

Teams: Virtualness and Media Choice

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Abstract

This paper describes a research framework defining “virtualness” based on work cycle synchronicity and differences in member location and culture. This framework is extended into a research model investigating relationships between work team virtualness and communication. Various facets of communication are examined including media choice and communication effectiveness.

A discussion of an on-going exploratory study within a single organization is presented. Case descriptions, survey data, and communication logs are used to better understand the relationships between teams which vary as to their degree of virtualness and communication.

The findings suggest significant differences between teams varying in their degree of virtualness with respect to media choice preferences, perceptions of task/media fit, social context factors, and team effectiveness. Within our sample, teams with increased degrees of virtualness are associated with less trust, cooperation, and conflict management problems.

1. Introduction

Virtual organizational forms, such as virtual teams, are proliferating throughout and across organizations. A virtual organizations is characterized as “...edgeless, with permeable and continuously changing interfaces between company, supplier, and customers” [10, p. 5-6] and “...a temporary network of companies coming together in response to a market opportunity” [16, p. 206]. Virtual entities, be it organizations or teams within or across organizations, enable organizational and/or individual core competencies to be brought together when needed and disbanded when no longer required [36].

The fluidity of creating and disbanding teams as needed has been brought about by advances in communication technologies. Communication media and information technologies, such as voice and electronic mail, facilitate more rapid exchange of information. In addition, more recent technological innovations such as groupware and videoconferencing, enable sharing of non-verbal communication including documents, annotations, facial expressions, and interactive discussion, to emulate the face-to-face communication processes.

Past research examining communication processes has focused on communication task/media fit in the context of traditional organizations where work and project teams are typically co-located and able to engage in frequent face-to-face contact [8, 37]. Similar research needs to be established in virtual teams as they become used more frequently within and across organizations.

Therefore, the emergence of virtual organizations is explicitly tied to advances in communication technologies. How are these technologies being used? How effective are these technologies in facilitating information sharing and exchange in a virtual context as compared to a more traditional work environment? Do these technologies effectively stimulate social interactions throughout the virtual entity? This paper lays a theoretical foundation for examining these questions and presents the results of an on-going exploratory field study to highlight issues that appear to be particularly salient in the examination of virtual organizations and communication processes and media.

First, we review existing relevant literature on virtual organizations and specifically, virtual teams. Second, a framework is presented enabling the assessment of “virtualness” across organizational structures and the relevant literature examining media choice and communication is discussed. Third, based upon the review of these literatures, a research model and questions are derived focusing on the relationships

between the degree of team “virtualness”, media choice, and communication effectiveness. Fourth, a description of the field study used to examine the research questions is then described followed by a presentation of the findings. The final section provides a discussion of the empirical findings and future research opportunities.

2. Virtual Organizations

The emergence of the “virtual organization” as an organizational form has evolved from a futuristic concept to an identifiable structure across a variety of organizations [10]. Although the virtual organization is frequently described in the literature, there is not a commonly held definition of the term:

“...physically distributed, complementary competencies can remain dispersed and still be synthesized into a coherent productive resource, one whose synthesized character is invisible or borderless...” [16]

“...work displaced as greatly as possible from office space (common physical buildings) into cyberspace (computing and electronic communication links)” [2]

“The virtual organization demands...the right partners with compatible goals and values” [12]

Virtual organizations face a tradeoff between incentives for participating and control of process [5]. The coordination of the group is critical to achieving the desired results of increased value added to both business processes and organizational mechanisms [45]. It would appear that challenges associated with coordination in the virtual context can be associated with differences in member location, work cycle synchronicity, and culture.

Therefore, one definition of virtual organizations would suggest that organizational structures are virtual when producing work deliverables across different locations, at differing work cycles, and across cultures. The location dimension addresses virtual member proximity as tasks are performed [17]. Colocation of members enables informal discussion of work to occur and facilitates face-to-face communication. Remote location of virtual members requires the integration of communications technology and other mechanisms to support the segregated nature of work. Interestingly, remote locations are most frequently thought of as outside a specific building, city, or even country. However, proximity effects reducing communication frequency have previously been found for relatively short distances (100 yards) and across different floors of the same building [1, 26].

Similarly, the work cycle reflects the degree to which team interactions are synchronous versus asynchronous. If all team activity is performed synchronously, there is little if any ambiguity regarding what and how activities

were accomplished. If work is performed asynchronously, there may be additional time and communication required to provide members of the virtual team an understanding of the various facets of the work [3].

Finally, the cultural dimension addresses the degree to which virtual members share values and beliefs regarding their work [42]. Cultures tend to be more similar within functional areas and/or companies than across companies. However, in some instances, similar organizations may have greater congruence in culture than differing business units or functions within the same organization [41].

At any instant in time or for a specific organizational activity, each of the three dimensions of virtualness can be viewed as dichotomous. For example, [17] identify appropriate communication media to support team activity based on same versus different team locations and synchronous versus asynchronous timing. However, when team activity is examined longitudinally, a variety of interaction types and communication media are used to facilitate the completion of work [11]. Therefore, when examined over time, each of the three dimensions of virtualness is really continuous in nature and should be evaluated across a continuum.

For example, the work cycle should be examined as the degree to which organizational or team interactions occur synchronously versus asynchronously. Location interactions can be assessed on the degree to which virtual members were located in neighboring offices, within the same building, campus of buildings, metropolitan area, geographic proximity, or country. Finally, culture can be examined based on the degree to which members share values and beliefs regarding how work should be conducted (see Figure 1). The traditional, colocated, single firm team performing well-defined work (such as an accounting or payroll function) defines the first quadrant in Figure 1. This quadrant might also include a team with multiple firms represented, for example an outsourced function such as payroll. A team with less synchronized work, members from across departments, in a colocated environment (a cross-functional project such as workflow design) occupies the second quadrant in Figure 1. Teams with members stationed at remote sites from a variety of organizations and functions working asynchronously (such as multiple partners focusing on new product development initiatives) define the third quadrant in Figure 1. The final quadrant, with remote teams working synchronously is less likely to occur. Examples might be advertising or promotion teams working remotely on developing campaigns. These projects might involve a single or multiple firms. This quadrant will increase in

the future as technologies become available to support ongoing connections between remote locations. The model reflects the dynamic nature of teams, as they have the potential to change position over time, as the work, membership, and locations change in response to organizational needs.

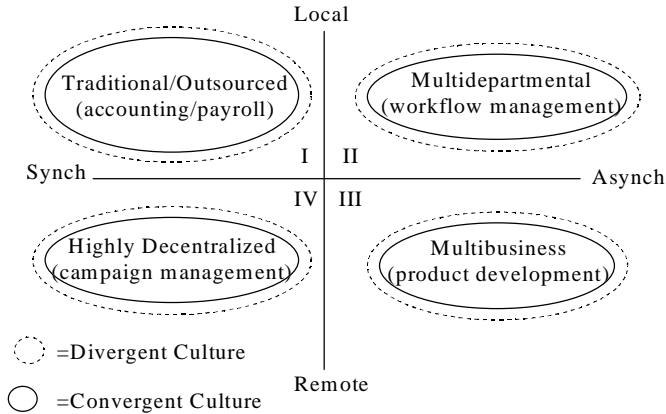


Figure 1. Multidimensional map of virtualness

2.1 Virtual Teams

Virtual organizations appear in various forms across the organizational landscape [27] including newly formed temporary organizations, virtual teams, and virtual project groups [35]. Each virtual form is likely to play a different organizational role and have different support and control needs [5, 28]. The virtual form most broadly implemented across organizations is the virtual team.

Virtual teams exist within and across organizations exhibiting relatively permanent structures with fluid membership [7]. Team focus is typically on a specific task output and information technology is often necessary for disseminating and collaborating on information related to work deliverables [15]. In addition, virtual teams overlay across the authority structure of the organization as members will have permanent physical homes as well as “psychological” virtual homes.

One type of virtual team is made-up of individuals from the same parent organization, representing different functional areas or strategic business units (SBUs). In some cases, team members are housed in different locations and time zones, and while reflecting the parent organizational culture, often reflect the sub-culture of the specific department or SBU. In addition, members of a team that cross international boundaries are likely to embody the culture of the country in which the members are located. Another example is a teleworking team, operating in the same functional area, but using communications technology to connect the team members [18].

Intra-organizational teams frequently are created to tackle business process reengineering initiatives [40] and product development [10]. Typically, these intra-organizational teams differ in culture across functional and horizontal links in an organization making interactions more difficult [5].

Communication within virtual organizational forms increasingly needs to be supported by information technology [11, 17]. Therefore, we not only need an understanding of the location, work cycle, and cultural issues influencing virtual teams, but also an understanding of the communication processes and the variety of information technologies used to develop and sustain these virtual teams.

The role of communication processes within and across organizations has been tightly linked to organizational structure [8, 22] and communication media choice and effectiveness [8, 9]. These two concepts are implicitly linked due to the fact that the structure of an organization can preclude or facilitate the use of a certain media. For example, members of a team that are not co-located must rely heavily on communication media for transmitting and sharing information to take the place of face-to-face interactions.

2.2 Task/Media Fit

Communication technologies have provided organizations and individuals with a myriad of tools through which to exchange information. More traditional communication media such as face-to-face, textual documents, and telephone communication have been supplemented with electronic media including video-conferencing, electronic mail, electronic posting of information, and electronic document and file sharing.

Prior research has compared communication effectiveness across various types of media, predominately focusing on the way in which non face-to-face media compares to face-to-face interaction [13, 23]. The results of this early research suggest that different media can affect communication processes and effectiveness differently. However, researchers concluded that the specific influence of a given media on the nature of the communication is dependent on the task that is being performed [8, 33, 37].

The relationship between task type and technology has been explained and widely applied in Media Richness Theory (MRT) [8]. MRT purports that task performance is enhanced when a specific medium’s ability to convey information is closely related to the task being undertaken. Media are assessed along a richness continuum, where rich media have greater language variety, more cues, greater personalization, and more rapid feedback.

[33] suggest that media characteristics should be matched to the task types characterized by [31]. [31] describes five task types which involve increasing degrees of team member convergence: 1) idea generation, 2) intellectual tasks, 3) tasks with a correct answer, 4) judgment tasks, 5) and negotiation tasks. Tasks requiring little need to reach convergence (e.g., idea generation) are best supported by lean media (e.g., computer-mediated systems) while tasks requiring more convergence among team members (e.g., negotiation tasks) are best supported by rich media (e.g., face-to-face communication) [33].

Empirical results examining the issue related to task/technology fit suggest that fit alone does not explain technology choice [21, 37, 43, 44]. Some technology-related issues have been identified such as the need for a critical mass of users [29], media availability [39, 48], and technical ability to use a medium [24]. The social context in which communication is carried out plays an important role in explaining media choice [30, 38, 47].

2.3 Social Context

The concept of task/media fit has intuitive theoretical appeal and yet has not demonstrated consistent empirical support. [30] suggests that task/media fit is an appropriate frame-of-reference from which to examine communication processes and effectiveness, but does not totally capture the events that take place. She discovered that the rationale behind using a specific media channel was more complex than matching the media channel to the type of task being performed.

[32] has proposed Time, Interaction, and Performance Theory—(TIP) as a means of examining groups within the social and organizational systems in which they are embedded. TIP theory suggests that group activity represents three different functions that occur simultaneously as group members work together: 1) production, 2) member-support, and 3) group well-being. Therefore, TIP theory provides an initial means of linking together both the task and social context which together influence media choice.

3. Model Development

As described in Figure 2, the interaction between task/media fit and social context influences team communication effectiveness. However, when virtual teams are considered, the work cycle synchronicity, location, and cultural differences are likely to influence the social context of the team and perceptions of task/media fit.

For example, individuals who make-up virtual teams have fewer opportunities to engage in face-to-face contact with their teammates, therefore encouraging team members to use other forms of communication media to facilitate information sharing. Teams characterized as

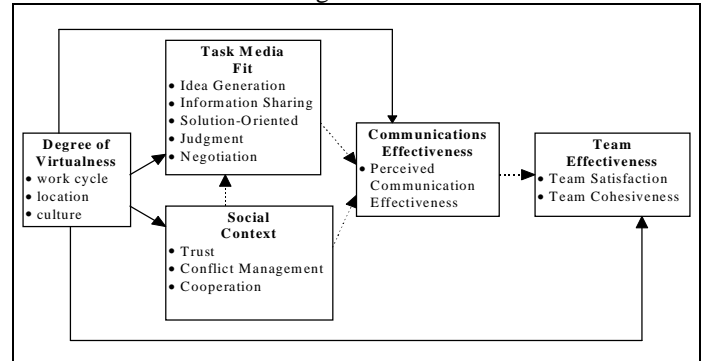


Figure 2. Virtual Teams and Communication

highly virtual are likely to rely on non face-to-face media channels to share information and develop within-group social interactions. These teams must find mechanisms to work around the typically preferred face-to-face communication used to initially build team relationships and communicate highly equivocal information.

Similarly, members of virtual teams are less likely to directly interact with one another and function without a cohesive social context. Team members may be separated physically, culturally, and working asynchronously providing limited time and opportunity to develop social norms or relationships.

We are interested in which technologies are used to support specific work activities and how the use of these technologies differ as teams become more virtual. Task/media factors would suggest that highly equivocal discussions would be supported using the most rich media possible. Excluding face-to-face meetings, video and phone conferencing should be the most likely substitutes. In face-to-face meetings, participants are able to provide detailed descriptions using a variety of symbols facilitating information sharing. To supplement this rich variety of symbols, virtual groups are likely to increase their use of idea and document sharing using electronic media such as bulletin boards and groupware to get information to team members rapidly.

RQ1: Are there differences in communication media usage between more and less virtual teams?

TIP Theory [32] suggests that there are three different group functions which need to be supported on an ongoing basis. One of those functions, member-support addresses the social relationships which develop between group members. In a less virtual team, group members have frequent opportunities to informally meet throughout the work day initiating the development of

social relationships. However, in a more virtual team, there are fewer opportunities for face-to-face interaction.

RQ1A: Are there differences in the perception of the social characteristics of the media between more and less virtual teams?

As membership of teams becomes more virtual, team members are likely to report to different managers or even different organizations. Members' choice of media may be influenced by locational constraints, the degree of synchronicity of the work process, and the cultural norms, or lack of same.

RQ2: Are there differences in perceptions of social context between more and less virtual teams?

MRT is predicated on the notion that individuals are able to identify highly equivocal situations and select a medium that is high in richness. Individuals may gravitate to groupware products to provide "rich" document sharing or rely on video-conferencing to increase the types of cues communicated across the medium. On the other hand, team members may find ways to adapt email and voice mail communications to more explicitly address the situation equivocality.

RQ3: Are there differences in task/media fit between more and less virtual teams?

Regardless of the mechanisms to enhance communication, it is likely that teams characterized as highly virtual will exhibit lower perceived communication effectiveness over that of non-virtual teams. These virtual teams may produce results equal in quality to non-virtual teams, but require more time to establish effective processes. In addition, these virtual teams would likely need more time and effort to develop effective work processes and communication flows.

RQ4: Are there differences in perceived communication effectiveness between more and less virtual teams?

Enhanced communication effectiveness should result in increased team effectiveness. This increased effectiveness could be seen both in objective performance measures as well as team member perceptions regarding team cohesiveness and satisfaction.

RQ5: Are there differences in team effectiveness between more and less virtual teams?

4. Research Method

To examine our virtualness framework and research questions, a field study within a single organization was conducted to investigate the differences in communication media choice and effectiveness between less and highly virtual teams. Although examining communication processes across teams within a single

site limits generalizability, it provides some additional control over environmental differences between organizations.

Multiple methods were used to collect data regarding team communication processes. These data methods included a combination of anecdotal case studies, interviews, surveys, and communication logs with the CIO, team leaders, and team members.

4.1 Site Selection and Description

In order to assess teams with varying degrees of "virtualness", we identified an organization housing multiple independent, yet related divisions that operate across multiple locations. Koch Industries International is the second largest privately held company in the United States, with revenues over \$28 billion. In North America, the firm has 14,000 employees housed across ten separate business units. A hallmark of the Koch business approach is the use of Market-Based Management (MBM) principles espoused by CEO Charles Koch. MBM results in a pervasive culture and includes an underlying premise that teaming within and between the business groups creates positive synergy, while permitting the businesses to retain their autonomy [14].

With respect to communication technology, Koch personnel have electronic and voice mail capabilities as well as Lotus Notes groupware products. In addition, 4000 employees make use of Microsoft Schedule+ to facilitate and plan meetings. The corporate culture encourages meetings, which include face-to-face encounters as well as videoconferencing.

4.2 Instrument Design

Three instruments were used to collect data on different teams within the organization. All team leaders completed a "team background" instrument which was followed up by unstructured interviews. The team leader provided contextual information regarding the length of time the team had been in existence, the purpose of the team, performance evaluations, etc.

The survey queried team members about their role and longevity with the team, which communications media were available to the member, media choice preferences [30], team cohesiveness [6], trust [4], task interdependence [4], heterogeneity [4], group cooperation [4], perceived communication effectiveness [20], conflict management [34], and team satisfaction [46].

Members of two teams maintained a communication log over a two day period [19]. Each team member was asked to keep track of all team communications received and sent during that two day time frame. The following

information was also captured regarding each communication: 1) ongoing or new communication, 2) location from which the communication was received or sent, 3) communication media used, 4) purpose of the communication [31], and 5) the task activity [33].

5. Results

Three different Koch Industries teams were examined. Initial descriptions of the teams are provided below and each team is mapped into the model developed previously based on the degree of team virtualness (Figure 3). This is followed by a presentation of the findings related to each of the five research questions.

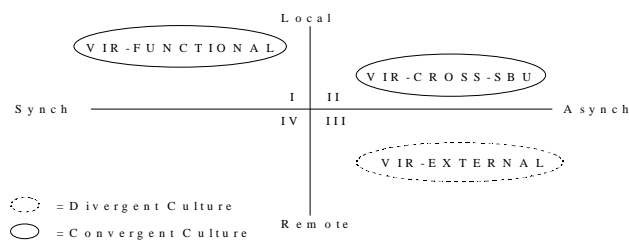


Figure 3. Virtualness map of responding teams

The three Koch teams investigated were distinct from each other on at least one of the three dimensions of virtualness: synchronicity of work, location, or culture. A brief description of the teams follows:

1. **VIR-FUNCTIONAL:** A colocated internal information technology (IT) team. All members report to the same manager. All are Koch employees. Work is highly technical, synchronized application development. Team has 15 members.

2. **VIR- CROSS-SBU:** A virtual internal IT team, reporting to many different Koch managers. Located in same building, but across multiple floors. Work involves variety of asynchronous and synchronous technical development work. Team has 10 members.

3. **VIR-EXTERNAL:** A project development team including an outside vendor, internal Koch IT and controller staff. Located across three locations, two within the same building. Work involved substantial asynchronous project lifecycle tasks in developing an accounting information system. Team has 3 members.

Table 1. RQ1A: Preferred Media for Specific Situations by Team. Pearson Chi-square

Specific Activities	Production Situations			Admin-Coord Situations			Social Situations		
	Chi-sq	df	p value	Chi-sq	df	p value	Chi-sq	df	p value
Casual or informal	20.24	10	.03	21.92	12	.04	28.36	10	.002
Solicit input on draft	10.58	6	.10	18.24	4	.001	6.79	6	.15
Keep someone informed	11.71	6	.07	2.74	4	.60	4.32	6	.36
Communicate same thing to many	13.37	8	.10	15.20	8	.06	10.77	6	.10
Show authority, status, prestige	18.86	12	.09	13.03	10	.22	9.87	10	.45

Members of all three teams completed the survey instrument and members of the VIR-FUNCTIONAL and VIR- CROSS-SBU teams completed communications logs. A total of 25 individuals identified 768 individual communications. Of those, 533 were from VIR-FUNCTIONAL and 235 from VIR- CROSS-SBU. Team members entered all received and sent communications into their log books. To ensure that communications between two team members are not “double-counted”, only communications sent by each team member are included in the analysis. As this was an exploratory investigation of the research questions, a significance level of .10 was used.

5.1 Media Use

Chi-square analysis was used to assess any differences in media usage across the three teams. No significant overall effect regarding choice of media was found ($p = .23$) when examining all media used. However, when the five top media were selected (96 % of total media used) based on usage in this sample, the VIR-EXTERNAL team showed significantly more use of email ($p = .08$), and the VIR-FUNCTIONAL team demonstrated significantly more use of voice mail ($p = .05$). There was no significant difference between VIR-FUNCTIONAL and VIR- CROSS-SBU on media usage.

Respondents were also asked to identify the media of choice across hypothetical situations for media usage in production, administrative/coordinating, and social activities (see Table 1). The results identified significant differences in the perceptions regarding media selection to support casual or informal communication in all situation types (production ($p=.03$), administrative ($p=.04$) and social ($p=.002$)). The VIR-FUNCTIONAL team perceived the phone and face-to-face conversations to be most effective for communicating while the VIR-CROSS-SBU team preferred to use email when performing casual social, production, and administrative tasks. The VIR-EXTERNAL team would prefer to use electronic bulletin boards for communicating social, production, and administrative task information. The preferred communication mode for communicating social information was face-to-face interactions.

Respond to straightforward telephone message	2.11	4	.72	3.16	4	.53	11.23	4	.02
Influence, persuade, sell ideas	4.53	6	.60	3.15	4	.53	12.35	6	.05

There was also a significant difference between team's perceptions regarding the use of media to communicate the same information to many people (production (p=.10), administrative (p=.06), and social (p=.10)). All teams preferred email as a primary means to share information to multiple recipients across task types. The VIR-EXTERNAL team would choose to supplement these communications by using electronic bulletin boards while the VIR- CROSS-SBU team preferred electronic document sharing.

When performing production activities, there was a significant difference between team's perceptions when soliciting input on a draft document (p=.10), when keeping someone informed (p=.07), and when wanting to show prestige (p=.09). For each of these production task activities, the VIR-EXTERNAL group would prefer to use the telephone to communicate with team members.

There were also significant differences in perceptions of the media selected regarding administrative situations when soliciting inputs on a draft document (p=.001). The VIR-EXTERNAL team would prefer to use memos while the other two teams preferred to use email. Finally, there were significant differences in preferred media use when responding to a straightforward social phone message (p=.02) and when wanting to influence an idea which was social in nature (p=.05).

5.2 Social Context

Social context consisted of several dimensions, including cooperation, conflict management, and trust. Given the unequal number of responses for each team, the relationship between team virtualness and each social context construct was assessed using Kruskal-Wallis Anova (see Table 2). Teams exhibited significant differences on all three aspects of social context measured where VIR-EXTERNAL demonstrated significantly lower levels of cooperation (p=.08), conflict management (p=.01), and trust (p=.09), as compared to teams VIR- CROSS-SBU and VIR-FUNCTIONAL.

5.3 Communication and Team Effectiveness

Communication effectiveness was measured using a single four item construct measuring group member perceptions of communication effectiveness. Kruskal-Wallis Anova was used to detect differences between teams. The results of this analysis indicate that there are no significant differences between the three teams (p=.27).

Team effectiveness was measured using two perceptual measures—team satisfaction and team cohesion. Kruskal-Wallis Anova was used to assess differences between the teams. From this analysis, team satisfaction was marginally significant (p=.10) while team cohesiveness was not significant (p=.57). It appears that the VIR- CROSS-SBU team felt the greatest degree of team satisfaction while the VIR-EXTERNAL team felt the least amount of team satisfaction.

5.4 Task/Media Fit

Relationships were investigated between team, media and communication purpose. In addition, team and media were also investigated with each of the task types independently. Log-linear analysis was used to assess this relationship and results are presented in Table 3 (note that a specified model is significant if $p > .10$). Log-linear analytical techniques are used when there are more than two variables of interest and they are all categorical in nature. Log linear analysis tests each variable and the various interactions which can occur to find the linear model which best fits the observed frequencies in the data. Once the best model fit is identified, each non-significant interaction is removed from the model to provide the most parsimonious model to explain the data frequencies.

As presented in the table, the log linear analysis between team, media, and purpose suggests that the model with the best fit involves an interaction between team and purpose (p>.475). It appears that the VIR-FUNCTIONAL team makes use of telephone conversations for social interactions while the VIR-CROSS-SBU team does not.

Table 2. Team Comparisons on Social Context, Communication Effectiveness, and Team Effectiveness (Means of Constructs (1= strongly agree to 7=strongly disagree) by Team, Kruskal-Wallis ANOVA by ranks)

Question		Team 1 n=15	Team 2 n=10	Team 3 n=3		
	Constructs	Mean (SD)	Mean (SD)	Mean (SD)	Kruskal-Wallis	p-level
RQ2	Cooperation	2.21 (.71)	2.37 (.78)	3.67 (1.20)	5.13	.08
RQ2	Conflict Mgmt	3.75 (.70)	3.18 (1.06)	4.93 (.11)	8.43	.01

RQ2	Trust	3.42 (.91)	3.32 (.91)	4.67 (.63)	4.75	.09
RQ4	Commun Effective	3.24 (1.34)	2.93 (1.25)	4.44 (1.07)	2.64	.27
RQ5	Group Satisfaction	3.49 (1.06)	2.98 (.89)	4.60 (.53)	4.68	.10
RQ5	Cohesiveness	2.54 (1.24)	2.81(1.55)	2.72 (.25)	1.13	.57

Table 3. RQ3: Log-Linear Analysis Examining Team Virtualness and Task/Media Fit

Best Model (as determined by the automatic model function)	Maximum Likelihood Chi-Square	df	p-value
Team X Purpose, Media	19.725	20	.475*
Team X Idea Generation, Media	11.065	8	.198*
Team X Information Sharing , Media X Information Sharing	13.770	8	.088
Team X Solution Orientation, Team X Media	15.105	8	.059
Team, Judgment, Media	16.556	13	.220*
Team, Negotiation, Media	15.743	13	.263*

* Model significantly fits the data if $p > .10$ Effects are eliminated if their significance $p > .05$ Delta = .05 for all analysis Overall, there is very little social interaction among members of VIR- CROSS-SBU

Similarly, there was a significant interaction between team and idea generation in explaining the frequency of media use ($p > .198$). The VIR- CROSS-SBU team makes greater use of both informal face-to-face meetings and formal meetings to accomplish idea generation than their counterparts in the VIR-FUNCTIONAL team.

The log-linear analysis could not determine a model which significantly fit the frequency data for either the information sharing ($p > .088$) or solution-orientation ($p > .059$) tasks. Finally, the frequency of media usage associated with both the judgment ($p > .220$) and negotiation tasks ($p > .263$) were explained as strictly main effects from the three variables with no interaction influence.

6. Discussion

The findings suggest only moderate differences in actual media use, when comparing the VIR-EXTERNAL which used significantly more email and VIR-FUNCTIONAL significantly more voice mail. The teams have most of the same media available, but some differences in the perceptions regarding media use in hypothetical situations does emerge. These differences are most significant in the casual or informal interactions and communicating the same information to many people supporting production, administrative and social situations. They differ to a lesser extent on keeping others informed, soliciting input on draft documents, and influence and persuasion. Teams that are more virtual appear to understand the functionality in recently developed communication technologies. This may be due to their use of this technology or their understandings of the functionality required to support a virtual team.

Although these were hypothetical situations, these findings suggest perceptual differences in some

communication processes (across all three purposes) associated with differences in team virtualness. The findings suggest that VIR- CROSS-SBU and VIR-EXTERNAL perceive differences in the media, preferring email and voice mail over the use of face-to-face and telephone as compared to team VIR-FUNCTIONAL. Similarly, VIR- CROSS-SBU and VIR-EXTERNAL would choose to use electronic media for non production related activities, including substantially greater use of electronic media for administration and coordination activities, but also for social interaction.

These work situations begin to identify elements of communication processes that make up the cultural milieu. The VIR-EXTERNAL team initiated team interactions with several face-to-face meetings to establish system specifications. The consulting firm quickly developed a rapport with members of the business unit, but the internal IT group was less attuned to the specific business needs and the non-technical information used by the business unit. E-mail and Lotus Notes communication technologies provided continued support for project management.

Team virtualness does appear to be associated with differences in social context. Significant differences on the social constructs of cooperation, conflict, and trust suggest a strong need for additional team development activities for effective virtual teams. In VIR-EXTERNAL, communication between consultants and the business unit was informal. The lack of alignment in incentives and information asymmetry might explain the low levels of trust, cooperation, and problems in conflict management experienced by the VIR-EXTERNAL team.

The lack of significant differences between teams regarding perceived communication effectiveness, the significant differences on key social context issues, and the significant differences on team effectiveness suggest the need for social context to be addressed more successfully in planning for virtual teams. Overcoming

divergent cultures on virtual teams appears to require not only supportive communication technologies, but group process improvements to address the social context concerns.

7. Conclusion

Although the generalizability of the study is limited, focusing our sample in a single location allowed us to better control some of the location, work synchronicity, and cultural differences when comparing teams. Although our communication log provided a rich data set from which to examine communication processes, there may be differences in communication processes and media choice based on the length of time the team has been together and/or specific deliverables and deadlines which might have occurred during data collection. Collecting data longitudinally would enable us to address this issue.

The findings, if replicated in other settings, provide a startup point in suggesting a set of communication processes that are associated with increasing degrees of team virtualness. This includes the need for greater attention to social context, particularly in light of the poorer team effectiveness exhibited by the more virtual team (VIR-EXTERNAL) in this study. The use of non face-to-face media across a variety of work situations (production, administrative, and social) and task types (idea generation, information sharing, solution orientation) suggest a need for attention to processes that support work in a more virtual environment through both communication media as well as improved team processes.

The virtual team, in our study, exhibited to a greater degree than the nonvirtual team more work asynchronicity, more work tasks completed while distant with other team members and a more heterogeneous cultural climate. Work asynchronicity has resulted in the use of communications technologies to support group members.

It would appear the divergence in locational proximity in virtual teams also demands support from communication technologies. Whether replicating existing physical analogs, such as staff meetings, “water cooler” conversations, or informal social contacts, the communications media must provide opportunities for these processes. The results from this study suggest that team members who are operating in a more virtual context perceive email as a tool to further social exchange. In addition, the communication data associated with the sample under investigation suggests that telephone conversations were used to supplement social interactions which would take place in a colocated environment.

Cultural climate in virtual organizations has been routinely included in the virtual organizational concept as the positive alliance of core competencies at the organizational level. At the implementation level, incarnated in a group of individuals from different organizational or functional backgrounds, the issues of personal incentives, decision rights, level of shared understanding, and willingness or ability to share potentially sensitive information makes for a delicate communication and management process. As the results from this exploratory study suggest, social context variables appear to be exacerbated by increased degrees of virtualness. Better definition of these variables is needed in future research.

Finally, the three dimensions of virtualness (location, synchronicity of work, and culture) also suggest the potential for coordination costs as overhead to the virtual organizational design. Our findings suggest that there are significant differences in the social context in which teams operate. It would appear that more virtual teams cannot merely focus on task or even the “best” technology to support a task, but must have a strong processual focus to achieve team effectiveness.

References

1. Allen, T.J. (1977), *Managing the Flow of Technology*, Cambridge, MA: MIT Press
2. Barnatt, C. (1995), “Office Space, Cyberspace and Virtual Organization,” *Journal of General Management*, 20, 4, Summer, 78-91.
3. Barry, B. and T.S. Bateman (1992), “Perceptions of Influence in Managerial Dyads: The Role of Hierarchy, Media, and Tactics,” *Human Relations*, 45, 6, 555-574.
4. Campion M.A., G.J. Medsker, and A.C. Higgs (1993), “Relations between work group characteristics and effectiveness: Implications for designing effective work groups”, *Personnel Psychology*, 46, 823-850.
5. Chesbrough, H. W. and D. J. Teece (1996), “When is virtual virtuous?” *Harvard Business Review*, Jan-Feb, 65-73.
6. Chin, W.W., W.D. Salisbury, A. Gopal (1997), “Perceived cohesion in groups: a confirmatory factor analysis of the dimensions of belonging and morale,” *AIS Proceedings*
7. Cohen, S.G. (1993), “New approaches to teams and teamwork,” In J.R. Galbraith and E.E. Lawler (Eds) *Organizing for the Future*. San Francisco: Jossey-Bass, 194-226.
8. Daft, R.L. and R.H. Lengel (1986), “Organizational Information Requirements, Media Richness and Structural Design,” *Management Science*, 32, 554-571.
9. Daft, R.L., R.H. Lengel, and L.K. Trevino (1987), “Message equivocality, media selection, and manager performance: implications of information systems,” *MIS Quarterly*, 355-366.
10. Davidow, W. H. and M. S. Malone (1992), *The Virtual Corporation*, New York: Harper Business.

11. DeSanctis, G. and Jackson, B.M. (1994), Coordination of information technology management: team-based structures and computer-based communication systems, *Journal of Management Information Systems*, 10, 4, 85-110.
12. Dess, G. G., A. M. A. Rasheed, K. J. McLaughlin, and R. L. Priem (1995), "The New Corporate Architecture," *Academy of Management Executive*, 9, 3, 7-17.
13. Fowler, G. and M. Wackerbrith (1980), "Audio teleconferencing vs face-to-face conferencing: a synthesis of the literature," *Western Journal of Speech Communication*, 44, 236-252.
14. Gable, W. and J. Ellig. (1993), *Introduction to Market Based Management*, Center for Market Processes.
15. Galbraith, J.R. (1995), *Designing Organizations: An Executive Briefing on Strategy, Structure, and Process*. San Francisco: Jossey-Bass Publishers.
16. Goldman, S. L., R. N. Nagel and K. Preiss (1995), *Agile Competitors and Virtual Organizations: Strategies for Enriching the Customer*, New York: Van Nostrand Reinhold.
17. Gray, P. and M. Igarria (1996), "The Virtual Society," *ORMS Today*, December, 44-48.
18. Harrington, S.J. and C.R. Ruppel (1996), "The Contingency Effect of Organization Size on Programmer/Analyst Telecommuting," *Proceedings of the 1996 ACM SIGCPR/SIGMIS Conference*, Denver, CO, 234-243.
19. Hinds, P. and S. Kiesler (1995), "Communication across boundaries: work, structure, and use of communication technologies in a large organization," *Organization Science*, 373-393.
20. Hoevemeyer, V.A. (1993), "How effective is your team?," *Training and Development*, 47, 9, 67-71.
21. Hollingshead, A.B., J.E. McGrath, and K.M. O'Connor (1993), "Group task performance and communication technology: A longitudinal study of computer-mediated vs. face-to-face work groups," *Small Group Research*, 24, 3, 307-333.
22. Huber, G.P. (1990), "A theory of the effects of advanced information technologies on organizational design", *Academy of Management Review*, 15, 1, 47-71.
23. Johansen, R., J. Vallee, and K. Spangler (1979). *Electronic meetings: Technological alternatives and social choices*, New York: Academic Press.
24. King, R.C., A. Hartman, and K. Hartzel (1992), "Message creation versatility, media capacity, and media choice: A forward looking perspective", *Proceedings of ICIS*, Dallas, TX, 257.
25. Kinlaw, D.C. (1991), *Developing Superior Work Teams: Building Quality and the Competitive Edge*, San Diego, CA: Lexington Books.
26. Kraut, R., C. Egidio, and J. Galegher (1990), "Patterns of contact and communication in scientific research collaborations," in J. Galegher, R. Kraut and C. Egidio (Eds.) *Intellectual Teamwork: Social and Technological Foundations of Cooperative Work*, Hillsdale, NJ: Lawrence Erlbaum, 149-172.
27. Lucas, H. and J. Baroudi (1994), "The role of Information Technology in Organization Design", *Journal of Management Information Systems*, 19, 4, 9-23.
28. Malone, T.W. and J.F. Rockart (1993), "How will information technology reshape organizations? computers as coordination technology." In: Bradley, S.P., Haisman, J.A. and Nolan, R.L. (Eds.) *Globalization, Technology and Competition: The Fusion of Computers and Telecommunications in the 1990s*, Boston: Harvard Business School Press, 37-52.
29. Markus, M. L. (1990), "Toward a 'Critical Mass' Theory of Interactive Media" in Fulk, J. and C. W. Steinfield (Eds.) *Organizations and Communications Technology*, Thousand Oaks, CA: Sage.
30. Markus, M.L. (1994), "Electronic Mail as the Medium of Managerial Choice", *Organization Science*, 5, 4, 502-526.
31. McGrath, J.E. (1984), *Groups: Interaction and performance*, Englewood Cliffs, NJ: Prentice-Hall, Inc.
32. McGrath, J.E. (1991), "Time, interaction and performance TIP: A theory of groups," *Small Group Research*, 22, 2, 147-174.
33. McGrath, J.E. and A. B. Hollingshead (1993), "Putting the "group" back in group support systems," In *Group Support Systems: New Perspectives*, L.M. Jessup and J.S. Valacich (Eds.), New York: Macmillan, 78-96.
34. O'Reilly, III, C.A. and K.H. Roberts (1977), "Task, group structure, communication, and effectiveness in three organizations," *Journal of Applied Psychology*, 62, 6, 674-681.
35. Palmer, J. W. (in press), "The Use of Information Technology in Virtual Organizations," in *The Virtual Workplace*, M. Igarria and M. Tan (Eds.), Idea Group Publishing.
36. Peters, T. (1992), *Liberation Management*, NY: Alfred Knopf.
37. Rice, R.E. (1992), "Task analyzability, use of new media, and effectiveness: A multi-site exploration of media richness," *Organization Science*, 3, 4, 475-500.
38. Rice, R.E. and C. Aydin (1991), "Attitudes toward new organizational technology: Network proximity as a mechanism for social information processing," *Administrative Science Quarterly*, 36, 219-244.
39. Rice, R.E. and D. Shook (1990), "Relationships of job categories and organizational levels to use of communication channels, including electronic mail: A meta-analysis and extension," *Journal of Management Studies*, 27, 2, 195-229.
40. Rockart, J. F. and J. E. Short (1991), "The Networked Organization and the Management of Interdependence"; in *The Corporation of the 1990s: Information Technology and Organizational Transformation*, M. Scott Morton (Ed.), Oxford University Press, 189-219.
41. Schein, E. (1992) *Organizational Culture and Leadership*, San Francisco, CA: Jossey-Bass.
42. Schein, E., (1990), "Organizational Culture," *American Psychologist*, 45, 2, 109-119.
43. Valacich, J.S., B.E. Mennecke, R. Wachter, and B.C. Wheeler (1995), "Extensions to media richness theory: A

- test of the task-media fit hypothesis,” *Organizational Behavior and Human Decision Processes*,
44. Valacich, J.S., D. Paranka, J.F. George, and J.F. Nunamaker, Jr. (1993), “Communication concurrency and the new media: A new dimension for media richness,” *Communications Research*, 20, 2, 249-276.
 45. Venkatraman, N. (1995), “The IS Function in the Virtual Organization: Who’s Wagging Whom?” *Panel 10 of the Sixteenth International Conference on Information Systems*, Amsterdam, December 10-13, 378.
 46. Wilson Learning Corporation (1986), *Team Interaction Profile*, Wilson Learning Corporation, WLC 014680, EngTip 2.0.
 47. Zack, M.H. and J.L. McKenney (1995), “Social Context and Interaction in Ongoing Computer-supported Management Groups,” *Organization Science*, 6, 4, 394-422.
 48. Zmud, R.W., M.R. Lind, and F.W. Young (1990), “An attribute space for organizational communication channels,” *Information Systems Research*, 1, 4, 440-457.