

Culturally Heterogeneous vs. Culturally Homogeneous Groups in Distributed Group Support Systems: Effects on Group Process and Consensus

William N. Anderson
 Department of Computer and Information Science
 New Jersey Institute of Technology
 Newark, New Jersey 01702
 anderson@adm.njit.edu

Starr Roxanne Hiltz
 Department of Computer and Information Science
 New Jersey Institute of Technology
 Newark, New Jersey 01702
 roxanne@vc.njit.edu

Abstract

As global virtual teams become more common, the need to better understand how groups composed of individuals from different cultural backgrounds perform has never been more pressing. This study compares groups from the same cultural background with groups from varied cultural backgrounds when they used two different communication media (face-to-face and an asynchronous conferencing system). Data was collected on 46 groups, which included a total of 268 subjects representing 39 countries. Research questions regarding group process and consensus were addressed specifically as they relate to cross-cultural group work. The results of this study suggest that distributed, asynchronous GSS may be effectively used by mixed cultural groups facing a value-based cognitive conflict (negotiation) task.

1. Introduction

Jessup and Valacich [26] recommend that future GSS research needs to focus primarily on issues related to the group, rather than the technology, and include studies of cultural norms, values, and processes. They define this challenge as "culture bridging" (p. 316). Raman and Wei [35] suggest that differences in cultural attributes and decision environments have important implications in the design of GDSS for people of different cultures. These differences include communication style and mode, status, appropriate ways of expressing disagreement, and recognizing that in collectivist countries, the preservation of group harmony may be more important than the pursuit of the organization's short-term goals. Task-oriented considerations for some cultures may be far less important than social-oriented considerations. Consequently, different types and levels of communication support may be needed.

As Watson, Ho & Raman [50] note, "Cross-cultural studies of GSS technology are highly relevant to a post-industrial society in which managerial teams, often composed of individuals from different national

cultures, will make extensive use of information technology to support group decision-making." Despite the potential importance of cultural composition to the process and outcomes of groups using Group Support Systems, very few studies have used this variable. The review by Fjermestad and Hiltz [16] of 200 GSS experiments identified only six studies where either ethnic diversity or culture were used as an independent variable. All of these studies involved the use of synchronous (decision room) systems, and none of them compared culturally homogeneous to culturally heterogeneous groups.

1.1 Cultural Dimensions

Most definitions of culture include direct or indirect references to the notion of shared values and beliefs that produce norms which, in turn, guide and influence behavior [28, 48]. Beliefs and values emerge from the educational and life experiences that take place within a cultural environment.

Among the most influential work in the area of cross-cultural research is the substantial contribution of Hofstede [24]. Based on an ecological factor analysis of data collected on nearly 117,000 questionnaires completed by employees of a large multinational U.S. firm (IBM), Hofstede proposed a series of four dimensions that differentiate work-related values. Bond [5] later proposed a fifth dimension as a result of a study he completed with 2,200 subjects in 22 countries. These five cultural dimensions are briefly described below.

Individualism-Collectivism - individualism implies a loosely knit social framework in which people are supposed to take care of themselves and of their immediate families only, while collectivism is characterized by a tight social framework in which people distinguish between in-groups and out-groups; they expect their in-group (relatives, clan, organizations) to look after them, in exchange for that they feel they owe absolute loyalty to it.

Power Distance - the extent to which a society accepts the fact that power in institutions and organizations is

distributed unequally. It's reflected in the values of the less powerful members of society as well as in those of the more powerful.

Uncertainty Avoidance - the extent to which a society feels threatened by uncertain and ambiguous situations and tries to avoid these situations by providing greater career stability, establishing more formal rules, not tolerating deviant ideas and behaviors, and believing in absolute truths and the attainment of expertise. Societies in which uncertainty is strong are also characterized by a high level of anxiety and aggressiveness that creates, among other things, a stronger inner urge in people to work hard.

Masculinity-Femininity - the extent to which the dominant values in society are "masculine" - that is, assertiveness, the acquisition of money and things, and not caring for others, the quality of life, or people.

Confucian Dynamism - the extent to which a national culture is oriented toward the future (places value on thrift and perseverance) rather than an orientation toward the past and present (places value on respect for tradition and fulfilling social expectations). Also referred to as long-term versus short-term orientation.

Considerable evidence in support of the existence of cultural differences, in general, and Hofstede and Bond's cultural dimensions, specifically, is found in the literature. Shackleton and Ali [39] used Hofstede's Values Survey Module (VSM) in a study that included 214 Sudanese, British and Pakistani managers. After correcting for educational level, the authors found evidence to support Hofstede's dimensions of power distance and uncertainty avoidance.

A second (of many) examples was reported by Shane [40] who collected data on the number of patented inventions in 33 countries and compared them to Hofstede's indices of individualism/collectivism and power distance. Shane's hypotheses were based on the assumptions that "individualistic societies value freedom more than collectivistic societies, and freedom is necessary for creativity" (p.30), which is related to invention. Furthermore, he posited that creativity and inventiveness would be inhibited in societies scoring high on Hofstede's power distance dimension (cultures that stress social hierarchy where rules and procedures are emphasized). The results of a Spearman-Rank correlation between Hofstede's indices and inventiveness adjusted for wealth indicated that invention was positively correlated with individualism and negatively correlated with high power distance.

In his review of Hofstede's book, Culture's Consequences: International Differences in Work-Related Values, Triandis [45] raised several questions regarding cultural differences that relate to the contextual and adaptation factors considered important in the design

of computer mediated communication systems (CMCS) as described by Fjermestad, Hiltz and Turoff [15]. Specifically, Triandis asks,

- a) What cues do people use to extract information from the environment; that is, what do they *perceive*? For example, do they pay attention to the age, sex, race, language, religion, or status of the other person?
- b) How do people process the information they extract in the previous step, that is, what are their *cognitions*?
- c) How do people evaluate their information? That is, what *values* interact with the cognitions?
- d) What do people *do* after they go through those three steps - that is, what visible *behaviors* occur then?

These questions raise issues, which may be of particular importance for the design of computer-mediated communications systems that support the work of groups composed of individuals from different cultural backgrounds.

1.1 Previous Studies of Cross-Cultural Interaction in GSS

Our understanding of how individuals and groups interact electronically has advanced considerably during the past 20 years [2, 21], but much remains unknown. This is particularly true for cross-cultural work groups since most electronic communication research has taken place within a culturally narrow framework [7, 50]. It has been found that individuals from different national and cultural backgrounds communicate and make decisions differently [4, 6, 19, 46]. These differences have been attributed to variations in cultural values [24]. Furthermore, cultural differences have also been found to affect attitudes toward the adaptation of technology generally and computer technology specifically [1, 34]. The two major programs in cross-cultural GSS studies have involved Singapore and Mexico.

Singapore: The major cross-cultural GSS research program is in the Department of Information Systems and Computer Science at the National University of Singapore (NUS). Researchers there include Teck Hua Ho, Wei Huang, L.H. Lim, Krishnamurthy S. Raman, Bernard C.Y. Tan, Hock-Hai Teo, and Kwok-Kee Wei. Contributors to their efforts have also included Richard T. Watson and Robert P. Bostrom, both presently at the University of Georgia. Together, this group is responsible for 17 published studies that have, for the most part, used Singaporean students as subjects, with a version of SAMM, a synchronous GSS system. This provides researchers with the opportunity to compare the findings obtained with Singaporean subjects with those obtained with other culturally homogeneous groups. While the NUS researchers have not as yet undertaken

studies with culturally heterogeneous groups, they have established a strong research agenda.

Mexico: Mejias et al. [31, 32] compared culturally homogeneous groups of Americans and Mexicans in studies using the same research design and task. The researchers measured the number of comments and unique ideas, consensus, consensus change, decision satisfaction, and perceived participation equality. For both cultures, GSS supported groups generated a greater number of average comments per individual than manual groups. American manual groups generated more unique ideas than American GSS supported groups while the Mexican GSS supported groups generated more unique ideas than face-to-face groups. For both cultures, face-to-face manual groups reached higher levels of consensus than GSS supported groups. On the other hand, GSS-anonymous and GSS-identified groups experienced higher levels of consensus change. The GSS supported Mexican groups reported higher levels of decision satisfaction and perceived participation equality than the GDSS supported American groups.

Two prior studies have compared the performance of culturally homogeneous and culturally diverse groups where cultural background alone was used to determine group membership [11, 12]. The second of these evaluated the performance of culturally homogeneous (U.S.) groups and multicultural (Anglo and Mexican) groups in either a face-to-face or GDSS environment. Groups completed three case studies related to campus climate. GDSS groups reported higher levels of perceived contribution and generated more ideas than face-to-face groups. No differences were found with respect to communication mode for commitment to decision and personal influence. In terms of culture, multicultural groups generated a significantly higher number of ideas than culturally homogeneous groups. No differences were found for the other dependent variables. However, a limitation of these two studies is the small size of the subject pool (53 subjects in each).

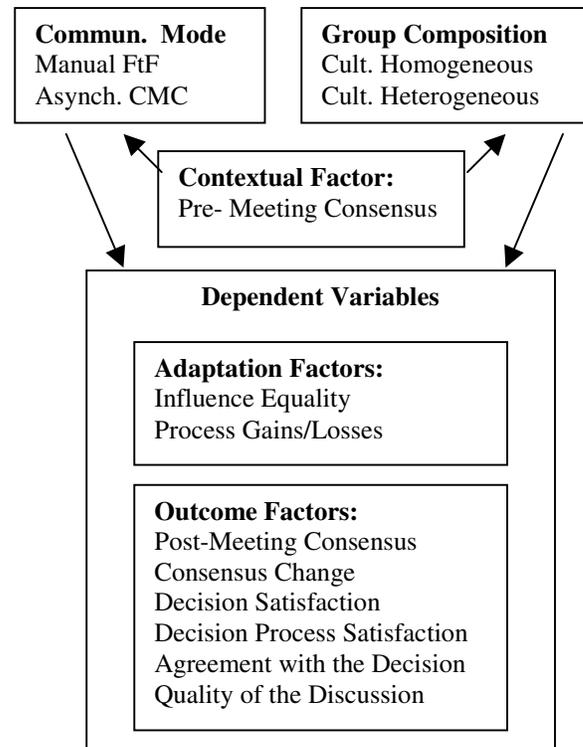
2.0 Research Questions and Hypotheses

Stated in the form of research questions, given the differences in values among people from various national cultures,

- ◆ How does the cultural composition of the group effect group decision-making?
- ◆ Does medium of communication influence group outcome factors of consensus, effectiveness, and satisfaction?
- ◆ What interaction effects occur between culture and technology?

This study was designed to measure the contextual factor of pre-meeting consensus, the adaptation factors of influence equality and process gains/losses, and the effect of communication mode on outcome factors (consensus, satisfaction and effectiveness) when group composition varies by culture. The conceptual model is shown below as Figure 1.

Figure 1: Conceptual Model



For this paper, we will focus on only a subset of the variables included in the full study: Influence Equality, Post-Meeting Consensus, and Consensus Change.

Influence Equality: With few exceptions, there appears to be general agreement among researchers and reviewers that GSS increases participation which, in turn, reduces domination, thereby resulting in greater equality of influence [3, 25, 27, 30]. However, these findings are limited to studies where groups consisted of members from an individualistic culture (U.S.). It has yet to be determined whether increased participation is related to greater equality of influence for other cultural groups, either homogeneous or heterogeneous.

In studies of influence equality that included culturally homogeneous groups (Mexican, Singaporean, and U.S.), researchers have found no significant differences related to medium of communication [22, 23,

31, 32, 42, 43, 44, 49]. Influence equality was, however, found to be significantly higher for Mexican and Singaporean groups than for U.S. groups [31, 32, 50]. Several researchers have proposed arguments suggesting that GSS technology structures designed to reduce certain processes losses are not effective when conformity, harmony, and status differences are the cultural norm [13, 50]. Furthermore, groups may not uniformly appropriate technology structures particularly if those structures affect group social structures and norms [31].

People from collectivist cultures are concerned with group harmony and consensus. However, GSS designs to date are based on a North American (individualistic) perspective, which encourages independent thinking and participation from all group members. As a result, the egalitarian spirit of a GSS may conflict with norms of acceptable behavior in non-egalitarian societies. The results of these studies serve as the foundation for the following hypotheses:

- H1a. Asynchronous groups will have a higher level of influence equality than face-to-face groups.
- H1b. Culturally heterogeneous groups will have a higher level of influence equality than culturally homogeneous groups.

Post-meeting Consensus: In general, CMC studies have shown that computer-supported groups have lower levels of post-meeting consensus than face-to-face groups [18, 42, 43, 47]. Similar findings have also been noted in reviews of the literature on group communication support systems [27] and group support systems [30].

Research on post-meeting consensus based on the cultural background of the group is quite limited. Mejias et al. [31] found no significant differences between groups composed of Mexican subjects and groups composed of U.S. subjects on idea generation and preference tasks. Similarly, Watson et al. [50] found no significant differences on post-meeting consensus between Singaporean and U.S. groups on a preference task. However, both of these studies compared culturally homogeneous groups (Mexicans with U.S.; Singaporean with U.S.). No empirical GSS studies have yet examined post-meeting consensus of culturally mixed (heterogeneous) groups.

The task (Noble Industries) used in this study is described below. This task was specifically developed as a Type 5-cognitive conflict task. On tasks of this type there is intra-unit conflict since group members are required to resolve conflicts of viewpoint. In this situation, group members do not simply have different preferences, but they have systematically different preference structures [29]. Specifically, preferences are

based on value systems, which vary considerably from one culture to another. Consequently, this type of task is referred to as a value-laden cognitive conflict task (see [49] for another example).

Based on Hall's [20] framework, people from low context (individualistic) cultures rely on the use of words to convey meaning. Unambiguity and specificity are characteristics of low context communication in which messages are spelled out clearly [14]. In a high context (collectivist) culture, people do not rely on language alone for communication. Tone of voice, timing, facial expressions, and behaving in ways considered acceptable in the society are major means of expression [17]. Media richness theory proposes that task effectiveness is improved when task needs are matched to a medium's ability to convey information [9, 10]. For groups composed of individuals from individualistic cultures, an asynchronous CMC is unlikely to satisfy the divergent information needs and communication styles of all of the group's members, thereby resulting in a lower level of post-meeting consensus among these groups.

- H2a. Asynchronous groups will have a lower level of post-meeting consensus than face-to-face groups.
- H2b. Culturally heterogeneous groups will have a lower level of post-meeting consensus than culturally homogeneous groups.

Consensus Change: has been explored from several perspectives. Studies with culturally homogeneous groups (Singaporeans) found no difference between communication modes [41, 43], but reported conflicting results with respect to task type (intellective versus preference). Raman, Tan & Wei [36] found that face-to-face groups showed higher levels of consensus change on a preference task, but not on an intellective task. Watson et al. [50] found that post-meeting consensus was positively related to pre-meeting consensus in manual (face-to-face) and GDSS supported groups, whereas there was no difference in baseline groups. Furthermore, groups composed of U.S. subjects had a significantly higher level of consensus change than groups composed of Singaporean subjects. Mejias, et al. [32] found no difference in consensus change between groups of Mexican and U.S. subjects, however GSS supported groups showed significantly higher levels of consensus change than face-to-face groups. Together, these studies report mixed results with respect to medium of communication and cultural background of the groups.

In a study of face-to-face groups that worked on a negotiation task, Cox, Lobel, and McLeod [8] found that culturally diverse groups composed of Asians, Hispanics, and Black-Americans exhibited more cooperative behavior than culturally homogeneous groups (U.S.).

Furthermore, when cooperative behavior was expected, the diverse groups increased their levels of cooperation, whereas the culturally homogeneous groups (an individualistic culture) did not. The willingness of the culturally diverse groups (generally classified as collectivists) to work together suggests that collectivists may be inclined to modify their own preferences and positions more readily than individualists. The following hypothesis are based on these findings:

- H3a. Asynchronous groups will have a lower level of consensus change than face-to-face groups.
- H3b. Culturally heterogeneous groups will have a higher level of consensus change than culturally homogeneous groups.

No hypotheses were listed for interaction effects. Because there has been no previous research with culturally heterogeneous groups using asynchronous CMC, we did not have a firm basis for predictions. However, ANOVA will be used to check for interaction effects on all three sets of hypotheses.

3.0 Method

3.1 Experimental Design

The study is a controlled experiment with a 2 × 2 factorial design. In order to provide a sufficient level of "power" to the statistical analysis, a minimum of ten groups per cell were included in the study. Two independent factors were selected, group composition (culturally homogeneous vs. culturally heterogeneous) and medium of communication (face-to-face vs. asynchronous CMC). Figure 2 below represents these factors and the numbers of groups and subjects (in parentheses) in each condition. A total of 46 groups (268 subjects) were included in this study.

Figure 2. Groups by Treatment Condition

Cultural Composition	Manual F-t-F	Asynch. CMC
Homogeneous (U.S.)	10 (60)	10 (56)
Heterogeneous (non-U.S.)	15 (90)	11 (62)

Individuals were assigned to groups based on cultural identity (country of birth, native language, number of years of formal education in their country of birth, number of years living in the U.S., and self-identification) and then groups were randomly assigned to condition. Heterogeneous groups were designed to be as mixed as possible, in terms of both cultural identity

and gender. Figure 3 shows the composition of four sample heterogeneous groups.

Figure 3. Examples of Culturally Heterogeneous Groups

S	F-t-F	F-t-F	Asynch.	Asynch.
1	India-f	Brazil-m	S.Kor.-m	Ghana-m
2	U.S.-m	Ghana-m	India-f	DmRp-m
3	Japan-f	Jamaica-m	Peru-m	China-m
4	DmRp.-m	India-f	India-m	Pakist.-f
5	Poland-m	Egypt-m	Poland-f	Vietnm-f
6	Taiwan-m	Hong K.-m	Philip.-f	India-m

S=subject number; f=female; m=male

All groups completed the same task and were required to reach consensus. The four conditions were as follows:

Condition 1. Homogeneous/face-to-face included groups of U.S. subjects who discussed the task in a face-to-face setting.

Condition 2. Homogeneous/asynchronous CMC included groups of U.S. subjects who discussed the task in an asynchronous electronic conference.

Condition 3. Heterogeneous/face-to-face included groups of culturally mixed subjects who discussed the task in a face-to-face setting.

Condition 4. Heterogeneous/asynchronous CMC included groups of culturally mixed subjects who discussed the task in an asynchronous computer conference.

Face-to-face groups were formed when subjects arrived at the pre-arranged location. Subjects in both the face-to-face and asynchronous CMC conditions were assigned to groups based on their cultural background as described below. The computerized conferencing system (WEB-EIES) enabled members to participate in a threaded discussion and the system stored a permanent transcript. One member of each group was randomly selected to serve as the group facilitator. The facilitator's role was to get the group discussion started, help the group arrive at consensus, and record the group's decision.

Culturally homogeneous groups were formed with subjects from the same cultural background (U.S.). Culturally heterogeneous groups included subjects from a wide range of countries. An effort was made to balance all groups by gender by having at least two females in each group. However, based on the available subject pool (two urban universities and one suburban university), the groups were predominantly male. Group size was controlled at six subjects per group. This was true for all face-to-face groups. Some subjects assigned to the asynchronous condition spontaneously

"dropped out", leaving some groups with fewer than six subjects. Only groups with a minimum of five subjects per group were included in the study. The remaining groups were discarded.

3.2 Task: Noble Industries

Subjects completed the Noble Industries task (created by the first author), a value-laden cognitive conflict task [29]. To date, relatively few asynchronous CMC studies have been undertaken and only a few have used cognitive conflict or negotiation tasks [16].

The Noble Industries task (available from the first author) involves ranking the order in which ten fellow employees may be laid off in a possible corporate downsizing. In addition to demographic information about the employees, the task also included a four or five sentence description about each employee under the general heading "Supervisor's Comments". Each employee was characterized in the supervisor's comments to represent one pole of the five dimensions of culture as identified by Hofstede [24] and Bond [5] as described above. Consequently, the ranking task was designed specifically to force subjects to make decisions based on their values and, therefore, highlight individual similarities and differences within the groups.

3.3 Subjects and Procedures

A total of 175 subjects were involved in testing the instruments and the experimental methods in pilot studies. For this experiment, subjects included undergraduate students from the United States as well as from thirty-eight other countries. Their incentive to participate was credit counted in their final grade for a participating course. Undergraduate students were selected primarily because of their limited employment and supervisory experience. Since the task requires subjects to make decisions about possible lay-offs in a corporate downsizing, it was decided that limiting the subject pool to undergraduates would control for work and supervisory experience relevant to the task. In this way it was expected that subjects would need to rely on their personal values on the employee-ranking task.

The United States was selected as the culturally homogeneous culture for three reasons. First, since most CMC studies have been conducted in North America, it was felt that a study comparing U.S. groups with mixed cultural groups would be of considerable research value. Second, this study was conducted in the U.S. and so the subject pool was readily available. Third, the culture of the United States places it at the extremes of several of Hofstede [24] and Bond's [5] cultural dimensions (the United States scores highest in individualism, and ranks

in the bottom third on both the power distance and long term/short term dimensions).

In addition to completing the task activities, subjects also completed a series of survey instruments described below:

1. **Pre-Meeting Questionnaire** - the purpose of this instrument is to collect demographic information on each subject and to assign subjects to groups based on their cultural background.
2. **Subject Consent Statement** - a standard form used at NJIT whereby subjects are informed of the procedures, risks, and benefits of participation in the study.
3. **Rokeach Value Survey** - the purpose of the instrument is to collect information on the personal values of the subjects. The Value Survey requires subjects to rank their terminal and instrumental values. Terminal values refer to social and personal concerns while instrumental values refer to morality and competence [36, 37]. Since subjects would be working on a value-laden cognitive conflict task, the Rokeach Value Survey was administered to make the task activity more salient.
4. **Task Survey** - questions on this instrument were used to measure subjects' perceptions regarding the task. This instrument was completed after the subject read the description of the task, but before the subject began actual work on the rankings.
5. **Post-Task Questionnaire (Individual)** - questions on this instrument were used to measure subjects' perceptions regarding the task. This instrument was completed after the subject finished the ranking task.
6. **Post-Task Questionnaire (Group)** - questions on this instrument were used to measure subjects' perceptions regarding the group process. This instrument was completed after the group finished the ranking task.
7. **Final Employee Ranking Form (Individual)** - this instrument required subjects to rank the employees in the Noble Industries task. This instrument was completed after the group had reached consensus. It is the basis for determining the final level of actual consensus, and of consensus change.

4.0 RESULTS

4.1 Influence Equality

This measure represents the difference between the group's pre-meeting ranking and group's consensus ranking. Low scores indicate an equal distribution of influence among the group while high scores suggest that some group members had more influence over the group. Values for this measure range from 0 to 41.67. A full

description of this and subsequent measures is available from the first author.

The mean for culturally homogeneous (US) groups was 20.97 and the mean for culturally heterogeneous (mixed) groups was 21.85. The ANOVA obtained was not significant ($F= 0.381$; $p = 0.540$). The mean for face-to-face groups was 21.67 and the mean for asynchronous groups was 21.23. The ANOVA obtained was not significant ($F= 0.074$; $p = 0.787$). There were no interaction effects.

- H1a. Asynchronous groups will have a higher level of influence equality than face-to-face groups. **Not Supported**
- H1b. Culturally heterogeneous groups will have a higher level of influence equality than culturally homogeneous groups. **Not Supported**

4.2 Post-meeting Consensus

Group rankings on the Noble Industries task were analyzed to determine the level of post-meeting agreement. A Kendall's coefficient of concordance (W) was obtained for each group in the four treatment conditions. Kendall's W scores ranged from 0.495 to 1.000 (perfect agreement) for the face-to-face groups and from 0.355 to 0.921 for the asynchronous groups.

In order to test for differences on post-meeting consensus between treatment groups, the Kendall's W values were evaluated to determine if the data could be analyzed using the general linear model (GLM). The data did not satisfy the requirements for normality and various transformations were unsuccessful. The Kendall's W 's were converted to ranks and analyzed using the Kruskal-Wallis test [33].

Face-to-face culturally heterogeneous (mixed) groups had the highest level of post-meeting consensus (mean = 28.17) while asynchronous culturally homogeneous (U.S.) groups had the lowest level of post-meeting consensus (mean = 15.95). The p -value of 0.077 is not significant at the desired 0.05 level, therefore no difference can be stated for the post-meeting consensus measure. However, the 0.10 significance suggests that some differences in the population means exist. This was confirmed by the median test where a chi-square of 7.139 with a p -value of 0.068 (0.1 significance) was obtained.

- H2a. Asynchronous groups will have a lower level of post-meeting consensus than face-to-face groups. **Not Supported**
- H2b. Culturally heterogeneous groups will have a lower level of post-meeting consensus than culturally homogeneous groups. **Not Supported**

4.3 Consensus Change

This measure represents the difference between the group's pre-meeting and post-meeting ranking. Low scores indicate similarity between each group's pre-meeting and post-meeting ranking, suggesting that the group discussion had little effect on the employee ranking preferences. High scores indicate dissimilarity between the group's pre-meeting and post-meeting ranking, suggesting that the group discussion changed the group's preferences regarding the employee rankings. Values for this measure range from 0 to 50.

The mean for culturally homogeneous (U.S.) groups was 13.23 and the mean for culturally heterogeneous (mixed) groups was 15.01. The ANOVA obtained was not significant ($F= 1.502$; $p = 0.227$). The mean for face-to-face groups was 16.32 and the mean for asynchronous groups was 11.74. The ANOVA obtained was significant ($F= 14.583$; $p = 0.001$). There were no interaction effects.

Culturally homogeneous (U.S.) groups in the asynchronous condition had the lowest consensus change (mean = 10.91) while culturally heterogeneous (mixed) groups in the face-to-face condition had the highest level of consensus change (mean = 16.85).

- H3a. Asynchronous groups will have a lower level of consensus change than face-to-face groups. **Supported**
- H3b. Culturally heterogeneous groups will have a higher level of consensus change than culturally homogeneous groups. **Not Supported**

5.0 Discussion

5.1 Influence Equality

No significant differences for influence equality were found for medium of communication or culture. The findings with respect to medium of communication are consistent with other studies that used subjects from the same cultural background [22, 32, 43]. An inherent characteristic of synchronous or asynchronous GSS is their ability to reduce the pressure higher status members may exert on other members of the group. Unlike group behavior on an intellectual task (type 2) where one or more members may have specialized domain knowledge, groups working on decision-making (type 4) and cognitive conflict (type 5) tasks may recognize that input from each member is valuable.

In terms of culture, Mejias et al. [32] found that groups composed of Mexican subjects had higher levels of influence equality than groups composed of U.S. subjects. Similarly, Watson et al. [50] reported higher levels of influence equality for groups composed of Singaporean subjects than groups composed of U.S.

subjects. Since both Mexico and Singapore are high in both collectivism and power distance, it is possible that the GSS was successful in reducing status differences thereby promoting influence equality.

In this study no differences were found based on cultural composition of the group. It is suggested that since ad hoc culturally heterogeneous groups do not share the same history and values, status differences are minimal and so conformance pressure and evaluation apprehension are less likely to occur. Consequently, it appears that an asynchronous communication system can be used effectively for both culturally homogeneous and culturally heterogeneous ad hoc groups.

5.2 Post-Meeting Consensus

Face-to-face groups had higher, although not statistically significant, levels of post-meeting agreement than asynchronous groups. The richness of the face-to-face setting may have provided subjects with an environment where they could more easily discuss and made decisions about the task. Even with ad hoc groups, discussion in the face-to-face groups was lively and subjects were thoroughly engaged in the task. In fact, some of the groups wanted to continue their discussion with one another after the subjects were debriefed and dismissed. Based on these results, it appears that the combination of cultural homogeneity and a lean medium of communication may tend to result in relatively low, but not statistically significant, levels of post-meeting consensus on a value-based cognitive conflict task.

5.3 Consensus Change

As expected, groups in the face-to-face condition experienced the highest level of consensus change. Apparently, the richness of the face-to-face discussions enabled subjects to articulate their arguments for and against each of the employees more extensively and persuasively than those assigned to the asynchronous condition.

While culturally heterogeneous face-to-face groups had the highest level of consensus change, no significant differences were found based on cultural composition of the groups. This is of particular interest since this finding supports that of Mejias et al. [31] who reported no differences in consensus change for Mexican and U.S. groups. On the other hand, Watson et al. [50] found consensus change to be higher for U.S. groups than for Singaporean groups. These conflicting findings may be a function of the task type. The subjects in Mejias' study used an idea generation (type 2) task while the subjects in Watson's study used a preference (type 4)

task. Ethnocentric (same culture) studies that have considered consensus change and task type have also reported conflicting results [41, 43].

Significant differences on consensus change were found based on medium of communication with face-to-face groups having higher levels than asynchronous groups. Culturally homogeneous (U.S.) groups who discussed the task on-line had the lowest level of consensus change. One explanation for this is the cultural background of the groups. In highly individualistic cultures, members pursue their own interests and frequently do not consider the interests of others. Consequently, task type and cultural background of the group's members must be considered when consensus is desired or required.

There were several constraints that limit the generalizability of the findings. First, the subject pool consisted of undergraduate students with little employment history who were formed into ad hoc groups. While there is a danger that students are likely to quickly concede their position due to absence of personal "cost", groups were observed to be actively engaged in often-heated discussions about the employee rankings. The majority of the subjects were majoring in computer science or information systems and, as a result, those assigned to the asynchronous condition may have been familiar and comfortable with the technology. Another concern is the classification of subjects as either culturally homogeneous (U.S.) or culturally heterogeneous (mixed). Ideally, the non-U.S. culture subjects would have all been living overseas and not international students or recent U.S. immigrants. While this would not have posed insurmountable problems for electronic groups, it would have been difficult to assemble face-to-face groups.

Finally, on each of the three dependent variables reported in this study, culturally mixed groups equaled U.S. groups, in the asynchronous as well as face-to-face condition. Thus, the practical results of this research are that multi-cultural groups can succeed on-line in decision making, at least as well as homogeneous U.S. groups. Research on the performance of mixed cultural groups using distributed, asynchronous GSS needs to be continued to insure that theories are developed from a global rather than a parochial perspective.

Acknowledgements

Partial funding for this research was provided by a grant from the National Science Foundation (CISE-ITO 9732354) and the New Jersey Center for Multimedia Research.

References

- [1] Abdul-Gader, H. Abdulla and Kozar, Kenneth (1995). "The impact of computer alienation on information technology investment decisions: an exploratory cross-national analysis", *MIS Quarterly*, (December), pp. 535-559.
- [2] Baecker, Ronald M., (1993). *Groupware and computer-supported cooperative work*, San Francisco, CA; Morgan Kaufmann.
- [3] Benbasat, I. and Lim., L.H., 1993. The Effects of Group, Task, Context, and Technology Variables on the Usefulness of Group Support Systems: A Meta-Analysis of Experimental Studies, *Small Group Research*, 24, 430-462.
- [4] Blackman, B. (1983). "Toward a grounded theory for intercultural communication", In W.B. Gudykunst (Ed.), *International and intercultural communication: Current perspectives*, Beverly Hills, CA; Sage.
- [5] Bond, Michael Harris (1988). "Finding universal dimensions of variation in multicultural studies of values: The Rokeach and Chinese value surveys", *Journal of Personality and Social Psychology*, Vol. 55, N. 6; pp. 1009-1015.
- [6] Carbaugh, D. (1984). "Cultural communication and organizing", In W.B. Gudykunst and Y.Y. Kim (Eds.), *International and intercultural annual*, Beverly Hills, CA; Sage.
- [7] Chidambaram, Laku (1992). "The electronic meeting room with an international view", In R.P. Bostrom, R.T. Watson and S.T. Kinney (Eds.), *Computer augmented teamwork: a guided tour*; pp. 285-297, New York; Van Nostrand Reinhold.
- [8] Cox, T. H., Lobel, S., and McLeod, P.L. (1991). "Effects of ethnic group cultural differences on cooperation and competitive behavior on a group task", *Academy of Management Journal*, Vol. 34, N. 4; pp. 827-847.
- [9] Daft, R. L. and Lengel, R.H. (1986), "Organizational information requirements, media richness and structural design", *Management Science*, Vol. 32; pp. 554-571.
- [10] Daft, R.L., Lengel, R.H. and Trevino, L.K.,(1987). "Message equivocality, media selection and manager performance: implications for information systems", *MIS Quarterly*, Vol. 11; pp. 355-366.
- [11] Daily, Bonnie, Whatley, Art, Ash, Steven R. and Steiner, Robert (1996). "The effects of a group decision support system on culturally diverse and culturally homogeneous group decision making", *Information and Management*, Vol. 30; pp. 281-289.
- [12] Daily, Bonnie and Steiner, Robert (1998). "The influence of GDSS on contribution and commitment levels in multicultural and culturally homogeneous decision making groups", *Computers in Human Behavior*, Vol. 14 (1); pp. 147-162.
- [13] El-Shinnawy, M. and Vinze, A. S. (1997). "Technology, culture and persuasiveness: a study of choice-shifts in group settings", *International Journal of Human-Computer Studies*, Vol. 47; pp. 473-496.
- [14] Fatehi, Kamal (1996). *International Management: A Cross-Cultural and Functional Perspective*. Upper Saddle River, New Jersey; Prentice Hall.
- [15] Fjermestad, Jerry, Hiltz, Starr Roxanne, and Turoff, Murray (1993). "An integrative framework for the study of group decision support systems", *Proceedings of the Twenty-Sixth Hawaii International Conference on System Sciences*, Vol. 4, pp. 179-188.
- [16] Fjermestad, Jerry & Hiltz, Starr Roxanne (1999). "An assessment of group support systems research: methodology", *Journal of Management Information Systems*, Vol. 15 (3); pp. 7-149.
- [17] Francesco, Anne Marie and Gold, Barry Allen (1998). *International Organizational Behavior*. Upper Saddle River, N.J., Prentice Hall.
- [18] Gallupe, B.R., DeSanctis, G., and Dickson, G.W., 1988. Computer-Based Support for Group Problem-Finding: An Experimental Investigation, *MIS Quarterly*, 12(2), 277-298.
- [19] Gudykunst, William B. and Ting-Toomey, Stella (1988). *Culture and interpersonal communication*, Newbury Park, CA; Sage.
- [20] Hall, E.T. (1976). *Beyond Culture*. Garden City, N.Y.; Anchor Books.
- [21] Hiltz, Starr Roxanne and Turoff, Murray (1993). *The Network Nation: Human Communication via Computer* (revised edition), Cambridge, MA; MIT Press.
- [22] Ho, T.H. and Raman, K.S. and Watson, Richard T. (1989). "Group decision support systems: the cultural factor", *Proceedings of the Tenth International Conference on Information Systems*; pp. 119-129.
- [23] Ho, T.H. and Raman, K.S. (1991). "The effects of GDSS and elected leadership on small group meetings", *Journal of Management Information Systems*, Vol. 8, N. 2 (Fall); pp. 109-133.
- [24] Hofstede, Geert (1980). *Culture's consequences: international differences in work-related values*, Beverly Hills, CA; Sage.
- [25] Hollingshead, A.B. and McGrath, J.E. (1995). "Computer-assisted groups: a critical review of the empirical research.". In Guzzo, R.A., Salas, E. and Associates (Eds.). *Team Effectiveness and Decision Making in Organizations*, San Francisco; Jossey-Bass.

- [26] Jessup, Leonard M. and Joseph S. Valacich (1993). "Future directions and challenges in the evolution of group support systems", In L.M. Jessup and J.S. Valacich (Eds.), *Group support systems: New perspectives*, pp. 311-318, New York; Macmillan.
- [27] Kraemer, Kenneth L. and Pinsonneault, Alain (1989). "The implications of group support technologies: An evaluation of the empirical research", *Proceedings of the Twenty-Second Hawaii International Conference on System Sciences*, Vol. 3, pp. 326-336.
- [28] Kroeber, A.L. and Kluckhohn, C. (1952) *Culture: A Critical Review of Concepts and Definitions*. Harvard University, Papers of the Peabody Museum of American Archaeology and Ethnology. Vol. 47.
- [29] McGrath, Joseph E. (1984). *Groups: Interaction and Performance*, Englewood Cliffs, New Jersey; Prentice Hall
- [30] McLeod, P.L (1992). "An assessment of the experimental literature on electronic support of group work: results of a meta-analysis", *Human-Computer Interaction*, Vol. 7; pp. 257-280.
- [31] Mejias, Roberto J., Vogel, Douglas R. and Shepherd, Morgan M., (1997). "GSS meeting productivity and participation equity: a U.S. & Mexico cross-cultural field study" *Proceedings of the Thirtieth Hawaii International Conference on Systems Sciences*, Vol. 2; pp. 469-478.
- [32] Mejias, Roberto J., Shepherd, Morgan M., Vogel, Douglas R. and Lazaneo, Litva (1997). Consensus and perceived satisfaction levels: a cross-cultural comparison of GSS and non-GSS outcomes within and between the United States and Mexico", *Journal of Management Information Systems*, Vol. 13, N. 3; pp. 137-161.
- [33] Neter, John, Wasserman, William and Kutner, Michael H. (1990). *Applied linear statistical models*. Homewood, Illinois: Irwin.
- [34] Querishi, Sajda (1995). "Meeting and working on an electronic social space: behavioral considerations and implications for cross-cultural end user computing", *Journal of End User Computing*, Vol. 7 (4); pp. 12-21.
- [35] Raman, K.S. and Wei, K.K. (1992). "The GDSS research project", In Robert P. Bostrom, Richard T. Watson, and Susan T. Kinney (Eds.) *Computer Augmented Teamwork: A Guided Tour*, pp. 210-220. New York; Van Nostrand Reinhold.
- [36] Raman, K.S., Tan, B.C.Y. and Wei, K.K. (1993). "An empirical study of task type and communication medium in GDSS", *Proceedings of the Twenty-Sixth Hawaii International Conference on System Sciences*, Vol.4, pp. 161-168.
- [37] Rokeach, Milton (1973), *The nature of human values*. New York: The Free Press.
- [38] Schwartz, Shalom H. (1994b). "Are there universal aspects in the structure and contents of human values?", *Journal of Social Issues*, Vol. 50, (4); pp. 19-45.
- [39] Shackleton, Viv A. and Ali, Abbas H. (1990). "Work-related values of managers: A test of the Hofstede Model", *Journal of Cross-Cultural Psychology*, Vol. 23, N. 1; pp. 109-118.
- [40] Shane, S. A. (1992). "Why do some societies invent more than others?", *Journal of Business Venturing*, Vol. 7; pp. 29-46.
- [41] Sia, Choon-Ling, Tan, Bernard C.Y. and Wei, Kwok-Kee (1996). "Exploring the effects of some display and task factors on GSS user groups", *Information and Management*, Vol. 30, pp. 35-41.
- [42] Tan, Bernard Cheng-Yian, Wei, Kwok-Kee and Raman, Krishnamurthy Sundara (1991). "Effects of support and task type on group decision outcome: a study using SAMM", *Proceedings of the Twenty-Fourth Hawaii International Conference on System Sciences*, Vol.4, pp. 537-546.
- [43] Tan, Bernard C.Y., Raman, Krishnamurthy S. and Wei, Kwok-Kee (1994). "An empirical study of the task dimension of group support system", *IEEE Transactions on Systems, Man, and Cybernetics*, Vol. 24, N. 7; pp. 1054-1060.
- [44] Tan, Bernard C. Y., Wei, Kwok-Kee, Watson, Richard T. and Walczuch, Rita M. (1998). "Reducing status effects with computer-mediated communication: evidence from two distinct national cultures", *Journal of Management Information Systems*, pp. 119-142.
- [45] Triandis, Harry C. (1982). [Review of *Culture's consequences*], *Human Organization*, Vol. 41; pp. 86-90.
- [46] Tse, Davis K., Lee, Kam-hon, Vertinsky, Ilan and Wehrung, Donald (1988). "Does culture matter? A cross-cultural study of executives' choice, decisiveness, and risk adjustment in international marketing", *Journal of Marketing*, Vol. 52, (October), pp. 81-95.
- [47] Turoff, Murray and Hiltz, Starr Roxanne (1982). "Computer support for group versus individual decisions", *IEEE Transactions on Communications*, Vol. 30, N. 1; pp. 82-91.
- [48] Tylor, Sir Edward Burnett (1871), *Primitive culture: Researches into the development of mythology, philosophy, religion, language, art and custom*. London; J. Murray.
- [49] Valacich, J.S., Mennecke, B.E., Wachter, R.M., and Wheeler, B.C., 1994. Extensions to Media Richness Theory: a test of task-media fit hypothesis. *Proceedings of the Twenty-Seventh Hawaii International Conference on Systems Sciences*, 4, 11-20.
- [50] Watson, Richard T., Ho, Teck Hua and Raman, K.S. (1994). "Culture: the fourth dimension of group support systems", *Communications of the ACM*, Vol. 37, N. 10 (October); pp. 45-55.

Figure 1: Conceptual Model

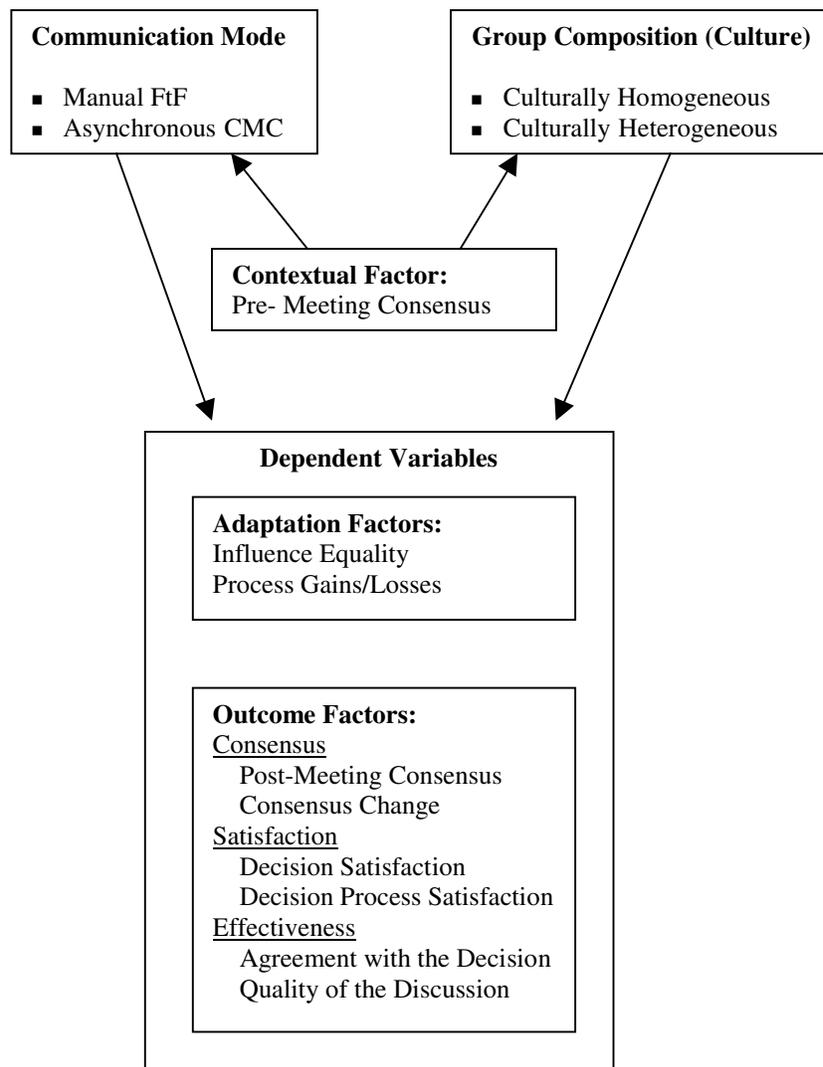


Figure 2: Experimental Design

Subjects and Groups by Treatment Condition

	Manual F-t-F		Asynch. CMC		Totals	
	Sbjcts.	Grps.	Sbjcts	Grps.	Sbjcts.	Grps.
Cult. Homog.	60	10	56	10	116	20
Cult. Heterog.	90	15	62	11	152	26
Totals	150	25	118	21	268	46

Figure 3: Examples of Culturally Heterogeneous Groups

Condition (Group #)	Subj. #1	Subj. #2	Subj. #3	Subj. #4	Subj. #5	Subj. #6
FtF (1)	India (f)	U.S. (m)	Japan (f)	Dom. Rep. (m)	Poland (m)	Taiwan (m)
FtF (3)	Brazil (m)	Ghana (f)	Jamaica (m)	India (f)	Egypt (m)	Hong Kong (m)
Asynch. (3)	S. Korea (m)	India (f)	Peru (m)	India (m)	Poland (f)	Philippines (f)
Asynch. (9)	Ghana (m)	Dom. Rep.(m)	China (m)	Pakistan (f)	Vietnam (f)	India (m)

f = female; m = male

Table 1: GLM Analysis of Influence Equality

	Means by Condition		
	Manual Face-to-Face	Asynchronous CMC	
Homogeneous (U.S.)	21.77	20.17	20.97
Heterogeneous (Mixed)	21.61	22.19	21.85
	21.67	21.23	
Model (CCG MC CCG*MC)	F = 0.364	p = 0.779	
Cultural Composition of the Group (CCG)	F = 0.381	p = 0.540	
Medium of Communication (MC)	F = 0.074	p = 0.787	
Interaction (CCG*MC)	F = 0.608	p = 0.440	

* = Significant at p < 0.1; ** = Significant at p < 0.05; *** = Significant at p < 0.01

Table 2: Analysis of Post-Meeting Consensus (Kruskal-Wallis Test)

Treatment Condition	Mean Rank	Chi-square	df	p-value
Manual Face-to-face (U.S.)	27.95	6.845	3	0.077*
Asynchronous CMC (U.S.)	15.95			
Manual Face-to-face (mixed)	28.17			
Asynchronous CMC (mixed)	19.95			

* = Significant at p < 0.1; ** = Significant at p < 0.05; *** = Significant at p < 0.01

Table 3: GLM Analysis of Consensus Change

	Means by Condition		
	Manual Face-to-Face	Asynchronous CMC	
Homogeneous (U.S.)	15.55	10.91	13.23
Heterogeneous (Mixed)	16.85	12.51	15.01
	16.32	11.74	
Model (CCG MC CCG*MC)	F = 5.639	p = 0.002	***
Cultural Composition of the Group (CCG)	F = 1.502	p = 0.227	
Medium of Communication (MC)	F = 14.583	p = 0.000	***
Interaction (CCG*MC)	F = 0.017	p = 0.898	

* = Significant at $p < 0.1$; ** = Significant at $p < 0.05$; *** = Significant at $p < 0.01$

Figure 1: Conceptual Model

