Computer Mediated Communication among Virtual Teams: What are "Teams" and how are they "Virtual"?

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Introduction

This chapter is concerned with computer-mediated communication among virtual teams. A focus on social factors in small group interaction is required to adequately answer the question: what is a "virtual team" and how can it be said to be "virtual?" Understanding the role of social factors in small group interaction is important since governments and corporations around the world are increasing their reliance on information technology as a surrogate for face-to-face interaction among distributed teams. Work in this area is particularly timely since, as 'virtual teaming' has been on the rise, research in small groups has declined (Ilgen, 1999); (Gladstein, 1984). A survey of social science research on small groups will conceivably help software designers design 'group friendly' electronic environments for virtual teams. It is the first step towards knowing, for example, when a 3-D rendered virtual collaboration environment would better support collaboration than e-mail, a conference call or a face-to-face meeting. It is anticipated that work in this area will also inform management on the social-psychological impacts of distance on small group collaboration.

Approach

It has not been determined empirically that any set of critical constructs describes small groups better than large groups, or work groups better than social groups. In fact, the field of Group Dynamics is based on the assumptions that general laws concerning human interaction within groups are identifiable and can be used to analyze all types of groups. Group dynamicists assert: "the various criteria that have been used to identify "types" of groups should be conceived as variables that may enter into a single general theory of groups" (Cartwright & Zander, 1968). Thus the approach of this chapter is to draw upon literature from various disciplines – sociology, social psychology, management science, organizational behavior, industrial relations – to inform an understanding of cohesion among groups. Because it is good scientific practice to study the intellectual lineage of a concept before applying it, Section 1 of this chapter begins with a brief history of small group research and the origins of the concept of 'social group.' It then defines virtual teaming with respect to social science definitions of 'groups,' 'small groups' and teams in the organizational context. Section 2 presents a discussion of group cohesion as it is defined in the social science literature. Implications of physical collocation on cohesion is also discussed. Section 3 applies these concepts to empirical data of the use of Computer Mediated Communication Technologies (CMC).

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Section 1 – Small Group Research: History and Definitions

"The set of research on teams embedded in organizations represents more of a portfolio model than a neatly bound paradigm." (Ilgen, 1999)

Interdisciplinary Interest in Groups

Implied by the quote above, research on teams has not been associated exclusively with any one academic discipline. In the social sciences, intellectual veins of small group research can be followed in sociology, social psychology and more recently, cognitive science. Early research on small groups in the work place arose out of the scientific management movement. This research agenda took a mechanistic perspective on the relationship between worker and task. Economic implications surrounding the influence of physical environment on human performance spurred the National Academy of Sciences to fund, in 1924, the well-known Western Electric Company experiments at the Hawthorne Works in Chicago. The objective of the Hawthorne studies was to identify the "relation of quality and quantity of illumination on efficiency in industry" (Sundstrom & Sundstrom, 1986). Ironically, the Hawthorne studies are seen as the seminal work in the field of human relations. This is ironic because the implicit assumption of the Western Electric researchers was deterministic – that environment, in this case illumination, determined production. While searching for a dependency relationship between environment and production, the Hawthorne researchers found that social factors strongly influenced production. They attributed production variability to employee attitudes and to socially negotiated standards of production (i.e. norms) that arose among informal social groups.

It has been said that the failure of the Hawthorne studies to find a direct correlation between lighting and production widened the focus of industrial psychologists to include employees' attitudes, interpersonal relations and groups (Sundstrom & Sundstrom, 1986). The heyday of small group research was the 40-year period after the Hawthorn studies. In the latter part of this period, the seminal ideas of Kurt Lewin (Lewin, 1948); (Lewin, 1951) were applied to theories of social comparison process (Festinger, 1954), cooperation and competition (Deutsch, 1949) social power (French, 1959), and the social psychology of groups (Thibaut & Kelley, 1959). A hotbed for small group research, the University of Michigan was the birthplace of the field of Group Dynamics (Cartwright & Zander, 1968). In his 1966, 600-page survey of small group research, McGrath summarized the history of small group research in this way:

> "The 1930's emphasized national problems such as leadership…and contained the broad theorizing of Kurt Lewin. The postwar 1940's were times of application and amplification. We entered the 1950's with vigor and increased resources, scurrying to conduct research on matters learned about during the war… That decade saw a research boom which has continued into the 1960's." (McGrath, 1990)

In a more recent survey of small group research, McGrath (McGrath, 1997) identified the following seven fields producing research on small groups: organizational behavior, speech communications, political decision making, group therapy, family studies, human relations and management. Recent work on self-managed work teams reported by Sundstrom (Sundstrom, DeMuse, & Futrell, 1990) comes from the field of organizational behavior. Table 1 lists several definitions of group and team from the relevant literature.

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What is a group?

There is little agreement in the literature about how to define a group. Size, function, extent of in-group communication, persistence over time – are only a few of the dimensions of groups. Interaction is one criterion commonly used to distinguish a collection of individuals, such as a crowd waiting for a New York subway, from a "social group." Proponents of the interaction theory believe human interaction defines a group. Simply stated: "for a collection of individuals to be considered a group, there must be some interaction"(Hare, 1962). Interactionists believe that once interaction is enabled, four properties of groups emerge:

1. Shared goal. Members of a group share one or more motives or goals that determine the direction in which the group will move.
2. Norms. Members develop a code of behaviors, or norms, which set boundaries within which interpersonal relations may be established and activity carried out.
3. Roles. Relative position and responsibilities of group members stabilize over time.
4. Cohesion. Explicit "likes" and "dislikes" of members for one another refines group membership and creates a network of interpersonal attraction (adapted from Hare, 1962)

Alternatively, social identity theorists maintain that affiliation, not interaction, defines a group. Individuals identifying with a group, defines the group (Tajfel, 1978). Another school of thought maintains that interdependence is the essential property of a social group (Lewin, 1948) (Rabbie, 1991). According to this line of thinking, a group exists if members perceive themselves to be interdependent with respect to a common goal and means to attain the goal (Rabbie, 1991).

Table 1: Definitions of Groups & Teams

Reference	Field	Definition
(Lewin, 1948)	Social Psychology	"**Groups** are sociological wholes; the unity of these sociological wholes can be defined operationally in the same way as a unity of any other dynamic whole, namely by the interdependence of its parts."
(Rabbie, 1991)	Social Psychology	"A **group** becomes a compact 'we-group' or 'social group' to the extent that individuals are subjected to the experiences of a common fate, perceive themselves to be interdependent with respect to their common goals and means to attain those goals, view themselves (and are considered by others) as a distinctive social unit, can directly communicate with one another and engage in cooperative fact-to-face interactions in an effort to achieve a group product or a common outcome."
(Hare, 1962)	Sociology	"For a collection of individuals to be considered a **group**, there must be some interaction. In addition… four features of group life typically emerge: shared motive or goals…, norms, stabilized roles, and a network of interpersonal attraction."

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(Goodman et al., 1978)	Organizational Behavior	"**Groups** [are] collections of individuals who interact with each other in pursuit of some common goal."
(Homans, 1950)	Sociology	"A **group** is a number of persons who communicate with one another often over a span of time, and who are few enough so that each person is able to communicate with all the others, not at second hand, through other people, but face-to-face."
(Mink, Mink, & Owen, 1987)	Human Resource Management	**"Groups** are three or more persons in a combination of mental energy… groups form to engage in a task – to work."
(Sundstrom & Sundstrom, 1986)	Environmental Psychology	"A **group** is social entity that represents more than the collection of individuals who make it up."
(Bales, 1950)	Social Psychology	"A **small group** is defined as any number of persons engaged in interaction with each other in a single face-to-face meeting or a series of such meetings, in which each member receives some impression or perception of each other member…"
(Sayles, 1958)	Industrial Relations	"The **work group** is the primary focus of registering discontent as well as the organizational mechanism for releasing productivity. Being able to identify in advance the work groups that will support or attack management or union programs, the administrator gains a major tactical advantage."
(Mohrman, et. al., 1995)	Management	"**Teams** have responsibility for a "whole" part of the work. These teams have been described a "empowered," because in theory they do not have to seek hierarchical approval for many of their decisions about how to do their work… sometimes referred to as "self-managing," because they perform for themselves many of the tasks that management used to perform, such as scheduling and monitoring performance."
(Haywood, 1998)	Management	"… the primary factor that distinguishes a **virtual team** from other types of teams is that one or more of the team members is geographically separated from the other members."
(see page 6)	–	A ***virtual team*** *is a small group using technology to communicate with one or more geographically remote member…* members operate in an organizational context, assume differentiated roles, are interdependent, and produce some intellectual or physical product for which members have collective responsibility.

Although an interesting topic, the ontology of groups is not the focus of this chapter. However, an examination of group theory is germane to a study of virtual teams to the extent that it uncovers implicit assumptions about distance and collaboration within groups. For example, it is important to note that the definition of "groupness" provided by the interdependence school presumes face-to-face interaction:

> "A **group** becomes a compact we-group to the extent that individuals…can directly communicate with one another and engage in cooperative face-to-face interactions in an effort to achieve a group product or a common outcome" (Rabbie, 1991).

According to Hare (Hare, 1962) the most commonly used definition of a small group is that given by Bales:

> "A **small group** is defined as any number of persons engaged in interaction with each other in a single face-to-face meeting or a series of such meetings, in which each member receives some impression or perception of each other member…" (Bales, 1950)

Face-to-face interaction is explicit in this definition as well. Although it is not possible to know precisely why physical collocation is explicit in these definitions, one can guess that face-to-face interaction was prescribed by the research questions and protocols used by these researchers to study small groups. It suffices to say that classical theories of small group interaction should be cautiously applied to the study of geographically distributed teams. With that in mind, this chapter has been organized such that discussions of theory are separated from discussions of implications raised by theory and regarding collocation.

Work Groups in Organizations

A collection of frequently cited definitions of the terms 'group,' 'work group' and 'team' is listed in Table 1. The definition of 'work group' proposed here is drawn from Hackman (Hackman, 1990). He defines three essential attributes:

1. Work groups are *real groups*. They are intact social systems, with boundaries, interdependence among members and differentiated member roles.
2. They have one or more tasks to perform. The group produces some outcome for which members have collective responsibility and whose acceptability is potentially assessable.
3. They operate in an organizational context. The group, as a collective, manages relations with other individuals or groups in the larger social system in which the group operates. (Hackman, 1990)

The fact that work groups are embedded in organizations produces interesting questions about all manner of issues concerning human interaction. Since the organizational context does not distinguish virtual teams from other work groups, adopting an "organizational" perspective does not provide the intellectual currency to warrant extensive discussion here. However, it is important to note that implicit in Hackman's definition and all preceding definitions of 'groups' discussed here, is the assumption that people *first* orient towards their common goal *then* determine the means, i.e. process, to achieve that goal. Arguably appropriate for analyses of social groups (e.g. a street gang or Mother's Against Drunk Drivers), this assumption is troublesome when applied to groups in the organizational context. It is troublesome because people at work are often not granted the latitude to orient towards a goal; goal orientation is explicitly or implicitly mandated in their job description. So too is group participation.

What is a Team?

One approach to defining work teams is to consider the dichotomies often used to classify groups (work/social; informal/formal, etc.). Teams are small groups in which participation is either implicitly or explicitly mandated by management. In teams, formal roles are prescribed by the organizational structure

(managers don't stop being managers when they work on a team). Informal roles, such as team peacemaker, are emergent. Like the work groups defined above, teams are *real groups*, have a task to perform and operate in the context of an organization. Lastly, time matters in teams (McGrath, 1990). Work teams have a task; that task is planned and carried out over a period of time.

What's Virtual about Virtual Teams?

A debatable, but commonly held assumption about teams is that they out perform individuals, especially when performance requires multiple skills, judgements and experience (Katzenbach & Smith, 1993). The trend towards reengineering organizations around teams (Ilgen, 1999) has occurred in parallel with the proliferation of computer-mediated communication, rise in telecommuting and increased reliance on information technology in organizations. The teaming trend and 'wiring of the workplace' have lain the organizational and technological groundwork for virtual teams. Findings from a survey of teams in US companies indicate that 66% had at least one member who was permanently assigned to a location geographically distant from the rest of the team (Kinney & Panko, 1996). Among these distributed teams, 31% of the members were not collocated with the others on their team. Although recent academic studies of virtual teaming at Boeing Corporation (Poltrock & Engelbeck, 1997) and management texts (e.g. (Haywood, 1998) have identified some features of virtual teams that may distinguish them from collocated work teams,[1] the only distinguishing factor considered here is geographic distance mediated by communication technology.

Thus, a *virtual team is a small group using technology to communicate with one or more geographically remote member.* A 'significant' time period connotes at least half the life-span of the team. In practice, it often constitutes the entire life-span. In addition, members of virtual teams operate in an organizational context, assume differentiated roles, are interdependent, and produce some intellectual or physical product for which members have collective responsibility. Thus, 'virtual' is shorthand for 'virtual collocation.' It connotes technology-mediated communication which *may or may not* involve an artificial environment provided by a computer, i.e. 'virtual reality.' Technology-mediated communication in virtual teaming may be as elaborated as a 3-D rendered electronic environment or as mundane as a conference call.

Section 2 – Cohesion in Groups

*"**There is virtually no end to the list of symptoms one could use to characterize a group**."* (Weick, 1979)

The focus of this chapter is on virtual teams in the workplace. Related issues not addressed are the implications of the organizational context of groups (Gladstein & Caldwell, 1988), the division of cognitive labor across workers and tools (Hutchins, 1990), the influence of leadership on group decision quality (Maier & Solem, 1952) development (Gersick, 1988) performance (Steiner, 1972) and norm formation (Phillip & Dunphy, 1959). For discussions of these topics and the interesting questions therein the reader is directed to the references provided. The issue addressed here is cohesion. According to the

[1] Factors that could be considered unique to virtual teams are the coordination problems caused by transfer of physical deliverables, the fact that membership on virtual teams often spans organizational boundaries and the empirical evidence that a single employee will have occasion participate on multiple teams, when teams become virtual.

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definition of virtual team constructed in Section 1, the absence of collocation is a defining property of virtual teams. Since 'virtual' is synonymous with 'virtual collocation,' implications of collocation are discussed with regard to the formation of norms and cohesion. In this section, collocation is discussed in terms of issues directly implied by the social science theories cited above.

Cohesion Defined

Cohesion has been defined as "the tendency of group members to stick together" (Sproull & Kiesler, 1991), as "in-group favoritism" (Tajfel, 1978) and as the sum of all forces which act on individuals to stay in a group (Festinger, 1968). Since the focus of this study is work groups and not social groups, the notion of cohesion as in-group favoritism is not examined here. Considered here are conceptualizations of cohesion which impact aspects of group decision making, specifically consensus. The effects of cohesion on productivity are examined in the next section.

How cohesion influences interpersonal attraction among group members is an interesting question. Leon Festinger examined this question in his laboratory experiments in the 1950's (Festinger, 1954). In his seminal study, Festinger assembled small groups of subjects and introduced a controversial topic to them. He required each subject write his/her opinion on the issue on a piece of paper. He convinced the subjects that he had accurately computed the distribution of opinions and gave each subject a copy of the results. Some subjects received results indicating their opinion was held by a majority of the group members. Others received results indicating their opinion was quite contrary to the majority. After the experiment, each subject was asked how well they liked others in their group. In each of eight different experimental conditions, subjects who felt others held contrary opinions, were less attracted to members of their group.

The notion of attraction is just one component of cohesion. Another component is uniformity of opinion, or consensus. As an extension of the experiment reported above, Festinger asked subjects to rate their confidence in their opinion after discovering the opinions of others in their group. Findings show that those who learn they hold a minority opinion, become less confident in their opinion and are prone to change their opinion. Festinger generalizes these findings in this way: "The availability of comparison with others whose opinions or abilities are somewhat different from one's own will produce tendencies to change one's evaluation of the opinion or ability in question (Festinger, 1954). This hypothesis, taken with the finding that a person will be less attracted to groups of others who hold opinions contrary to his own, suggests that uniformity of opinion, if not cohesion, is self-perpetuating.

Another way to articulate Festinger's findings is to say that a group creates a socially persuasive force that acts to reinforce the majority opinion. This is the essence of groupthink. Coined by Irving Janis in 1972, 'groupthink' is: "a mode of thinking that people engage in when they are deeply involved in a *cohesive* group, when the members' strivings for *unanimity* override their motivation to realistically appraise alternative courses of action" (Janis, 1972). The canonical example of groupthink is the Bay of Pigs invasion of Cuba. This decision made by US President John F. Kennedy and his cabinet, best described as a grave political fiasco, is viewed by Janis as a "defective decision" caused by groupthink. Janis reports Kennedy and his cabinet reached consensus at the time the decision was made although it was later revealed that certain members did not support the decision.

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It is not precisely known what was said, implied, or otherwise communicated outside the Oval Office such that consensus was reached on the decision to launch the Bay of Pigs invasion. However, Janis uses this event to abstract several sources of groupthink: illusions of invulnerability, stereotyping outsiders, bounded rationality, belief in inherent morality, self-censorship and direct pressure on dissenters (Janis, 1972). Festinger supplies empirical evidence to support two of these so-called sources of groupthink. He reports that his studies "have shown clearly that the presence of disagreement in a group leads to attempts to influence others who disagree and also to tendencies to change one's own opinions to agree more with the others" (Festinger, 1954).

Collocation and Cohesion

If Festinger's findings are correct, self-censorship and direct pressure on dissenters are inherent properties of collocated groups. In an interesting study of automobile factory line workers (Walker & Guest, 1952), workers were asked to list the names of others in their work group. This study showed that workers almost invariably listed ten people in their group. It is not the size, but the consistency in the composition of the group that is interesting. Workers reported that their groups consisted of the two pairs of workers occupying the position immediately before theirs, the person directly across from them, and the two pairs of workers occupying the position immediately after theirs. This continued, systematically down the line. Although it is clear that these groups were the product of individual perceptions (Sundstrom & Sundstrom, 1986) what is not clear from this study is if proximity *or* task interdependence, both of which are dictated by the structure of the assembly line, alone contributed to the common conceptualization of the work group.

Walker's factory line workers are examples of what human relations experts call "occupational groups" (Sayles, 1958). Sayles summarized findings from his groundbreaking fieldwork in this quote:

> "Frictions and discontent at the work place are reduced when the work team incorporates [i.e. collocates] all individuals whose work is highly interdependent. [When separated] the intimate communications and self-control mechanisms of the work group do not function efficiently: one individual tends to blame another (whom he does not know) for failure to complete the work quota and for other shortcomings of coordination. Recriminations build onto on another and grievances follow… Where the work unit is artificially divided by some physical communications barrier, work-derived discontents are constantly boiling over and giving these areas a reputation for erratic behavior." (Sayles, 1958)

Exemplified by Sayles' work, studies of informal groups that arise from on-the-job interaction with coworkers have been the focus of much research in the field of industrial relations since the Hawthorn studies (mentioned above). The reader may recall from our earlier discussion that the Hawthorne studies established that work groups can exert social pressure to produce at or below management expectations. Furthermore, in the Hawthorne studies, group members who produced above quota were called "rate busters." They were pressured by others to reduce their output so as not to raise management expectations. This finding spawned numerous scholarly studies of occupational status and organizational design (Sayles, 1958). This body of work examined the relationships between collocation and cohesion by measuring job satisfaction, incidence of grievance, and incidence of worker insurgence. Keen interest in these issues arose because the serial nature of assembly operation makes it particularly vulnerable to

strikes and slowdowns. Most studies produced in this time period concluded that physical collocation fostered increased cohesion among both informal and formal groups.

Section 3 – Computer Mediated Communication *and Virtual Teams*

"Organizations will tacitly create agreements about the relative level of informality that is acceptable in electronic messages. These unspoken agreements can have an impact on both the anxiety level of the users and the communication strategies they use." (Ehrlich, 1987)

If collocation fosters cohesion, do virtual teams, by definition, have low cohesion? To review, a virtual team is a small group using technology to communicate with one or more geographically remote member. A type of 'work group,' virtual teams operate in an organizational context. A type of 'group,' virtual teams assume differentiated roles, are interdependent, and produce some intellectual or physical product for which members have collective responsibility. Cohesion is the tendency of group members to stick together. An interesting question to ask is if cohesion of virtual teams suffers as a direct consequence of being distributed and using CMC to mediate communication. In the paragraphs below, two types of CMC technologies and their implications on group cohesion are discussed.

Chat in the Workplace

This section discusses a qualitative study of the use of a proprietary chat system called "BABBLE" by six groups in a large U.S. corporation (Bradner, Kellogg, & Erickson, 1999). Six groups at the IBM T. J. Watson Research Center (USA) were studied, including a Software Engineering, Staff, and Human Resources group, a professional and a social cohort, and "the BABBLE Lab" group (which developed the system). Group size ranged from 5 to 175 people. The Software Engineering, Staff, and Human Resources groups were collocated (i.e., had adjacent offices) and organizationally bound (i.e., members belonged to the same department). Cohorts were geographically distributed but shared professional or social interests. The BABBLE lab's members were co-located and organizationally bound.

The BABBLE Interface

BABBLE is a chat-like communication tool in which typed messages are transmitted across a TCP/IP network, stored on a server and displayed to each client. BABBLE allows its users to engage in synchronous or asynchronous textual conversations, and provides visual feedback regarding who has recently participated in a conversation (Erickson et al., 1999).

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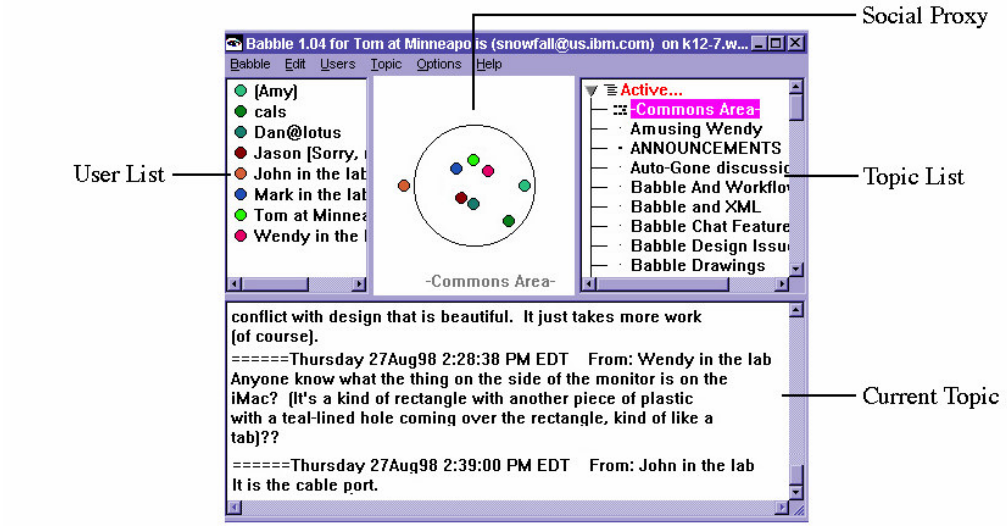

Figure 1: The BABBLE Interface

The panes of the BABBLE window (**Figure 1**) display the following information: a list of all connected users; the social proxy (a minimalist graphical representation of user activity); a list of topics (user-defined conversation areas); the current topic (i.e., text of the conversation). Messages appear in the order posted.

Three features of BABBLE distinguish it from other chat systems. First, BABBLE conversations are persistent: the conversations stay on the server permanently, thus permitting asynchronous conversations and activities. A user who is not on-line when a comment is made can see it later, and can scroll back through the entire history of a conversation. Second, a minimalist graphical representation called a social proxy is used to provide information about who is currently present in the conversation. The proxy uses a large circle to represent the conversation, and colored dots (a.k.a. "marbles") to represent individuals. A marble inside the circle represents a user who is 'in' the displayed conversation; a marble outside the circle is in some other conversation. When a user interacts with BABBLE — either by posting a message, or simply by scrolling or clicking on the interface — her marble rapidly moves towards the center of the circle; with inactivity the marble will slowly drift out to the inner edge of the circle. In Figure 1, five participants have recently 'spoken' or 'listened,' two have been idle, and one is in a different conversation. The third distinguishing feature of BABBLE is that it lacks technical mechanisms for enforcing behavior. Originally intended for small workgroups, it provides no technical means for 'kicking' people off, creating private topics, etc. With the exception of private, one-to-one chats, all BABBLE conversations were visible to everyone in a deployment group. Although various usage conventions have arisen, all negotiation and enforcement of such conventions is social.

Cohesion and Workplace Chat

In much the same way that levels of accountability vary between groups, so do levels of formality and informality in communication. Interviews of BABBLE users revealed that BABBLE promotes 'informality' in conversation. This informality results, in part, from the access control mechanisms built in to the system. It also results from the sociability and trust that exists among group members who use BABBLE. With respect to access control, a firewall exists to restrict access to only IBM users, and separate BABBLE servers are configured for each group to ensure that users can access only the BABBLE topics

created by their group. It can be argued that these technical features of BABBLE, i.e. the firewall and access control, enable a cyber analogy of what Goffman calls the 'backstage' (Goffman, 1961). Goffman proposes that "if a [group's] performance is to be effective it will be likely that the extent and character of the cooperation that makes this possible will be concealed and kept secret" (*ibid.* p. 104). The informality of communication, indecision, uncertainty and imperfection that characterizes a collaborative work of drafting a business proposal, for example, is carefully concealed by the professionalism, formality and certainty portrayed when a group presents the final proposal to a potential customer. Interview data indicates that the technical properties of secure communication and access control of BABBLE promotes feelings that BABBLE is a 'safe' place to talk. Thus, restricting access to 'members only' promotes informal conversation, free exchange of ideas, and social banter characteristic of Goffman's 'backstage.' When the security of the backstage is threatened, as was the case when one member of a BABBLE group invited an outsider (a customer) to participate in group discussions, the informality and security of the 'backstage' is lost.

The informality of conversation and trust afforded by the features of BABBLE among the groups studied suggests that BABBLE affords cohesion. Recall from the discussion above that cohesion is the tendency of group members to like and trust one another. A group is said to be cohesive where levels of trust and affinity among members is high. It *can't* be argued that cohesion is a *property* of BABBLE, much like it *can't* be argued that accountability is a *property* of BABBLE. Yet, trust and mutual attraction are implicit in the comments that some BABBLE users make when they describe their experience using BABBLE with members of their workgroup. These users report that conversation in BABBLE is "more relaxed" and "less obtrusive" than conversation via e-mail or the phone. These groups use BABBLE to keep others abreast of their decisions and activities – to keep one another 'in the loop', so to speak. The fact that these groups prefer a communication medium such as BABBLE – that is informal, enables free exchange of ideas and provides synchronous access to one another – suggests they are cohesive. Cohesion, thus, is a property of these groups that use BABBLE. It is technologically enabled by the features of BABBLE and socially enabled by the trust and mutual attraction that exists among members of these groups.

Interview data show that the technical properties of secure communication and access control promoted the feeling that BABBLE was a 'safe' place to talk. Informants stressed that restricting access to 'members only' promoted informal conversation, a free-flowing exchange of ideas, and social banter.

> "I think [BABBLE is] less formal. I treat it less formal. I wouldn't write mail about someone else's bug unless I check very very carefully that it is indeed in their code. It's funny but it's OK to write things [in BABBLE] that are not 100% finished…not that thought through…half-baked ideas are OK. Somehow it's much more like conversation." – Software Engineer

Users also said that they were less careful about the mechanical aspects of writing using BABBLE (e.g., as compared to e-mail) because they knew that BABBLE discussion was confined to the group. For example:

> "When you are in Babble it seems like a more relaxed atmosphere and you don't have to watch your spelling, you don't have to have your sentence structure perfect and all that. [In e-mail] you feel like everything has to be correct." – Recruiter

That BABBLE provides a safe sanctuary becomes quite evident when members perceive that quality being threatened. This occurred in the Software Engineering group when a client joined BABBLE. Several core members voiced strong concerns that the client's presence threatened the integrity of their BABBLE, for example:

> "Peter asked the person in Lyon to be on all the time. So I think to myself, 'is she listening to every word?' Once you start being very careful [about what you say] then you start to lose something essential to the discussion." – Software Engineer

These concerns are serious because BABBLE's access control is all or none: once 'outsiders' are allowed in, they can see everything. Conversely, because BABBLE makes user actions visible via the social proxy, and provides ways of finding out who has been in a topic, 'outsider' behavior can be monitored.

To summarize, this discussion examined communicative practices of small groups using a proprietary chat tool. The cohesion fostered by the tool is evidenced by a candid and informal tone of conversation and by the frequent and explicit acts of keeping others 'in the loop'. These practices emerge from the technical features of the BABBLE environment and the social dynamics of each workgroup.

Instant Messaging in the Workplace

We turn now to another kind of computer-mediated communication technology used the workplace: instant messaging (IM). This section discusses qualitative study of 20 workplace users of IM across three technology organizations (Nardi, Whittaker, & Bradner, 2000). A defining characteristic of all instant messaging applications, including those studied which were AOL's Instant Messenger and Excite's PAL, is the use of 'buddy lists' to initiate messages and show status. Status indicators vary among systems, yet most show 'log in' and 'log out' at a minimum. When a user sends a message to a buddy, the message appears either expanded in a small pop-up window on the recipient's screen or minimized in the buddy's task bar. The following paragraphs explore ways in which the design of IM affords different aspects of cohesion such as social bonding and impression management, discussed below.

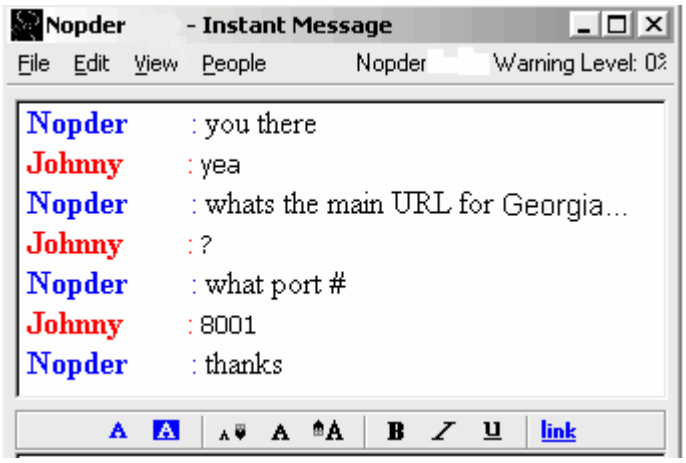

Figure 2: An Example of Information Exchange via IM

Cohesion in IM: Social Bonding

One use of IM that was observed in the workplace is social bonding. IM users reported monitoring their buddy list for activity, not to exchange messages, but simply to 'know who is around.' In this case, IM was used to produce a feeling of closeness with others, rather than to exchange information. Users described the connectedness they experience from using IM with comments such as: "You feel like

you're not the only one working on a weekend… You feel like you're in this world together so this creates a little universe" and "You can see when people log in and out…. you get a visual image in your mind of that person and I feel closer to the people I work with as a result of that."

Collocated workers maintain a sense of the presence of others through opportunistic encounters in shared spaces such as coffee rooms or hallways (Bly, Harrison, & Irwin, 1993); (Dourish & Bly, 1993); (Fish, Kraut, Root, & Rice, 1992); (Olson & Olson, 2000); (Tang, Isaacs, & Rua, 1994). But for people collaborating at distance, such encounters are rare. One IM user, with colleagues on the opposite coast of the US, explained that IM can partially address this lack of connectedness: "I tell people about [IM] because it helps overcome some social problems you experience when you're a thousand miles away from your coworkers. Things like forgetting that they're there."

Impression Management

Another social affordance of IM is impression management. The concept of impression management refers to the way in which we actively guide and control the impressions others form of us (Goffman, 1961). An interesting instance of impression management that IM mediates is responsiveness. Many of the workers studied felt they could ignore instant messages without offending the sender. They were able to do this because the features of IM don't allow the sender to confirm if the intended recipient has read a given message. Consequently, the lack of a response is not necessarily interpreted as rude or uncooperative. This ambiguity surrounding the responsiveness, or lack thereof, of the recipient has been called *plausible deniability* (Nardi *et. al.* 2000).

The *plausible deniability* afforded by IM is described by one informant in this way: "One thing I like about [IM] is that I'll see a message but I won't have to acknowledge my presence. So I'll respond to them later when I have time." Another IM user said: "You can choose if you want to respond. It's like voicemail but more accessible. I can choose not to respond for a while. It [the message] is still sitting there. I don't have to go in, get my messages...It's a nice, clean, easy way to communicate." In effect, IM users associate both fewer social costs and fewer cognitive costs with not responding to an IM, compared with other media. Unlike e-mail and voicemail, not responding to instant messages for an extended period of time is not going to produce information overload nor will it label someone as a loafing subordinate or disinterested manager. In contrast, people often feel compelled to answer the phone because they do not know the identity of the caller or their reason for calling. One active IM user observed, "So the phone can be a very intrusive thing, whereas IM is a lot friendlier because it's just a quick thing of, 'Are you there and available' or very short questions. I don't mind that interruption. With a phone call, you don't know if it's really urgent because there's no way to know who's calling, whether it's urgent and what the topic is." Additionally, instant messages can only be sent from people who appear on the user's buddy list. Thus senders are already 'screened' and messages more likely to be germane to the work at hand.

Thus, one can maintain the impression that one is conscientious and responsive to another's needs without immediately responding to the other's instant message because he knows that the other doesn't know if he has seen the other's message and is deliberately ignoring it *or* if he has not seen it at all. Some level of plausible deniability is acceptable in a white-collar office but little to no deniability is tolerable in the control room of a nuclear submarine, for example. A similar logic holds that using IM to selectively block others from communicating with you is probably not acceptable in a white-collar office, but is perfectly acceptable in the social context of teenage banter. Blocking is a feature of most instant messaging tools. It allows one user to selectively block others from receiving updates to his log in status. Users who have been blocked will perpetually see the blocking user as 'not logged in' on their

buddy lists. One IM user interviewed reported blocking her mother from seeing her in IM because, as she put it:

> "It was hideous… she was so excited she could call me up that easily, she went overboard. I was on a deadline and it was going BING!, BING!, BING! in the background. I shut it off and made myself hidden [from her]. I didn't want to hurt her feelings, but I didn't want to have to worry about that again." – Web site designer

By using the blocking feature in IM, this user cut communication with her mother, plausibly denied that she was accessible via IM and maintained the impression that she was still quite happy to communicate with her mother when communication was mediated by other technologies. Some researchers have examined IM use in social contexts, specifically among teenage users in the home (Grinter, 2000). They found that the plausible deniability afforded by the blocking feature of IM was instrumental in the construction and maintenance of conversational cliques. Grinter compares adult use with teenage use and found that teenagers rely heavily on the blocking features of IM to create deniability:

> Specifically, they [teenagers] needed to create the illusion that they were not available to their friends at times, and they used access control [i.e. blocking] to achieve this. The difference between adult and teenage use of IM suggests that adults can hide behind the ambiguity of the wide range of uses of the computer, and their importance of accomplishing "work"… the teenagers used access control to attain their required unavailability. (Grinter, 2000)

'Open' Conversation

Lastly, the near-synchronous, perpetually 'open' channel of communication that exists in IM once an IM connection is made between two buddies affords what social linguists call an 'open' conversational system (Kendon, 1977). Open conversations are created when one enters the workplace in the morning, greets coworkers and begins to work. The conversation is said to be 'open' until the end of the day when a 'terminal exchange' takes place such as 'good-bye: good-bye.' In effect, when we greet others upon arriving in the morning, they tacitly consent to a social contract that permits us to approach them, at any point later in the day, and begin discussing business matters without formally greeting them a second time. Once a conversation is 'opened', it is mutually agreed that discussion can be resumed, paused and re-purposed without requiring additional formal greetings or other explicit addresses.

Likewise, in instant messaging, during any given day, once an initial message is sent and received a conversation is 'open' until one or the other buddy explicitly closes the communication by saying something like 'good-bye.' Alternatively, the recipient may fail to respond for an extended period of time such that the message initiator concludes that the recipient has left the vicinity of his computer. Subjects discussed these 'open' IM conversations with statements like: "I never feel on IM that I've got to find something to say back. It's okay if it sits there and we don't talk for awhile" and "You [IM] for five minutes and then you do something and communicate again. It doesn't have to be a continuous, make sure you've got everything thought through [conversation]."

IM participants seemed to create a virtual environment similar to a shared physical office, where people engaged in work-related tasks, interspersing sporadic interchanges throughout their individual work (Bradner et al., 1999); (Churchill & Bly, 1999); (Dourish, Adler, Bellotti, & Henderson, 1996); (Heath & Luff, 1991); (Heath & Luff, 1992); (Olson & Olson, 2000). In IM, messages are persistent and visible which helps preserve ongoing conversational context. These observations are similar to the "virtual shared office" that is characteristic of open video links (Dourish et. al., 1996); (Kraut & Attewell, 1997).

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However, the key differences between IM and video are that IM supplies a record of conversation which provides thematic context for ongoing 'open' conversations and affords plausible deniability of presence.

Summary

In her early study of computer-mediated communication in the workplace, Ehrlich reported: "Organizations will tacitly create agreements about the relative level of informality that is acceptable in electronic messages. These unspoken agreements can have an impact on both the anxiety level of the users and the communication strategies they use" (Ehrlich, 1987). The data reported in this chapter help to answer questions such as: 'Why do organizations create norms of informality?' and 'How do communicative norms such as informality give rise to cohesion in groups?' More generally, the qualitative data reported here demonstrated how specific technical properties of different CMC systems (chat and IM) interact with the social characteristics of groups to enable a variety of communicative practices.

This chapter has also demonstrated that social science knowledge of collocation among groups has several implications for virtual teams. Empirical studies suggest collocation fosters cohesion and separation fosters discontent (Sayles, 1958) and groupthink (Janis, 1972). Other empirical studies show that permitting communication between opponents as they play a game significantly increases the likelihood that a cooperative strategy will be adopted. When communication is not possible, a competitive strategy is more commonly adopted (Rabbie, 1991). Thus, there is some evidence that direct communication fosters a norm of cooperation.

But is technology-mediated communication 'direct' communication? This is another unanswered question. Over the past 20 years, significant inroads have been made towards understanding the technical dimensions of computer-mediated distance collaboration (e.g. Poltrock & Engelbeck, 1997; Mark, Grudin, & Poltrock, 1999). Along the way, efforts to unite sociological and technical perspectives on small group interaction have been made (e.g. Galegher, Kraut, & Egido, 1990). The long-term goal of this research should not be to outline how to digitally re-construct the physical experience of collocation but to go beyond 'being there.' That is to say, the goal should be to capitalize on social and technical affordances to better support distance collaboration. This chapter offers a principled understanding of social-psychological dimensions of interpersonal interaction (e.g., cohesion) in groups. This understanding can help software designers generate socially informed software requirements. In other words, the question that motivated this chapter, i.e., "What is a team and how can it be said to be virtual?" is the first question software designers should ask when collecting functional requirements for software to support virtual teaming. It is wise to start with this question because it engages the social issues surrounding distance collaboration among small groups which are likely to impact adoption (c.f. Grudin, 1994). Finally, this chapter reveals a gap in small group research – there seems to be a lack of empirical studies which examine the extent to which fundamental theories of small group interaction (e.g., social comparison, groupthink) describe communication among geographically distributed groups.

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