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Jawaid A. Ghani
Western Michigan University

Roberta Supnick
Western Michigan University

Pamela Rooney
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Jawaid A. Ghani
Roberta Supnick
Pamela Rooney
Department of Business Information Systems
Haworth College of Business
Western Michigan University

ABSTRACT

This paper proposes that "optimal flow," based on a cognitive theory of human motivation, provides a useful measure of individuals' experiences as they participate in group work. Individuals' experiences of flow, a state of being characterized by involvement in and enjoyment of a task, were determined to be significantly greater in computer-mediated groups than in face-to-face groups. Variables associated with flow included perceived control, task challenge, and required skill during a problem-solving activity performed by fifty-nine undergraduate business students in both settings. The level of skill was found to be positively linked with perceived control in both face-to-face and computer-mediated groups. Perceived control in turn, was positively linked with the flow experience in both groups. Results indicate that while skill is important in explaining flow in the face-to-face task, the perceived challenge is important in explaining flow in the computer-mediated task. Suggestions are offered for future research on flow and computer-supported collaborative work.

1. INTRODUCTION

Individuals' experiences as they participate in group work varies from person to person and from meeting to meeting. As the importance of computer supported collaborative work (CSCW) has become recognized, a growing body of research has focused on the effects of CSCW on group processes and outcomes. The computer support ranges from electronic mail and bulletin boards to electronic meeting systems and group decision support systems (GDSS). The group task might involve problem solving or open-ended discussion and brainstorming. Outcome measures typically include decision time and quality, while process measures include group communication and member satisfaction variables.

User satisfaction has been one of the key dependent variables (together with group performance) in the CSCW literature. Results from empirical studies of user satisfaction, however, have been mixed (DeSanctis and Gallupe 1987) and do not yet provide a coherent framework for understanding the effects of CSCW on individual experiences within groups. It has been noted that "there is currently no theory concerning satisfaction and computer-mediated communication" (George et al. 1990). A better understanding of mediating variables in the process requires a closer examination of the individual's experience. In this paper, we propose that "optimal flow" provides a useful measure of individuals' experiences as they participate in group work. Optimal flow is based on a cognitive theory of human motivation. The theory emphasizes the role of context rather than individual differences in explaining human motivation and is in keeping with recent trends in the study of motivation (Maehr 1989).

Flow is characterized by involvement and enjoyment. These two characteristics, together and separately, have been cited frequently as an important determinant of behavior in a variety of literatures: organizational behavior (Kahn 1990), learning (Malone 1981), marketing (Zaichkowsky 1985), sociology (Lyng 1990), and human-computer interaction (Ghani 1991, Webster 1989). An individual in flow is completely engaged in a task, experiencing concentration and enjoyment. Different from "participation," which is often measured by number of exchanges within a group or a member's perception of inclusion, flow is an individual state of being; that flow is an essential element of creativity has been the focus of other CSCW research (Ghani 1991).

While considerable research has been conducted on the determinants, consequences, and characteristics of flow in individuals (Csikszentmihalyi and Csikszentmihalyi 1988), we know very little of the group effects on individual flow. This paper explores how both face-to-face and computer-mediated groups affect the experience of flow. The flow construct developed by Csikszentmihalyi and his colleagues and related work on play, intrinsic motivation, and job involvement are reviewed briefly in the next section. A set of hypotheses concerning flow in group contexts is then advanced. The hypotheses were tested using data collected from a student sample participating in face-to-face and computer-supported group decision making exercises. Our discussion of the results suggests the importance of flow as a research variable in CSCW studies, possibilities for further investigations, and managerial implications.

2. RESEARCH BACKGROUND

"Flow" is the term used to describe the "holistic sensation that people feel when they act with total involvement" (Csikszentmihalyi 1975, pg. 36). Researchers in a variety of disciplines have found the concept of an optimal state of experience theoretically useful and have used it to study a diverse set of activities from rock climbing and ocean cruising to meditation and ordinary work (Csikszentmihalyi and Csikszentmihalyi 1988). Figure 1 illustrates factors associated with the flow experience. In this paper we have chosen to focus on two key characteristics of flow: the total concentration in an activity and the enjoyment which one derives from an activity. The importance of these same two characteristics has been emphasized for learning by numerous researchers (Lepper and Malone 1987; Deci and Ryan 1985; Lieberman 1977). Turkle (1984) uses the term "holding power" to describe the intense absorption of many individuals when they use computers. The enjoyment which users experience while using computers has been studied in terms of the different levels of playfulness in human-computer interaction (Webster 1989) and in terms of the factors which make computer games fun (Malone 1981, Malone and Lepper 1987).

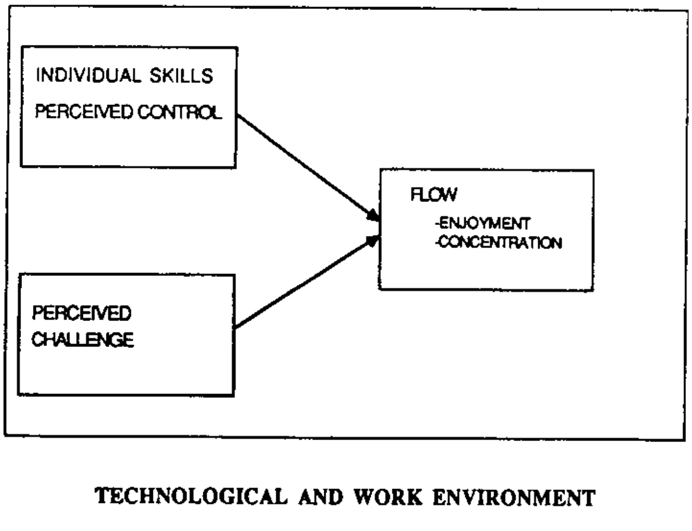


Figure 1. Factors Affecting Flow

The concept of flow is related to "user satisfaction," a variable which has attracted considerable attention in the information systems literature (for a recent review see Baroudi and Orlikowski 1988), and also in the CSCW literature (DeSanctis and Gallupe 1987). An individual who experiences flow in an activity will also be satisfied with the activity. However, an individual who is satisfied with a particular computer system will not necessarily be in flow while using the system. While user satisfaction may be the most appropriate construct for measuring the adequacy of most traditional information systems, flow seems a more appropriate construct for describing and measuring the kind of participation and creativity-enhancing behavior which is the goal of many CSCW systems. Indeed, Elam and Mead (1990) cite the two characteristics of flow – becoming deeply engrossed in an activity and enjoyment – as the key characteristics of a creativity-enhancing decision support system.

In computer-mediated groups (CM) the individual is faced with a more "limited stimulus field" than in a face-to-face (FTF) setting. There is less social presence (Connolly, Jessup and Valacich 1990) and thus we expect it to be easier for individuals to concentrate. Siegel et al. (1986) suggest that the speed and flexibility of CM communication might focus attention on the task, and that reduced sociability would be expected to cause deeper absorption in immediate cues. Several studies of CM users have found that the level of concentration is higher in CM groups than in FTF groups. Based on the experience of using electronic meeting systems by over 15,000 people at thirty-three IBM sites, Grohowski and his colleagues (1990) observe that group members stay focused on their task throughout the meeting, that they stay involved, and that the level of non-task interactions are lower in CM groups compared to historical (FTF) groups. In a study of electronic brainstorming groups, users reported feeling more "engaged," comfortable, and stimulated with the task (Cooper, Gallupe and Bastianutti 1990). While several studies report higher satisfaction in electronically-supported groups, other studies indicate the opposite result. In two separate laboratory studies, GDSS users reported lower satisfaction and confidence than did non-GDSS users (Gallupe, DeSanctis and Dickson 1988; Watson, DeSanctis and Poole 1988), while another study reported no significant differences in satisfaction (Jarvenpaa, Rao and Huber 1988). As George and his colleagues (1990) observe, there may be no "pure" test of GDSS effects. The fit between the software and the task, and also the transient effects (which are expected to diminish as the group continues to use a system) may explain the mixed results. Another problem may be with the satisfaction construct itself. A user may be absorbed and remain highly focused on the task, but yet may not report a higher level of satisfaction. This is an area which needs further research. However, based on the general direction of the results and particularly on the extensive experience of GDSS use at IBM (cited above), we hypothesize the following:

Hypothesis 1: Individuals will experience a higher level of flow during computer-mediated group decision making than during face-to-face decision making.

The precondition for flow is a balance between the challenges perceived in a given situation and the skills a person brings to it (Csikszentmihalyi 1975). A mismatch results in either anxiety or boredom, depending on whether the challenges are too high, or too low, relative to one's skills. A related factor is the sense of control over one's environment. Csikszentmihalyi describes this sense of control over the environment as perhaps the most salient element of the flow state. Lepper and Malone (1987) found that one of the most frequently cited explanations for why people find computer games so captivating is the powerful sense of control these games give their players. Hill, Smith and Mann (1987) found that perceived efficacy with respect to computers, i.e., the belief that one is able to master and control the particular behavior, is an important factor in determining an individual's decision to use computers. Rushinek and Rushinek (1986) found that the sense of control which microcomputers provide users is an important factor in user satisfaction and perceived user friendliness. Research on play, which has been referred to as "the flow experience par excellence" (Csikszentmihalyi 1975, p. 37), also identifies this sense of control, the feeling that one can deal with the environment, as a key prerequisite of playful behavior (Lieberman 1977). Similarly, research on intrinsic motivation[1] identifies the feeling of control over the environment, or at least the sense that one has a choice whether to be in control, as a pre-requisite for intrinsically motivated behavior (Deci and Ryan 1985). In studies of groups using CSCW systems, researchers have noted several problems which occur when users find the system too challenging. In a study of eighty-two groups with a task requiring resolution of personal preferences, the GDSS groups is described as appearing to struggle with the problem of how to effectively use the technology (Watson, DeSanctis and Poole 1988). Frustration with group processes have been found to lead to dissatisfaction in group decision making (Hackman 1984; Hirokawa 1983). In fact, frustration is one of the items which is commonly used to measure user dissatisfaction (Hiltz and Johnson 1990).

Perceived control comes from being able to predict the outcomes of particular actions. In the extreme case the user feels *direct engagement* wherein the computer becomes so transparent that the user feels part of the task (Norman 1987). Thus control should be directly affected by the level of one's skills in performing the task. When the level of skills is high, the individual should feel a sense of control, which in turn should result in a higher level of flow. When the level of skills is low, the individual should feel a sense of inadequacy and frustration, which in turn should result in a low level of flow. This leads us to the following two hypotheses:

Hypothesis 2: Flow is positively related to perceived control.

Hypothesis 3: Perceived control is positively related to the level of skills possessed by an individual.

As long as one perceives a sense of control, then greater levels of challenge result in greater flow. Individuals have a need to feel competent, and this leads people to seek and conquer challenges that are optimal for their capacities (Deci and Ryan 1985).

The effect of different levels of task challenge on group behavior has been noted in several CSCW studies. In a study of the effects of evaluative tone on group processes, it was found that a critical evaluative tone (manipulated through confederate group members) resulted in the generation of a greater number of ideas than did a supportive evaluative tone (Connolly, Jessup and Valacich 1990). An explanation proposed is that critical feedback is interpreted by the subject as a signal that more development of the idea is needed, leading to greater efforts and more ideas. The individuals may thus be taking the critical comments as a challenge which they wish to overcome. We thus expect challenges and skills to be important for the flow experience, leading to our next hypothesis.

Hypothesis 4: Flow is positively related to the level of perceived challenge in task.

Do other members in a CM group affect the individual experience of flow differently from members in FTF groups? We do know that flow is a result of interactions between individuals and an environment (Csikszentmihalyi and Csikszentmihalyi 1988). In a group decision-making context, the group is the environment. Studies have shown that in CM groups the individual is somewhat insulated from the group, that there is a sense of impersonality, and that there is less social presence (Jessup, Connolly and Galegher 1990; Connolly, Jessup and Valacich 1990). We thus expect CM groups to be more heterogeneous in terms of flow than FTF groups. In CM groups, each individual is somewhat isolated from the rest of the group, and hence is less affected by the level of flow of other group members. This leads us to our final hypothesis:

Hypothesis 5: Face-to-face groups are more homogeneous in terms of their experience of flow, than computer-mediated groups.

3. METHODOLOGY

3.1 Sample

The sample of the study consisted of fifty-nine students taking junior-level courses in business communication and writing in a business college of a Midwestern university. Students were randomly assigned to three-person groups and completed three group activities: an orientation to computer-mediated conferencing, a CM group exercise, and a FTF group exercise. The order of the exercises was the same for all students. The activities lasted forty-five minutes and were completed during regular class sessions. Computer-mediated exercises were conducted in the college's computer laboratory, one student per terminal station. During the orientation session, students learned the basics of computer conferencing. The task assigned for this session was for group members to introduce themselves and then discuss their perceptions of the college's advising office. Students did not know who the other members of their group were prior to the exercise.

The group problem-solving exercises involved tasks of the intellective type using McGrath's (1984) typology, solving problems that have correct answers. Specific exercises used were "Lost on the Moon" and "Desert Survival," each of which present students with a disaster scenario and ten items available to the group described in the problem (Note: The number of items for these exercises was reduced from fifteen to ten to accommodate the forty-five minute time frame.) At the beginning of each exercise, students received a copy of the problem, their group assignment, and a copy of the questionnaire which was completed immediately after each group exercise (see Appendix for questionnaire items).

In the computer-mediated exercise, as in the orientation, students were seated at individual terminal work stations and did not know the identity of other group members. They were instructed to read the problem, rank the ten items in order of their importance for the group's survival, log in to the computer conference, establish contact with other members of their group, discuss individual rankings, and rank the ten items as a team. Each student was also instructed to record both individual and team rankings on the sheet provided. All communication was carried out through a "read, review, and input" system; there was no oral communication of any kind during this process as group members were distributed throughout the lab and not in proximity with one another.

In the face-to-face exercise, students followed exactly the same procedure for ranking the items individually. They then met in groups to discuss their rankings and determine team rankings. The groups for this exercise were the same ones used in the computer-mediated exercise. Again, each individual recorded both an individual and a team ranking on the handout.

3.2 Measurement

This section contains a discussion of the instruments used to measure the variables in the model. The complete list of instrument items is contained in the appendix.

3.2.1 Flow and perceived control: As discussed in the previous section, we identified enjoyment and concentration as the two main characteristics of the flow experience. Four items were developed for each of the three variables: enjoyment, concentration, and perceived control. These items were adapted from an earlier two-stage study of 600 individuals (Ghani 1991), which itself was based on prior instruments developed by Csikszentmihalyi (1975) and Webster (1989). Cronbach's alphas for enjoyment, concentration, and control were .88, .82, and .73, respectively in the CM task, and .90, .84, and .58, respectively in the FTF task. Intensity of flow was calculated as the sum of enjoyment and concentration. The reliability of the flow construct measured by Cronbach's alpha was 0.87 and 0.91 in the CM and FTF tasks, respectively.

3.2.2 Skill and Challenge: Single items (on a ten point scale from low to high) were used to measure the level of skill and perceived challenge in the activity. These were adapted from the "Experience Sampling Form" (Csikszentmihalyi and Csikszentmihalyi 1988, pg. 258).

4. RESULTS

Table 1 shows the zero-order correlation coefficients, and the means and standard deviations for the key variables considered, for each of the two groups (CM and FTF). Hypothesis 1, dealing with the difference in the intensity of flow in the FTF and CM tasks, was tested using a paired-samples t-test. Hypotheses 2 through 4, dealing with causal factors affecting individual flow were tested using structural relationship modeling (LISREL VI). Hypothesis 5, dealing with the group effect on flow, was tested using analysis of variance with covariates. A summary of the results for each hypothesis is shown in Table 2.

Table 1. Correlations between Variables for Computer-Mediated and Face-to-Face Tasks

VARIABLE	Mean (SD)	1	2	3
COMPUTER MEDIATED TASK (N=59)				
1. Flow	12.35(1.21)	-		
2. Control	5.48(1.03)	41**		
3. Skills	7.81(1.34)	45**	32*	
4. Challenges	6.06(1.84)	8	-15	-5
FACE-TO-FACE TASK (N=59)				
1. Flow	10.70(1.92)	-		
2. Control	5.68 (.83)	26		
3. Skills	7.62(1.20)	12	51*	
4. Challenges	5.44(2.04)	53**	-15	-4

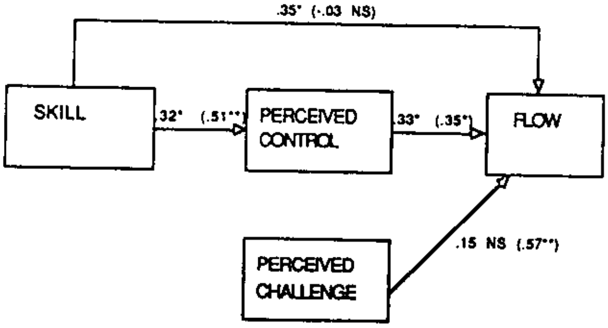
*p<.05 **p<.01
Decimal points are omitted for correlation coefficients

Consistent with hypothesis 1, the level of flow was higher in the CM task than in the FTF task ($t=6.06$, $p<0.001$ in a paired sample t-test). A separate analysis of the two components of flow showed that the level of enjoyment and concentration were both significantly higher in the CM than in the FTF task ($p<0.001$). Thus individuals were able to concentrate more and enjoyed themselves more in a CM setting. Why was flow higher in CM groups? Results indicated no significant difference in the level of skills in the two situations, nor in the level of perceived control. However, the CM task was seen as significantly more challenging ($t=2.65$, $p<0.01$).

Table 2. Results of Hypothesis Tests

Hypothesis	Test	Result
H1: Flow in CM > Flow in FTF	Paired Sample t-test	t=6.06, p.001
H2: Perceived control affects flow	t-test for path coefficient	CM: t=2.65,p<0.01 FTF: t=2.71,p<0.01
H3: Skill affects perceived control	t-test for path coefficient	CM: t=2.36,p<0.01 FTF: t=3.99,p<0.001
H4: Challenge affects flow	t-test for path coefficient	CM: t=1.30, p<0.1 FTF: t=5.11, p<0.001
H5: FTF groups more homogeneous than CM groups	ANOVA group effect (CM versus FTF)	CM: No significant group effect FTF: No significant group effect

A path analysis was conducted using LISREL VI (Joreskog and Sorbom 1986). Data for the two tasks (CM and FTF) were analyzed separately, and the path coefficients for both tasks are reported in Figure 2. Consistent with hypothesis 2, perceived control was found to be significantly ($p<0.01$) linked with flow in both the CM and the FTF tasks. Consistent with hypothesis 3, the level of skill was also found to be significantly ($p<0.01$ for the CM task and $p<0.001$ for the FTF task) linked to perceived control. Hypothesis 4 suggests that perceived challenge affects the level of flow. This was found to be true for the FTF task ($p<0.001$), but not so for the CM task. Thus while hypotheses 2 and 3 were confirmed, hypothesis 4 was only partially confirmed.



*p<.01 **p<.001

Path Coefficients for the CM task are shown first followed by path coefficients for the FTF task (in parentheses).

CM Task: AGFI = .90 Chi-square = 1.07 d.f. = 1 p = .3
FTF Task:AGFI = .89 Chi-square = 1.06 d.f. = 1 p = .3

Figure 2. Path Coefficients

Another difference between the two tasks was the effect of skill level on the level of flow. For the FTF task, the only effect of skill level on flow was an indirect one through perceived control. However, for the CM task, skill level also had a direct effect on flow, in addition to the indirect effect through perceived control. Thus, for the CM task, the level of skill was linked to flow, independent of the level of perceived control.

Two primary indices are computed by LISREL VI which indicate how well the data fits the model: a chi-square index and a goodness-of-fit index. Both indices indicated a good fit between the model and the data. For the CM task, the chi-square value was 1.07 ($p=0.3$) and the adjusted goodness of fit index (AGFI) was 0.90. For the FTF task, the chi-square value was 1.06 ($p=0.3$) and AGFI was 0.89. Note that a low chi-square value (with a probability value greater than 0.05) indicates a satisfactory fit, as also do AGFI values over 0.90. In addition to using LISREL VI, a series of step-wise regressions was conducted on the data. In the CM task, perceived control and skill level were found to explain 29% of the variance in flow. In the FTF task, perceived control and perceived challenge explained 40% of the variance in flow.

Hypothesis 5 deals with the group effect on individual flow. Tables 3 and 4 show the results of an ANOVA test for the effect of the group on individual flow. The covariates were chosen based on the earlier path coefficients and regression results. The group effect was found to be not significant in both the CM and the FTF tasks. Thus hypothesis 5 was not confirmed. However, the group effect was somewhat higher in the FTF task compared to the CM task ($F=1.5$, $p=.16$ in FTF versus $F=1.2$, $p=.34$ in CM). This is consistent with hypothesis 5, which suggested that CM groups would be more isolated from the group and hence the effect of the group would be felt less than in FTF groups.

Table 3. Analysis of Variance for Computer Mediated Groups Using Covariates Control and Skills with Group as Main Effect

Source of Variation	SS	df	MS	F	Significance
Covariates	22.54	2	11.27	10.47	.000
Control	6.70	1	6.70	6.22	.018
Skills	8.71	1	8.71	8.09	.008
Group Effect	21.55	17	1.27	1.18	.335
Explained	44.08	19	2.32	2.16	.027
Total	78.53	51	1.54	1.54	

5. DISCUSSION

The theoretical framework for this study suggested that a cognitive theory of human motivation would improve our understanding of the experience of individuals engaged in group decision making. Building on prior research, we defined optimal flow to occur when an individual intensely concentrates in an activity and derives enjoyment from the activity. Among the noteworthy results of the study are:

- There are variations in the experience of flow among individuals engaged in group decision making.

Table 4. Analysis of Variance for Face-to-Face Groups Using Covariates Control and Challenges with Group as Main Effect

Source of Variation	SS	df	MS	F	Significance
Covariates	70.19	2	35.10	18.44	.000
Control	19.95	1	19.95	10.48	.003
Challenges	59.13	1	59.13	31.06	.000
Group Effect	51.236	17	2.85	1.50	.163
Explained	121.43	20	6.07	3.19	.002
Total	176.64	49	3.61	1.54	

- The intensity of flow of individuals participating in computer-mediated groups was significantly greater than of those in face-to-face groups. CM groups reported higher levels of both concentration and enjoyment compared to FTF groups.

- In CM groups, the level of perceived control and the level of skill were significantly linked to flow. In FTF groups, the level of perceived control and perceived challenge were significantly linked to flow. Perceived control was itself significantly linked to the level of skill.

These results are consistent with the basic model of optimal flow suggested by Csikszentmihalyi (1975). The higher concentration and enjoyment in CM groups is consistent with the findings reported in previous studies of CSCW (Grohowski et al. 1990; Cooper, Gallupe and Bastianutti 1990). Why did individuals report higher levels of flow while engaged in CM groups? The lower social presence in CM groups may have helped individuals concentrate and focus on a limited stimulus field. Another factor may have been the higher challenge which individuals felt while participating in the CM groups. This may have been due to the fact that the technology was relatively novel to most of them. Yet the technology was not so challenging as to interfere with the task, as evidenced by the non-significant difference in perceived control between the CM and FTF tasks.

The factors affecting flow were somewhat different in the two groups. Perceived control was important in both groups. However, while skills in using the technology are important in CM groups, being faced with a challenging task is important in FTF groups. Note that individuals generally perceived the CM task to be significantly more challenging compared to the FTF task (mean of 6.1 versus 5.4). It appears that in the CM groups, most people felt quite challenged. The difference in whether the individual experienced flow was determined more by the level of skill possessed for accomplishing the task. In the FTF groups, the overall level of challenge (and flow) was perceived as low. The individuals who were able to enjoy themselves and concentrate were also those who somehow perceived the task as challenging.

There was no significant difference in the degree of homogeneity in flow between the two groups. The direction of results did indicate however, that the FTF groups were slightly more homogeneous than were the CM groups. Further research is needed to understand the dynamics of the flow experience in different settings.

These findings must of course be interpreted with caution. The parameter estimates obtained can be interpreted only in the context of the variables included in the model. Skill and perceived challenge were measured by single items. All the data was collected using self-reported instruments. Two particular points need to be noted regarding the design of the study. The CM groups were anonymous, while the FTF groups were not. Also, all groups went through the CM task first, and then went through the FTF task. Thus it is possible that some of the difference in the intensity of flow between the CM and FTF groups may be due to anonymity and sequence effects. Despite these limitations, this study has several practical and theoretical implications.

Because groups are often the basic work units in organizations (Finholt and Sproull 1990), individual experiences within work groups assume a critical importance. Employees will repeat processes that are enjoyable; concomitantly, members are likely to become more productive and creative if engaging fully in the group task. Increased and more meaningful participation, a positive outcome of computer-mediated groups, combines with individuals' experiences of optimal flow to provide organizational benefit. The issue of control is important; individuals felt similar degrees of control while in both groups, contributing to their experience of flow. Because managerial implications include providing work environments conducive to productive group decision making, facilitating employees' feelings of control over the technology becomes essential. Harnessing the power of computer-mediated group communication will involve special attention to the individual experience, particularly those variables we associate with optimal flow: enjoyment, concentration, control, and challenges.

The need for a coherent framework for understanding the relationship between satisfaction and CM communication has been voiced in the literature (George et al. 1990; DeSanctis and Gallupe 1987). The theory of optimal flow provides a theoretically-based framework for describing the experience of individuals engaged in an activity and also identifies some of the determinants and consequences of these experiences. Future studies of CSCW can benefit by including the flow construct and related variables in the research design. This would measure affective responses to a system and also identify the factors contributing to this response. One particularly promising area for research is to build on the theory of optimal flow to explain the phenomenon of social loafing. Another is to relate flow to creativity in electronic brainstorming.

While this study has explored some of the determinants of the flow experience, there is room for considerable research in this area. For instance, does the variable "perceived control" mean the same thing in a CM context as in a FTF context? Feeling in control may mean different things depending on whether one is thinking of machines or other humans. This may explain the much lower reliability of the control variable in the FTF data compared with the CM data.

Whether groups as discrete entities can also experience flow remains an intriguing question and deserves further attention. Group identity and cohesiveness seem to approximate the concept of flow in our review of group communication research but may lack the dynamic components we associate with individual flow: concentration and enjoyment while absorbed in a task. Is it possible for a group to be singularly engaged or do the moderating effects of personalities prevent focused absorption? Janis' (1972) "groupthink" construct, characterized by group suppression of dissent, feelings of invulnerability among members, and closed communication boundaries, describes a group's behavior as a collective unit. Designing measures of group flow provides another challenge to researchers. In conclusion, we believe that the flow construct can open up a rich set of research possibilities when used to investigate user attitudes and behavior.

6. ACKNOWLEDGEMENTS

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8. ENDNOTE

1. Note that theories of intrinsic motivation and flow have much in common. Indeed, flow has been referred to as one of the "purer instances of intrinsic motivation (Deci and Ryan 1985, pg. 29).

APPENDIX

The items used to measure the different constructs are listed below. Note that in the actual questionnaire the sequence of items was random. Respondents were asked to complete the questionnaire immediately after completing the group exercise (face-to-face and computer-mediated) and were asked to "Describe how you felt during this particular group exercise."

ENJOYMENT

Session was interesting	___:___:___:___:___:___:___	Uninteresting
Session was enjoyable	___:___:___:___:___:___:___	Not Enjoyable
Session was exciting	___:___:___:___:___:___:___	Dull
Session was fun	___:___:___:___:___:___:___	Not Fun

CONCENTRATION

Was absorbed intensely in activity	___:___:___:___:___:___:___	Not absorbed intensely
Attention was focused on activity	___:___:___:___:___:___:___	Attention not focused
Concentrated fully on activity	___:___:___:___:___:___:___	Did not fully concentrate
Was deeply engrossed in activity	___:___:___:___:___:___:___	Not deeply engrossed

CONTROL

Clearly knew the right things to do	___:___:___:___:___:___:___	Felt confused about what to do
Felt calm	___:___:___:___:___:___:___	Felt agitated
Felt in control	___:___:___:___:___:___:___	Did not feel in control
Felt frustrated	___:___:___:___:___:___:___	Did not feel frustrated

SKILLS AND CHALLENGES

Indicate how you felt about the exercise (circle a number between 0 and 9):

Overall challenges of the exercise	*Low*	0	1	2	3	4	5	6	7	8	9	*High*
Your overall skills for doing the exercise	*Low*	0	1	2	3	4	5	6	7	8	9	*High*