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Telecommuters and Work Groups: A Communication Network Analysis

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1. INTRODUCTION

Today’s workforce comprises an increasing number of telecommuters. At the same time, more and more of the work being performed by both telecommuters and office workers involves the manipulation of information, otherwise known as knowledge work. Most knowledge workers need substantial communications to perform their jobs. Before the advent of telecommuting, most communications were mediated by the physical proximity of workers. Today, however, communication technologies play an ever increasing role in supporting individual and organizational communications. In this research, telecommuting is defined as working away from the traditional office at least one day a week, while using computers and telecommunication facilities to maintain a link to the office (Belanger and Collins 1998).

1.1 Research Objectives

Individuals who are part of work groups often need to communicate with their colleagues in order to perform their job. For example, sometimes this work-related information is on how to do certain tasks; other times, it is to obtain status information on certain projects. This research investigates the nature of communication links between telecommuters and non-telecommuters in a work group. Does physical proximity make a difference in determining which individuals communicate together? Are telecommuters being left out of the office network, which can have significant career impacts in the long run? Do telecommuters form their own cliques by seeking the support of their telecommuter peers instead of office workers? In communication networks, cliques represent subgroups of individuals with higher communication linkages between them. It can be expected that non-telecommuters will tend to communicate more with other non-telecommuters because of their close physical proximity (e.g., dropping by a colleague’s cubicle to ask questions). Conversely, telecommuters should communicate with colleagues in any work setting equally since they are all considered remote from their point of view. To investigate these issues, a communication network analysis of two large work groups with both telecommuters and non-telecommuters was performed. The research identifies subgroups or blocks within the work groups, and determines if they are formed according to individuals’ work setting.

2. THEORITICAL FOUNDATIONS

2.1 Organizational Communications

There are few empirical studies on individual and group communication in telecommuting. Some of them investigate how implementation of telecommuting programs impact formal or informal communications. Different theories are used in understanding communications in telecommuting, including media richness, social presence, and social information processing. Media richness and group support system studies suggest that face-to-face interactions are better than telephone, or other methods of communication for groups to perform their work. Of course, this is easier when members of the groups are in close proximity (Seta and Schkade 1976) where they can communicate directly with other members. Some findings suggest that remote workers
use less face-to-face communications, but equal amounts of electronic mail and telephone than traditional workers (Fulk and DeSanctis 1995; Watson-Fritz, Narasimhan, and Rhee 1996). The more employees use face-to-face communication, the more they are satisfied with informal communications in general, and the more they use electronic mail and telephone, the less they are satisfied. In other words, it is not telecommuting that has an impact on informal communications, but the communication medium used. Other telecommuters feel that electronic mail does not provide them with the desired visibility and interaction (Szajna and Stephens 1996). A proposed solution to the lack of informal communication potential is to create “virtual water coolers” where employees can “meet” electronically. Jobs with cognitive demands, like those of knowledge workers, typically require more communications. Teleworkers, however, tend to have more control over their work schedules and may therefore need less contacts. Overall, researchers find that formal and informal communications and interactions with co-workers are very important concerns of telecommuters.

2.2 Communication Networks

When there are multiple members in a group, there is always a minimum of communication required. Bavelas (1951) proposes to look at the number of communication exchanges occurring to establish the communication structure of a group. He calculates both the sum of neighbors (people you talk to) and the sum of distances (the number of links for communication between members). There are four basic communication patterns (networks) for small groups: wheel, circle, chain, and all-channel, and not all structures perform the same. The wheel, in which communication is through a central person, is faster and involves fewer errors, but only when a task is simple (i.e., when no role overload exists on the central member). The circle is superior for complex tasks. However, the usage of new technologies can change which communication networks perform better, with the potential for the wheel to always do better than the circle (Pennings 1992). Most of this research was done in experimental settings, not necessarily reflecting the dynamic nature of organizations, but provides the background behind the more recent network analysis methodologies.

2.3 Network Analysis

“Network analysis is a conceptually sophisticated tool for studying patterns of information exchange and communication, and has tremendous potential for further advancing our theoretical understanding of organizations” (Fulk and Boyd 1991). Each individual in a network is an actor or a node. The methodology is used to understand the patterns of linkages among actors. It requires “mapping” of the communication network by asking all organizational members to identify those other members that they communicate with, how often, and about what. Several summaries of network analysis studies have been published (Fulk and Boyd 1991; Wigand 1988). Analysis of network data can be done via matrix analysis, factor analysis, block modeling techniques, multidimensional techniques (MDS), cluster analysis, or specific software packages like NEGOPY (Wigand 1988) or UCINET (Borgatti, Everett, and Freeman 1992). The package UCINET IV is used for network analysis in this research.

Network analysis is a mathematical approach which provides two basic insights into communication networks: understanding the actual structure (structural or positional perspective) and comprehending “elements within the structure” (relational perspective) (Knake and Kuklinski 1982, p. 11). There are three basic levels of analysis in this procedure: egocentric (each individual node); dyad (pairs of nodes) or tryads (three nodes), also called the clique level; and, complete networks or systems. The present study investigates cliques and blocks of nodes in complete networks, where networks are defined as the formal work groups. Various properties in communication networks can be studied: properties of the links, roles, position, and content, and properties of the network itself (Fulk and Boyd 1991). Links, roles, and position are usually studied at the individual (ego) network level. Content refers to what the communication exchange is about. Properties of networks that can be studied include connectedness or density (extent of interlinkages between individuals), reachability (degree to which people can be reached with minimum of intermediaries), openness or integrativeness (extent of linkages outside the group), and flexibility (Fulk and Boyd 1991; Wigand 1988).

Undoubtedly, communication is one of the most affected processes in telecommuting. Horizontal communications are usually between peers and more for social aspects of organizational life: socializing, support, and spreading corporate culture (Kraut...
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They are usually promoted via physical proximity of workers (Szajna and Stephens 1996; Watson-Fritz, Narasimhan, and Rhee 1996). Vertical communication is between hierarchical levels, usually for coordination and control (Kraut 1989). When seeking job-relevant information, individuals communicate more with structurally equivalent actors than cohesive actors (Shah 1998). Structurally equivalent actors are those individuals with the same position in the network as the individual studied. Cohesive actors are those individuals with whom an actor has close interpersonal ties such as friendship. This study investigates structurally equivalent actors. As such, content of communication is defined as work-related communications between coworkers.

3. METHODOLOGY

To understand the impacts of telecommuting, a survey instrument on various telecommuting issues was developed. In addition to communication data, the questionnaire collected information on demographics, technology, coordination, telecommuting outcomes, and free format comments. Tests of the instrument and results of the survey are available in Belanger, Collins and Cheney (1998). Respondents indicated whether they telecommuted or not. However, they were considered telecommuters only if they worked at home at least one day a week, and had been doing so for at least three months. The communication instrument was adapted to each work group, containing the list of names of all individuals in the group. Respondents were asked to circle the ID number next to their name, and place an X next to the names of individuals with whom they had work-related communications. They then circled the number representing the frequency of communications with those individuals, which ranged from never (0) to several times a day or more (6) (Wigand 1988).

3.1 Demographics

Managers from local organizations were contacted to participate in the study, and two of them working for a high technology organization supervised work groups large enough to be part of this study. All individuals in their groups received envelopes containing a request for participation letter with a brief background about telecommuting research, the survey, and a self-addressed stamped envelope. Respondents mailed surveys directly to the researcher to ensure confidentiality of their responses. A reminder note was sent three weeks after the original mailing. Data collection occurred in 1997, after the instrument was pilot tested. Table 1 presents group sizes and response rates. Network 1 had 14 telecommuters and 17 non-telecommuters. Those proportions for network 2 were 27 and 16 respectively. In the total sample there were 12 female telecommuters and eight female non-telecommuters. For males, these numbers are 27 and 28 respectively (there were two “unknown” gender respondents). The average age of the sample is 41 years and the average number of years with the organization is 12.8. These numbers are very close to the averages for both telecommuter and non-telecommuter samples.

<table>
<thead>
<tr>
<th>Group</th>
<th>Surveys sent</th>
<th>Surveys returned</th>
<th>Response rate</th>
<th>Usable in network analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>88</td>
<td>33</td>
<td>38 %</td>
<td>31</td>
</tr>
<tr>
<td>2</td>
<td>80</td>
<td>43</td>
<td>54 %</td>
<td>43</td>
</tr>
<tr>
<td>Total</td>
<td>168</td>
<td>76</td>
<td>46 %</td>
<td>74</td>
</tr>
</tbody>
</table>

While individuals typically worked with the dissemination of information (knowledge work), there were four categories of employees in the total sample, as categorized using the Watson-Fritz, Narasimhan, and Rhee categorization of titles. In network 1, there was one individual with a staff function job (help desk specialist), one line function job (consultant), and one clerical job (office assistant). The rest of the sample is made up mostly of IS staff jobs with titles like systems engineer, systems analyst, and systems administrator (26 in network 1, 40 in network 2). These individuals typically helped others in this high-tech
organization with technical problems. There were also a few section managers (supervisory category) who were responsible for subgroups of employees (two in network 1, three in network 2).

3.2 Network Analysis

Responses were entered into Excel spreadsheets, with the rows indicating “who” communicates with “whom” (columns). A zero indicates no work-related communication (or less than once per month) between individuals (nodes). There are two problems to contend with when trying to do communication network analysis. First, there is the frequent problem of missing data (Knoke and Kuklinski 1982). Second, there are conflicts in ratings between participants. Most network analysis researchers “symmetrize” their data when “investigating reciprocal or mutual communication channels,” such as between co-workers (Knoke and Kuklinski 1982, p. 43). Of the various ways to handle this, forcing replication by changing one of the values was selected.

The communication network matrices were examined for the level of agreement between individuals. For example, in network 1, 31 respondents rated each other’s communications. There are therefore \( n(n-1)/2 \) communications to be rated among individuals, or 465 communications. There was a 68% agreement (or slight disagreement) achieved. The convention used for deciding on reconciliation of ratings was to take the rounded up average between the two. For example, if frequencies were rated as 3 and 6 by two individuals, the average is 4.5, and therefore the number 5 was used as communication frequency between those individuals. The rationale is that individuals may forget some communications that happen for work-related purposes (for example, if the exchange was relatively short). In network 2, 85% of the 903 communications rated were in agreement or slight disagreement (1 level difference). There were no differences of more than 4 levels in the frequencies of communication rated. The high level of agreement in the frequency ratings helps alleviate the problem of missing data. Frequencies were added in the matrices according to the ratings provided by the respondents. Rows and columns where there were still missing data (e.g., no data provided by at least one respondent) were deleted from the matrix. While the remaining data are not as accurate as they would be with two raters, they were provided by at least one informant.

3.3 Results

The data were converted to the DL format required by UCINET IV (Borgatti, Everett, and Freeman 1992). The first tests were the CLIQUE and N-CLIQUE procedures to find cliques in the work groups. Cliques are subgroups of individuals with a higher number of linkages among them. Cliques allow individuals to belong to more than one group. An initial clique analysis for network 1 (\( n = 31 \)), for example, led to 103 cliques found for sizes of three or more members, and 193 for network 2 (\( n = 43 \)). For the sake of simplicity, and to clearly delineate the subgroups individuals mostly belonged to, blocking procedures in UCINET IV were used. These algorithms classify individuals in one and only one block of individuals with high communication linkages by looking at structural equivalence.

The structural equivalence procedures CONCOR and TABU were used to determine individuals’ membership in different blocks. The first procedure was used to establish the number of blocks for each network. The higher the number of blocks, the better the \( r \)-squared, or explained variance. This, however, must be balanced with ensuring that blocks contain more than one or two individuals, and that the intra-block correlations are high while the inter-block correlations are low. It was determined that seven blocks were best for network 1 while six blocks were best for network 2. The TABU procedure then assigned individuals to the blocks.

Preliminary results indicate a tendency for telecommuters to belong to blocks that contain mostly telecommuters and for non-telecommuters to belong mostly to non-telecommuter blocks. For example, of the seven blocks for network 1, three include only telecommuters (except for one manager and one exception), and three include only non-telecommuters (except for one exception in two of the groups). Further analysis will determine statistical significance of group membership and include gender analysis. Network plots, complete results including statistical significance of group membership and gender analyses, and implications will be discussed at the Conference.
References


