UNDERSTANDING VIRTUAL TEAM DEVELOPMENT PROCESS:
AN EMPIRICAL ANALYSIS AND A THEORETICAL MODEL

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UNDERSTANDING VIRTUAL TEAM DEVELOPMENT PROCESS

Abstract

In this paper, we develop an understanding of how virtual teams develop over time. We do so by inductively examining communication patterns of 12 virtual teams consisting of students drawn from two large North American universities – one located in the US and the other in Canada, engaged in semester-long systems analysis and development projects for actual clients located in Canada. Our analysis is based upon two influential streams of theoretical social science research: 1) Goffman’s interaction analysis, which helped us understand the micro-processes of communication taking place between members of a virtual team; and 3) Giddens’ structuration theory, which provided a meta-framework to help link the micro-level communication patterns with the more macro-structures representing the states in the development of virtual teams over time. Based on our inductive analysis, we propose a theoretical model to describe how virtual teams develop over time and discuss its implications for understanding the link between communication and collaboration. We also discuss implications of the model for the understanding of co-located teams more generally.

Key words: virtual teams, virtual team development, interpretive case studies, technology mediated communication, conversational analysis, structuration theory.

ISRL Categories: AI0102, AI0802, AJ, HA08
INTRODUCTION

Increasingly, teams have become an integral part of organizational life (Gersick 1988; Bettenhausen 1991). Recent trends in globalization and advances in telecommunications have increasingly led to teams, especially those involved in Information Systems Development (ISD), being temporally and geographically distributed (e.g., Jablin and Sias 2000, Sahay and Krishna 2000). These teams, which are popularly referred to as “virtual teams,” consist of geographically dispersed team-members who primarily interact using different information and communication technologies (ICTs) such as email, groupware, video, and computer-based conferencing systems to produce a deliverable that is evaluated as a team outcome (Furst, Blackburn, and Rosen 1999). Briggs, Nunamaker, and Sprague (1998) have observed that while the demand for virtual teams grow, “little is known on how to actually conduct team telework” (p. 11). We believe that a key question that needs to be addressed in order to conduct work in virtual teams effectively is -- how do these virtual teams develop over time? Given the body of knowledge we have accumulated on co-located teams through years of research and practice, it is also useful to ask ourselves how different is virtual team development from the development of co-located teams? Understanding the process of evolution of virtual teams using a social perspective allows us to interrogate what is behind this collective effort that creates synergy within the computer-mediated social body (Hansson 1999). Identifying specific tactics that appear to be effective in building and maintaining this collective competence/synergy over the period of the project is another important area of investigation.
Over the years, there has been much research towards understanding the development of co-located groups (Chidambaram 1989; Bales 1970; Tuckman 1965; Poole and Doelger 1986; Gersick 1988; McGrath 1991). Different relational and communication aspects of how co-located electronic groups evolve over time have also been reported (Finholt and Sproull 1990; Fulk and DeSanctis 1995; Huff, Sproull and Kiesler 1989; Kerr and Hiltz 1982; Hiltz 1988; Hiltz 1984; Walther 1992). More recently, empirical studies on virtual team interactions and performance have started to appear in IS literature (Knoll and Jarvenpaa 1998; Warkentin, Sayeed and Hightower 1997). Jarvenpaa and Knoll (1999) argue for the need to adopt a “developmental view” to understanding virtual teams.

According to Mennecke, Hoffer, and Wynne (1992, p.526), group development\(^2\) refers to “the degree of maturity and cohesion that a group achieves over time as members interact, learn about one another, and structure relationships and roles within the team.” Researchers have proposed different group development models (e.g., Bales 1970; McGrath 1991; Tuckman 1965) with contrasting assumptions (Gersick 1988). Research on temporally and spatially dispersed groups emphasize the importance of communication, including how relational intimacy that is as good as or better than traditional face-to-face group can be developed through repeated interactions (for example, Chidambaram 1996, Walther 1992, 1995, and Walther and Burgoon 1992). Different theories including social information processing (Chidambaram 1996; Walther

\(^2\) The reference here is to co-located groups. Also, we use the terms “group” and “team” synonymously in this paper.
Research has identified various complexities inherent in virtual teams in terms of trust relationships (Jarvenpaa and Leidner 1999), knowledge management, identity, and network building (Jackson 1999), communication, socialization, and collaboration skills (Jarvenpaa and Knoll 1998), and the relation between cohesion and satisfaction with the time-space separation of team-members (Warkentin, Sayeed and Hightower 1997). Given these complexities, virtual teams differ from co-located teams regarding how they should be managed over time (e.g., Lipnack and Stamps 1997). Also, there are some more meta-level characteristics in virtual teams that are similar to co-located teams, for example the need for members to communicate and collaborate with each other. This indicates a need for systematic empirical inquiry into what contributes to the effective development and management of virtual teams, as suggested by Briggs, et al. (1998).

As a starting point, it is useful to revisit the views expressed by Gersick (1988) regarding the state of the co-located group development literature, since the same observations seem applicable to the current understanding of virtual team development (informed to a large extent by the existing group development literature):

*Traditional [group development] models shed little light on the triggers or mechanisms of change or on the role of a group’s environment in its development. Both areas are of key importance to group development* (p. 9).

This gap in the literature may have arisen primarily because group development researchers have focussed on understanding either the micro-level team processes of group problem solving (e.g., through an examination of communication -- “rhetorical
form of group members’ talk” or “discovering the sequences of activities”), or the macro-level group structures of socialization (e.g., “dependency, control, and intimacy”) (Gersick 1988, p. 10). The interactions among micro and macro issues, and the context of group development have also been ignored in most prior studies of electronically mediated groups (Lea, O’Shea, and Fung 1995). A focus exclusively on one of the two levels (micro or macro) creates a dualism which Pentland (1992) criticizes in his analysis of studies on organizational knowledge where the attention is directed on the cognitive aspect of beliefs and perceptions or on the structural features of objects, structures, and routines. In the context of virtual teams, such a dualism leads to two key limitations:

1. An incomplete understanding of team development: While investigations regarding group dynamics exist at both the micro and macro levels, they are incomplete in themselves, as they do not tell us how these two levels relate with each other. A lack of understanding of the group dynamics at both the macro and the micro levels and the inter-relationship between the micro-macro levels further inhibits the identification of mechanisms (i.e., actions) and the contextual elements (e.g., norms) that play significant roles in a team’s development.

2. An unclear conceptualization of the notion of collaboration in teams in the literature, which appears to stem from the first issue. For example, it is unclear if communication is a necessary or a sufficient condition for collaboration, and what is the relationship between communication, collaboration and team development.

Pentland (1992) argues that limitations arising out of such a dualism can be addressed by a more situational approach that takes situations and not individuals or structures to be the most appropriate level for organizational analysis. Knorr-Cetina (1981) refers to this approach as “methodological situationalism.” In our study, we were interested in how members communicate in different virtual team situations, and how actions implied in their communication (i.e. communicative actions) can be related to team structure over
time. Such a situational perspective provides a “phenomenologically valid point of contact between the individual and the organization: The actions of members are always shaped to some extent by the situation they find themselves in” (Pentland 1992, p.529). Situated approaches are in line with existing context-based IS research which seek to describe mutual inter-relationships between the context and process of IS design and use in organizations (Walsham 1993). A situated approach, we thus argue, allows for a coherent understanding of communication, collaboration, team development, and how they mutually relate to each other. We extend existing literature on team interaction and development to advance the theoretical understanding of virtual team development. We do this by asking two research questions:

1. **What are different micro-level communicative actions in virtual team situations and how can they be analyzed?**
2. **How can micro-level communicative actions be related to the changing nature of macro-level structural properties of virtual teams over the course of a project?**

We address these research questions through an intensive empirical analysis of 12 virtual teams situations, which results in an inductively developed theoretical model that links the micro level of communication with the macro level team structure. This mutual linkage between the micro and macro levels is what we conceptualize as “virtual team development,” and our focus on the study of the “process of virtual team development” over time during the course of a systems development project. The key contribution of this paper is an empirically based model that describes the process of virtual team development and relates it to communication and collaboration in micro-level situations.

The theoretical model, although based on an empirical analysis of virtual teams, also has implications for understanding co-located teams. While the nature of communication and collaboration are different between virtual and co-located teams, the
broader conceptual framework of linking structure with communication and collaboration is fundamental in both settings. A careful examination of communication and structural characteristics in virtual teams due to differences arising from the temporal and spatial separation of members can sensitize researchers of face to face teams to key communication and team structural dynamics that they may have otherwise overlooked.

The rest of the paper is organized as follows. In the following section, we outline the theoretical approach. The next section contains the empirical description. Thereafter, we present the case analysis and model development. Finally, we discuss the theoretical implications, the practical implications, and some limitations of our work.

STUDY OF VIRTUAL TEAM DEVELOPMENT: THEORETICAL APPROACH

Our research is an inductively grounded interpretive case study (Walsham 1995) of the process by which virtual teams developed over a particular 14 week information systems development (ISD) project. While the analysis is primarily inductive, we draw upon social theory to sensitize us issues of importance, and to provide a conceptual lens for examining data. The metaphor of theory as language (Van Maanen 1989) allows us to interactively communicate between the worlds of our conceptual understandings and empirical data. We adopt an interactionist perspective to studying communication that Myers (1987, p. 251) argues finds “new life” in computer-based settings:

Missing has been the conceptualization of communication as a developmental process (Miller, 1977) highly dependent on social norms (Feldman & March, 1981) wherein meanings are continuously negotiated through symbolic interaction. Such an interactionist perspective finds new life in heavily interactive, computer-based media.

We draw on Giddens’ Structuration Theory to examine the analytical devices to recursively link micro-level communication with the macro-context of virtual team structural properties. Our approach is consistent with the more general concern (for
example, Conrad and Haynes 2000; Lea, O’Shea, and Fung 1995) of integrating “social action” (human communication) with “social structure” in the study of communication in non-deterministic ways. In the words of Conrad and Haynes (2000):

Symbolic acts are central to the constitution of organizational ‘reality’... Giddens’s duality of structure provides a process-oriented framework for scholars to explore the emergence, reproduction, and transformation of meaning systems and communicative interaction... The resulting perspective serves as a corrective to deterministic tendencies while not ignoring social structure or reducing it to ideation.

Our study is primarily informed by two streams of social theory: 1) *Interaction analysis* (Goffman 1959, 1967, 1983; Meltzer 1993) to understand the micro-world of communicative action of the virtual team-members; and 2) *Structuration Theory* (Giddens 1976, 1979, 1982, 1984) to link communicative action with virtual team structure, through a structurational process of “virtual team development.” The situational perspective offers a way to examine team members’ communicative performances and interpret structural characteristics of their teams, i.e. “discern what is distinctively organizational about their performances” (Pentland 1992, p. 529). Taken together, interactional analysis and structuration theory characterize virtual team members as knowledgeable agents and do not resort to purely cognitive or structural explanations of behavior.

**Micro level of communicative action**

Interaction analysis as popularized by the writings of Goffman (1959, 1983), helps us to analyze the patterns of communication between virtual team members. Interaction is treated as an “achievement amongst possibilities” (Pentland quoting

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4 The term “communicative action” is often associated with the work of Habermas (1984) of the Critical Social Theory tradition, which focuses on communication distortions. However, in this study, we use this term in a general sense to represent the action (e.g., impression management, calling upon higher authority, etc.) implied in a communication transaction (say, text in an electronic message).
Schegloff, p.530), something that is constructed and not given or pre-planned. A particular piece of communication cannot be understood without knowing what provoked it and what response it invokes. This pattern of interaction is termed by Goffman as the “interaction order” comprising of a set of interactional rights and obligations that are linked to both the micro level of personal identity and to the large-scale macro institutions such as family, education, and religion. Interaction analysis is an interdisciplinary method of studying interaction of human beings with each other and with objects in their environment (Jordan and Henderson 1994).

According to Silverman, “the world’s business gets done in talk and in conversation” (Denzin and Lincoln 2000, p. 640). This makes the analysis of conversations (i.e. communication) a powerful mode for comprehending how work is accomplished in a variety of contexts, especially in virtual team situations, where much of the conversations can be captured in secondary storage devices of computers, and analyzed later. In this study, we draw upon conversation analysis (Heritage 1984; Silverman 1993; Fairhurst and Putnam 2000), one of the traditions in which interaction analysis finds its roots, to understand the computer-mediated conversation between members of a virtual team. Two types of approaches to conversation analysis can be seen in the literature (e.g., Psathas 1995). One approach assumes pre-existing institutional circumstances to enclose interaction. For example, conversation between management and union members assumes a certain form of pre-existing relationship that is reflected in patterns of conversations. The second type assumes that the “context” is both a project and product of participants’ actions, and it is fundamentally through interaction that

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5 We use the terms interaction analysis and conversational analysis to represent the broad approach for analyzing social interaction (e.g., Goffman, 1959) and not as a specific structuralist methodology for
context is built, invoked, and managed (Correll 1995). In the words of Heritage, “participants build the context of their talk in and through their talk.” The second approach is appropriate to analyze virtual teams’ “talk” because members come together with no prior history, and evolve the context in the process of engaging in and making sense of their virtual interactions.

The literature on conversation analysis outlines a number of strategies utilized by participants in interactions -- turn-taking, patterns for handling conversational problems, utterance length (i.e., how long a participant holds the floor), adjacency pairs, and initiation and management of topics (Putnam and Fairhurst, 2000; Farnell and Graham 1998). In this paper, we focused on two strategies, turn-taking and dealing with conversational problems, because we found them to be directly relevant to virtual team situations. Below, we describe these concepts.

**Turn taking:** “Taking a turn” allows members to participate in an interactional exchange system (Jordan and Henderson 1994), mark the “speakers control of the floor” (Putnam and Fairhurst 2000), to define or negotiate “the situation” and respond to a particular piece of conversation (Goffman 1959; Scheff 1968). Giddens (1984) describes the importance of turn-taking to understand social life:

*Turntaking... expresses fundamental aspects of the nature of interaction. Moreover, turn-taking is one major feature of the serial character of social life, hence connecting with the overall character of social reproduction.*

To take turns in interaction, members have to be co-present. In co-located teams, this meant participants’ physical situatedness in time-space (Giddens 1984). In virtual teams, co-presence implies that the actors must be in the “perceptual field of the other” (Couch 1986, p. 115). We term this condition as “virtual presence” in which virtual team discourse analysis (e.g., Psathas 1995).
members share consciousness of each-other's presence (synchronously or asynchronously) through a combination of text, auditory, and visual contact.

In conditions of *virtual presence*, conversations need not always be "single-order" or sequential. Castells (1996) describes simultaneity and timelessness to characterize electronic mediated communication. An on-line chat refers to an example of a simultaneous conversation where both actors could be writing something at the same time. Multi-media technologies allows for a “timelessness” with “mixing of times in the media, creating a temporal collage, where not only genres are mixed, but their timing becomes synchronous in a flat horizon, with no beginning, no end, no sequence” (p. 462). Castells describes this “as the culture at the same time of the eternal and of the ephemeral” (p. 463). For example, e-mail offers people the capability to either reply immediately to a message or to set it aside to reply in the future, or not reply at all (Walsham 2001). The conditions of separation and mediation of ICTs make turn taking extremely complex and multi-faceted, and influenced by three conditions: *contents* of messages; *artifacts and documents* being exchanged; *technologies* in use.

*Contents* of messages carry a distinctive symbolism. Couch (1996) describes two kinds of *information symbols* --referential and evocative. *Referential symbols* may be seen to include “requests, invitations, instructions, order, and/or commands” (Putnam and Fairhurst 2000, p. 90) which help coordinate activities and tasks. For example, scheduling a video-conference meeting involves the use of referential symbols within a directive, in response to which a “turn” needs to be taken by members of the other side to confirm their presence in the session. An *evocative symbol* reflects “socio-emotional content” (e.g., Rice and Love 1987) such as a shared joke which allows members to
emote in unison and develop social solidarity through an interactional exchange (Couch 1996). Evocative symbolism can be embedded in particular characters of text, such as quotations (Baym 1996), or in animated and colorful icons. The intertwined use of evocative symbolism with directives can help minimize the “face threatening potential of directive use” (Putnam and Fairhurst 2000, p. 90).

Turn taking is also facilitated through the exchange of documents and artifacts since actors are expected to acknowledge receipt or respond with comments. Jordan and Henderson (1994) describe artifacts to be ubiquitously present in all human endeavors, and which generate problems, and provide resources for the solution of difficulties as they arise. Conversation analysis seeks to understand how activities and interactions around particular material objects engender and support social interactions between members. The process of jointly constructing, revising, completing documents (such as a requirements document in a systems development project), provides resources for participants to monitor the degree of agreement between members. In virtual teams, of special interest is the manner in which artifacts and documents are transmitted, to whom they are sent, how they are accessed and the clarity by which they can be interpreted by members. These objects serve as “territory markers” pointing to the responsibilities of persons and the time frames permitted to take the turns.

Technologies play a key role in defining who takes a turn and when. For example, whether the message is sent through the email or conferencing system can define whether the message is in the public or private domain. Anomalies become visible in the public

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6 We recognize, based on earlier work of scholars such as Wynn (1979), that work-related symbolism cannot be isolated from socially-oriented symbolism. However, Couch’s typology of referential and evocative symbolism, is used in this paper for analytic convenience in examining the nature of turn taking.
domain and draw in multiple expertise into processes of explanation and resolution. In the private domain the onus of responsibility for taking turn is limited to the person to whom the message was sent.

Turn taking could be done through other means, but we found the above three mechanisms to be most relevant to our virtual teams. Turn taking both reflects and enacts structure of the virtual team. For example, in a socially cohesive team messages could typically be sent to the public domain where one of the members would deal with that issue. In this process of taking a turn and dealing with the issue, the member would both reflect the socially cohesive nature of the team and also reinforce that structural characteristic. The “turn” as a basis to interpret team development is similar to Pentland’s (1992) concept of a “move” which described three kinds of turns taken by software technical support specialists in response to a customer call for help: respond to call; seek help from others; give the call away. In the manner by which this move was made, Pentland made interpretations about the nature and structure of organizational knowledge.

**Dealing with Trouble:** Anthropologists have since long focused on how people deal with trouble to develop insights on the unspoken rules by which activities are organized in particular social spheres, and the constraints of social interaction. A trouble can occur when a team member is perceived as contradicting, discrediting, or doubting an agreed upon norm of interaction. For example, trouble may arise because a member did not respond to an email within an agreed upon time period. Analysis of troubles leads to an understanding of the new kinds of opportunities that are opened up (or closed off) as a result, and how actors engage in the avoidance and repair of trouble.
Putnam and Fairhurst (2000) describe the use of *disclaimers* and *alignments* in conversations. *Disclaimers* serve as feedback strategies that aid in preventing conversational breakdowns. In virtual teams, disclaimers could be expressed through statements such as “I did not mean it this way” or “I am not an expert on this issue” to ease apprehensions of powerlessness arising from a lack of expertise about the technology or the project.

*Alignments* refer to corrections used by members to breakdown situations. For example, trouble arising from one person’s inability to use ICQ can lead to newer opportunities for other members to provide explanations to align the situation. A breakdown arising from a statement being misunderstood could lead to explanations by members on what they actually meant, and clarify the meaning of a prior turn, or the intention of the communicator (Putnam and Fairhurst 2000). Under cooperative conditions of teamwork, trouble may be repaired before it leads to a “breakdown,” and if breakdown actually occurs, a repair can still be possible. While in uncooperative settings, even a minor trouble may spiral into an irretrievable breakdown that is beyond repair. For example, a member expressing inability to use ICQ can lead to other team-members making an interpretation about his or her lack of seriousness to use the tool, leading to closure of other opportunities for collaboration.

In summary, the tradition of interaction analysis provides us with a set of concepts that enables us, from pieces of text (which we refer to as “communicative transactions”), to develop interpretations about “communication action” and the strategies used by members in communication. The two strategies that we have chosen are compatible with Silverman’s three guidelines on “how to do conversation analysis” (2000, p. 831):
1. Try to identify sequences of related talk (through the notion of turn taking and how and why they occur).
2. Try to understand how speakers take on certain roles and identities (by connecting turn taking to particular members and virtual team structures).
3. Look for particular outcomes in the talk (for example, trouble and repair)

Armed with an approach to understand micro-level communicative action, we turn our discussion to the macro-level of “participant structure.”

Macro level of virtual team development as participant structures

Participant structures in virtual teams (i.e. team structures) are composed of two dimensions of “participation” and “structure.” Structure refers to the domain of orderly and repetitive relationships amongst members and between members and technologies within the context of a project. “Participation” specifies the domain of the orderly phenomenon that is virtual teamwork taking place primarily through communication. Taken together, the concept of participant structure reflects both a collective and emergent level of analysis (Zimmerman and Boden 1991). It provides constraints on how members communicate; defining the medium that they use and also specific strategies for communication. At the same time, communication enacts structure. This ontological belief raises the key question of “how is micro-level communicative action constrained by structure and how through its enactment structural properties change over time?” The notion of “participation structure” from conversation analysis helps to theoretically understand structure while Giddens’ structuration theory provides us with the analytical devices to study the nature of macro-micro linkage.

Like Giddens (1979), we see structure to be manifested in structural properties of social systems including rules and resources that human agents use in their everyday interaction. Structure refers to more than just the formal characteristics of virtual teams – it may be seen as participants' "memory traces" regarding features of team work that are
persistent over certain periods of time. Seen in this perspective, *participant structures represent the rules and resources by which virtually present individuals share a common task orientation and attentional focus* (Jordan and Henderson 1994).

Drawing from the literature on co-located groups (Bettenhausen 1991; Mennecke, Hoffer and Wynne 1992), two aspects of structure are relevant for virtual team analysis—*production structure* and *social structure*. While these two aspects of structure are mutually inter-related and influencing each other, for analytical purposes they are discussed independently. *Production structure*, which relates to the rules and resources around how groups perform their production related functions, comprise of two dimensions: *task focus* which refers to the extent to which virtual team-members are focused on substantive project related issues; *task ability* which reflects the expertise of members to use technologies and achieve project objectives. Apart from specific task-related skills pertaining to ISD, a critical aspect of task ability, especially in the context of virtual teams, is captured in the notion of “communication competence” which, according to Jablin and Sias (2000) includes: 1) *technical skill* of “an understanding and ability to use computer-mediated communication systems to send and receive messages and to obtain, process, and interpret information” (p. 840); and 2) *behavioral skills* such as “altercentricism (empathy, listening, supportiveness, and other-orientation) and interaction management (including appropriate turn taking and episode punctuation)” (p. 822).

*Social structure* reflects the rules and resources that structure social interactions in particular ways, and is conceptualized through these five inter-related but analytically separable dimensions:
• *Virtual presence*, as discussed earlier, refers to the situation in which potential collaborators share consciousness of each other's presence through some combination of text, auditory, and visual contact (Couch 1989; Walther 1992). This translates to the extent to which team members are available on the electronic medium to engage in communicative acts with other members.

• *Social responsiveness*, according to Couch (1989), highlights the degree of reciprocity in the communication patterns among team-members. There are three levels of social responsiveness (listed in increasing order of desirability for cooperative action): *unidirectional responsiveness* refers to both sides showing a lack of social responsiveness to the other; *bilateral*, where the concerned individuals routinely act with respect to (or talk past) the other, without respecting the other’s goals and interests; *mutual*, when individuals involved routinely interact or converse with the other, that is, each party willingly surrenders a degree of autonomy to the other party, and “there is at least a minimal merger of self and the other” (Couch 1989 p. 52).

• *Shared goals* reflect the degree to which team members share the project objectives with other members of the team (McGrath et al. 1993). Formation of shared goals is a pre-requisite for future-oriented cooperative action (Couch 1989), especially where there is a high level of task-interdependence amongst the teams (Knoll and Jarvenpaa 1998; Huff, Sproull and Kiesler 1989; Hiltz and Wellman 1997).

• *Identity* is created and experienced through the “negotiation and co-construction” over “meanings and manners” among team-members interacting in a specific context (Wynn and Katz 1997). *Identity*, when congruent/shared, reflects the sense of oneness
amongst the members and the project at hand, irrespective of their own personal biographies or geographical locations (Couch 1989). Cheney and Christensen (2000) write that a shared identity allows organizational (team) members to “perceive themselves as part of a whole, autonomous, and anthropomorphic entity” (p. 246).

*The role of coordinators or facilitators*, which has been recognized as “a key element” to the success of computer-mediated teams (Griffith, Fuller, and Northcraft 1998, p. 21; Clawson, Bostrom and Anson 1993). In our context, it refers to the extent and manner in which the project coordinators were actively participating in and shaping patterns of interaction among the team-member.

**Linking the micro with the macro domain of virtual team development**

Baszanger and Dodier (1997) describe a key aim of a social science analysis is to connect the facts that s/he observes with the specific features of the backdrop against which these facts occur. They describe the process of generalization from in-situ studies as one of “totalization” carried out by integrating different observation sequences into a global referential framework. Knorr-Cetina (1981) describes this approach as “methodological situationalism.” In our study, the observation sequences were the interpretations of communicative action at the micro-level of 12 virtual teams as they exchanged electronic messages during the course of their project work. These interpretations were totalized in a conceptual framework in terms of “participant structure” including production and social structures. The linkage between the micro and macro levels over time is what we conceptualize as “virtual team development.”

Structuration theory provides a conceptual frame to reciprocally link the micro and macro levels. Through regular action, patterns of interaction become established as
standard practices in social systems that can be reified over time. Drawing on a
structurational perspective, Orlikowski and Yates (1994) describe communication as “an
essential element in the ongoing process through which social structures are produced,
reproduced, and changed” (p. 541). Giddens interrogates the linkage between the micro
and macro levels through the concepts of meaning, power, and norms. Meanings are
achieved via interpretative schemes (stocks of knowledge) that actors draw upon in
taking and making sense of their action. Power enters into human interaction by
providing capabilities to humans to influence outcomes mediated via the use of resources.

Norms are conventions and rules that define “appropriate” conduct in organizations
(Orlikowski 1992). The modalities of power, norms, and meanings are interrelated, for
example, actors can exercise power in communications to redefine existing interpretive
schemes (Mumby 2000). The recursive relationship between communicative action and
participant structure, and its mediation through norms, meaning, and power is
schematically depicted as our initial conceptual model in Figure 1 below.

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EMPIRICAL APPROACH

In this section, we provide a brief outline of the study setting, data collection
process, data analysis, and our presentation strategy for the case study and its analysis.

The Study Setting

In our study, the virtual teams were comprised of students from two universities
working collaboratively to analyze a business information systems problem, converting it
into a systems design, and then developing a working prototype. More specifically, the
participants were students enrolled in Information Systems courses at two large North
American Universities, one based in Canada (which we call UA) and the other in the U.S. (which we call UB). Typically, each virtual team consisted of 4-5 "internal" or "local" group members who were matched with 4-5 "external" or "remote" members from the other university. Thus, each virtual team consisted of about 8-10 members drawn almost equally from UA and UB. The projects lasted for about 14 week-long semesters. A total of 12 teams participated in this study – five in Fall of 1997 and seven in Spring of 1998.

The task assigned to each virtual team was to jointly define, design and develop an information system for a "real" organization. The UA members of each virtual team acted as “business systems analysts” and were responsible for going into an organization and identifying a “problem” situation that they believed needed resolution using a computer-based information system. They were to then create a rich narrative of the problem in the form of an “information requirement document” (IRD), which was to be then transmitted to their counterpart “external” team members at UB who were acting as “systems analysts/designers.” In addition, UA members were required to provide a preliminary design of the user-interfaces that would be preferred by the organizational clients. The UB members of each team were responsible for using the IRD to create a detailed systems design (including an Entity-Relationship - E-R - diagram) and then a working prototype of the database system. Finally, UA and UB team-members were to make a joint presentation of their entire project, including the working prototype and a discussion of potential challenges to implementation. In Table 2, we list the participants in this project. Next, in Table 3, we summarize the project events with time lines.

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7 In UA, the focus of the course was on “Decision Support Systems” and in UB it was on “Database Systems.”
A number of communication and coordination technologies were available to team members, including Webboard (an asynchronous computer conferencing tool), e-mail, videoconferencing, faxes and telephones. Webboard was officially designated by the coordinators as the primary channel of communication for the project. While e-mail was also used, usually for one-to-one communication, Webboard allowed communication to take place in a public domain. That is, communication over the Webboard was visible to all other team-members (local and remote) and also the faculty coordinators. While all communication on the Webboard was automatically recorded and saved, students were asked to provide as a part of the project documentation, copies of all e-mails exchanged, “minutes” of videoconferences, telephone talks and Internet chat sessions.

Data Collection

Data was collected from several sources at different points in time. Two main types of data were collected: the communication transactions among virtual team-members (both public and private); and each student’s reflection of their experience at the end of the project. In addition, Table 3 summarizes our data collection efforts.

Data Analysis

Data analysis was conducted by the three researchers who themselves worked as a geographically dispersed or “virtual team,” and this provided additional theoretical sensitivity into the inductive theory building process (Strauss and Corbin 1990). Two of

--- INSERT TABLE 1 HERE ---

--- INSERT TABLE 2 HERE ---

--- INSERT TABLE 3 HERE ---

8 There were minor differences in the schedules of the virtual team projects in the two semesters, and to avoid confusion, in this paper, we will describe the details of the Spring '98 semester as representing the
the researchers were course instructors and project coordinators at the UA and UB locations, and therefore, participant-observers in this study. The data analysis process spread over more than a year during which period the three researchers met face-to-face three times to discuss the evolving analysis. Our analysis approach was “interpretive” in nature, where through the reading and re-reading of the communication transcripts, we each developed initial themes for the individual cases, and then in our joint meetings we discussed our interpretations of them.

At the next level of analysis, we studied these individual case descriptions to discern broader patterns which became the basis for our initial theoretical model which was further refined with discussions and our own reading of theory. These processes of reading and descriptions helped to clarify and refine our interpretations and lead to further investigation of theory to elaborate on the analysis. Thus the data analysis approach involved a reflexive and continuing dialogue in our minds and amongst ourselves concerning the data collected in the form of text, our own observations, our interpretations, and discussions with colleagues (Alvesson and Skoldberg 2000). A brief summary of the process of data analysis is provided in table 4.

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Insert Table 4 here

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**Presentation Strategy**

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9 The “direct observations” data provided us with: 1) a context for interpreting the conversations, and also 2) an access to additional conversations not recorded on the electronic media.

10 Further details about the data analysis can be provided on request to interested readers.
In writing the case analysis, we struggled with two representational problems:

- The “selection” problem of which cases to present and in what level of detail to deal with the issues of space constraints (Walsham 1997, p. 476) and information overload.
- The separation of the “case description” from our “interpretations”

With respect to the first problem, we were confronted with in-depth data on 12 virtual teams, each quite unique in its dynamics and character. Our dilemma was whether to do justice to the individual teams through detailed narratives of each case, or focus on discerning the “overall patterns in the process” (Leonard-Barton 1990) emerging through the cross-case analysis (Eisenhardt 1989). Given that our aim was to theorize about the nature of team development, we decided to provide examples from different teams with a view to illustrate the broader theoretical model of virtual team development. The process model systematically organizes the salient aspects of the team development process as a “consultable record” (Walsham 1995, quoting Geertz 1973) in a diverse set of contexts.

The second problem concerns how to separate (or not) description of the case from our own interpretations. A “realist” account of the case study would involve separation of the case description from the analysis. We tried this approach, but it proved to be unsatisfactory for us. We realized that the case description was inherently an interpretive process because even in deciding what to present we were making interpretive judgements (Van Maanen 1988). Consciously embracing the interpretive approach where case description and analysis are seen as inextricably intertwined (Walsham 1995), we focussed on the process of development of the theoretical model, drawing upon examples to selectively highlight various facets of the model. At the end
of the description of each stage of the development process, we provide snapshots of key elements of the structure of the team, recurring communicative actions, and the modalities of the interaction between the two. Tables 5, 6, and 7 summarize the three stages in terms of the three key elements (structure, communicative actions, and modalities) respectively. We describe the case analysis and theory development process.

CASE ANALYSIS AND THEORY DEVELOPMENT

Stage I (Initiation Stage)

Project initiation at UA and UB was marked by the coordinators (PA and PB) describing the project through the course syllabus on the Websites and class discussions. At both locations, teams were self-formed often based on whether members were from the same country of origin (e.g., Hong Kong) or if they had worked together in a lab or in a project in a prior course. In this initiation stage, the social structure was primarily derived from two sources: 1) prior shared experiences as a result of same cultural/national backgrounds, and/or professional experiences; 2) team-members’ (i.e., students’) beliefs regarding their facilitator’s (professor’s) expectations of the project.

Production structure of the teams came from team-members’ status as “IS Majors” which implied certain skills and competencies, including a familiarity with technologies such as e-mail. However, familiarity with newer technologies like Webboard and Videoconferencing was limited\(^{11}\). Broadly, we inferred that in this stage both the production and social structures were marginal and undefined.

\(^{11}\) For example, one team-member, who was a native English speaker, consistently referred to the Webboard as the “Web-boat” in both oral and written communication during this period, and some others found the novelty associated with videoconferencing as the most important/attractive aspect of the project. Also, many students had never used ICQ. In addition, at least in the early phases of the project, the “behavioral skills” (i.e., altercentrism and interaction management) related to posting messages on the webboard and videoconferencing were also seen to be poor, in general.
At this stage, many students felt overawed by the “unknown” nature of the project, their remote team-members, and of the complexities felt with respect to new technologies. The high weightage given to the project (40% of the course) gave extreme power to the coordinators, who unilaterally specified certain norms of communication and coordination of the teams. An introductory message to the Webboard posted by one of the coordinators (PA) reflected their (the coordinators’) power over students to influence their teams’ norms and meanings:

... I can’t over-emphasize the importance of communication in such collaborative work. An effective group is one which has clearly defined channels of communication. So, it is important for you to start defining these channels, and agreeing on the parameters for subsequent work. Please post all messages that relate specifically to your group work under this Topic.12.

The norms of communication proposed by the coordinators provided the initial set of rules and resources for communication, and these were later negotiated and appropriated by team members. In most teams, the UA side made the first move to invite the UB counterparts to participate in the conversation with the following communicative actions:

- **Issuing greetings** (“saying hello”) and invitations (“feel free to e-mail us any time”).
- **Managing impression** by projecting an image of a competent and dedicated professional (“myself and John we pretty much live in the computer lab here”) or a “cool” person (“if you want to know more about me, check out my website at ….”), or by proposing the use of alternate technologies that could bridge time-space gaps in turn-taking (“My ICQ number is.. Feel free to use it anytime. By using it you will automatically page me or send messages to my computer at home. It also allows for real-time chat”).

12 an area designated for the team to exchange messages on the Webboard.
• *Proposing norms* and, in some cases, rejecting or modifying “external” norms set by the coordinators (“it would be nice to start collaborating on a regular basis so that we can get into the groove of doing it regularly. We will e-mail you as well as post information on the Webboard, so please keep updated by checking both regularly.”

• *Defining and negotiating situation* to clarify the project objectives. For example, a UA member wrote “It seems as though our team is in the management role and your team is playing the role of IS professionals.” The use of the term “management” (rather than, for example, “user” or “business analyst”) could be interpreted as defining power relationships in terms of roles.

While initial messages often reflected team-members’ focus on individual identities (e.g., “Hello from the lone female” or “If you want to know more about me check out my web-site at…”), subsequent messages, in many cases, reflected the members’ differentiated identities (based on location) who had still not accepted themselves as part of one geographically dispersed team (e.g., through the frequent use of the terms “your team” and “our team” referring to the remote members and to the local members respectively). This behavior appears consistent with the IS literature that links identity of members and with the social context of electronic interactions (Myers 1987). The process of team naming reflected the fragmented identities, which were further reinforced through messages that were individualistic or location-centric in nature. A particular example of this individual/local identification was of UA team naming itself “DFLKK,” representing the starting alphabet of their local team-members, completely oblivious of the existence of their counterpart UB members.
During this stage, UB members in general maintained silence in response to the UA messages. UA members interpreted this lack of turn-taking by UB members as potentially signaling the initiation of a troubled project with remote members deliberately trying to ignore or reject their proposed norms of communication. This sense of trouble was magnified when during the first videoconference when very few of the UB members of some teams showed up. For example, in one case, only 2 of the 5 UB members participated in the meeting and a UA member later reflected on this lack of professionalism:

The videoconference was not as hoped since only two of the UB members showed up. It would be nice to have a complete turnout for the first conference; it is as they say after all, first impressions count. This project was meant for a professional setting, and having a handful of members show on the first videoconference seems to show a certain lack of professionalism.

In absence of turn-taking by UB members, despite repeated Webboard messages and the Videoconference (i.e., technology-mediated turns), norms could not be solidified through practice. The power relationships, though still largely un-negotiated, were tilted in favor of UA because of their “management status,” their early presence on the Webboard, and the structural condition of them “driving” the first phase of the project of requirement analysis. During this period, UA members relied primarily on the use of referential symbols, for example, by providing deadlines for tasks. Little use of humor and other such evocative symbols reflected a lack of social solidarity at this stage, contributing further to an image of team fragmentation. To counter the anticipated trouble arising from UB’s non-participation, UA members utilized a number of problem-avoidance strategies (communicative actions) including the following:

- **Wooing** (e.g., “we are interested in working with you.”)
• Reference to norms of performance (e.g., “it would be nice to start collaborating on a regular basis.”)

• Reference to tasks and roles (e.g., “I have just sent you all an e-mail concerning who will be responsible on your end to facilitate communication and the times when you as a group will be available to communicate with us.”)

• Calling upon higher authorities (e.g., “Hi professor… we have posted numerous messages, and yet we have received no feedback from our counterparts… we are skeptical to their commitment to the project”).

These strategies, in most cases slowly started to evoke a response from UB, enabling teams to make a transition from initiation to the next stage of “exploration.” The structurational process of Stage I is summarized in Tables 5, 6, and 7 respectively.

**Stage II (Exploration)**

The UB silence could be seen to represent a typical technocentric systems developer attitude13 of: *send us the complete requirement specifications, and “then we can get the show on the road here at UB” (i.e., we will start building the system).* UB members, in their role as systems developers, couldn’t quite comprehend the need for communication with UA members who had still not “frozen” their requirements. When they reluctantly started to respond to UA’s different strategies, they crafted their responses carefully in order to exercise “considerable control over the front” they presented (Correll 1995, p. 277). UB adopted the following “problem-repair” strategies:

• Thanking UA members for their early initiative (e.g., “We quite appreciate your efforts in this project, and hopefully, can catch up with your steps.”)

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13 Such attitudes have been documented elsewhere in the literature (e.g. Hirschheim and Klein 1989).
• **Apologizing** for not being co-present and not taking turns thereby attempting to create an “alignment” by providing an explanation (e.g., “I wanted to apologize for not using the Webboard as frequently as I should. I appreciate your patience.”).

*Shifting blame on technology for missing deadlines* (e.g., “We are sorry for the delay in posting the E-R model. [We] tried to post it…but as you know in this world of computers this kinds of incidences happen”), or *transferring blame on to the coordinators* for not clearly explaining project requirements (“Our class has not officially discussed specific requirements”). Again, communicative transactions of this nature may be seen as an attempt towards creating an “alignment.”

• **Managing impressions** (e.g., “I wanted to say that the project/problem is very interesting. Since I do have interest in retail management, I will post my thoughts.”).

• **Making excuses and admitting screw-ups** in posting messages (e.g., “I’m not really with it (the Webboard) and I think I screwed up a couple of times. Oops!”) This may also be seen as an example of issuing a “disclaimer” regarding the lack of expertise in using a particular communication technology.

As communication exchanges became more intensified in their turn takings, the role of the coordinators started to be redefined from one of directive regulation/law enforcement (“Can you please post minutes of the meeting ASAP?” or “Please reply to [UB member’s] message”) to one facilitating group communication (“Please see updated schedule for videoconferencing… Note the TWO HOUR DIFFERENCE between the time zones…”) as well as aiding in information processing (e.g., explaining some subtle elements of project requirements). However, in teams where the communication was still “unsatisfactory,” the coordinators continued to play a primarily directive role.
As different members started sending messages, there was an increased virtual presence, though still intermittent in case of many team-members. There were still few norms on the intensity/frequency/length of presence on different media, or of members informing absence due to reasons of illness, travel, or exams. Some UB members questioned the structures, for example the presumed privileged position of UA acting as “managers” or the norms of communication proposed by UA. The local origins of norms of this stage and their bilateral negotiation, is illustrated in the following exchange where the members were acting with respect to each other:

**UA member:** ... 

Communication Policy

Main contact from UA will be Tom...

If you have something important to say... notify the designated person of each university... the reason behind communicating (through) an individual .. is that we (UA group) tend to check our e-mail more frequently than going to the web board..

**UB member:** ...We cannot have only 1 “communicator” for the group. Our professor encouraged us to do this because our grade is based on participation. Although you had mentioned.. that you would like to communicate via e-mail.. this will hurt our grade. Our professor encouraged us to post everything on the webboard...

During this stage, team-members also seemed oblivious to and disinterested in the time/schedules of remote team-members. Distinctions of the type of “our group” and “your group” based on location continued to be dominant. However, greetings like “Hi there in UB” and “Hello UA” suggested that the individual member-level identities of the first stage were being superseded by a location-based identity. Goals of team were still predominantly local, as defined by the local coordinator. With little interest expressed to identify goals of remote members and project aims, there was still limited coordinated action. The “us-them” distinction was reflected and reinforced by bi-directional communication with members not ready to surrender their autonomy to remote members for project goals.
At this stage, the modalities of meaning and power represented local interests with UA’s concern limited to their IRD deliverables and UB to the database they needed to design. While both sides monitored the virtual presence of others, they did not appear to respond directly to queries by the other. Instead, they spoke past each-other, with frequent “topic shifts” (Putnam and Fairhurst 2000) symbolizing lack of regard for the other, as seen in the following sequence of turns:

**UA member:** I will send the Gantt chart since it did not copy to the Webboard.

(No messages for a few days from either side)

**UB member:** I am one of the members of your team, I never got a chance to talk to you before… I was extremely sick, and then my house caught fire. I guess it is my lucky year.

(Remarkably, in their subsequent turns, UA members ignored this message posted by the UB member – no one welcomed her or sympathized with her!).

Thus, to summarize, the teams’ social structure during this stage, while more “developed” compared to the previous stage due to increased virtual presence, still reflected a lack of social integration required for effective cooperation (Couch 1989). The sense of oneness among all team-members was still notably absent. The production structure of the teams was also more functionally developed than during Stage 1 with members showing greater understanding of project goals and familiarity with the ICTs in use. Members were seen to be experimenting with various technical features of the tools, for example, providing links to personal web pages, uploading attachments, and conducting chats. This greater understanding about the project and technology contributed to improving both task ability and task focus. However, in absence of mutuality in social responsiveness among team-members, this increased communication did not result in significantly increased coordination and collaborative efforts.

Communication was largely sluggish and continued in a disorganized fashion, with teams

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14 The policy strongly reflected the recommendations made by PA in a meeting with UA team members.
acting opportunistically with little concern for the other side or the entire team. However, this sluggishness was not universal across the 12 teams, and some teams actively pursued a more cohesive relationship from their partners. Some turn-taking strategies adopted by teams that contribute to their transition to a more mature stage of development (which we term “Collaboration”) included:

- **Demonstrating interest in the requirements of remote members** as, for example, in the following message excerpt of a UA team-member (“we were wondering if it would be possible for you to tell us what Professor (PB) has outlined as the requirements on your part of the project… Therefore we may tailor our information to meet your needs as well as ours.”)

- **Building social solidarity through the use of evocative symbols** (e.g., UB member: “have ya’ll been watching the Olympics... we’ll see ya on the ice rink;-). A UA member of the team responded soon after: “It could be interesting if (we) could maybe bet some beers on the OLY’s, if only we could send them over this piece of technology as easily as words.”) Similar social bonding through inclusion of “humanistic details” in communication by virtual team-members is reported by Edwards et al. (1996, p. 164).

- **Attending to external events** such as deadlines – for many teams, external events such as project deliverable deadlines acted as a powerful rallying force for team-members to coordinate activities and develop a form of “swift trust” (Jarvenpaa, Knoll, and Leidner 1998; Jarvenpaa and Leidner 1999).

- **Using media-rich technology** such as video-conferencing, which by virtue of its properties of synchronicity and multiple channels of communication (audio and
video) members to develop intimacy by putting “faces to names” and be able to solve some problems through real time discussion, which was difficult through email.\textsuperscript{15}

Before moving on to the next stage of Collaboration, we refer readers to Tables 5, 6, and 7 (under Stage II) for a summary of the Exploration stage in our model.

\textit{Stage III (Collaboration)}

After a period of jerky and awkward turn-taking in Stage II, many teams made a transition to a collaborative mode of working. This was reflected in teams through the expression of interest in local requirements of remote members, and through extensive use of evocative symbols in an attempt to develop social solidarity, and to satisfy the coordinators who explicitly emphasized the importance of social bonding for effective collaboration. Changes in social structure started becoming evident with identity becoming \textit{integrated at the team-level}, and social responsiveness becoming more \textit{mutual}. The increasing mutuality helped in developing shared meanings and norms, and also in diffusing the power from local locations as defined by initial project parameters to the other location as negotiated through communicative action. Some team-members voluntarily surrendered their rights of making critical decisions about the project to their remote members to whom they could now rely upon, given the congruence in both the work and social spheres. For example, UB members were required to implement the user interface specified by UA, and any deviation from the specifications had to be approved by UA. In the following exchange, we note how UA members approved UB changes without a fuss:

\textsuperscript{15} However, we would like to emphasize here that the technology did not automatically create the close relationships among remote members in all teams – this, we believe, happened only in teams whose members were: 1) well-prepared for the videoconference, 2) appeared professional yet sociable/humorous, and 3) appeared sincerely interested in developing a social rapport with the remote members.
UB member: .. we changed the forms... hopefully that’s OK with you guys.
UA member 1: Personally that is alright with me. I don’t know if the rest of my group has seen this message but I think they would agree with me..
UA member 2: The format of the forms are ultimately up to you...If it works.. I don’t think that our group here has a problem with the layout.

The mutuality in social responsiveness contributed to the clarification and stabilization of norms of timeliness (including those for dealing with time zone differences) and frequency for turn-taking. These norms were reinforced in practice and routinized through turn-taking by both sides:

The following strip of communication characterizes the typical state of teams in this stage-- reflects the integrated sense of identity not differentiated by location (“Fellow Group Members”), a sensitivity to time differences (9:30 to 10 for you guys) as well as interweaving of referential and evocative symbolism (“wake up so early on a Saturday”) indicating mutuality and sense of oneness and empathy in the social relationship.

UB member: Hello Fellow Group Members! Just a reminder for everybody... our group is scheduled for 11:30 to 12:00 (UB) time, that means 9:30 to 10 for you guys. I am sorry you have to wake up so early on Saturday, but what can you do? We look forward to “seeing” you on Saturday!

With a collaborative social structure co-constructed and enacted by both sides, and major project deadlines approaching, the frequency of turn-taking intensified and discussions took place on substantive issues with virtually no abrupt topic shifts, reflecting a high task focus. The following sequence of turns illustrates this:

UB Member (March 4., 3:333 PM):
The following is our agenda for the 3/7 Videoconference:
I. General progress up to this point.
II. Discussions & Questions regarding the Client Contact Sheet information.
   A. “Service Provided” Entry
      1. Are specific details necessary?
      2. Are there certain categories that fall under this?
      “Sector Entry” – What does this refer to?
   E. “Officer” Entry – does this refer to the employee that is answering the phone call?
   V. Any updates – future progress

We look forward to speaking with you this Saturday.

UA Member (March 5., 01:30 AM): Looks like a great agenda! I’ll try to answer some of your questions on the board right now.
> A. “Service Provided” Entry
> 1. Are specific details necessary?
>   - the “service provided entry” is a description what the client service officer did to resolve the situation,
>     For ex., the client service officer could have...
>     The way the officers fill out this section now, is really up to them... I guess in a database, this section could
>     be a short description section with about 500 characters (50 words or so)
> 2. Are there certain categories that fall under this?
>   - let me get back to you on that during the meeting.
> B. “Sector Entry” – What does this refer to?
>   - sector means the type of industry... For example...
>   It sounds like you guys are progressing really well. Can’t wait to hear all about it at the meeting.

As teams were engaged in intense collaborative activity directed towards team-level goals, the possibility of trouble seemed to be in the background in most cases. However, teams without a strongly developed social solidarity or "social glue" (i.e., those relying primarily on “swift trust”) showed greater potential of regressing quickly to earlier stages with few recovery mechanisms from sticky situations (e.g., when norms of communication were severely violated without prior notice, or a local deadline was missed due to the perceived indifference of the remote members, or a critical document could not be opened on time). Two strategies were effective to deal with such “sticky” situations:

- *Timely intervention* by project-coordinators, who, by and large, were playing the role of “silent monitors” during this stage;

- *Sincere apology* (to enable re-alignment) by erring team-member for norm violation.

We narrate an episode to illustrate the above. Julie, a UB member, posted a query that she needed answered in order to proceed with system development. When the query went unanswered by UA members for a week, UB members’ confidence in their remote members started to dwindle, and the UB members let their displeasure be known to one of the coordinators. This prompted the facilitator to post a brief but firm directive: “UA members, please respond to Julie’s query.” The very next day a UA member posted:
In response to Julie’s concern…. We will also make sure that at least one of us is checking the webboard once a day so as to get the info you need back to you ASAP. (Sorry about this delay!)

Given that some level of social solidarity had already been established in this team prior to this “trouble,” this apologetic note helped the team get back on track promptly. Some additional problem avoidance strategies used by members of different teams included:

- **Appreciating and incorporating ideas** from remote team-members, and using evocative symbols wherever appropriate;

- **Handling substantive disagreements** (e.g., Toulmin 1958) with remote team-members with care and sensitivity.

These strategies reflect Baym’s (1996) “strategic mitigation,” which, in case of teams in this stage, appeared to be exercised in a taken-for-granted manner by drawing on existing mutuality in the structure, norms, meaning, and power relationships that had evolved from, and in support of, such a structure. We refer you to in Tables 5, 6, and 7 respectively (under Stage III) for summary of the Collaboration stage.

An important point that became apparent to us in studying the 12 teams is that passage of time is only one, albeit important, antecedent condition to the development of mutuality in social responsiveness (Walther 1992). In fact, we found that some teams continued to operate in an exploratory mode (i.e., in Stage II) throughout much of the assigned time to complete the project, and made a transition directly to Stage IV with the final project deadlines approaching.

**Stage IV (Culmination and Dissolution)**

This stage involves physical closure of the project with team-members presenting final project deliverables to the coordinators and clients, and subsequent disbanding of
the virtual teams. The sense of urgency due to the rapidly approaching deadline, as evidenced in the increased frequency and intensity of turn-taking, was reflected in all teams. In some cases, there was a frantic rush, and others which had already stabilized to a stage of collaboration, there was a natural transition to completion.

Teams making a transition from Exploration to completion: Disorganized and Desperate

Even as the project was drawing to a close, such teams showed a weak production and also social structure (e.g., poor communication competence, lack of integrative identity and shared social goals, intermittent virtual presence, and focus on local interests). For example, in one of the teams, with just 11 days remaining before the final presentation, the frequency of turn-taking became frenetic, though not very effective. While effective teams were in the process of fine tuning their presentations, these teams were still engaged in finalizing the conceptual data model. Even at this late stage of the project, members were unaware of the usefulness of certain ICTs, and showed unfamiliarity with the roles of remote team-members, and acted bilaterally in most instances. We provide below an example of one such team and annotate the turns with our own interpretations enclosed in “/* */”:

UA Member 1 (April 06): uh sorry to rush you but we need the ER diagram .. so could you hurry up and send them. This portion of the (our) assignment is due tomorrow... /* clearly bilateral responsiveness focusing on local */

UA Member 2 (April 07): Here is the documentation of the user-interface... the presentation is coming up and it's on the 18th April... My ICQ# is ... /* by itself, this message looks fine. However, it has no connection with any previous message – abrupt topic change in turn-taking*/

UB member 1 (April 07, 12:16 PM): Hello, UA team, Sorry that we did not post the latest version of the E-R diagram. But I checked your interfaces and documentation, which are great... By the way, how to create a chat account?! /* With over 3 months of communication, chat account creation should not have been an issue */

UA Member 2: (April 07, 2:40 PM): All you need is go to the website and download the latest ICQ... find the word “DOWNLOAD”. IT’s all self explanatory. /* very bilateral, unhelpful attitude */

UB Member 2 (April 08): Hi guys, we are sorry for being late to post the last version of the E-R model. We will do it today. <UB member 1>, you are the one who has the disk, I only have the copy. Please post it today or give it to me and I will do it./* Finally ?! Also, even local members are not working in a coordinated manner, UB members’ identities appear fragmented as is characteristic of Stage I */

...
UB member 1 (April 08): We just revised the E-R again according to your interface document. Please check it again and give your feedback... Also, since you have finished the interface, I am wondering if you have connected it to the real database? Do we need to create the database according to the E-R?

Coordinator, PB (April 08): You should start your development. Next Saturday, you are required to demonstrate your prototype.

UA member 2 (April 08): There are NO database connected! The interface is just an interface, it’s a suggestion of how the interface should (look) like.

Such teams expressed their sense of project closure by expressing individual relief that the stressful experience of virtual teamwork is over, or by assigning blame and presenting excuses. Excuses included remote team-members’ low commitment and poor quality, team member attrition, the unrealistic scope of the project, poor technical infrastructure, in-sufficient training in technologies, and also poor health. Most participants chose to communicate these sentiments using personal channels of e-mail or reflection documents directly to the two coordinators. In one extreme case, one UB team-member experienced a complete breakdown during the final videoconference, and lamented about the lack of support, personal stress, and overwork. Needless to say, most teams within this category submitted poor products, and also made poorly coordinated final presentations. These teams were noticeable for their abrupt and complete termination of communication with their remote partners after the formal project end.

Teams making a transition from Stage III to Stage IV: Steady and Joyful

In sharp contrast to the above, teams here delivered superior products and also made superior (well-planned and well-coordinated) presentations. Some teams signed off with

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16 We recognize that, depending on the technical complexity of the system, the relative contribution of production and social structure to the project outcome (i.e. the quality of product delivered) may vary. There are also other unique factors associated with projects – such as presence of a super-programmer, who may pull of an entire project without the need to develop mutuality or congruence among the remote team-members. That notwithstanding, in our case, which involved projects of moderate complexity using skills
joy but with little emotional attachment (“It was great working with you guys. I think we worked really well as a team. I hope you enjoy your vacation, take care.”). Other teams expressed their joy, and also emotional attachment, signifying the pain of parting company. In these teams, communication continued even past formal closure of the project, and personal information was also exchanged in anticipation of the possibility of a future rendezvous. We give an example of such an emotional-filled parting:

UB member: Just wanted to let you all know that I thought that the videoconference went very well... It was great seeing you guys again...
UA member: It was a pleasure working with you all, and I am looking forward to my last exam...then I will be visiting your Country shortly after – baking in the sun in Phoenix. The Consensus from all I think is that we did a pretty good job, and should be proud of our efforts.
UB member: I also thought everyone did a good job especially with all the technical problems... hopefully, our final product will be “da bomb.”
Is anybody graduating? I am graduating on May 17. I 'm kind of the old guy.. I’ll be 24 in June. Ben just turned 21, Mike will be 21 in about a month, and I think Julie turns 21 later on this year. I am curious to know how old you guys are...
Another UB member: It was a pleasure working with you all. Thanks Karin and Kevin for Birthday wishes.. Karin, yes, I did get messed up. I woke up on the wood floor in my apartment, wondering how the hell I got there! I hope you all keep in touch...
PA (Co-ordinator from UA side): Hi, that was a really wonderful presentation. Makes it feel that it was all worth it.
Another UA member: Thank you.. for the praise, it feels good to hear it. As for our ages, I can only divulge my own – 24...
Another UA member: ... good luck with the rest of you term and have a great summer.
Another UB member: I guess it’s my turn to say job well done and wish you all well ... (crying smiley)... The one thing that most of us have learned in UB is that it’s a small world, so maybe we’ll run into each other one day. It will probably be stumbling out of the bar, so we really won’t recognize each other, but our paths will cross nonetheless...

As formal project activities came to an end, many of the participants, including the coordinators, reflected on their virtual team experiences, which became part of their “stocks of knowledge” for future similar experiences. This experience was incorporated into the institutional frameworks of the two participating universities in different degrees and in varying ways. For example, in UA the project became part of the curriculum, students talked about their experience to new students, and new students immediately that were more or less covered in class but large enough so as to demand pooled resources of the team-members, we found that the teams achieved most of their actual work in Stage III.
associated the course with the project. Some participants in employment searches emphasized this virtual team experience.

We summarize the above discussion in Tables 5, 6, and 7 respectively (under Stage IV), and in Figure 2, we represent the entire process model of virtual team development. A comparison of Figures 1 and 2 shows how our initial theoretical model (Fig. 1) has been extended to a substantive process model in the context virtual collaboration for ISD through an intensive examination of communication patterns in different teams. In the next section, we present key theoretical implications of our study.

THEORETICAL IMPLICATIONS

We discuss our theoretical implications under three areas:

1. Theoretical understanding of the process of virtual team development.
2. An understanding of the relationship between communication, collaboration, and team development.
3. Usefulness of our analysis for co-located teams.

Theoretical understanding of the process of virtual team development

The key aim of this paper was to develop theoretical insights into the “process of virtual team development.” Virtual teams typically come together for a limited period for executing a project. It is hence of interest to investigate how (for example) team-members get to know each other, how project goals are formulated, and how the technology is selected/used. This understanding, which can be applied to execute a project, is not something that is pre-defined and existing, but is constructed and accomplished over time through the process of interaction between members. An understanding of the process of technology-mediated interaction provides insights into the virtual team's development
process over time. Different kinds of communication patterns contribute to create varying structural conditions of teams reflecting both the social relationship and project task-related ability and focus. Studying the intricate link between “communication,” “structure” and “team development” was the aim of our study which asked the following questions:

1. *What are the micro-level communicative processes in virtual teams and how can they be studied?*

2. *How can micro-level communicative processes be related to the macro-level structural properties of virtual teams over the course of a project?*

The underlying premise was that virtual team development cannot be studied by focussing only on the micro-level examination of how team-members communicate with each other or at the macro level of structural characteristics. A micro-level focus obscures our understanding of the structural properties of teams related to production and social relationship, and how these structural conditions shape communication processes. Similarly, a macro-level structural focus ignores communication processes that are fundamental to the functioning of virtual teams and to creation of the team's context. We believe that most prior research on teams have focussed primarily on either of these two levels, which has led to an incomplete understanding of the development process and how it can be managed.

A key implication of our research is the articulation of an empirically situated theoretical framework to understand “virtual team development” based on an integration of the micro-level of communicative action with the macro-level of team structure. Our analytical focus was on 12 sets of “situations” of virtual team work, reflecting a form of "methodological situationalism" (Knorr-Cetina 1981), to make ultra-detailed observation
of what people do and say in situ to build macro-sociological conceptions. Our "ultra detailed observations" “in situ” included the examination of each and every communication transaction of the virtual team-members in order to develop interpretations about communicative action, macro-sociological team structure, and a broad conception of virtual team development over time. While readers can define different particularities in different team situations and transition mechanisms, we believe the meta-level approach to understand virtual team development can be used in different situations. This, we believe, is the key contribution of the paper.

Relationship between communication, collaboration, and team development

In our model of virtual team development, we make an important distinction between “communication” and “collaboration,” and how they contribute to team development. In the literature on teams, often the distinction between communication and collaboration is unclear which leads to ambivalence in the understanding of how communication, collaboration, and development are related. Often, it is assumed that increased communication is a desirable state, leading to more effective team outcomes. This assumption leads organizational efforts to be focussed on how to apply ICTs to enhance the level of communication. In this deterministic view, communication, collaboration, and development are treated synonymously, similar to equating increased information sharing with learning. While increased information sharing may be a necessary condition for learning, it is not a sufficient one. For learning to take place the information also needs to be effectively assimilated, put to practice in day to day social conduct, and its consequences actively reflected upon. Similarly, while communication
is a necessary pre-condition for virtual team development, it is not sufficient, because it also needs to be “effective.”

To differentiate between communication and collaboration, we have posited “collaboration” as the third stage of our team development model. The basic assumption here is under certain conditions of communication, teams exhibit both a mature production structure of high task focus and task ability, and also a well developed social structure including shared goals, social cohesiveness, and shared identity. A well-developed social structure provides the social glue that acts as a deterrent for a team to regress from a stage of collaboration to exploration given certain breakdown conditions. Or, in case of a breakdown, there is enough confidence in the relationship that a member could merely offer a brief apology that would be accepted by the offended other and things would be back on track. Thus, while a well-developed production structure in itself could be adequate for collaboration, but when this coupled with a mature social structure, the collaboration in the teams becomes inherently more sustainable. To summarize, only communication characterized by: 1) focus on the “other,” and 2) substantiveness is considered "effective," and reflects and constitutes “collaboration.” Another implication of this point is that the mere presence of communication in an assembled virtual team should not be seen as a sufficient condition for its progression to the collaborative stage - communication is only a necessary not sufficient condition.

**Implications of our analysis for co-located team**

While our focus has been primarily on virtual teams, we emphasize the point that team development is not an issue in the virtual context alone. While "development" may proceed differently, or require different tactics in ICT-mediated virtual teams, the
theoretical framework that we have proposed could very easily be applied to co-located teams, where communication takes place through verbal and other non-verbal means. So, for example, while particular means of turn taking and dealing with trouble could be different in co-located teams because of the team members' physical proximity during the interaction, the fact that strategies for turn taking are required in these teams will remain unchanged. While we have drawn on a limited set of concepts from the tradition of interaction analysis to study communicative action in virtual teams, additional concepts can be drawn upon to account for the specific characteristics of co-located teams.

Aspects of production and social structure are essential to co-located teams, even though the particular rules and resources that make up aspects of structure are different from virtual teams. For example, task ability will not be inferred based on what members write about what they are going to do, but instead maybe by physically observing what has been achieved. Similarly, social solidarity is not inferred from evocative symbols that are exchanged in text, but on how members physically socialize with each other.

In applying the model of virtual team development to co-located teams, two key differences have to be kept in mind: 1) the nature of initial norms of interaction; 2) the separation of time, space, and culture in virtual teams.

*Initial norms:* Virtual team members typically come from different backgrounds with little prior shared experiences, and are assembled for a specific project and then disbanded once that is completed. These conditions imply that members have few initial shared frames of reference to engage in coordinated social action. In contrast, in co-located teams there may be prior-shared understanding already existing because members are from the same location, and often, share institutional as well as location-related
assumptions/norms. Also, there would be different avenues for establishing norms for teamwork (for example, face-to-face discussions) than those available in virtual teams. These differences have implications on how team development takes place over time. As pointed out in our discussion, team development is initially based on who proposes norms first, the specific contents of messages, and the technologies used. In co-located teams, there could exist initial shared frames because of prior interactions among team members, which would introduce different dynamics of team development.

*Separation of time and space:* Another difference between virtual teams and co-located teams is the separation of members by time, space, and cultures. For example, in our project, one part of the virtual team (the business systems analysts) were based in Western Canada and the other part, the technical developers were based in Washington, DC. Project team members were thus separated by 3000 miles and a two-hour time difference, and situated in two distinct university settings (e.g., public versus private) with different student demographic profiles. As a result, it becomes extremely important to understand the role of time and space in the structuring of virtual team interactions which is likely to be far less important in co-located teams. Virtual and co-located teams have different time and space conditions, thus leading to variations in the synchronicity, rhythms, and patterns of messaging among members. These variations have implications on both the choices of channels used for communication, the structure and contents of the message, as well as the nature of artifacts team-members may be comfortable with. These differences in turn-taking mechanisms could lead to varying turn-taking strategies with distinctive implications on team development.
MANAGERIAL IMPLICATIONS

Our study suggests that even though in a student-term-project context, complex activities such as information systems development (ISD) can be effectively conducted in geographically distributed teams. A key implication is that an IT infrastructure enabling communication can only be a necessary and certainly not a sufficient condition for effective collaboration to occur. Specifically, we have found that the teams require certain structural characteristics to effectively accomplish project tasks, and we thus provide implications to help virtual teams attain a collaborative state. This aim is more complex to achieve than in the case of face-to-face teams, because of the discontinuity in the contexts of team-members in virtual teams. We discuss tactics associated with three arenas of virtual team management: team formation, training of members, and intervention of coordinators.

Team formation: Selection of people with appropriate skills is key to creating a team with the potential of achieving a state of effective collaboration. Team formation has to be done keeping in mind the objectives of both task and social competencies. In the particular case of ISD in virtual teams, for ensuring task ability, analysts/developers need to know (or need to have the ability to quickly grasp and adapt to) the ISD methodologies and technologies that are relevant to the project. Equally important is the participants’ communication skills with different ICTs, their ability to take the perspective of other team-members and communicate technical issues in an articulate and yet cordial manner. Team-members should have the ability to work with diverse set of individuals from different backgrounds. Team members need to have a deep appreciation of the complex socio-technical nature of systems and of systems development (e.g., Bostrom and Heinen
1977; Orlikowski 1992) with sensitivity to the need for mutuality among the different stakeholders (e.g., Churchman and Schainblatt 1965), the changing nature of systems requirements (e.g., Hirschheim and Klein 1989), the different ways in which texts are appropriated by different stakeholder groups (e.g., Boland 1991; Lee 1994), and the importance of symbolism in ISD related communication (e.g., Hirschheim and Newman 1991).

Project coordinators should have the capability to mediate communication processes through use of power or by aiding information processing (Griffith et al.1998) so that they can play an important role in the team’s development and maintenance of norms and interpretive schemes. The coordinators should have substantive understanding of the project so that they can help to frame and reframe the project for the team-members as it evolves over time. The coordinators themselves need to be extremely good communicators with good grasp over the technologies in use. Since the time for projects is typically short, the coordinators should be capable of taking decisive action when required. They need to be able to switch between the roles of autocratic dictator (law maker and law enforcer), mediator in negotiations, facilitator of group communications and information processing, and sometimes, as a silent monitor, as necessary. The selection process should strive to identify coordinators with the above mentioned characteristics.

**Training:** Since virtual team-work requires a number of competencies, and in many cases, companies may not be able to recruit team-members with all desirable skills, the role of training becomes critical. Prior identification of training needs is important given the short duration of the project. There is also the need to provide training on the job as
the project progresses and requirements change over time. Careful monitoring of on-going communication may help in timely identification of “deficient” areas that need to be strengthened through training.

**Intervention:** An important implication of our study is that geographically distributed teams do not (and cannot) start *collaborating* from the moment they are formed, and need to attain certain structural characteristics (routine virtual presence, mutual responsiveness, integrated team-level identity, shared social goal, task focus, and task ability) before team-members can tackle inter-dependent tasks in a seamless and effective fashion. The faster they attain these characteristics, the more effective the team is likely to be, in terms of achieving its goals. The role of the project coordinators, then, is to manage (i.e., monitor and shape) the patterns of communication so that the team can progress systematically but rapidly into the collaborative stage. A number of tactics (e.g., guiding the development and appropriation of team norms of communication and technology use; the use of humor, personal stories, and anecdotes interspersed with discussions on substantive issues; etc.) that can, for example, help induce transition from one stage to another have been discussed in the paper. Also, having guided a team to a particular (say, collaborative) stage, the coordinators must not become complacent, and need to ensure that the team does not regress to a less functional state. This is accomplished by prompting/guiding teams in their use of communicative actions that are directed toward avoiding and rapidly repairing breakdowns in communication and/or social relationships. Finally, ensuring the availability of appropriate ICT infrastructure throughout the project also remains a critical concern for the virtual team managers.
Summarizing, we have outlined some key practical implications from our study grounded in a socio-technical perspective. Implications are presented for the coordinators and team members since they both play a key role in the project. The aim of the implications is to nurture and cultivate the communicative capability of participants so that a collaborative state can be achieved and maintained. At one level, these implications are also useful for co-located teams, though the guidelines must be interpreted in light of the differences among virtual and co-located teams.

A limitation of our study is that the empirical basis of our findings is student behavior in the university context, where the conditions are presumably very different from those existing in virtual teams in organizations. For example, some may argue that a professor’s power over students is of a significantly different nature than a manager’s power over his/her subordinates. Also, one would generally expect a lower proportion of apathetic behavior in organizational virtual teams than in student virtual teams. While acknowledging this situation, we would like to make two points to help mitigate the downside of using student groups:

- Given the longitudinal and intense nature of the projects, students are likely to be appropriated by the world of virtual teamwork, wherein they enact what they perceive as their roles of interconnected and interdependent team-members involved in ISD, rather than behave as “typical” students interested in merely passing a course;¹⁷
- Our theoretical model, a form of analytical generalization based on observed tendencies in specific types of "virtual team situations," could still be applied to

¹⁷ We believe that there is greater likelihood of such behavior in cross-sectional studies where the students are not immersed in the context.
different “real-world” situations, though one would have to account for the elements of the model such as modalities of norms, power, and meanings differently. Thus, we emphasize that the theoretical/conceptual framework presented in this paper using which team dynamics in a virtual context can be analyzed, rather than the description of *specifics* of a particular kind of virtual team, be viewed as our primary contribution\(^\text{18}\).

\(^{18}\) The importance of conceptual knowledge of this nature to academics as well as practitioners in management has been established in the literature (e.g., Astley and Zammuto 1992).
REFERENCES


53


Giddens, A. *Profiles and Critiques in Social Theory*, University of California, Berkeley, CA, 1982.


## TABLE 1: PROJECT PARTICIPANTS

<table>
<thead>
<tr>
<th>Main Participants</th>
<th>Brief description</th>
</tr>
</thead>
<tbody>
<tr>
<td>UA members</td>
<td>Members of virtual teams who were students at UA. Primarily involved in interacting with the clients and defining information and end-user interface requirements</td>
</tr>
<tr>
<td>UB members</td>
<td>Members of virtual teams who were students at UB. Primarily involved in logical design and implementation of the system based on specifications created by UA members in their teams.</td>
</tr>
<tr>
<td>PA</td>
<td>Professor facilitating the virtual teams from the UA side</td>
</tr>
<tr>
<td>PB</td>
<td>Professor facilitating the virtual teams from the UB side.</td>
</tr>
<tr>
<td>Companies (each team interacted with a different company)</td>
<td>Located in the same city as UA. UA members interacted with company representatives to define the systems requirements.</td>
</tr>
<tr>
<td>Phase of the Project</td>
<td>Timeline (in weeks)</td>
</tr>
<tr>
<td>----------------------------------------------------------</td>
<td>---------------------</td>
</tr>
</tbody>
</table>
| **Phase I: Formation of the team and creation of work plans** | Week 0 to week 4    | - Event 1: creation of the virtual team by PA and PB  
- Event 2: Selection of organization by UA members for which the virtual team would develop a system  
- Event 3: introductory videoconference #1  
- Event 4: completion of project proposal by UA members |
| **Phase II: Defining the business problem**              | Week 5 to week 8    | - Event 5: Completion of the Information Requirements Document (IRD) by UA members  
- Event 6: Videoconference #2 to clarify the contents of IRD |
| **Phase III: System design, development and delivery**   | Week 9 to week 14   | - Event 7: Completion of conceptual/logical design by UB members  
- Event 8: Completion of user interfaces by UA  
- Event 9: Prototype delivery by UB members and joint presentation in videoconference #3 |
<table>
<thead>
<tr>
<th>Source of data</th>
<th>Nature of data collected</th>
<th>Time/frequency of data collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Webboard</td>
<td>All messages and attachments posted</td>
<td>Throughout the life of the project</td>
</tr>
</tbody>
</table>
| Electronic mail                      | ❖ E-mails sent directly to coordinators, PA or PB  
❖ E-mails exchanged among team-members                                                                                                                                  | ❖ At different times  
❖ Compiled and submitted by each team at the end of the project |
| Videoconferencing                    | ❖ Real-time observations by coordinators during the meeting  
❖ Videotapes of the meetings                                                                                                                                             | During the three videoconferencing sessions |
| Participant/direct observation by coordinators | Informal feedback from participants and direct observations                                                                                                                                                                       | Throughout the life of the project |
| Final team reports on project        | Substantive description of the problem, design, development and collaboration process                                                                                                                                              | At the end of the project                                                        |
| Reflection documents                 | Summary of individual experiences in the project, and lessons learned                                                                                                                                                        | At the end of the project                                                        |
| Evaluations of other team-members    | Quantitative and qualitative feedback on team-members' performances through e-mail to the coordinators                                                                                                                                 | At the end of the project                                                        |
| On-line feedback (optional)          | Comments on the virtual team project itself                                                                                                                                                                                  | As and when completed by participants                                              |
### TABLE 4: SUMMARY OF THE DATA ANALYSIS PROCESS

<table>
<thead>
<tr>
<th>Stages of Analysis</th>
<th>Important Activities</th>
<th>Outputs/outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stage I: Preliminary coding</strong></td>
<td>- Development of theoretical sensitivity by the researchers</td>
<td>- Three researchers gaining intimate knowledge of the data.</td>
</tr>
<tr>
<td>(message level)</td>
<td>- Examination of individual messages to develop &quot;open codes&quot;</td>
<td>- Identification and development of initial concepts drawing on Couch (1992; 1994)</td>
</tr>
<tr>
<td></td>
<td>- Importing transcripts into Nudist, and cross referencing &quot;strips&quot; with emerging codes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Three researchers gaining intimate knowledge of the data.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Identification and development of initial concepts drawing on Couch (1992; 1994)</td>
<td></td>
</tr>
<tr>
<td><strong>Stage II: Intra-team analysis</strong></td>
<td>- Further development of theoretical sensitivity by the researchers</td>
<td>- Individual virtual team case narratives</td>
</tr>
<tr>
<td></td>
<td>- Developing individual team narratives</td>
<td>- Preliminary theoretical model of virtual team development using Giddens (1984)</td>
</tr>
<tr>
<td></td>
<td>- Developing a linkage between the concepts</td>
<td>and Couch (1992; 1994)</td>
</tr>
<tr>
<td><strong>Stage III: Across team analysis</strong></td>
<td>- Identification of similarities and differences in the development of different teams</td>
<td>- Archetype of virtual teams</td>
</tr>
<tr>
<td></td>
<td>- Identification of mechanisms of transitions from one stage of team development to another</td>
<td>- Integrated theoretical model of virtual team development</td>
</tr>
</tbody>
</table>
## TABLE 5: CHANGING STRUCTURE IN VIRTUAL TEAMS

<table>
<thead>
<tr>
<th>STAGES</th>
<th>Stage 1</th>
<th>Stage 2</th>
<th>Stage 3</th>
<th>Stage 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Virtual presence</strong></td>
<td>Virtual presence limited to initiating side members in most cases.</td>
<td>Increased but intermittent virtual presence of members from both sides. No shared norms of virtual presence.</td>
<td>Most members uniformly co-present as per established/accepted norms.</td>
<td>For &quot;effective&quot; teams (those making a transition from Stage 3), virtual presence remains uniformly high till project end, and sometimes persists after the project ends. In other teams, virtual presence is intermittent and abruptly disappears immediately after project presentation.</td>
</tr>
<tr>
<td><strong>Social responsiveness</strong></td>
<td>Unidirectional (from the direction of initiating group, other side largely silent.)</td>
<td>Bi-directional (both sides conversing past each other)</td>
<td>Mutual (both sides conversing with each other)</td>
<td>For effective teams, remains mutual till the end of the project, and, often, beyond. Not so for the other unsuccessful teams.</td>
</tr>
<tr>
<td><strong>Nature of goals</strong></td>
<td>Reflect individual concerns. Team members unsure about local goals and unaware of overall project goals.</td>
<td>Reflect the local concerns of satisfying members' local (course) requirements.</td>
<td>Shared goal (of building an acceptable IS for the client, and delivering impressive presentation.) Evidence of supporting remote members' specific goals.</td>
<td>For effective teams, successful joint presentation of the IS and good grades (i.e., joint success). For teams transitioning from second stage, there is no shared goal – focus is on getting a good grade (favorable individual evaluation) at any cost.</td>
</tr>
<tr>
<td><strong>Identities</strong></td>
<td>Participants switch between individual identities and identities linked with some local members with shared bio (fragmentation).</td>
<td>Differentiated identities develop and solidify based on local affiliation.</td>
<td>Team-level integrative identities form, that appear to transcend locations.</td>
<td>Team-level integrative identities persist in &quot;effective&quot; teams, while, in others, project or team-related identities disappear.</td>
</tr>
<tr>
<td><strong>Coordinators’ Position/Role</strong></td>
<td>Overtly autocratic and directive.</td>
<td>Usually facilitative and helping to mediate disagreements, but often directive.</td>
<td>Silent monitor in the background (&quot;lurking&quot;), occasionally facilitative.</td>
<td>Facilitative or directive depending on team.</td>
</tr>
<tr>
<td><strong>Task Focus</strong></td>
<td>Low focus, formed primarily based on artifacts created by project coordinators, (i.e., web-site information in the form of syllabus, etc.)</td>
<td>Increasing focus as Communication occurs on the project requirements among team members (both sides) and with coordinators.</td>
<td>High focus reflected in substantive discussions, and precise responses made to specific questions (over an extended period).</td>
<td>Peaking of task focus in virtually all teams.</td>
</tr>
<tr>
<td><strong>Task Ability</strong></td>
<td>Low wrt. Communication competence and task-related skills Ability based on prior coursework and experiences with IT.</td>
<td>An improvement in ISD and communication skills that are required for the project (e.g., Access, ER modeling, VBA, Videoconference, altercentrism)</td>
<td>Rapidly increasing (i.e., high task ability) as team members gain experience &amp; delegate responsibilities according to competence or interest.</td>
<td>In effective teams, high task ability clearly evident. In the less effective teams, task ability remains marginal -- limited to making &quot;grade-saving&quot; development &amp; presentation.</td>
</tr>
</tbody>
</table>
### TABLE 6: EXAMPLES OF RECURRING COMMUNICATIVE ACTIONS IN THE DIFFERENT STAGES OF VIRTUAL TEAM DEVELOPMENT

<table>
<thead>
<tr>
<th>STAGES</th>
<th>Stage 1</th>
<th>Stage 2</th>
<th>Stage 3</th>
<th>Stage 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Definition/ Negotiation of situation</td>
<td>Coordinators define project landscape, as UA members enact their local affiliations and self-centeredness (e.g., the team-name DFLKK proposed by UA members represented the starting alphabet of each UA member's name).</td>
<td>UA and UB redefine project unilaterally according to their local frames (course foci) – UA as wanting a &quot;DSS&quot; and UB's aim to develop a database. UA members define themselves as &quot;managers.&quot; Power implications and proposed norms of communication are negotiated.</td>
<td>Effective groups agree on clarity of deadlines, and technical parameters of the system.</td>
</tr>
<tr>
<td>TURN-TAKING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Impression management</td>
<td>UA members try to establish technical credibility, and also use symbols (icons) to project an image of being &quot;cool&quot; individuals.</td>
<td>Both sides attempt to portray an image of being professional and credible. Some teams use humor to express collegiality.</td>
<td>Teams attempt to impress coordinators and other teams both from the pride of completing a complex project, and for obtaining best grades.</td>
</tr>
<tr>
<td></td>
<td>Exchanging artifacts</td>
<td>None between members.</td>
<td>Transmission of formal documents relating to proposal and requirements, without any ostensive purpose. No shared norm(s) on ITs to be used for document transfer (e-mail or Webboard or fax)</td>
<td>Formal as well as informal documents and diagrams exchanged frequently, comfortably, and purposefully using different Its. Norms on which IT to be used for what purpose, e.g. e-mail for large attachment and web-board for smaller documents</td>
</tr>
<tr>
<td></td>
<td>Use of referential/ evocative symbols</td>
<td>Minimal use, other than proposals on names being done locally.</td>
<td>Primarily referential symbols used, some evocative symbols with reference to sports and drinking used in a disjoint manner.</td>
<td>Frequent use of evocative symbols seamlessly weaved with referential symbols. Helps the project evolve into a fun and productive work environment.</td>
</tr>
<tr>
<td>DEALING WITH TROUBLE</td>
<td>Problem avoidance</td>
<td>UA members use various strategies, including wooling, calling on external norms, appealing to coordinators to intervene.</td>
<td>Humor proposed to &quot;break the ice&quot; and establish an environment in which problems don’t occur. Those showing initiative and knowledge are publicly praised.</td>
<td>Explicit appreciation of the ideas and efforts of the others, and substantive disagreements resolved through polite but reasoned argumentation – &quot;strategic mitigation.&quot; Referential and evocative symbols intertwined. Anticipated violation of norms normally accompanied with a prior notice/excuses.</td>
</tr>
<tr>
<td></td>
<td>Problem Repair</td>
<td>Coordinators intervene to repair problems caused by UB not responding to UA messages, who interpret this silence as a sign of lack of seriousness.</td>
<td>UB repair early negative interpretations of UA by thanking UA for their patience, blaming technology or their knowledge of it and blaming the coordinators for poor communication.</td>
<td>Intervention required by coordinators in isolated cases to defuse potentially negative situations. Apologies and humor used by team members to sort out problems.</td>
</tr>
<tr>
<td>STAGES</td>
<td>Stage 1</td>
<td>Stage 2</td>
<td>Stage 3</td>
<td>Stage 4</td>
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<td>--------</td>
<td>-------------------------------------------------------------------------</td>
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<tr>
<td>POWER</td>
<td>* Institutional position of the coordinators</td>
<td>* Coordinators’ institutional position to reward and punish</td>
<td>* Awareness of complexity of achieving shared social goal</td>
<td>* Evaluative criteria specified in the project document (syllabus) by</td>
</tr>
<tr>
<td></td>
<td>* Project structure and evaluation criteria specified by the coordinators</td>
<td>* Roles implied in the project structure (“manager”).</td>
<td>* Coordinators’ institutional position to reward and punish (subtle</td>
<td>the coordinators</td>
</tr>
<tr>
<td></td>
<td>* Project related uncertainty</td>
<td>* Knowledge of technology and techniques (or lack of)</td>
<td>but present)</td>
<td>* Coordinators’ institutional position to reward and punish more</td>
</tr>
<tr>
<td></td>
<td>* Knowledge of technology (or lack of)</td>
<td></td>
<td>* Mutuality enabling the abdication of formal power to remote members</td>
<td>prominent.</td>
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<td></td>
<td></td>
<td></td>
<td>in the interest of expediency.</td>
<td>* Individual technical skills especially become important</td>
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<td></td>
<td></td>
<td>* Individual technical &amp; behavioral skills.</td>
<td>source of power in the team.</td>
</tr>
<tr>
<td>NORMS</td>
<td>* Few pre-existing views on effectively participating in virtual</td>
<td>* Norms of satisfying requirements of the local institution.</td>
<td>* Taken-for-granted shared rules (across location) of virtual presence</td>
<td>* Taken-for-granted of shared rules (across location) of virtual</td>
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<td></td>
<td>collaboration.</td>
<td>* Working rules of technology use, responsiveness, etc. proposed,</td>
<td>maintenance, technology-use, technology-use, turn-taking, etc.</td>
<td>presence maintenance, technology-use, responsiveness, etc.</td>
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<td></td>
<td></td>
<td>negotiated, and/or appropriated.</td>
<td></td>
<td>* Some norms (e.g. timeliness, technology-use) stretched to (beyond)</td>
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<td></td>
<td></td>
<td>* Expectations of professionalism and collegiality as proposed by</td>
<td></td>
<td>limit members frantically try to achieve project deliverables.</td>
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<td></td>
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<td>project coordinators.</td>
<td></td>
<td>* Project parameters and evaluative criteria described in syllabus</td>
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<td>become the main source of norms for structuring interaction and final</td>
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<td>artifacts.</td>
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<td>MEANINGS</td>
<td>* “Virtual team” holds little meaning. Also, team-membership not part</td>
<td>* Emergent understanding of ISD concepts from the course</td>
<td>* Shared frame of reference regarding project.</td>
<td>* Joy or anger or relief based on experiences in the project</td>
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<td></td>
<td>of self-definition.</td>
<td>* Emergent understanding of project requirements/structure.</td>
<td>* Responsibility towards the client.</td>
<td>* Emotional closeness, irritation or indifference with team-members</td>
</tr>
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<td></td>
<td>* Course and term project meanings based on discussion with past</td>
<td>* Natural identification with local (“us”) versus remote (“them”).</td>
<td>* Inter-relatedness of the global requirements and local requirements</td>
<td>* Learning become “shared stocks of knowledge” for both the coordinators</td>
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<td>students at the same location.</td>
<td></td>
<td>of each side.</td>
<td>and students wrt future virtual team projects.</td>
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<td></td>
<td>* Meanings about the efficacy and novelty of different technologies</td>
<td></td>
<td>* The entire project team viewed as an anthropomorphic whole, and a</td>
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<tr>
<td></td>
<td>(paging, e-mail, videoconferencing, etc.) and the project itself.</td>
<td></td>
<td>sense of belonging to this whole.</td>
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<td></td>
<td>* Meanings held by coordinators based on their research embedded in</td>
<td></td>
<td>* Positive affect regarding the project, framed as a unique and</td>
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<td></td>
<td>artifacts (syllabus).</td>
<td></td>
<td>realistic experience.</td>
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FIGURE 1: THEORETICAL FRAMEWORK FOR THE STUDY

VIRTUAL TEAM STRUCTURE

- Production Structure
- Social Structure

MODALITIES OF STRUCTURATION

- Power
- Norms
- Meanings

COMMUNICATIVE ACTION

(Action implied through communication)

- Turn-taking (utilizing contents of the communication transactions, artifacts and documents, and communication technologies)
- Dealing with trouble
FIGURE 2: TEAM DEVELOPMENT STAGES CONCEPTUALIZED IN TERMS OF THE RECIPROCAL INTERACTION BETWEEN THE MACRO AND THE MICRO

Some teams fail to reach/remain in the stage of Collaboration, and make a transition to the final stage directly from the Exploration stage as the final deadline approaches.

Stage 1: Initiation
Stage 2: Exploration
Stage 3: Collaboration
Stage 4: Culmination and Dissolution

Communicative actions aiding in transition to Stage II: 1) Wooing; 2) Reference to tasks, roles, norms; 3) Calling upon higher authorities

From Stage II to Stage III: 1) Taking interest in remote members’ goals/constraints; 2) Using evocative symbols; 3) Rallying around external deadlines

From Stage III to Stage IV: 1) Attending to requirements of the final deadlines; 2) Anticipating the climax of the project presentation, etc.

Virtual Team Structure – Macro Level (see Table 5)
- Production Structure: task focus, and task ability
- Social Structure: nature of virtual presence, social responsiveness, nature of goals, nature of identities, and position of project coordinators

Modalities of Structuration (see Table 7)
- Power – course grades, deadlines, uncertainty regarding evaluation, artifacts of coordinators, structure of project, technical competence, etc.
- Norms - institutional, facilitator-created artifacts, records of team-member communications, etc.
- Meaning - past experience, frames of reference (disjoint or shared), inter-relation of local and global issues, personal identification with the outcome, lessons for the future, etc.

Communicative Action at Micro Level (see Table 6)
- Turn-taking: Definition/negotiation of situation, impression management, exchanging artifacts, use of referential and evocative symbols, requesting or mandating the use of different technologies/techniques
- Dealing with trouble: Problem avoidance and problem repair using disclaimers and alignments

Virtual Team Structure – Macro Level (see Table 5)

Some teams revert back to the Exploration Stage after they reach Collaboration Stage because they are unable to effectively deal with trouble. Lack of social solidarity is often the cause.