VOTING BEFORE DISCUSSING: ELECTRONIC VOTING AS SOCIAL INTERACTION[1]

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Abstract. *A field study is presented which used voting before discussing (VBD) as a means of social influence and communication in a computer supported group interaction, rather than using voting as the final stage in a rational decision-making process. The approach used is based on a cognitive, three-process model of group interaction, which proposes that group cohesion and agreement arise primarily from normative rather than informational or personal influence. It was found from this initial investigation that the VBD technique can result in higher agreement of group members with the decisions of the group, higher satisfaction with the computer-mediated interaction, higher satisfaction with group performance, and higher group awareness. The voting before discussion method may be useful in situations where agreement is an important group output, or where interpersonal conflict is creating problems in meetings.*

Keywords: Agreement, cognitive, CSCW, conflict, group interaction, GDSS, normative influence, CMC, social influence, voting.

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1 Introduction

Voting before discussing (VBD) is a proposed method of computer support for group interaction where electronic voting is used as a pre-discussion social interaction tool, rather than a post-discussion decision making tool. The VBD method uses computer-supported normative influence to establish a cohesive social environment before embarking on the risks of face-to-face discussion. The two major differences from traditional group support voting use are *when* voting occurs (before discussion rather than after), and *why* voting occurs (to support agreement rather than support decision making). The aim of this research was not to compare computer supported with non-computer supported meetings, but to explore whether voting before discussing was feasible for a realistic organizational problem, and explore the potential advantages and problems of the approach. This approach is novel, as media-lean computers are traditionally seen as deficient in social functions like building agreement and consensus (Adrianson & Hjelmquist, 1991; Fjermestad & Hiltz, 1999; McGrath & Hollingshead, 1991; McLeod, 1992).

There are significant group benefits to socially generated agreement. Making a wrong task decision may be the most temporary problem people face in interacting groups. Since many real life problems cannot be solved by reason alone (Daft et.al., 1987), even the most rational person can expect "mistakes" every day. Most of these are reparable. But to lose a friend (or make an enemy) is more serious, as relationships usually continue over many tasks. A single enemy can affect everything a person does. Even worse is the disintegration of an important social group, like a religious, cultural or work group, as such groups usually persist as members come and go. Relationships and groups are contextual to task activity. Agreement seems more fundamental than task correctness, as groups must first agree on a position, before that position can succeed or fail. A group that cannot agree cannot even act, so task success is irrelevant. A group that makes task errors is in many ways a normal group, but a democratic group that cannot agree can fall apart, so that it is not a group at all.

The theoretical base of the VBD method is a cognitive three process (C3P) model, which suggests that for people interacting in groups, task information exchange usually occurs within a context of interpersonal relationships, and both in turn usually occur within a context of a unified group identity (Whitworth, et al., 2000). The cognitive processes used to resolve task information, build interpersonal relationships and develop group unity are fundamentally different, because each presents a different type of problem. Any group discussion, while on the surface involving only the risk of task information errors of analysis, also risks negative outcomes at the social contextual levels. For example personality clashes between individuals may lead to open conflict between individuals, which may then cause the task analysis to fail. Or if the group fails to agree it may split into two opposing factions. The C3P model proposes that computer support for all three underlying processes is important, however supports one process may hinder another. For example while increasing task information exchange improves decision quality (by increasing the group's domain of information), it also reduces member confidence and group unity (Sniezek et.al., 1990).

For groups, successful online interaction involves more than factual information exchange and the rational analysis of task information. Contextual relational and group unity

issues must also be supported. Rather than using computers to exclude social influence, the VBD method seeks to use computers to support the normal social function of normative influence. This approach can reduce interpersonal conflict and enhance unity, and is indicated where agreement is an ongoing problem with group interaction.

Normative decision making, which aims to maintain group unity, is simple and fast, as it avoids:

- Time wasted discussing proposals everyone already agrees on.
- Time wasted arguing weak proposals with little chance of group acceptance.
- Early disagreement souring personal relations, causing the meeting to bog down in personality conflicts.
- Members, unaware of the degree of opposition, fail to present a minority position effectively.

In the case presented, computer support gave anonymity and avoided time-consuming, and potentially disruptive, manual methods of collecting "straw" votes. The following sections introduce the theoretical basis behind this new approach, report on the field application, and then discuss implications and future directions.

2 Theoretical foundations

2.1 Rational task analysis

Face-to-face discussion is a complex interaction which computer software has often tried to support and improve upon (Nunamaker, et al., 1997). A common theoretical base for these computer tools are the steps of rational decision making, articulated by Simon (1957):

- *Intelligence*. A period of idea generation when the problem is defined and relevant ideas and information are brought out in the open.
- *Design*. A period of analysis, where alternatives are identified and arguments presented.
- *Choice*. The final stage where one or more decisions are made, with the intention to implement them.

Other steps have been added both before (problem awareness and problem definition) and after (implementation and feedback), but the central three steps have not changed in over 40 years (Briggs & Nunamaker, 1994). This linear, rational decision method, summarized in Figure 1, implies that typical group discussions should begin with an initial "brainstorming" period of information exchange (intelligence), followed by presentation of arguments regarding alternatives (design), leading finally a decision making phase (choice), perhaps involving an explicit formal vote. Anything else is considered a deviation from the "best" procedure resulting in poorer quality decisions (e.g. by immediately searching for alternative solutions, or calling a final vote too soon, (Hackman & Kaplan, 1974; Hirokawa, 1983). The surfacing and resolution of conflict is considered a natural and necessary part of the procedure (McGrath, 1990; Sambamurthy & Chin, 1994).

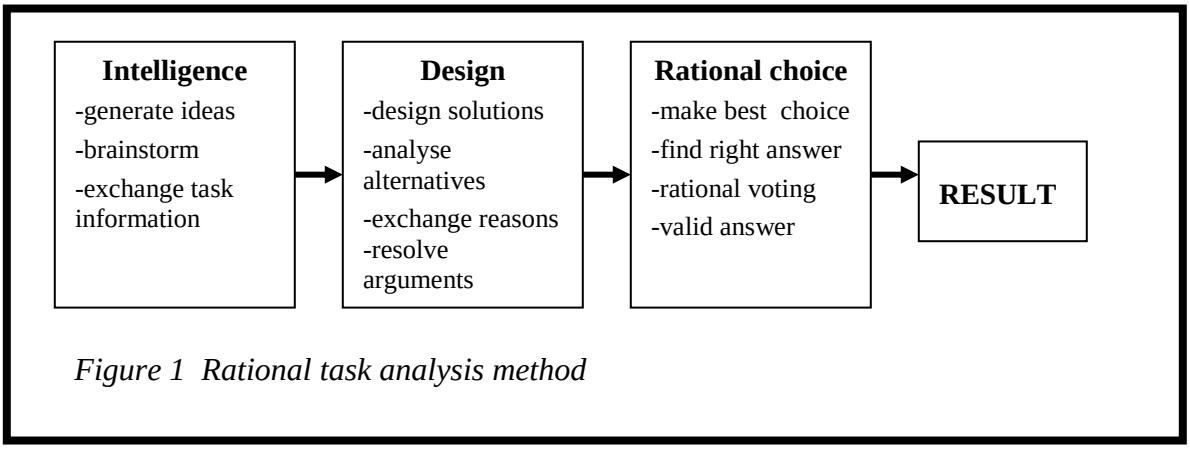

Figure 1 Rational task analysis method

These ideas have strongly influenced groupware design, beginning with DeSanctis and Gallupe's foundation paper on group decision support systems, which defined a decision making group as ". . . two or more people who are jointly responsible for detecting a problem, elaborating on the nature of the problem, generating possible solutions, evaluating potential solutions, or formulating strategies for implementing solutions." (DeSanctis & Gallupe, 1987, p 590). The Software Aided Meeting Management (SAMM) agenda implied a corresponding rational process (define problem and criteria, discussion, define alternatives, rate/rank/vote on alternatives, and define decision) (Watson et. al., 1988). Group Systems software has equivalent tools for idea generation, idea organization and prioritizing (voting) (Nunamaker et al., 1997, Valacich et.al., 1992). In summary, traditional groupware is essentially a computer implementation of a process of rational decision making which assumes groups resolve problems by rational analysis of "facts", or if they don't, it is desirable that they should.

The limitations of this traditional "systems rationalist" paradigm, which pervades the theory and design of groupware, have been pointed out elsewhere (Lea & Spears, 1991). The criticism is not that the approach is incorrect, but that it is insufficient, because it ignores necessary social influences on group decision making: "Most efforts have focused on the relatively narrow, rational view of the decision process …" (Kraemer & King, 1988). The assumption questioned is that analyzing the given task is the only problem task groups face. The suggestion is that social processes are being ignored, and the gap between social requirements and technical capabilities, the social-technical gap, is a serious deficiency in groupware today (Ackerman, 2000).

2.2 The C3P model

A recently proposed cognitive three-process (C3P) model suggests that groups have two other problems, in addition to task information analysis, namely inter-personal relationships and group unity (Whitworth, et al., 2000). Interacting group members must all at once:

- *Resolve task information:* Involving informational influence based on factual information exchange.

- *Relate to others:* Involving personal influence, based on the reciprocal exchange of sender state information.
- *Represent the group identity:* Involving normative influence, based on many-to-many exchange of position information from the group and to the group.

Each purpose has different requirements, and hence evokes a distinct internal psychological process. These processes (or purposes) overlap as the resolution of task information, the building of interpersonal relationships, and the development of a unified group identity *must manifest through the same set of communicative acts*. For example an individual could respond positively to a suggestion because it was a good idea in itself, *and/or* because they liked the person making it, *and/or* because it is the norm. Such overlap is not new to group research. After Bales (Bales, 1950) distinguished socio-emotional from task information communication, it became apparent that a single message could include both types of information at once (McGrath, 1984). One level could even contradict the other (as for example saying "I AM NOT UPSET" in an upset voice). The C3P model proposes that Bale's "socio-emotional" category is further divided into personal/emotional information, and impersonal group level normative information. In a recent CMC study, Reid et. al. (1996, p 1034) conclude that "…it is essential to differentiate acts that function to regulate conversation…or express fleeting emotional states…from those linked to group formation and cohesiveness ..."

The C3P model suggests that group communications have three meaning levels: the literal message content, the sender state context, and group position information. Interpretive analysis also verifies the existence of these three types of information in groupware interaction, namely information about the topic in question, information about subject's emotional states, and information about subject's behaviors or intended behaviors (Trauth and Jessup, 2000). Recent evidence from channel expansion theory also supports the view that there are three distinct underlying psychological processes in human interaction. In addition to learning about the computer medium itself, communication experience can be partitioned into experience with the message content, with the message sender, and with the organizational context and norms, corresponding to the three processes above (Carlson & Zmud, 1999).

The key prediction of the C3P model for this study is that social decision making can occur without informational or interpersonal influence (Baron et.al., 1992; Laughlin et.al., 1995).

2.3 Normative influence

The normative process is illustrated by the actions of natural social groups, like a herd or flock, where each group member attends the movement choices (or positions) of others, and adapts its behavior to stay with the group body. Without some cohesive process, such groups would soon drift apart, as individual members were attracted in different directions. Clearly the cohesive process in animal groups is not a rational one (i.e. not based on argument or reason). Nor is it attributable to personal relationships between individuals, as for very large groups of many hundreds, such as the buffaloes of the plains, there are too many individuals for this to be a factor. Since in comparative psychology terms, human beings are group or social animals, one can expect the same process still remains in us. It seems of less relevance

today, as we no longer roam the savannahs, but we do roam in intellectual "worlds", and given people can hold intellectual "positions", a normative process can be proposed to occur in group discussion. An intellectual position is a subject's intellectual choice with respect to the space of available choices, just as a subject's physical position is their behavioral choice in physical space. Lewin's idea of "valence" as the acceptability of a solution option expresses the same concept (Lewin, 1935). For example the statement "We may need the corkscrew" gives the information that the corkscrew may be needed, but also implies the speaker would choose to take the corkscrew rather than leave it.

The model predicts that a subject's anonymous agree or disagree position (or valence) will alone be effective in generating agreement (though not necessarily the best task response!). The historical argument between *persuasive arguments theory* (Vinokur & Burnstein, 1974), supporting informational influence, and *social comparison theory* (Sanders & Baron, 1977), supporting normative influence, can be resolved by accepting both as overlapping cognitive processes. If the goal is agreement rather than task correctness, normative influence seems most effective. Computer-mediated studies have shown that the exchange of anonymous positions without arguments can be just as effective in generating agreement as the exchange of positions with arguments (Postmes, 1997; Sia et.al., 1996; Whitworth, 2001). We propose a social normative process, as shown in Figure 2, which operates to maintain group unity.

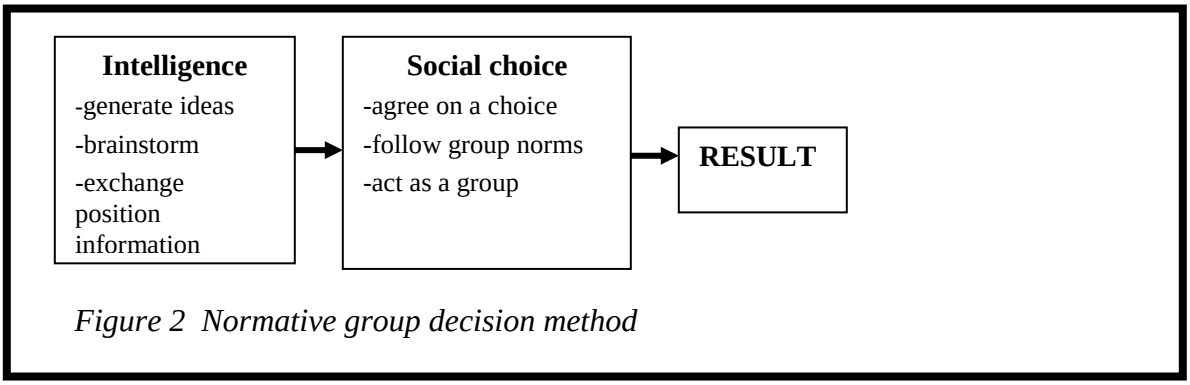

Figure 2 Normative group decision method

Normative influence is proposed to be the primary process keeping social groups together, and to be both impersonal and non-rational (in the sense of not based on argument). It is proposed to require the exchange of group position information only, without reasons or knowledge of personal identity. That normative influence can generate agreement apart from informational influence is not to deny the effects of persuasive arguments. Nor does the influence of anonymous voting deny the importance of relationships. The C3P model sees all three processes as important, and allows them to operate in parallel, though each has a different purpose and nature.

2.4 Voting as normative influence

An anonymous vote can be seen as the pure expression of a position, representing a person's behavioral choice, without any attached task argument or sender state information. Group voting can thus be seen as *the efficient exchange of group member position information*. Voting has been described as a highly condensed form of human communication

(Hiltz & Turoff, 1985). It is many-to-many, rather than person-to-person, interaction, being from all group members to all group members. Computer-mediated interaction allows the normative process, and its effects, to be distinguished from the influence of both task and personal information exchange processes, because if no task information is available, it can't be analyzed, and if messages are anonymous, this excludes personal influence.

By contrast, in a face-to-face discussion normative influence is easily "covered", as it were, by the more obvious task information exchange and argument occurring. If the multi-level nature of communication is recognized, it is clear that people in a group discussion are also informally "voting", or exchanging position information by their comments.

Normative influence is hidden because it may operate *at the same time as* rational and personal interaction processes. Member position information can be conveyed by paralinguistic signals, such as sounds, facial expressions or body language. Body language responses to a statement may amount to an informal instant vote on its acceptability by the group. A normative interpretation of group interaction fits well with what natural groups do, which is to immediately generate final solutions (or positions) without rationally considering all the alternatives (Hirokawa, 1983). There is also evidence that once the group "valence' for a given option reaches a certain threshold, members perceive the group to have made its decision and adjust their positions accordingly (Hoffman & Maier, 1961).

For normative influence to generate agreement in this way, the surfacing and resolution of nascent interpersonal or task conflicts is neither required nor desired. While the normative process is not itself a rational one, if each individual's choice is rational, their combination will be rational (though equally if each choice is irrational, or biased, so will their combination be). Normative influence can "crystallize" the group in either direction (Thorndike, 1938). First advocate research illustrates the potential confusion between group information as a social influence, or cause, and group information as an outcome. Studies show that the first advocate of a position predicts the group's final decision better than the pre-decision group preferences (McGuire et.al., 1987). This was initially taken to suggest that the arguments of the first advocate influenced, or led, the rest of the group (Vinokur & Burnstein, 1974). However, when no prior discussion was allowed, the first advocate effect disappeared, and the group seemed no longer influenced by the first advocate (Weisband, 1992). They concluded the first advocate was simply listening and reflecting the evolving group position, rather than directing it, i.e. the first advocates were the group's normative "radar", those members most sensitive to where normative influence was taking the group.

In summary, voting can be used in two ways; as a tool in rational decision making, or as a tool in normative decision making (Winniford, 1991). Some research suggests the normative approach of voting early and often is viable and useful (Nunamaker et. al., 1997). The difference between these two uses of voting is considerable. In the first case, voting is a once only "formal vote" operation that occurs at the end of a session only if the group cannot reach consensus by any other means. Its role is at best marginal. By contrast voting as social influence is an ongoing dynamic activity that is normally threaded within the group interaction from the very beginning of the session.

2.5 Voting before discussing

Electronic voting was initially based on formal face-to-face voting methods. It is initiated by the group leader, and requires the entire group to stop anything else they may be doing. It is expected to occur after a period of discussion, and is a one-time activity whose purpose is to finally resolve an issue. Although such voting tools are theoretically a critical design feature of groupware, a survey of 135 randomly selected organizations showed that of the organizations that used computer decision rooms, only 7% actually used the electronic voting capability provided, and even for those that do use it, its contribution is considered marginal (Beauclair & Straub, 1990). Our theoretical model suggests that as long as voting is designed and implemented as a rational decision tool, its use is likely to remain marginal.

The VBD method uses voting as a social tool, giving it a central, rather than marginal role in group interaction. It represents the implied "voting" that occurs in face-to-face discussions via back-channels. Hence after ideas are generated by brainstorming, group members immediately vote on them. Subjects can vote throughout the interaction, as an on-going rather than one-time activity. The software allowed each individual to vote whenever they wished, on whatever they were reading at the time, rather than requiring all group members to vote on the same item at the same time. The computer made group voting easy. Subjects just voted, leaving the computer to calculate and distribute the results. E-mail lowered the user cost or effort to send a message compared to ordinary mail (Reid et.al., 1996), so e-mail is seen by users as a relatively spontaneous medium, more like using the telephone than writing a letter (Lea, 1991). Electronic voting can likewise reduce the “cost” of a group vote, and electronic voting may be as different from a traditional formal ballot as e-mail is from written mail.

Secondly, if social choice does not give a unanimous result, face-to-face discussion offers an alternative path. In this study, any single person disagreeing forced a discussion. The onus was on individuals to avoid group think by raising concerns, following the precept that “Groups don’t think, individuals do”. If no individual was willing to raise a concern by computer, it was felt they might be equally unlikely to do so if the item had been discussed first.

The VBD method, shown in Figure 3, combines electronic voting with face-to-face discussion, but using the former first. The method aimed to establish areas of group agreement before individuals interacted face-to-face. It deliberately reduced inter-personal interaction initially, to allow the group identity to become established. Where the group already agrees, social decision making gives a short path to a result, bypassing time-consuming and risky face-to-face discussion, which is only used when needed. The method aims to combine the best of both worlds, social and rational, social unity and decision quality.

This method is expected to produce initial agreement on most items, leaving the contentious ones for later discussion. This early focus on areas of agreement should set a tone of group unity that will carry over into the face-to-face discussion. Person-to-person conflict is bypassed, at least at the beginning, as the computer interaction is anonymous. The VBD method is indicated when group agreement is a problem, or where inter-personal interactions are disrupting or prolonging meetings. Since the initial phase of the interaction is computer-mediated and asynchronous, it could occur on a distributed network. Only the face-to-face discussion of non-agreed items requires members to meet in the same-place. In summary, the VBD method uses electronic voting to support only the group normative process initially, which was expected to reduce initial interpersonal conflict and information exchange, and moves to face-to-face discussion only as necessary.

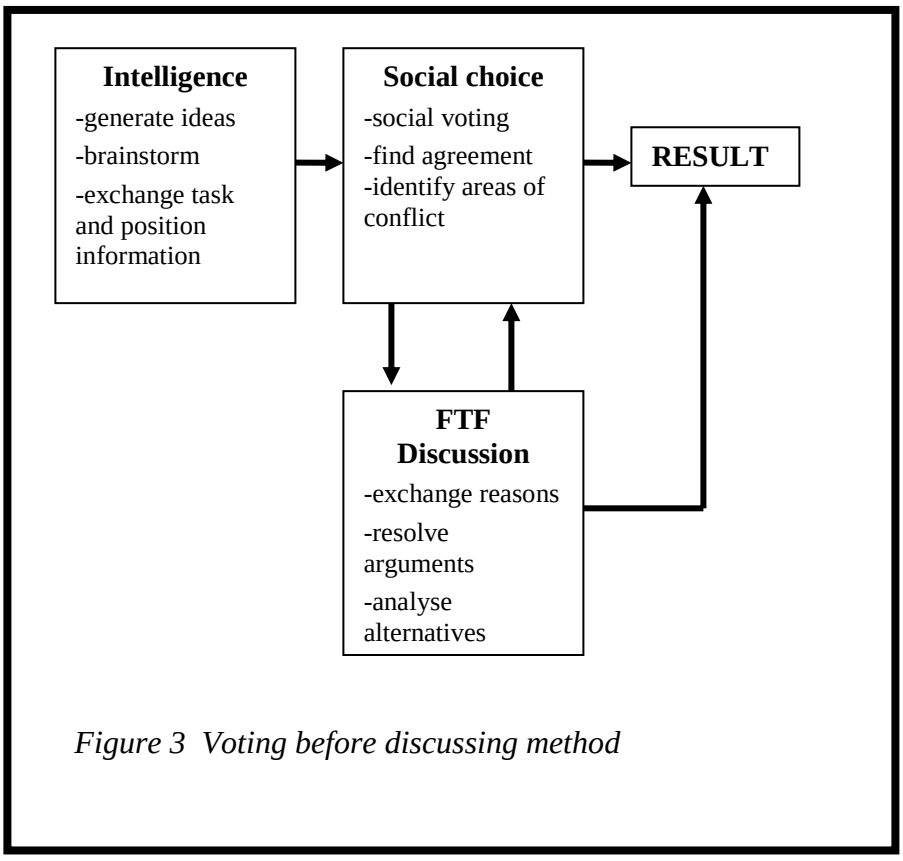

Figure 3 Voting before discussing method

3 Case study

3.1 Rationale and environment

To test these theoretical concepts, it was decided to undertake a small study in a live field situation using a prototype group support tool developed by the first author. The study took place at Manukau Institute of Technology (Manukau), an educational institution located in Auckland, New Zealand. Manukau provides post-secondary trade and degree programmes to a student population of approximately 10,000 full time equivalent students. Manukau, and other similar institutions, are facing pressures of government initiated change designed to make them more market responsive. The case study reports on meetings held to formulate a

Tasks	Sub-tasks	Items
Window 1: (analyze environment)	Market analysis	49
	Customer analysis	101
	Competitor analysis	13
	Environment	26
Window 2: (SWOT analysis)	Strengths	9
	Weaknesses	14
	Opportunities	10
	Threats	6
Window 3: (marketing objectives)	Target groups	23
	Job seekers, overseas students, . . .	
Window 4: (develop strategies)	One prime and seven sub-aims were taken from task window 3	37

Table 1. Task structure

strategic marketing plan for the institute. Meetings were conducted over three sessions (of 6.5, 4 and 4 hours), with a separation of 13 working days between sessions 1 and 2, and three working days between 2 and 3. The first author acted as software guide and, to a limited extent, discussion facilitator. After the final meeting, the second author conducted semi-structured interviews with each of the participants of approximately 30 minutes duration on that same afternoon, the recordings of which were transcribed for subsequent analysis.

3.2 Subjects

The six professional staff members of the Manukau Marketing Section were all strong minded, expressive people, each with very different backgrounds, whose individual opinions often differed on any given issue. Face-to-face discussions of "the way ahead" in the past had typically involved conflict between conservative and radical styles. These meetings often involved long, heated discussions, which frequently moved off the subject to wider issues, and generally resulted in little agreement being achieved. This group seemed appropriate for testing the VBD method, as generation of group agreement was a problem. It was also considered very unlikely that, for this group anyway, normative influence would be so powerful as to override individual judgment.

3.3 Task

The task was a complex, unstructured problem – to develop a marketing plan for the institute. It was structured into sub-tasks, based on marketing theory, as shown in Table 1. This task structure was visible to all from the beginning. The *Items* column shows how many contributions were made under each heading.

3.4 Interaction method

Subjects were all in the same room with computers facing outward so each could not see the others screen while working at their own. Simply by turning their seats inward, they could formed a face-to-face discussion circle. In general subjects either worked on the computer or discussed face-to-face. No-one attempted to do both.

While the *task structure* decomposed the task, the *group interaction procedure* aimed at producing group agreement. Within each task window, the facilitator encouraged the following steps:

- Electronic brainstorming: Enter ideas anonymously.
- Read other's ideas: If you disagree, suggest a better alternative.
- Electronic voting: Vote on all items, to uncover the group position.
- Face-to-face discussion:
    - Discuss unresolved items face-to-face.
    - Clarify ambiguous items.
    - Remove duplicates.
    - Advocate minority opinions or concerns.
    - Re-vote: Optional, if necessary.

Steps two and three of the traditional paradigm have been interchanged, and discussion is the optional final step, rather than voting. Voting was on the scale:

1. Strongly disagree
2. Disagree
3. Slightly disagree
4. In the middle
5. Slightly agree
6. Agree
7. Strongly agree

Subjects could vote and re-vote as often as they wished. After all votes on an item were in, the computer automatically calculated the results in real time over the network. Participants saw a display of member votes, and the group position, in a single line format, as follows:

155556	**SLIGHTLY AGREE**

The display presented the votes in numerical order, left to right, so votes were anonymous, though visible to all. In this example, one person voted *Strongly disagree (1)*, four voted *Slightly agree (5)*, and one voted *Agree (6)*. The majority position, calculated as the median of the votes, was s*lightly agree*, as indicated in words on the right. The normative influence process suggests that the group position be given in the same form as the individual position (rather than for example as a mean score). Such an item, where one or more people disagreed with the rest, was automatically raised for discussion. In addition to the seven vote levels, participants could also enter *abstain* or *don't understand*. Items with a *Don't understand* vote were also automatically raised for discussion, allowing anyone to call a discussion on any item, even without taking a position.

3.5 Software

The groupware used, Forum DGSS (Distributed Group Support System) was developed by the first author as a research tool. The software has been used by more than a thousand people over a three-year period at Manukau, and was designed to provide a computer-mediated environment within which participants have *autonomy of action*, with very little direct central control. It differs from "tool kit" type systems, like Group Systems, where software “tools” are initiated and controlled by a central facilitator. To illustrate this participant-driven capability, in this study the group was supposed to first brainstorm and then vote on the ideas brainstormed, as two separate phases. However often subjects in the middle of voting would suddenly think of another idea. The FORUM system allowed them to stop voting, add a new idea to the list, and then continue voting. The software automatically informed the group a new item had been added for voting, so subjects were not forced into a fixed sequence of events. Experimenter control was exerted not by direct central manipulation, but indirectly, by control over the properties of the computer-mediated environment. These were defined in over 150 parameters which the experimenter could adapt or “tailor” prior to the situation (Turoff, 1991) (Table 2).

Action	Properties
Add	Only the Chairperson could add/edit subject headings.
Edit/Delete	Except for the chair, only the item owner could edit or delete.
Order	Some lists were automatically ordered by vote agreement, others were prioritised by the chairperson.
Vote	Votes were anonymous. The group position was visible to all.
Comment	Commenting was unavailable for windows 1 and 2, and for headings.

Table 2. Example FORUM DGSS environment parameters

Just as in the physical environment, all actions (like voting, commenting, and mail) were end-user initiated, and *potentially* available at any time during the session, although local properties determined what was actually available in any particular situation. For example in the first two task windows, it was not possible to argue, even anonymously, because the commenting facility was turned off. If a participant disagreed with an idea presented, the only way to "argue" was to suggest a better alternative, and let the group vote decide between the two.

4 Results

4.1 General

In each session, subjects voted many times, not just at the end but throughout the interaction. Although this may have been expected to be a chore, subjects showed considerable interest at all times in the revelation of the group's position on various topics. Typically only a few items needed discussion, usually 5-8 from a set of 30-40. After discussion, the item was re-voted and usually agreement was reached. Occasionally the group

simply agreed to differ and moved on. However approximately once or twice per session an issue arose that challenged some aspect of the given situation. Such challenges demanded face-to-face discussion, and taxed both group and facilitator. For example confusion arose over what to do when one agreed with an item, but disagreed with the heading it was under (e.g. agreeing with the statement "Staff are practically rather than theoretically orientated" given under the heading "Weaknesses", but felt it was a strength not a weakness). The facilitator had to resolve this issue immediately, and decided that agreement meant agreement *under that heading*, so if you disagreed with the item placement you had to vote against the item. In a distributed environment such querying of system itself could have more serious results, perhaps with subjects losing faith in its integrity.

A problem occurred when some members questioned the given task, suggesting we should be considering organizational objectives, not marketing objectives. Others noted this group did not control organizational objectives. There was considerable discussion about whether production should drive marketing or the other way around, a controversy which simmered in every session. Disagreement about this derailed the whole process for a while, and caused considerable concern. In the end, the facilitator produced a compromise, that the group restrict itself to marketing aims, but that a key marketing aim should be to raise the profile of marketing in the process of setting organization goals.

Such problems, where members seek to move the group "outside the field" of the given task, making the task a "moving target", are not restricted to computer-mediated interaction (Reeves & Lemke, 1991). Dealing with such movement required what can best be described as "insight". It seems computer-mediated interaction operates within a task framework, and one of the prime roles of the facilitator is to provide this framework and maintain its validity.

4.2 Top down task structure

The task structure to arrive at the desired marketing strategy involved a top down approach, first defining the marketing objectives and then the strategies to bring those objectives about. Participants seemed to have difficulty working in this top down way. Most of the objectives initially brainstormed were seen, on reflection, to be strategies (or means to an end). People seemed to prefer to begin with the concrete causes and then consider the end result they wanted to achieve, rather than work from end to means. For example, to establish a career counseling service was initially put forward as an objective, and then seen to be a strategy.

4.3 End product

The end product was unpolished and uneven in quality. As one subject said: "…I believe that the deliberations that come out of one of these sessions are really raw material, they're not for distribution, and they look half baked, naïve, ill conceived, incoherent … and I believe it would be quite dangerous to use that output of a session like this and spread it around". The end product lacked consistency and focus, perhaps reflecting its multiple authorship. It had to be reworked by the director to improve this, for example adding dates and responsibilities. The production of a coherent document seems best done by an individual, not a group. However the end product had the quality that everyone felt ownership of it, had contributed to it, and had agreed upon it.

4.4 Questionnaire feedback

Participants independently completed an electronic questionnaire at the end of the sessions. The results (Table 3) showed subjects felt the sessions generated more agreement than equivalent face-to-face sessions, and that the overall contribution of computer support was beneficial. The response scores for questions 1, 2, 7 and 8 were similar to those obtained in a laboratory experiment on normative influence with similar questions on the same scale (Whitworth et al, 2001). In that experiment, to the question "I think I agreed with most of what the group decided.", 90 subjects gave a mean response of 4.08 when working blind, but a mean response of 5.6 when subject to normative influence, a difference which was a highly significant difference ($p < 0.001$), and which matches closely the result of 5.5 in Table 3 for question 2.

Question	Majority decision	Mean	SD
1. I disagreed with a lot of what the group decided	Disagree	2.5	1.3
2. I agreed with most of the group decisions	Agree	5.5	1.3
3. Using the computer gave more agreement than normal meetings would	Slightly agree	5.2	1.7
4. This group task would be better done in a face to face meeting	Disagree	2.2	1.1
5. This is a good way to develop a business plan	Slightly agree	5.0	1.0
6. This is a bad way to develop a plan for anything	Disagree	1.8	0.4
7. I think our group did quite well on this exercise	Slightly agree	5.6	0.8
8. I was not aware of the rest of the group through the computer	Disagree	2.7	1.3
9. I felt we were working as a group	In the middle	4.8	1.7

Table 3 Questionnaire responses

5 Interview themes

After the group sessions were completed, individual interviews were conducted with participants in the several weeks following. The interview questions were designed to reveal perceptions about the process and outcomes of the sessions, the effect of voting before discussing, and the computer software in general. The following themes emerged.

5.1 Comparison to face-to-face

The interviews confirmed that previous face-to-face discussions tended to easily go off track and involve personality clashes. One subject recalled their experience with face to face brainstorming "… was disastrous, because they wouldn't obey the rules… [of not making value judgments on others' ideas]". Another reported an attempt at face-to-face brainstorming was "an unmitigated disaster".

5.2 Personality clashes

The method used seems to have reduced or avoided personality conflicts. When asked what would have happened if a normal face-to-face process had been used, one subject catalogued the personality conflicts in detail:

"I can tell you almost exactly what would have happened. Member A would probably have arrived late, and member B would be getting totally hacked off with that, and they then would have a fight over something … Member C would probably get all magisterial and annoy the rest of us, and then sort of sit and get sulky, and another one would probably whine gently, and we'd all be at each other's throats in a wonderful way."

Computer interaction avoided such outcomes. It provided "…an opportunity for people to contribute ideas to a group situation without those ideas being colored by their personality…". Another thought: "…ideas were judged on their merit, not by, or influenced by, the person who [was] advocating them". Another felt " able … to give opinions without being identified or being criticized". While some liked being able to brainstorm without "... worrying about the dynamics of the group [or] being dominated by any personalities or agendas…", others missed the "bouncing" type of interaction experienced in face-to-face interaction.

5.3 Voting before discussing

Without voting before discussing, one participant said: "…I think we would have had much more tension in our meetings, [and] we certainly would have gone down a whole number of different blind alleys, …. so I think overall the meetings would not have been so efficient or effective and we would have ended up with a lot of people feeling pretty angry about each other…". Another said: "…I certainly think it helped our group in terms of our cohesiveness, and I think we all enjoyed each others' company in doing the process and things were pretty relaxed", and another: "I found we were more aligned and more thinking on the same wave track than … if I'd been asked prior to the event would have said". Interestingly, subjects generally did not mind voting on all items. When asked if they would have preferred a leader to pre-select items for the group to vote on, a typical response was: "No I was quite happy to give my opinion on all of them". Subjects seemed very interested to discover the group position by exchanging votes through the computer: "I found it very interesting each time to see what [the group's] final priority order was …". Group position information, represented by the vote results, while simple unemotional information, seems a naturally interesting form of group communication.

5.4 Face-to-face discussion

Many confirmed the usefulness of the discussion option, as an antidote to "groupthink" effects: "I believe this process where you vote before you discuss is an excellent way of saving time on things where there is no disagreement … so long as people have the opportunity to discuss. … for example there was one issue on which I voted strongly disagree … when they came to ask me why, I persuaded the whole lot of them that they were on the wrong track because they hadn't seen the implications of it …". A final discussion phase seemed sufficient to retain the desirable properties of face-to-face discussion: "When we had

a contentious issue the author of the statement had to stand up and be counted, so we then got into the usual group dynamics and dominant personalities etc".

5.5 Computer interaction

Participants all agreed that after these sessions, their opinion on groupware systems remained good, had moved from neutral to recommend, or had risen from previous experiences. The following comments typify those whose opinions were positive about its use: "I think this system was better"; "… so yeh I guess I've moved from a position of total neutrality to one of approval" ; " …I think [computers] are a useful tool, I see them as a tool, and I would use them, yes.". However, one subject provided the caveat: … I don't believe it [computer interaction] is a total substitute for face to face discussion…".

6 Discussion

6.1 Conclusions

The VBD method seemed to increase feelings of group identity, reduce personality conflicts, and reduce needless discussion. Subjects needed to be wary of mindlessly going along with the group, and remember to raise issues for discussion when they felt the group had got it wrong. The group agreement achieved through voting was generated without prior surfacing and resolution of conflict, contradicting views that conflict resolution is a necessary pre-requisite to group agreement. However such "social agreement" could be fragile in the face of well-reasoned opposition. On several occasions a point of disagreement, starting with only one person, led to discussion where new information was presented that caused the entire group to alter its position. Normative influence without rational discussion can generate confidence, but this may be short lived if group members are not "inoculated" to alternative ideas and arguments (Sniezek & Henry, 1990). A combination of multiple processes, as in the VBD method, seems the best way.

These findings are unusual, because more often than not, other studies have suggested computer interaction involves reduced agreement and increased conflict, both in the field (George et.al., 1992) and in the laboratory (Adrianson & Hjelmquist, 1991; Cass et.al., 1991; Dufner & Hiltz, 1990; Gallupe & McKeen, 1990; Kraut et.al., 1992; McGrath & Hollingshead, 1991; McLeod, 1992). However such conclusions may depend on how the groupware is implemented (Fjermestad & Hiltz, 1999), and some experimental studies support our conclusion that computer-mediated groups can more easily generate agreement (Lea & Spears, 1991; Whitworth et. al., 2001).

6.2 Limitations

This study was a field trial of a new method using prototype software, and because the amount of data collected was small, further studies will be needed to establish a working methodology. The opportunity for field data collection arose suddenly and advantage was taken of the opportunity by the researchers, and the planning period for the study was very short as a result. There was no control group and hence no way to distinguish for certain which parameters influenced the output effects. For example this study cannot distinguish the effects of computer mediation from those of the VBD method, although previous research

suggests that computer-mediation alone usually does not increase agreement. Equally these results may apply only to this small group, or only to people in our small country. To generalize this result some other group must replicate our finding. What happens with this method if group size is increased, say to a group of 20 or 40, is not clear. There may come a point when the individual is too overloaded with input from others to effectively process it. However for six people this did not occur. The format of a face-to-face meeting of 20-40 people would also be different from our small committee.

6.3 Future research

These results suggest the VBD method is worth further study, if only as an alternative method for certain situations. The cognitive three-process theory upon which the method is based raises this method as only one among many possibilities. If there are three distinguishable processes in group interaction, and if computer-mediation allows those normally parallel processes to be independently supported, the possibilities for computer-mediated interaction are expanded considerably beyond those implied by a systems rationalist, one-process model of group interaction. Computers can support a rational task focused interaction, keeping the group position and idea author identities hidden, and for some situations this may be appropriate. But equally for other situations, as demonstrated here, it may be appropriate to focus on social or interpersonal outcomes, like agreement and relationships. One could imagine situations where an initial focus on building person to person relationships, or getting to know each other, would be more appropriate than the focus on normative influence taken in this study.

Obviously such relation building interaction could not occur if the software insisted on keeping participants anonymous, because the groupware designers believed this was the best way of interacting. The C3P model proposes there is no "best" group interaction process, since each different process has a useful purpose, and each is advantageous in some situations. As the conditions favoring one process may contradict another, it follows there is no "best" form of computer support, or at least what is best will depend on the contingencies of the situation (Gutek, 1990). Indeed face-to-face interaction allows this sort of flexibility, and there are many types of group "meeting", including social gatherings, discussions and formal meetings. Computer support should add to, not reduce this flexibility. For example, to regard anonymity as an always desirable property of computer-mediated interaction seems a mistake (Er & Ng, 1995).

This study suggests that it is possible to enhance the group interaction process by generating agreement initially, before moving to simultaneous use of all three interaction processes in a face-to-face discussion. It seems equally possible to devise methods using groupware to focus on either of the other two processes initially if needed. It may also be possible, in a computer-mediated situation, to support two processes together, while excluding a third. Clearly, although only three base processes are proposed, the options available for groupware are considerable, especially given different sequence combinations. Just as the three primary colors red, green and blue, which derive from three types of retinal cone receptor processing, can give the myriad colors we see, so the richness of group activity could arise from combinations of three primary cognitive interaction processes. As computer interaction allows these processes, and their effects, to be disentangled, the VBD method may

be just one of many new ways that computer support can be tailored to the nature of the group and the task situation.

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