

Analysis of Group Process with Instant Messaging Technology

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Abstract

This study examines group process patterns when Instant Messaging is used for decision-making, and examines how these patterns are associated with creative solutions to problems. Our research suggests that certain communication behavior of a group, when appropriately organized, can enhance creative production of outcomes. A qualitative analysis is conducted on communication patterns based on text-based conversation protocols. Specifically, this research tries to extend existing studies on group-work by focusing on the interactive communication process among participants.

Study results include that the production of creative outcome depends on the temporal sequence of discussion pattern among group members. (1) Appropriate control of the discussion process is essential to obtain a high level of performance. (2) It is also important to set up discussion rules and rules for the use of communication medium in the early stages of the discussion. (3) Active participants use various protocol types while less-active members rely mainly on "cognitive" protocols.

I. Introduction

Advances in communication and information technologies have provided opportunities to improve collaborative work in organizations. Collaborative work is now an important factor of business activities for achieving success in the new networked economy (CNN, 2001; Gartner Group, 2001; Shuman, Twombly, and Rottenberg, 2001). Early attempts to make tools to support collaborative work focused on audio and video environments (Bly, Harrison, and Irwin, 1993; Fish, Kraut, Root, and Rice, 1993; Hindus, Ackerman, Mainwaring, and Starr, 1996). But, these attempts have not been widely adopted for several reasons in organizations, including the lack of support for user tasks, cost, privacy concerns, and implementation difficulties (Bly, Harrison, and Irwin, 1993; Isaacs, Whittaker, Frohlich, and O'Conaill, 1997). In contrast, groups that work and coordinate their activities using Instant Messaging (IM) continue to increase. These work styles are considered as an emergent organizational form or a new channel of inter-organizational marketing communication (CNN, 2002). Group members rely heavily or entirely on IM as a medium of information exchange, and have little or no face-to-face interactions (Bradner and Mark, 2002). IM is considered notably useful for group work in and out-of an organization (e.g., virtual team's project, customer management, in-house training, or internal communication) (Herbsleb, Atkins, Boyer, Handel, and Finholt, 2002; Nardi, Whittaker, and Bradner, 2000).

While group process with IM creates better opportunities for improving organizational efficiency, group managers find it difficult to manage, coordinate, and maintain close collaboration among the

members. A better understanding of the properties of group process with IM would help in the design of collaborative work. Most of IM tools possess a mixture of functionalities (e.g., chatting, file transfer, or remote screen sharing). In this environment, participants interact by means of written scripts typed and read on computer screens. So, IM produces a large amount of text-based dialogue data, providing us a good opportunity to apply language analysis to draw useful conclusions on group process.

This study identifies communication patterns in group process with IM, and examines how these patterns are associated with creative performance of the groups involved. Researches in GSS (group support systems) and into the relationship between group dynamics and performance have focused on similar issues. Unfortunately results from previous research in GSS performance showed some inconsistencies (Gopal and Parad, 2000). In addition, quantitative studies on group dynamics with electronic medium could not draw sufficient insights into the interim process and the needs for process investigation have been pointed out (Dennis, Wixom, and Vandenberg, 2001; Fjermestad and Hiltz, 2001; Grinter and Palen, 2002; Trauth and Jessup, 2000). With the premise that certain communication activities among group members can help to improve creative outcomes, we examine the process of communication among group participants. A qualitative analysis method is employed to analyze the communication patterns.

II. Research Background

2.1 Creativity as Outcome of Group Work

The importance of the value created and supported by information and knowledge increases rapidly. Creativity or the enhancement of it, in this regard, has quickly become the focus of corporate attention. IS researchers also showed interests in the relationship between the use of IT and the ability to solve problems creatively (Elam and Mead, 1990). In practice, groups with IM are frequently formed to generate idea and build knowledge.

In this research we used creativity as the major criteria of outcome quality. The idea generation task such as the one we used in the research has a close relationship with the level of creativity (Hender, Dean, Rodgers, and Nunamaker, 2002; Parent, Gallupe, Salisbury, and Handelman, 2000). Creative ideas generally lead to better solutions. In brainstorming, there are some specific creativity measures: the quantitative (number of ideas) and qualitative (quality of ideas) components (Shirani, Tafti, and Affisco, 1999). According to Lubart (1994) creativity is also composed of several sub-components as follows:

- Fluency: number of ideas or images produced
- Flexibility: number of categories where the outcomes belong
- Originality: infrequency and unusualness of the response
- Elaborateness: depth of contemplation

We specifically focused on the level of creativity outcome, as reflected in the outcome of the task. Other views and measures sometimes focused more on the process of thinking such as divergent data gathering, brainstorming and convergent idea integration.

2.2 Group Work with Instant Messaging

Groups with IM are considered to have several advantages compared to face-to-face groups. As group members with IM have less face-to-face interactions, IM takes the major role for information exchange. Among all, the use of IM has become a focus of interest in activities for a team project, customer management, in-house training, and internal collaborative work. Communication with electronic medium can also provides several supportive functionalities for effective group activities (Hender, Dean, Rodgers, and Nunamaker, 2002; Lurey and Raisinghani, 2001; Maznevski and Chudoba, 2000).

Participants in those groups mainly use text-based messages. So, the physiological mechanisms of IM are identical to those required for keyboard skills; dexterity, speed, and precision are assets. It is different from writing on the e-mail or BBS, because none of these can be substituted for nor eliminated if interaction is to occur. Just as there are physiological aspects of online chatting that seem more akin to writing skills, there is one noticeable aspect that is more like spoken conversation; online chatting is synchronous, but in a slightly different manner than spoken discourse. Online chatting has been called synchronous communication because a message can subsequently be read by all participants onto same session. Hence, online chatting takes place in real time and appears on computer monitor like as actual conversation is in process. Turns of group members occur one after another without overlap unlike spoken conversation (Werry, 1996). In spoken conversation, the speaker may try to employ various devices to extend his or her turn. This provides no advantage to the online chatter because individual chatters may create dialogue independent from the occurring conversation. In other words, the last person to contribute has no perceptible way of limiting the production of other chatters. Thus, turn lengths tend to be shorter (Freiermuth, 1998; Suler, 1997).

III. Research Strategy

The main purpose of this study is to explore the dynamics within group decision-making process, where IM is used as a medium. This research will focus on the identification of communication patterns used by group members. We had the following research questions in mind:

- **How do group members discuss for their decision-making by using synchronous text communication medium?**

3.1 Design of Experiment

Idea generation exercise is used as an experimental task. Idea generation work is an unstructured task with high level of ambiguity (McGrath, 1984). Group members would need to communicate extensively to reduce uncertainty and resolve ambiguity. We furnished experimental subjects with IM tool (MSN Messenger 3.0 from Microsoft). IM supports group chatting. Through a pretest with five graduate students majoring MIS, the design of the instructions and materials were reviewed, adjusted, and outcome measures were calibrated. 46 Hanyang University students taking “decision support systems” course from the school of business administration served as experimental subjects. Those students who could understand the context of the experiment were believed to meet our objective. Ten artificially designed groups were examined and their communication patterns were compared. They were motivated to participate in the experiment as part of class requirements. The subjects are positioned randomly in two computer laboratories and a specific time limit (25 minutes) was set. Log data were collected throughout experimental online decision-making process. To explore the internal processes, text protocols were qualitatively analyzed using content analysis method.

3.2 Data Analysis Method: Content Analysis

Henri’s (1992) framework was developed to analyze attendants of computer conferencing. It was reported that the framework was useful for understanding the communication processes and contents of computer-mediated conferencing messages. This model highlights five dimensions of communication process: participation, interaction, social, cognitive, and meta-cognitive dimensions (see Table 1). Based on the language analysis approach, we could characterize the following dimensions.

- Metacognitive statements are used for creating shared and interpretive context, building norms.
- Cognitive statements are used for communication within an established context and norms.
- Interactive and social statements support building context among members.

<Table 1> Framework for Communication Pattern Analysis

Dimension	Definition	Indicators
Cognitive	Statement exhibiting knowledge and skills related to the learning process	Asking questions Making inferences Formulating hypotheses
Metacognitive	Statement related to general knowledge and skills and showing awareness, self-control, and self-regulation of learning	“I understand...” “I wonder...”
Interactive	Chain of connected messages	“In response to Celine...” “As we said earlier...”
Social	Statement or part of statement not related to formal content of subject matter	Self-introduction Verbal support “I’m feeling great...”
Participative	Compilation of the number of messages or statements transmitted by one person or group	Number of messages Number of statements

(Henri, 1992)

We applied “pattern coding” method to chatting scripts of each group (Miles and Huberman, 1994). Two post-graduate MIS students served as coders. We first asked two coders to divide the chatting scripts into individual paragraphs. A paragraph was defined as a single thought or topic or quotes one speaker's continuous words. We then asked them to classify these paragraphs into conceptual categories. The paragraphs are classified into “cognition,” “metacognition,” “interaction,” and “social” categories. After checking and improving the reliability of coding procedure, the major coding work was completed. After each group was reviewed individually, a cross-group analysis was done to further explore the similarities and differences across groups.

IV. Results

4.1 Analysis on the Group Protocols

Validity and Reliability

Reliability of content analysis is assessed based on agreements among two or more coders on their ratings of the same events or objects (Kidder and Judd, 1986). In the first round of coding of arbitrarily selected scripts, the resulting inter-coder agreement was 0.623. The disagreements were discussed and guidelines were adjusted. In the third round inter-coder agreement increased to 0.814, higher than 0.7 – acceptable level of inter-coder agreement (Riffe, Lacy, and Fico, 1998).

The participants were also asked to submit results of group work for creativity analysis. Creative Product Test measures were developed by authors by adjusting existing instruments used for measuring the level of general creativity. Two coders evaluated the level of creativity of the outcomes based on a set of pre-defined rules. The inter-rater reliability was 0.745. The scores for creative fluency, flexibility, originality, and elaborateness were also computed in Table 2. The highest scored group was group 3, and the lowest was group 5.

<Table 2> Comparison of Creative Decision Outcomes with respect to Group

No	Group Name	Fluency	Flexibility	Originality	Elaborateness	Avg.
1	Canz.com	4	1	4	4	3.3
2	eBrain	4	5	1	2	3.0
3	Flower Deer	5	5	2	5	4.3
4	Jolly Roger	3	3	2	4	3.0
5	JSM	2	2	2	4	2.5
6	LK Family	2	2	3	4	2.8
7	Mixer	5	3	1	2	2.8

8	Solution No.5	3	2	5	5	3.8
9	Speed.com	5	4	2	3	3.5
10	Strawberry Brother	4	5	2	3	3.5

Protocol Pattern Analysis

We chose to further analyze the difference between the high and low performance groups. We specifically analyzed the best performing group (Group 3, creativity score = 4.3) and the worst performing group (Group 5, creativity score = 2.5). <Table 3> briefly summarizes the patterns of communication used by the high and low performance groups. Participative factor is the sum of cognitive, meta-cognitive, interactive, and social statements. There is a correlation between participative factor and other statements. Nevertheless, we will only make observation of distribution and previous researches support this logic. The followings are some of the major findings:

- Two groups relied heavily on cognitive statements than other statements. The result implies that cognitive statements are of great importance for idea generation works.
- The best performance group shows a relatively evenly distributed balance of different communication activities (S.D. = 18.45) than the worst performance group (S.D = 25.02). These groups, however, did not have any clear connection with the level of creativity and/or that of participation.
- Although the worst performance group used cognitive statements heavily (61.0%), the level of their creativity was not high. It means that the outcome creativity is not proportional to the heavy use of cognitive statements.

<Table 3> Comparison of Communication Pattern with respect to Group: Summary

	Cognitive	Meta-cognitive	Interactive	Social	Total	Standard Deviation
Best Performance Group (Group 3)	180 (46.4)	60 (15.5)	129 (33.2)	19 (4.9)	388 (100)	18.45
Worst Performance Group (Group 5)	128 (61.0)	39 (18.6)	37 (17.6)	6 (2.9)	210 (100)	25.02

(): Percentage

According to some previous related research, high level of participation among group members has a tendency to lead a high level of performance (Bikson, 1996; Henri, 1992). Some of the observation from this research shows a contradiction. For example, the best performance group (group 3) and worst performance group (group 5) both showed a high level of total communication representing high level of member participation. Hirokawa (1983) found effective groups were much more attentive to the procedures used to solve the problem. Specifically, one member would make a statement of procedural direction (such as metacognitive statement), and the others would adopt this direction (such as interactive statement). An effective group also must maintain a balance between independent thinking and structured, coordinated work (Poole and Jackson, 1993). Too much independence shatters group cohesion and may encourage members to

focus on individual needs. Too much synchronous, structured work is likely to regiment group thinking and stifle creative ideas. Therefore, creative idea may come from communication processes reflected in the use of interactive statements.

State-Transition Analysis

We think analyzing the temporal sequence of protocols can reveal important findings as for the communication behavior of group members. We summarized the temporal aspects in a simple table. We performed a close investigation about state-transition of the communication processes and made two tables – one for the groups with high performance and another for low performance. <Tables 4 and 5> help us to compare the communication patterns between the two groups. Vertical axis of <Table 4 and 5> is the protocols that come right before the protocols residing in the horizontal axis. For example, the probability that a cognitive statement is followed by another cognitive statement is 55.3% on the communication of high creative group.

**<Table 4> State-Transition of Protocol:
High Creative Group**

From \ To	Cognitive	Meta cognitive	Interactive	Social	Total
Cognitive	99 (55.3)	17 (9.5)	58 (32.4)	5 (2.8)	168 (100)
Meta cognitive	20 (38.0)	8 (28.7)	10 (26.8)	1 (6.5)	39 (100)
Interactive	42 (45.1)	6 (19.5)	24 (32.8)	6 (2.6)	78 (100)
Social	11 (41.7)	3 (26.2)	2 (7.2)	12 (24.9)	28 (100)

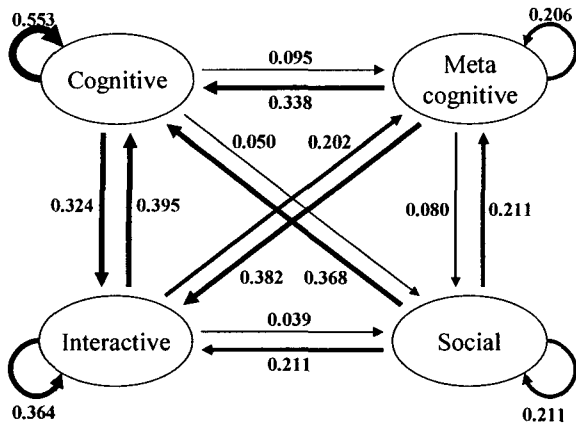
(): Percentage

**<Table 5> State-Transition of Protocol:
Low Creative Group**

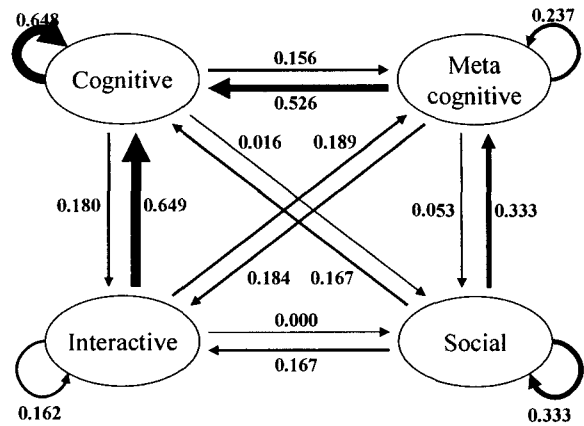
From \ To	Cognitive	Meta cognitive	Interactive	Social	Total
Cognitive	121 (65.1)	17 (9.8)	32 (18.6)	12 (6.5)	182 (100)
Meta cognitive	17 (52.5)	4 (17.9)	7 (20.1)	2 (9.5)	30 (100)
Interactive	33 (56.4)	7 (12.3)	19 (27.7)	2 (3.7)	61 (100)
Social	11 (28.5)	3 (29.0)	3 (18.4)	5 (24.2)	22 (100)

(): Percentage

To visualize the results transition diagrams were also drawn (see Figure 1 and 2). The convergence pattern of the high performance group is quite different from that of the low performance group. From the diagrams on high-performing and low-performing groups (see Figure 1 and 2), one can observe the importance of the mixed use of different mental strategies. Groups having diverse types of statements tend to achieve high performance regardless of the total amount of statements. Generation of creative idea is expected to require an appropriate level of control (represented by meta-cognitive statements) and proper responses (interactive statement) to a thought or a new idea (cognitive statement). That is, to get a creative idea, the sequence balance of protocol types is important to groups with synchronous text communication medium than face-to-face groups.



<Figure 1> State-Transition Diagram of Protocol:
High Creative Group



<Figure 2> State-Transition Diagram of Protocol:
Low Creative Group

Usage Pattern Analysis

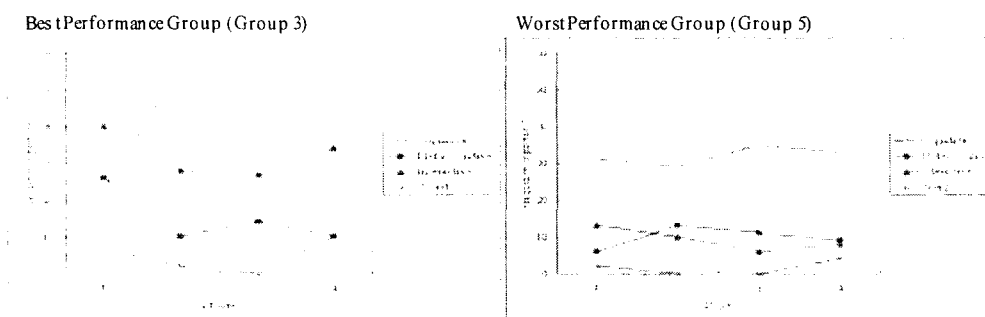
For below example (see Table 6), members of the best performance group (group 3) concentrated their attention on their task and responded quickly and properly. However, members of the worst performance group (group 5) didn't focus on their communication. We could find frequently these cases. From this analysis, we found that members of the high performance group concentrated quickly on the discussion and responded timely and relevantly to other member's toss of idea. However, members of the low performing group were lacking focus. This group placed more weight on cognitive communication. They produced and dealt with various ideas at the same time, but couldn't manage all the ideas well. The group focusing too much on meta-cognitive communication may obtain a high level of efficiency but lack originality.

<Table 6> Examples of Group Communication

	Best Performance Group (Group 3)	Worst Performance Group (Group 5)
Script Example	A: "It's also important to consider business possibility as creativity" B: "Ah..." C: "We also have to build factories" D: "Right" D: "Sure" C: "Let's think about to minimize additional cost" B: "Proposal people suggested" D: "We have to make expensive products to make money"	A: "How about..." A: "Using for recreation" B: "Maybe, does the cost will be needed over a thousand millions" A: "For example," B: "Rifle range?" C: "What is a road sign?" A: "Survival game filed, etc" D: "What about using construction materials?" C: "Does it have durability of disused tires..." B: "Not for road sign" C: "Can we use it for construction material?" B: "Crash prevention"

In the analysis of the cumulative graph of protocols (see Figure 3), we could observe that the high performance group relied much on meta-cognitive and interactive statements during the early stage of the

discussion (see Table 7). Through the extensive use of meta-cognitive and interactive statements, discussion rules were determined quickly from the beginning for effective decision-making. But, overall the worst group used a relatively stable mix of protocol types. For both of the two groups social protocols were used only in the initial and the last stages, and hardly used in the mean time.



<Figure 3> Frequency of Protocol: Stage

<Table 7> Example of the Early Stage of Discussion

Best Performance Group (Group 3)	
Script	A: "First, don't break when someone speaks" B: "Yep ~"
Example	A: "Second, insert "/" when someone concludes one's speech" C: "OK/"

Findings from Analysis on the Group Protocols

Based on 'Protocol Pattern Analysis,' 'State-Transition Analysis,' and 'Usage Pattern Analysis,' we propose that:

PROPOSITION 1: *For group with synchronous text communication medium, it is important to manage interactive responses and control on the new idea for the more creative idea.*

Face-to-face interaction and text-based synchronous interaction have about the same decision making schema and protocol usage pattern on the one-to-one online chatting (Condon and Čech, 1996). But, properties of group chatting are different from those of one-to-one. For example, in group chatting environment, we could find that multiple decision-making processes happen simultaneously and are mixed frequently on the script of the worst performance group. Their conversation types are shown another kind of story-telling. On their decision-making process, various conversation topics are in progress at the same time. The expression, which wandered off the subject, occurred many times in their conversation. Researchers have identified a number of reasons why cooperation may be more difficult as group size increases (Dawes, 1980). In online meeting of four or five members, convergence of group decision-making went down, contrary to one-to-one chatting (Condon and Čech, 1996). The larger the group, the more difficult it may be to affect others' outcomes by one's own actions. So, groups with IM need to manage themselves.

PROPOSITION 2: *High creative group with synchronous text communication medium depend much on meta-cognitive and interactive protocol for its making discussion rules in the early stage.*

Any successful groups or community will have a set of rules – whether they are implicit or explicit – that govern how common resources should be used and who is responsible for producing and maintaining collective goods (Kollock and Smith, 1996). So, it is important that the rules are tailored to the specific needs and circumstances of the group. For successful group decision making, group members must mainly use ‘meta-cognitive’ and ‘interactive’ protocols in ‘orientation’ stage, ‘cognitive’ statement in ‘suggestion’ stage, and ‘interactive’ or ‘meta-cognitive’ statement in ‘consensus’ stage.

4.2 Analysis on the Behavior of Group Members

Analysis on the Protocol of Group Members

In preview section, we found out that group chatting was easy to fail. For exploring in detail, we analyzed the interaction on group members. In Table 9 we briefly summarized participation of group members. So, we chose seven members from four groups that are group 4, 5, 8, and 10¹ (see the bold style character in Table 9). They were heavy or small user than others.

<Table 9> Comparison of Participation with respect to Group Members

No	Group Name	Member No					Total	Avg.
		1	2	3	4	5		
1	Canz.com	30 (16.7)	39 (21.7)	42 (23.3)	31 (17.2)	38 (21.1)	180	36
2	eBrain	48 (16.6)	42 (14.5)	69 (23.8)	52 (17.9)	79 (27.2)	290	58
3	Flower Deer	66 (16.2)	79 (20.9)	76 (25.3)	65 (15.7)	82 (21.9)	388	76.5
4	Jolly Roger	55 (41.7)	29 (22.0)	32 (24.2)	16 (12.1)	-	132	33
5	JSM	39 (18.6)	33 (15.7)	64 (30.5)	74 (35.2)	-	210	52.5
6	LK Family	50 (26.2)	64 (33.5)	43 (22.5)	34 (17.8)	-	191	47.8
7	Mixer	52 (17.6)	80 (27.0)	55 (18.6)	46 (15.5)	63 (21.3)	296	59.2
8	Solution No.5	40 (18.8)	25 (11.7)	38 (17.8)	48 (22.5)	62 (29.1)	213	42.6
9	Speed.com	48 (27.6)	33 (19.0)	39 (22.4)	54 (31.0)	-	174	43.5
10	Strawberry Brother	60 (18.9)	136 (42.9)	43 (13.6)	78 (24.6)	-	317	79.3

(): Percentage

<Table 10> summarizes communication with respect to group members. The followings are some of the major findings from Table 10:

¹ Selection condition

- If number of members were 4, we chose members out of 15 – 35 %
- If number of members were 5, we chose members out of 12 – 28%

- Group 4: The heavy user (member 1) used heavily meta-cognitive, interactive, and social protocols than others. The small user (member 4) used mostly cognitive protocols.
- Group 5: The heavy user (member 4) made good use of meta-cognitive and interactive protocols in their group decision making.
- Group 8: The heavy user (member 5) used heavily meta-cognitive, interactive, and social protocols than others. The small user (member 2) used mostly cognitive protocols.
- Group 10: The heavy user (member 2) used heavily all kinds of protocols than others. The small user (member 3) used a few meta-cognitive protocols than others.

<Table 10> Communication with respect to Group Members

Members	Cognitive	Meta cognitive	Interactive	Social	Total	Finding Facts
Group 4	1 32 (58.2)	5 (9.1)	11 (20.0)	7 (12.7)	55	Heavy user; High MC and SC
	2 24 (82.8)	2 (6.9)	3 (10.3)	0 (0.0)	29	
	3 27 (84.4)	3 (9.4)	2 (6.3)	0 (0.0)	32	
	4 15 (93.8)	0 (0.0)	1 (6.3)	0 (0.0)	16	Small user; Low CG and MC; Mostly CG used
Group 5	1 29 (74.4)	5 (12.8)	3 (7.7)	2 (5.1)	39	
	2 24 (72.7)	2 (6.1)	6 (18.2)	1 (3.0)	33	
	3 39 (60.9)	13 (20.3)	10 (15.6)	2 (3.1)	64	
	4 36 (48.6)	19 (25.7)	18 (24.3)	1 (1.4)	74	Heavy user; High MC and IT
Group 8	1 24 (60.0)	6 (15.0)	10 (25.0)	0 (0.0)	40	
	2 21 (84.0)	0 (0.0)	4 (16.0)	0 (0.0)	25	Small user; Low MC and IT; Mostly CG used
	3 17 (44.7)	2 (5.3)	18 (47.4)	1 (2.6)	38	
	4 31 (66.0)	8 (17.0)	8 (17.0)	0 (0.0)	47	
	5 17 (27.4)	20 (32.3)	21 (33.9)	4 (6.5)	62	Heavy user; MC, IT, and SC High
Group 10	1 29 (48.3)	9 (15.0)	16 (26.7)	6 (10.0)	60	
	2 79 (58.1)	14 (10.3)	30 (22.1)	13 (9.6)	136	Heavy user; High CG, MC, IT, and SC
	3 20 (46.5)	4 (9.3)	13 (30.2)	6 (14.0)	43	Small user; Low CG and MC; Quite CG used
	4 41 (53.2)	12 (15.6)	20 (26.0)	4 (5.2)	77	

(): Percentage

We found out some facts through this analysis. First, small users used mainly cognitive protocol. Second, Heavy user utilized relatively meta-cognitive and interactive protocols than others. Why do these phenomena happen to? In case of small user, they might type lately and have difficulty in following a group discussion. Then they might speak only a necessity (e.g., cognitive statements). Otherwise, they might be a low performance user. Therefore, we propose that:

PROPOSITION 3: *In group with synchronous text communication medium, heavy written-discourse users*

utilize various language protocols, and small written-discourse user use mainly cognitive protocol.

V. Conclusions

In our study we analyzed communication behavior of group members with IM, and their relationship to group performance. There are ample opportunities to analyze online group communication using various qualitative analyses, and such research has high potential to produce good practical implications. In addition, more structured research should also be performed to confirm the conclusions and obtain calibrated generalizability.

We find four facts from these analyses as the following.

First, the production of creative outcome may depend on the process or sequence of discussion among group members with IM. That is, proper interactive responses (e.g., interactive protocol) and appropriate control (e.g., meta-cognitive protocol) of the discussion process are essential to obtain a high level of performance. Groups in this study followed a very similar decision making process which closely parallels the recommended decision making process for groups. Good performance groups performed effectively their decision-making with *interactive control and response*. But, bad performance groups performed difficultly their job with improper control and response.

Second, it is import to make discuss rules based on meta-cognitive and interactive protocols in the early stage. Explicit rules relating to internal group processes as well as communication medium use are even more important to groups with IM than face-to-face groups. For good performance groups, having explicit rules was a critical element of the group's interaction. Organizations have no norms to govern behavior and processes in virtual teams or virtual communities (Kiesler and Sproull, 1992), however, the groups in this study quickly developed similar rules or protocols to guide the way they interacted during their chats.

Third, heavy users use various language protocols, but small users utilize mainly cognitive protocol. Group members, who are experienced written-discourse method, utilized various language protocols during their group decision-making; otherwise, the others used mainly cognitive protocol.

This paper has two specific contributions to the body of our knowledge on group communication and its decision making.

First, this study shows the new understandings of IM. According to traditional researchers, they adopted text medium as lean. But, due to a perception of the limitations imposed by the medium, group members can adapt their behavior in order to overcome such limitation, producing outcomes whose quality is perceived as higher by them than in richer media (Kock, 1998; Panteli, 2002; Wijayanayake and Higa, 1999). Therefore, even though chatting is often presented as a lean medium, the way text-based messages are constructed may convey the social cues of different style that are traditionally used to determine status differences in organizations. The study argues that chatting is a richer communication medium than is reflected in the scale

of information richness theory.

Second, this research presents insights about communication patterns in group with IM. Since technology profoundly affects the nature of group work (Suh, 1999), it is inappropriate to generalize the outcomes from face-to-face work groups to the electronic environment. Moreover, despite the persistently lower social presence of leaner media, groups with IM performed better than their face-to-face groups.

Third, this study is unique in that it is a rare attempt to linguistically investigate the interaction of group communication. With the premise that certain communication activities among members in a group can help to improve creative outcomes, we examined the process of communication among group participants. A qualitative analysis method was employed to analyze the communication patterns. This language approach has led to increased interest by organization theorists in such issues as the intimate relationship between language and organization.

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