Intertwining material and virtual work

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Abstract

Virtual work in organizations continues to be promoted despite the absence of a strong conceptual understanding of virtual work and its consequences. In this paper, we draw from Sotto (1997) and Turoff (1997), who treat virtual work as a second, electronically mediated representation of material work. The virtual and material representations co-exist and intertwine, potentially allowing teams and organizations to extend their capabilities. We identify four aspects of intertwining: reinforcement, complementarity, synergy, and reciprocity. In instances where the relationship between virtual and material worlds of work lack one or more of these aspects, ironic and confused outcomes may result. We illustrate these aspects with anecdotal images, findings from published research, and an original case study. Although our primary focus is upon virtual teams and organizations, we also speculate on the relevance of intertwining to individuals, communities and markets.

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1. Introduction: two images of contemporary work

Image 1: The human resources staff at JWC Partners, a management consulting firm, were delighted with their new recruiting intranet, which solicited electronic submissions for job openings, facilitated access to submitted documents, guided staff reviews of job applicants, and generated a variety of reports that ranked job applicants for various skill positions. In the past, recruiting and interviewing had been a messy, paper-based process in which applications for positions were stored along with evaluative comments in manila folders. Whereas before it was hard for everyone

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involved in hiring decisions to lay their hands on a folder when they wanted it, the recruiting intranet delivered all applicant information to the desktop.

Each month, the partners and associates involved in recruiting met in the conference room to review the applicants for open positions. Because the conference room was not equipped with computers, the recruiting staff typically printed out the resumes and other material from the intranet in their offices. They clipped and stacked these materials, or placed them into manila folders, and walked down the hall to the conference room. During the meeting, papers moved around the room, as staff members requested copies of material they had not brought with them, such as a particular applicant’s college transcripts or letters of recommendation. Typically, the meetings lasted several hours during which the conference room table and portions of the floor were covered with paper documents bearing written comments scrawled on them during discussion.

Image 2: The card that arrived in the postal mail invited JWC consultants to visit the website of a commercial software vendor and download sample products that were available “now.” Excitedly, Louise typed in the URL to see what she could find. When her browser loaded the page, she started looking for samples to download. Each click and search effort resulted in failure; nowhere on the site was there anything matching the promise received through the mail.

Not wishing to give up the search, Louise sent an email to the vendor to explain that her search had been futile. Within an hour a response came from <customer service>: “We are sorry but software samples are not available for downloading.” Louise wrote back to explain that she had just received a postcard saying that software was available and that this conflicted with the information from customer service. Within 30 minutes another email arrived, this time from <Tom Stevens>, who explained that the postcard also invited recipients to stop by the vendor’s booth at the upcoming trade show to receive a demonstration of the website’s new feature. Moreover, Tom Stevens explained, the new service would not be available on the website for another three weeks.

Both of these images capture the irony of much contemporary work. As work has become increasingly mediated by information and communication technologies, workers often find themselves in a bind, not knowing when or how to coordinate their use and storage of electronic and printed documents. The images reveal ironic consequences that correspond to two levels of social analysis: the team and the organization, respectively. In the first image, recruiting teams operate virtually through an intranet, even though they are co-located on the same floor. Ironically, hiring decisions are made during a face-to-face team meeting with the electronic documents left behind on the desktops. In the second image, the software vendor has not successfully coordinated its paper-based promotional campaign with its electronically mediated services, much to the distress of the customer. The two images may seem to reflect innocuous practices with no serious consequences. However, the images can also be interpreted as symptoms of more profound problems in the design and performance of work that resides in both the material, or physical world and the nonmaterial, or virtual world. Because contemporary work increasingly
engages both worlds, work practices must address the relationship between material and virtual representations of work.

In this paper we explore the relationship between the material and virtual worlds of work. We begin by reviewing the virtues and vices of virtual work, as rendered in published professional and academic discourse. We then articulate an ontology of work as a phenomenon that simultaneously exists in both material and virtual “layers.” We adopt this ontological position because it draws attention to the relationships between virtual and material representations of work instead of focusing on one or the other independently. We then employ the metaphor of intertwining to articulate four aspects of the relationship between virtual and material work. Intertwining is defined to include reinforcement, complementarity, synergy, and reciprocity. We then examine three empirical studies of virtual teams and one study of a virtual organization for evidence to support our conceptions and claims. We conclude with speculations on a new perspective of work that is simultaneously mediated by information technology and materially present. Such a perspective may extend beyond the work of teams and organizations to include the work of individuals, communities and markets.

2. The virtues and vices of virtual work

For at least a decade, the professional and academic discourse on virtual work arrangements has been both optimistic and critical (Schultze & Orlikowski, 2001). Most accounts directed at practicing managers portray information technologies as the key enablers of forms of work that are more temporally and spatially dispersed and that draw upon temporary alliances and partnerships with other organizations (Boudreau, Loch, Robey & Straub, 1998; Cascio, 2000; Townsend, DeMarie, & Henrickson, 1998). Such dispersed work environments are commonly referred to as virtual teams or virtual organizations (Alexander, 1997; Benjamin & Wigand, 1995; Mowshowitz, 2002; Schultze & Orlikowski, 2001). For example, Robey, Boudreau and Storey (1998) defined the virtual organization as “a temporary, flexible arrangement of dispersed components, contributed by multiple organizations and linked together with information technologies” (p. 275). Specific virtual work arrangements include telecommuting, mobile or remote workers, “hoteling,” and globalization (Apgar, 1998; Davenport & Pearson, 1998).

The virtues attributed to such virtual work practices are many. By eliminating office space and reducing other overhead expenses, companies are able to save real estate costs. McCune (1998), for example, estimated the savings from remote work to be twice the amount invested. In addition to saving costs, employees often enjoy the greater autonomy that virtual offices provide (Davenport & Pearson, 1998). Because virtual work is typically more attractive to highly motivated, talented employees, companies that use virtual workplaces can attract and retain the best human resources in the marketplace (Apgar, 1998). By spending less time with coworkers, employees may spend more time face-to-face with clients, thereby improving customer service (Cascio, 2000). Environmental benefits exist as well. Some
companies use remote work to meet US Clean Air Act requirements, thereby avoiding government fines. A US government study estimated savings of 102,000 gallons of gasoline and 82,000 pounds of carbon dioxide emissions per week if 20,000 federal workers worked from home just one day per week (Cascio, 2000).

Although virtual work is associated with these and other virtues, vices are also frequently discussed. Although virtual work is sometimes motivated by cost-savings, the total costs of setting up and maintaining remote work sites can exceed those of more traditional forms of work. Moreover, cost efficiencies associated with sharing centrally located resources are lost when resources are dispersed. Skepticism about economic benefits is complemented by concern about the effects of social isolation. Due to the lack of social interaction, verbal and non-verbal cues typical of face-to-face communication may be missing. Employees involved in virtual work can feel isolated, and some may be cut off from important communication channels and decision-makers, which may impact their careers negatively (Cascio, 2000). Virtual work is also associated with exploitation of workers who, no longer bound by spatial and temporal boundaries, are prone to working excessive hours. Prolonged interaction with information technologies has also been associated with a variety of physical problems, including eyestrain, carpal tunnel syndrome, and back aches.

Clearly, virtual work arrangements are challenging, so their proponents have offered prescriptions for making them more effective. For example, Apgar (1998) advised that workers be trained in methods for performing remote work and managers be trained in monitoring remote workers. Davenport and Pearlson (1998) encouraged using information technology in creative ways to establish alternative work arrangements as well as developing new approaches to evaluating, training and communicating with workers. Cascio (2000) advised managers to shift from focusing on time to focusing on results, and to maintain clear lines of authority and responsibility while providing workers with greater autonomy than in traditional organizations.

Unfortunately, the prescriptions derived from the practitioner literature on virtual work are largely self-evident and lacking in insight. As virtual work arrangements gain in popularity and significance, there is ample justification for more careful theoretical and empirical examinations. In the following section, we propose a conception of virtual work that differs from customary treatments and that leads to alternative prescriptions for extending the capabilities of teams and organizations.

3. A dual ontology of work

Ontology is a branch of metaphysics that deals with the nature of reality (Schwandt, 1997). In the social sciences, ontology has most recently been used to describe the assumptions that scientists make about phenomena they study. Ontological positions, therefore, are not considered to be assertions about the true nature of reality but rather operating assumptions designed to guide empirical research efforts. As posed by Mason (1996, p. 11), the researcher should ask: “What is the nature of the phenomena, or entities, or social ‘reality’, which I wish to investigate?”
Ontology is closely related to epistemology, which deals with assumptions about how knowledge is generated. While ontological assumptions reflect the researcher’s assumptions about the phenomenon being studied, epistemological assumptions reflect the researcher’s judgments about what “counts as evidence” of that reality (Mason, 1996). By clarifying ontological and epistemological assumptions, researchers orient both themselves and the research community to an investigation.

Ontology and epistemology were brought into organization science by Burrell and Morgan (1979), who devised a scheme for classifying organizational analysis. On the one hand, assumptions that social reality was integrated and orderly were associated with a conservative, functionalist sociology. On the other hand, assumptions of disorder and conflict supported a radical, humanistic sociology. Such distinctions prove useful when seeking to broaden conventional views of complex phenomena. For example, Hirschheim adopted Burrell and Morgan’s approach in his critical analysis of office automation (Hirschheim, 1985) and IS development paradigms (Hirschheim & Klein, 1989). More recently, Schultz and Leidner, (2002) examined the philosophical differences in conceptions of “knowledge” to critique the growing literature on knowledge management. Considerations of ontology and epistemology have helped to distinguish between positivist and interpretive research paradigms in both organization science and information systems (Orlikowski & Baroudi, 1991).

Unfortunately, the joint association of ontology and epistemology with research paradigms has shifted attention away from an independent focus on ontological assumptions. Beyond basic questions about social reality being objective or socially constructed, or whether social reality is orderly or disorderly, little attention has been paid to ontological assumptions in information systems. Even critics of Burrell and Morgan’s typology (e.g., Deetz, 1996) have offered only minor variations on the basic typology rather than distinctively new ways of conceiving social reality.1

Consequently, researchers investigating virtual work empirically have adopted conservative assumptions in which virtual arrangements are treated as extensions of dimensions that have always described work and organizations (Robey et al., 1998). According to these treatments, the distinguishing characteristic of virtual work is its more spatial and temporal distribution. Defining virtual work in this manner calls for no radical revisions to traditional theories of work because space and time have always separated members of teams to some degree. Indeed, it would be peculiar to find co-located teams working in constant face-to-face interaction. In conventional work settings, team members usually work in private offices or cubicles for much of their time and regularly interact via electronic and telephonic media in addition to meeting face-to-face. Extending the distances between team members from several meters to thousands of kilometers creates new demands, but the basic nature of work remains the same.

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1 An exception to this criticism is Latour’s (1996) “variable ontology” for technologies that could be switched on and off. In effect, such technologies would exist if switched on and not exist if switched off.
4. Virtual and material layers of work

The notion that virtual and material layers of an organization exist and are interrelated is attributed to Sotto (1997). Sotto drew from a definition of virtuality that originated in science fiction (Gibson, 1984) and is reflected most commonly in the popular notions of “cyberspace” and “virtual reality.” Benedikt (1992) explained the nature of virtual reality and cyberspace as follows:

Cyberspace is a globally networked, computer sustained, computer accessed, and computer generated, multidimensional, artificial and “virtual” reality. In this reality, to which every computer is a window, seen or heard objects are neither physical nor, necessarily, representations of physical objects but are, rather, in form, character and action, made up of data, or pure information (p. 51).

Benedikt offered examples of virtual n-dimensional “spaces” that can exist only in mathematical coordinate systems and be described only with equations. He concluded that “…space itself is something not necessarily physical: rather that it is a ‘field of play’ for all information, only one of whose manifestations is the gravitational and electromagnetic field of play that we live in and that we call the real world” (Benedikt, 1992, p. 20).

According to this conception, virtual reality is not defined as an extension of material reality on a continuum of time and physical space. Rather, virtual reality is defined as a separate, artificial representation of reality, which exists independent of material reality. Although virtual reality may represent physical or social objects, for example as mathematical symbols, virtual representations do not need to be faithful to the physical shape or geographic location of material objects. The virtual world is not an electronic copy or analogue of the material world. Rather, the virtual world offers the potential to represent, manipulate, reconstruct, and “re-present” elements of reality in ways that are unbound by physical constraints (Sotto, 1997; Turoff, 1997).

According to Laurel (1991):

The adjective virtual describes things—worlds, phenomena, etc.—that look and feel like reality but that lack the traditional physical substance. A virtual object, for instance, may be one that has no real world equivalent, but the persuasiveness of its representation allows us to respond to it as if it were real” (p. 8, emphasis in the original).

Laurel used theater as a metaphor to theorize about the design of human–computer interfaces. In theater, the relationship between virtual and material is essential for meaningful artistic expression because virtual representations must be relevant to material existence to be meaningful. However, successful theater never simply duplicates material reality. Likewise, a worker’s participation in a computer-mediated representation of business transactions is not the same as participation in the material world of business, but it does have material consequences. In this sense, virtual and material presentations stand in particular and necessary relation to one another. Thus,
“Designing human-computer experience isn’t about building a better desktop. It’s about creating imaginary worlds that have a special relationship to reality—worlds in which we can extend, amplify, and enrich our own capacities to think, feel, and act” (Laurel, 1991, pp. 32-33).

Fig. 1 conveys the idea that material and virtual reality exist as separate, yet related planes of reality. Although concepts from the material plane may map onto concepts in the virtual plane, virtual settings are not merely copies of a real world embedded in software or other symbolic forms. Rather, virtual work is a separate yet parallel “re-presentation” of the material world (Sotto, 1997). Although virtual reality depends upon material substances, its physical properties have no material bearing on the meaning or significance of virtual reality. Rather, virtual reality depends upon human perception and engagement to become real.

The dual ontology reflects our assumptions about the nature of contemporary work. It is, of course, possible to make alternative ontological assumptions about virtual work. On the one hand, we can assume that all phenomena have material substance, including electronically mediated communications. The material substance consists of lights on a computer screen, the electromagnetic charges in computer memory, the electrical charges that power electronic devices, and so on. Thus, arguments about virtual work having a relationship to material work can be rendered meaningless if we assume that all work is material at an elementary level. On the other hand, we
can assume that all work is virtual because the whole concept of work is socially defined. Work has no physical or material characteristics because it is an abstraction, like the concepts of organization or governance.

Although such assumptions can and have been made by others, we propose a more complex, dual ontology of virtual work because it draws attention to neglected issues in the design, performance and outcomes of work. Our motivation is not to violate the principle of parsimony by offering a more complicated view of work for its own sake. Rather, our objective is to understand problems such as those described in the two images that introduce this article. The dual ontology of work described above draws attention to the relationship between the two representations and the need for virtual and material work to be effectively intertwined.

5. Intertwining: four aspects

The metaphor, intertwine, is chosen to describe the relationship between virtual and material worlds of work for two reasons. First, intertwining literally refers to the weaving, braiding, and entangling of filaments such as silk, wool or hair. Such intertwining of distinct elements augments the performance of individual elements by creating, for example, greater strength and beauty. Analogously, we argue that work capabilities can be enhanced by intertwining material and virtual representations of work. Second, intertwining figuratively means “mutually involved.” In this sense, the intertwining of material and virtual representations of work not only suggests that separate elements are engaged, but also that each element’s contribution depends on its reciprocal involvement with the other element.

Four aspects of intertwining are considered: reinforcement, complementarity, synergy, and reciprocity. For each aspect, we first refer to the literal meaning as captured in the basic metaphor. We then show how the metaphorical meaning is transferred into work settings. This discussion is summarized in Table 1.

5.1. Reinforcement

Reinforcement strengthens a relationship by adding an element that amplifies the effect of another element. In the case of intertwined filaments, reinforcement simply refers to the fact that more filaments are stronger than fewer. In the case of material and virtual work, reinforcement suggests that multiple, redundant elements have an additive effect on work performance. Redundancy is a fundamental principle of systems design, particularly in the area of information security. In the security context, backed up files make it possible to survive security breaches and other accidents. However, backups should not be restricted to files saved on different servers. Recoveries from military attacks and natural catastrophes remind us that it is not sufficient to back up electronic files on separate servers, but also locate backup facilities in a distant physical location that is not likely to be affected by the disaster. Redundancy also adds strength to marketing strategy. For example, the combination of direct mail and electronic mail advertising is often an effective promotional strat-
Table 1
Four aspects of intertwining

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Reinforcement</th>
<th>Complementarity</th>
<th>Synergy</th>
<th>Reciprocity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>Each element amplifies the effect of the other element.</td>
<td>Each element offers unique characteristics. When combined with the other, the two compensate for each other’s weaknesses.</td>
<td>One element interacts with the other to produce effects that exceed the effects from the individual elements.</td>
<td>Elements are mutually interdependent, each depending on the other.</td>
</tr>
<tr>
<td>Literal examples of intertwined filaments</td>
<td>More filaments are stronger than fewer.</td>
<td>One filament may provide flexibility while the other provides strength.</td>
<td>The intertwining of copper and aluminum alloys into electronic cables that produce high bandwidth, low interference and superior sound.</td>
<td>Filaments are mutually dependent.</td>
</tr>
<tr>
<td>Extension of metaphor to material and virtual work</td>
<td>Redundant elements have an additive effect on work performance.</td>
<td>Material and virtual work elements are combined to allow one’s strength to complement the other’s weakness. Example: team meetings conducted in both virtual and material space.</td>
<td>Material and virtual work representations allow for radical changes in the way work is done. Example: information technologies that enable the continuous replenishment of a company’s inventory.</td>
<td>Neither the material nor the virtual representation of work is dominant.</td>
</tr>
<tr>
<td>Example: Backup computer files at remote physical locations provide protection against security breaches and physical disasters.</td>
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gency because it introduces repetition through multiple channels, thus reinforcing the message. However, as image 2 in the introduction suggests, reinforcing relationships require conscious coordination between the two channels, that is, more careful intertwining.

5.2. Complementarity

The second aspect of intertwining is the complementary relationship between components. In a complementary relationship, two elements offer different characteristics. Thus, in a filament, one element may provide flexibility while another may provide strength. Woven together, the two elements compensate for each other’s weaknesses and produce a product with the strengths of both. In the case of material and virtual work, complementarity suggests that material and virtual representations
be used together in ways that allow one’s strengths to compensate for the other’s weaknesses. For example, image 1 in the introduction shows a team operating both virtually and in face-to-face meetings. The strengths of the virtual representation include the systematic organization of materials and the capturing of members’ contributions to the task. The strengths of the material representation include the ability to discuss key issues face-to-face. Although the image also reveals the irony of abandoning the virtual representation’s strengths during face-to-face meetings, it does show the complementary relationship between the virtual and material. A more successfully intertwined practice would use the two representations simultaneously so that the complementary relationship would not be restricted to specific times and places.

5.3. Synergy

The third aspect of intertwining is synergy, which involves the combination of elements to create new properties that did not exist before. In contrast to the additive relationships of reinforcement and the compensatory relationship of complementarity, synergistic relationships are catalytic in the sense that one element reacts with another to produce performance effects that surpass the effects from the individual elements. Among the filaments that produce synergistic effects are electronic cables for conducting signals between the components of a high fidelity music system. Such cables wind proprietary copper or aluminum alloys with other elements into coated strands that offer high bandwidth, low interference conduction and clear sound. Such alchemy is difficult to explain, but the effects are audible. In the case of material and virtual work, synergy is apparent when material and virtual representations allow for radical changes in business processes. Although much maligned for its simplistic assumptions about social systems, business process reengineering sought to produce synergies in work processes by managing information in the virtual realm that enabled streamlined flows of material goods. Contemporary applications of supply chain management, for example, use information technologies to make feasible applications such as continuous replenishment, which drastically streamline the physical distribution of inventory.

5.4. Reciprocity

Finally, reciprocity suggests that intertwined relationships are mutually interdependent, that is, each element depends upon the other. Intertwined filaments in the examples given above all work together—reinforcing, complementing or serving as catalysts for each other. In an intertwined work relationship, reciprocity implies no lead or dominant element but rather an equal partnership between material and virtual representations.
6. Relationships between material and virtual work in teams

In a virtual team, two or more workers typically coordinate their work practices across space and time using electronic media, interacting only rarely in material workplaces. The team may negotiate not only the configuration of various media used in communication, but also the nature, frequency and intensity of communications among members on each available medium. When successful, virtual teams extend their capabilities by intertwining electronically mediated communication with material encounters. Three case studies illustrate the various aspects of intertwining in virtual teams.

Majchrzak and her colleagues (2000) studied an inter-organizational design team established to produce an innovative product design. Comprised of eight members from three different organizations, the team’s initial decision on process was to use their dedicated Notebook technology for all team communication. The authors explained:

“This only presented a problem for two of the members, who tended to see each other in the lunch room, but the other team members felt so strongly that they needed to be involved in all conversations that they persuaded the two members to agree to holding only public discussions, made accessible via the Notebook (Majchrzak, Rice, Malhotra, King & Ba, 2000, p. 582).

Three weeks into the project, however, news of a private conversation became known. After much electronic debate about this transgression, “the team finally decided to sanction face-to-face meetings as long as the results of the meeting were documented later on” (Majchrzak et al., 2000, p. 589). After 40 weeks of the project’s life, the team had again relaxed the ban on non-electronic communication to include synchronized telephone conferences in which members maintained voice communication in addition to being linked through the Notebook technology. The reason for this adaptation was to improve knowledge capture because the Notebook feature designed to capture the assumptions underlying comments was rarely used. By discussing assumptions orally, better understanding could be achieved, and 89 telephone conferences were held. The authors explained the adaptation by considering the failed attempt to capture information to be a “discrepant event,” in this case “the lack of good solutions to difficult collaboration problems” (p. 593). They suggested that collaborative technologies be designed “with an expectation that they will be coupled with informal and oral forms of communication that are not necessarily face-to-face” (Majchrzak et al., 2000, p. 596).

Our interpretation of this case is that it is consistent with the notion of work being performed at two, interdependent levels of reality. Initially, the team tried to restrict its work to the virtual, electronically-mediated level, but it later discovered a more effective, reciprocal relationship. Rather than abandoning the technology in favor of face-to-face meetings, the team devised practices that took advantage of the relative strengths of the virtual and material representations of their work. The description of the synchronized telephone conferences suggests that the group was consciously
seeking a more material medium that compensated for the limitations of the purely virtual medium. In the authors’ assessment, the team was highly effective because it was able to adapt its practices to emerging demands and produced an innovative and superior product design. Our interpretation is that the adaptation introduced greater reciprocity and complementarity between the virtual and material layers of the team’s work.

Maznevski and Chudoba’s (2000) study of global virtual teams offers a supporting example of the value of face-to-face interaction in virtual teamwork. Comparisons across three teams, involving members from several different organizations, revealed consistent patterns of interaction among members. Although most of the teams’ work was conducted via electronic media, periodic team meetings were scheduled when key directions needed to be assessed. Face-to-face team meetings introduced a “deep rhythm” to the work of the team, punctuating longer periods of time where interactions were mediated electronically.

These meetings were extremely intense, with an agenda full of complex demonstrations, resolution of previous ambiguities, idea generation, comprehensive decision making, commitment generation, and relationship building. Interaction between coordination meetings was mainly in response to the previous meeting or in anticipation of the next one. The coordination meetings served as a heartbeat, rhythmically pumping new life into the team’s processes before members circulated to different parts of the world and task, returning again at a predictable pace. These beats were spaced closer together in time if the task required greater interdependence and group members did not work together as easily, and further apart with less required interdependence and stronger group relationships (Maznevski & Chudoba, 2000, p. 486).

Thus, the material presence of team members in face-to-face meetings compensated for the limitations of the virtual communication, therefore allowing the team to resume their productive periods of remote work. This study also suggests relative dominance of the virtual representation over the physical, insofar as the face-to-face meetings were arranged when breakdowns in virtual communication appeared. The relationship between material and virtual, therefore, was not completely reciprocal.

A third study of virtual teams in a single company (Robey, Khoo, & Powers, 2000) also suggests the value of face-to-face meetings in enhancing the ability of team members to work across spatial and cultural divides. Although separated by hundreds of miles and divided by regional cultural differences, workers in the teams effectively engaged in almost continuous contact with their counterparts in other locations. The authors concluded that the opportunity for face-to-face communication was a key factor contributing to team success. Team members attended several days of quarterly meetings, which permitted them to know each other socially and to work out logistical details of their virtual interaction. In addition, team members occasionally traveled between work sites to spend several consecutive days working with their counterparts face-to-face. Remote and face-to-face communications thus intertwined in ways that satisfied team members’ social and task needs. “The closer
interpersonal relationships helped them to devise mutually compatible procedures for using remote communication technologies to accomplish their shared work so that customers were satisfied and performance goals were met” (Robey et al., 2000, p. 10). The effects of combining remote and face-to-face communications were also synergistic. Physical meetings were not simply used to reinforce or compensate for the limitations of remote communication, although they were useful in those regards. More importantly, the physical meetings imbued the relationship between workers in the two locations with stronger social bonds, which in turn fueled mutual commitment in solving team problems.

In each of these studies, team members overcame the limitations of working within a strictly technology-mediated, virtual representation of their work. They adapted, learned, and appropriated the tools at their disposal to make their virtual and material worlds more effectively intertwined. They introduced voice and face-to-face modes of communication in temporally appropriate fashion, abandoning neither the practice of co-location or remote work. Rather, they leveraged their oral and visual encounters to make their virtual encounters more effective.

7. Relationships between material and virtual work in organizations

Unfortunately, there are few empirical accounts of virtual organizations that contain details comparable to the studies of virtual teams reviewed above. A participant observation study conducted by the authors, however, sought to identify the ways that an organization (here called E-Talk) that offered a free Internet voicemail service was able to intertwine its virtual and material layers (Jin, 2002; Jin & Robey, 2002). Instead of describing the relationships among individual members in a team context, we examine the company’s product strategy and human resource policies.

The strongest evidence of intertwining virtual with material work is E-Talk’s product strategy. Like many Internet startups, E-Talk made substantial investments in its virtual layer. Its founders were essentially software engineers who spent countless hours writing complex programs to enable an Internet voicemail service. However, it also carefully constituted its material layer and devised effective means for intertwining physical infrastructures with its virtual service. E-Talk established alliances with traditional telephone operating companies to gain access to the physical networks needed to provide a key service to its customers, home answering. The company saw this as its core competence, which differentiated E-Talk from other, pure Internet players. As explained by one of E-Talk’s executives:

How does [E-Talk] distinguish itself from OneBox, from BuzzMe, you know, other players? Really, the only distinction was home answering. …They were just trying to go to the virtual voicemail, meaning we don’t answer your phone [but] give you a 1-800 number…So it’s like a mailbox set up somewhere. It’s like an email… How are we are going to be different? We have this home answering thing. So let’s push that. So we kind of like pushed aside the virtual side, to concentrate on home answering.
Home answering allowed E-Talk to set up a high entry barrier for competitors and to provide their own customers with a “sticky service,” which to them meant that “customers always come back.” Unlike the strategy employed by free Internet service providers, who attract many new customers but only retain 25% of them, E-Talk’s customer retention rate was 82%.

When we answer your phone, it’s very very personal. Which means that, if you have the E-Talk button on, on your site, you associated your site with E-Talk. Since people will always use E-Talk, they will always stay with your system.

E-Talk’s product strategy illustrates how the virtual and material layers of an organization reinforced each other. E-Talk avoided complete dependence on Internet-enabled (virtual) services and strengthened their product by allowing access to physical telephone infrastructures in which customers were already invested.

The second evidence for intertwining was E-Talk’s approach to human resources. Initially, E-Talk began like many Internet startups with a small staff in cramped quarters and a focus upon building the virtual networks of their e-service infrastructure. As one manager described it:

At one point, we had 50 people working for [E-Talk] in a space that is supposed to hold maybe 12. So we had people lined up on tables. We had six people in an office that was intended for one, we had cubicles with more than one person sitting in them…We were crammed into this little tiny space.

Very quickly, however, E-Talk realized the importance of human resources. They recruited people from regional Bell operating companies (RBOCs) who brought both valuable telephony experience and contacts within the industry. The value of these hires was evident in E-Talk’s ventures to establish alliances with regional phone companies:

All these people came from Pacific Bell, and did this before, and we know the people in these companies, and … we know the regulatory rules. … One of the RBOCs told me that they had a whole bunch of people asking for the same kind of things that we’re asking for, but we are the only one that got it. And I said why is that? And he said because the rest of them we went “boo” to, and they ran away. Well, you guys, when we boo, you didn’t run.

Well, I didn’t run, because when they went boo, I asked what is that? It was not scary to me, because I knew they were wrong, I knew they were bluffing… I knew the laws behind it, I knew what button to push, I knew what phrases to quote, I knew what people to call. And if you know this kind of thing, you can kind of get through it all. So having telephony experience, having worked in telephone companies, is extremely valuable.

Thus, human resources were key to managing the interdependencies between E-
Talk’s virtual service and the telephone companies upon which it depended. The telephony hires, in effect, compensated for the limitations of E-Talk’s founders, who were primarily focused on designing software to run on the Internet. While the founding engineers designed the virtual voicemail service capabilities, the telephony hires forged links to the physical world of telephone switches and the installed base of home telephones. Clearly, E-Talk’s human resource and product strategies were complementary. Without knowledgeable employees with connections in the telephone industry, E-Talk’s access to the physical infrastructure would have been too limited to create its product strategy.

We return to E-talk’s product strategy to illustrate synergy between the company’s virtual and material representations. Because E-Talk’s voicemail services implicated both material and virtual layers, they allowed E-Talk to provide a range of services unknown to traditional telephone companies: Internet call waiting, multiple phone voicemail, and group messaging. Internet call waiting notified E-Talk’s customers of incoming voicemail through a browser-based, pop-up message while they were connected to the Internet. This was a popular feature among heavy Internet users. Multiple phone voicemail enabled customers to associate their home, office, and cell phone numbers with one central voicemail box.

The best example of synergy, however, was group messaging. By setting up a voicemail account and mailbox for a group of people, messages intended for group distribution could be left in the mailbox by any of the group members. Replies to messages could also be left as voicemail in the same mailbox. By sharing an account and password, group members created a free chat room feature that served group interests. Many different kinds of groups took advantage of this synergy.

There are a lot of different types of groups out there. We’ve got like cookbook chat groups, religious chat groups, chat groups for blind people, chat groups for gay people, chat groups for animal lovers, chat groups for people in certain regions, like they’d pick an area code, it would be something like 408 chat group.

Among these user communities, blind people were among the most active users of group messaging. Because the oral communication medium freed blind users from the need to read messages, they could keep contact with each other more easily. A story at E-Talk involved the romantic relationship between two blind users:

Actually, there were two blind people who met by this chat community. They use this one mailbox as a way to chat, and met on that platform and they actually got engaged. They sent a voicemail to our Customer Service saying how great the service is and repeated the story essentially of how they met and told us that they were going to get married.

As these examples illustrate, relationships between virtual and material representations of organizations can be characterized as reciprocal, reinforcing, complementary, and synergistic. Although E-Talk eventually failed to sustain its business model (Jin & Robey, 2002), its initial success against a host of “pure players,” who offered
only Internet voicemail services but not home answering, group voicemail, or other features, can be attributed to its ability to intertwine its virtual and material layers of operation.

8. Extensions and conclusions

Although we acknowledge the contribution of virtual work arrangements to the performance of teams and organizations, virtual arrangements do not augment the performance of all work. To the contrary, disconnections between virtual and material work arrangements can confuse and impede effective performance. We have argued that intertwining virtual and material representations of work offers significant advantages. Intertwined relationships between virtual and material do not occur where the virtual is designed as an electronic analogue of the material. One-to-one correspondence between elements of each layer potentially ignores the distinctive qualities of each and their interrelationships. Intertwining virtual and material work requires conscious appropriation of virtual and material representations for distinct purposes.

More specifically, intertwining involves four aspects of the relationship between virtual and material representations of work: reinforcement, complementarity, synergy, and reciprocity. Using virtual and material representations to reinforce and complement each other are perhaps the most obvious aspects of the relationship. A synergistic relationship strives for new capabilities arising out of the interaction between virtual and material work. Finally, reciprocity is the principle that virtual and material representations operate as equal partners, each serving the other, rather than one dominating the relationship. These aspects have been illustrated with empirical examples from the literature on virtual teams and organizations.

Drawing attention to the intertwining of virtual and material work implies a closer connection between the design of virtual and material work arrangements. Although it is traditional practice for the tools enabling virtual work to be designed and implemented by information technology professionals, designing virtual workspaces needs to be coordinated with professional and business needs. As web authoring tools continue to become more user friendly, business users should be able to play a more active role in designing virtual representations of team and organizational work. Because users are more familiar with business needs and the requirements of material work, they should be better prepared to design both material and virtual representations that intertwine effectively. By the same token, information technology professionals need to complement their technical training with business knowledge. Perhaps soon the distinction between work design and systems design will no longer be meaningful because material and virtual representations will be created via the same processes and by the same people.

Although our analysis has focused on work by teams and organizations, our arguments could also include work performed by individuals, communities and markets. Individual work comprises both virtual and material representations because of the ubiquitous presence of personal computers and other devices with Internet access.
Much work can simply be transferred from the material world to the virtual using information technology, increasing its accessibility. Although individual work is unquestionably aided by virtual representations, effective intertwining requires reflection on the relationship between material and virtual work. Electronic mail, for example, may become such an important medium of communication that individuals neglect other media such as postal mail or face-to-face meetings. An individual worker may allow the email in-basket to dictate the scheduling of the entire day. A routine of “beginning with email” may remove time required for more meaningful work, especially if the in-basket is compulsively monitored throughout the day (and evening). Responding to email is important because urgent situations need to be addressed immediately, but other work may be performed in a more fragmented, unfocused manner as a result. The effective extension of individual work capabilities requires the virtual and material resources to be intertwined.

Electronic communities also represent a relatively neglected social unit of analysis, yet their influence is likely to grow as more participants get connected to mediating technologies. In addition to communities of local residents, professional communities offer an interesting look at work that spans particular organizations and geographic boundaries. Indeed, the early uses of ARPANET, which eventually became the Internet, were to allow scholars at multiple universities and institutes to share data and information. Contemporary listservs provide professional associations of many kinds with the ability to exchange information and conduct matters of community interest electronically (e.g., McClure Wasko & Faraj, 2000). However, it is also readily apparent that virtual community interaction has not replaced material conferences. One may question the economic cost of sharing research findings through traditional convention venues, which require participants to travel. However, face-to-face meetings may complement and reinforce subsequent electronic communications, for example, by building the trust that is prerequisite to the functioning of electronic communities. Thus, communities may intertwine their virtual and material activities in a manner similar to the virtual teams reviewed earlier in this paper.

Finally, work performed in markets has also become more virtual. Among the virtual market aids available to consumers are shopping ‘bots, which search multiple sites for named products and show direct price comparisons; buying clubs, in which large groups of consumers influence pricing through volume buying; open auctions, which allow buyers and sellers to make direct contact; and demand collection auctions, which allow consumers to name a price for a specific product (Kambil & van Heck, 2002). These alternatives extend the capabilities of markets in ways similar to the extension of individual, team and organizational capabilities. However, virtual markets must also intertwine effectively with their material counterparts. Studies of traditional markets undergoing transitions to electronic trading illustrate the importance of physical media and personal contact (Barrett and Walsham, 1999; Kambil & van Heck, 1998). Material characteristics (face to face meetings, physical trading spaces, paper instruments for bidding and executing trades, clocks, and so on) are important because knowledge is embedded in material trading artifacts. Moreover, engendering trust and judging competence are activities that experienced traders only do in the material world (Barrett & Walsham, 1999). Electronic trading certainly
enhances the performance of markets, but market effectiveness may increase even further where material and virtual resources are intertwined.

In summary, we have examined the interrelationships between material and virtual worlds of work and concluded that their intertwining is instrumental to extending work capabilities. Many anomalies, such as the ironic practices described at the beginning of this paper, result where virtual and material representations of work are not intertwined. As new technologies ease the creation of virtual representations of work at all levels of analyses, it is important for both designers and performers of work to exercise conscious reflection on the relationship between virtual and material work. Our analysis provides a conceptual basis for considering how these two worlds may be more effectively intertwined.

References


