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Discontinuities and Continuities: A New Way to Understand Virtual Work

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Description/Abstract

“Virtual” is a potent buzzword, freely applied to many situations, with many meanings. In this exploratory study, we develop a more precise understanding of "virtual" to describe changing work environments. Specifically, we propose a framework to classify work environments based on the type of discontinuities involved. Discontinuities are gaps or a lack of coherence in aspects of work. The framework allows us to compare research across different topics and work settings. We use the framework to classify 75 published articles on virtual work environments or earlier, related research streams. We observed that many studies were simultaneously addressing existing or emerging continuities, factors or strategies for overcoming discontinuities. The focus of "virtual" is on changes in the work environment; however, our analysis suggests the need to be equally aware of factors that have not changed and which may become more critical with the introduction of discontinuities.

Keywords

work environments, virtual, online, discontinuities

Disciplines

Systems and Communications

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ABSTRACT

"Virtual" is a potent buzzword, freely applied to many situations, with many meanings. In this exploratory study, we develop a more precise understanding of "virtual" to describe changing work environments. Specifically, we propose a framework to classify work environments based on the type of discontinuities involved. Discontinuities are gaps or a lack of coherence in aspects of work. The framework allows us to compare research across different topics and work settings. We use the framework to classify 75 published articles on virtual work environments or earlier, related research streams. We observed that many studies were simultaneously addressing existing or emerging continuities, factors or strategies for overcoming discontinuities. The focus of "virtual" is on changes in the work environment; however, our analysis suggests the need to be equally aware of factors that have not changed and which may become more critical with the introduction of discontinuities.

KEYWORDS

Virtual, virtual work, discontinuities

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INTRODUCTION

Organizations increasingly find that virtual work structures are one strategy they can follow to provide increased flexibility in an economic environment of continuous change. Advanced information and communication technologies have enabled new options in organizational structure and design (DeSanctis & Monge, 1998; Davidow & Malone, 1992). Dramatic changes in work environments are evidenced as boundaries of time, space, and even organization are transcended. The word "virtual" has become a compelling catchphrase to describe these changes, and as such, is freely applied to many situations, with many meanings. As a result, it is in danger of meaning nothing.

Overuse of the term "virtual" creates two problems. Since the term is used non-systematically and to describe many different work environments, it is not clear if and when results from different studies should be compared. For example, should researchers investigating "virtual work" where employees are telecommuters look to research done on "virtual work" where employees are members of globally distributed software development teams? What commonalties, if any, exist among these diverse "virtual" work environments?

Second, emphasis on the term "virtual" to describe so many different situations may lead investigators to overlook earlier potentially relevant research. For example, when investigating virtual organizations, research on communities of practice, alliances, and manufacturing districts may provide insight. However, without a more precise understanding of the concepts underlying the use of the term, it is difficult to identify relevant research that was not described with the explicit keyword of "virtual".

In this paper, our goal is to develop a more precise understanding of how the word "virtual" is used to describe changing work environments. We propose a framework to classify these different work environments. The framework allows us to compare research across a variety of different topics and work settings and provides a foundation for future research that investigates managing and working in this new environment. We test the framework by using it to analyze recent research on virtual work environments and then tie this work to earlier research streams.

THEORY

Myriad Uses of the Word "Virtual"

The term "virtual" has been used to identify a variety of emergent work forms that differ from traditional work on numerous dimensions, such as the location of the workers, where and how work is accomplished, and the basis for relationships between workers and organizations and between organizations. "Virtual" is often used to differentiate work environments where individuals are physically or temporally dispersed. Such work environments include individuals working at home (telecommuting) as well as teams of employees from different organizations who manage a supply chain, pulled together based on skill and not location (Townsend et al., 1998). These purportedly nimbler teams form to work on projects and disband when the project is over. Members of these teams may be located in different countries and have very different cultural backgrounds (Boudreau et al., 1998; Carmel, 1999). In addition to the physical dispersion of the workers, people working in these arrangements may describe their work as "virtual" because it occurs mostly via computer, using simulated images and processes rather than exchanges of physical materials and performance of physical processes.

Many new configurations of work involve a shift in the employee-employer relationship. A "virtual worker" might be a contingent or contract employee who is self-employed and has no dominant

organizational affiliation but has temporary relationships with multiple organizations (Mowshowitz, 1997). These electronically connected contractors, or e-lancers, are part of the move from an economy whose fundamental unit is command-and-control organizations to one based on the work of individuals (Malone and Laubacher, 1998). "Virtual" is also used to describe new kinds of inter-organizational relationships. For example, employees of multiple organizations may collaborate to develop a product, provide a service, or foster new legislation. Even as individuals cooperate to achieve a common goal, they retain their membership in different organizations (Townsend et al. 1998). These inter-organizational partnerships may be temporary, as in the case of a product-development team, or may be more long-standing, such as a procurement team in a supply chain.

Finally, "virtual" may be used to describe online gatherings of people with an interest for a given topic or product (Hagel and Armstrong, 1997). Included in this broad category are MUDs, news groups, and government-supported infrastructure for communication and information sharing. Communities of practice such as those that have evolved around software development (Ahuja and Carley, 2000; Markus and Agres, 2000) exemplify virtual societies. For example, members of the Linux community of practice use electronic bulletin boards and discussion groups to share programming problems and solutions, although group members rarely, if ever, meet face-to-face.

Even though researchers may be careful to define the meaning of the term "virtual" as it applies in their studies, readers of the work, especially non-researchers, may be confused when so many different work environments are described by a single term. Additionally, while the term may be carefully and appropriately defined for each study, the different definitions limit the use of the findings in studies of other similar, but differently classified, work environments. To facilitate progress in these diverse areas, a more precise understanding of the term "virtual" as it applies to work in the 21st century is needed.

Work that Spans Discontinuities

In our view, the common thread that ties together these uses of the word "virtual" is the notion of discontinuity. We build here on Wanda Orlikowski's notion of discontinuity and Gerardine DeSanctis' model of dimensions of virtual work proposed in an unpublished 1999 Academy of Management symposium. Discontinuities are gaps or a lack of coherence in aspects of work, such as work setting, task, and relations with other workers or managers. An individual may work from home rather than in an office, or move from a work location in one geographic area to one in another. A person may interact with a constantly changing set of co-workers, including some whom he or she rarely, if ever, meets face-to-face. Paychecks may come from different sources, and the person may report to different managers or even different employers for different projects. Discontinuities can arise in factors such as the location of the workers, where and how work is accomplished, and the bases for relationships between workers and organizations, and between organizations.

Discontinuities come in two forms. First, a discontinuity may be temporal, meaning a break in some kind of logical succession. For example, when workers move from one company to another, there is a discontinuity in employer. Second, a discontinuity may be cross-sectional, meaning a lack of coherence in aspects of an individual's work. For example, when workers report to different bosses for different parts of their work, there is a discontinuity in supervision, creating potential difficulties for both employees and supervisors.

In all of these examples of virtual work, the word "virtual" is applied to describe work that spans one or more discontinuities. A partial list of different types of discontinuities includes temporal work location (e.g., working asynchronously across time zones), geographic work location, work group member membership (who you work with), organizational affiliation, and cultural backgrounds, either

national or professional. By adopting this perspective, the varying uses of virtual discussed above can be understood as follows:

- Virtual employees can be seen as those having discontinuous organizational affiliation, work group memberships or physical or temporal locations.
- Virtual groups can be seen as those having continuous employer but discontinuities in physical or temporal locations.
- Virtual teams can be seen as those having continuous employer but discontinuous location, work group membership, and perhaps even discontinuous tasks.
- Virtual organizations can be seen as those having individuals working continuously for some employer, but interacting with a discontinuous set of other people working for other companies on a discontinuous set of projects.
- Virtual societies may have individuals communicating about a common subject or issue, with discontinuities in physical or temporal locations.

Research Propositions

Our objective in this paper is to apply the framework by describing different work environments in terms of discontinuities and assessing the consequences and implications of these discontinuities. The type and number of discontinuities may have different consequences or possibly the degree of the consequence may be different. For example, difficulty in developing and maintaining working relationships in a virtual environment may be one consequence. This discontinuity may be extremely difficult for contingent workers, while less difficult for members of teams who are employees of the same organization but work in different geographic locations. Additionally, what is perceived as a discontinuity among one group of workers may not be a discontinuity in another context.

We offer the following two research propositions for this study:

1. Identifying discontinuities and their implications provides more systematic understanding of different uses of the term “virtual”.
2. Identifying discontinuities and their implications is a basis for integrating research results from studies with different uses of the term “virtual”, as well as studies using different terms (e.g., telecommuting).

METHODS

In this paper, we report on a pilot study of the usefulness of our conceptual framework for understanding and linking diverse research findings. Our two research propositions address the nature of research rather than the nature of reality itself. Therefore, we addressed these propositions by content analyzing published research articles that used the term "virtual," as well as earlier work on topics related to spanning of discontinuities. We used the published research article as the unit of analysis for this work because published articles provide a clear sampling frame, as well as the best view of what is accepted in the research community.

To develop a pilot database of articles, we searched the *ABI Inform* article database for research articles that used terms such as "virtual work" or "virtual organization" (a complete list of terms is described below). We also searched for articles on related topics, such as "distributed group" or "telecommuting." The authors have conducted research in different areas of the domain, and independently generated lists of keywords based on their knowledge of the topic.

Next, we analyzed each article according to our framework. We summarized the key concepts and findings of each article and coded each on several dimensions (shown in Table I) that we felt were important in understanding the nature of research conducted in this area. One author did the bulk of the coding reported here. As a check, a second author coded a random subset of articles. However, the goal of this exploratory analysis was to refine the codes rather than to test the coding system. Therefore, disagreements in coding were discussed and used to refine the coding system.

Take in Table I

ABI Inform was chosen for the pilot because it includes the full-text of articles from a cross-section of business publications and because it allows searches to be restricted to peer-reviewed publications. Because we wanted only research articles, we limited our search to the "ABI/INFORM Global" and "PA Research II—Peer Reviewed" databases and limited results to peer reviewed articles. We manually filtered out articles of fewer than 8 pages, in an effort to eliminate non-research articles in peer reviewed publications, such as columns or editorials. Finally, to facilitate our analysis for this pilot study, we restricted our sample to articles for which full-text was available on-line. This search retrieved a total of 75 documents, listed in the Appendix. Articles retrieved were published between 1986 and spring 2001. A complete list of search terms and the number of documents retrieved is shown in Table 2. Citations for the articles analyzed can be found in the Appendix.

Take in Table II

RESULTS

As expected, most studies we examined addressed discontinuities of time and space. All articles found under the keywords "telecommuting" and "telework" addressed space as a discontinuity, and with few exceptions, also addressed temporal discontinuities. These articles did not address other discontinuities, such as organization or culture. An example of this type of article is one by Hartman, Stoner and Arora (1992), who reported on a survey of 262 telecommuters from 11 organizations. A majority of telecommuters reported higher productivity at home. Satisfaction with telecommuting was significantly correlated with positive support and understanding from organizational superiors.

Articles found under keywords "distributed group" and "distributed team" more often addressed discontinuities in space than time. Most of this research is focused on the design of systems for groups

with the groups working synchronously, i.e., discontinuous in space but not in time. For example, based on five case studies of different distributed group support, Turoff, et al. (1993) presented a conceptual framework of systems that aid in classifying and comparing such systems. The results of the case studies demonstrate that design requirements and the associated research issues for group support systems can be very different in the distributed environment as compared to the same-place, decision room approach.

When examining the articles with keywords including virtual as adjective, we found three groupings. "Virtual office," "virtual work," and "virtual workplace" articles addressed both time and space, but no other discontinuity. For example, Hill et al. (2001) used a large survey of IBM employees to examine the influence of perceived flexibility in the timing and location of work on work-family balance. Because of the focus on individuals and time/space discontinuities, this work may be seen as a continuation of the earlier stream of work on telecommuting. On the other hand, articles found under keyword "virtual supply chain" typically addressed only an organizational discontinuity. For example, Chandrashekar and Schary (1999) discussed the evolution of supply chains to more flexible virtual supply chains and present associated managerial and technical issues. Finally, "virtual organization" and "virtual community" articles addressed a more complicated environment, often discussing combinations of time, space and organizational discontinuities. Many of these articles were conceptual rather than empirical. There was an understandable but regrettable lack of empirical articles in this area. Perhaps the best example of an empirical article was one by Barnatt (1997), which offered a case study of an SME (Cavendish Management Resources in the UK) that linked remote workers into a virtual organization.

Of course, our search results also included a number of articles that did not fit our framework and which we were unable to code. These articles fell into roughly three categories. First, articles that were too general, or at such a high level of analysis that specific discontinuities and consequences could not be determined, were ruled out. For example, a number of articles discussed the changing nature of

corporate strategy in a "virtual" environment without directly discussing the nature of these environments. Second, articles which did not address organizational or managerial implications of discontinuities were not coded, e.g., Handy & Mokhtarian (1995) who investigated the growth of telecommuting relative to growth of transit use or Markham (1998), who argued for the application of scientific visualization to organization science. There were also a few "false drops" or articles that had the term "virtual" but which were not in fact about the subject (e.g., an article on leaks in the UK government (Tant, 1995) that coincidentally used the word "virtual" near another search term). Finally, articles found with the search term "flexible office" generally did not fit the framework. These articles assumed the existence of discontinuities, usually of time and space, but researchers were primarily interested in other associated outcomes, such as the allocation of employee benefits (e.g., Caputo 2000).

By classifying articles based on discontinuities, we also were able to identify areas where discontinuities are occurring but where we found relatively little research. For example, we found few articles examining a single outside contractor or contingent worker (i.e., discontinuity in relationship with organizations), even though this is a growing area of the work force. We did not find articles that investigated distributed groups of people (e.g. multiple product development groups each located in different geographic locations). These omissions may be because of our initial choice of search terms and because this work has not yet been described as "virtual," despite its apparent connections to other kinds of "virtual" work. Finally, we found that the work on systems design was conducted primarily at the group level using student groups. There seems to be little work investigating the support for information needs of individuals in this complicated environment or of the role of enterprise systems in enabling (or indeed hindering) virtual organizations.

We also grouped the articles and search terms by year of publication. While this analysis is limited by the search restrictions for our pilot study, it is interesting to note that our keyword search

produced 15 articles published between 1993 and 1996, and 60 articles published between 1997 and 2000. With the exception of "virtual office" and "virtual organization," all keywords with adjective virtual first appeared in 1997 and 1998. This outcome can be partially explained by the integration of the Web into firm activities and processes, increasing the ease of cooperation between organizations, i.e., organizational discontinuity. The dramatic increase in number of articles indicates an increase in interest in organizational innovation through technology during this time period and continuing.

DISCUSSION

We have found important research being conducted with the goal of better understanding changing work environments. Although the number of articles investigating the virtual work environment has increased dramatically, our analysis indicates that the field is not yet converging. Instead of trying to make sense of "virtual" as a whole, it is important for researchers to look more closely at the work situation and investigate more precise phenomena.

Organizing articles by discontinuity allows us to differentiate groupings of research studies, and to identify similar phenomena being investigated. The framework suggests that work can be divided and grouped by type of discontinuity enabling researchers to link similar studies which may not be readily identified, e.g., work on a single individual discontinuous in time and space likely can be linked to work on telecommuting. The framework also helps to separate out "virtual" studies that would not be appropriate, e.g., this same work on a single individual would not informed by "virtual" studies which solely discuss organizational discontinuity.

Continuities – Constancy in a Sea of Change

As we analyzed the research in terms of discontinuities, it became apparent that many studies were simultaneously addressing existing or emerging *continuities*, i.e., factors or strategies for

overcoming discontinuities. The focus of "virtual" is on the changes in the work environment; however, our analysis suggests the need to be equally aware of factors that have not changed and which may become more critical with the introduction of discontinuities.

Discontinuities introduced into organizational processes are accompanied by continuities, i.e., factors that are in place or emerge to bridge the discontinuities. Continuities play a significant role in bridging the potential differences introduced with discontinuities. Surfacing continuities helps bridge new situations. Finding or creating continuities to deal with discontinuities helps to make coherent what we already know. For example, flight operations staff at United and American airlines found themselves dealing with unexpected radical behavior on September 11, 2001 (McCartney and Carey, 2001). Prior expectations – mental models – about dealing with hijacked airplanes were no longer valid. Operations staff tried to make sense of what was happening by finding aspects of the situation that were still applicable. In other words, they tried to find or create continuities to help them make sense of the situation.

Continuities are factors that influence behaviors that workers are aware of and consciously act on, or they may be implicit and unrecognized. In the development of dyadic relationships, the process of developing mutual expectations, or overcoming differences, "will appear to be routine, invisible, or tacit, except where differences in initial expectations are clear" (Gaborro, 1990). The process of moving through different stages of the relationship usually occurs as routine interactions take place, e.g., "ad hoc encounters, meetings, progress reviews, and discussions of task-based problems."

Between the individual and the organization, the continuity is a collective understanding of some aspects of the work environment. In studying open-source software development projects where members joined on a voluntary basis and communicated through the Internet, Markus, Brook, and

Agres (1997) found well-structured governance mechanisms. Despite the potential for "free-loading, unstable membership, and low-quality contributions" in an informal virtual organization, the projects worked "remarkably well." They attribute effective coordination and management of many open source projects to the members' shared context of a "hacker culture." In addition, there is also a shared motivator - "the ability to commercialize the product," and make money from it - which gave the groups a common goal.

Continuities, such as shared motivation, understanding of the task, mutual expectations, and others, provide the stability necessary to deal with the introduction of discontinuities or differences. Indeed, stability seems to be a prerequisite for flexible and adaptable behavior. Organizations typically strive for continuities because of their inherent efficiency and predictability (Leanna & Barry, 2000), which may be why we found that discontinuities in organizational processes were accompanied by continuities that were explicitly in place or that emerged to bridge the discontinuities. This interaction of continuities and discontinuities parallels the notion of semi-structures in organizations as described by Brown and Eisenhardt (1997). They describe semi-structures as "some (organizational) features are prescribed, e.g., responsibilities, project priorities, time intervals between projects) and determined, but other aspects are not." There is then partial order, or stability, which they find enables continuous change in organizations.

Recently, authors have recognized the existence of continuous change, changes that are "ongoing, evolving, and cumulative" (Pettigrew, Woodman, & Cameron 2001). In the virtual work environment, individuals may not only be managing continuous change, but also there is a continuous potential for change adding to the complexity of the work process. Virtual team membership may change fluidly due to environmental factors. Also, only a portion of an individual's work may involve discontinuities. For example, an employee working on an inter-organizational team in a supply chain

will probably also work with intra-organizational teams. And she may only be involved in the supply chain team on an as-needed basis.

For example, we need to unpack group membership to understand what concretely happens so members can successfully work in a discontinuous environment. What are the continuities that enable the group to function effectively and overcome the discontinuity of space? Groups appear to fall back on their continuities in order to successfully deal with the discontinuities, so researchers should explore what is shared in the group of individuals who are collaborating at a distance: common task, common beliefs and values, common media, common work practices. Groups may also need to more explicitly agree on communication strategies in a "virtual" environment than in a more traditional environment.

A number of the studies we examined assumed technology could be a fundamental continuity in the work environments being investigated. The development and use of information and/or communication technologies were the focus of many studies we examined (e.g., Dennis et al., 1998, Burke et al., 1999). However, going beyond this assumption about the use of technology encourages a more comprehensive examination of the work environment, and can surface other, more subtle but critical, continuities. It is therefore necessary to investigate both discontinuities that introduce change *and* continuities that help overcome the effects of the change if we want to provide useful insight and guidance for working and managing in virtual environments.

The preceding discussion illustrates the importance of investigating virtual work over time rather than in cross-sectional studies. Continuities and discontinuities may emerge and evolve as time passes, leading to different forms of virtual work. As those participating in virtual work arrangements become familiar with each, develop shared norms and expectations, and so forth, what was perceived as a

discontinuity at one point in time, may later be perceived as a continuity. Put another way, over time, workers in virtual work environments may routine-ize discontinuities into continuities.

Our approach also highlights the need for research that addresses individuals and groups in actual work situations, and calls into question the use of student groups in research on virtual work. This research predominantly investigates the use of technologies to overcome discontinuities of time and space, and more recently national culture (Jarvenpaa et al., 1998). While these are important questions, the nature of this research limits our ability to separate out the effects of other discontinuities, e.g., organization, and to identify and investigate important continuities.

Finally, we have shown that our framework enables researchers to integrate findings from different bodies of literature, i.e., linking telecommuting/telework literature to "virtual" literature. Highlighting continuities in our framework can lead to the integration of other topics, which may not be as obvious, but are relevant and useful. For example, we have identified common professional identity as an important continuity in one study where there is organizational discontinuity (Barnatt, 1997). This insight could lead the researcher to link research on developing professional identify with "virtual" research addressing organizational discontinuity.

Limitations

This pilot study has limitations that must be noted. First, is that our article search was limited to a single database, *ABI/Inform*. This database does not include articles some of the more prominent journals such as *Information Systems Research*, a consistently top-ranked journal in the MIS field. Our search was also limited to full-text articles, which further bounded the results. We do not believe, however, that the omission of these articles from our study significantly biases our results. There is little

reason to believe that the research published in the journals not included in our analysis would differ substantially from those in our selection in terms of the discontinuities being addressed.

A primary objective of this research is to understand the different uses of the term "virtual" in the research community at large. Our search did include journals from a variety of academic disciplines, e.g., geography, transportation, health management, public policy, and others. Looking at this broad subset of the total articles published using the term "virtual" to describe different work situations allowed us to accomplish this objective.

Conclusions

Results from this pilot study indicate that our framework provides a more systematic understanding of research being conducted in the area of virtual work and changes occurring in the work environment. Additional work is needed to clarify our definitions and refine our coding system, as well as coding articles more systematically. For example, we need to develop a method to handle articles that have been assigned multiple keywords as there is currently overlap in the categorization of this type of article.

One option for future work is to obtain a larger and more comprehensive sample of articles to analyze. We could expand our search by manually retrieving articles instead of limiting our search to full-text articles. In addition, we could search additional databases with different or more extensive journal coverage.

We believe that it is more useful to further cumulate findings from the research that has been done. Our initial analysis has resulted in a number of interesting insights into the virtual work environment and the research being conducted that warrant further examination. A more complete

examination of the literature, especially focusing on the continuities that are explicitly or implicitly addressed, would be valuable.

REFERENCES

Ahuja, M. and Carley, (1999) "Network structure in virtual organizations," *Organization Science*, Vol. 10, No. 6, pp. 741-757.

Boudreau, M.-C., Loch, K.D., Robey, D., and Straub, D. (1998) "Going global: Using information technology to advance the competitiveness of the virtual transnational organization," *Academy of Management Executive*, Vol. 12, No. 4, pp.120-128.

Brown, S. and Eisenhardt, K. (1997) "The art of continuous change: Linking complexity theory and time-paced evolution in relentlessly shifting organizations," *Administrative Science Quarterly*, Vol. 42, pp. 1-37.

Carmel, E. (1999) *Global Software Teams: Collaborating Across Borders and Time Zones*, Upper Saddle River, NJ: Prentice Hall.

Davidow, W. H. and Malone, M. S. (1992) *The Virtual Corporation,* New York: Harper.

DeSanctis, G. and Monge, P. (1999) "Introduction to the special issue: Communication processes for virtual organizations," *Organization Science*, Vol. 10, No. 6, pp. 693-703.

Gaborro, J. (1990) "The development of working relationships" in J. Galegher, R. E. Kraut, & C. Egido (Eds.), *Intellectual Teamwork* . Hillsdale, N. J.: Lawrence Erlbaum Associates.

Hagel III, J. and Armstrong, A. (1997) *Net Gain: Expanding markets through virtual communities*, Boston, MA: Harvard Business School Press.

Leanna, C. R. and Barry, B. (2000) "Stability and change as simultaneous experiences in organizational life," *The Academy of Management Review*, Vol. 25, No. 4, pp. 753-759.

Malone, T. and Laubacher, R. J. (1998) "The dawn of the e-lance economy," *Harvard Business Review*, pp. 145-152.

Markus, M. L., & Agres, B. M. C. E. (2000) "What makes a virtual organization work?" *Sloan Management Review,* Vol. 42, No. 1, pp. 13-26.

Meadows, C.J. (1996) "Globalizing software development," *Journal of Global Information Management*, Vol. 4, No. 1, pp. 5-14.

McCartney, S. and Carey, S. (2001) "Flying blind: On that fateful day, two airlines faced their darkest scenario," *Wall Street Journal*, October 15, p. A1.

Mowshowitz, A. (1997) "Virtual organization," *Communications of the ACM*, Vol. 40, No. 9, pp. 30-37.

Pettigrew, A. M., Woodman, R. W., and Cameron, K.S. (2001) "Studying organizational change and development: Challenges for future research," *Academy of Management Journal*, Vol. 4, pp. 697-713.

Townsend, A. M., DeMarie, S.M., and Hendrickson, A.R. (1998) "Virtual teams: Technology and the workplace of the future," *Academy of Management Executive*, Vol. 12, No. 3, pp. 17-29.

Watson-Manheim, M.B., Crowston, K., and Chudoba, K.M. (2002) "A new perspective on "virtual": Analyzing discontinuities in the work environment," *Proceedings of the 35th Annual Hawaii International Conference on System Sciences*.

Table I. Dimensions Coded in Research on Virtual Work
(Watson-Manheim et al., 2002)

- The research approach:
  - Field Research, Survey
  - Field Research, Case Study
  - Field Research, Interviews
  - Conceptual
  - Theoretical, Model Building
  - Experimental, Student Groups
  - Field Research, Student Groups
  - Prescriptive

- The **level of analysis:**
  - System
  - Individual
  - Group
  - Managerial
  - Organization
  - Inter-organization
  - Community
  - Society

- The **nature of the virtual work environment**:
  - Virtual supply chain: network of individual organizational units organized around a specific task (on-going relationship)
  - Virtual organizations staffed primarily by contract or temporary workers, with core of full-time permanent employees
  - Virtual corporation: temporary network of independent companies linked through IT.
  - Volunteer organization of individuals (e.g., developing open source software code)
  - Distributed organization: organizations consisting of 2 or more semi-autonomous units in different geographical locations linked through IT
  - Virtual Enterprise networks: aggregation of small to medium enterprises (as opposed to decomposition of large organizations)
  - Distributed individuals in field settings
  - Distributed individuals in student groups

- **Discontinuities** - the dimensions of the work that were discontinuous:
  - Physical location
  - Temporal location
  - Work group membership
  - Organizational affiliation
  - Relationship with an organization (e.g., permanent vs. self-employed or temporary worker)
  - Culture
    - Functional
    - Organizational Regional
    - National

Table II. Search terms and number of articles retrieved

Search term	Number of Articles Retrieved
distributed group	5
distributed organization	0
distributed team	1
distributed work	2
flexible office	11
geographically dispersed team	0
global team	0
hoteling	0
telecommuting	21
telework	7
virtual community	6
virtual corporation	16
virtual office	7
virtual organization	15
virtual supply chain	3
virtual team	5
virtual work	4
virtual workplace	3
TOTAL	75

Notes:
1) Total is less than the column sum because some articles matched multiple search terms.
2) Citations for articles analyzed are listed in the Appendix.

APPENDIX
Articles Analyzed In Pilot Study

Citation	Keyword(s)
Adacher, L., Agnetis, A., & Meloni, C. (2000). Autonomous agents architectures and algorithms in flexible manufacturing systems. *IIE Transactions, 32*(10), 941-951.	Flexible office
Adams, P. C. (1997). Cyberspace and virtual places. *Geographical Review, 87*(2), 155-171.	Virtual office
Adams, T. L. (1997). Follow the yellow brick road: Using diffusion of innovations theory to enrich virtual organizations in cyberspace. *The Southern Communication Journal, 62*(2), 133-148.	Virtual corporation, virtual organization
Allcorn, S. (1997). Parallel virtual organizations: managing and working in the virtual workplace. *Administration & Society, 29*(4), 412.	Virtual organization, virtual work, virtual workplace
Anderson, R. E. (1996). Personal selling and sales management in the new millennium. *The Journal of Personal Selling & Sales Management, 16*(4), 17-32.	Virtual office
Bae, C.-H. C. (1993). Air quality and travel behavior. *American Planning Association. Journal of the American Planning Association, 59*(1), 65.	Telecommuting
Bal, J., Wilding, R., & Gundry, J. (1999). Virtual teaming in the agile supply chain. *International Journal of Logistics Management, 10*(2), 71-82.	Virtual corporation, virtual supply chain
Barnatt, C. (1997). Virtual organisation in the small business sector: The case of Cavendish Management Resources. *International Small Business Journal, 15*(4), 36-47.	Virtual corporation, virtual organization
Barry, D., & Elmes, M. (1997). Strategy retold: Toward a narrative view of strategic discourse. *Academy of Management. The Academy of Management Review, 22*(2), 429-452.	Virtual organization
Bezold, C., Mayer, E., & Dighe, A. (1997). Visionary leadership and the future of VA health system. *Hospital & Health Services Administration, 42*(3), 367-382.	Virtual organization
Boczkowski, P. J. (1999). Mutual shaping of users and technologies in a national virtual community. *Journal of Communication, 49*(2), 86-108.	Virtual community

Citation	Keyword(s)
Boudreau, M.-C., Loch, K. D., Robey, D., & Straud, D. (1998). Going global: Using information technology to advance the competitiveness of the virtual transnational organization. *The Academy of Management Executive, 12*(4), 120-128.	Virtual corporation, virtual organization
Briggs, R. O., Nunamaker, J. F., Jr., & Sprague, R. H., Jr. (1997). 1001 unanswered research questions in GSS. *Journal of Management Information Systems, 14*(3), 3-21.	Telework, virtual work, virtual workplace
Burke, K., Aytes, K., Chidambaram, L., & Johnson, J. J. (1999). A study of partially distributed work groups: The impact of media, location, and time on perceptions and performance. *Small Group Research, 30*(4), 453-490.	Distributed group, distributed work
Caputo, R. K. (2000). The availability of traditional and family-friendly employee benefits among a cohort of young women, 1968-1995. *Families in Society, 81*(4), 422-436.	Flexible office
Carnoy, M. (1999). The family, flexible work and social cohesion at risk. *International Labour Review, 138*(4), 411-429.	Flexible office
Cascio, W. F. (2000). Managing a virtual workplace. *The Academy of Management Executive, 14*(3), 81-90.	Telecommuting, telework, virtual team, virtual work, virtual workplace
Chandrashekar, A., & Schary, P. B. (1999). Toward the virtual supply chain: The convergence of IT and organization. *International Journal of Logistics Management, 10*(2), 27-39.	Virtual corporation, virtual organization, virtual supply chain
Crawford, J. W., Jr, & Krahn, S. L. (1998). The demanding customer and the hollow organization: Meeting today's contract management challenge. *Public Productivity & Management Review, 22*(1), 107-118.	Virtual corporation
Davenport, T. H., & Pearlson, K. (1998). Two cheers for the virtual office. *Sloan Management Review, 39*(4), 51-65.	Telecommuting, virtual corporation, virtual organization, virtual work
Dennis, A. R., Pootheri, S. K., & Natarajan, V. L. (1998). Lessons from the Early Adopters of Web Groupware. *Journal of Management Information Systems, 14*(4), 65-86.	Virtual community

Citation	Keyword(s)
Dombrow, J. C. (1998). Electronic communications and the law: Help or hindrance to telecommuting? *Federal Communications Law Journal, 50*(3), 685-709.	Telecommuting
Fairweather, N. B. (1999). Surveillance in employment: The case of teleworking. *Journal of Business Ethics, 22*(1 2), 39-49.	Telecommuting, telework
Fitzpatrick, W. M., & Burke, D. R. (2000). Form, functions, and financial performance realities for the virtual organization. *S.A.M. Advanced Management Journal, 65*(3), 13-20.	Virtual corporation, virtual organization
Fox, N., & Roberts, C. (1999). GPs in cyberspace: The sociology of a 'virtual community'. *The Sociological Review, 47*(4), 643-671.	Virtual community
Fritz, M. B. W., Narasimhan, S., & Rhee, H.-S. (1998). Communication and coordination in the Virtual Office. *Journal of Management Information Systems, 14*(4), 7-28.	Telecommuting, virtual office
Gavish, B., Gerdes, J. J., & Sridhar, S. (1995). CM3: A distributed group decision support system. *IIE Transactions, 27*(6), 722.	Distributed group
Golden, L. (2001). Flexible work schedules: Which workers get them? *The American Behavioral Scientist, 44*(7), 1157-1178.	Flexible office
Handy, S. L., & Mokhtarian, P. L. (1995). Planning for telecommuting. *American Planning Association. Journal of the American Planning Association, 61*(1), 99.	Telecommuting
Hartman, R. I., Stoner, C. R., & Arora, R. (1992). Developing successful organizational telecommuting arrangements: Worker perceptions and managerial prescriptions. *S.A.M. Advanced Management Journal, 57*(3), 35.	Telecommuting
Hawkins, R., Mansell, R., & Steinmueller, W. E. (1999). Toward digital intermediation in the information society. *Journal of Economic Issues, 33*(2), 383-392.	Virtual community
Herschel, R. T., & Andrews, P. H. (1997). Ethical implications of technological advances on business communication. *The Journal of Business Communication, 34*(2), 160-170.	Telecommuting
Hill, E. J., Hawkins, A. J., Ferris, M., & Weitzman, M. (2001). Finding an extra day a week: The positive influence of perceived job flexibility on work and family life balance. *Family Relations, 50*(1), 49-58.	Virtual office

Citation	Keyword(s)
Hill, E. J., Hawkins, A. J., & Miller, B. C. (1996). Work and family in the virtual office: Perceived influences of mobile telework. *Family Relations, 45*(3), 293.	Telecommuting, telework
Hill, E. J., Miller, B. C., Weiner, S. P., & Colihan, J. (1998). Influences of the virtual office on aspects of work and work/life balance. *Personnel Psychology, 51*(3), 667-683.	Telecommuting, telework, virtual corporation, virtual office
Hoogeweegen, M. R., Teunissen, W. J. M., Vervest, P. H. M., Wagenaar, R. W. (1999). Modular network design: Using information and communication technology to allocate production tasks in a virtual organization. *Decision Sciences, 30*(4), 1073-1103.	Virtual corporation, virtual organization
Huh, S.-Y., Chung, Q. B., & Kim, H.-M. (2000). Collaborative model management in departmental computing. *INFOR, 38*(4), 373-389.	Distributed group
Igbaria, M., & Guimaraes, T. (1999). Exploring differences in employee turnover intentions and its determinants among telecommuters and non-telecommuters. *Journal of Management Information Systems, 16*(1), 147-164.	Telecommuting
Jarvenpaa, S. L., Knoll, K., & Leidner, D. E. (1998). Is Anybody Out There? Antecedents of Trust in Global Virtual Teams. *Journal of Management Information Systems, 14*(4), 29-64.	Virtual team
Kasarda, J. D., & Rondinelli, D. A. (1998). Innovative infrastructure for agile manufacturers. *Sloan Management Review, 39*(2), 73-82.	Virtual corporation
Kemp, D. R. (1995). Telecommuting in the public sector: An overview and a survey of the states. *Review of Public Personnel Administration, 15*(3), 5.	Telecommuting
Khan, M. B., Tung, L. L., & Turban, E. (1997). Telecommunicating: Comparing Singapore to Southern California. *Human Systems Management, 16*(2), 91-98.	Telecommuting
Kinard, J., & Little, B. (1999). Are hospitals facing a critical shortage of skilled workers? *The Health Care Supervisor, 17*(4), 54-62.	Flexible office
Koch, C. (2000). Collective influence on information technology in virtual organizations-emancipatory management of technology? *Technology Analysis & Strategic Management, 12*(3), 357-368.	Virtual organization
Kraut, R. E. (1989). Telecommuting: The Trade-Offs of Home Work. *Journal of Communication, 39*(3), 19.	Telecommuting

Citation	Keyword(s)
Leach, N. P., Makatsoris, C., & Richards, H. D. (1997). Supply chain control: Trade-offs and system requirements. *Human Systems Management, 16*(3), 159-169.	Virtual supply chain
Lewis, R. (1998). Membership and management of a 'virtual' team: The perspectives of a research manager. *R & D Management, 28*(1), 5-12.	Distributed team
Lucas, H. C. J., & Baroudi, J. (1994). The role of information technology in organization design. *Journal of Management Information Systems, 10*(4), 9.	Virtual organization
Markham, S. E. (1998). The scientific visualization of organizations: A rationale for a new approach to organizational modeling. *Decision Sciences, 29*(1), 1-23.	Virtual corporation
Markus, M. L., & Agres, B. M. C. E. (2000). What makes a virtual organization work? *Sloan Management Review, 42*(1), 13-26.	Virtual organization
Mirchandani, K. (1999). Legitimizing work: Telework and the gendered reification of the work-nonwork dichotomy. *The Canadian Review of Sociology and Anthropology, 36*(1), 87-107.	Telecommuting, telework
Mirvis, P. H. (1997). Human resource management: Leaders, laggards, and followers. *The Academy of Management Executive, 11*(2), 43-56.	Flexible office
Mokhtarian, P. L. (1998). A synthetic approach to estimating the impacts of telecommuting on travel. *Urban Studies, 35*(2), 215-241.	Telecommuting
Ocker, R., Hiltz, S. R., Turoff, M., & Fjermestad, J. (1995). The effects of distributed group support and process structuring on software requirements development teams: Results on creativity and quality. *Journal of Management Information Systems, 12*(3), 127.	Distributed group
Ogilvie, H. (1994). This old office. *The Journal of Business Strategy, 15*(5), 26.	Telecommuting, virtual office
Osterman, P. (1994). How common is workplace transformation and who adopts it? *Industrial & Labor Relations Review, 47*(2), 173.	Flexible office
Preston, V., Holmes, J. N., & Williams, A. (1997). Working with 'Wild Rose I': Lean production in a Greenfield mill. *Canadian Geographer, 41*(1), 88-104.	Flexible office
Rehm, M. L. (2000). An aesthetic approach to virtual community. *Family and Consumer Sciences Research Journal, 29*(2), 153-172.	Virtual community

Citation	Keyword(s)
Reinsch, N. L., Jr. (1997). Relationships between telecommuting workers and their managers: An exploratory study. *The Journal of Business Communication, 34*(4), 343-369.	Telecommuting
Reinsch, N. L., Jr. (1999). Selected communication variables and telecommuting participation decisions: Data from telecommuting workers. *The Journal of Business Communication, 36*(3), 247-260.	Telecommuting
Robey, D., Khoo, H. M., & Powers, C. (2000). Situated learning in cross-functional virtual teams. *Technical Communication, 47*(1), 51-66.	Virtual team
Roy, U., & Kodkani, S. S. (1999). Product modeling within the framework of the World Wide Web. *IIE Transactions, 31*(7), 667-677.	Virtual organization
Shepard, E. M. I., Clifton, T. J., & Kruse, D. (1996). Flexible work hours and productivity: Some evidence from the pharmaceutical industry. *Industrial Relations, 35*(1), 123-139.	Flexible office
Silver, H., & Goldscheider, F. (1994). Flexible work and housework: Work and family constraints on women's domestic labor. *Social Forces, 72*(4), 1103.	Flexible office
Smith, A. E. (1993). Canadian industrial relations in transition. *Relations Industrielles, 48*(4), 641.	Flexible office
Tant, A. P. (1995). 'Leaks' and the nature of British government. *The Political Quarterly, 66*(2), 197.	Virtual organization
Townsend, A. M., DeMarie, S. M., & Hendrickson, A. R. (1998). Virtual teams: Technology and the workplace of the future. *The Academy of Management Executive, 12*(3), 17-29.	Virtual corporation, virtual team
Turoff, M., Hiltz, S. R., Bahgat, A. N. F., & Rana, A. R. (1993). Distributed group support systems. *MIS Quarterly, 17*(4), 399.	Distributed group
Tyler, K., McGirr, D., & Stanley, E. (1998). Contextualising: Technology, relationships and time in a finacial services virtual organisation. *The Service Industries Journal, 18*(3), 70-89.	Virtual corporation
Venkatraman, N., & Henderson, J. C. (1998). Real strategies for virtual organizing. *Sloan Management Review, 40*(1), 33-48.	Virtual corporation
Warkentin, M. E., Sayeed, L., & Hightower, R. (1997). Virtual teams versus face-to-face teams: An exploratory study of a Web-based conference system. *Decision Sciences, 28*(4), 975-996.	Virtual team

Citation	Keyword(s)
Watad, M. M., & DiSanzo, F. J. (2000). Case study: The synergism of telecommuting and office automation. *Sloan Management Review, 41*(2), 85-96.	Telecommuting, telework
Williams, M. (2000). Virtually criminal: Discourse, deviance and anxiety within virtual communities. *International Review of Law, Computers & Technology, 14*(1), 95-104.	Virtual community
Wilson, F. (1999). Cultural control within the virtual organization. *The Sociological Review, 47*(4), 672-694.	Virtual corporation, virtual organization
Woolridge, B. (1994). Changing demographics of the workforce: Implications for the use of technology as a productivity improvement strategy. *Public Productivity & Management Review, 17*(4), 371.	Distributed work