Hypothesis 7: Telecommuting is negatively related to employee role stress.

"Face time," or visibility, at a central location is thought to be critical for outstanding performance evaluations (O'Mahony & Barley, 1999), and such evaluations are pivotal for career success. Therefore, telecommuters are likely to experience concerns that working away from a central location could hamper their career prospects. Further, because they are more likely to be out of sight, out of mind (McCloskey & Igarria, 2003), they are likely to perceive fewer behavioral opportunities to demonstrate high performance in a face-to-face, highly salient context. They may also sense that others might view them as less committed and less loyal to the organization and as prioritizing personal life over professional obligations, which may also contribute to their concerns about their prospects for advancement (McCloskey & Igarria, 2003). This confluence of factors leads to our next proposition:

Hypothesis 8: Telecommuting is negatively related to perceived career prospects.

Telecommuting, Psychological Mediators, and Individual Outcomes

In our earlier sections, we have shown that conceptual arguments form the connection between telecommuting and psychological mediators. We have also offered our reasoning above for anticipating telecommuting's effects on individual outcomes. The remaining connections in our framework are the upshot of well-established evidence linking our proposed psychological mediators to those outcomes, and therefore we do not offer them as separate hypotheses. In particular, empirical research has consistently demonstrated that perceived autonomy has beneficial effects on job satisfaction (Loher, Noe, Moeller, & Fitzgerald, 1985) and other individual outcomes, such as turnover intent, performance, and stress, as summarized in a comprehensive meta-analysis (Spector, 1986). Other meta-analyses provide robust evidence for the beneficial effects of lower work–family conflict on job satisfaction, performance, turnover intent, and stress (T. D. Allen, Herst, Bruck, & Sutton, 2000; Kossek & Ozeki, 1998). Yet another stream of findings from meta-analyses and nationally representative samples suggests that employees' quality of relationships with supervisors and coworkers can influence job satisfaction, performance, turnover intent, stress, and perceptions of career progress (Gerstner & Day, 1997; Kinicki, McKee-Ryan, Schriesheim, & Carson, 2002;

Sousa-Poza & Sousa-Poza, 2000; Stanton et al., 2002; Viswesvaran et al., 1999).

Now that we have assembled each of the piecemeal elements and relations in our framework (Figure 1), one more set of propositions is logically deduced from and virtually defined by its recursive structure. Perceived autonomy, work–family conflict, and relationship quality serve as intervening mechanisms or, at the least, partial conveyors of the effects of telecommuting onto individual outcomes. That is, telecommuting indirectly influences job satisfaction, performance, and turnover intent by raising perceptions of control over the location, timing, and means of completing one's work. Indeed, perceived control has long been theorized as an antidote to stress (Karasek, 1979; Ganster & Schaubroeck, 1991). Similarly, by creating opportunities for greater synchronization between demands from the work and family domains, telecommuting could indirectly influence individual outcomes, such as heightened satisfaction and reduced role stress, by lowering work–family conflict. However, earlier in our discussion of the telecommuting paradox, we contended that telecommuting is expected to have negative effects on relationship quality. By potentially harming the quality of an employee's ties to supervisors and coworkers, telecommuting could indirectly have harmful effects on individual outcomes of telecommuting. More formally, we therefore offer the following:

Hypothesis 9: Telecommuting's beneficial effects on individual outcomes are mediated by (a) perceived autonomy and (b) work–family conflict, and its detrimental effects are mediated by (c) relationship quality with the supervisor and (d) relationship quality with coworkers.

The Moderating Role of Telecommuting Intensity

By treating telecommuting as a single, undifferentiated program, the previous hypotheses tend to overlook potentially important structural distinctions among work arrangements. The chief structural distinction made by previous investigators deals with what we refer to as *telecommuting intensity*: the extent or amount of scheduled time that employees spend doing tasks away from a central work location. This idea has been referred under various guises, as *virtual status* by Wiesenfeld, Raghuram, and Garud (1999, p. 782), as *virtuality* by Scott and Timmerman (1999, p. 242), and as *home-centered* versus *office-centered telework* by Konradt et al. (2003, p. 62), among other terms (Hill, Ferris, & Martinson, 2003).

An emerging perspective on telecommuting intensity in the literature is that when telecommuters spend the majority, versus a minority, of their scheduled time away from a central location, it crosses a psychological threshold (in a sense, creating two "taxons," or classes, of employees in telecommuting arrangements; Meehl, 1992). High-intensity telecommuters spend the majority (or all) of their workdays away from a central location. Low-intensity telecommuters spend the majority of their workdays at a central (conventional) location, working remotely for only 1 or 2 days a week. Konradt et al. (2003) found that telecommuters who spent more than 50% of their time away from the office (home centered) had different motivations for telecommuting relative to those who spent less than 50% of their time away (office centered). Home-centered or high-intensity telecommuters sought to balance

their work and family demands, while office-centered or low-intensity telecommuters sought freedom from interruptions. Similarly, Wiesenfeld et al. (1999) found that high virtual status employees (those who work 3 or more days per week away from a central work location, usually home) had different communication patterns relative to low virtual status employees (those who work 3 or more days a week at a central location). Coveyduck (1997), DeLay (1995), Mackie-Lewis (1998), Schneider-Borowicz (2003), Scott and Timmerman (1999), and Taveras (1998) also used similar splits of scheduled work time at work and at home as an indicator of behavioral immersion in telecommuting.

In our framework, telecommuting intensity moderates the effects of telecommuting on the three psychological mediators—perceived autonomy, work–family conflict, and relationship quality. Moving further into the first conceptual theme in this literature, we propose that high-intensity telecommuters are likely to receive and perceive a greater sense of autonomy relative to those who telecommute less frequently. That is, high-intensity telecommuters are likely to experience enhanced discretion over the means of completing their tasks relative to those in low-intensity arrangements because of lower levels of scrutiny from their supervisors. Such perceptions of discretion could also be a result of increased self-reliance from completing one's tasks by accessing appropriate virtual technologies (e.g., knowledge management systems, intranet databases) instead of relying on relational sources for task support, such as supervisors and coworkers (Raghuram et al., 2001), which are relatively less accessible. In addition, high-intensity telecommuters have more opportunities to exercise control over scheduling work for peak productivity times, exercising greater control over their availability to other organizational members, and, therefore, better managing interruptions to their work. Finally, at lower intensities, an employee's identity as a telecommuter is likely to be less salient (Bailey & Kurland, 2002), which further limits feelings of autonomy with such an arrangement. Thus, we expect the following:

Hypothesis 10: Telecommuting intensity moderates the positive impact of telecommuting on perceived autonomy by accentuating its positive effects.

Earlier, we proposed that a second conceptual theme in the telecommuting literature is that it reduces work–family conflict. In this section, we suggest that the intensity of telecommuting accentuates that reduction. The greater boundary flexibility experienced by high-intensity telecommuters relative to those in low-intensity arrangements translates to a higher degree of potential synchronization between the work and family domains (Ashforth et al., 2000). High-intensity telecommuters also experience greater savings of time and energy from reduced commutes and less time spent in transitions to and from work relative to low-intensity telecommuters. Reducing conflict between domains, this could mean more time and energy available to attend to family responsibilities.

Further, high-intensity telecommuting represents a greater psychological commitment to the unconventional work arrangement. Such a level of commitment possibly reflects a strong desire for greater integration between the domains of work and family (Konradt et al., 2003). This greater commitment means that high-intensity telecommuters are likely to proactively evolve norms and

routines to manage the increased boundary permeability between the work and family domains, which could offset the gains due to greater flexibility (Ashforth et al., 2000). For example, over time, high-intensity telecommuters might be more likely to create dedicated home office spaces or make other, relatively permanent investments in supporting the work arrangement, such as meshing child care arrangements with home-working hours. Low-intensity telecommuters might be less effective at managing boundary permeability because their work arrangements might be perceived by themselves and family members as too ad hoc or infrequent to negotiate major adjustments in boundary management. Taken as a whole, these arguments point to the following hypothesis:

Hypothesis 11: Telecommuting intensity moderates the negative impact of telecommuting on work–family conflict by accentuating its negative (beneficial) effects.

Our third conceptual theme, relational impoverishment, suggests that higher telecommuting intensity exacerbates the negative impacts of telecommuting on quality of interpersonal interactions with others in one's workplace. Spending the majority of one's work week away from office implies fewer opportunities for rich face-to-face interactions with supervisors and coworkers, presenting fewer opportunities for spontaneous informal interactions (Mackie-Lewis, 1998). The interactions that do occur are mediated mainly by leaner media (Daft & Lengel, 1986), contributing to lower social presence (Short et al., 1976) relative to those practicing low-intensity telecommuting. This leads to sharply diminished perceptions of intimacy and immediacy, which are crucial to effective interpersonal communication (Lombard & Ditton, 1997). Altogether, this drives a much greater deterioration in the relationship quality between high-intensity telecommuters and their supervisors or coworkers when compared to that of low-intensity telecommuters. Indeed, Kurland and Cooper (2002) found that some employees reduced their telecommuting intensity when they sensed their relationship with their manager was at risk or that they were targets of coworker gossip and resentment. Therefore, we propose the following, countervailing (to those relating to perceived autonomy and work–family conflict) influences of telecommuting intensity. Together, Hypotheses 10, 11, and 12 suggest that the potential tension of a telecommuting paradox will be especially sharp for those who spend more of their work time in such an arrangement.

Hypothesis 12: Telecommuting intensity moderates the negative impact of telecommuting on relationship quality, accentuating its negative effects on interpersonal ties with (a) supervisors and (b) coworkers.

Other Moderators

Our hypotheses for telecommuting intensity follow from our discussion of the theoretical framework. However, we acknowledge that additional moderators might temper or strengthen telecommuting's effects on the psychological mediators. On the basis of a search of the telecommuting literature, we identified and attempted to code the following moderators: voluntariness of the telecommuting arrangement, task interdependence, job type of the telecommuter (cf. Feldman & Gainey, 1997), technology em-

ployed while telecommuting, gender (cf. McCloskey, Igbaria, & Parasuraman, 1998), and experience with telecommuting (cf. Raghuram et al., 2001). Information about the first four of these moderators in the studies included in this meta-analysis was, unfortunately, not regularly included in the sample or work arrangement description, and authors who were directly contacted about their studies could not provide it. Hence, available data allowed us only to do an examination of the latter two potential moderators: gender and experience with telecommuting.

First, gender has been hypothesized to alter the effect of telecommuting on autonomy and work–family conflict (Dixon & Webster, 1998; McCloskey et al., 1998; see also Harrison & Martocchio, 1998, for arguments about the ubiquity of gender as a moderator of similar work–home transition processes). Second, a process-based view of telecommuting suggests that, over time, as individuals gain experience with telecommuting, they begin to modify the technology and processes of working from a distance to have lesser costs and greater benefits (see Walther, 1992, and Hinds & Bailey, 2003, for a related discussion).

Method

Collecting Effect Sizes

As the consequences of telecommuting arrangements have interested scholars across many disciplines, we searched electronic databases in management, psychology, information systems, management science, logistics, engineering, sociology, and education. Those databases included ABI/Inform, ProQuest, PsycINFO, Elsevier Science Direct, Academic Ideal, EBSCO, ERIC, Sociological Abstracts, JSTOR, Web of Science, and Dissertation Abstracts International. Original studies were found in journal articles, dissertations, and book chapters. Keywords for our search included *telecommuting*, *remote work*, *telework*, *distributed work*, *mobile work*, *work at home*, and *flex-place*. We also searched the Internet and <http://scholar.google.com> with the same terms to locate working papers and unpublished conference papers.

To minimize the potential file drawer problem (Rosenthal, 1984), we posted to several listservs and personally contacted authors who had completed dissertations or had published in this research domain, asking for unpublished or soon-to-be published evidence. In addition, we searched through reference lists of existing articles. Through this process, we identified approximately 212 works that might have contained effect sizes to contribute to our meta-analysis. However, most of those works lacked data. They were often instructional rather than empirical (e.g., forwarding “how to” advice on setting up remote work arrangements).

Inclusion and Exclusion Criteria

Papers we eventually retained for this meta-analysis fitted several inclusion criteria. One criterion was data based and straightforward. The paper needed to include an effect size for telecommuting (e.g., r , t , F , chi-square) or report enough data to compute one (e.g., means and variances across two groups). A second, related criterion was that the paper needed to address one of the broadly defined, individual-level consequences given in our hypotheses. The third criterion was conceptual and more of a meta-analytic judgment call (Wanous, Sullivan, & Malinak, 1989). We

excluded studies based on (a) employees doing “supplemental work” (tasks done after scheduled hours in addition to work done at the conventional office), (b) definitions of remote locations that equated them with the more common idea of branch offices, (c) investigation of home-based craft work, and (d) participants who were self-employed or independent contractors. Our fourth and final criterion was that our retained studies examined the phenomenon as it was being experienced by employees in organizations (i.e., in the field).

Data from 46 studies met all of our inclusion criteria and contributed to a test of at least one of the hypotheses above (highlighted by an asterisk in our reference list). The 46 studies included 27 published works and 19 unpublished dissertations. We checked whether there were any systematic differences in effect sizes based on the rigor of peer review. We assigned the highest level of such rigor to journal articles, the lowest to unpublished dissertations, and an intermediate level to book chapters and conference papers. We conducted a study-level categorical moderator test (Hedges & Olkin, 1985) to test for differences in cumulative effect sizes between the three categories of rigor of peer review. We did not find any systematic differences ($Q_b = .96, ns$).

Final Sample and Coding

Each of the 46 studies in our final sample used survey or interview techniques to measure the proximal and distal outcomes of telecommuting. The average response rate for those forms of data elicitation was 51%. The typical telecommuter was a manager (composing an average of 31% of any original sample) or a professional from either the information technology or the sales and marketing function of a firm (averaging 57% of the functional background of a typical sample). The mean age of telecommuters was 39 years. The average proportion of women in any original sample was 49%.

Independent construct. The independent construct—telecommuting—was typically treated as a dichotomous or categorical indicator. That is, in original studies, consequences for individuals working under a conventional arrangement were usually compared to consequences for those working under a telecommuting arrangement. Other studies measured multiple levels of telecommuting, from zero telecommuting to full-time telecommuting (e.g., 0–5 days). A study-level categorical moderator test (Hedges & Olkin, 1985) for dissimilarity in cumulative effect sizes between the two types of indicators of telecommuting did not reveal any systematic differences ($Q_b = .04, ns$). Therefore, we treated effect sizes derived from the two types of indicators of telecommuting as equivalent. Almost all papers used *telecommuting* to describe the arrangement, so identification of the independent variable was straightforward.

Hypothesized moderator. For many of the accumulated studies, the average number of days per week spent telecommuting was also reported. We used that average to code our main moderator variable: telecommuting intensity. If the telecommuters in a given sample spent the majority of their workdays working remotely—2.5 or more days per week—the sample was coded as one involving high-intensity telecommuters. Studies reporting an average of fewer than 2.5 days per week working remotely were coded as a sample of low-intensity telecommuters. Conceptual, substantive, and empirical reasons for using these two classifications were

given above (see Baltes et al., 1999, for a similar dichotomization in the context of alternative scheduling arrangements). Of the 46 studies in the meta-analysis, 37 provided information that allowed us to code for telecommuting intensity. Of these, 19 studies (51%) involved high-intensity telecommuting, and 18 studies (49%) involved low-intensity telecommuting.

Other moderators. We also checked for the effects of two other moderators that were not explicitly mentioned in our hypotheses: gender and personal experience with telecommuting. We used the percentage of women in each meta-analyzed sample as a study-level index for gender. When possible, we calculated experience with telecommuting as the time that had elapsed between introduction of telecommuting in the organization at hand and the date of the data collection within a study. Because many studies only reported a range (e.g., “more than 12 months”) for this measure, we classified studies into two groups. One group included studies in which the average telecommuter had a year or less experience with the arrangement; another included studies in which the average telecommuter had more than a year’s experience.

Dependent constructs. We followed widely accepted definitions for most of our dependent constructs and their construct-label synonyms. The constructs constituting the psychological mediators in our theoretical framework included perceived autonomy (perceived control, job discretion), work–family conflict (work–family conflict and work–family balance, the latter of which was reversed coded), quality of relationship with supervisor (satisfaction with supervision, trust in supervisor, degree of interaction or communication with one’s supervisor, extent of support from one’s boss, and supervisor–subordinate leader–member exchange quality), and quality of relationship with coworkers (satisfaction with coworkers, trust in coworkers, degree of interaction or communication with coworkers, support from coworkers, perceived cohesiveness with the work group, and identification with or commitment to the focal person’s team or work unit). Individual outcomes included job satisfaction (work satisfaction, individual morale), turnover intent (withdrawal cognitions, likelihood of changing job, intent to stay; the latter of these was reverse coded), role stress (tension, role ambiguity, interrole conflict), and perceived career prospects (satisfaction with promotion, career opportunities, chances for promotion). Job performance included measures of assignment completion, assessments of productivity, and overall evaluations or ratings. We coded separately for self-rated performance and supervisor or objective ratings of performance.

Meta-Analytic Techniques and Statistical Adjustments

We used methods described by Hedges and Olkin (1985) to calculate the meta-analytic effect sizes for testing each of our hypotheses. We first transformed reported statistics such as means and standard deviations, chi-square values, *t* tests, and *F* tests into correlations. Prior to calculating the estimated population effect size, its variance, and confidence intervals (CIs), we used the sample-adjusted meta-analytic deviancy statistic, developed by Huffcutt and Arthur (1995), to identify outliers in effect sizes for relationships of telecommuting to each of its proposed proximal (mediating) or distal outcomes. This resulted in the elimination of one study entirely from the meta-analysis because the effect sizes

coded from it were identified as outliers across all the outcomes it involved. Our contact with the authors also revealed that the original data were not available for confirming the size of the effects as unmistakable. Further, for each cumulation involving a particular mediator or outcome, we did not include a study in that particular meta-analytic estimate if its effect size was identified as a statistical outlier.

We disattenuated each correlation for the unreliability of the variables involved (as reported in each original study), using procedures described by Hedges and Olkin (1985). For studies that did not report reliabilities, we imputed an average reliability from the other investigations that involved the same construct, an emerging norm in meta-analyses (e.g., Bhaskar-Shrinivas, Harrison, Shaffer, & Luk, 2005). We calculated meta-analytic estimates only when we had at least $k = 4$ independent effect sizes.

One other adjustment dealt with nonindependence of results—conceptual replication within a study—which can bias estimates of the true variation in effect sizes across studies and jeopardize tests of moderators (Hunter & Schmidt, 2004). That is, when there were multiple measures of the same dependent construct within a single study and, hence, multiple effect sizes for that construct, we carried forward the median of the multiple effect sizes. For example, if one study reported correlations of telecommuting with (a) satisfaction with supervision, (b) trust in one’s supervisor, and (c) communication frequency with one’s supervisor (all of which we coded as ways to operationalize relationship quality with one’s supervisor), we used the median of correlations (a–c) in our meta-analytic summary tables and tests.

Results

Telecommuting’s Effects on Psychological Mediators: Hypotheses 1–3

In our first hypothesis, we proposed that telecommuting would be associated with higher perceived autonomy for employees. Our meta-analytic findings in Table 1 support the idea. Telecommuting was positively related to this psychological mediator. The average correlation corrected for unreliability was $\hat{\rho} = .22$ ($k = 11$; $n = 3,040$). The CI for the uncorrected correlation did not include zero

(95% CI = .16 to .22). The Q statistic, $\chi^2(10) = 15.69$, was nonsignificant, indicating that the variance in this sample of effect sizes was not greater than what would be expected as a result of sampling error.

Our second hypothesis asserted lower work–family conflict as a proximal consequence (and mediator) of telecommuting. As predicted, the relationship between telecommuting and work–family conflict was negative ($\hat{\rho} = -.13$; $k = 19$; $n = 9,852$). It was also a modest correlation, but the CI for the uncorrected relationship did not include zero (95% CI = $-.13$ to $-.10$). A significant Q statistic suggested the presence of moderators, $\chi^2(18) = 51.67$, $p < .01$.

A subset of original studies that contributed the effect sizes for this relationship also examined the work–family consequences of telecommuting at a greater level of granularity, investigating bidirectional forms of conflict between the work and family domains. We conducted a post hoc analysis of the effects of work interference with family conflict and family interference with work conflict. Consistent with its overall effect on work–family conflict, we found telecommuting to have a negative effect on work interference with family conflict ($\hat{\rho} = -.16$; $k = 7$; $n = 1,248$; 95% CI = $-.19$ to $-.08$) as well as on family interference with work conflict ($\hat{\rho} = -.15$; $k = 6$; $n = 794$; 95% CI = $-.21$ to $-.07$). There was no appreciable difference in the size of these bidirectional effects.

Because of restricted breadth of communication and social isolation, we predicted that another proximal consequence (psychological mediator) of telecommuting would be damage to interpersonal relationships at the workplace. Hypothesis 3a dealt with the proposed negative effect of telecommuting on an employee’s relationship with his or her supervisor. Contrary to our expectations, we found a positive effect of telecommuting on the employee–supervisor relationship. The average corrected correlation was $\hat{\rho} = .12$ ($k = 14$; $n = 2,888$). The meta-analytic 95% CI ranged between .08 and .15. The Q statistic, $\chi^2(13) = 22.05$, was nonsignificant, suggesting that the effect sizes were homogenous across the original studies included in this analysis. Hypothesis 3b predicted that telecommuting would be negatively related to co-worker relationship quality. We did not find support for this

Table 1
Meta-Analytic Relationships of Telecommuting With Proposed Psychological Mediators and Distal Outcomes: Hypotheses 1–8

Variable	<i>k</i>	<i>n</i>	Mean <i>r</i>	Effect size <i>d</i>	Mean 95% CI	<i>Q</i> statistic χ^2	Estimated ρ	Average reliability
Psychological mediator								
Perceived autonomy	11	3,040	.19	.39	.16, .22	15.69	.22	.77
Work-family conflict	19	9,852	-.11	-.23	-.13, -.10	51.67**	-.13	.84
Relationship quality—supervisor	14	2,888	.12	.23	.08, .15	22.05	.12	.86
Relationship quality—coworker	14	3,269	.00	.00	-.03, .03	39.74**	.00	.83
Individual outcome								
Job satisfaction	28	7,764	.09	.18	.07, .11	22.92	.10	.83
Performance: self-rated	9	7,419	.01	.02	-.01, .03	29.65**	.01	.76
Performance: supervisor-rated or objective measure	4	484	.18	.36	.09, .26	9.79*	.19	.88
Turnover intent	9	7,580	-.08	-.17	-.11, -.06	17.06*	-.10	.83
Role stress	11	2,406	-.11	-.23	-.15, -.07	29.08**	-.13	.84
Perceived career prospects	8	1,038	.00	.01	-.06, .07	32.00**	.00	.83

Note. CI = confidence interval.
* $p < .05$. ** $p < .01$.

proposition. Instead, we found the relationship to be very close to zero (95% CI = $-.03$ to $.03$; $\hat{\rho} = .003$; $k = 14$; $n = 3,269$). The Q statistic was significant, implying the operation of moderators, $\chi^2(13) = 39.74$, $p < .01$.

Telecommuting's Effects on Individual Outcomes: Hypotheses 4–8

Hypothesis 4 asserted greater job satisfaction as a (distal) outcome of telecommuting. As predicted, the telecommuting–satisfaction relationship was positive ($\hat{\rho} = .10$; $k = 28$; $n = 7,764$). The CI for the uncorrected relationship did not include zero (95% CI = $.07$ to $.11$), and the Q statistic was nonsignificant, $\chi^2(27) = 22.92$.

Hypothesis 5 stated that telecommuting leads to enhanced job performance. Results did not match theoretical and practical expectations for self-rated performance, as there was no demonstrable connection between this variable and telecommuting ($\hat{\rho} = .01$; $k = 9$; $n = 7,419$). Its 95% CI for the uncorrected correlation included zero (95% CI = $-.01$ to $.03$). However, telecommuting's relationship with supervisor ratings or archival records of performance was positive ($\hat{\rho} = .19$; $k = 4$; $n = 484$), and its 95% CI did not contain zero (95% CI = $.09$ to $.26$). The Q statistic was significant for both types of indicators of performance—self-rated, $\chi^2(8) = 29.65$, $p < .01$; ratings or records, $\chi^2(3) = 9.79$, $p < .05$ —indicating the likely operation of moderators.

We predicted in Hypothesis 6 that telecommuting would be negatively associated with employee turnover intention. In support of this hypothesis, we found the meta-analytic correlation from accumulated studies was $\hat{\rho} = -.10$ ($k = 9$; $n = 7,580$). The 95% CI for the uncorrected correlation again excluded zero (95% CI = $-.11$ to $-.06$), and the Q statistic was again significant, $\chi^2(8) = 17.06$, $p < .05$. Consistent with Hypothesis 7, telecommuting was negatively connected to employees' role stress ($\hat{\rho} = -.13$; $k = 11$; $n = 2,406$; 95% CI = $-.07$ to $-.15$). Once more, the Q statistic was significant, $\chi^2(10) = 29.08$, $p < .01$. This relationship was likely moderated by other factors. Finally, telecommuters did not necessarily perceive diminished career prospects relative to those under typical work arrangements, which was expected in Hypothesis 8. The average corrected correlation was $\hat{\rho} = .00$ ($k = 8$; $n =$

$1,038$; 95% CI = $-.06$ to $.07$). The Q statistic was large and significant, $\chi^2(7) = 32.00$, $p < .01$.

Mediating Effects: Hypotheses 9a–9d

We examined the mediating effects of perceived autonomy, work–family conflict, and relationship quality on the individual outcomes using a series of partial correlations based on the meta-analytic estimates given above about $X \rightarrow M$ and $X \rightarrow Y$ (where X is telecommuting, M is the proposed psychological mediator, and Y is the proposed individual outcome). We used prior meta-analytic estimates or correlations from large, nationally representative samples to estimate mediator–outcome connections ($M \rightarrow Y$). The perceived autonomy–individual outcome correlations were sourced from Spector (1986); correlations between work–family conflict and individual outcomes were taken from T. D. Allen et al. (2000), and the correlations between relationship quality and individual outcomes came from Kinicki et al. (2002) and Stanton et al. (2002).

We computed a partial correlation (corrected for unreliability; $\hat{\rho}$) for each telecommuting–individual outcome pair after controlling for the effect of their respective psychological mediators, given in Hypotheses 9a–9d and shown in Figure 1. Table 2 provides the original and partial correlation for each of the hypothesized telecommuting–mediator–outcome mechanisms. We computed the sample size for the significance test of the partial correlations by calculating the harmonic mean of the sample sizes for each of the three meta-analytic correlations (Viswesvaran & Ones, 1995).

Evidence suggesting a mediating effect is inferred from the degree to which the original correlation is reduced after the effect of the psychological mediator is accounted for (Blalock, 1961). If the test of the partial correlation suggests that the correlation is not significantly different from zero, then it indicates that there is an intervening effect of the mediator. However, if the partial correlation is equal to the original correlation, then it suggests that there is no intervening effect. If the original correlation is higher than the partial correlation and the directional significance test of the partial correlation suggests that it is nonzero, then we can infer that there is a partial intervening effect of the mediator. It is important to note that because partial correlations do not provide conclusive evi-

Table 2
Partial Correlations Between Telecommuting and Its Individual Outcomes After Controlling for Psychological Mediators: Hypotheses 9a–9d

Individual outcome	Estimated ρ	Partial correlations after controlling for			
		Perceived autonomy	Work-family conflict	Relationship quality	
				Supervisor	Coworker
Job satisfaction	.10** (7,764)	.02 (5,839)	.07** (9,591)	.04* (1,708)	.10** (1,749)
Performance: self-rated	.01 (7,419)	-.05 (1,172)	.00 (2,889)	.01 (1,376)	.01 (3,222)
Performance: supervisor-rated or objective measure	.19** (484)	.14** (4,816)	.18** (1,008)	.18** (728)	.19** (1,046)
Turnover intent	-.10** (7,580)	-.05** (2,826)	.07** (5,146)	-.07** (4,054)	-.10** (4,355)
Role stress	-.13** (2,406)	-.05** (1,797)	-.10** (2,862)	-.11** (2,756)	-.13** (2,656)
Perceived career prospects	.00 (1,038)			-.04* (1,920)	.00 (1,973)

Note. The significance of partial correlations was evaluated against the harmonic mean of sample sizes (in parentheses). * $p < .05$. ** $p < .01$.

dence for the directionality of the mediating mechanism, our review of results reported below should be interpreted with caution, as representing only tentative evidence for causality.

Hypothesis 9a made predictions about the mediating role of perceived autonomy. Comparing the original correlations with the partial correlations for Hypothesis 9a in Table 2 suggests that perceived autonomy fully mediated the effect of telecommuting on job satisfaction. It also reveals that perceived autonomy might have partially mediated the effect of telecommuting on supervisor-rated performance, turnover intent, and role stress. There was no mediating effect, however, for self-rated performance, because its original correlation with telecommuting was zero. Perceived autonomy seemed to be one of the principal mechanisms through which telecommuting had its positive attitudinal and behavioral effects.

We predicted that work–family conflict would mediate telecommuting's effects on individual outcomes in Hypothesis 9b. The comparison of original correlations with partial correlations (see Table 2) for Hypothesis 9b suggests that work–family conflict partially mediated the impacts of telecommuting on job satisfaction, turnover intent, and role stress. This partial mediating effect of work–family conflict was modest. Work–family conflict did not appear to intervene between telecommuting and any measure of (self-rated or supervisor or objective rated) performance.

Hypotheses 9c and 9d proposed that relationship quality—with supervisors and coworkers, respectively—would also mediate the effect of telecommuting on individual outcomes. The partial correlations for supervisor relationship quality (Hypothesis 9c) suggest partial mediation for job satisfaction and turnover intent when compared with the relevant original correlations. Supervisor relationship quality did not appear to mediate telecommuting's effects on the other individual outcomes. The lack of connection between telecommuting and coworker relationship quality meant that no mediating effect was possible. Thus, we did not find evidence to support Hypothesis 9d, and the overall pattern of mediating effects was weak for the proposed mechanism of relationship damage.

Moderating Effects of Telecommuting Intensity: Hypotheses 10–12

Our last hypotheses about the consequences of telecommuting focused on moderating mechanisms. Does the majority of work time spent in this distributed work arrangement—high (home centered) versus low (office centered) telecommuting intensity—accentuate the strength of the relationship between telecommuting and its proximal outcomes? That is, does telecommuting intensity accentuate the good of greater perceived autonomy (Hypothesis 10) and lesser work–family conflict (Hypothesis 11), as well as the bad of poorer relationship quality with supervisors (Hypothesis 12a) and coworkers (Hypothesis 12b)? We followed procedures for categorical moderator tests outlined in Hedges and Olkin (1985) to analyze this proposed moderating effect. Table 3 presents evidence for Hypotheses 10–12. The presence of a moderating effect was supported by a significant Q_b statistic (Hedges & Olkin, 1985). Because several of the original studies did not contain enough information to make moderator codes, k s for the subgroups in Table 2 do not sum to the overall k s in Table 1 for all studies taken together.

Hypothesis 10 was not supported. Intensity did not moderate the effects of telecommuting on perceived autonomy, $\chi^2(1) = 0.01$, ns ($r = .16$: high-intensity condition; $r = .15$: low-intensity condition). We found evidence, favoring Hypothesis 11, for the moderating effect of intensity on telecommuting's relationship with work–family conflict, $\chi^2(1) = 20.16$, $p < .01$. Telecommuting had a negative effect on work–family conflict for high-intensity arrangements ($r = -.16$, 95% CI = $-.18$ to $-.13$), but not for low-intensity arrangements ($r = -.05$, 95% CI = $-.10$ to $.00$).

Hypotheses 12a–12b proposed that intensity would exacerbate harmful effects of telecommuting on workplace relationship quality. Specifically, Hypothesis 12a proposed that intensity would amplify the negative impact of telecommuting on the quality of employees' relationship with their supervisors. The data do not support this contention, $\chi^2(1) = 0.11$, ns ($r = .13$: high-intensity condition; $r = .14$: low-intensity condition) We did, however, find

Table 3
Telecommuting Intensity as a Moderator of Effects on Psychological Mediators: Hypotheses 10–12b

	<i>k</i>	<i>n</i>	Mean <i>r</i>	95% CI for <i>r</i>	Homogeneity tests	
					Q_b	Q_w
Telecommuting and perceived autonomy					0.01	
Low-intensity telecommuting	8	2,750	.15	.11, .19		34.69**
High-intensity telecommuting	4	355	.16	.05, .26		2.86
Telecommuting and work-family conflict					13.64**	
Low-intensity telecommuting	7	1,388	-.05	-.10, .00		6.30
High-intensity telecommuting	8	7,035	-.16	-.18, -.13		10.80
Telecommuting and supervisor relationship quality					0.11	
Low-intensity telecommuting	5	636	.14	.07, .22		2.96
High-intensity telecommuting	8	1,665	.13	.08, .18		11.02
Telecommuting and coworker relationship quality					14.52**	
Low-intensity telecommuting	7	2,522	.03	-.01, .07		8.26
High-intensity telecommuting	4	353	-.19	-.30, -.08		2.87

Note. Q_b is the test of equivalent correlations between moderator conditions; Q_w is the test of homogeneous correlations within moderator conditions. CI = confidence interval.

** $p < .01$.

support for Hypothesis 12b. Intensity did amplify a negative or damaging effect of telecommuting on coworker relationship quality, $\chi^2(1) = 14.52, p < .01$. Telecommuting was unrelated to coworker relationship quality for low-intensity telecommuting ($r = .03, 95\% \text{ CI} = -.01 \text{ to } .07$) but had a negative effect for high-intensity telecommuting ($r = -.19, 95\% \text{ CI} = -.30 \text{ to } -.08$).

Other Moderators

We now turn to other potential moderators that are more exploratory but potentially important or practical. We used the percentage of women in the original samples as a study-level proxy for gender. Because this was a continuous moderator, we used the weighted regression moderator test, as described by Hedges and Olkin (1985). We found telecommuting's relationship with supervisor-rated performance was stronger and more positive for samples with a higher percentage of women ($Q_{\text{regression}} = 7.71, p < .01; B = 0.69, p < .01; \beta = .91$). Similarly, the telecommuting-perceived career prospects relationship was more strongly positive for samples with a higher percentage of women ($Q_{\text{regression}} = 5.68, p < .05; B = 0.42, p < .05; \beta = .42$). However, gender did not contribute to systematic variation in the effect sizes for any other mediators or outcomes.

We also found evidence for a moderating effect for experience with this distributed work arrangement for telecommuting's relationship with work-family conflict, $\chi^2(1) = 6.88, p < .01$, and role stress, $\chi^2(1) = 4.12, p < .05$. Greater experience meant a more beneficial impact on work-family conflict ($r = -.22, 95\% \text{ CI} = -.17 \text{ to } -.27$) relative to those with less than a year's experience ($r = -.12, 95\% \text{ CI} = -.21 \text{ to } -.03$). In the same way, those with greater than a year's experience with the arrangement experienced lower role stress ($r = -.22, 95\% \text{ CI} = -.28 \text{ to } -.17$) compared to those with less than a year's experience ($r = -.13, 95\% \text{ CI} = -.20 \text{ to } -.06$). Experience, however, did not moderate telecommuting's relationship with the other outcomes.

Discussion

Reducing the Unknown About Telecommuting: The Good and the Bad

Main effects. We set out to answer three fundamental questions in this investigation. First, is telecommuting effective? What are its predictable positive (and negative) consequences? In answering that question and the others below, we constructed a framework that predicted that telecommuting would have initial effects on three proximal outcomes or mediating mechanisms (perceived autonomy, work-family conflict, and workplace relationship quality) as well as several more distal outcomes (job satisfaction, turnover intention, performance, role stress, and perceived career prospects). Our meta-analytic findings indicate that telecommuting is mainly a good thing. In terms of the psychological mediators, it is associated with increased perceptions of autonomy and lower work-family conflict. Being a telecommuter does not appear to damage one's social ties with others at work, at least in a direct way—we did not observe the bad relational outcomes that are expected in this domain and that we hypothesized. In fact, contrary to our expectations, we found that telecommuting was positively associated with the quality of employee-

supervisor relationship (see the discussion below). Altogether, these findings provide evidence that the telecommuting paradox implied by the confluence of the three main conceptual themes in the literature did not materialize.

Consistent with its effects on the psychological mediators, telecommuting's impact on the more distal individual outcomes also points to mainly beneficial consequences. Increased job satisfaction and lower turnover intent and role stress were associated with this type of distributed work arrangement, as were higher supervisor ratings or archival records of job performance. However, claims about improved performance under telecommuting were not borne out when such performance was self-rated. Baltes et al. (1999), in a meta-analysis of alternative work schedules, also found a similar pattern of results: Flex-time work schedules had a significant effect on objective measures of performance (productivity) but no effect on self-rated performance. This pattern of results argues against a general common-method or same-source bias in these data, which would have reflected telecommuters "voting" for their work arrangement by saying they are better performers (than their nontelecommuting counterparts). Finally, another widely touted negative consequence of telecommuting was not observed. There was no adverse effect on employees' perceived career prospects.

The juxtaposition of findings that (a) telecommuting was positively associated with supervisor or objective ratings of performance and (b) telecommuting was positively associated with supervisor relationship quality raises the possibility of reverse causality. Supervisors might be more willing to grant the possibility of telecommuting as a prerequisite to those who are already performing well or who are part of their inner circle. Another plausible explanation for this pattern of findings is that telecommuters are aware of the potential for deterioration in relationship quality, and they strategically focus on developing high-quality employee-supervisor relationships. For example, they may ensure that the supervisor is kept updated of their efforts through regular reports and phone conversations. Supervisors, too, might focus greater attention on and employ structured communication with telecommuters because they have fewer opportunities to observe those employees on a casual basis (e.g., Duxbury & Neufeld, 1999; Halford, 2005).

It is important to note that finding support for the proposed beneficial effects of telecommuting on key mediators and outcomes was not a foregone conclusion. Although there are consistent themes in the telecommuting literature that highlight the good, there have been opposing themes about the bad, as scholars debated the direction of such effects. For example, telecommuting has been hypothesized to diminish employees' perceptions of autonomy (Gurstein, 2001; Shamir & Salomon, 1985), in part because telecommuters often have to sign agreements that dictate activities and performance levels with greater specificity than for work done at a central location (Harrison, Johns, & Martocchio, 2000). Those whose telecommuting tasks are online might also have experienced decreased feelings of autonomy, because electronic monitoring of work is relatively easy but also hidden and potentially ongoing at any instant (Ambrose & Adler, 2000; Daniels, 2000). Similarly, we pointed out earlier that scholars have raised the possibility that telecommuting may increase work-family conflict by making boundaries between domains more permeable (Duxbury et al., 1998; Golden, Veiga, & Simsek, 2006;

Shamir & Salomon, 1985). Telecommuting has also been hypothesized to lower job satisfaction (DuBrin, 1991; Shamir & Salomon, 1985), because such an arrangement might carry lower levels of core dimensions of job characteristics: feedback and task significance (Hackman & Oldham, 1976).

A key contribution of our meta-analysis is that our results largely resolve these lingering debates about telecommuting's positive versus negative effects on key outcomes. The low magnitudes and concomitantly high variabilities of connections we found (β s ranged from .10 to .20) are likely culprits in fueling the prior theoretical arguments and counterarguments or, at the least, in creating a puzzling, ambiguous pattern of effects in prior research (Bailey & Kurland, 2002). With some exceptions (e.g., Hill et al., 2003), studies of telecommuting have suffered from a problem of low sample size (McCloskey & Igarria, 1998), which exacerbates the problems of detecting weak to moderate effects. A meta-analysis such as this one provides much greater power to detect an overall main effect on telecommuting's proposed consequences.

Psychological mediators. Our meta-analysis attempted to answer a second fundamental question: How do the consequences of telecommuting come about? What psychological mechanisms carry telecommuting's effects? Our framework proposed that perceived autonomy, work-family conflict, and relationship quality are the intervening mechanisms. Analysis of partial correlations between each telecommuting-outcome pair, after we controlled for the effect of each hypothesized mediator, provided tentative evidence for the operation of these intervening mechanisms. Of the three psychological mediators, perceived autonomy appeared to be the most influential and extensive conveyor of telecommuting's effects. It fully mediated positive impacts on job satisfaction and partially mediated impacts on supervisor or objective ratings of performance, turnover intent, and role stress. These results seem to favor the conceptual stream that emphasizes the pivotal role of (perceived) control in one's work arrangements (Desrosiers, 2001; Hackman & Oldham, 1976; Raghuram, Wiesenfeld, & Garud, 2003; Spector, 1986). Work-family conflict and employee-supervisor relationship quality had, at best, a modest role as mediators compared to perceived autonomy.

Structural moderator. Our third question was, when do telecommuting's consequences occur? Under what conditions does it have its strongest effects? We proposed that one such moderator, telecommuting intensity, was a structural aspect of this distributed work practice that could be thought of as primarily a home-based (high-intensity) versus office-based (low-intensity) arrangement. We found that home-centered or high-intensity telecommuting accentuated its beneficial effects on work-family conflict. Yet this same mechanism led to deterioration of coworker relationships. The more extreme loss of "face time" that comes with being a high-intensity telecommuter undermined the depth of ties with peers in the workplace. Intensity, however, did not moderate telecommuting's effects on perceived autonomy and employees' relationships with supervisors. Both high- and low-intensity telecommuters experienced similar levels of autonomy, which suggests, perhaps, that after an initial increase in perceptions of control that accrues from telecommuting for even a day or 2, there is only a marginal increment to feelings of control from a marked increase in time spent telecommuting.

Although we did not pose any specific hypotheses about the moderating effect of intensity on telecommuting's effects on indi-

vidual outcomes, a post hoc analysis provides evidence for the beneficial effect of intensity on the telecommuting-role stress relationship. High-intensity telecommuters showed an even greater reduction in role stress. We did not find evidence for the moderating role of intensity for any of the other individual outcomes. Our meta-analysis also uncovered the influence of gender and experience on telecommuting's relationship with its outcomes. Samples with greater proportions of women experienced greater benefits in the form of improved performance (supervisor or objective ratings) and improved, rather than worsened, perceived career prospects. Perhaps because women continue to have the primary responsibility in the family domain (Cinamon, 2006), they benefit more through increased control over work and family domains, relative to men. The simultaneous demands from work and family placed on them are also widely recognized (Duxbury et al., 1998), even by others in the workplace, and, therefore, women might be given greater latitude to structure their telecommuting in ways that are beneficial to them. As a result, they are less likely to perceive diminished career prospects because of telecommuting. Men, however, may see telecommuting as less normatively appropriate for them and therefore perceive more negative career consequences (McCloskey et al., 1998).

We also found that experience with telecommuting strengthened the beneficial impact of telecommuting on work-family conflict and role stress. This parallels our findings for the moderating role of intensity, suggesting that, perhaps to no one's surprise, there is a learning curve associated with adjusting to telecommuting. As employees spend greater time spent working under this arrangement and as they spend a greater proportion of their work time under this arrangement, they learn to structure tasks and routines to minimize conflicts between work and family demands and to mitigate the stresses of juggling multiple roles.

Limitations and Future Research Directions

Meta-analyses are constrained by the methodological choices of original studies from which effects are drawn, especially if those choices are widely shared or systemic (Martocchio, Harrison, & Berkson, 2000). For instance, we purposely limited our investigation to studies conducted in natural settings, believing that telecommuting's consequences need time to develop and cohere. However, almost all of those studies were nonexperimental and involved one wave of data collection (for exceptions, see Duxbury et al., 1998, and Ramsower, 1983). There were no randomized, highly controlled field experiments in any of our collected studies, and, indeed, it would be impossible to create placebo or double-blind conditions for such an elaborate work arrangement as telecommuting. Hence, causal relationships from this meta-analysis are tentative.

Yet, despite the majority of study designs being cross-sectional, the status of telecommuting as an independent variable is reasonably well established. It had existed as a work arrangement in each setting of an original study for at least several months, and sometimes several years, before measurement of individual outcomes. Also, we are not aware of theories predicting that those who experience higher autonomy and lower work-family conflict would therefore choose to spend more of their time away from what had been a central work location. Still, the lack of randomization raises the possibility of self-selection into telecommuting

arrangements—especially high-intensity ones—on the basis of previous (negative) relationships with coworkers and (positive relationships with) supervisors. Thus, there is a broad opportunity for future research to draw stronger causal inferences by true experimentation in the field, perhaps through a staggered rollout of the arrangement, with different employees randomly assigned to telecommuting at different stages (see Frayne & Latham, 1987, for a similar experimental scheme in the context of an attendance control program). Another limitation is that the consequences of telecommuting identified in our meta-analysis were at an individual level of analysis. However, our finding that deterioration in telecommuters' relationships with coworkers became detectable when a majority of time was spent away from a central location suggests team- or unit-level impacts that future research might examine.

Our meta-analysis was also limited by the sparse information in studies about potentially important moderators of the telecommuting–outcome relationship. Earlier, in our discussion of other moderators, we identified potentially important variables—especially regarding the nature of telecommuting media, tasks, and means of joining the arrangement. However, we were unable to collect original data about them. Of these other moderators, we believe that voluntariness of the telecommuting arrangement and task interdependence are especially important for future research to examine. Voluntary telecommuting supports perceived autonomy and empowers employees by giving them the choice to telecommute as well as control over the degree of desired integration between work and family domains (Ashforth et al., 2000). The absence of choice in mandatory telecommuting or “electronic homeworking” (Qvortrup, 1998) arrangements could increase stress and negative affect and even decrease job satisfaction and performance (K. W. Thomas & Velthouse, 1990).

Task interdependence reflects the communication and coordination between telecommuters and other organizational members. A high degree of reciprocal interdependence (Thompson, 1967) between telecommuters and their work group members could hamper performance and hinder collaboration, because interactions are mediated by relatively lower bandwidth channels (Bell & Kozlowski, 2002; Bordia, 1997). Over time, these difficulties could also strain the telecommuter's interpersonal connections with work group members. However, telecommuting is likely to have relatively benign outcomes when jobs involve mainly pooled or sequential interdependence (Thompson, 1967).

In addition to the two individual-level moderators we have identified, a potential team-level moderator, alluded to above but not explored in the telecommuting literature, might reflect its normative versus idiosyncratic adoption by members of the work unit and the organization as a whole (Bettenhausen & Murnighan, 1991). Because it is more likely to compel a team to forge new processes (McGrath, Arrow, Gruenfeld, Hollingshead, & O'Connor, 1993), normative telecommuting should result in development of team communication routines, schedules, and methods of completing work that maximize the potential gains in autonomy from telecommuting. Conversely, under idiosyncratic practice, telecommuters may be forced to adhere to existing work group norms that favor colocation. For example, they might be required to synchronize schedules with those working at the central location. They may have to work longer and harder to overcome inequity perceptions from peers or to justify their special

status (e.g., Florey & Harrison, 2000). Those in idiosyncratic arrangements might also feel greater psychological remoteness from coworkers because they miss formal and informal interactions among the collocated majority.

Implications for Practice

Overall, our meta-analysis points to a tempered but positive view of telecommuting's consequences. There are several benefits to this work arrangement, but their uptake is modest. These modest benefits are comparable to those from adoption of alternate work schedules (Baltes et al., 1999). Moreover, the benefits appear to come without generally severe relationship or career costs. Overall, organizations offering telecommuting as a work–family benefit may find that their employees experience mild reductions in work–family conflict. Employers can maximize these reductions by allowing employees to spend most of their time away from their central work location. Doing so would also maximize the stress-lowering benefits of telecommuting. However, if organizations allow employees to spend a majority of their time working remotely, they will likely need to intervene to manage the damaged coworker relationships that result. One such intervention might be to designate one day as collocated, scheduling face-to-face meetings, working lunches, and informal social activities with the telecommuter's work group. Another intervention might be to cast telecommuting as normative rather than exceptional or privileged.

Because our results suggest that perceived autonomy is pivotal for maximizing their beneficial outcomes, telecommuting arrangements should be designed to allow employees to experience increased control while simultaneously meeting managers' need to monitor employees' performance when they work away from a central location (Davenport & Pearlson, 1998; Kurland & Cooper, 2002). Particularly for clerical and administrative jobs, such as insurance claims processing or medical transcription, managers may resort to electronic monitoring techniques that run counter to the sense of control that might otherwise have helped telecommuting employees. Research suggests that employees dislike electronic monitoring and often perceive it as unjust, which can result in other negative consequences for organizations (Alge, 2001; Ambrose & Adler, 2000). Instead, an a priori, more trust-based strategy might be to create written telecommuting agreements that clearly lay out managerial expectations about work outcomes (Handy, 1995), but such an approach does not have to neutralize the autonomy of the telecommuter in that he or she can choose how and when performance goals will be achieved.

An emerging possibility that could adversely affect employee perceptions of autonomy concerns legislation that holds the employer responsible for employees' safety and health (e.g., Occupational Health and Safety legislation in Australia) even when they are telecommuting from their home. Such legislation could compel employers to encroach on the physical layout of work spaces at home as well as impose work schedules and processes during telecommuting, which could erode the favorable perceptions of control that are associated with such a work arrangement. This legislation could also be a barrier to implementing formal telecommuting arrangements. Therefore, we could see greater incidence of informal, voluntary, and idiosyncratic telecommuting arrangements, which may be exempt under such legislation.

Conclusion

A common refrain in reviews of telecommuting research has been the inability, over 20 years of studies, to draw consistent conclusions about even its most basic consequences (e.g., Bailey & Kurland, 2002; McCloskey & Igarria, 1998). Our results tackle some of these unknowns and suggest that telecommuting is likely more good than bad for individuals. Telecommuting has a clear upside: small but favorable effects on perceived autonomy, work-family conflict, job satisfaction, performance, turnover intent, and stress. Contrary to expectations in both academic and practitioner literatures, telecommuting also has no straightforward, damaging effects on the quality of workplace relationships or perceived career prospects. However, there is a downside of higher intensity telecommuting in that it does seem to send coworker (but not supervisor) relationships in a harmful direction. Some of the complexities of these consequences have yet to be explored, but the evidence and theory reviewed here suggest that they can be managed effectively through informed human resources policies.

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(References marked with an asterisk indicate studies included in the meta-analysis.)

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