An Investigation of the Influence of National Culture and Group Support Systems on Group Processes and Outcomes

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Abstract

Group support systems (GSS) have been shown to be effective in a variety of managerial applications such as business process reengineering, strategic planning, and intelligence gathering. The majority of experiments and case studies that have reported GSS effectiveness, however, have been conducted in Western environments, which have individualistic and low power-distance cultures. It is not clear, however, if features such as anonymity and equal access to participation will be as effective in Asian cultures, which are collectivistic and high power-distance. This study reports a cross-cultural experiment using Hong Kong and U.S. students that examines the influence of GSS and national culture on group processes, meeting satisfaction, and group outcomes. Results indicate that the influence of GSS was consistent with prior research but the influence of culture was much less predictable.

1. Introduction

Group support systems (GSS) have been shown to be effective in a variety of managerial applications such as business process reengineering [9], strategic planning [40], intelligence gathering [4], and environmental planning [10]. Multi-use field studies at Boeing [30], IBM [18] and the Army National Guard [27] have reported significant labor savings and reductions in project completion times of as much as 90%. The benefit of using GSS stems from three principle features of the technology: anonymity of participation, parallel communication, and group memory [28]. Thus, in applications where anonymity and equal access to participation are important, GSS may prove useful. It is interesting to note, however, that much of the research reporting benefits from GSS has been conducted in Western cultures; cultures that are distinct from Asian cultures. Countries such as Hong Kong and Singapore, have received increased attention from GSS researchers [2, 8, 36, 39], indicating a growing interest in exploring how GSS affects group processes and outcomes in non-Western cultures, such as Asia. This research is a necessary first step for system builders to create dynamic systems that can be used effectively across multiple cultures.

The purpose of this paper is to examine the influence of GSS use and national culture on group processes and outcomes. We begin by examining national culture and how it differs between Western and Asian cultures. We then develop a set of hypotheses and research questions that address the impact of meeting environment and culture on (1) production blocking and dominance, (2) meeting satisfaction, and (3) group consensus and participation equality. A cross-cultural experiment designed to test these hypotheses and examine the research questions is then presented with the analysis and results. Finally, we discuss the implications of our findings and potential areas for future research.

2. Theory & Hypotheses

National culture is an important factor to consider when exploring the globalization of information and groupware technologies [19, 34]. Hofstede defines culture as the "collective programming of the mind which distinguishes the members of one group or category of people from another [23, p. 5]." Culture is an important consideration in the organizational context. For example, it has been shown that management systems need to be compatible with local cultural norms in order to be effective [13]. Consequently, we would expect groupware technologies to be less effective when they are incompatible with the cultural norms of the environment in which they are implemented. With GSS in particular, there is an assumption that it is more desirable for participants to be anonymous and equal than to be identified and unequal. and equal than to be identified and unequal. While this assumption may be reasonable in Western cultures, it may not be appropriate in certain Asian cultures.

Hofstede's model of cultural differentiation is often used to explain the influence of national culture on the use and design of information technology [26, 33, 36]. Hofstede [23] identifies five dimensions of culture that may be useful for comparing Western and

Asian cultures. These include individualism, power-distance, masculinity, uncertainty avoidance, and long-term orientation. Though the impact of these dimensions on GSS is not entirely known, the dimensions of power-distance and individualism have been shown to affect certain GSS outcomes [36]. Previous cross-cultural GSS studies have used the power-distance and individualism dimensions together because they have been shown to be most relevant to group behavior and group outcomes [e.g., 36, 39].

Power-distance is the degree to which less powerful members of an organization or society accept the unequal distribution of power [23]. Thus, members of low power-distance cultures (e.g., U.S.) may be more inclined to adopt technologies that reduce power-distance. Individualistic cultures value individual achievement, self-reliance, and the welfare of their immediate families. In contrast, collectivistic cultures (e.g., Hong Kong) value group achievement, group harmony and the welfare of their extended families [23]. Thus, members of collectivistic cultures might seek technologies that enhance group harmony and agreement. Cross-cultural researchers have noted that individualism and power-distance are inversely related [23, 24, 37]. Many Western countries such as the United States, Great Britain and Australia have been described as individualistic, low power-distance cultures, while many Asian countries such as Hong Kong, Singapore, and China have been described as collectivistic, high power-distance cultures [23].

The anonymity and simultaneous input features of GSS support low power-distance and individualistic cultural norms of desirable group behavior [39]. Anonymity reduces social status cues, which is consistent with those cultures that do not readily accept power status differentials. Simultaneous input encourages participation equality, which is consistent with those cultures that value individual contributions. It is not entirely clear, however, how collaborative technologies such as GSS will be received in non-Western, high power-distance, collectivistic cultures. To address this question, we develop a set of hypotheses and research questions examining group process variables, meeting satisfaction and group outcomes.

GSS can improve meeting effectiveness through the reduction of certain process losses such as production blocking and dominance [28]. Production blocking occurs when individuals do not express their ideas because they forget them while waiting for a turn to speak. Dominance refers to the tendency of an individual or small set of individuals to control a disproportionate share of group deliberations. GSS may reduce production blocking and dominance through simultaneous and anonymous input. Thus, we hypothesize:

H1: All else being equal, members of GSS supported groups will report less production blocking and less dominance than members of FtF groups.

It is not clear how national culture influences production blocking and dominance. Therefore, we state the following research question for exploration:

R1: Do members of groups in individualistic, low power-distance cultures report different levels of production blocking and dominance than members of collectivistic, high power-distance cultures?

Groups often meet for the purpose of reaching or increasing consensus. Social information processing (SIP) theory [38], may offer an explanation of how GSS use influences group consensus. SIP theory is based on a number of assumptions including, (1) interpersonal development requires numerous interactions over nonverbal and verbal-textual channels, and (2) computer-mediated communication (CMC) messages take longer to process than FtF messages. Thus, according to SIP theory we would expect GSS groups to under-perform FtF groups in consensus-oriented tasks for early meetings but not necessarily for later or subsequent, repeated meetings. Chidambaram [6] demonstrates that GSS groups may improve their performance over subsequent GSS supported meetings. However, the experiment reported here uses ad hoc groups meeting for the first time. According to SIP theory, and consistent with prior research [e.g., 1, 15, 16], we expect GSS supported groups of this nature to achieve lower consensus than FtF groups.

H2: All else being equal, ad hoc groups meeting for the first time will achieve higher levels of consensus when meeting FTF than when using GSS.

In terms of culture, individualism may have an impact on consensus. Collectivistic cultures, cultures that value group harmony and agreement, are likely to outperform individualistic cultures in terms of consensus. Researchers have argued that collectivism promotes consensus and is less tolerant of conflict and discord [24, 39, 41]. Thus we hypothesize:

H3: All else being equal, groups from collectivistic cultures will achieve higher levels of consensus than groups from individualistic cultures.

Meeting satisfaction is an important construct to GSS researchers, accounting for over 25% of all GSS hypotheses over a twenty-year period [14]. Perceived net goal attainment has been identified as a primary

cause of meeting satisfaction [3, 5] and relative individual goal attainment has been shown to correlate with consensus [31]. This suggests that groups with high consensus tend to have members with high relative individual goal attainment and that groups with low consensus tend to have members with low relative individual goal attainment. Therefore, we would expect that collaborative technologies that increase consensus also increase meeting satisfaction, and that collaborative technologies that reduce meeting consensus also reduce meeting satisfaction. Meeting satisfaction is two-dimensional; it consists of satisfaction with meeting outcome and satisfaction with meeting process [5]. Here, we are interested in participant satisfaction of the process used in completing the experimental task. Thus, we hypothesize:

H4: All else being equal, ad hoc groups meeting for the first time and engaging in a consensus seeking task, will report greater satisfaction with process when meeting FtF than when using GSS.

It is not clear, however, what impact, if any, culture has on meeting satisfaction. Although meeting satisfaction is caused by perceived individual goal attainment, cultures may differ in the nature of individual goals. For example, members of individualistic societies may be less likely to adopt group goals than members of a collectivistic society. Meeting satisfaction is also caused by the perceived future gains arising from a collaboration technology or process [5, 31], and it is not clear how cultures vary in their perceived utility of various meeting processes. Therefore, we state the following research question:

R2: Do members of groups in individualistic, low power-distance cultures report different levels of satisfaction with meeting process than members of groups in collectivistic, high power-distance cultures?

Participation equality refers to the relative equality of distribution of comments among group members. Because GSS encourages participation through anonymity and simultaneity, participation equality is often greater in GSS groups than FtF groups [12, 16, 25, 35], although some findings have been inconclusive [20]. Thus, we hypothesize:

H5: All else being equal, GSS supported groups will have greater participation equality than FtF groups.

It is not clear what the impact of national culture is on participation equality. Therefore we propose the following research question:

R3: Do groups in individualistic, low power-distance cultures have different levels of participation equality than groups in collectivistic, high power-distance cultures?

The following section describes the research methodology that was undertaken to test these hypotheses and explore the research questions.

3. Methodology

The current research study used a 2 x 2 factorial experimental design with meeting environment (GSS versus FtF) and national culture (individualistic, low power-distance versus collectivistic, high power-distance) as the independent variables. A U.S. sample represented an individualistic, low power-distance national culture and Hong Kong represented a collectivistic, high power-distance national culture. Group size was either seven or eight participants for all groups. U.S. participants were undergraduate business students at a large public university in the Midwest. There were twenty-two U.S. groups comprised of 171 participants, including eleven GSS groups (fifty-two males, thirty-one females) and eleven FtF groups (forty-five males, forty-three females). Hong Kong participants were undergraduate business students at an English-speaking public university in Hong Kong. There were eighteen Hong Kong groups comprised of 136 participants, including nine GSS groups (twenty-five males, forty-three females) and nine FtF groups (twenty-nine males, thirty-nine females). Two researchers, one in Hong Kong and one in the U.S., conducted all of the experimental sessions.

The experimental task required participants to assume the role of members of a "Community Resource Allocation Task Force" and rank-order nine projects that would be most deserving of money donated by local corporations for the betterment of their respective communities in the U.S. and Hong Kong (Appendix A). Participants were asked to rank these projects from most important to least important. An experimental script was used to ensure that the researchers consistently performed the following six steps:

Step 1: Participants rank-ordered the nine community projects individually.
Step 2: The researcher tabulated the results and presented the group the rank sums and a measure of their consensus level.
Step 3: Participants were then instructed to discuss the relative merits of each of the nine projects for thirty minutes in order to improve their consensus on the rank ordering.

Step 4: Participants then rank-ordered the projects a second time.
Step 5: The researcher again tabulated the results and presented the rank sums and a final measure of their consensus level.
Step 6: Participants completed a post-experimental survey and were dismissed.

GSS groups completed these steps in a computer lab equipped with GroupSystems by GroupSystems.com and FtF groups completed these steps in a conference room equipped with a large oval-shaped table. GSS participants logged into the system with an anonymous pen name and used the system for the voting in steps one and four and for the discussion in step three.

4. Analysis and Results

Five constructs were measured to test the hypotheses and research questions presented in this study. Three are perceptual measures at the individual unit of analysis (production blocking, dominance, and satisfaction with process) and two are observed measures at the group level of analysis (consensus and participation equality). The survey included nine items (Appendix B), three each to measures production blocking [11], dominance, and satisfaction with meeting process [17]. Consensus was calculated using Kendall's coefficient of concordance for the first rank-ordering (Vote 1) and the final rank-ordering (Vote 2). Change in consensus was calculated by subtracting the Kendall's coefficient of concordance measure of Vote 1 from Vote 2. Participation equality (E) was calculated by sorting the number of comments submitted by each group member in ascending order, and then using $E = 1 - \frac{\frac{1}{N}\sum_{i=1}^{N}(E_i - O_i)}{\frac{1}{2}\left(1 - \frac{1}{N}\right)}$ where N is the number of group members, E_i is the expected cumulative portion of comments, and O_i is the observed cumulative portion of comments [21]. E ranges from 0 to 1, with 0 representing a monologue and 1 representing perfect equality of participation [21].

Table 1. Factor Loadings

	Factor 1	Factor 2	Factor 3
PB1	**0.748**	-0.139	0.004
PB2	**0.744**	-0.107	-0.004
PB3	**0.708**	-0.110	0.024
DM1	-0.029	-0.108	**0.459**
DM2	0.115	-0.088	**0.640**
DM3	-0.064	0.028	**0.904**
SP1	-0.140	**0.619**	-0.114
SP2	-0.186	**0.700**	-0.055
SP3	-0.038	**0.825**	-0.064

Note: Factor analysis used Varimax rotation. Production blocking items: PB1-PB3, Dominance items DM1-DM3, Satisfaction with process items: SP1-SP3. Boldface indicates the heaviest factor loading for an item.

Table 2. Correlation Matrix of Survey Items

	PB1	PB2	PB3	DM1	DM2	DM3	SP1	SP2	SP3
PB1	1.000								
PB2	0.575***	1.000							
PB3	0.527***	0.536***	1.000						
DM1	-0.011	-0.003	0.002	1.000					
DM2	0.130*	0.095	0.102	0.292***	1.000				
DM3	-0.049	-0.032	-0.012	0.420***	0.577***	1.000			
SP1	-0.176**	-0.148**	-0.171**	-0.120*	-0.180**	-0.027	1.000		
SP2	-0.261***	-0.205***	-0.196***	-0.097	-0.098	-0.035	0.460***	1.000	
SP3	-0.135*	-0.139*	-0.116*	-0.114*	-0.105	-0.051	0.515***	0.593***	1.000

Note: *p<0.05, **p<0.01, ***p<0.001, Cronbach's α for production blocking items (PB1-PB3) = 0.783, Cronbach's α for dominance items (DM1-DM3) = 0.693, Cronbach's α for satisfaction with process items (SP1-SP3) = 0.766.

Table 3. Summary Data of Dependent Variables

Treatment	Production Blocking			Dominance			Satisfaction with Process		
	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.
U.S. FtF	83	2.56	1.13	82	4.10	1.12	83	5.42	0.98
U.S. GSS	88	1.99	0.96	87	3.43	1.28	88	5.16	1.06
Hong Kong FtF	68	3.53	1.22	68	3.64	1.15	68	4.91	0.80
Hong Kong GSS	68	3.27	1.14	68	3.13	1.11	68	4.64	0.85

Treatment	Vote 1 Consensus			Vote 2 Consensus		Change in Consensus		Participation Equality	
	N	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
U.S. FtF	11	0.30	0.09	0.61	0.07	0.31	0.06	0.63	0.07
U.S. GSS	11	0.29	0.12	0.44	0.10	0.15	0.14	0.85	0.04
Hong Kong FtF	9	0.44	0.12	0.75	0.09	0.30	0.11	0.63	0.08
Hong Kong GSS	9	0.39	0.12	0.50	0.15	0.11	0.07	0.86	0.06

A factor analysis, with varimax rotation on the nine survey items is reported in Table 1. Each of the items loaded heavily on a single factor, along with its two other intra-construct items and no item loaded heavily on a factor representing another construct. A correlation matrix of the nine items reveals that all the correlations between items measuring the same construct were greater than all correlations between items measuring different constructs (Table 2). The Chronbach's α was 0.783 for the production blocking items, 0.693 for the dominance items, and was 0.766 for the satisfaction with process items. The Chronbach's α measures were relatively low, partly because only three items were used per construct [7], but were nevertheless above or very near the minimum threshold of 0.70 [29]. The mean value of the three items for each construct was used to represent the construct for hypothesis testing. The summary data for all perceptual measures and group measures is presented in Table 3.

All hypotheses and research questions were tested using GLM analysis. Culture was coded as United States = 0, and Hong Kong =1. GSS use was coded as FtF = 0, and GSS =1. Gender was included in the analysis to control for any effects caused from the gender of the individual respondent or the gender makeup of a particular group. Gender was coded as male = 0, and female = 1 for the individual unit of analysis and the percentage of group members that are male for the group level of analysis. This also controlled for uneven distribution of gender among the experimental treatments.

4.1 Findings

The results supported Hypothesis 1 in that GSS participants reported less production blocking and less dominance than FtF participants across both the U.S. and Hong Kong samples (Table 4). Thus, it appears that the features of anonymity and parallel communication were successful in reducing these process losses. The results were also significant with respect to research question 1. Hong Kong participants reported more production blocking across both FtF and GSS treatments than did U.S. participants. Interestingly, Hong Kong participants reported less dominance across both FtF and GSS treatments than did U.S. participants (Table 4).

The results supported Hypothesis 2 in that FtF groups achieved higher levels of consensus than GSS groups across both the U.S. and Hong Kong samples (Table 5). GSS groups and FtF groups were not significantly different in their Vote 1 consensus, but FtF groups had significantly greater change in consensus, and significantly higher Vote 2 consensus. This supports earlier findings that ad hoc groups meeting for the first time achieved lower consensus when using GSS than when meeting FtF [22]. The results did not support Hypothesis 3 in that Hong Kong groups did not achieve significantly greater Vote 2 consensus or change in consensus than did U.S. groups across both meeting environments. However, the difference was close to being significant for Vote 2 consensus ($p=0.058$), raising the possibility of a Type II error. Interestingly, Hong Kong groups did have significantly greater Vote 1 consensus than did U.S. groups.

The results supported Hypothesis 4 in that ad hoc FtF groups meeting for the first time reported greater satisfaction with process than did corresponding GSS groups across both the U.S. and Hong Kong samples (Table 4). There were significant findings for research question 2 in that U.S. participants reported greater satisfaction with process than did Hong Kong

participants across both GSS supported and FtF groups (Table 4).

Table 4. GLM Results for Process Variables and Satisfaction with Process

Production Blocking $F(4, 302) = 23.03^{***}$, $R^2 = 23.38\%$			
Parameter	β	SE	t value
Intercept	2.50	0.13	19.11^{***}
Culture	1.04	0.14	7.18^{***}
GSS	-0.51	0.14	-3.58^{***}
Gender	0.06	0.14	0.40
Interaction	0.27	0.25	1.08
Dominance $F(4, 300) = 7.07^{***}$, $R^2 = 8.61\%$			
Parameter	β	SE	t value
Intercept	4.07	0.14	29.45^{***}
Culture	-0.44	0.15	-2.90^{**}
GSS	-0.65	0.15	-4.34^{***}
Gender	0.05	0.15	0.31
Interaction	0.19	0.26	0.72
Satisfaction with Process $F(4, 302) = 7.47^{***}$, $R^2 = 9.01\%$			
Parameter	β	SE	t value
Intercept	5.43	0.11	49.18^{***}
Culture	-0.57	0.12	-4.69^{***}
GSS	-0.31	0.12	-2.63^{**}
Gender	0.03	0.12	0.25
Interaction	0.18	0.21	0.84

Note: $^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$. Variables are coded as follows: Culture: U.S. = 0, Hong Kong = 1, GSS: Face-to-Face = 0, GSS = 1, Gender: Male = 0, Female = 1

The results supported Hypothesis 5 in that GSS groups generated greater participation equality than FtF groups across both U.S. and Hong Kong cultures (Table 5). However, there were no significant findings for research question 3. The participation equality measures were virtually identical across cultures. The implications of these findings are discussed in the following section.

5. Discussion

The four hypotheses regarding the effects of GSS usage were all supported. This is encouraging for GSS research as we are beginning to understand the implications of GSS usage, and verify that the influence of GSS is significant in both Western and non-Western cultures. As expected, GSS groups reported less production blocking, less dominance, and less satisfaction with process than FtF groups. GSS groups had greater participation equality and achieved lower levels of consensus than did FtF groups. Noting, however, that the GSS groups here are ad hoc groups meeting for the first time. It is quite possible that satisfaction and consensus would increase to equal or exceed the levels of FtF groups in subsequent meetings.

Table 5. GLM Results for Outcome Variables

Vote 1 Consensus $F(4, 35)=3.37^{*}$, $R^2 = 27.78\%$			
Parameter	β	SE	t value
Intercept	0.35	0.07	4.95^{***}
Culture	0.12	0.06	2.16^{*}
GSS	-0.02	0.05	-0.42
Gender	-0.09	0.10	-0.92
Interaction	-0.06	0.14	-0.41
Vote 2 Consensus $F(4, 35)=14.31^{***}$, $R^2 = 62.05\%$			
Parameter	β	SE	t value
Intercept	0.71	0.06	11.14^{***}
Culture	0.10	0.05	1.96
GSS	-0.19	0.04	-4.55^{***}
Gender	-0.16	0.09	-1.80
Interaction	-0.10	0.13	-0.75
Change in Consensus $F(4, 35)=7.61^{***}$, $R^2 = 46.53\%$			
Parameter	β	SE	t value
Intercept	0.35	0.06	5.42^{***}
Culture	-0.02	0.05	-0.46
GSS	-0.17	0.04	-3.98^{***}
Gender	-0.07	0.09	-0.74
Interaction	-0.04	0.13	-0.29
Participation Equality $F(4, 35)=28.63^{***}$, $R^2 = 76.59\%$			
Parameter	β	SE	t value
Intercept	0.62	0.04	14.88^{***}
Culture	0.00	0.03	0.09
GSS	0.21	0.03	7.84^{***}
Gender	0.03	0.06	0.65
Interaction	0.04	0.08	0.50

Note: $^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$. Variables are coded as follows: Culture: U.S. = 0, Hong Kong = 1, GSS: Face-to-Face = 0, GSS = 1, Gender: percentage of group members that are male.

There were a number of interesting findings with respect to the influence of culture. Not only were there differences in process losses across cultures, but these differences existed for both GSS and FtF groups. For example, Hong Kong groups reported greater production blocking than U.S. groups across both meeting environments. However, GSS was successful in reducing production blocking within Hong Kong groups just as GSS reduced production blocking within U.S. groups. Dominance was reduced by GSS in both cultures but was greater in U.S. groups than Hong Kong groups. It appears that cultures may differ significantly in the degree to which certain process losses affect their group behavior, or at least the degree to which process losses are reported as manifest. This may suggest that designers need to place greater focus on certain process losses, such as production blocking, in some cultures more than others. For example, despite the fact that GSS lowered production blocking in both U.S. and Hong Kong groups, Hong Kong groups with GSS support still reported greater production blocking than U.S. groups meeting FtF ($t=3.80$, $df=149$, $p<0.001$).

The findings with regard to meeting satisfaction support the model developed and tested in the literature [5, 31]. Specifically, participants in experimental treatments that achieved significantly lower consensus also reported less satisfaction with meeting process. This is because groups with lower consensus levels are more likely to contain members whose individual preferences differ from the group's preference. Such participants have low levels of individual goal attainment and, consequently, tend to report lower levels of satisfaction. Likewise, groups with higher consensus levels are more likely to contain members whose individual preferences agree with the group's preference. Such participants have high levels of individual goal attainment and, consequently, tend to report higher levels of satisfaction.

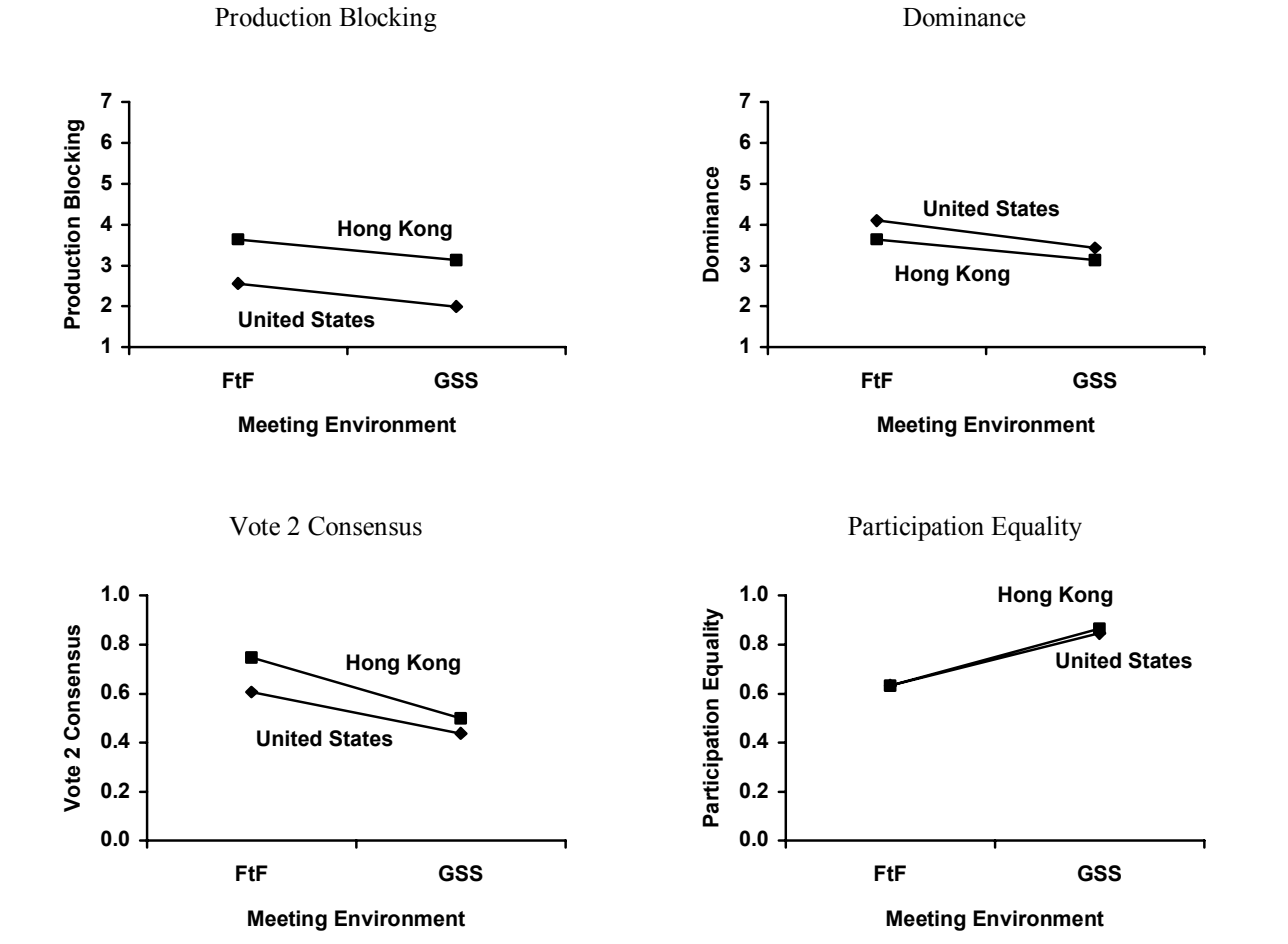

Figure 1. Mean Values for Process Losses and Group Outcomes by Treatment

However, Hong Kong groups also reported significantly less satisfaction with meeting process than did U.S groups across both meeting environments. This may suggest that the experimental procedures may have been more inline with Western cultures and thus seen as more beneficiary, in the long term, to Westerner participants in attaining their goals.

Group consensus was affected more by meeting environment than by culture. Hong Kong groups had higher levels of consensus than U.S. groups for Vote 1, and the difference was close to being significant for Vote 2 ($p=0.058$). Watson et al., [39] report a similar finding; Singaporean groups had higher consensus than U.S. groups in their initial vote on a rank-order task, but not significantly higher consensus on their post-meeting vote. One reason for these findings may be that the populous of Hong Kong and Singapore are more homogenous than the populous of the U.S. Such homogeneity may lead to more cohesive belief systems in preference type tasks, such as the one used in the experiment reported here. If Hong Kong groups do have a more homogenous belief system, with respect to the task used in this experiment, then the final decisions reached by Hong Kong groups should have greater similarity than the final decisions reach by U.S. groups. This difference was tested by comparing the 153 Spearman rank-order correlation coefficients (r_s) computed from the Vote 2 rankings of the Hong Kong groups to the 231 U.S. measures of r_s computed from the Vote 2 rankings of the U.S. groups[1]. The Wilcoxon-Mann-Whitney test [32] was significant ($z=-5.56$, $p<0.000$), indicating that Hong Kong groups had greater similarity in their final decisions than did U.S. groups.

Although gender may influence group outcomes in some circumstances, we did not find any gender effects for the variables examined in this study. Nor were there any interaction effects between gender, culture and GSS usage. A separate GLM analysis was conducted on all of the variables without controlling for gender and there were no significant interaction effects between meeting environment and culture.

6. Conclusion

In this paper we examined the influence of meeting environment and national culture on process losses, meeting satisfaction, and group outcomes. Our findings indicate that both GSS use and national culture significantly influenced variables such as production blocking, dominance, and satisfaction with meeting process, indicating that national culture may be an important factor to consider when designing and implementing collaborative technology. Some process losses appear to be more problematic in some cultures than in others. Thus, designers need to be aware of such cultural differences when designing collaboration technology for use in non-Western environments.

We did not find substantial differences between cultures with regard to group outcomes. GSS increased participation equality and reduced consensus levels across both cultures.

However, given that the study used ad hoc groups that were meeting for the first time, it is not clear that the differences in consensus would have persisted across subsequent meetings. We encourage future research that uses longitudinal studies in Western and Asian cultures to examine cross-cultural comparisons over multiple meetings.

An important finding from this study is that GSS influenced group dynamics similarly across both cultures (Figure 1). The lack of interaction effects between culture and meeting environment is significant because it implies that the theoretical models on which GSS were developed [e.g., 28] apply consistently across diverse cultures. For example, GSS use resulted in similar increases in participation equality across individualistic, low power-distance cultures and collectivistic, high power-distance cultures. Future research is encouraged to investigate the effects of national culture on group processes and outcomes, so that collaboration technology may be more effectively designed and implemented.

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Appendix A. Community Resource Allocation Task Force

A large amount of money has recently been donated by local corporations for the betterment of Hong Kong <Norman>. You have been assigned to a team of respected citizens to decide how this money is going to be spent. You have nine projects to choose from. These projects are listed below. Your task is to rank these projects according to your own personal values. Place a 1 by the project you feel is most important, a 2 by the project you feel is second most important and continue ranking the projects until you give a 9 to the one that you feel is least important.
Proposed Projects include: AIDS Awareness Campaign, Anti-drug Abuse Campaign, Community Fine Arts and Music , Conduct Cancer and Heart Research, Environment Clean-up Project, Increase in Police Force, Public Housing, Small Business Loans, Special Care for the Elderly.

Appendix B. Survey Items

PB1: When I thought of an idea, I … (1=could express it immediately, 4=neutral, 7=had to wait to express it)

PB2: Did you express your ideas … (1=soon after you thought of them, 4=neutral, 7=after waiting a while)

PB3: I was able to express my ideas as soon as they occurred to me. (1=strongly agree, 4=neutral, 7=strongly disagree)

DM1: During the meeting, there was at least one person in the group who tended to dominate the group discussion (1=strongly agree, 4=neutral, 7=strongly agree)

DM2: It seemed as though one person had more influence over the final solution than the rest of the group. (1=strongly agree, 4=neutral, 7=strongly disagree)

DM3: One or two members strongly influenced the group's decision. (1=strongly agree, 4=neutral, 7=strongly disagree)

SP1: I would describe our group's problem solving process as (1=very unfair, 4=neutral, 7=very fair)

SP2: I would describe our group's problem solving process as (1=very confusing, 4=neutral, 7=very understandable)

SP3: I would describe our group's problem solving process as (1=very unsatisfying, 4=neutral, 7=very satisfying)

Note: PB=Production blocking, DM=Dominance, SP=Satisfaction with process.