

# Small group decision-making in face-to-face and computer-mediated environments: the role of personality

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**Abstract.** This study investigates the potential influence of personality dimensions on the behaviour and individual processes of small group decision-making in face-to-face and computer-mediated groups. A sample of 90 students was divided into 16 groups, with between four and seven students per group. The groups were randomly assigned to start with one of two different discussion media and one of two different leaderless group discussion problems. Measures of leadership, initiative, judgement, and interpersonal sensitivity were obtained for each subject from two raters working independently using video-tapes of the face-to-face sessions and the logged interactions of the computer-mediated sessions. Further, 'satisfaction with the process' and 'satisfaction with the outcome' were assessed using a Likert-type scale. Personality was measured using the Myers Briggs Type Inventory (MBTI®). Using correlations and repeated measures ANOVAs across the outcome dimensions and the psychological type scores, the findings of this research suggest that personality plays a minor role in differentiating between the media conditions.

## 1. Introduction

Advances in communication technology have provided organisations with new forms of computer-mediated communication that enable groups to operate at great distances. However, computer-mediated communication poses new challenges for interpersonal communication and decision-making. DeSanctis and Gallupe (1987) have noted that while group decision-making does not require members of the group to be located in the same physical location, it is necessary for them to be aware of one another and to perceive themselves as being part of the group making a decision. A combination of workplace democracy and a dynamic internationalised environment means that organisations

are increasingly relying on group decision-making to keep pace with changes and challenges of conducting business in a global economy. However, due to the lack of comprehensive theories and the number of confounding variables, the literature on the efficiency of face-to-face (FTF) group decision-making is, at best, equivocal (Davis and Toseland 1987). Davis and Toseland (1987) maintain that the efficacy of group decision-making can usually be ascertained by considering the balance between group process gains vs. group process losses.

### 1.1. Group decision-making: process gains and losses

Group process gains refer to the positive aspects of collaborating in a group. The literature (e.g. Hill 1982, Dennis and Valacich 1993, Nunamaker 1997) refers to a number of group process gains. Groups have been shown to provide synergy (i.e. a group participant being creatively stimulated by other group participants), the efficient exchange of information, offering different views on problems, providing (objective) evaluation feedback, having a greater range of alternatives, and learning effects (i.e. novices learning from experts within the same group). Despite these apparent benefits, numerous authors have suggested that groups are not always as effective as they could be. These authors (e.g. DeSanctis and Gallupe 1987, Dennis and Valacich 1993; Valacich *et al.* 1994, Weisband and Atwater 1999) suggest that there are a large number of group process losses that serve to negate the positive aspects of group interaction.

The common group processes losses cited in the literature include dominance (e.g. Hiltz *et al.* 1986),

where one group member dominates the group, and production blocking (e.g. Diehl and Stroebe 1991), which occurs in FTF groups where only one person is able to speak at a time, resulting in other ideas being forgotten, suppressed or not given enough time to be expressed. Evaluation apprehension refers to group participants being unwilling to participate and express ideas for fear of negative evaluations by other group participants (Diehl and Stroebe 1991) and social loafing occurs when individual members feel less inclined to exert effort in a group because they feel their efforts might be diluted (Barry and Stewart 1997). A final common group process loss is free-riding that occurs when a group participant feels that their contribution is dispensable (Diehle and Stroebe 1997). In such a case, the group participant goes along with the majority and makes little or no contribution to the process. Other group process losses commonly found in the literature include cognitive inertia (getting stuck in a particular pattern of thought), information overload (groups generating too many ideas to effectively synthesise), and excessive socialising (spending too much time devoted to social networking). Effective group decision-making is thought to occur when the process gains within a particular group outweigh the process losses.

### 1.2. Computer-mediated vs. face-to-face decision-making

Computer-mediated (CM) group decision support systems (GDSS) have been developed in response to some of the group process losses found in FTF groups. Such decision support systems allow team participants to express themselves simultaneously, allow all members an equal opportunity to express themselves, keep a record of each participant's contribution, and focus their attention on the decision task. Such GDSS have shown their effectiveness as research has shown that CM decision-making can be qualitatively equal to FTF decision-making (Adrianson and Hjelmquist 1999). However, Adrianson and Hjelmquist (1999) also note that allowing all participants to express themselves means that CM decision-making tends to take longer and it is harder to reach consensus. Two theories have been used consistently in the literature to explain the differences between CM and FTF communication: Short *et al.*'s (1976) social presence theory and Daft and Lengel's (1986) media richness theory.

The most obvious feature of CM communication is the lack of direct physical presence between the communicators. Social presence theory (Short *et al.* 1976) argues that communication media vary according to the degree of 'social presence' (i.e. the feeling that

communication exchanges are social, warm, personal and sensitive). It could be argued that the degree of social presence is determined by the number of channels available in the communication medium. Hiltz *et al.* (1986) regards CM communication as being extremely low on social presence, whereas FTF communication would be considered as very high on social presence. Ambiguities in the communicated message would be a direct result of a lack of social presence. The media richness theory (Daft and Lengel 1986) concentrates on the ability of the communication medium to accurately transmit the intended message. The 'rich' media are able to provide immediate feedback, multiple cues and language variety (Daft and Lengel 1986) whereas the 'poorer' media (such as CM communication) lack the ability to convey messages along multiple channels. There is a great deal of overlap between these two theories. An important difference though, is that the media richness theory proposes that the 'richness' of the medium should match the task's information processing requirements. Hence, while FTF might be a generally 'richer' medium, certain tasks might require a lower degree of richness to be performed.

In addition to these two theories that concentrate on the medium of communication, other differences that have been used to compare the CM and FTF media are verbal and nonverbal cues (e.g. eye contact, facial expressions, body language and intonation), structural differences in the discussion (e.g. the number of people making points simultaneously, and the ability to record comments and ideas), and the level of depersonalisation (e.g. anonymity and de-individuation).

The results of studies comparing FTF and CM media on the effectiveness of group decision-making have been fairly ambiguous. A number of studies claim that CM communication is superior to FTF (e.g. Hiltz *et al.* 1986, DeSanctis and Gallupe 1987), while an equal number of studies have found the opposite (e.g., Debrowsky *et al.* 1991, Boiney 1998), and the most common result is that there are no differences between the two media (e.g. Adrianson and Hjelmquist 1991, Straus and McGrath 1994). The group process losses and gains together with the levels of social presence and media richness have been used to explain the ambiguities in these results. In general, the results of the studies show that while CM communication may stimulate a higher level of participation, it is no better than FTF communication and at times worse for certain judgement tasks. CM groups also require substantially more time than FTF groups to complete the task. Due to the reduced social presence, Beals (1991) found that CM communication reduced levels of socio-emotional support, leading to higher levels of depersonalisation and de-individuation. On the other hand, Walther (1992) found that CM commu-

nication actually increased perceptions of immediacy and affection. The majority of studies do appear to indicate that group participants would be less satisfied with the communication process in CM as opposed to FTF (DeSanctis and Gallupe 1987).

### 1.3. Personality issues in group decision-making

The literature on group decision-making and decision-making through different media has noted a great deal of variability in the participation levels of different participants. Adrianson and Hjelmquist (1991) and Savicki *et al.* (1996) have investigated this individual variability by tentatively looking at factors such as gender, culture, motivation, computer experience and personality. While personality has often been implicated as one of the possible causes of variability between individuals in group decision-making situations, very few studies have systematically investigated this within the context of CM communication. Studies on personality dimensions and group decision-making in FTF situations have found that 'sociability' is positively related to overall performance, levels of 'affectivity' are associated with the overall emotional tone of the group (George 1990), and that 'type A' leaders are perceived to be more competent than 'type B' leaders (Strube *et al.* 1989). In addition, 'extraversion' has been shown to be positively correlated with levels of participation and with the increase in the number of verbal exchanges (Barry and Stewart 1997). Straus (1996) found a positive correlation between 'extraversion' and levels of group participation.

Only Adrianson and Hjelmquist (1991) and Straus (1996) have compared the potential role of personality in FTF and CM group processes. Adrianson and Hjelmquist (1991) used Eysenck's Personality Inventory and found no differences between the FTF and CM groups, while Straus (1996) found a positive correlation between extraversion and levels of participation in both communication media using a self-devised 8-question extraversion scale. One of the possible reasons for the lack of consistency with regard to research on the role of personality in group decision-making is the lack of uniformity in its measurement. The research reviewed briefly here utilises a number of different personality measures and dimensions, some measures without adequate reliability or validity. This study uses the MBTI<sup>®</sup>, one of the most widely used personality measures in organisations. The MBTI<sup>®</sup> operationalises Jungian personality types by assessing an individual's preferences on four pairs of psychological types (Introversion–Extraversion, Sensing–Intuition, Judging–Perceiving, Thinking–Feeling).

### 1.4. Research questions

Due to the paucity of previous research in this area (both the lack of literature on personality and small group decision-making and the lack of literature on the role of the communication medium in this regard) it is difficult to draw many cogent research hypotheses. This research should therefore be seen as exploratory, investigating the emergent relationships between personality (as measured by the MBTI<sup>®</sup>) and group process outcomes (leadership, initiative, judgement, interpersonal sensitivity), 'satisfaction with the outcome' and 'satisfaction with the process') to be discussed in the methodology section.

1.4.1. *Research Question 1:* What role does psychological type play in the individual's initiative, leadership, judgement and interpersonal sensitivity in small group decision-making and how does this differ across FTF and CM decision-making?

1.4.2. *Research Question 2:* What role does psychological type play in an individual's 'satisfaction with the decision-making process' and 'satisfaction with the decision-making outcome', and how does this differ across FTF and CM decision-making?

Having defined these rather broad exploratory research questions it is also worthwhile noting that literature on personality suggests three further research hypotheses that can be stated more specifically. The research on extraversion and group decision-making appears particularly pertinent. According to Myers (1993) extraverts prefer to participate actively in tasks, whereas introverts prefer quiet observation. Furthermore, extraverts prefer to communicate face-to-face whereas introverts prefer written communication. Extraverts are more likely to talk loudly and express their ideas. All of these characteristics would indicate that extraverts would be more likely to contribute to face-to-face group discussion than their introverted counterparts. In addition, the reduced social presence and media richness in the CM context would mean that extravert leaders would be less able to exert their influence when communicating via this medium.

1.4.3. *Research Hypothesis 1:* Individuals with an extravert preference will score higher on outcome measures (group process dimensions, 'satisfaction with the decision-making process' and 'satisfaction with the decision-making outcome') in the FTF condition than the individuals with an introvert preference. These influences would be reduced in the CM condition.

According to Walck (1997), intuitive individuals are more likely to recognise written problems than their

sensing counterparts. Since the CM condition in this study utilised written communication it is likely that individuals with a sensing preference would be at a disadvantage.

1.4.4. *Research Hypothesis 2*: Individuals with an intuitive performance will score higher than those individuals with a sensing preference on the judgement dimension and with 'satisfaction with the decision outcome' in the CM condition.

Finally, Myers (1993) suggests that individuals with a feeling preference would be able to show more interpersonal sensitivity. This effect is likely to be stronger in the FTF condition where they are able to use nonverbal and social context cues and weaker in the CM condition where these cues are absent.

1.4.5. *Research Hypothesis 3*: Individuals with a feeling preference will score higher on interpersonal sensitivity than those with a thinking preference, and that this effect would be stronger in the FTF condition than the CM condition.

## 2. Method

### 2.1. Subjects

The subjects used in this research were second year Human Resources Psychology students in the Department of Psychology at the University of the Witwatersrand. The final sample was 90 volunteer students out of a potential pool of 120 (75%). The sample consisted of 70 women and 20 men, which was reflective of the population registered for this course. In terms of race, the majority of the sample was Black (53%), followed by White (29%), then Indian (12%). Both Asian and coloured students were minimally represented in the sample. The mean age of the sample was 21.1 years, ranging from 19 to 36. Home language was divided into either English or others, as a large component of this research involved communicating in English. In this respect, the sample was evenly split between English (48%) and other (52%). While the home language of many of the subjects may not have been English, the medium of instruction at the university is English. All the students are expected to read, write and speak English at a reasonably high level of proficiency. The sample varied in terms of their computer experience scores, from experienced to novice on a composite computer experience scale (i.e. measuring length of computer use, frequency of computer use, type of computer use, etc.).

The 90 students were divided into 16 groups comprising four to seven students per group. Each group participated in two leaderless group discussions, one FTF and the other CM. The starting condition was randomly assigned. Each group dealt with a leaderless group discussion situation/context comprising four different scenarios. Two of these scenarios were dealt with in the FTF condition and the remaining two in the CM condition. The scenarios were also randomly assigned to the condition.

### 2.2. Materials and equipment

The CM scenario was conducted using TeamWave, a group decision support system. TeamWave is a well-developed GDSS, incorporating a wide variety of traditional support tools. Due to the nature of the sample as well as a lack of time, training in the use of these tools would not have been practical. As a result, TeamWave was used as a 'plain vanilla' system, incorporating only its capacity for plain text transfer allowing multiple group members to collaborate synchronously, same time, different place via instantaneous text transfer. Prior to using the system, time was taken to show each participant how the software was used. Each participant in the CM discussion was then taken to a separate office in the Psychology building and logged into the TeamWave program. In the CM condition, allocating each of the participants a nickname provided anonymity. It was decided to use the letters of the Greek alphabet as nicknames (e.g. alpha, beta, delta, gamma etc.) as these do not have any gender affiliations.

### 2.3. Design and procedure

Data gathering proceeded over 8 days across a 3 week period, with two groups being accommodated per day of data gathering. On a given day, the two groups were initially joined together for the purposes of briefing (including a short introduction to the TeamWave GDSS) and to fill out the biographical questionnaire and the Myers Briggs Type Indicator (MBTI®). Once the questionnaire and the MBTI® had been completed, the participants were divided into their respective groups. The one group then engaged in the FTF leaderless group discussion whilst the other group simultaneously began the CM condition. After completing their initial condition they swapped conditions. After each group completed their respective discussion they were required to fill out a post-discussion questionnaire assessing their satisfaction with the decisions

made as well as satisfaction with the process used (either FTF or CM).

The FTF discussions were captured on videotape so that they could be assessed and scored at a later stage. The CM discussions were captured and recorded by the TeamWave program and later printed out for analysis.

The leaderless group discussion (the situation/context and four scenarios) consisted of a non-assigned role group discussion provided by a prominent South African consulting company operating within the minerals and resources industry. One of the key business areas of this company is the sourcing and supplying of psychological assessments as well as managerial simulation instruments. The non-assigned role simulation selected was designed to be used for entry-level employees, hence making it applicable to the student sample used. The simulation instrument consisted of a description of the situation and four scenarios which needed decisions. Each group was required to undertake two of the four scenarios in the FTF condition and two in the CM condition, the scenarios being randomly assigned to each condition.

Participants were allotted 30 min in the FTF condition to discuss the problems and summarise their proposed solutions. In comparison to this they were allotted 40 min in the CM condition, in recognition of the increased time required to type and read as opposed to talk and listen. As it was necessary to observe the participants' behaviour and interaction in order to score the group processes validly and reliably, the extra time was provided to ensure that sufficient behaviour and interaction occurred for this purpose.

#### 2.4. Measures

The independent variables in this research consisted of personality typology as measured via the MBTI<sup>®</sup> as well as the two communication conditions (face-to-face and computer mediated).

2.4.1. *MBTI<sup>®</sup>*: Form G of the MBTI<sup>®</sup> was used for the reason that it remains the most widely used form in organisations at present. The aim of the MBTI<sup>®</sup> is to sort people according to their psychological preferences. The data obtained is therefore considered to be categorical rather than continuous, as it does not seek to measure how much of a personality trait someone has, or whether it is good or bad (Myers and McCaulley 1985). When an individual completes the MBTI<sup>®</sup> they receive a score, which is indicative of their preference on each of the four scales (Extraversion–Introversion (E–I), Sensing–Intuition (S–N), Thinking–Feeling (T–F) and Judging–Perceiving (J–P)). People with an extra-

verted preference have a desire to act on the environment to affirm its importance or to increase its effect. On the other hand, in an introvert, energy is drawn from the environment and focused inward to generate ideas and emotions (Myers 1993). A person with a judging preference is concerned with making decisions and seeking closure through purposeful behaviour while a perceiving person is spontaneous and adaptable, open to new events and changes (Myers 1993). People with a sensing preference wish to acquire experiences through the senses and focus on immediate experiences, facts and details. The intuitive person prefers to look at possibilities for the future and abstractions of the present (Myers 1993). The person with a thinking preference would like to link ideas and thoughts, creating logical connections and might come across as analytical and impersonal. Finally, the feeling person prefers to try and understand and support others through empathy and listening (Hirsch and Kummerow 1998).

These can then be combined to form one of 16 possible psychological types. Moreover, the individual receives a numerical value for each of the four preferences (e.g. E<sub>10</sub>) which indicates the strength of the preference. The MBTI<sup>®</sup> scores can be converted into continuous variables for use in research, particularly in the case of undertaking correlations. These conversions are performed by assigning the midpoint of a dimension as 100. The scores for E, S, T, J are then subtracted from 100 whilst the scores for I, N, F, P are added (Myers 1993).

The MBTI<sup>®</sup> is a remarkably popular instrument used in many organisations for its ease of application, good reliability and high validity (Carlyn 1977, Bayne 1995, Zeisset 1996). In terms of reliability, Harvey (1996) reports internal consistency measures of 0.84 and 0.86 and a score of 0.76 for temporal stability. Bayne (1995) reports the average reliability of the MBTI<sup>®</sup> to be over 0.80. With regards to its validity, Hammer (1996), reporting on a decade of research findings (1985–1996), concludes that the MBTI<sup>®</sup> has good convergent, discriminant and predictive validity with regards to: (1) best-fit type assessments; (2) scores on other personality inventories; (3) occupational preference choice; and (4) independent behavioural observation. Moreover he identifies strong support for the validity of the predicted four factor structure, strong construct validity supported by factor analysis and finally substantial convergent validity between the MBTI<sup>®</sup> and the Five-Factor model of personality assessment.

The dependent variables assessed in this research included four non-assigned role, leaderless group discussion dimensions of Leadership, Initiative, Judgment and Interpersonal Sensitivity. Satisfaction with the decision and satisfaction with the process were addi-

tional dependent variables. The four dimensions used in this research were chosen for a number of reasons. Firstly they clearly relate back to past research on decision-making groups across different communication conditions, and secondly, they were very easily adapted for use in both the FTF and the CM conditions.

**2.4.2. Leadership:** This dimension is a measure of emergent leadership. It involves an assessment of the utilisation of appropriate interpersonal styles and methods to guide individuals or groups towards task accomplishment (M.A.D. 1998). A subject scores positively on this dimension if they: switch from a collaborative to a more directive style should the group start running out of time; take control and steer the group in the desired action (e.g. summarising at appropriate times to keep the discussion on course; clarifying aims and objectives; raising group process issues such as the role of timekeeper or scribe; encouraging, motivating and enthusing the group). However, the person will score negatively on behaviours including: failure to provide focus and to steer the group when it is needed; propensity to dominate rather than lead group members.

**2.4.3. Initiative:** Initiative in this research is a subjective measure of the group member's propensity to participate in the discussion. It involves actively influencing the discussion rather than passively accepting it, originating action in the group, and acting on opportunities when they are seen (M.A.D. 1998). A person will score positively for behaviours such as leading the discussion with suggestions relating to how the group could tackle the task. On the other hand, behaviours that will elicit negative scores include low levels of participation and prolonged periods of silence, as well as making few recommendations.

**2.4.4. Judgement:** Judgement involves the ability to evaluate data and the course of action, and to reach logical decisions that will be beneficial to the organisation being simulated. This variable equates very closely to the focus of previous research on performance and decision-quality. Each scenario in the leaderless group discussion tasks came with model answers that could be used to assess the quality of solutions put forward by the participants.

**2.4.5. Interpersonal sensitivity:** This variable is very much in line with the focus on socio-emotional behaviours taken from the literature. It involves an awareness of other people in the group and the impact on them, and actions indicating a consideration of the feelings and needs of others in the

interaction. Behaviours that will score positively include: listening and taking account of others' point of view by acknowledging and or agreeing to what they say; showing recognition of the needs of others in the group (how they relate to each other); appreciating the need to build effective relationships with other group members; engendering a spirit of co-operation. Behaviours that are scored negatively include those that are in antithesis to these mentioned.

The measurement of these variables followed the classic assessment centre method of a leaderless group discussion. As this involves the subjective evaluation of an individual's behaviour, standard steps were taken to maximise reliability. Firstly the multiple assessor approach was adopted to minimise individual bias and to provide inter-rater reliability. Two assessors were used for this purpose, both trained and experienced in the assessment of leaderless group discussions. Secondly, the four group process dimensions were clarified and very clearly defined in order to ensure both assessors were scoring the same construct. Each assessor scored the subjects independently on a scale from one to seven for each of the process dimensions, with one being very bad, four being average and seven being excellent. After a score had been allocated the assessors collaborated to determine a final score for each dimension. In rare cases where consensus could not be achieved, the two scores were added together and divided by two to obtain an average. The inter-rater reliabilities for each of the dimensions in each of the conditions is given in table 1.

**2.4.6. Satisfaction variables:** It was decided that it was of importance to ascertain the extent to which the subjects were satisfied with the communication process used (i.e. FTF and CM), as well as the degree to which they were satisfied with the decisions made in the group discussions. Although these two questions did not constitute major aspects of the research rationale, it was nevertheless felt that they should be addressed due to the important moderating nature of their consequences. Unfortunately, no scales exist for measurement of either satisfaction with the process or the decisions made. It was therefore decided to assess them superficially with two single items: 'How satisfied were you with the decisions agreed upon?' and 'How satisfied were you with the process used (either FTF or CM)?' A scale of one to seven was used for these items, where one was completely unsatisfied and seven was completely satisfied.

Covariates taken into consideration included age, race, home language, sex, level of education and computer experience.

### 2.5. Data analysis

The purpose of this research was essentially two-fold. Firstly, and primarily, the purpose was to assess the role that psychological type played in the four group processes leadership, initiative, judgement and interpersonal sensitivity in small decision-making groups. Secondly, it was to assess group processes in decision-making groups, in comparison to previous research in the field.

In order to investigate these aims, this research made use firstly of correlational analysis utilising Pearson's product moment correlation coefficient to assess the relationships between the dependent and independent variables. Secondly, repeated-measures analysis of variance was used in order to determine if there were significant differences between the dependent measures both within and across the two communication media.

**2.5.1. Correlations:** Karl Pearson's product moment correlation coefficient ( $r$ ) was employed in order to assess the strength of the relationships between the independent variables (E-I, S-N, T-F, J-P) and the dependent variables (leadership, intuition, judgement, interpersonal sensitivity, satisfaction with the decision, satisfaction with the process). When conducting such correlational research with the MBTI<sup>®</sup>, it is necessary to convert all preferences to a single continuous score according to the formula discussed earlier.

**2.5.2. Repeated-measures analysis of variance:** This research made use of the repeated-measures analyses of variance due to the fact that it involved a matched sample being measured across two conditions. Initially, a repeated-measures analysis of variance was conducted to assess any differences between any of the dependent variables independently of the biographic information. Once this had been completed, a second repeated-measures analysis of variance was conducted, this time including all the biographical information (age, race, home language, gender, level of education, computer experience) as covariates. This

was undertaken in order to assess the extent to which the biographical details may have affected the relationships between the independent and dependent variables. The results of the covariate analysis were only reported if they altered the significances obtained from the independent analysis of variance. A repeated-measures analysis of variance runs the risk of a carry over effect, in which a subject may learn something in one condition that will influence them on the next. In order to alleviate this, this research made use of counter-balancing, which involves having half the subjects in a study undergo condition one followed by condition two, and the other half of the subjects undergo condition two followed by condition one.

### 3. Results

The frequencies of the psychological types in the sample are given in table 2, with the preferences being relatively evenly distributed across the four psychological type dichotomies. The results are organised according to the six dependent variable measures (e.g. the four group process behaviours and the two satisfaction scores).

Table 2. Frequencies of the MBTI<sup>®</sup> psychological types.

Preference	Frequency	% of sample
<b>E-I</b>		
Extraverted	49	54
Introverted	41	46
<b>S-N</b>		
Sensing	48	53
Intuition	42	47
<b>T-F</b>		
Thinking	58	64
Feeling	32	36
<b>J-P</b>		
Judging	56	62
Perceiving	34	38

Table 1. Inter-rater reliability.

FTF condition	Correlation coefficient (Spearman's)	Computer-mediated condition	Correlation coefficient (Spearman's)
Leadership	0.95	Leadership	0.91
Initiative	0.95	Initiative	0.92
Judgement	0.88	Judgement	0.87
Interpersonal sensitivity	0.80	Interpersonal sensitivity	0.73

### 3.1. Leadership

The only statistically significant relationship found in the correlations of the continuous scoring of the psychological type dimensions with leadership was found for the Thinking–Feeling dimension. The correlation was statistically significant in both the FTF ( $r = 0.21$ ,  $p < 0.05$ ) and the CM ( $r = 0.33$ ,  $p < 0.05$ ) conditions. This correlation demonstrates that as a subject's preference moves closer to the feeling pole, the leadership score tends to increase.

There were very few differences with respect to leadership in the repeated-measures ANOVA in table 3. Similarly to the correlations, the only statistically significant difference was found for the Thinking–Feeling dimension. An analysis of the means shows that those subjects with a feeling preference ( $M = 3.42$ ) scored significantly higher on leadership than those subjects with a thinking preference ( $M = 2.67$ ). The non-significance of the main effect of media and the interaction effect indicates that this difference is consistent across the FTF and CM conditions. The results of the repeated measures ANOVA with the leadership scores are shown in table 3.

### 3.2. Initiative

The only statistically significant relationship found in the correlations of the continuous scoring of the psychological type dimensions with initiative was also found for the Thinking–Feeling dimension. The correlation was statistically significant in both the FTF ( $r = 0.29$ ,  $p < 0.05$ ) and the CM ( $r = 0.26$ ,  $p < 0.05$ ) conditions. This correlation demonstrates that as a subject's preference moves closer to the feeling pole, the initiative score tends to increase.

Table 3. Repeated-measures ANOVA for leadership.

	F-Statistic	P-Value
Extraversion–Introversion (E–I)	0.48	0.49
Media	0.69	0.41
Media $\times$ E–I	0.43	0.51
Sensing–Intuition (S–N)	0.20	0.66
Media	0.73	0.40
Media $\times$ S–N	1.20	0.28
Thinking–Feeling (T–F)	5.81	0.02 *
Media	0.12	0.73
Media $\times$ T–F	1.97	0.16
Judging–Perceiving (J–P)	0.02	0.90
Media	0.19	0.67
Media $\times$ J–P	1.83	0.18

\* = Statistically significant at the  $p < 0.01$  level.

There were a number of significant differences with respect to initiative in the repeated-measures ANOVA in table 4. The most obvious result in these analyses is the significant main effect of media across all the psychological type dichotomies. An analysis of the means indicates that the initiative scores were significantly higher in the CM condition than the FTF condition, irrespective of psychological type. In addition, the results from table 4 also show a difference in the Thinking–Feeling dimension. An analysis of the means indicates that those subjects with a feeling preference ( $M = 5.13$ ) scored significantly higher on initiative than those subjects with a thinking preference ( $M = 4.13$ ). The lack of interaction effect shows that this difference is consistent across the media conditions.

### 3.3. Judgement

The only statistically significant relationship in the correlations of judgement with psychological type was for the sensing–intuition dimension. The correlation was statistically significant only in the FTF ( $r = 0.22$ ,  $p < 0.05$ ) condition. This correlation demonstrates that as a subject's preference moves closer to the intuition pole, the judgement score tends to increase.

Table 5 shows that similarly to initiative, there were statistically significant differences in judgement across the communication media for all the psychological type dimensions. An analysis of the means shows that the judgement scores are higher in the FTF condition than the CM condition. None of the main effects of psychological type or the interaction effects were statistically significant indicating that the differences in judgement across the two communication media are unrelated to psychological type.

### 3.4. Interpersonal sensitivity

Once again, only a single statistically significant relationship was found in the correlations of the continuous scoring of the psychological type dimension of interpersonal sensitivity, also for the Sensing–Intuition dimension. This correlation was statistically significant only in the FTF ( $r = 0.24$ ,  $p < 0.05$ ) condition, which demonstrates that as a subject's preference moves closer to the intuition pole, the interpersonal sensitivity score tends to increase.

As with leadership, the analysis of interpersonal sensitivity elicited very few statistically significant differences. The results from table 6 show that the only statistically significant result was in the Thinking–Feeling dimension. An analysis of the means show that

Table 4. Repeated-measures ANOVA for initiative.

	F-Statistic	P-Value
Extraversion–Introversion (E–I)	0.25	0.62
Media	18.90	0.00 *
Media × E–I	2.15	0.15
Sensing–Intuition (S–N)	2.02	0.16
Media	17.23	0.00 *
Media × S–N	0.14	0.71
Thinking–Feeling (T–F)	7.77	0.01 *
Media	16.20	0.00 *
Media × T–F	0.01	0.94
Judging–Perceiving (J–P)	0.01	0.92
Media	17.71	0.00 *
Media × J–P	0.35	0.56

\* = Statistically significant at the  $p < 0.01$  level.

Table 5. Repeated-measures ANOVA for judgement.

	F-Statistic	P-Value
Extraversion–Introversion (E–I)	0.00	0.98
Media	16.46	0.00 *
Media × E–I	0.56	0.46
Sensing–Intuition (S–N)	1.60	0.21
Media	17.51	0.00 *
Media × S–N	3.65	0.06
Thinking–Feeling (T–F)	2.41	0.12
Media	14.76	0.00 *
Media × T–F	0.00	0.96
Judging–Perceiving (J–P)	0.85	0.36
Media	12.73	0.00 *
Media × J–P	2.24	0.14

\* = Statistically significant at the  $p < 0.01$  level.

Table 6. Repeated-measures ANOVA for interpersonal sensitivity.

	F-Statistic	P-Value
Extraversion–Introversion (E–I)	0.30	0.59
Media	0.93	0.34
Media × E–I	0.01	0.94
Sensing–Intuition (S–N)	0.30	0.59
Media	0.66	0.39
Media × S–N	3.34	0.07
Thinking–Feeling (T–F)	8.09	0.01 *
Media	1.51	0.22
Media × T–F	1.10	0.30
Judging–Perceiving (J–P)	0.59	0.44
Media	1.15	0.29
Media × J–P	0.33	0.57

\* = Statistically significant at the  $p < 0.01$  level.

subjects with a feeling preference ( $M = 4.93$ ) display more interpersonal sensitivity than those displaying a thinking preference ( $M = 4.46$ ). The lack of significant differences in the main effect of media conditions and in the interaction effect shows that this difference is consistent across the two media conditions.

### 3.5. Satisfaction with the process

The correlations undertaken for the psychological type dimensions with respect to ‘satisfaction with the process’, indicated one significant relationship for that of Judging–Perceiving. The correlation was statistically significant only in the CM ( $r = -0.40$ ,  $p < 0.05$ ) condition. This correlation demonstrates that as a subject’s preference moves closer to the judging pole, the satisfaction with the process score tends to increase.

Similarly to both initiative and judgement, there was a significant media effect across all the psychological types as shown in table 7. From an analysis of the means this indicates that satisfaction with the process was higher in the FTF condition than in the CM condition across the psychological types. In addition, there was a statistically significant difference in the main effect of psychological type and the interaction effect in the Judging–Perceiving dimension. An analysis of the means is shown in table 8, where the arrows indicate a statistically significant difference between the means at the  $p < 0.01$  level.

From table 8 it is possible to determine that ‘satisfaction with the process’ does not differ between judging and perceiving subjects in the FTF condition, but does differ significantly in the CM condition, with judging subjects more satisfied than perceiving subjects. In addition, there is a significant difference across the media conditions for both the judging and the perceiving subjects.

Table 7. Repeated-measures ANOVA for satisfaction with the process.

	F-Statistic	P-Value
Extraversion–Introversion (E–I)	0.64	0.43
Media	35.64	0.00 *
Media × E–I	0.76	0.39
Sensing–Intuition (S–N)	0.10	0.76
Media	35.39	0.00 *
Media × S–N	0.19	0.66
Thinking–Feeling (T–F)	0.46	0.50
Media	37.20	0.00 *
Media × T–F	1.40	0.25
Judging–Perceiving (J–P)	6.90	0.01 *
Media	44.74	0.00 *
Media × J–P	6.83	0.01 *

\* = Statistically significant at the  $p < 0.01$  level.

### 3.6. Satisfaction with the decision outcome

A very similar result to that of 'satisfaction with the process' was found for 'satisfaction with the decision outcome' in terms of the correlations performed on the psychological type dimensions. Likewise the only statistically significant relationship found was for the Judging–Perceiving dimension. The correlation was statistically significant only in the CM ( $r = -0.33$ ,  $p < 0.05$ ) condition. This correlation demonstrates that as a subject's preference moves closer to the judging pole, the satisfaction with the decision outcome score tends to increase.

The results of the repeated measures ANOVA for 'satisfaction with the decision outcome' as shown in table 9, are virtually identical to the results for 'satisfaction with the process'. There was a significant media effect across all the psychological types for satisfaction with the decision outcome. From an analysis of the means this indicates that 'satisfaction with the decision outcome' was higher in the FTF condition than in the CM condition across the psychological types. Also, similarly to 'satisfaction with the process', there was a statistically significant difference in the main effect of psychological type and the interaction effect in the Judging–Perceiving dimension. An analysis of the means is given in table 10 where the arrows indicate a statistically significant difference between the means.

Table 8. Comparison of means across communication media in J–P dimension for satisfaction with the process.

	Face-to-Face		Computer mediated	
Judging	6.06	→	5.15	
Perceiving	6.07	→	4.00	↓

Table 9. Repeated-measures ANOVA for satisfaction with the decision outcome.

	F-Statistic	P-Value
Extraversion–Introversion (E–I)	0.66	0.42
Media	42.55	0.00 *
Media × E–I	0.14	0.71
Sensing–Intuition (S–N)	0.66	0.42
Media	42.18	0.00 *
Media × S–N	0.00	0.98
Thinking–Feeling (T–F)	0.31	0.58
Media	40.72	0.00 *
Media × T–F	0.35	0.56
Judging–Perceiving (J–P)	6.59	0.01 *
Media	50.18	0.00 *
Media × J–P	5.28	0.02*

\* = Statistically significant at the  $p < 0.01$  level.

The results from table 10 mirror those for 'satisfaction with the process'. The 'satisfaction with the decision outcome' does not differ between judging and perceiving subjects in the FTF condition, but does differ significantly in the CM condition. Again, subjects with a judging preference are more satisfied than those with a perceiving preference. In addition, there is a significant difference across the media conditions for both the judging and the perceiving subjects with greater satisfaction in the FTF condition.

What is also interesting is that none of the biographical variables entered as covariates (age, race, gender, home language, educational level and computer experience) altered the significance values, either by introducing new significant values, or rendering already significant values non-significant. This result was consistent across the six dependent variables suggesting that these biographical variables do not significantly alter the relationships.

## 4. Discussion

The discussion is organised in the same manner as the presentation of the results (e.g. for each of the six dependent variables). The first four subsections (subsections 4.1.–4.4.) consider research question 1 and the following two subsections (subsections 4.5. and 4.6.) consider research question 2.

### 4.1. Leadership

Considering the first dependent variable of leadership, from our results it would seem that this variable was not affected by the communication medium at all. This emerged as rather an interesting finding considering that it is contrary to the majority of other studies investigating similar variables under similar conditions (e.g. Watson *et al.* 1988, Dennis 1996), as well as that which the theory on the subject proposes (e.g. Kiesler *et al.* 1984). However, an explanation for this can be proposed. In the FTF scenario, the cumulative percentage of people scoring higher on leadership (5–7) was 27% whilst in the CM conditions it was only 17%. This

Table 10. Comparison of means across communication media in J–P dimension for satisfaction with the decision outcome.

	Face-to-Face		Computer Mediated	
Judging	6.07	→	5.23	
Perceiving	5.90	→	4.23	↓

indicates that there was a propensity for subjects to score higher on leadership in the FTF condition than the CM condition. However, there was also a propensity for certain subjects to score lower on leadership in the FTF condition than in the CM condition. For example 30% of the sample was rated low on leadership in the FTF condition, whilst only 20% were rated similarly in the CM condition. Therefore, although there was no difference between the two conditions in terms of overall leadership, it appears that this was due to an equalising effect in the CM condition and a normal distribution of leaders in the FTF condition.

What was interesting to note however, was the increase in leadership scores from the FTF condition to the CM condition for all the subjects (one would expect those subjects who were low on leadership in the FTF condition to remain low in the CM condition). There is, however, an explanation that could account for this. In the FTF condition, the majority of the subjects may have been content to passively follow the few leaders who emerged. In comparison to this, in the CM condition the general ability of leaders to emerge was restricted, which could have resulted in difficulties for the group to reach consensus. Therefore, as there was no more strong leadership to steer the group in the CM condition, it may have facilitated a greater attempt on behalf of the majority to try and steer the group towards a conclusion. In the CM condition, which is high in ambiguity, low in feedback and social presence, it is easy for confusion to reign. As a result, those who would have been content in the FTF condition would have become frustrated and acted, through leadership behaviours, to bring structure to the chaos. These explanations serve to account for the lack of difference between the means of leadership across the two communication mediums whilst still accounting for the theory.

The next finding of interest was that of the positive correlation between the T–F continuous variable across both communication conditions (also found in the repeated measures ANOVA), which could be accounted for in the way that the leadership variable was scored. In this research, participative/enabling styles of leadership received the most positive scores (those who led scored higher than those who dominated, which in turn scored higher than those with a passive approach). Such behaviour included facilitative behaviours such as steering the group by consensus and engaging others in how they felt regarding the various proposals. Therefore, it is unsurprising that those with a feeling preference scored higher. Feeling types regard human needs and values as important aspects of deciding (e.g. soliciting input from others), are empathetic and accepting, and seek involvement with others in meetings (Hirsh and Kummerow 1998). It is interesting to note

that research hypothesis 1 (extraverts scoring higher on leadership) was not supported for this dimension.

#### 4.2. Initiative

One of the greatest effects suggested by CM communication is an equalisation effect when it comes to participation across group members (Hiltz *et al.* 1986, Dubrovsky *et al.* 1991, Weisband 1992, Straus 1996). The results of this research support this contention. A second important finding was that for extraversion–introversion. Despite past interest that has been shown in this personality variable to explain effects, this research found no significant differences between E–I and initiative in either the FTF or the CM condition (thus, a failure to support research hypothesis 1). Although a similar result was found by Adrianson and Hjelmquist (1991), a contrary finding was obtained by Barry and Stewart, (1997), Thomas *et al.* (1996) and Straus (1996). Therefore, despite the great interest in this personality dimension, as well as the intuitive expectation that it should play a role in such a variable as initiative (participation), this was not substantiated in research using the MBTI<sup>®</sup>. An explanation for this finding could be that the MBTI<sup>®</sup> measures preferences rather than traits. Therefore even though an individual displays a preference for introversion, it does not preclude that person acting in an extraverted manner should it be necessary. By specifically placing the subject in a situation requiring extraverted behaviour (e.g. a leaderless group discussion), it may have merely facilitated their adoption of a primarily extraverted disposition for the duration of the exercise. Another likely explanation is that motivation to participate (which was not measured in this research) plays a stronger role than personality variables such as extraversion–introversion.

A curious result that arose with respect to this variable was that of the significance of the T–F scale, in which the initiative scores of the feeling types were higher than those with a thinking preference. Although the reason for this is not immediately apparent from the theory, in that this scale should not necessarily affect the *degree* to which the subjects engage in a group meeting. Whereas it should affect the *manner* (i.e. leadership) of participation it is not clear why it should affect levels (amount) of participation. It may just be that the amount and type of communication that a person performs in a group is related to the probability of that person being perceived as the leader, such that the close relationship between leadership and this variable resulted in the occurrence of these findings.

### 4.3. Judgement

The results with respect to the judgement variable appear to mirror exactly what would be expected from an analysis of the literature. The first result worth mentioning is that, like initiative, the judgement in the CM condition was lower than that in the FTF condition. This was entirely to be expected considering the nature of the task being completed was essentially a judgement task requiring coordination and timing amongst group member activities, as well as consensus on the issues at hand (Straus and McGrath 1994). Such tasks do not necessarily have a correct answer. Instead the group confers on a number of issues in order to reach consensus on preferred alternatives. As a result, they require a large degree of coordination and timing amongst members' activities in order to achieve this consensus. In this research, in the CM condition, the subjects had difficulty keeping up with what was going on as well as following what was going on. Therefore, to reduce the cognitive load, a strategy of limiting the number of issues put on the table for discussion was adopted. It was apparent that this lack of coordination impeded the subjects' ability to consider a wide range of potential solutions and to look at the issues objectively from different sides in the CM condition, thereby negatively affecting the judgement score, an aspect that coincides with past research (Dubrovsky *et al.* 1991). This situation appeared to be exacerbated by time constraints, such that had there been unlimited time to hash out the various issues, it is possible that the judgement scores would have been the same across communication conditions. Therefore one cannot say with any degree of certainty whether CM communication is less suited for judgement tasks than FTF communication.

Looking at the role played by psychological type in these proceedings, the significant correlation of S–N in the FTF condition was to be expected based on MBTI<sup>®</sup> literature and provides partial support for research hypothesis 2 (since this difference was not statistically significant across the communication media). When a person prefers sensing, they are interested in the actuality around them and they have little time to spare for ideas coming faintly from nowhere (Van Rooyen *et al.* 1999). Therefore it makes sense that someone preferring intuition is likely to score higher than sensing types on a judgement task in a situation such as a leaderless group discussion, as they are more likely to make intuitive leaps, consider the bigger picture, and come up with novel solutions (Myers 1993). In addition to being congruent with what is expected from the literature on the MBTI<sup>®</sup>, this result is in line with past research on this area, which also found intuitive subjects

were more likely to recognise problems in written case studies (such as this research) than their sensing counterparts (Walck 1997). Although this relationship was not shown in the CM condition, this is most likely due to the performance ceiling created by the time constraints. There was no support for research hypothesis 1 for the judgement dimension.

### 4.4. Interpersonal sensitivity

The results obtained for this variable were rather mixed but, with one exception, generally consistent with what one would expect from the literature. Looking at the media effect of the repeated-measures analysis of variance, one can see that it is not significant for any of the MBTI<sup>®</sup> scales. Thus, it is safe to assume in this research, that there was no difference in interpersonal sensitivity across the two communication media and therefore provides no support for research hypotheses 1 or 3. At a first glance this seems to contradict the literature on this subject, as CM communication, with its paucity of social cues, narrow bandwidth and lack of non-verbal behaviour should be less suited to transmitting socio-emotional information, and hence would be regarded as more impersonal and mainly suited for transmitting task-related information (Lea 1991). Part of the answer to this lies in the way in which the dependent variables in this research were measured—by scoring specific, observable behaviours, indicative of the dimensions of interest. Therefore, in the FTF condition a large number of the observed and hence scored interpersonal sensitivity behaviours were likely to consist of non-verbal/social actions, whereas in the CM condition these did not exist. This does not necessarily negate the need for such regulatory behaviour nor does it preclude attempts to give it. It merely alters the manner in which such behaviour may be conducted, as well its effectiveness. Quite obviously, the only way in which this behaviour *can* be conducted in the CM condition is through written, verbal behaviour, and this is what occurred. For example, where nodding or shrugging was sufficient for transmitting intent in the FTF condition, subjects in the CM condition attempted to compensate with frequent comments such as 'How does everyone feel about...?', 'Is everyone happy with what I've been saying' etc.

Therefore although the nature of the behaviours changed from being non-verbal and verbal to *only* verbal, they were still observable, and indicative of interpersonal sensitivity. Thus, interpersonal sensitivity was scored equally across communication conditions. What needs to be done in the future is to differentiate between observed behaviours and the potential impact

of these behaviours. Although in this research there was no difference in observed interpersonal sensitivity behaviour across communication conditions, it is entirely possible that verbal interpersonal/socio-emotional behaviours are less effective than verbal and non-verbal behaviours combined.

In terms of the role that psychological type played, there were two findings of interest; one seems to defy explanation whilst the other was expected. The former consists of the positive correlation found between the S–N continuous variable and interpersonal sensitivity. The way in which a person perceives information (either by focussing on the facts or by summarising possibilities) has an influence on interpersonal sensitivity. This does not lend itself to an easy explanation. Other than it being a statistical artefact of the sample, or an artefact of the task, the literature is unable to elucidate this finding. The second finding relating to the role psychological type plays with respect to interpersonal sensitivity was the significant T–F finding in the test of between-subject effects in the repeated-measures analysis of variance. This was entirely expected and explained via the fact that those displaying a feeling preference tended to work in harmony with others, concentrating on the task and enjoyed meeting peoples' needs even in small matters (Hirsh and Kummerow 1998). They tended to be sympathetic and avoided criticising people, were personable and tended to favour agreement, were interpersonally appreciative and accepting, and in meetings sought involvement with people first before the task (Hirsh and Kummerow 1998). In contrast to this, thinking types are happy to work without harmony, focusing instead on the task at hand. They are known to upset people inadvertently by overlooking emotions.

#### 4.5. *Satisfaction with the process*

The majority of the research on this subject indicates that group members will be less satisfied with the communication process in CM as opposed to FTF decision-making. Furthermore, this dissatisfaction was purported to be greater when the task is a judgement task, which requires high coordination in the reaching of consensus (Daly 1993). However, the research findings on this topic were not unanimous, with some finding satisfaction with the CM process to be as high (and at times higher) as satisfaction with the FTF process (Straus and McGrath 1994). Archer (1990) investigated the causes of these differences in findings, and after maximising group homogeneity in terms of skill, experience, education and task, concluded that some other factor was the cause of variation in member

satisfaction with the process. One such proposed factor was individual characteristics such as extraversion-introversion and cognitive style. The findings of this research are able to shed some light on this proposition.

First of all, in this research, as with many others, the 'satisfaction with process' was found to increase in the FTF condition in comparison to the CM one. It is however interesting to note that E–I had no effect on 'satisfaction with the process' whatsoever (therefore refuting research hypothesis 1), while there was a significant interaction effect for the J–P scale. It would appear that in the FTF condition, there is no difference between the judging and perceiving preference in terms of their satisfaction with the communication process. However, in the CM condition, although both the judging and the perceiving preferences decrease in relation to the FTF score, the decrease experienced by the perceiving preference is far greater, resulting in a significant difference between judging and perceiving in the CM condition.

This result is easily interpreted when taken in the context of the available literature on the MBTI®. Judging types tend to be far more focused on decision-making over information getting in meetings, they concentrate on task completion and tend to approach the world seeking closure, bringing issues to order and to a resolution (Myers 1993). Perceiving types however, enjoy the gathering of information more than deciding and doing, want to hear about options and opportunities and, most importantly, in meetings concentrate on the process being used rather than the task completion (Myers 1993, Hirsh and Kummerow 1998). It is clear therefore that the CM condition inhibits this information/process oriented frame of mind from which perceiving types operate. Judging types, although most likely finding the CM process frustrating, were still able to operate from their decision-making frame of mind. They were able to focus on a few solutions and appeared to filter the amount of presented information in the CM condition.

#### 4.6. *Satisfaction with the decision outcome*

It appears that the results found for satisfaction with the communication process are mirrored for 'satisfaction with the decision outcome'. The repeated-measures analysis of variance indicates that satisfaction with the decision decreases in the CM condition in comparison to the FTF condition. Moreover the significant interaction effect for the J–P dimension indicates that the decreased experienced by perceiving types is far greater than that experienced by judging types. According to the literature, satisfaction with the decision in the CM commu-

nication condition can be affected in two ways. Firstly, it can increase due to increased participation levels and group members feeling they had contributed. Secondly it can decrease as a result of a frustrating experience with the process (Hiltz *et al.* 1986). It is entirely possible in this research that the cause of the decrease in 'satisfaction with the decision outcome' is directly related to the negative views held regarding the CM process. This would also account for the fact that the relationship displayed by the J–P dimension for 'satisfaction with the decision outcome' is identical to that displayed for 'satisfaction with the process'. Therefore, it appears in this research that subjects' satisfaction with the group's decisions were adversely affected by their experiences of the CM communication medium, and that psychological type, with respect to J–P, plays a significant role across communication media. The results of this study fail to provide support for research hypothesis 1 and 2 for the 'satisfaction with the decision outcome' dimension.

## 5. Limitations and conclusions

One of the limitations of this type of research is the use of the ubiquitous student sample, and not a real-life working sample and task. These groups would have had a rather unusual motivation to participate (in comparison to real working groups) and this might have had a systematic influence on their behaviour. Additionally, the methods used to assess the four group process variables were different for the CM (written transcripts) and FTF (video-taped behaviours) conditions. The danger with this is that differences between the two conditions might be an artefact of the measurement methods. One must also remember that this study looked at personality from the perspective of one personality measure, the MBTI<sup>®</sup>. While this instrument has been used extensively in research and in industry (e.g. Hammer 1996) it is still possible that different personality instruments might support different conclusions (a problem that hampers much research that includes personality dimensions as variables under investigation).

Over recent years an incredible amount of literature has been devoted to investigating the advantages, disadvantages and relative differences between face-to-face and computer-mediated communication. This study undertook to add to this wealth of knowledge by looking to clarify the role of personality, as measured by the MBTI<sup>®</sup>, in these proceedings. Throughout the literature, obscure references are frequently made to 'individual characteristics' and 'personality' as inherent causes of the differences in many variables across alternative communication conditions. More often than

not specific references have been made to the potential role of extraversion and introversion as the case for many of these differences. Obviously this has in the past been proposed in order to try and explain to some extent why these differences occur. However relatively few empirical studies have sought to investigate the actual role of these personality factors.

The results of this research indicate that the role of personality, as measured by the MBTI<sup>®</sup>, across communication media, for the four variables of leadership, initiative, judgement and interpersonal sensitivity, is small and possibly due to measurement artefacts. While we have attempted to provide explanations for these rather interesting findings, the implications of this are that personality may not significantly influence decision-making across the communication media. Although a number of personality effects were displayed, these were largely consistent across both communication conditions and therefore were not related to the communication medium *per se*, but rather to the task at hand. Quite importantly the much-vaunted role of extraversion did not materialise in any way in this research (research hypothesis 1). One can therefore conclude that, for the primary dependent variables considered in this research, some other factor plays a stronger role than that of personality in determining the many differences found between face-to-face and computer-mediated small group decision-making. Psychological type therefore remains a variable of interest in group research in general, but should be regarded sceptically in terms of its ability to interact with leadership, initiative, judgement and interpersonal sensitivity across different communication media.

This was not so for the secondary dependent variables of satisfaction assessed in this research. It was quite apparent that the MBTI<sup>®</sup> preferences of J–P interact significantly with communication medium with respect to 'satisfaction with the process' and most likely by proxy with 'satisfaction with the decision outcome'. This emerged as a new finding in the human–computer interaction field, and one that we hope will be confirmed through later research. It is of interest as it adds insight into the individual characteristics that have been implicated as a cause of satisfaction with computer-mediated decision-making. Moreover this finding will hopefully serve as an impetus to move away from the intuitive scrutiny of extraversion, to a realisation that other personality variables are likely to have interesting effects. Extraversion has up until now been a panacea for many potentially unexplained results found in previous studies, however research empirically testing this supposition has been minimal, something that this research has successfully addressed.

Finally, this research contributes to the theory by indicating that alluring as the concept of personality may be for many researchers, its role is not as great as many might think, and perhaps it is time to start looking for other answers in these respects rather than blindly turning, without empirical analysis, to the role of personality for explanations. If we combine this finding with the findings on the non-significant influence of the biographical covariates it would suggest that we need to look further than personality and individual differences to explain the contradictory results. It may prove more fruitful to follow the advice of Daft and Lengel (1986) and look for aspects of the task that might explain differences in decision-making performance.

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