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**2<sup>nd</sup> of 3 files**

**Chapters 4-8**

**ANALYSING THE DEVELOPMENT, MANANGEMENT AND  
GROWTH OF INTEGRATED DIGITAL COMMUNITIES**

by  
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## CHAPTER 4

### EXTENDING WEB BASED INTERACTION THROUGH THE INTRODUCTION OF TEXT MESSAGING

In this chapter the community framework is used to analyse and characterise an integrated digital community developed around the topic of the World Cup. Continuing to explore the theme of media integration noted in chapter 3, an online community is extended through the use of text messaging. Guidelines from the results of chapter 3 feed into the design of a system based upon this specification. The chapter reports on how the framework was used to characterise the nature of the community that developed and in particular to examine the integration of the two media. Members took part in competitions and discussions and it was noted that a sense of community was fostered through digital media even within the short time frame of the study.

#### 4 Introduction

In chapter 3, the community framework was used to characterise and compare two online fan communities. It was shown in both communities how members used the technology they were provided with to create a sense of community around the topic of Harry Potter. In addition, the communities extended beyond the provided technology as members sought new ways to discuss their interest in the topic. Site B, in particular, became a community concerned with Harry Potter not a community concerned with being online or using the technology per se.

A central theme of this thesis is that digital communities are more than simply web based communities. In the last chapter members of a supposedly web based community adapted and integrated the provided technology and made reference to other media as they sought

ways of extending their interactions. In this chapter the notion of extending web based interaction is explored directly. A community built around the topic of the World Cup using text messaging integrated with a web site is analysed and characterised using the community framework.

#### **4.1 SMS and website integration**

In the previous chapter, the members of the two Harry Potter fan communities cited a number of reasons for joining the groups. These included making friends, exchanging ideas about story lines and keeping up-to-date with all the latest Harry Potter news. Passing on the latest news and gossip is an important element in many types of interest groups and is a feature of many newsgroups and online communities (Harrington & Bielby, 1995). For sport fans, up-to-date information is of maximum importance and they are always looking out for new ways of exchanging information.

One way of delivering up-to-the minute information is via the mobile phone in particular via text messaging or Short Messaging Service (SMS). SMS allows messages up to 160 characters in length to be exchanged via mobile phones. A limited number of messages can be stored on the phone but there is no provision for message threading. Text messaging is an ideal way of providing short amounts of information directly to customers wherever they are. Mobile phone network operators provide a number of text messaging alert services. The alerts pertain to the news, weather and sport and can be tailored to the client's interests. Subscribers to this service receive appropriate text messages via their mobile phones.

Although receiving information is important, being able to supply others with information is equally important within a community setting. Chapter 3 demonstrated the importance of being able to make a personal investment in the community. Members took pleasure from sourcing and providing information to other members. It was also important for members to be able to put before the group carefully thought through ideas for future plot lines. Whilst a website provides a location for the community and a

permanent record of their interaction history, text messaging or SMS could extend interaction and provide a more appropriate way of integrating up-to-date information and ideas. SMS is already a well used medium for exchanging information amongst friends (Ling & Yttri, 1999; Kopomaa, 2000). It allows messages to be sent from any location at any time and often initiates an immediate response (Ling, 2000, Ling & Yttri, 1999).

This study proposes that combining a website with SMS may lead to improved interaction between participants, increased interest in the topic and furthermore to the development of a cohesive group of members. This study aims to see if a community of football fans, interested in the World Cup, can be developed and supported in a short space of time using a combination of web and SMS based interaction. If so then what sort of group can develop under such conditions and what part do the two components of the interaction play in shaping the community? A review of current attempts to integrate SMS with a website are discussed below and then a specification for SMS-web based interaction is outlined.

#### **4.1.1 Previous attempts at integration**

Most attempts at integration are driven by the need to capture the user's attention and then direct it to the area of interest. Integrated SMS alert systems, for example, function to direct the user's attention to the main source of information, often a website. The system alerts users to changes and updates on the website. The online hitch hikers guide to the galaxy ([www.h2g2.com](http://www.h2g2.com)) is to launch a SMS service, which consists of 'Don't Panic Alerts' -general tips from the Guide, and 'h2g2 Alerts' -which let you know what has been recently added to the guide. A more advanced form of the alert exists in the Knowsley Council SMS Soap Opera Project ([www.knowitall.org.uk](http://www.knowitall.org.uk)). To relieve the stress of GCSE revision, subscribers can keep up with the adventures of three teenagers- Kym, Jez and Abi. Every day one of the characters sends a message, which goes to all the subscribers. Each of the characters has an online diary to supplement the messages, which is a way of getting youngsters to use the website and - it is hoped – to read the serious revision advice webpages. These integrated alerts encourage interaction with the



website but not social interaction with other people. Studies of SMS use have focused upon pre-existing friendship groups and in particular one-to-one interactions (Ling & Yttri, 1999) and it has been suggested that text messaging may not be an appropriate way of making first contact with someone (Benson, 2000). There have been attempts, however, to foster social relations using SMS.

**Group based chat using SMS:** A number of new SMS services allow interaction between strangers or between existing groups of friends. SMS based chat rooms e.g. [www.itextu.com](http://www.itextu.com) allow users to navigate various interest based rooms via SMS commands and to send messages to other SMS users registered in those chat rooms. The associated website allows users to see which rooms are occupied and to read the profile of potential new friends. Whilst your username appears as being present in one of the chat rooms, the system is based around one-to-one, private communication and SMS messages cannot be seen by anyone else. More group-based communication can be achieved using Upoc ([www.upoc.com](http://www.upoc.com)). People can register groups on the website and then use the service to send out broadcast text messages to the whole group. Existing groups can be registered or an individual can start up a new group and invite like-minded people to join.

**Group based SMS-TV Chat:** SMS-TV chat also allows communication between groups of people rather than one-to-one chat. It is a popular system in Germany and Scandinavia and involves subscribers sending SMS messages to a central phone number. These messages are then displayed on the television via teletext pages. The listing of messages is divided into areas of common interest such as motor racing or football and a monitoring team is present to ensure that all users stick to the rules of Chatiquette. In the UK similar systems have been used for specific television programs. Messages airing opinions about the programs can be sent via SMS and appear on a teletext page after the show has finished. Another SMS TV system is being developed in the UK. It allows existing friends to send each other a text message via the television and it is hoped will exploit those ‘did you see that?’ moments (Marks, 2002).

In terms of SMS and website integration there has been little attempt to combine the two in order to develop social relations. Integration has primarily been for the purposes of directing users to information sources. Other SMS integrated systems have focused on chat at the expense of providing up-to-date information sources.

#### **4.2 Specification for SMS-Web based interaction**

The review has shown that, at least so far, combining websites with SMS has made only a limited range of interactions possible. Interactions are limited by the number of participants, the direction of messages and the presence of either chat or information but not both. This study proposes that combining a website with SMS may lead to improved interaction between participants and furthermore to the development of a cohesive group of members. Previous attempts to link a website with SMS have used the website as an area to display information rather than a way of facilitating group interaction. Systems that have incorporated chat, have failed to provide users with any other incentives to view the messages and become involved in the group. SMS-web based interaction needs to include the following features:

- Utilising SMS as a mobile technology, provide a simple way of sending SMS messages to the website.
- A website containing an archive of chat messages and the relations between them.
- The website would contain additional information and resources which can be constantly updated thus providing another incentive to view the website.
- An interactive system. The group need to be able to send messages to the website. In addition, the group can receive messages from the system host and where appropriate receive messages directly from the other group members.

Combining a website with SMS allows an archive of SMS messages to be stored and presented to the group members. The group can see a transcript of their collective messages, see when they were sent and by whom. They can follow group discussions and direct messages to the whole group as well as replying to individual messages using the

threading facility. The website also provides a group wide accessible area for displaying additional information and resources regarding the topic of interest. Additional information on the website gives members another reason to view the website and engage with the group. SMS itself allows messages to be sent anytime from any location. It can be used as a broadcast medium for delivering ideas and information to the rest of the group. A SMS-web based system could also deliver SMS messages from the system to the group and, if required, could relay on individual members' messages to the rest of the group.

In methodological terms, the development of a SMS-web based system allows increased control over the type and quantity of data collected. This will allow more detailed assessments of the members' sense of community to be made. It will also allow cross matching of website activity with external events. This specification for SMS-web based interaction should allow the development of a common interest based group. The conditions necessary for the development of such groups are discussed below along with a brief description of the aim of this study in terms of developing a community of World Cup football fans.

### **4.3 Creating a community around the World Cup**

The overall aim of this project was to see how a SMS-web based interaction system could be used to support and generate discussion around the topic of the World Cup. The World Cup was chosen for a number of reasons. Firstly, as a topic for discussion it has a definite beginning and end. Specific events such as this have been used before to create a compressed version of an online community (Boettcher, 1997). Secondly, as both football and the Internet are traditionally regarded as more male dominated activities, it provides an opportunity to bring together a group of people unaccustomed to being online as a collective, i.e. by skewing the sample to a female dominated community. Finally, the World Cup provides an opportunity to host simple competitions. Group members will be allocated teams to follow in order to enter these competitions. It is hoped that through

group discussion and through the competitions, members will report increased interest and knowledge in the World Cup and in addition, will grow to become a cohesive group.

#### **4.3.1 Conditions needed to create online communities**

Despite the increasing use of the web as a way of maintaining relations between like-minded people, there is growing recognition that online groups are unlikely to develop unaided. In chapter 3 a review of Preece's (2000) work on online community design guidelines was presented. Preece (2000) suggests that designer decisions regarding usability (i.e. the human-computer interaction) and sociability (i.e. the social interaction between group members) affect the character and to some extent the success of online communities. It was shown in chapter 3 that usability and sociability guidelines did in most instances lead to the predicted behaviour and character of the group. Some usability guidelines appear to be robust. Threading messages together, for example, did lead to more interactive discussions. In fan or common interest based groups, the discussion is very susceptible to the influence of events and activities associated with the shared interest. Activity within such groups is also affected by the introduction of new features or items such as new topics for discussion, short quizzes and votes. Design guidelines, however, often failed to recognise the strength of member adaptation of the technology and the rules to meet their own needs. Members develop special codes and norms, move the focus of discussion away from the prescribed topic when necessary and integrate the online environment with other media and face-to-face interactions.

The conditions necessary to create an online group of football fans appear to be present in the SMS-web system. The website provides a distinctive gathering place for the community and it has a clearly defined purpose i.e. to discuss the World Cup. Previous work on usability and sociability of online communities and work on SMS suggest that features present in this system should encourage and facilitate interaction.

4.4 Aims and objectives of the study

The overall aim of this project is to see how a SMS-web based system can be used to support and generate discussion around the topic of the World Cup. Table 4.1 shows a section from the original table (1.1) presented in chapter 1. It details the features of the two technologies studied in this chapter.

Type	Sync	Async	Ad-hoc	Organised	One-to-one	One-to-many	Mobile	Fixed	CMC technologies
2		•	•		•		•		Text messaging
3		•	•			•		•	Message board

Table 4.1 Classification features of the two technologies studied in this chapter

The specific objectives of the chapter are as follows:

- To generate a cohesive group using the SMS-web system
- To generate increased interest in the topic
- To assess the impact of the facilitator on involvement and discussion
- To assess similarities and differences in how the two elements of the SMS-web system are used

In addition a number of predictions are made concerning interaction behaviour and group perceptions.

1. Activity within the group will be affected by the stage of the World Cup
2. People are more likely to reply to a SMS message, relayed message or alert
3. Threading will make messages posted after reading the website more interactive
4. Interest and knowledge about football and the World Cup will increase over time
5. Cohesion and sense of belonging will increase over time

## **4.5 Method**

### **4.5.1 Overview**

The study ran over the four weeks of the World Cup 2002. The nature of the World Cup means that external events feeding into the community discussions are constantly changing. Teams get knocked out of the tournament and issues rise and fade. The inherently evolving nature of groups also makes activity subject to change. This change was managed to some extent by using a number of facilitator interventions at set times during the study. The study was run in four blocks, each block consisting of one week. Each weekly block focused on an intervention. The repeated use of questionnaires, for example, was one way of managing the change within the group. Table 4.2 shows the weekly interventions.

Week Block	Focus of Week Block	Main Interventions
1	Open questions, practice	QUESTIONS TO STIMULATE DISCUSSION, ENCOURAGEMENT TO PRACTICE POSTING
2	Novice/experts questions	Invitation to experts to explain facts and rules to novices (culminating in a competition judged by a novice member). Encourage novices to ask questions of experts. Questionnaire 1 posted
3	Sharing teams	Allowed members to share teams. Members had to request to join another team, both teams offered double points Questionnaire 2 posted
4	Relaying messages	SMS messages sent by members relayed to other members of group as well as appearing on website Questionnaire 3 posted

*Table 4.2 Schedule of interventions over the course of the study*

#### 4.5.2. Participants

16 people took part in the study 10 female and 6 male participants. The participants ranged in age from 18-42 and the median age was 25. The participants were chosen on the basis of two requirements. Firstly access to the Internet and ownership of a mobile phone. Secondly, some degree of interest in the World Cup tournament. A background demographics questionnaire revealed a range of interest and knowledge. Measures of competitiveness and extraversion revealed a wide spread across the participants. Participants were not paid for their involvement but two small cash sums were offered as prizes for the competitions.

#### 4.5.3 Task

Participants had to take part in a SMS World Cup football group. The purpose of the group was twofold. The first aim was to engage in discussion about the World Cup. The

scope of the discussion was open-ended. Participants discussed the World Cup by sending text messages to a specially designed SMS football website (see figure 4.2) and by reading other peoples' messages on the website. The second aim was to take part in two World Cup competitions, one concerning assigned teams and the other concerning assigned numbers (these competitions are described below in section 4.5.4). Participants were invited to send SMS messages to a website and to follow the football games in order to take part in the competitions which spanned the four weeks of the tournament.

#### **4.5.4 Procedure**

Each participant was assigned two teams to support. The first team was taken from the higher ranks of the competition and the second from the lower ranks. Each participant was identified on the website by the ISO standard codes representing their teams e.g. BR/ZA (Brazil and South Africa). Each player was also assigned two player numbers. Each combination of player numbers was used twice. Therefore two participants held, for example, the numbers 9 and 17. Participants could make a claim to the wins table every time either of their teams won, lost or drew. Participants gained three points for a win and one point for a draw. Participants could also block the opposing team from earning points by registering their own team's loss first. Participants were encouraged to send at least two chat messages a week to the message board and as many claims to the league table competitions as they wished. To differentiate competition messages from chat messages participants used a pre-determined format for competition messages. Two examples are shown in figure 4.1. Participants were given a comprehensive set of instructions and a membership card containing a summary of their access information (details can be found in Appendix C).



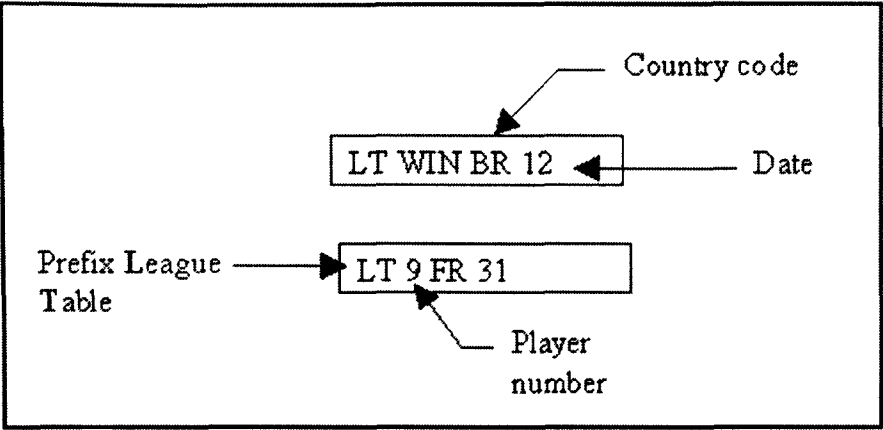


Figure 4.1 Format of SMS messages for claiming wins and goals

#### 4.5.5 System architecture

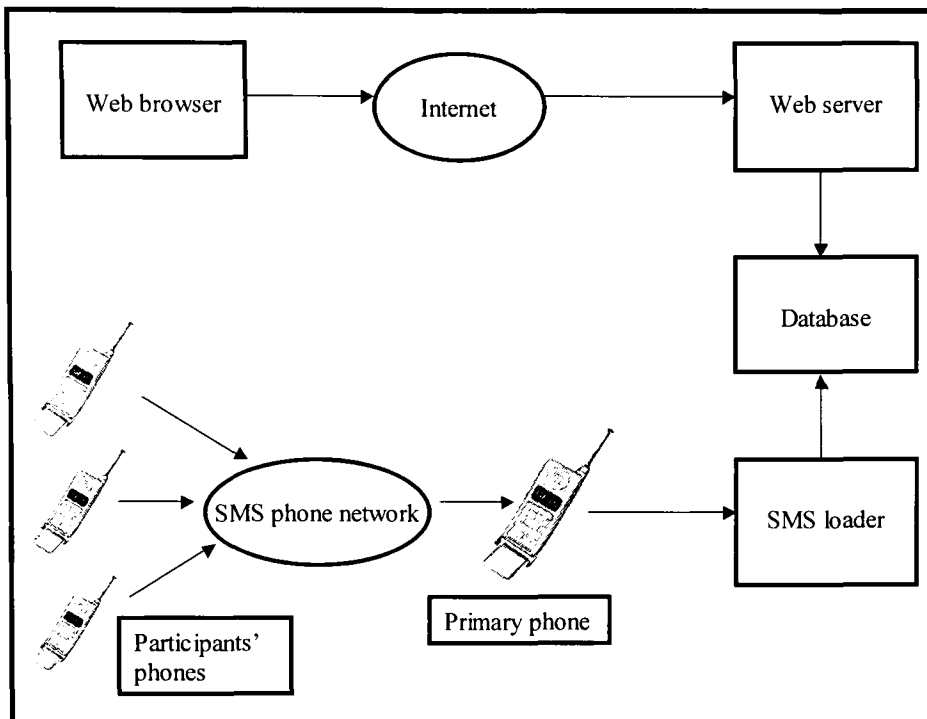


Figure 4.2 SMS-Web architecture

The system architecture is shown in figure 4.2. The system was purpose built for the research. The system was built by a friend, Martin Sillence, based upon a number of requirements including:

- Automatically retrieve and upload messages
- Automatically update competitions
- Provide manual override facility to prevent cheating and to deal with network delays to messages
- Recording of all messages including unauthorised or incorrectly formatted messages
- Authenticate access to website and recording of page requests

The system allowed SMS messages to be pulled off the phone and loaded the messages into the database. Here the messages were authorised and then the website dynamically

generated web pages from the entries in the database. For a more detailed specification see Appendix D.

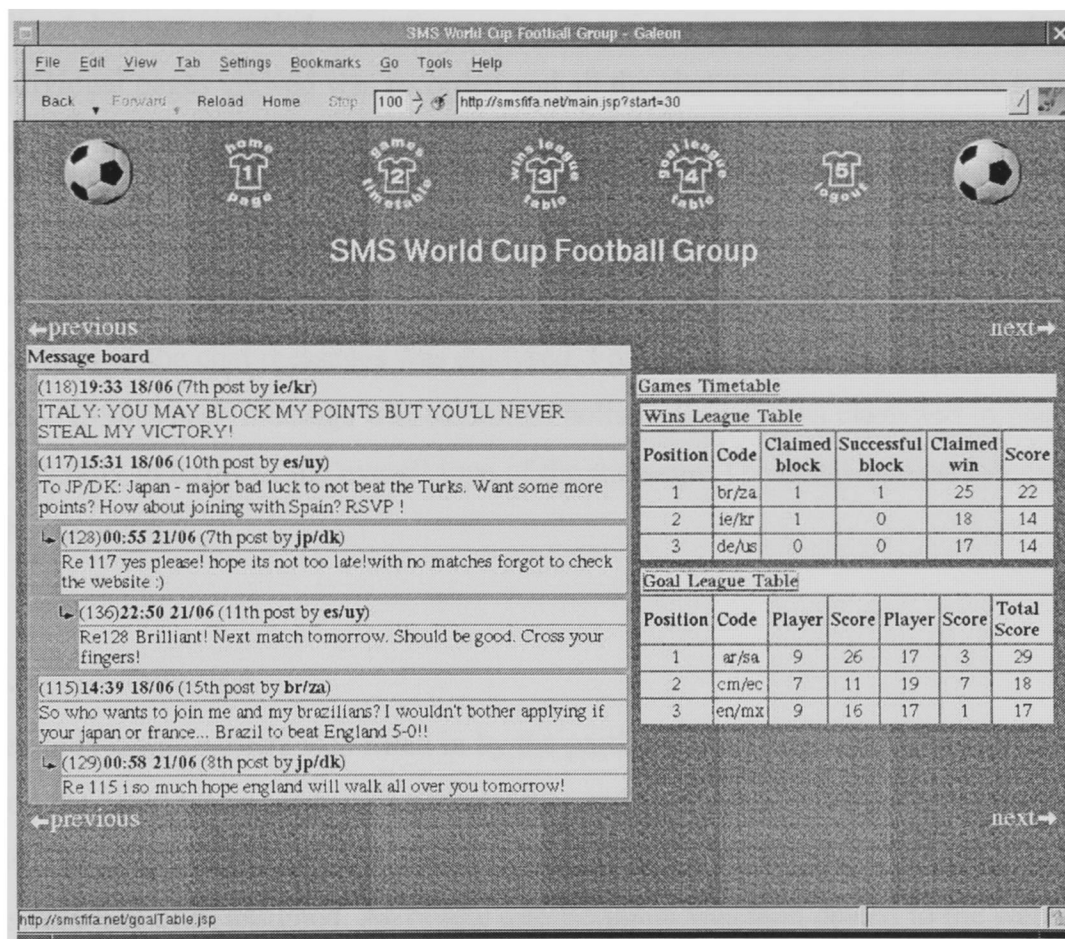


Figure 4.3 Screen shot of the Home page

The website (see figure 4.3) consisted of four web pages: a message board, two competition tables, one for the wins competition and one for the goals competitions and a games table (Appendix D contains further screen shots). The games table listed all fixtures and results. The website although small and simple was designed and checked according to usability heuristics (Nielsen, 1994b) and web specific usability heuristics (Instone, 1997).

#### **4.5.6 Data collection**

##### ***4.5.6.1 Interaction activity***

Measures of community activity were taken in weekly blocks. All activity on the website was automatically logged. Website activity was recorded as the total number of hits to the website. A hit was recorded every time a member viewed a page on the website. Data on the individual pages viewed was recorded and all the chat messages and claims to the two league tables were recorded.

##### ***4.5.6.2 Message analysis***

The content of the chat messages was analysed. Following the approach of Preece & Ghozati (1998b) each message was examined holistically and was classified in one category only in terms of the overall tone of the message. The classification categories are shown in 4.6.2.

##### ***4.5.6.3 Questionnaires***

A pre-study questionnaire was filled in by the participants. This collected background data on their text messaging and Internet usage and their interest in football and the World Cup. Each participant was also asked to rate their interest and knowledge in the teams they had been assigned. An online questionnaire was then posted to the website three times during the study period (copies of questionnaires can be found in Appendix E). These repeated the questions concerning football interest and knowledge thus allowing comparisons to be made across the study. The online questionnaires also took repeated measures of the participants' sense of community. Social identity or group cohesion was measured by Chin et al's (1999) perceived cohesion scale and had a Cronbach's alpha of 0.83. Other assessments of involvement and interest in the community were also made. Finally, the online questionnaires also examined issues relating to each week's interventions as shown in table 4.2.

### 4.6 Results

One member had to be excluded from the study when unforeseen work commitments meant that she was out of the country for much of the study period. The results from the remaining 15 participants are presented below. The analysis of the interaction activity, message and questionnaire data is divided into 2 sections. The first examines how the system was used over the course of the study. In the second, the results are discussed in terms of their implications for the five headings of the community framework. Technological support for the community’s activities is examined before the wider implications of the results are then described in the discussion section.

#### 4.6.1 Overall interaction activity

Table 4.3 shows the overall interaction activity results.

	Week1	Week2	Week3	Week4
Total chat messages	40	29	32	18
Number sending a chat message (out of 15)	10	11	10	8
Total claims to wins table	35	30	12	7
Proportion of matches claimed for	22/23	21/25	10/10	5/6
Number sending a claim to wins (out of those eligible to claim)	13/15	12/15	9/10	5/6
Total claims to goals table	41	52	16	5
Proportion of goals claimed for	41/100	52/128	16/42	5/16
Number sending a claim to goals	12	11	7	2
Total hits to website	336	455	350	232
Average number of hits per day	42	65	50	26
% of hits to message board page	66%	64%	63%	73%
% of hits to games page	10%	12%	9%	6%
% of hits to goals table page	10%	7%	10%	6%
% of hits to wins table page	14%	11%	12%	6%
% of hits to questionnaire page	0%	6%	6%	9%
Number looking at website (out of 15)	12	13	14	13
Average number of individual viewers per day	4.9	6.3	5.4	3

Table 4.3 Summary data of activity within the SMS football group

In terms of activity the SMS football group was a great success. In total 317 messages were sent to the website. This included 119 chat messages, 84 claims to wins table and 114 claims to the goals table. In terms of the competitions 58/64 of the matches were claimed for and 40% of the 286 claimable goals were claimed. The summary data in table 4.3 suggests that the stage of the World Cup affected activity on and off the site (i.e. posting behaviour). There was increased activity whilst members’ teams were still in the tournament and surrounding all the England matches. There were activity dips between games and reduced activity towards the end of the tournament. Claims to the competitions fell dramatically towards the end of week 3 as the number of matches decreased. During the main portion of the competition, weeks 2 and 3, there was an increase in the hits to the website. The questionnaires issued during these weeks do not seem to have overly influenced hits, accounting for only 6% of the total number of hits to the website.

A number of observations were made with respect to the different facilitator interventions over the four weeks. These are shown in table 4.4.

Week	Intervention	Observations
1	Open questions	<ul style="list-style-type: none"> <li>Members responded to facilitator’s questions and started to engage with one another</li> </ul>
2	Novice/experts questions	<ul style="list-style-type: none"> <li>Previous non-posters posted for the first time</li> <li>Novice judge became knowledgeable and took more part thereafter</li> <li>Other novices approached judge for explanations and discussions</li> <li>Disputes following judging of the competition</li> </ul>
3	Sharing teams	<ul style="list-style-type: none"> <li>More one-to-one conversations</li> </ul>
4	Relaying messages	<ul style="list-style-type: none"> <li>All relayed messages answered within five minutes</li> <li>Members rated this their favourite intervention</li> </ul>

*Table 4.4 Summary of intervention observations*

4.6.2 Interactivity

The interactive nature of the chat messages is assessed in terms of the number of replies, the presence of threading, the speed of responses and the targeting of messages. 42% of the messages in this study were at least reactive i.e. a response to a previous communication and 58% were individual, standalone messages. The reactive messages can be subdivided into threaded messages and replies to SMS messages. Threaded messages accounted for 20% of all the messages, (48% of the reactive messages) and are replies to specific messages seen on the website using the re: function. Replies to SMS messages sent by the facilitator or relayed from an individual to the group accounted for 22% of all the messages, (52% of the reactive messages). Interactive discussions, which took into account responses to previous messages all used the threading function on the website. In terms of message targeting, 71% of the messages were directed to the whole group and 29% of the messages were targeted at an individual.

Question	Number of responses		Time to respond							
	Web	SMS	Web				SMS			
			<5 mins	That day	Next day	2 days	<5 mins	That day	Next day	2 days
1.	3	5	1			2	3	2		
2.	2	9		1		1	4	2	1	2
3.	2	6		1		1	3		3	
Totals	7	20	1	2	0	4	10	4	4	2

Table 4.5 Response times to questions posted simultaneously on the web and via SMS

The speed of response and the response rate itself to a question or comment sent by the facilitator varied depending on whether the message was posted to the message board or was sent via SMS (see table 4.5). Three direct comparisons between the two media were made. The same question was posted to the website and sent out via SMS simultaneously. Across all three questions more people responded to SMS messages, and more people responded within five minutes of the message being sent. There was also a persistent effect of SMS with some of the questions still being responded to 2 days after they were sent.

Threading varied as a function of the message content. A content analysis was performed to determine the types of messages sent to the website. As in the previous chapter a taxonomy of content types was developed with respect to the overall tone of the message. The six categories were: Opinion, information, chant, running commentary, personal narrative and a catch-all category, other. Two colleagues classified all 119 chat messages according to the taxonomy. This produced a high inter-researcher reliability of 93%. The content types are explained in more detail below and the results are shown in table 4.6.

**Opinion:** Concerns expressing personal opinion or speculation

**Information:** Message is concerned with asking for or providing information to the group

**Chant:** Message is like a football chant e.g. come on England

**Running commentary:** Provides a comment as the match is being watched

**Personal narrative:** Message is personal and provides brief insight into sender’s life

**Other:** A catch-all category including technical problems

	Content category					
	Opinion	Information	Chant	Running commentary	Personal narrative	Other
Week 1	21	3	12	3	0	1
Week 2	9	10	4	1	1	3
Week 3	10	10	3	1	3	2
Week 4	13	1	2	1	4	2
Totals	53	24	21	6	8	8
% of total messages	44%	20%	18%	5%	7%	7%
Proportion of total threaded messages	18/23	1/23	3/23	0/23	1/23	0/23

Table 4.6 The number of different types of messages sent to the website



Table 4.6 shows the majority of messages were opinion or information messages. 44% of the messages were opinion messages and over three-quarters of the threaded messages were opinion based.

### 4.6.3 Integration data

Integration between sources of information and the system was noted. The main source of information for claims was watching the match live. Everyone that made a claim used this source of information. The logs show that 67% of the wins claims were made within 5 minutes of the match finishing. Members claimed for 40% of the goals whilst watching the matches. Integration between the two components, SMS and web, was also noted and is discussed in more detail in the framework analysis section (4.7).

### 4.6.4 Identity

	Questionnaire			
	Pre-study	1	2	3
Interest in football	3.2	3.7*	3.4	3.3
Interest in World Cup	3.8	4.6*	3.9*	3.9
Affiliation with team 1 (higher ranking)	3.8	4.2	NA+	NA+
Affiliation with team 2 (lower ranking)	3.1	3.7*	NA+	NA+
Knowledge of team 1	2.5	2.8*	NA+	NA+
Knowledge of team 2	1.4	2**	NA+	NA+
Level of group cohesion	NA	31.1	28.9*	30.3

Table 4.7 A summary of the means and significant differences between the longitudinal measures at each measurement stage

\* indicates significant difference from previous score at p<0.05 level  
 \*\* indicates significant difference from previous score at p<0.01 level  
 + it was not possible to compare affiliation and knowledge after questionnaire 1 as the tournament entered the knockout phase and not all teams remained in the competition

Table 4.7 shows the results of the questionnaires relating to interest, knowledge and group cohesion (identity). Three online questionnaires were placed on the website during the study. One questionnaire was posted during week two, another during week three and the final one during week four. The results from the online questionnaires are compared with the pre-study questionnaire that was administered to the participants prior to the start of the World Cup. The results were analysed using the Wilcoxon Signed ranks test.

The scores for the interest, affiliation and knowledge questions are taken directly from the relevant questionnaire responses e.g. questions 1-5 within questionnaire 1.

A sense of social identity and affiliation with the group was measured using Chin et al's (1999) perceived cohesion scale. This scale was embedded into the three questionnaires and appears, for example, as question 7 within questionnaire 1. The participants' scores across the five statements of the cohesion scale were summed and then divided by five to obtain the mean group cohesion score as appears in table 4.7. Although cohesion fluctuated over the course of the study the mean summed cohesiveness score across the three assessment points was 30.1. This is moderately high for a group that has never met. By way of comparison, Salisbury et al (1997) reported a mean summed cohesiveness score of 31.6 in a group of co-located students collaborating on a task over a three-week period. Those students met in groups of five once a week and were able to make use of a Group Support System at their discretion. The participants in the current study also reported the existence of a moderate sense of community (4 on a scale of 1-7, where 1 is not at all and 7 is to a very great extent). Table 4.7 also shows how interest in football and in the World Cup fluctuated over the course of the study. Interest in the World Cup and in football itself did rise significantly between the pre-study questionnaire and the first online questionnaire but then fell again to pre-study levels. Figure 4.4 shows that members increasingly enjoyed taking part in discussions and finding out more about each other as the study progressed.

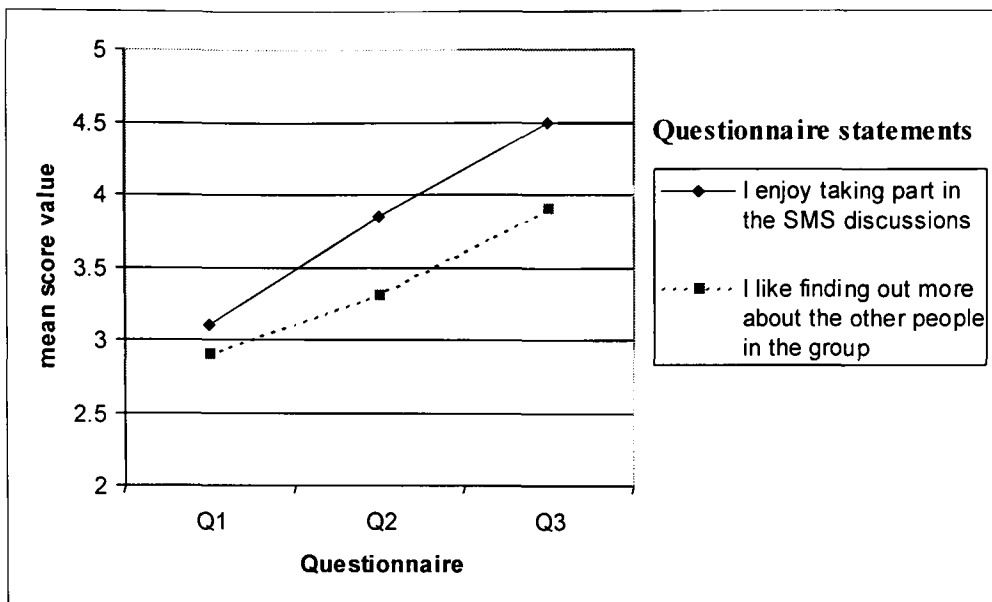


Figure 4.4 Graph showing increasing levels of agreement with questionnaire statements over the study

## 4.7 Community framework analysis

The results are now discussed in terms of the five headings of the community framework.

### 4.7.1 Membership component

Despite the anonymity on the website the results in section 4.6.4 show that members expressed relatively high levels of affiliation with the group and reported a moderate sense of community. There was a strong sense of social identity within the group. Members expressed a sense of shared human feeling and many took it upon themselves to provide useful information for the group. One member, for example, after lamenting the reduced coverage on Radio 5 Live, researched another radio station and provided the group with the details. Members increasingly enjoyed taking part in discussions and finding out more about each other. There was group-wide communication with some group specific abbreviations and codes. Most people looked up the ISO country codes in the games table and made use of them when referring to another country. The group also adopted “WC” when referring to the World Cup. Some of the messages contained standard SMS abbreviations e.g. **r, u, 4, 2, ppl, tho** and emoticons. Although the messages as a whole contained a relatively small amount of text speak.

Even within the short time scale of this community, a shared history had been established. Questionnaire 2 revealed that most members had been following events on the website and were able to name the winners of the various competitions. People also had a good idea about how many messages were present on the website.

The sense of being part of a group was even more evident towards the end of the tournament when fewer teams were left. There were calls for which team the entire group should be supporting in the finals:

(156) 20:00 28/06 (15<sup>th</sup> post by **it/tn**)

WE HAVE GOT TO SUPPORT BRAZIL. GERMANY R SUCH AN ORDINARY TEAM. IT  
WOULD BE A TRAVESTY IF THEY WON IT.

In the final questionnaire, members reported that they had enjoyed taking part and felt that they had got more out of the World Cup by being involved in the group. Two-thirds (10/15) of the group felt that being in the group had greatly increased their interest in the World Cup. Members had watched more matches involving their assigned teams than they would have done otherwise. Three-quarters of the group (12/15) had watched many more or a few more football matches in general because of their participation in the group.

As members did not have to reveal their identities, personal identity was allowed to shine through in other ways. The informal nature of the messages revealed humour and sarcasm:

(8) 14:53 31/05 (1st post by **br/za**)

alex ferguson says brazil is going to win, and he's a footballing god... So he must be right! and bad  
luck france, ha ha ha ha ha

80) 20:47 12/06 (7th post by **es/uy**)

Poor uraguay. Paraguay went through instead. Somebody got their 'aguay's mixed up.

Gender was revealed in a number of messages, expertise and domestic football alliances in others. Unusual words also helped to differentiate people:

(110) 21:17 17/06 (14<sup>th</sup> post by ar/sa)

I've just eaten 250 grams of pasta. I'm a little podgificated (?)

Messages did not contain the same level of familiarity as many of the Harry Potter messages in chapter 3 but this is not surprising given the fairly short duration of the community.

#### 4.7.2 Organisation component

The engaged discussion within the community around the topic of the world cup incorporated member generated content and the provided key content on the website. 42% of the messages in the study were at least reactive i.e. a response to a previous communication. Replying to a group rather than to an individual did not appear to pose a problem and the permanent transcript of messages on the website made it easier to target messages appropriately, for example:

So **turkey**, you think you're clever....

To **JP/DK**: Japan – major bad luck not to beat the Turks...

The example of the threaded message below highlights the ongoing nature of the discussions over a number of days and the way in which members could control the level of their involvement with the community. It also provides an example of the increased one-to-one communication that occurred following the 'sharing teams' intervention made by the facilitator during week 3.

(117) 15:31 18/06 (10th post by es/uy)

To **JP/DK**: Japan - major bad luck to not beat the Turks. Want some more points? How about joining with Spain? RSVP !

(128) 00:55 21/06 (7th post by jp/dk)

Re 117 yes please! hope its not too late! with no matches forgot to check the website :)

(136) 22:50 21/06 (11th post by es/uy)

Re128 Brilliant! Next match tomorrow. Should be good. Cross your fingers!

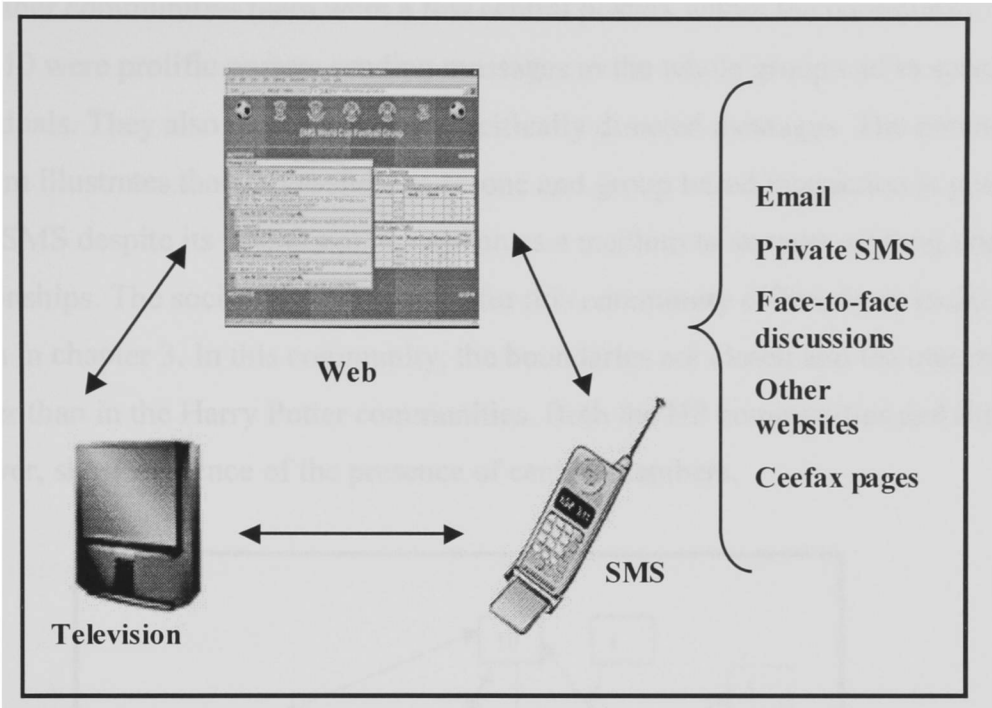
Threading supported interactive discussions as was the case in Site B in chapter 3. Interactive discussions took place between most members of the community. Members varied in respect to their football knowledge and expertise. Some members felt less comfortable engaging in discussions but were happy to provide expert facts and figures for the group. The novice and expert intervention during week 2 encouraged some members to post for the first time.

#### **4.7.3 Integration**

The community used the different components of the system to support their activities. The two technical components of the system were well integrated and allowed different types of interaction. SMS messages sent without referring to the website were less interactive and tended to be slightly shorter. SMS, however, allowed messages to be spontaneous and context based. It did not hamper discussions and was seen as a natural medium for discussion about the World Cup. SMS messages were responded to immediately and provided a perfect medium for alerting people to changes on the website.

The website allowed a permanent transcript of the messages to be recorded and displayed. The website also contained extra features including the two competitions. In addition, members used the television, radio and other websites to support their discussions and claims. Information concerning the goal scorer was particularly difficult to locate post match. Members reported finding this information via Ceefax pages and obscure websites. Face-to-face communication also played a role as did SMS messages and emails. Figure 4.5 shows the integrated components of the community. Members that knew each other combined technologies to enhance their chances of successful claims at

the expense of others. One member rang another member’s mobile phone from a landline. This ensured that the other member could not send in a winning SMS claim before they did.



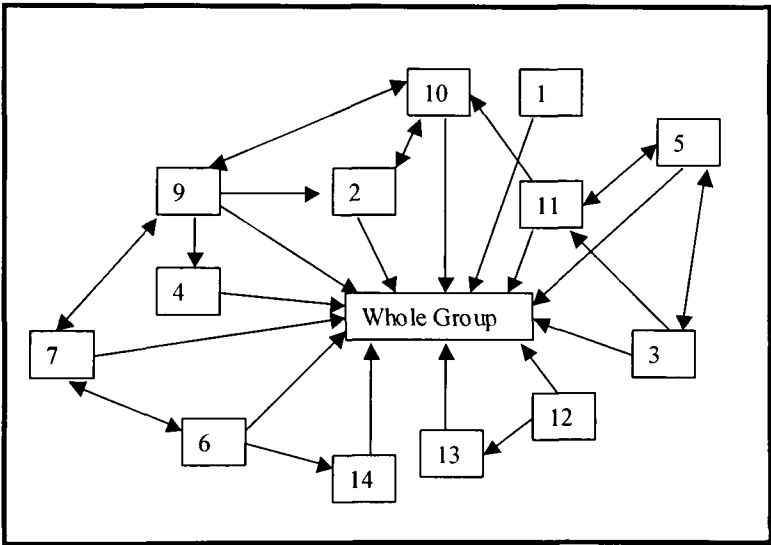
*Figure 4.5 Integration amongst technologies for community support*

The questionnaire results showed that members discussed the group with other members in face-to-face settings and via phone calls, SMS messages and emails. When interaction within a system is primarily technology mediated, as in the SMS football group, it is predictable that the same media will be used to extend the discussions beyond the system. The fact that members also communicated with each other face-to-face reinforces the idea of media integration within digital communities. Members also discussed the group with friends, family and work colleagues, again using a variety of media.

**4.7.4 Social network**

Figure 4.6 illustrates how the members interacted with one another and the whole group via the common virtual place. The numbers represent the members. The connecting lines indicate communication direction. The network diagram indicates that all the members

that posted a message posted at least one to the whole group. The majority of members also posted messages to specific individuals. The vast majority of interactions were between ‘strangers’ i.e. the poster did not know the identity of the recipient. In common with other communities there were a few central posters within the community. Members 9 and 10 were prolific posters sending messages to the whole group and to specific individuals. They also received many specifically directed messages. The network diagram illustrates that successful one-to-one and group based interaction is possible using SMS despite its traditional perception as a medium to support existing one-to-one relationships. The social network pattern for this community differs from social networks shown in chapter 3. In this community, the boundaries are closed and the community is smaller than in the Harry Potter communities. Both the HP communities and this one, however, show evidence of the presence of central members.



*Figure 4.6 Network ties between members of the SMS football group*

**4.7.5 Location**

As with the Site B Harry Potter community described in chapter 3, this community had a shared online meeting place in the form of the website and the message board in particular. This provided members with a community location. This socially produced space provided a meeting place and a location for the transcript of the community’s



interactions. The history of the community was played out through these transcripts. The SMS part of the system had three implications for the location of the community. Firstly, SMS alerts and messages sent by the facilitator encouraged interaction and importantly encouraged members to visit the shared location of the website. Secondly, the SMS alerts and messages could be received by members anywhere and at anytime. The community messages encroached upon their physical, real world locations. In turn, members' responses sometimes revealed their actual locations and so in a way extended the location of the entire community. Finally, during relayed SMS messages all members were connected to the community base via their real, physical locations. The SMS feature of this community extended the location of the community in a way that was not possible within the Harry Potter communities studied in chapter 3.

#### **4.7.6 Summary of the community in terms of the framework**

##### **Membership component**

The community was characterised by a strong sense of social identity borne out of a shared topic of interest and latterly out of personal interest in fellow members. Making a personal investment in the community and the ability to create and follow the group's shared history are also key features.

##### **Organisation component**

The community was characterised by an emphasis on reactive member generated content. This content included common SMS abbreviations and as well as standard English. It was combined with provided and updated information on competitions and match results.

##### **Integration**

Integration between media was very important in this community. SMS alerts integrated well with hits to the website. Members successfully combined the television, the website and SMS to support their communication needs.

### **Social network**

The community was characterised by a moderately interconnected network. All members posted messages to the entire group and the majority of members also posted messages to specific individuals. A couple of central members were identifiable.

### **Location**

The community had a shared online meeting place in the form of the website and the message board in particular. This provided members with a community location and a transcript of their interactions and history. The SMS part of the system encouraged access to the website and extended the location of the community to include the members' real, physical locations.

4.8 Community activities

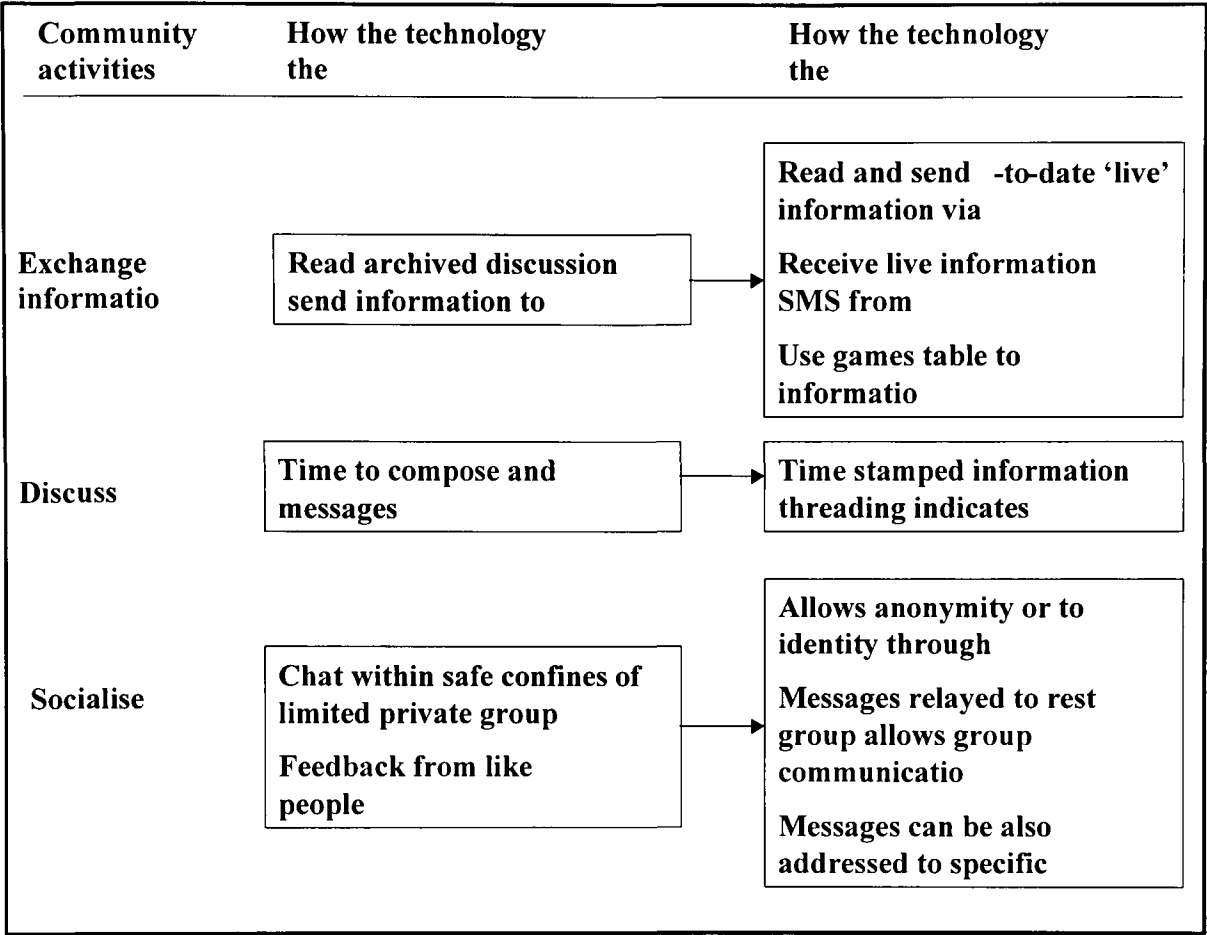


Figure 4.7 Community activities supported and enhanced by the SMS-web system

Figure 4.7 shows that members of the SMS-football community engage in a number of activities including exchanging information, discussing ideas and socialising. The activities are based on Preece’s (2000) activities (see 1.6.6.2). The system technologies support these activities by allowing time to compose and edit messages, by providing an archived discussion and by enabling a private group setting for discussion. The system enhances the activities by allowing up-to-date information to be sent and received via SMS, by providing threaded discussion and through the provision of additional features such as the games table.

## **4.9 Summary of main findings**

- High levels of cohesion were reported for a technology mediated group
- Interest in the topic increased at least initially
- Involvement with the group was heavily dependent on external activity
- Threading led to interactive discussions
- Differences between the two components in terms of speed of response to messages. Both components of the system were used. Members integrated the two components well and integrated the system with other media
- The facilitator interventions led to a number of interesting and observable events
- A variety of message types were sent including opinion, chant, information and personal narrative messages

## **4.10 Discussion**

This study has successfully developed and demonstrated a SMS and web based interaction system. The main aim of this study was to try and develop a digital community based around the World Cup using SMS in conjunction with a website. The results show that this was achieved to some extent. The mean level of cohesion was quite high and comparable with levels reported in face-to-face groups. All participants thought there was a moderately high sense of community between members.

### **4.10.1 Type of community**

Although this community only existed for a short period of time, it did possess characteristics present in much more developed and sustained communities. The community framework headings have provided a way of assessing the type of community that developed during the study. In terms of the membership component of the community, the messages sent to the website showed an understanding of the shared history of the group, a strong sense of social identity and of personal investment in terms

of time and effort. The organisation component of the community revealed that the members had produced an engaged, ongoing and lively community discussion. The different levels of interest and expertise in the topic helped promote a range of friendships and interactions. The community members successfully integrated the two components of the system. They used other media to support their information gathering and communication needs.

The community is characterised by a close network of ties between members. Ties between individual members existed and the community contained a few central members. Despite being a closed community, the questionnaire identified that discussions about the group itself had spread beyond the confines of its members. The SMS football group had become integrated into members' wider, personal communities. The website provides the community with a distinct location online where members can meet. The mobile aspect of the system, however, means that members can be connected to the community even when they are away from the shared location.

#### **4.10.2 Generating interest**

Interest in the topic of the World Cup showed an initial increase as the competition got under way. Although interest levels then returned to pre-study levels, members reported that their participation in the group had increased the number of matches watched, their enjoyment and their engagement with the tournament. In general the system was well liked and well used. Members generated considerable discussion around the topic of the World Cup and actively took part in the competitions.

**“I have enjoyed the extra interest that the SMS web site gave the world cup. In particular an interest in teams other than the usual European teams that are so often the focus of these events.” (Female 19)**

Given the finite nature of the study and its topic of interest it is perhaps not surprising that interest did not continue to grow over the four-week period. Participants were most interested in the topic of football whilst both their teams were still in the competition.

Interest in each other, however, continued to grow over the course of the study. Enjoyment in taking part in discussions and in finding out more about other members grew steadily. Although the system was only intended to last as long as the World Cup, several members were still keen to post messages after the end of the tournament. During the last week, with the competitions already decided and very few games left to play, chat messages continued at a reasonable rate. It appears that the social needs of the group drove the technology use in the final stages of the study.

#### **4.10.3 The nature of the discussions and facilitator interventions**

The messages sent to the website reflected an interest in both the assigned teams and the tournament as a whole. Chant type messages were specifically related to assigned teams whilst opinion messages related to all aspects of the tournament. As the tournament progressed and more teams were knocked out so chant messages, which were used to hype up the chances of assigned teams, decreased. As the tournament progressed people were able to critically discuss the merits of certain matches and players. Members began to spot home-grown experts and like-minded people or the opposite and responded accordingly. In particular a number of battles and friendships ensued.

The design of the study ensured that there was sufficient flexibility for the participants to interact and develop a sense of community. In order to achieve this flexibility tight controls could not be exerted over the study. In turn, this means that it was not possible to quantify the effects of the facilitator interventions on message and website activity. Nevertheless a number of interesting observations regarding these interventions were made during the study. The prompting questions posted by the facilitator during week 1 were useful in getting the members to start posting messages. Although supplying new and interesting information is important, the community members themselves need to be the ones generating the discussion. In the second week members were encouraged to interact with each other through novice and expert questions. Members were invited to submit their own explanation of the 'offside rule' for the benefit of one of the novice members who still had difficulty with the concept. The best explanation as judged by the

novice member won a few extra points. The offside competition allowed an easy way into the discussions for many members. It also provided a role within the community for the novice and increased her subsequent participation as she reported in the post study debriefing:

**“The judging became an opportunity for me to get involved.”(Female 26)**

The introduction of team sharing in week 3 encouraged members to communicate directly with each other. During this week there were noticeably more targeted messages. Members had to sort out sharing arrangements and explain why they did or did not want to share with a particular team. The team sharing increased the sense of closeness between some members which was expressed through their messages of condolence when their teams were eliminated.

(140) 18:39 22/06 (12th post by es/uy)

What the @&£\$ did that linesman think he was playing at? Sorry jp - out so soon.

All the relayed messages received some immediate responses and the final questionnaire revealed that the relaying on of SMS messages had been the most popular intervention.

#### **4.10.4 System use and integration**

The two components of the system were used in different but complimentary ways. The SMS medium proved to be a natural way of commenting on football matches and expressing opinions regarding players and results. SMS supported short informal messages, which were sent from many different locations, often in direct response to watching a match. The SMS component allowed alerts to be sent out to all the members ensuring that they continued to feel included and involved in the group. SMS also ensured rapid responses from group members. SMS broadcasts proved a faster and more reliable method for obtaining feedback than messages posted on the website. There may be differences between media depending on their voluntary aspects (Wellman, personal

communication). Face-to-face communication, for example, is not as voluntary as email communication. The fact that SMS elicited more responses may be due to the fact that people feel obliged to respond using this medium. The medium is quite intrusive and can interrupt other activities. As an asynchronous medium, however, it is not vital that an instant response ensues. The issue of SMS response rates will be examined further in the next chapter under more naturalistic conditions.

The limited length of SMS messages did not appear to restrict members' messages. Members had no difficulty explaining the offside rule in a single SMS and there was just one example of a comment running over into two text messages. The majority of messages contained standard, English words and phrases and there was little 'text speak'. Recent research suggests that text speak may not be used as universally as it was once thought (Döring, 2002a; Shortis, 2000). Some common abbreviations, however, were used. The paucity of 'text speak' may relate to the relative lack of member familiarity but may also relate to the balance between input device and output medium. Members may have felt that it was more appropriate to enter their messages as if using a qwerty keyboard because of the fact that their messages did not appear on another mobile phone but appeared on a website.

The website provided two main functions. It provided a communal space for the community. This space included the match fixtures and results and the competition scoreboards. The website also provided a threaded archive of all the groups' messages. In combination with SMS a communal memory of the group was built up. This allowed the group's activities to be played out in front of its members allowing them to become involved in its history. In addition, the members responded well to the notion of group texting. They sent messages directed to the entire group as well as messages directed at specific individuals. Despite the fact that members knew they were sending messages to an automated system they 'texted' as if directly to another person, yet were also able to cope with the notion of formatted SMS messages for the competitions. The group integrated the two components, SMS and the website, very well leading to a community that contained both spontaneous messages that captured the moment as well as more



reflective and in-depth discussion. Finally, the members of the digital community that developed used the system in conjunction with other technologies. These included the radio, television and other websites as sources of information. This is perhaps not surprising given the activity of the community and its relation to real-world events. Members did, however, integrate other communication technologies into their community in order to carry out their activities and strengthen their sense of community. In this chapter, as in chapter 3 the focus of the community has been on a real-world activity. In chapter 3 the focus on Harry Potter allowed comparisons to be made between the two different technologies underpinning the communities. In this chapter, the focus on the World Cup provided a discussion topic with a definite beginning and end. This was important in trying to create a community in a short space of time. Members of the Harry Potter communities in chapter 3 had started to develop friendships and interests that extended beyond Harry Potter. They used other media to communicate and enhance their relationships. The development of such relationships will make it more difficult to separate the online aspect of the community from the physical world. This suggests that other digital communities, even those without a real-world interest are likely to integrate other technologies into their social interactions.

The development of the SMS-web based system permitted a greater degree of control over the type and quantity of the data collected. The level of access to participants meant that more specific assessments of identity, for example, could be made. The community described here, however, demonstrated similarities with the communities described in chapter 3 in terms of a sense of social identity, interactive discussions and the presence of central members.

#### **4.10.5 Implications for design**

- Systems, which combine SMS and the web must take care to utilise the benefits of each medium. Make use of context and location with SMS and provide more detailed information on the website.

- The two components of the system must be well integrated. SMS alerts, for example, encourage people to look at the website. Alerts remind people they are part of the group, whilst viewing the website allows people to engage in the history of the group.
- Future designs might incorporate more SMS relaying into the system whilst maintaining the permanent transcript of messages present on the website.

#### **4.10.6 Implications for community**

- Developing this kind of digital community within a short time period is possible. The type of community that results displays a strong social identity and shared group history.
- Fan communities in particular are heavily dependent on external activity. A community topic must provide enough general activity to allow discussion to take place and must be sustained enough to allow time for personal relations to develop.
- To prolong and strengthen the community it is necessary to provide a number of different roles for members and opportunities for group members to get involved.

#### **4.11 Chapter summary**

In this chapter an integrated digital community was successfully developed around the topic of the World Cup. The community framework provided a way of assessing the type of community that developed during this study. Despite the limited time span, the combination of SMS with web-based technology led to a cohesive group of members possessing many characteristic community features. Members of the SMS football group successfully combined the two components to discuss football and the World Cup and to take part in two competitions. Involvement and engagement in the tournament increased and members reported moderately high levels of cohesion and sense of community.

The development of the SMS-web based system permitted a greater degree of control over the type and quantity of the data collected. More specific assessments of community feeling were made and activity logging enabled cross matching of messages and external events to take place. This chapter has further explored the notion of community in digital domains and has found that perceptions of a sense of community can be fostered through digital media even within very short time periods. The framework was particularly useful in identifying the importance of media integration within this digital community. Not only did the members successfully integrate the two components of the system but they also integrated a range of other media into the community. Members of this community, as in the Harry Potter communities of chapter 3, quickly integrated their involvement into their physical lives.

The use of SMS in this study highlights characteristics that make it suited to community support. These include, its informal nature and the way in which it elicits a rapid response. In the next chapter, SMS is explored in more detail within a naturalistic setting. The community framework is used to characterise the types of community that SMS does and could support.

## Chapter 5

### TEXT MESSAGING WITHIN DIGITAL COMMUNITIES

In this chapter the community framework is used to examine the types of communities supported by text messaging or SMS (Short Messaging Service). The growth of SMS use is reported and previous literature is reviewed. The use of SMS as a means to support communities is explored. This is achieved through the use of a diary study, which collects naturalistic data from participants. The diaries are supplemented by a social network questionnaire and informal telephone interviews. SMS is used to support the social interaction needs of geographically close community members. The integration of SMS and its adaptation towards a synchronous medium are also considered.

#### 5 Introduction

In chapter 4 it was shown how text messaging could be successfully integrated with a web site to support a short lived digital community. In this chapter, text messaging is explored in a more naturalistic setting. The community framework is used to characterise the types of community that SMS supports or could possibly support. A new methodology is introduced with the aim of gathering naturalistic data in the field. Before describing the study itself an overview of SMS, its history and existing research is presented.

Mobile phones, once thought of as solely a tool for businessmen, are now almost ubiquitous within the UK. Reports for February 2002 suggest that 73% of adults in the UK own a mobile phone. This figure rises to 89% for 15-24yr olds (Ofcom, 2002). Whilst mobile phones are incredibly popular it is their text messaging function that continues to attract attention. Text messaging or SMS was introduced commercially in 1995 and its popularity has been increasing ever since much to the surprise of the networks. SMS allows the exchange of short messages up to 160 characters in length. Users enter characters via the keypad on the mobile phone. Messages are typed using the numeric keys, e.g. key 2 can type 'A, B, C' (depending on whether you press the key one, two or three times), key 3 can type 'D, E, F' etc. Despite the restrictions in length and the awkwardness of input, SMS is used for a range of communication

purposes. Costs vary but on average a text message costs the sender about 10p. Approximately 10 messages can be stored at any one time on the phone. Messages are usually sent on a one-to-one basis although there are functions available on some mobile phones to send messages to multiple recipients.

### 5.1 Growth of SMS

In January 1999 that the network operators in Britain finally made it possible to use SMS across different networks. Since then SMS use has continued to increase. Figure 5.1 shows how the number of text messages sent in the UK has increased steadily over the last two years. Peak usage has been recorded in January and is thought to coincide with New Year. The increasing popularity of SMS has seen some networks exploring further ways of enhancing their most popular service through picture messaging or through landline based SMS (Cullen, 2002). In May 2002 Britons sent an average of 45 million text messages each day compared to 30 million in May 2001. It is estimated that the UK text messaging annual total for 2002 will be 16 billion (Mobile Data Association, 2002).

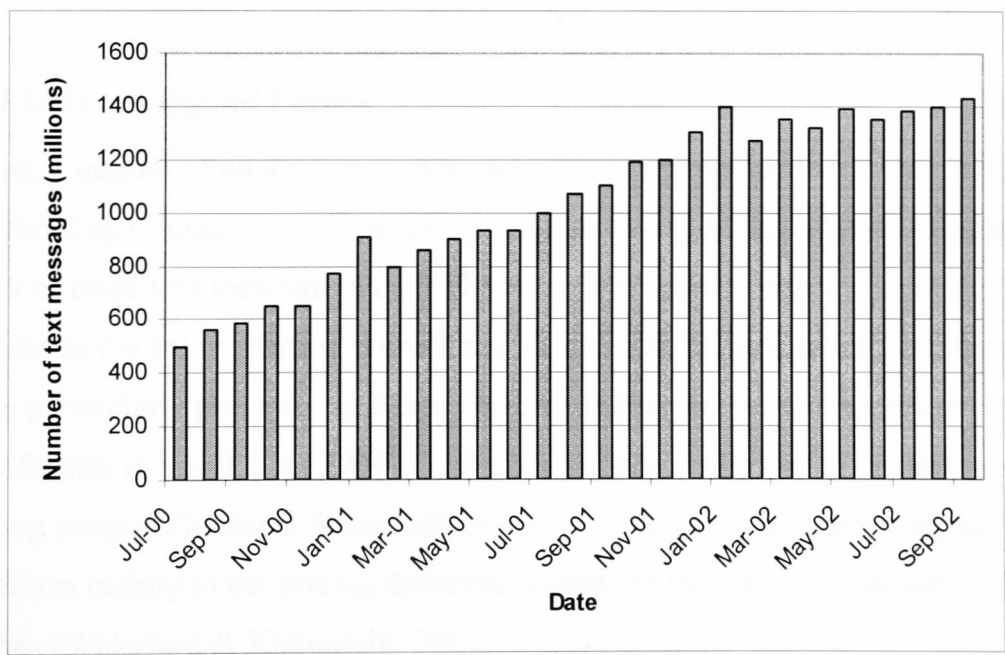


Figure 5.1 Text message growth in UK (July 2000-September 2002) (Source: Mobile Data Association)

## **5.2 Research on SMS use**

Although SMS is a relatively new technology, research from the UK and Scandinavia, where uptake has been the most prolific, reveals a number of interesting facts about its use.

### **5.2.1 SMS and young people**

Text messaging is particularly popular amongst young people (Ling & Yttri, 1999). In Finland, which has the highest mobile phone penetration most SMS users are young people. In the UK 18-24 year olds send on average 10 SMS messages a day (Vickers, 2000) and about 18% of the Dutch youth only uses their mobile phone for sending text messages (Algemeen Dagblad, 2001). 80% of 15-24 year olds conduct their social lives via SMS messages. 20% use them to arrange dates and 40% of the population use it to say 'I love you,' (BBC Joy of Text 2002). Network operators explain the appeal of SMS in terms of practicality (Benson, 2000). Cost, discretion, privacy, and the control factor, you get to read if you want when you want. Others, for example, Ling & Yttri (1999) suggest that SMS use concerns more than just practical issues. It is about being available, staying in touch and being part of something.

#### ***5.2.1.1 SMS use beyond Europe***

In Japan, a quarter of all 4-15 year olds own a mobile phone and well over half of high school age students have one, many Internet enabled. Half of these youngsters send 10 or more text messages a day. The content of these messages is not as important as the act of staying in touch itself (Ishii, 1999). In Australia too the use of SMS is particularly prevalent amongst children and teenagers and is used to contact closest friends (Carroll et al, 2001). In the US there is a high rate of instant messaging by young people (Grinter & Palen, 2002) whereas text messaging is hardly used at all. This relates mainly to the pricing differences between the two technologies in the two countries (Wakeford & Kotamraju, 2002).

### **5.2.2 Identity and belonging**

Mobile phone ownership relates to the creation of personal identity. The branding, size, model or colour of a mobile phone delineates 'street cred', (Taylor & Harper, 2001). A mobile telephone is an expression of your personality (Ling, 2001) and is the focus of discussions regarding how it should be carried and where it should be used (Ling & Yttri, 1999). Personalisation of mobile phones has been found to be widespread amongst users (Blom & Monk, forthcoming). Mobile phone ownership also relates to social identity. The mobile phone defines a social network, those who carry a mobile phone and those who are defined as mobile phone friends (Kopomaa, 2000). Sending and receiving text messages also acts as confirmation of one's membership within the group (Stuedhal cited in Ling & Yttri, 1999). Carroll et al (2001) report a common comment that was observed after participants checked for SMS messages. Finding no new messages they would state that "*No one loves me*".

### **5.2.3 Communicative functions of SMS**

Despite its restrictive length, SMS is used for a range of communication purposes. These functions are dependent to some degree on age. Adults are more likely to use SMS for instrumental purposes i.e. planning and coordinating events, sending out reminders and arranging other communication choices (Ling & Yttri, 1999; Döring, 2002b; Eldridge & Grinter, 2001). In addition to these instrumental or task based purposes, SMS is also used for expressive purposes (Ling & Yttri, 1999). Expressive messages convey more social or emotional content (Calhoun, 1992). In younger users the emphasis of SMS is on entertainment and socialising rather than the exchange of information (Kopomaa, 2000) although many people regularly combine expressive and instrumental content (Döring, 2002b). In addition to the actual content of the message, its meta-content is also important (Ling & Yttri, 1999). Meta-content refers to the idea that sending and receiving the message acts as confirmation of the relationship i.e. the receiver is in the thoughts of the sender. This appears to be a new form of communication and is illustrated in the 'goodnight message' (Eldridge & Grinter, 2001; Wakeford & Kotamraju, 2002).

5.2.4 The language of SMS

SMS only allows very brief messages to be sent. This need for brevity in messages is thought to be behind the development of so-called text-speak. This list of about 1000 commonly used abbreviations and acronyms e.g. R (for are) U (for you) and 2 (for to) has even been published in the form of a guide for beginners (Mander, 2001). Döring (2002a), however, suggests that despite space limitations, abbreviations and acronyms are not that frequently used in text messaging. Users are often able to formulate meaningful messages without having to resort to shortened words. They may be cultural differences. A corpus of 240 English language SMS messages reviewed by Shortis (2000) found a higher proportion of acronyms and abbreviations than that found in Döring’s German study.

Shortened forms, where they are used, are not only about saving space. In fact, on average only half the available space is used anyway (Döring, 2002a). Short forms may be associated with identity and play (Döring, 2002a). The carefully learnt letters and phrases associated with text messaging also allow youngsters to establish a common form of expression between peers (Taylor & Harper, 2001). SMS forms do not facilitate a general collective identity of SMS only users. The majority of abbreviations observed by Döring were either generally comprehensible to the public at large or referred to some aspect of a social group which existed independently of SMS communication. Döring (2002a) suggests that the second purpose of shortened forms concerns playing with the language, having fun with the construction of the message and leaving it open to interpretation.

5.3 The current study

This study explores the use of SMS within a community setting. Table 5.1 shows a section from the original classification table (1.1) presented in chapter1. It details the features of the technology studied in this chapter.

Type	Sync	Async	Ad-hoc	Organised	One-to-one	One-to-many	Mobile	Fixed	CMC technology
2		•	•		•		•		Text messaging

Table 5.1 Classification features of the technology studied in this chapter



The aim is to examine how SMS is used by members in support of their communities. This study is exploratory in nature but poses a number of specific questions of interest:

1. Does SMS contribute to a sense of community and of shared identity?
2. What are the characteristics of SMS messages within community groups?
3. What are the characteristics of SMS partners within community groups?
4. What type of community is supported by SMS?

### **5.3.1 Study overview**

In Hamman's (1999) study of network communities based around America Online, (AOL), he uses individual respondents as the starting point for examining those communities. In this study a similar approach is adopted. Regarding individuals as the starting point of their communities allows a sort of 'bottom-up' approach to the process of defining the type of community to which the participants' belong. The study examines community through a number of individuals rather than through a group of people with a well-defined membership as in the previous study. This allows an examination of ego-based networks as described in chapter 1. Data was collected using a diary study. Diary studies allow participants to record their behaviours and feelings in real time rather than having to rely on retrospection. Diary studies have been successfully used for the collection of naturalistic data in Human-Computer Interaction (HCI) and in Computer Supported Cooperative Work (CSCW) research (Adler et al, 1998; Rieman, 1993). Diaries are becoming increasingly useful in terms of collecting realistic data on mobile technology use (Eldridge & Grinter, 2001; Palen & Salzman, 2002; O'Hara et al, 2002). Diary design is highly research specific. Pre-study interviews determined key factors such as appropriate study period, layout, and pre-defined categories versus free text input. The diaries were designed on the basis of these factors and with reference to the guidelines provided by Corti (1993). The diaries were trialled before the study to ensure that they were readable and understandable.

### **5.3.2 Participants**

12 participants took part in the study, 8 male and 4 female with an age range of 17-40. All the participants owned a mobile phone, used text messaging and were willing to keep a diary for duration of study. Although some participants knew each other, they were not explicitly made aware of anyone else's involvement in the study.

### **5.3.3 Procedure**

Prior to the study participants completed a demographics questionnaire. This collected information on the length of mobile phone ownership, length of time using SMS and background information on age and employment status. After which the participants were each given a paper diary and asked to record in the diary any SMS messages that they sent or received over the next 10 days. Each SMS message was to be recorded on a separate page. The diaries contained 20 pages and participants were asked to hand back their diaries after the ten day period or when they had completed the 20 pages, whichever was sooner. A copy of a completed diary entry was included with the diaries providing clear instructions for filling in the diaries. Participants were contacted regularly throughout the study to check for any problems. After the diaries had been returned the participants completed a social network questionnaire. Following the completion of the study a number of the participants were contacted by telephone to discuss some of the issues arising from the diaries and questionnaires in more detail.

### **5.3.4 Data collection**

**Diaries:** Each diary entry page contained a series of multi-choice questions about the SMS message that the participant had sent or received. The questions included: who the message was from or to, the length of the message, the topic of the message and whether or not it was related to any other form of communication. Participants were told that they could include the exact transcription of any of the messages if they so wished.

**Social network questionnaire:** Once the diaries had been returned it was possible to make a note of each participant's communication partners. To find out more about the

communication partners, the participants were then sent a social network questionnaire to complete. The questionnaire contained multi-choice questions regarding each participant’s communication partners. This included, details about the length of relationship with the partner, the type of relationship, their relative location and other ways in which they communicated (copies of diaries and questionnaires can be found in Appendix F).

**Telephone Interviews:** These were informal discussions with some of the participants and covered their attitudes towards SMS and their perceptions of the communities to which they belong. The discussion guide for the telephone interviews is outlined in Appendix F.

**5.4 Results**

The analysis of the diary, questionnaire and telephone interview data is divided into 2 sections. The first examines how the diarists use text messaging. In the second, these results are then discussed in terms of their implications for the five headings of the community framework. Technological support for the community’s activities is examined before the wider implications of the results are then examined in the discussion section.

**5.4.1 SMS user types**

	Frequent users *	Less frequent users **
Number of users	6	6
Number of communication partners	6-8	1-5
Age range	17-26	21-40
Average length of mobile phone ownership	11 months	33 months
Average length of time using SMS	9 months	16 months

*Table 5.2 Characteristics of frequent and less frequent SMS users*

\* Completed all 20 entries within or before completion of 10 day study period  
\* Completed less than 20 entries despite completing 10 day study period

There was considerable individual variation across the diarists. Table 5.2 indicates that half the participants were classified as frequent users and half as less frequent users. The differences in usage were most related to age and length of mobile phone ownership. Frequent users were younger than the less frequent users. Frequent users on average have had a mobile phone for a shorter time and have used SMS for less time compared with less frequent users. Frequent users, however, used the mobile phone both to make calls and to send text messages from the outset. Less frequent users acquired their phones prior to the explosion of SMS use and may be more used to making calls with their phones.

**5.4.2 Message and partner characteristics of SMS**

**5.4.2.1 Interactivity**

Tables 5.3 and 5.4 show the interactive nature of SMS. 72% of the messages were related to another communication. Most SMS messages were related to another text message. SMS is used in a very immediate manner. 74% of the messages sent or received were for immediate use rather than future reference. As was noted in chapter 4, SMS messages tend to be responded to immediately. With the exception of one message during the study, all message and reply messages were completed during the same day.

Total messages	Sent (%)	Received (%)	% SMS for immediate use	% SMS for future reference	Message type	
175	46%	54%	74%	26%	Single Message & reply Session (> 1 reply)	53% 30% 17%

*Table 5.3 Summary of SMS Message characteristics (1)*

Half of the SMS messages were for greeting and planning purposes. Messages can be purposeful and often ask for and provide information (14%) or reminders (10%). They might contain jokes (13%) or light-hearted insults (7%). Sometimes participants described the content of their messages as ‘just for fun’. Replies might be an indication the previous message has been received and the recipient is available for communication. SMS also served as a quick method for distributing news or requests

without prolonged discussions. The technology has a functional and a social purpose for individuals and their community.

Message content		Location when message sent or received		Relation of messages to other types of communication		Length of message	
Greeting	26%	Home	34%	Another SMS	37%	<1 line	5%
Planning	24%	Travelling	22%	Face-to-face	21%	1-2 lines	29%
Information	14%	Pub/Café	19%	Landline call	10%	3-4 lines	41%
Joke	13%	Work/College	13%	Mobile call	3%	>4 lines	26%
Reminder	10%	Other	11%	Email	1%		
Insult	7%			Unrelated	28%		
Advice	3%						
Other	4%						

Table 5.4 Summary of SMS Message characteristics (2)

### 5.4.2.2 Integration data

Table 5.5 shows that most SMS partners were classified as close friends and over half of the partners live in the same town as the diarist. Communication media are well integrated into the majority of the diarists’ relationships. In all but a single relationship SMS is only one of the ways in which a pair communicates. The vast majority (66/70) of relationships were also supported by face-to-face communications. Over three-quarters (53/70) of the relationships were also supported by mobile phone calls and a third (23/70) by email.

Total number of partners	Location of partner		Close relationship		Length of relationship		Partner relationship	
70	Other town	19	Close	60	<3 months	2	Close friend	30
			Not close	10	3 months-1 yr	12	College mate	13
	Same town	43			1-3 years	21	Family	8
					> 3 years	35	Work colleague	7
	Same building	8					Casual friend	5
							Team mate	4
							Neighbour	2
							Other	1

Table 5.5 Summary of partner characteristics

Table 5.6 shows differences between partners in terms of their communication media. This difference depends to some extent on the location of the partner relative to the

diarist. All the diarists communicated face-to-face with partners in the same town as themselves.

Location of partner	Other methods of communication			
	Face-to-face	Mobile calls	Email	Landline
Same building	8/8	7/8	3/8	6/8
Same town	43/43	26/43	11/43	27/43
Different town	15/19	10/19	8/19	15/19

*Table 5.6 Communication methods for different partners*

A greater proportion of partners in different towns used landline calls and email to communicate compared with partners in the same town. Relationships between people in the same building or in the same town were on average supported by a greater number of communication media compared to those between people living in different towns (3 and 2.7 versus 2.5).

### 5.4.2.3 Identity

All the participants stated during the telephone interviews that SMS was important in supporting their sense of community.

## 5.5 Community framework analysis

The results are now discussed in terms of the five headings of the community framework.

### 5.5.1 Membership component

The results indicated that diarists considered SMS to be an important way of supporting their communities. Diarists also expressed a strong sense of community in regard to their SMS partners. SMS is used to maintain and support a sense of group identity. This is achieved in a number of ways. References to the group’s shared

history; a particular event, place or meaning is one such way. This can be seen in the following example with reference to the frog and duck pub or the “f&d”.

**B @ f&d 9ish, well? We r also goin 2 republic, so let me no mmmkay?**

The telephone interviews revealed that the act of sending and receiving messages rather than the actual content was also important in terms of group identity and feeling included within the group. Diarists did not want to feel that they were missing out on new information or gossip. Receiving a message let the diarist know that someone was thinking of them. Sending a text message was seen to be a good way of saying goodnight or to use one network operator’s terminology a good way of ‘touching someone’. Another diarist reported that being in an SMS conversation was being in a private world away from your physical surroundings. Because of this the diarist’s mother did not like her to send text messages in her presence and thought it was rude, like whispering. Finally the technology was used to organise group activities. Group activities allow personal and social identity to be maintained through face-to-face interaction as well.

SMS supports predominantly informal communication. Although participants communicated with work colleagues, the topic of the messages was always concerned with informal greetings or arrangements for social events. The expressive, playful nature of SMS allowed individuals to express themselves and to develop recognisable forms of language. Individual identity was developed in a number of ways. The use of signatures was one such way. In chapter 3 it was noted that group members used signature files at the end of their messages in order to convey information about themselves and to create a strong personal identity. As SMS messages are usually exchanged between close friends there is often no need for a sender to sign the message with their name. It is likely that the recipient knows the sender and that their name and number are stored in the recipient’s mobile phone address book. Therefore any incoming messages will be prefixed with the sender’s name. Senders still made use of signatures to convey individuating and stylistic information. One diarist used pictorial characters to represent herself in messages to certain communication partners (e.g. ☺). She also personalised messages by adding the thumbs up sign when she

thought something was a good idea. Another diarist used “**Mmmkay?**” as a signature to his messages with certain communication partners.

The use of so-called text-speak was another way of presenting individual identity. Diarists were expressive in their manipulation of the language and one diarist even presented his regional accent through his text messages “**R u comin oot 2nite?**” Other diarists purposely chose not to use text-speak but wrote complete messages in standard English. This also distinguished between diarists. The close set of relationships allowed diarists to become involved in their communities and a great deal of human feeling was expressed in the SMS messages. The study was conducted during the summer and many of the messages were concerned with exam results and helping each other make decisions about the future.

The social and personal identities displayed in this study are richer and more developed than those found in chapter 4. This is not surprising given the longer duration of the communities reported in this study. The community studied in chapter 4, however, was already using similar examples of social and personal identity language as found in this study.

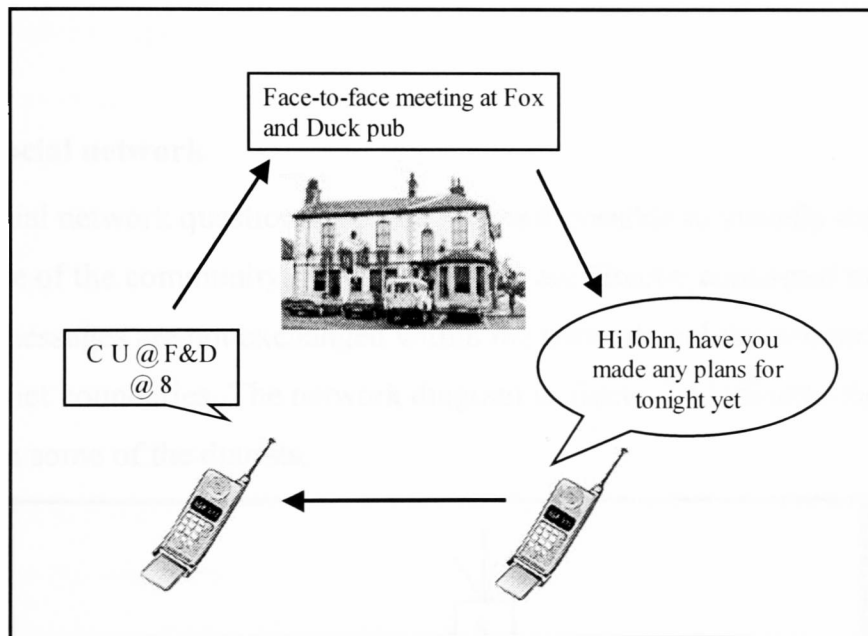
### **5.5.2 Organisation component**

The results indicate that the SMS messages displayed some level of interactivity. SMS was often used to link to conversations held previously in another medium or to pre-empt future discussions. Hammann & Hennessey (2002) noted that when a teenager sends out a SMS message a conversation usually ensues. This suggests that the content of SMS messages is likely to be highly interactive. The ongoing nature of the community, its relationships and conversations provides the time necessary to develop jointly produced meaning through the member generated content. Interactivity is useful in this respect. As mobile phones are usually ‘on’ it means that messages regarding advice and information, greetings, planning and friendly insults can all be received and replied to quickly. The content of some of the diarists’ messages was classified as being simply a reply as if the act of receiving a SMS message necessitates a reply of some form.



### 5.5.3 Integration

SMS use was varied. Despite being based upon a mobile technology, many text messages were sent or received at home. Using SMS can be appropriate when travelling on the train or in order to remain in contact when outside in a public place, e.g. on the beach. Diarists also reported using SMS when landlines were busy or at nighttime when it was felt to be less of a disturbance. In chapter 4 SMS was successfully integrated with a website. Figure 5.2 indicates that in naturalistic settings SMS is integrated with mobile phone voice calls and face-to-face meetings. Arrangements planned face-to-face or over the phone were often followed up with text messages.



*Figure 5.2 Integration of media (SMS, voice calls and face-to-face meetings)*

SMS is also used to follow up previous conversations. Figure 5.3 indicates an example from the study in which one diarist used SMS to send an update about a popular television show as it was happening. The original in-depth discussions had taken place face-to-face and via email. Several of the SMS messages also related to other sources of information including websites and television programs. In combination the diaries and social network questionnaire indicate that SMS supports pre-existing relations and helps to integrate technology and face-to-face interactions.

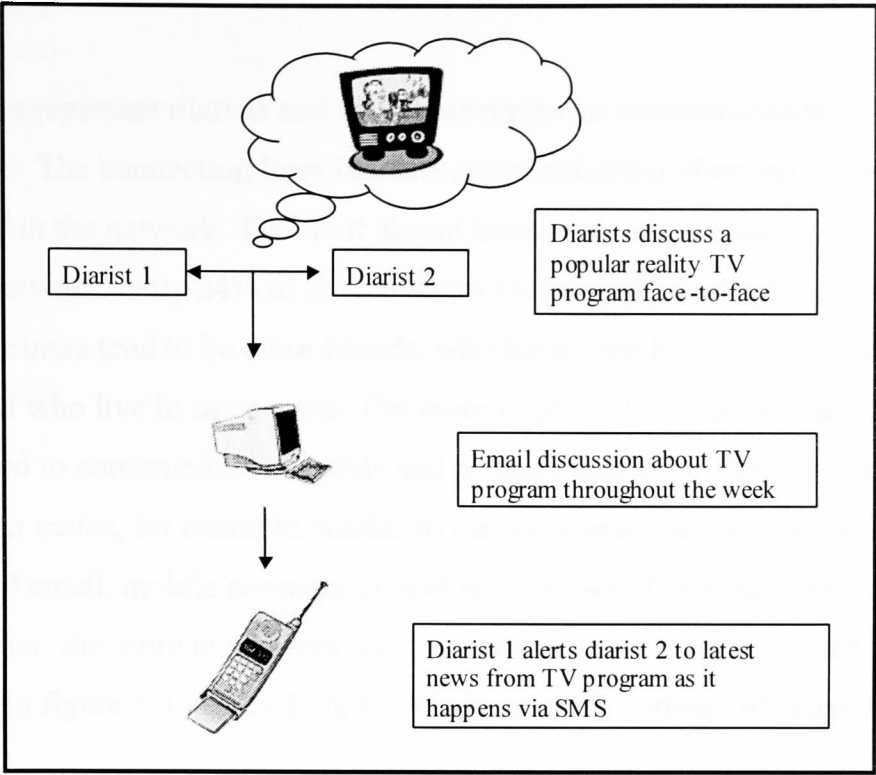


Figure 5.3 Integration of media across a number of days

5.5.4 Social network

The social network questionnaire data makes it possible to visually depict part of the structure of the community. Not all members are directly connected to one another. Many messages are not exchanged within the network and the community does not have strict boundaries. The network diagram in figure 5.4 indicates the relationships between some of the diarists.

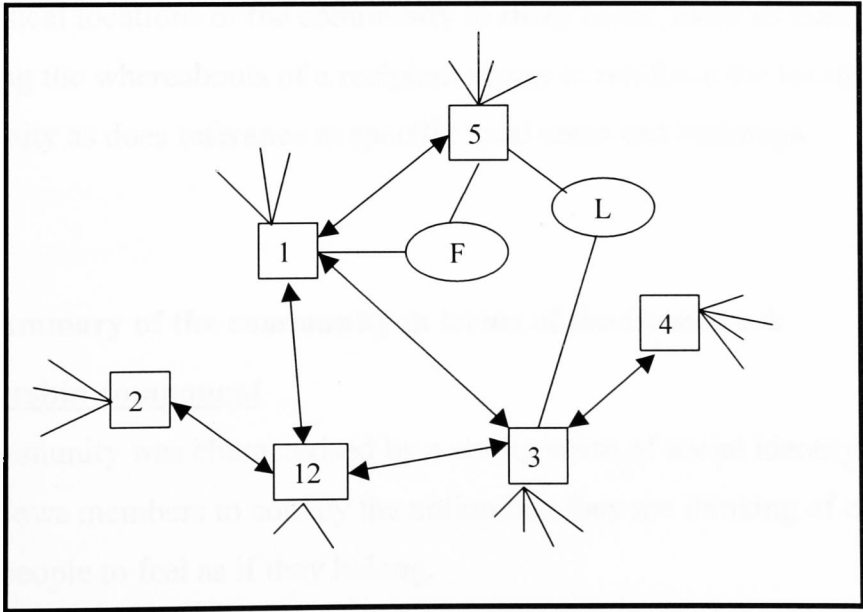


Figure 5.4 Social network diagram showing interactions between diarists

Numbers represent diarists and the letters represent communication partners in common. The connecting lines indicate communication direction between the diarists i.e., *within* the network. The short abrupt lines represent messages exchanged outside of the network. Only 24% of the messages exchanged remained within the network. SMS partners tend to be close friends, who have been know to the diarists for over a year and who live in same town. The more relations between partners the more media they used to communicate. Diarists and partners that were close friends, neighbours and team mates, for example, tended to use more methods of communication. These included email, mobile phone calls, and face-to-face. The longer people had known each other, the more media they used to communicate. The ego-based social network pattern in figure 5.4 differs from the whole network patterns of chapters 3 and 4.

#### **5.5.5 Location of community**

SMS is used to connect people in real locations. It does not provide a shared meeting place for the two communicators. SMS messages are usually exchanged between people who are both emotionally and geographically close. The diarists used the technology to encourage the community to meet up face-to-face in a shared location such as a pub or a café. SMS was also used to organise meetings between specific members of the community in private locations. The use of SMS supports a sense of community in between access to the shared locations of the community. It also keeps the physical locations of the community in sharp focus, more so than in chapter 4. Checking the whereabouts of a recipient serves to reinforce the location of the community as does reference to specific local areas and buildings.

#### **5.5.6 Summary of the community in terms of the framework**

##### **Membership component**

The community was characterised by a strong sense of social identity and belonging. SMS allows members to convey the notion that they are thinking of each other and it allows people to feel as if they belong.

### **Organisation component**

The community was characterised by an emphasis on reactive and interactive member generated content. SMS was commonly used to allow members to exchange greetings and to make plans.

### **Integration**

SMS allows media integration. It allows arrangements planned face-to-face or over the landline phone to be followed up and last minute amendments to be made.

Updates to conversations, for example those regarding television programs, can be made as and when they occur.

### **Social network**

The social network of the community indicates that not all diarists are directly connected to one another. Many messages are exchanged outside of the network and the community does not have strict boundaries. SMS supports a network of predominantly close friends. The longer members had known each other, the more media they used to communicate.

### **Location**

The technology in this community is used to connect people in real locations. It does not provide a shared meeting place for the communicators. SMS messages are usually exchanged between people who are geographically close. The diarists used the technology to encourage the community to meet up face-to-face in a shared location such as a pub or a café. The use of SMS supports a sense of community in between access to shared locations.

## **5.6 Community activities**

Figure 5.5 shows that members of this community engage in a number of activities including socialising, coordinating and planning events. The activities are based on Preece's (2000) activities (see 1.6.6.2) and have been expanded on the basis of the results of this study. SMS supports these activities by being discreet and private, by

allowing expressive language play and by allowing last minute plan changes to be made. The technology enhances these activities by allowing coordination anywhere at anytime and by enabling meta-content i.e. the idea that simply sending a message regardless of content lets the receiver feel included.

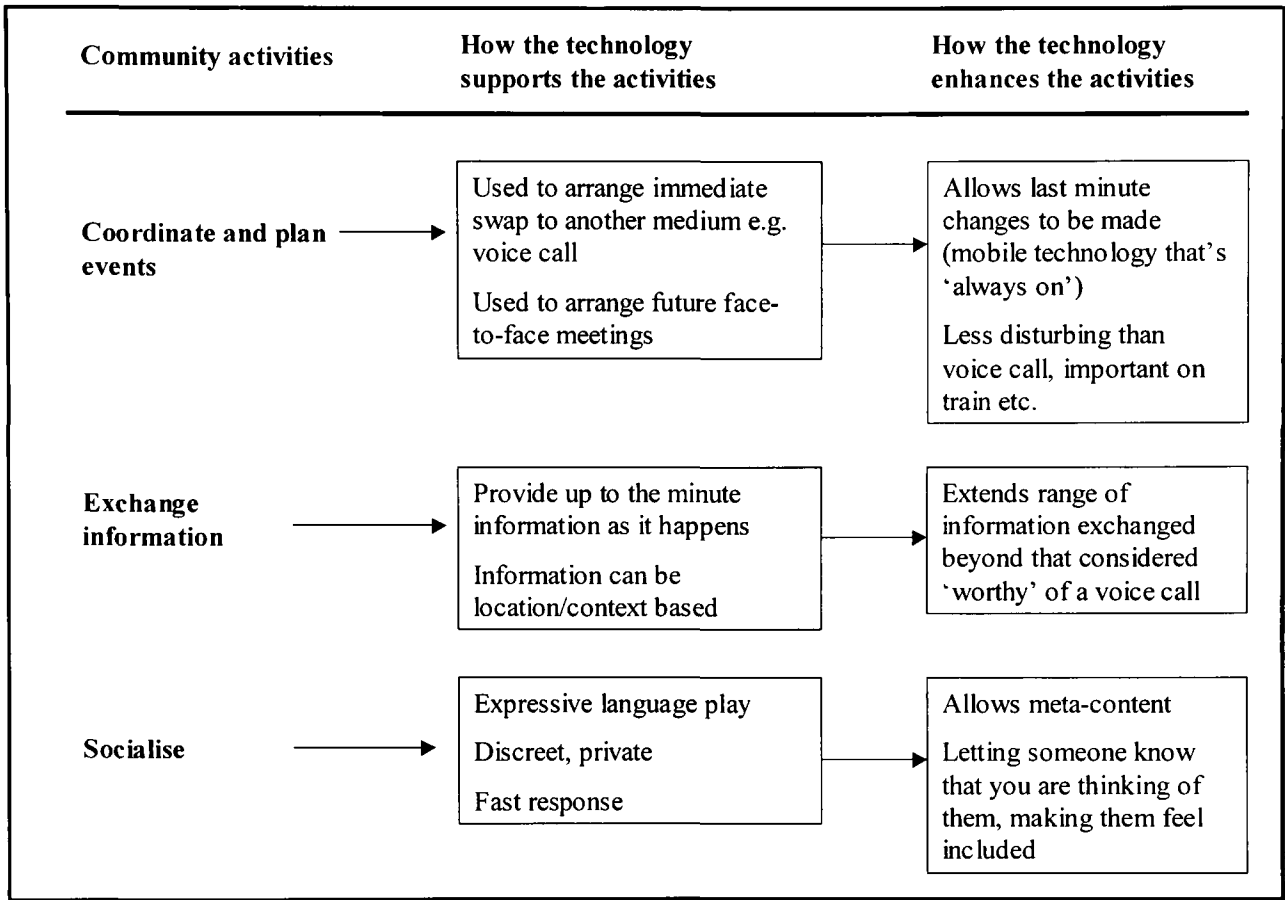


Figure 5.5 How SMS supports and enhances the activities of the community

### 5.7 Discussion

This study has confirmed some of the existing results on SMS behaviour and shed some light on new areas of interest. The diary methodology used allows a more comprehensive picture of SMS use within community groups to be established. Retrospective interviews, for example, Ling & Yttri (1999) gave a detailed insight into SMS behaviour. Diary studies, however, allow on the spot recording of behaviour and more of the message characteristics to be collected. In addition the use of social network questionnaires has made it possible to relate SMS messages to the sender-recipient relationship. This has allowed a clearer picture of the nature of SMS networks to be developed. The diary study has also made it possible to analyse the

content of SMS messages to some degree. This study found that combining expressive and task based content types is common within text messages. This has been confirmed by later studies using objective content analysis (Döring, 2002b).

### **5.7.1 How is SMS used?**

SMS is used predominantly between close friends who live in close proximity to each other. It supports a smaller group of partners than email. As a comparison Kanfer (1999) noted that people maintain between 46 and 356 unique communication partners across all forms of communication including face-to-face, email, voicemail and letters. SMS is used to send both expressive and instrumental or task-based messages. Often SMS messages contain a combination of these types. SMS appears to be used for a number of reasons. Cost does appear to be a factor. It is cheaper to send a text message than to make a voice call and allows the sender control over the cost (Shortis, 2000; Eldridge & Grinter, 2001). Being contactable rather than mobile seems to be important as well. A third of the messages were actually sent or received at home. Message content was often described as ‘where are you?’ messages. SMS and mobile phone calls allow people to keep in touch and gain direct access to each other without having to bypass any ‘gatekeepers’ (Lacohee & Anderson, 2001).

In chapter 4, response times to SMS messages were faster than to messages posted to the website. In this study, the asynchronous medium of SMS was actually being used in an almost synchronous manner by the diarists. This meant that more interactive discussions were held. These discussions can be more private and discreet than voice calls (Shortis, 2000). A common history or narrative develops between sender and recipient as they base a certain portion of their future interactions on the exchange of SMS messages (Ling & Yttri, 1999). This study indicates that this process may also work in reverse i.e. SMS messages can follow up a face-to-face interaction. SMS allows the continuation of discussions that were started in another medium. SMS allows for a lot of cross media interactivity (Shortis, 2000) including the specific use of SMS to arrange times to chat via different media (Döring, 2002b; Eldridge & Grinter, 2001). There are of course problems associated with SMS, especially concerning the speed of text entry or when large amounts of information need to be exchanged.

'Got fed up of texting and decided to call him' (female diarist)

Figure 5.5 showed how SMS supports the activities of the community and its members. In terms of socialising, for example, the simple act of sending a text message allows one member to know that another is thinking of them. In this way the technology supports the sense of community between members.

### **5.7.2 What type of community does or could SMS support?**

The community framework headings have provided a way of assessing the type of community that SMS supports and this assessment feeds into the implications below in section 5.7.3. SMS supports a network of close friends. The community exists in several places and has a loose structure of multiplex ties. SMS is primarily concerned with social networking functions. It is an ideal community technology as it is comfortably used both for coordinating activities and for conveying messages of social and emotional support. SMS naturally allows the two types of messages to be combined as the title of Döring's (2002b) paper illustrates: *1x bread, sausage, 5bags of apples, I.L.Y.* The type of community in this study is based on well-integrated media, which support and enhance relationships between members.

Within co-located communities SMS serves to reinforce both personal and social identities. Newly created words and abbreviations used by a limited group highlight the group as being separate from other social groupings. This effect was more pronounced than in chapter 4, probably because of the duration of the communities reported in this chapter compared to the SMS football group of chapter 4. Many messages contain group specific words and references to local places and shared activities. SMS is also used to develop and maintain personal identities. The asynchronous nature of SMS allows users to compose their 'face' in Goffman's (1959) terms. SMS users can make use of signatures and characters within their messages to present individuating information. The messages exchanged in this study contained far more personal abbreviations pertaining to individual identity than in the study by Döring (2002a). Eldridge & Grinter (2001) report that the large amount of individual abbreviations and special codes used by teenagers renders predictive text

input (a way of speeding up text entry) all but useless. These differences may be cultural or may relate to the nature of the SMS relationships studied. There is no account of the nature of relationships within Döring's study. In chapter 4 the language used within the text messages sent to the web message board contained very few abbreviations or so-called text-speak. This may relate to the relative anonymity present in that study compared to this. The fact that SMS messages exchanged in this study were intended to be viewed on a mobile phone as opposed to a web message board on a computer screen may also be relevant.

### **5.7.3 Implications for design**

- SMS messages appear to be used in an immediate manner rather than for future reference and messages are rarely stored. Services designed for SMS must take this into account. Advertisers, for example, should generate services that take into account a potential customer's location.
- New SMS applications should recognise the often private nature of the medium, for example, when deciding whether or not customers need to respond to the messages or alerts.
- The style and content of SMS messages is likely to vary depending on the medium used to display the message. SMS messages sent to a website may differ to those sent to a mobile phone. This is a consideration for the future development of mobile phones and for other mobile devices with SMS capability such as Personal Digital Assistants.

### **5.7.4 Implications for community**

- SMS is an ideal community technology as it is comfortably used both for coordinating activities and for conveying messages of social and emotional support.
- SMS typically supports co-located communities consisting of close friends
- One of the main functions of SMS is to bring community members together face-to-face to extend their sense of community through physical interaction.



## 5.8 Chapter summary

In this chapter the use of SMS as a technology for digital communities has been examined. The community framework has provided a way of assessing the type of community that SMS supports. Text messaging is used to support primarily close relations both close emotionally and physically. SMS supports the diarists' communities in a number of ways. The diarists use SMS in practical ways to arrange meetings or to follow up conversations. They also use SMS to express social and emotional content and simply to say 'hello' and to keep in touch with each other. The technology does not always support the social interaction needs of the community. Members are already adapting the asynchronous technology to be used in a more synchronous manner. When large amounts of information, for example, need to be exchanged, the limitations of SMS may force members into seeking new technologies in order to meet their interaction needs. The type of community supported by SMS has been explored. The naturalistic data collected through the diary study shows that SMS supports existing friendships in small co-located groups. SMS use within local settings acts as a facilitator of face-to-face interactions. It also integrates well with other media and makes up just one element of the digital community.

In the next chapter the community framework is used to examine whether SMS can be used to support a developing community of students. Email will be used as a comparison technology so that issues concerning media choice can be examined in greater depth.

## CHAPTER 6

# COMPARING TEXT MESSAGING AND EMAIL SUPPORT FOR DIGITAL COMMUNITIES

In this chapter the framework is used to characterise a developing community of student classmates. The role of SMS and email in supporting the community is examined with a view to understanding media choice and integration within communities. In study 1, SMS and email diaries are kept by a group of 1<sup>st</sup> year students. Data is recorded at the start and at the end of the year. The framework highlights how email and SMS are used in different ways throughout the year. In study 2, the effect of introducing examples of SMS and email ‘best practice’ is investigated in relation to students’ performance and perception of group coursework.

## 6 Introduction

In chapter 5 the community framework analysis revealed that SMS supported a certain type of digital community, one that was both close emotionally and physically.

The data collected through the diary studies in chapter 5 showed that established community groups are successfully using SMS to support their activities and reinforce their group membership. SMS is integrated with other technologies and media to support the social interaction needs of the community members.

In this chapter the question of whether or not SMS can be effective in supporting a developing community is addressed. The community framework is used to characterise a potential community, a group of first year undergraduate classmates. These students have an initial connection – their degree subject but this does not necessarily constitute a strong bond. As the students move through their first year together it is hoped that the ‘cohort’ of students becomes a community (Misanchuk & Anderson, 2001). Traditional

University settings provide an opportunity to study the role of personal mobile technologies alongside organisational media in supporting community development. Media choices themselves can also be studied in more detail. The students bring with them personal mobile technologies but are also given access to organisational media such as email. What factors affect media choices? Will students, for example, choose to discuss their work via email and socialise via SMS? Is there evidence of media integration and how does this occur? The two studies presented in this chapter allow these issues to be investigated through a comparison of SMS and email support. In the first study the community framework is used to analyse the development of community within a group of University classmates. The framework characterises the type of community and the longitudinal effect of both SMS and email on community development. The study continues with the methodology used in chapter 5 but supplements the data with an in-depth group interview. Differences between email and SMS use are discussed through a claims analysis. This compares the literature's claims with the diary and interview data.

In the second study the use of SMS and email is examined in the context of two specific pieces of group coursework.

## **6.1 The use of technology to support community development**

The introduction of technology to aid the development and support of communities has been reported across a range of settings including University undergraduate courses (Light & Light, 1999). The use of technology within educational settings allows for increased interaction between the students. These interactions are important in developing a sense of community between the students. The emphasis on creating community within learning settings is fuelled by research that reveals a number of positive benefits for individuals and their communities. Strong interpersonal ties increase willingness to share information and resources, increase the flow of information and the availability of support (Haythornthwaite et al, 2000).

The majority of Computer Mediated Communication (CMC) studies have focused on extending academic discussion and thus learning resources. However, the introduction of

email lists, for example, does not always increase the academic discussion either between students or between students and lecturers (Light et al, 1997). Students often feel that there is little encouragement to use such systems. Staff, likewise consider reading and posting messages a low priority. Course requirements or incentives increase participation but do not ensure 100% involvement (Bagherian & Thorngate, 2000).

Distance learning courses have provided an opportunity to examine the social rather than the academic outcomes of CMC systems. Additional CMC support proves popular in distance learning courses where there is little face-to-face contact between students and staff (Morris et al, 1999). Students often use CMC systems for practical reasons rather than for academic advancement and such systems have been enthusiastically adopted as a social medium (Johnson & Huff, 2000). A few studies have focused upon the question of community development amongst distance learners. Haythornthwaite et al, (2000) showed that distance students successfully used the prescribed technologies to develop a sense of community. Initial face-to-face sessions were also an important part of the community building process. The authors noted that whilst fellow students were central to the development of the community, certain others provided additional support. The students included lecturers, technical and administrative staff within the wider definition of their community. Other important figures included family members and those people who provided social and emotional support. This support was necessary for the students to complete their work and so feel part of the course. Distance learning students have to use technology in order to interact and complete their course requirements. Co-located students are not compelled to use technology in order to interact with one another. Consequently, technology may have a different part to play in supporting co-located community. This longitudinal study examines the spontaneous use of SMS and email in supporting community development within a group of co-located students.

## **6.2 Characteristics of SMS and email**

The characteristics of SMS have been described in some detail in chapter 5. A brief review of the literature pertaining to SMS in educational settings is given below along with a review of the characteristics of email.

### **6.2.1 SMS**

SMS and the mobile phone have not been received enthusiastically by many of those involved in education (see for example, Chris Woodhead's comments, BBC ONLINE, 2000a). Mobile phones are particularly popular amongst children and young adults. As such there have been a number of recent attempts to harness the potential of these 'disruptive devices' (Sharples, 2000) and include text messaging within educational projects (see, for example, [www.knowitall.org.uk](http://www.knowitall.org.uk)). Educational alert systems are also being pioneered. Garner et al (2002) used SMS to send out three types of information to 67 1<sup>st</sup> year psychology students over a four-month period. Eight messages were sent out consisting of a) course information e.g. exam dates, b) emergency information e.g. cancelled lecture and c) prompt information e.g. please collect coursework. The alerts were very favourably received by students who found them convenient, immediate and personal.

### **6.2.2 Email**

It has been argued that email has been the only really successful Computer Supported Cooperative Work (CSCW) application (Kraut, 1990). Email allows rapid transmission of digitised text to multiple others across time and space. Email systems allow messages to be stored, manipulated and processed. Messages can be edited and forwarded to other parties. In addition to the text body of an email, attachments allow other types of data to be sent including photographs, software programs and video clips. The study of email use has typically focused on organisational settings. Garton & Wellman (1995) provide a comprehensive review of email use within organisations. They divide the research into three areas: studies of media choice in relation to organisational context, studies of the structural impact of email and studies of the relational impact of email. As with other

forms of CMC, it has been suggested that email allows communication across boundaries and is resistant to the power and political pressures of face-to-face communication (Finholt & Sproull, 1990; Kiesler & Sproull, 1992). Whilst this may not be the case (Adrianson & Hjelmquist, 1991), it has certainly allowed the growth of distributed organisations (Garton & Wellman, 1995).

Email serves several different work functions and constitutes a major feature of the working day. Email has evolved to the point where it is used for multiple purposes. These include document delivery and archiving; work task delegation; and task tracking. These additional functions have been referred to as email overload (Whittaker & Sidner, 1996). Email overload creates problems and there have been attempts to redesign email applications to better support these new functions (Mackay, 1988; Whittaker & Sidner, 1996).

Email enables the development of new ties between workers. It allows access to a wider range of people and thus resources (Constant et al 1996; Sproull & Kielser, 1990). It is also used to maintain social-relationships over distance (Parks & Floyd, 1996) and adds a social element to work relations in co-located settings (Haythornthwaite & Wellman, 1998). Emailing co-located colleagues has been deemed harmful to face-to-face communications. One UK city council has banned staff from sending internal emails one day a week in an attempt to improve staff communications (BBC ONLINE 2002b).

Since the 1970s email has been the communication tool of choice for information technology academics and professionals (Berghel, 1997). By the 1990s, the popularity and ubiquitousness of email throughout the rest of academia established it as a communications standard within that area as well. Email is also a hugely popular communications medium with ordinary British people. Petrie (1999) studied a corpus of 38,000 emails in an attempt to explore how people use email in their daily lives. Petrie found that the majority of people use email for business and personal purposes. Personal purposes included enquiring after the well being of the recipient, sending thanks and organizing social events. Kanfer (1999) showed that email users had significantly more

communications with strangers and people outside their local neighbourhood than non-email users. Kanfer (1999) warns that the new distant communications come at the expense of relationships with people closer to home. Petrie (1999), however, is positive about the social effects of email. Rather than the Internet isolating people and decreasing social contact, “*the email corpus strongly suggests that it can be used to enhance our emotional lives in important ways*” (Petrie, 1999 p.35).

### **6.3 Factors affecting media use**

A number of factors have been proposed to explain media choices and use under different conditions. These include task-media fit, group norms and social network factors.

#### **6.3.1 Social presence and task-media fit**

Technology-mediated interactions, especially CMC have often been regarded as inferior to face-to-face interactions. Short et al, (1976) suggested that the inability of CMC to transmit nonverbal cues would have a negative effect on interpersonal communication. Interactions mediated by CMC exhibit less ‘social presence’ than face-to-face interactions i.e. the salience of the ‘other’ in mediated interactions is diminished. Recent reviews, however, have questioned the extent to which the social presence literature is generalisable to all communications media and to all applications (see for example Gunawardena & Zittle, 1997).

Daft & Lengel (1986) have described CMC as a less ‘rich’ medium. Rich media such as face-to-face communications convey a lot of information through cues and gestures, they also allow immediate feedback and use natural language. As such it is predicted that rich media will be chosen in situations where the sender wishes to reduce equivocality i.e. provide a careful explanation for an unclear situation. Leaner media such as written communication will be chosen in situations where the sender wishes to reduce uncertainty by providing large amounts of detailed information. These task-media fit theories suggest that communication outcomes are determined by the attributes of the technology.

### **6.3.2 Norms and social network factors**

The task-media approach has failed to recognize the social context in which communication takes place. Where people are highly motivated to communicate they modify or adapt the 'lean' CMC environment to support their needs (Baym, 1998). The development of group norms and conventions also affects the use of media within a specific context (DeSanctis & Poole, 1994). Within educational settings, for example, email is a prevalent form of communication and lecturers' email addresses are available on their web pages.

A social network approach allows an understanding of media use that takes into consideration how communicators maintain multiple relations through multiple media (chapter 2 contains a more detailed account of the social network approach). Social network theorists believe that individual and group behaviour is affected more by the nature of the ties and networks in which actors are involved than by the norms and attributes they possess. Thus grouping individuals as 'students' does not reveal the nature of their interactions and their communication networks (Haythornthwaite et al, 2000). Across a number of different communications technologies social network factors have been found to be important in media use. Grinter & Palen (2002) studied the use of Instant Messaging (IM) amongst 16 high school and college teenagers. Differences in usage related in part to the students' degree of autonomy, Internet connectivity and transport access. IM use, however, also relates to peer pressure, peer group membership and creating additional opportunities to socialise. In a study of young people in Australia, Carroll et al (2001) found that communication media were chosen according to the strength of the relationship. The most intimate relations are with those contacted frequently using SMS, then the mobile phone and those that are a little more remote are contacted via email. These people include family, longer distance friends and friends from previous social groups where there is now little face-to-face contact.



Finally, media use may also relate to other factors such as cost, accessibility and privacy. Eldridge & Grinter (2001) identified three reasons why teenagers choose SMS over other media. It is quicker, cheaper and easier or more convenient. The possible factors affecting media use will be examined during the course of this first study.

**6.4 Study 1: Longitudinal study of SMS and email usage**

A group of University students provides an opportunity to study the development of group interactions over time. It allows the roles of the technology within the group to be investigated. The students’ own assessment of the group can also be monitored. Table 6.1 shows a section of the original table (1.1) in chapter 1 and indicates the features of the two technologies studied in this chapter.

Type	Sync	Async	Ad-hoc	Organised	One-to-one	One-to-many	Mobile	Fixed	CMC technology
1		•	•		•			•	Email
2		•	•		•		•		Text messaging

*Table 6.1 Classification features of the two technologies studied in this chapter*

**6.4.1 Study predictions**

The aim of this study is to examine the use of SMS and email in supporting the development of a sense of community over the course of an academic year. To this end a number of specific predictions are examined:

- 1. The sense of community between the students will increase over the year
- 2. SMS and email will be used to contact different relationship partners
- 3. The use of both technologies will increase over the year

**6.4.2 Research setting**

The students were all enrolled on the undergraduate Interactive Systems (IS) course at the University. The course was full time and was delivered through traditional lectures,

tutorials and laboratory sessions within the department. Students were automatically assigned an email account upon registration. There is, however, no formal requirement to make use of this facility. Email facilities within the department were free. Students also had email access at home. Stage 1 of the study took place 6 weeks into the course before any group work had taken place. Stage 2 took place towards the end of the second semester, week 22. By this time the students had performed a group work project and a set of examinations.

### **6.4.3 Participants**

Text messaging and email diaries were distributed to a class of 22 students. Completion of the diaries was voluntary and no incentives were offered. Some students were unable to take part in the study because they did not use SMS or email. To be included in the study participants must have completed both diaries to the required standard. This involved completing a minimum of five entries per diary. A number of diaries were returned which did not meet the criteria, and contained too few entries. Diaries that did not meet these criteria were rejected. Seven participants met the criteria representing a 30% response rate. Six men and one woman took part and completed stages 1 and 2. The students were aged 18 to 21. Our strict inclusion criteria coupled with the lack of student incentives meant a reduction in the number of potential respondents. As such it was not possible to gather data from the non-respondents and in turn the results of this study cannot be generalised to the rest of the class. Despite the relatively small sample size the study nevertheless provides a set of interesting results.

### **6.4.4. Procedure**

Prior to the study all the participants completed a demographics questionnaire. During the two stages of the study the participants kept communication diaries for ten days. Participants kept an email diary and a text messaging diary. A diary entry was completed for every message that was sent or received. Following each diary phase participants completed a social network questionnaire and an identity questionnaire. Finally,

following the completion of stage 2 four of the participants took part in a group interview.

#### **6.4.5 Data collection**

**Diaries:** The diaries were of a similar design to those used in chapter 5. The SMS diary was adapted slightly for use with email. The information collected included the name of the message partner, the location when the message was sent or received, the content of the message and whether or not the message was related to any other communication.

**Social network questionnaires:** These were very similar to those used in chapter 5. The questionnaire captured additional data regarding the communication partners such as the length of time known, the type of relationship and the location relative to the diarist. Participants also indicated the other ways in which they communicated with the partners e.g. by landline telephone and face-to-face.

**Identity questionnaire:** To assess the presence of community an identity questionnaire was given to the diarists at stage 1 and again at stage 2. The questionnaire was based upon Chin et al's (1999) Perceived Cohesion scale and had a Cronbach's alpha of 0.85. A copy of the identity questionnaire can be found in Appendix G.

**Interview:** The group interview covered attitudes towards email and SMS and the issue of community. The interview helped establish the members of the wider community including lecturers, family and friends.

### **6.5 Results**

The analysis of the diary, questionnaire and interview data is divided into 3 sections. The first examines how the technologies were used over the course of the year. In the second, these results are then discussed in terms of their implications for the five headings of the community framework. In the third section the data is examined in terms

of media choice in an attempt to explain why students use SMS or email. The wider implications of the results are then described in the discussion section.

6.5.1 Message and partner characteristics of SMS and email

6.5.1.1 Interactivity

	Total mess- ages	Sent/ Rec.		Immediate/ future use		Related /unrelated message		Instrumental/ expressive or both		Location when message sent /received	
SMS (T1)	95	Sent Rec	45 50	Immediate Future	71 24	Related Unrelated	54 41	Instrumental Expressive Both	45 25 25	Home Travelling University Café	54 13 23 5
Email (T1)	36	Sent Rec	7 29	Immediate Future	20 16	Related Unrelated	16 20	Instrumental Expressive Both	18 12 6	Home University	16 20
SMS (T2)	106	Sent Rec	57 49	Immediate Future	86 20	Related Unrelated	60 46	Instrumental Expressive Both	74 24 8	Home Travelling University Café	63 10 19 14
Email (T2)	39	Sent Rec	10 29	Immediate Future	31 8	Related Unrelated	18 21	Instrumental Expressive Both	21 13 5	Home University	27 12

Table 6.2 Email and SMS message characteristics

Table 6.2 shows the interactive nature of SMS messages in particular. This is seen in terms of the volume and direction of messages, the immediacy of the interaction and the inter-relatedness of SMS messages. Diarists sent and received approximately two and half times as many text messages as emails over the two stages of the study.

Approximately equal numbers of SMS messages were sent and received. However, the email diaries reveal that over three quarters of the entries were received messages. Over three quarters of the SMS messages were for immediate use rather than future reference (71/95 and 86/106). Email messages are more evenly distributed between immediate and future use. Over half are related to a previous communication. These include previous SMS messages, face-to-face conversations and landline phone conversations. Email

messages are more likely to be single messages and over half are unrelated to another communication.

	Total number of partners	Location of partner		Close relationship		Length of relationship		Partner relationship	
SMS (T1)	36	Other town	8	Very close	3	<3 months	2	Classmate	4
		Same town	19	Quite close	9	3 months-1 yr	15	Friend	25
		Same building	9	Close	18	1-3 years	9	Family	1
				Not close	6	> 3 years	10	Team mate	2
								Neighbour	4
Email (T1)	12	Other town	3	Very close	1	<3 months	5	Classmate	1
		Same town	4	Close	3	3 months-1 yr	2	Friend	3
		Same building	5	Not close	8	1-3 years	2	Family	1
						> 3 years	3	Lecturer	6
								Organisation	1
SMS (T2)	43	Other town	8	Very close	17	<3 months	1	Classmate	9
		Same town	26	Quite close	3	3 months-1 yr	19	Friend	22
		Same building	9	Close	19	1-3 years	8	Family	4
				Not close	4	> 3 years	15	Team mate	3
								Neighbour	5
Email (T2)	25	Other town	11	Very close	7	<3 months	2	Classmate	2
		Same town	8	Quite close	1	3 months-1 yr	13	Friend	10
		Same building	6	Close	4	1-3 years	5	Family	3
				Not close	13	> 3 years	5	Lecturer	7
								Organisation	3

Table 6.3 Email and SMS partner characteristics

Table 6.3 shows how the messages were distributed between different kinds of partner e.g. classmates, friends and lecturers. Tables 6.2 and 6.3 suggest that differences exist between the uses and the functions of the two technologies and between the two stages of the study. These results suggest interesting differences concerning the community’s support and development.

### 6.5.1.2 Integration data

Table 6.4 shows that all the SMS relationships are maintained by at least one other form of communication. 21 SMS partners communicated by all four additional media, face-to-face meetings, mobile calls, land line calls and email. Email relationships were different.

One third of relationships were unsupported by any additional media, they were email only relationships.

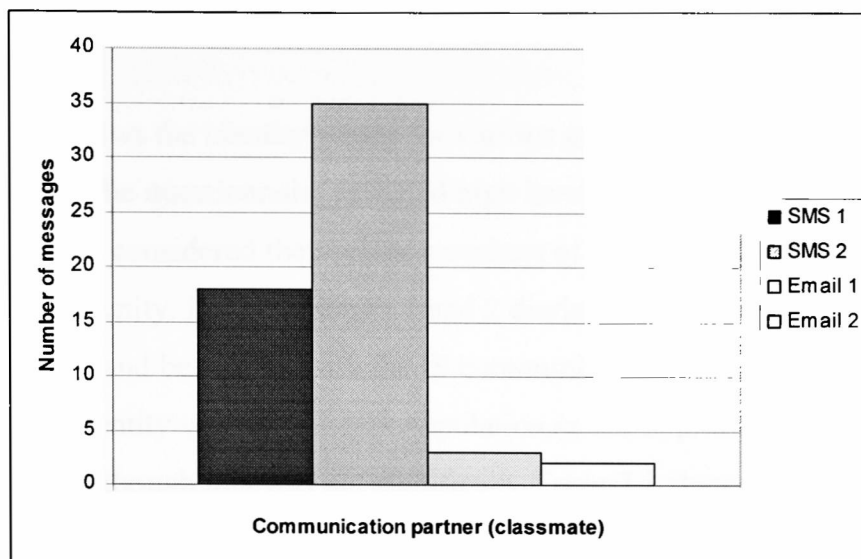
	Number of other media used to communicate with partner				
	0	1	2	3	4
SMS partners (T1)	0	1	14	12	9
SMS partners (T2)	0	2	12	17	12
Email partners (T1)	4	3	2	3	0
Email partners (T2)	8	2	5	3	7

*Table 6.4 Number of SMS and email partner relationships supported by other media*

### 6.5.2 Time effects

The use of SMS and email has changed over the course of the year. The use of both technologies has increased slightly over the study period. More interestingly the specific use of the two technologies has altered over the course of the year.

Figure 6.1 shows that classmate exchanges represent one third of all the messages sent during stage 2 compared with less than one fifth at stage 1. Email exchanges between classmates remained more constant across the two stages.



*Figure 6.1 Number of email and SMS messages exchanged between classmates at stages 1 and 2*

The content of SMS messages has altered subtly over the course of the study. Between stages 1 and 2 the number of SMS messages containing expressive content such as greetings, jokes, friendly insults and advice has stayed the same. During stage 1 25/95 messages contained both expressive and instrumental content. At stage 2 far fewer messages contained both types of content (8/106) and more contained instrumental content only. Instrumental messages include those exchanged between classmates concerning the planning and organisation of social as well as work related events. There was no change in the overall level of instrumental and expressive content in the emails but information content specifically increased. Changes in content type may relate to the increase in group-project work that occurred between the first and second stages of the study. In addition SMS was used more to contact people in the same building in stage 2 compared with stage 1.

#### **6.5.2.1 Identity**

Average identity score	Stage 1	Stage 2
IS community	4.2	6.47
Student population	5.17	3.9
Birmingham University	5.9	5.5

*Table 6.5 Identity scores between stages 1 and 2*

Table 6.5 shows the identity scores for various groups within the University. At stage 1 of the study the questionnaire revealed high levels of affiliation with the different groups. Most diarists considered themselves members of the student population and members of the IS community. Between stages 1 and 2 diarists showed increased feelings of membership and belonging with the IS community ( $z = 2.37$ ;  $p < 0.05$ ). Diarists showed decreased identity with the student population ( $z = 2.2$ ;  $p < 0.05$ ) and with Birmingham University although this was not significant. Table 7.3 showed that the number of SMS partners described as classmates doubled between stages 1 and 2. Table 6.6 indicates that the actual number of messages exchanged between the diarists and classmates also doubled from 18/95 to 35/106.

	Total number of messages	Number of messages exchanged between different partners			
SMS (T1)	95	Classmates	18	Team mates	2
		Friends	56	Neighbours	15
		Family	4		
Email (T1)	36	Classmates	3	Family	7
		Lecturer	14	Organisations	3
		Friends	9		
SMS (T2)	106	Classmates	35	Team mates	4
		Friends	47	Neighbours	16
		Family	4		
Email (T2)	39	Classmates	2	Family	3
		Lecturer	12	Organisations	4
		Friends	18		

Table 6.6 Distribution of Email and SMS messages between different partner types

### 6.6 Community framework analysis

The results are now discussed in terms of the five headings of the community framework.

#### 6.6.1 Membership component

The identity questionnaire revealed a developing sense of affiliation with the IS community. The group interview supported this view. One diarist argued that it was



difficult not to feel like a member. He suggested that the location of the department (away from the main campus) and the small size of the class were important factors. Given that a sense of belonging and community exists between the members of the IS course, the remaining questions concerning the use of SMS and email become more valid and interesting.

The diaries indicated how social and individual identities were established and maintained through the use of technology. As forms of asynchronous communication, SMS and email communication allow users to compose and present their outward 'face' (Goffman, 1959). SMS allows very personalised dialogue including abbreviations and signatures, for example, "**inabit.**" The email diaries reveal different forms of 'self' presentation. The larger capacity of email allows more information to be included in the presentation of personal identity. Email and SMS also help to maintain a sense of group identity. Group emails sent to students from a member of staff reinforce a sense of group membership. Both email and SMS maintain the sense of group identity during periods without face-to-face contact.

SMS exchanges often contain shared group references and meanings, an indication of the community's shared history. Taking part in group projects and inhabiting a shared location both contribute to the development of a shared history. Referring to common experiences associated with the course is another way group identity is supported. SMS also supports the extended IS community i.e. friends and flatmates within student accommodation who provide support for IS class members.

**How did the exam go? The whole of floor 9 wishes you luck**

SMS is also used to keep fellow students informed about lectures and there is a sense of shared human feeling within the group. Members help each other out with project work and alert one another to problems or changes with lectures or allocated marks. The community consisted of a number of different relationships. Relations within the community are multiplex (Haythornthwaite & Wellman, 1998). Although a partner might

primarily be classified as a classmate they may also be considered a friend. Some of these relationships have developed over the course of the study. The social network data showed that diarists' relations with other classmates have become closer and the number of classmates who were also thought of as friends increased. The number of additional media used with classmates has also increased. In chapter 5 it was noted that the number of media increases as a function of relationship length. This is also the case for the SMS and email-supported relationships reported here. This gradual strengthening of relations is also apparent with neighbours. Lecturer relations, however, did not develop in terms of closeness or media usage.

There are plenty of opportunities for members to make a personal investment in the community. The size of the community ensures that people remain visible within the community and can be credited with their knowledge and input. Whilst the group is essentially a task-based group, students engage in a lot of informal communication. This includes jokes, friendly insults and greetings messages. Email messages tended to be more formal and diarists often included several pieces of formal identification when signing off their emails, for example, *Yours, Matthew Rice (j111) Registration number 318888*. This contrasts with the more informal tone of SMS arrangements:

**Have u been captured by the squirrels r u coming in today? Meet u @ clock tower?**

### **6.6.2 Organisation component**

It is difficult to examine interactivity in any great detail without a complete set of message transcripts. As with chapter 5, the results, however, indicate that SMS communication is, at least at a high level, interactive. In this study over half of SMS messages were related to a previous communication (54/95 and 60/106). Nearly half of the emails were also related to another communication (16/36 and 18/39). The majority of SMS messages related to another text message but SMS interactivity spans media. Discussions started in one medium e.g. face-to-face or mobile phone, are often continued via text messaging. Emails are usually related to a text message or a mobile phone call rather than to another email. Over the course of the study the percentage of emails

relating to face-to-face communication increased. Interactive messages show a coherent engaged discussion is taking place. People are not just sending random, anonymous messages via email or SMS. The SMS diaries revealed approximately equal numbers of single messages and messages with replies. However, over three quarters of the email messages are single messages suggesting that email is a less interactive medium or is at least less immediately interactive.

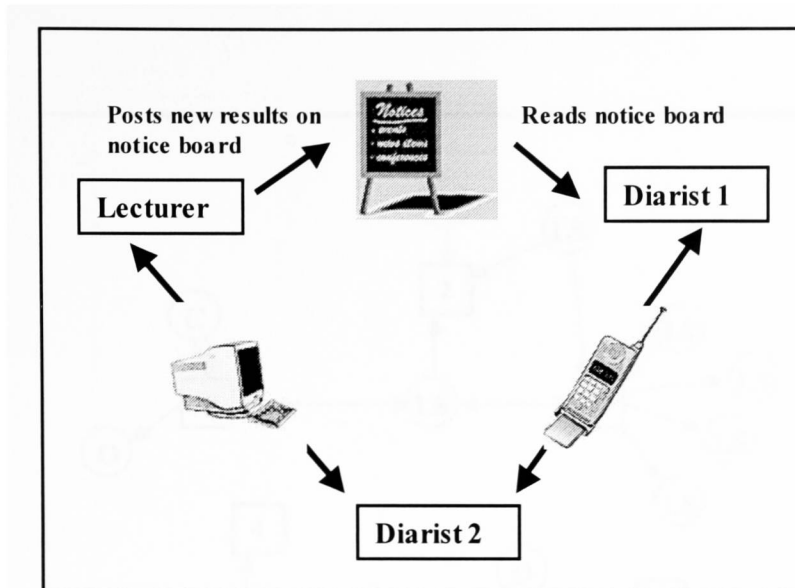
Interactivity is important in terms of the organisation of this community. Engagement in the discussions and with the community are important when trying to achieve a balanced task-based and social-based group and when coordinating groups both within and away from a shared location. Although there is limited member control within the community, students do to some extent retain control over their projects. Classmates made decisions regarding their roles within the group and how to manage their work. Importantly they also made decisions as to how to communicate with each other and one of the first things they did was to swap mobile phone numbers. Keeping in contact with the wider community in terms of teaching staff is also important. This type of discussion varies in terms of its interactivity. Staff provided content can take the form of oral information as well as group emails reminding students to attend progress meetings with their tutors. In this study students received far more emails than they sent. The difference may be due to the students' multiple group memberships (Crook & Webster, 1997; Petrie, 1999). Many received emails are general course related announcements and do not require a reply.

Interactivity is important within group projects (study 2 contains a more detailed discussion of group course work). Within project groups, students are quick to exploit members' differing interests and expertise. The group interview revealed the division of tasks upon the basis of expertise. Some students, for example, were particularly skilled in programming through hobbies, previous courses or extra curricular paid work. These students acted as programming experts and answered other members' queries. Despite the similar age of the IS classmates, diverse backgrounds and interests ensures that there is a large pool of diverse community expertise.

### **6.6.3 Integration**

As in chapter 5, this community contains both face-to-face and technology mediated communications. There are frequent face-to-face discussions amongst friends and within group projects. The community uses a variety of media. These include SMS, email, mobile and landline calls as well as face-to-face communications. Diarists use a wider variety of media with friends, whereas diarists tended to limit communications with staff to email. The social network questionnaires revealed that SMS and to some extent email are used as just one part of the communications between partners. The media are used to support face-to-face communications and to support each other. Both SMS and email are often used as just one part of the communications between partners. Within group work the technologies act in support of face-to-face communications by coordinating meetings or exchanging information between meetings.

The two technologies are well integrated. SMS is often used to alert members to incoming emails (study 2 contains more details on alerts). SMS and email are also integrated with other information sources such as the class notice board. An example of this is shown in figure 6.2. Diarist 1, looking at the class notice board, sees a problem with the mark for diarist 2 and alerts him to the fact via SMS. More SMS exchanges establish the details of the problem and then diarist 2 is in a position to email the lecturer to sort out the problem.



*Figure 6.2 Integration of SMS and email*

#### 6.6.4 Social network

SMS was used to support the communication between a greater number of partners than email. The majority of SMS partners are classified as friends. Other exchanges were between classmates, neighbours and family members. Far fewer emails were exchanged between friends and more were exchanged between the diarists and the lecturing staff. Email is used for less intimate relationships. Over half of email relationships were described as ‘not close’ (8/12 and 13/25). Only a tenth of SMS relationships were described similarly. Message content varies as a function of communication partner. This is particularly the case with email messages. Diarists use email to exchange information and planning messages with lecturing staff and classmates. They also use email to exchange greetings and joke messages but only with other partners i.e. friends and family.

Figure 6.3 shows the pattern of connections for diarists using email. It reveals little student-to-student communication. There is far more student-staff communication. Only 11% of the total messages exchanged were between classmates. 45% of the messages were exchanged between members of the wider IS community i.e. between diarists and staff.

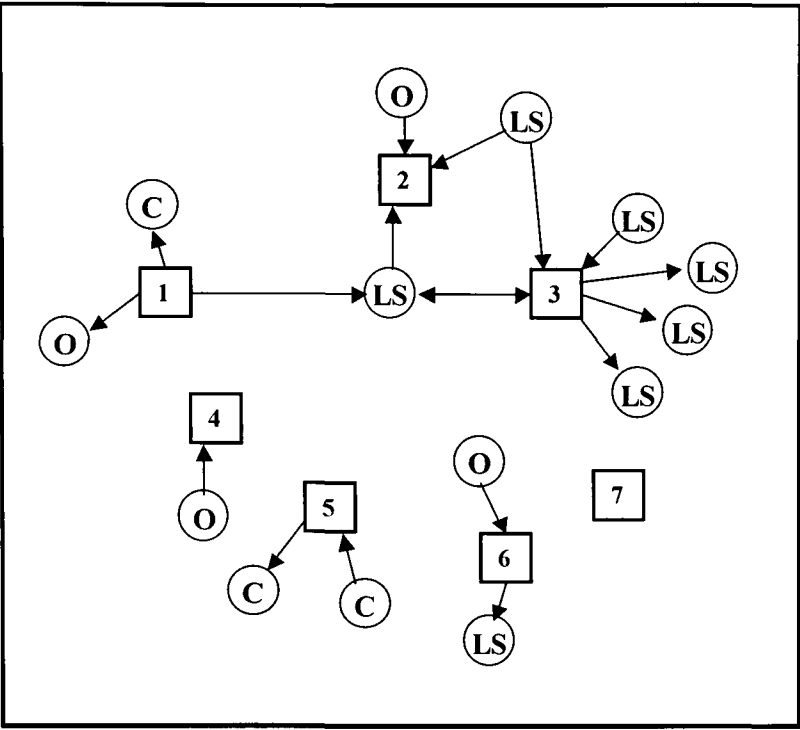


Figure 6.3 Social network diagram for email use

Numbers represent diarists, O = Organisation; C = Classmate; LS = Lecturing staff; (Friends and family not shown)

Figure 6.4 shows the pattern of connections for diarists using SMS. This network indicates far more connections between classmates. 26% of the all the SMS messages sent during the study were exchanged between classmates.

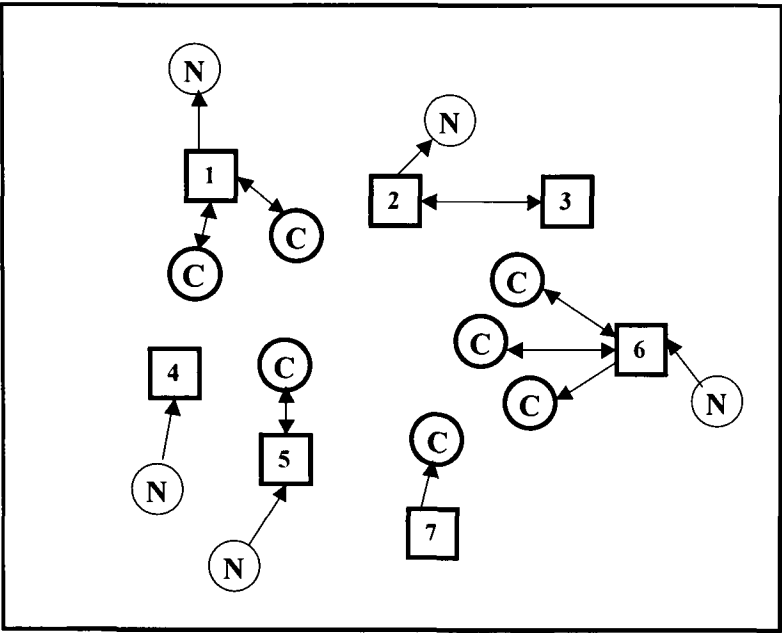


Figure 6.4 Social network diagram for SMS use

Numbers represent diarists, C = Classmates; N = Neighbours;(Friends and family not shown).

6.6.5 Location

The usual location for the community is the department. This provides a shared location for face-to-face interaction. The two technologies examined in this chapter, SMS and email support the community away from the shared location. This is important in terms of maintaining the sense of community between lectures and labs and extending the sense of community through social events away from the department. Half of the SMS messages recorded in this study were sent or received at home and the rest were exchanged at University, in cafes and bars or whilst travelling.

SMS connects two real, physical locations occupied by community members. It maintains relations between face-to-face contact and helps to arrange meetings within common places such as lectures, labs and the common room. The social network questionnaires show that over half of SMS partners lived in the same town as the diarist (19/36 and 46/43). Email appears to support longer distance relationships than SMS. More email partners lived in a different town to the diarist compared with SMS.

Email also connects private locations but can also provide an asynchronous meeting place. This sometimes happens when a group arranges to look at their email at the same time.

#### **6.6.6 Summary of the community in terms of the framework**

##### **Membership component**

The community is characterised by a strong sense of identification with the IS community. Multiplex relations are prominent as diarists maintain relations that are classmates and friends. Despite being a work group a lot of the communication is informal.

##### **Organisation component**

The community is characterised by reactive discussion that centres around social and task based content. Task based content in particular is organised around members' particular strengths. Home grown experts are a major feature of this community.

##### **Integration**

SMS and email are well integrated with face-to-face discussions and supplement the use of non-digital mediation such as notice boards. Email is used to maintain weak ties between diarists and staff. SMS builds upon the task based relations between classmates adding a social element.

##### **Social network**

The social network patterns for the community vary depending on the technology. The network supported by SMS contained far more classmate ties whereas the network supported by email contained far more staff-student ties.



**Location**

The department within the University provides a common meeting place for the community. SMS allows contact away from the shared location either through arrangements to meet in a more social setting or through 'thinking of you' messages. Email sometimes provides an asynchronous meeting place for the community.

## 6.7 Community activities

Figure 6.5 shows that members of the Interactive Systems community engage in a number of activities including exchanging information, socialising and planning. The activities are based on Preece’s (2000) activities (see 1.6.6.2) and have been expanded on the basis of the results of this study. The technologies, SMS and email, support these activities by providing time to compose messages and by enabling context and location-based information to be exchanged. The technologies enhance these activities by allowing attachments of code or video, by maintaining a sense of group inclusion away from the shared location and by recording ideas for future discussion.

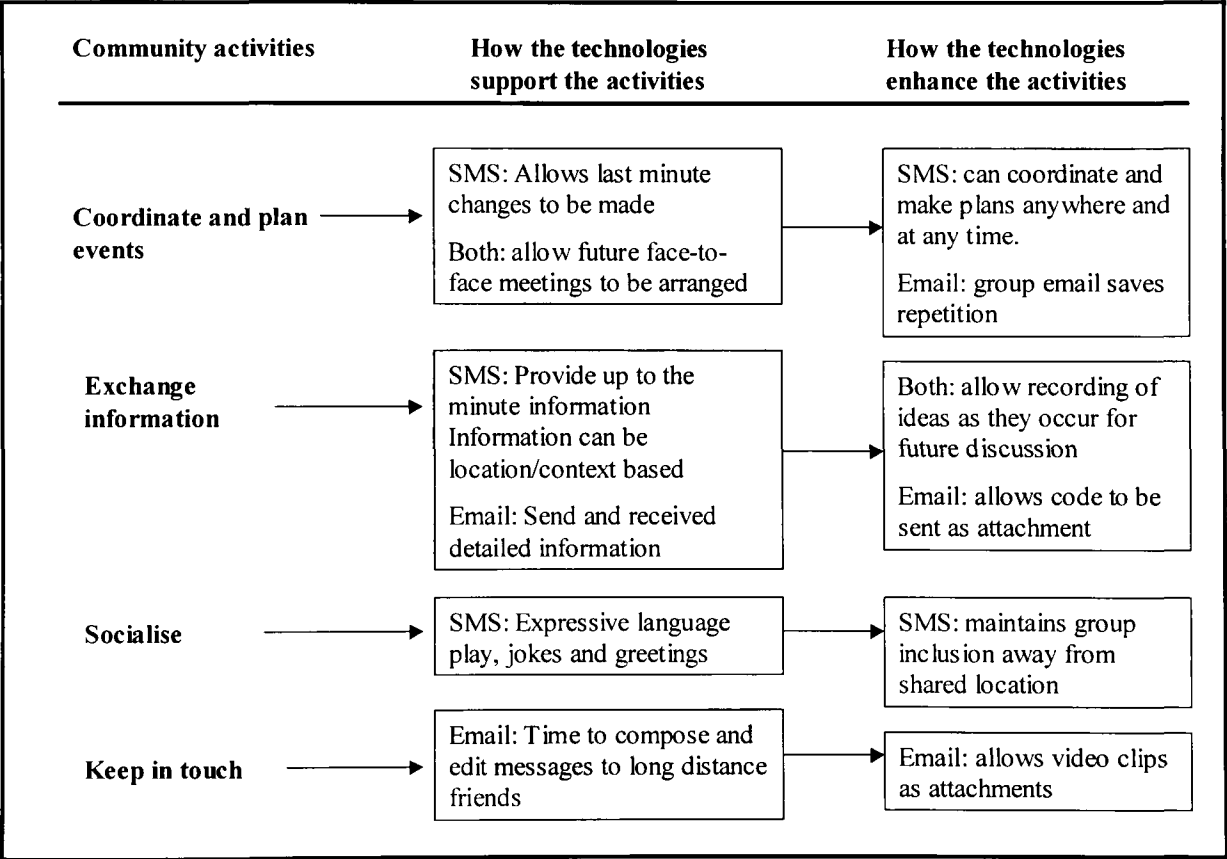


Figure 6.5 The community activities supported and extended by email and SMS

6.8 Media choice within the community: A claims analysis

The results suggest that SMS and email are used in different ways and for different purposes. Following the group interview the data was examined along with the diaries in order to explore the series of literature claims regarding media choice discussed in sections 6.3.1 and 6.3.2. Claims analysis is a technique commonly used in HCI research. In particular, it is used within scenario-based design and as a means of evaluating technology use (Carroll, 1995). A comparison of the literature claims with the data collected from the diaries and the group interview is shown in table 6.7. The claims analysis indicates that issues surrounding media choice and media use are quite complex. The important themes to emerge are presented below.

Literature Claim	Interview Evidence	Diaries Support/ Refute
Individuals will prefer email in order to exchange information to reduce uncertainty.	“Email is just more useful, you can put more stuff into it”	Support: Over 50% of emails were >10 lines. Emails included attachments and details of dates, times & phone numbers. Refute: SMS messages also contained plans and information
SMS displays more Social Presence than email.	“SMS messages tend to be quite personalized”  “Email is quite impersonal so you can write to somebody you haven’t heard from for ages without feeling awkward”	Support: Goodnight messages, jokes or ‘general chatting’. Messages contained personal signatures. Refute: Email messages to friends and family also contained expressive content
Email use is determined by group norms and conventions	“Yeah we contact staff via departmental email”	Support: In stage 1, 50% of emails were exchanged between diarists and members of staff. Communication with staff is via email or face-to-face only
Email supports less close relationships	“Email is impersonal its not embarrassing to contact people you don’t know”	Support: 57% of email messages were exchanged between ‘not close’ partners compared to 13% of SMS partners
SMS is used because it is a mobile communications medium	“I am pretty much anywhere (when I send and receive SMS), cos I generally have my phone with me”	Support: 18% of messages were sent or received at University, 9% whilst travelling. Refute: 58% of messages were sent or received at home
SMS use relates to an historical relationship	“Cos you know that if you’ve got their number that you are pretty alright sending them a text message”	Support: 80% of SMS partners were friends and 100% of SMS partners also communicated face-to-face
Group and individual behaviour is affected by the kinds of ties and networks people are involved in.	“I wouldn’t text message him cos I don’t know him that well”	Support: Number of communication media increased as a function of closeness. Close ties exchange both expressive and instrumental messages

*Table 6.7 Claims analysis for SMS and email*

### **6.8.1 Social presence**

Technology does not appear to remove the social presence or salience of the other person in these mediated interactions. Both SMS and email emphasized the *realness* of the other person and SMS in particular was perceived as being a social medium (Gunawardena & Zittle, 1997). The interview revealed that SMS was thought to be a useful way of flirting, saying goodnight or even asking someone if they wanted a cup of tea. Receiving an SMS message reaffirms group membership (Ling & Yttri, 1999).

### **6.8.2 Task-media fit**

Diarists were keen to point out that they thought using email or SMS was a task-based decision. Email was used if a lot of information needed to be conveyed. Although SMS messages do contain instrumental content they also contain expressive content and meta-content. Text messaging is often more about contact than content. Making contact and remaining available is a key feature of SMS use. The mobile nature of SMS over email was repeatedly emphasised and several people saw the development of mobile email as a potential threat to SMS. The issue of mobility is really one of accessibility. It is about being able to contact people and being contactable wherever people are.

### **6.8.3 Privacy and cost**

Privacy is an important factor in remaining accessible. It is an important issue for teenagers or those living in a shared house. Using mobile phones and SMS guarantees contact with the intended recipient. This bypasses anyone else in the house that might be acting as 'gatekeeper' to the landline telephone (Lacohee & Anderson, 2001). Cost does not appear to be a decisive factor when comparing SMS and email. More SMS messages were sent than emails despite the fact that email access is free at the University. Reasons

for not using email included problems with accessibility and restrictions over access to other, non-University email accounts.

#### **6.8.4 Group norms**

Although diarists often made reference to the specific attributes of the technologies, the data from the diaries reveal the importance of the relations and the ties within the network as well as group norms. Students adhere to the group norms surrounding email and use it to seek information from the lecturers and the staff. There is little student-student communication via email. Email is the most prevalent medium within the University organisation. Staff used email to send out announcements to the whole course in addition to formal messages to specific students.

#### **6.8.5 Social network ties**

There is a network of strong ties supported by SMS. Communication partners have close relationships and communicate expressive and instrumental relations. SMS partners are usually friends, family, neighbours or classmates. Diarists did not use SMS to communicate with the staff. The diaries show that, in comparison with SMS, email supports weak ties or non-close relations. Under some circumstances email can also support close relations. Emails sent and received at the diarists' homes were often exchanged between friends and family particularly over long distances. Previous work has noted that in work oriented relations media use is often affected by the nature of the tasks. In social relations, the nature of the relationship is the most important factor in determining media usage (Haythornthwaite & Wellman, 1998). The results of this study, however, suggest that the nature of the relationship appears to be influential even across work-oriented relations. In work-based relations between staff and students email is used regardless of the nature of the task. In these circumstances a diarist would still send an email even if the message contained little detailed information and the sender needed the recipient to respond quickly. Despite the benefits of SMS expressed during the interview,

diarists were unsure as to the use of the medium with lecturers and staff. Use was still dependent on the relationship with the recipient.

#### **6.8.6 Relationship history**

The length or history of the relationship with the recipient was also an important factor in media use. There seems to be a protocol to be followed in using SMS. Relationships supported by SMS have their origins in face-to-face meetings (Ling & Yttri, 1999). Mobile phone numbers are then exchanged and this then 'allows' text messages to be exchanged. The exchange of mobile phone numbers indicates a certain level of trust within a relationship (Licoppe & Heurtin, 2001). Receiving a text message from a complete stranger can be unnerving and may not be an appropriate method of making first contact (Benson, 2000). Email is a more formal and impersonal medium. Lecturers' email addresses unlike mobile phone numbers are often in the public domain via web pages. Email allows contact to be established without a prior history of exchange.

### **6.9 Discussion**

The community framework headings have provided a way of assessing and characterising the Interactive Systems community. The community contains a mixture of relationship types and strengths. It primarily exists within a shared location but utilises both email and SMS to support activities in between face-to-face contact. SMS is important in terms of maintaining a sense of membership and inclusion within the social group. It does this by reinforcing a sense of social identity away from the shared location of the department. In terms of the community's social network, SMS and email have been used to consolidate relationships. SMS has been used to strengthen existing relationships and email to maintain weaker ties. The community is founded on a series of work-based relations. SMS is used to build upon this foundation and extend the community through the inclusion of social interactions.

SMS and email are well integrated within the community. Email is important in generating both provided and member generated content and both technologies are

important in organising and coordinating social events and maintaining a sense of community in the absence of lectures and lab sessions. The two technologies are integrated into members' activities and are also integrated with non-digital resources such as the notice board.

The study provides evidence that the group of IS students have started to form a community. Diarists feel more like members of the community at the end of the year compared to the beginning. In addition to face-to-face interactions, the use of email and SMS has supported this process of community development. Email has also supported the relationships between the students and the lecturers. Lecturers and staff make up the extended IS community. They provide support and fulfil roles essential for the community. Email and SMS supported relationships within the wider community. The students' wider community includes friends, neighbours and family members. These people provide support for the IS students to complete their work and participate in the community.

As social interactions extend the IS community so more technologies are sought to support the strengthening relations. As in chapter 5, SMS is only one way in which social interaction between members of the digital community is supported. As this study has shown, media choice is not simply an issue of task-media fit. The group interview and the diary data together paint a more complex picture of specific group norms and importantly of relationship factors.

### **6.10 Study 2: The use of email and SMS to coordinate specific group projects**

In study 1 it was shown how students use SMS and email to support the development of their community. It was noted that over the year the students were using SMS and email to better coordinate their group work. This second study examines the use of email and SMS in supporting group work and was carried out over two semesters. During the first, the students' use of SMS and email was analysed and examples of 'best practice' were

derived. These examples were presented to the whole class before the onset of the second semester coursework. The aim of this study was to investigate whether better use of email and SMS can lead to increased group performance and team evaluation.

Team evaluation was studied to assess how the groups themselves rated their experience of working together and how much they enjoyed their group work. Performance is also important to the students but can be affected by many different factors including the general skill level of the group members and their familiarity with spoken and written English (many of the course members were International students). The provision of 'best practice' examples should encourage students to use SMS and email and perhaps in more productive ways. The specific predictions are:

1. The provision of 'best practice' examples will lead to an increase in the use of SMS and email
2. Performance should increase between semester 1 and 2
3. Team evaluation should increase between semester 1 and 2

#### **6.10.1 Study overview**

The study took place over two semesters and examined SMS and email use during two pieces of Java programming coursework. In the first semester the aim was to investigate SMS and email use and to develop examples of 'best practice'. In the second semester the students were given examples of 'best practice' and encouraged to adopt them where possible.

##### ***6.10.1.1 Participants***

A total of 64 students took part in the study. The students arranged themselves into groups of between 4-6 and there were 14 groups in total. The students remained in the same groups throughout the study period. All the students were 2<sup>nd</sup> year undergraduate students in the department of Electronic, Electrical and Computing Engineering.



6.10.1.2 Task

The students had to complete two pieces of Java programming coursework. One piece was completed in the first semester and one in the second semester. In addition to the programming demands of the coursework the students were required by their lecturer to complete time sheets for their projects. These time sheets were used to record the details of any face-to-face meetings or technology-mediated interactions e.g. mobile phone call or email that occurred between the team members. Finally, the students had to complete a team evaluation report. This report asked the students to comment on their time management and team working skills. The format of the report was left to the discretion of the students but contained a number of prompts including: time management skills; team working skills; areas for improvement.

6.10.1.3 Procedure

During the first semester the students kept time sheets of their group meetings. They were also asked to record any use of SMS and email that took place with reference to the coursework. The students also completed a team evaluation form, which was included in the finished report for the lecturer. The procedure for the second semester was similar to the first except that the students were given a series of ‘best practice’ examples of using SMS and email prior to the onset of the coursework (see table 6.8 below).

SMS	Email
<i>Use SMS to arrange meetings and to let each other know if arrangements alter</i>	<i>Use email to send code to group members for testing and developing</i>
<i>Use SMS to check that members are ok with their tasks.</i>	<i>Use email to send group members important references or URLs that you discover</i>
<i>Use SMS to arrange social events or just to say hello.</i>	

Table 6.8 Examples of best practice in terms of using SMS and email

6.10.1.4 Measures

**Performance:** A mark for the coursework was awarded to each group. The course lecturer marked the coursework according to undergraduate degree standards.

**Team evaluation:** Two judges assessed the team evaluation sheets according to the classification scheme shown in table 6.9. All the evaluation sheets were assessed and there was 93% agreement between the two judges. Team evaluation sheets were analysed to ascertain the degree to which the group felt that it worked well together and to assess the perceptions of group meetings and communication.

Classification category	Description of category
High	Group reports functioning very well. Examples of how and why the group worked well and examples of group dynamics at work
Medium	Group reports functioning well but little or no detail or examples of how and why this was the case
Low	Group reports some problems with functioning e.g. fewer meetings than planned and problems communicating

Table 6.9 Description of classification categories for team evaluation

**Level of SMS and email use:** Two judges assessed the level of SMS and email use and classified groups into high, medium and low categories. Two judges assessed the level of SMS and email according to the categories described below. There was 100% agreement between the two judges across the 14 groups. ‘High’ groups reported widespread use of SMS and email and provided examples, ‘medium’ groups reported some, limited use of SMS and email and did not provide any examples and ‘low’ groups did not report using SMS and email.

6.10.2 Results

Table 6.10 shows the overall results in terms of performance, team evaluation and SMS and email usage over the two semesters. The individual group results can be found in Appendix H.

Measures	Semester 1	Semester 2
Performance (average group mark)	56.71	64.6
Number of groups in each team evaluation category	High (4) Medium (8) Low (2)	High (9) Medium (5) Low (0)
Number of groups in each SMS and email use category	High (3) Medium (6) Low (5)	High (7) Medium (7) Low (0)

Table 6.10 Results table

6.10.2.1 Performance

Table 6.10 shows that the average mark for group work increased between semesters 1 and 2. This was a significant increase,  $t(13) = 2.6; p < 0.05$ .

6.10.2.2 Team evaluation

Positive team evaluations also increased between the two semesters. In the second semester all the groups were classified into the high or medium categories.

6.10.2.3 SMS and email usage

The provision of ‘best practice’ examples did lead to an increase in the use of SMS and email to support and coordinate group work. Table 6.10 shows, that in the second semester, all 14 groups reported using SMS and email and half were classified as being high users. Half the groups included detailed transcripts of their email and SMS contact.

6.10.3 Discussion of study 2

SMS and email can be used to improve group work through better contact and coordination. Groups that had very positive team evaluations had regular meetings, and regular contact to check progress, members’ well being and to make changes as and when necessary. These groups made more use of SMS and email. In contrast groups with low team evaluations reported poor communication between members. Groups 6 and 9 in particular reported difficulties in organising meetings.

**“Instead (of meetings) we communicated through lectures and labs that we had for other subjects, passing notes to each other and asking each other questions.” (Member of group 9)**

Those groups that did not use SMS and email during semester 1 tended to get lower marks and have lower team evaluations. Examples of ‘best practice’ regarding the use of SMS and email related to making arrangements, maintaining awareness of others and exchanging detailed information and code. Following the introduction of the ‘best practice’ examples, performance and team evaluation increased. The individual group data (Appendix H) shows that all 5 groups that were classified as low SMS and email users during semester 1 improved on their performance mark between semesters 1 and 2. Groups 6 & 9, for example, improved on both their marks and their team evaluation for semester 2. Their improvement in terms of producing a coherent piece of *group* work was particularly noted by their course lecturer.

The transcripts of SMS and email use during the second semester illustrated examples of the ‘best practice’ features outlined in table 6.8.

<b>SMS From: Lucy</b>	<b>To: Nicola</b>	<b>18:34</b>
Have done my review of one of the pacman games; do I need to do anything else?		
<b>SMS From: Nicola</b>	<b>To: Group</b>	<b>14:02</b>
Can we all meet in room 432 at 2:30 have to sort out what we are doing?		

**Email From: Mike   To: Nigel   14:49**

As Nigel pointed out I forgot to attach the pacman.java file on my last email...  
so here it is... :)

SMS and email were well integrated. SMS messages often alerted a group member to the fact that an email message had been sent. SMS was also a way of checking whether emails had been received.

**SMS From: Rob   To: Alex   12:17**

I have emailed you details of your assigned tasks

**SMS From: Ellen   To: Lee   19:44**

Just sent you another email this time to ur hotmail account cuz I cant get my uni account to work.

The SMS messages revealed some common problems with using email. Email is not as immediate medium as SMS and students were not always sure whether their emails had been received or read. This has repercussions for group work. There were also problems accessing University accounts at all times.

Other factors could have affected performance, for example, increased familiarity with the other group members and a better understanding of the course requirements. The ‘best practice’ examples, however, did encourage members to increase and adapt their SMS and email use and the course lecturer noted that the second semester reports submitted by these groups showed more evidence of communication and integration between members than the first semester reports.

#### **6.10.4 Implications for design**

- SMS alerts are a useful way of providing students with information. Students are more likely to respond straight away. SMS alerts or reminders can also reinforce a sense of group membership
- SMS could be used to direct attention towards an email containing more detailed information or towards a notice board
- Email systems need to be accessible from a variety of locations. Provision for multiple email account access would also encourage use

#### **6.10.5 Implications for community**

- Students' social lives are often inextricably linked to their work based lives i.e. the course. Encouraging a link between the two serves to reinforce a notion of community
- SMS is a useful medium for strengthening and extending relations within a community whilst email helps to maintain the weaker ties
- Providing guidelines on how to best to use or adapt SMS and email could improve communication between the community members

### **6.11 Chapter summary**

This chapter has shown that digital communities are communities whose members use a variety of technologies in support of their communication and interaction needs. In this community technologies such as email and SMS are integrated into the community in conjunction with face-to-face interactions. The framework has been used, as in chapter 3, to show how the two technologies differentially affect the community. It has also been used to characterise the type of community present. As in chapter 5, SMS is an immediate and informal technology that supports closer often more immediately geographically located groups of people.

It was shown that SMS and email are used in different ways. SMS is an immediate, informal technology that is used to extend work-based relations between classmates to include social interactions as well. Email, as a more formal medium is used to maintain relations between the students and the wider community of lecturers and family. Email is also used to exchange pieces of code for testing. Both technologies support the developing community of classmates in particular when the students are away from the shared location of the University department. The technologies are used for a variety of reasons and media choice appears to be based upon a number of factors. These include task-media fit, relationship factors and specific group norms. Study 1 highlighted the integration of multiple media within this digital community. Students used the two technologies in combination with their face-to-face interactions and in combination with other non-digital mediations, for example, notice boards.

In study 2, SMS and email use within the specific context of group work was examined. Students were given examples of SMS and email 'best practice' and many adapted their technology use accordingly. This led to increased SMS and email use and saw improved performance and team evaluation particularly among originally low SMS and email users. As noted in the previous SMS studies, the medium was often used to arrange face-to-face meetings. Students found email limiting under certain conditions. The asynchronous nature of email meant that the students were not always sure whether their emails had been received or read. In the next chapter, the group work theme is continued. The community framework is used to examine students using work board technologies to support their work-based communities.

## Chapter 7

# SHARED WHITEBOARDS AS GROUPWARE SUPPORT FOR COMMUNITIES

In this chapter the community framework is used to assess the nature of community of students using shared whiteboards, a relatively unfamiliar technology, to support their group work. A longitudinal study investigates student collaboration using shared whiteboards under a number of meeting conditions. Social and technological perceptions are assessed and information exchanges examined. The community framework identified areas affected by the technology in particular in terms of social and individual identities, shared history and member control. It was noted that the students were able to integrate and adapt the media to suit their task and social interaction needs.

## 7 Introduction

In chapter 6, the community framework was used to show how SMS and email are integrated in the digital communities of students on the Interactive Systems course. The two technologies were used in conjunction with face-to-face communication to develop and support members' social and work based communities. The two technologies were used differently depending on a variety of relationship and task factors. One finding was that students often found the asynchronous nature of email problematic in terms of their group work. It was also noted that, as in earlier chapters, community members are increasingly using asynchronous technologies in a synchronous manner. In this chapter the use of an intentionally synchronous medium by a group of students is examined.

Following on from the group work study in chapter 6, this chapter examines how students made use of whiteboard technologies to support their group projects. Whiteboards are



commonly used within industrial and corporate settings and are gradually becoming more common place within academic settings. Whilst whiteboard technologies allow for more diagrammatic forms of representation, it was envisioned that the nature of the task in this study would encourage the predominant use of text over diagram. Although, as a point of comparison, the technologies examined in chapters 3-6 all made use of additional forms of representation other than the basic text. SMS messages, for example, contained pictorial representations of the user.

The aim of this chapter was to examine whiteboard technologies as a form of support for student communities collaborating on project work. The fact that whiteboards are a relatively unfamiliar technology to the students, means that it is possible to examine how the students' attitudes towards the technology changes over time. With unfamiliar technologies this has implications for how members begin to integrate the new medium into their communities. Accordingly the first part of the chapter concentrates specifically on the members' attitudes towards the technology and how this interacts with their attitudes towards the group. The second part of the chapter examines in more detail how the students integrate the whiteboard technology into their community groups in order to support both their work and social interaction needs.

## **7.1 Shared whiteboards as a collaborative technology**

Desktop conferencing systems, such as Microsoft's NetMeeting, are designed to provide a means for geographically distributed teams to act as though co-located (Mark et al, 1999), i.e. by providing the opportunity to share the manipulation of objects or by providing multimodal communication channels. Good collaborative technologies function by becoming a highly visible part of the shared experience. The technology itself becomes an instrument of mutual knowledge construction for a group of people (Roschelle, 1992). Publicly acting on the technology involves gesturing, pointing to and generally talking about the problem and the technology.

A whiteboard would seem to fit this notion of collaborative technology and is a natural aid rather than an introduced tool that inhibits or distorts people's natural collaborative activities (Moran et al, 1996). Whiteboards are often a feature of face-to-face meetings. They provide a central display drawing surface that serves as a medium for presenting and capturing ideas, and a shared workspace around which groups can collaborate (Rekimoto, 1998). By extension, digital whiteboards could be important devices for computer-supported collaboration.

Digital whiteboards, for example the XeroxLiveBoard system (Elrod et al, 1992) are becoming more common in both organisational and educational settings (Howse et al, 2000; Abowd et al, 1998; Brna & Cooper, 2000). The digital whiteboard is not just a large computer display (Rekimoto, 1998). It offers a far more interactive environment. As well as actual text and diagrammatic input, the physical actions of its users such as pointing and gesturing are also important (Mark et al, 1999). Howse et al (2000) found that the use of a digital whiteboard facilitated interactive and collaborative learning. The students consistently engaged in a collaborative process by helping each other to learn how to use the digital whiteboard. Howse et al (2000) also found that using digital whiteboards led to the generation of more ideas than using a traditional board. Although text entry is more difficult using the digital whiteboard (Rekiomoto, 1998), words and concepts are easier to move around and link together.

## **7.2 Co-located group working**

Numerous studies have suggested a variety of benefits occur from having co-located work groups (see Olson & Olson, 2000 for a review). The main difference between face-to-face and distributed settings is that face-to-face meetings support the spatiality of human interaction. *"People and objects are located in space and their role in an ongoing discussion can be indexed by location"* (Olson & Olson, 2000 p 146). The features of face-to-face interaction such as observing facial reactions to ideas, pointing to lists and drawing out concepts in the air allow the establishment of common ground (Olson & Olson, 1991).

Common ground is vital for collaborative work and is easy to establish in face-to-face settings. Establishing common ground within distributed settings has often proved to be difficult (Olson & Olson, 2000). Groupware systems such as desktop conferencing, however, do allow group members to establish some common ground about the work context. In a study of NetMeeting use by a team at Boeing, for example, Mark et al (1999) found that meetings involving NetMeeting were rated as of high quality and a good use of time. Common ground was established to some extent through the telepointer and audio conferencing.

Distributed communication technologies often provide a structured interaction process, for example, to ensure that proper turn taking is achieved (Chidambaram, 1996). This sometimes means that such technologies encourage task focus at the expense of social interaction (Siegel et al, 1986). Groups, however, that achieve equilibrium between tasks and socio-emotional needs are more likely to develop and become productive (Ocker, 2001).

***Prediction:*** The literature suggests that distance still matters and that co-located settings will lead to more positive technological and social perceptions and to more social discussions.

One method of assessing technology use is to examine the types of information that flow through the groups via the media. This is useful in assessing different relationships within the groups and in examining what types of exchanges correspond to different media and distribution conditions. This approach has been used in the study of distance learning students. Haythornthwaite (1998), studying the development of community amongst a group of distance students, noted changes in four types of information exchange: collaborative work, exchanging advice, socialising and emotional support. These types of information exchange varied throughout the semester in relation to project deadlines and face-to-face meetings. Discussion types have been found to vary depending on the distribution and the media used (Haythornthwaite & Wellman, 1998).

**Prediction:** Discussions will be affected by distribution, media and will alter over the course of the study.

The effect of distribution will be affected by the technology or the media used. A common feature of distributed groups is that some members often lack control over or access to the collaborative technology. In some cases establishing shared representations is also limited. In technologies specifically designed for distributed communication added functionality can help make the experience more interactive for all. NetMeeting, for example, has a whiteboard function with a pointer, which allows remote people to gesture and point to areas of interest.

Remote students who have access to chat rooms, shared whiteboards and other highly interactive technologies have successfully completed distance learning courses (Haythornthwaite and colleagues, 1998; 2000). These remote students also exhibit high levels of group cohesion. Remote members are likely to face a number of problems compared to their co-located counterparts. Mark et al (1999) found that interacting through NetMeeting adversely affected performance by making it difficult to coordinate participation, identify remote speakers and to know who was present. Interaction was most difficult for remote members and they often reported not knowing when to interject (Mark et al, 1999). The communication problems in turn affect the development of social identity in virtual settings (Wiesenfeld et al, 1998). However, contrary to expectations, remote members of partially distributed working groups did not report lower technological perceptions (Burke et al, 1999). The authors suggest that the remote members found ways of supplementing the lean media.

Interaction difficulties might mean different patterns of discussion develop. If remote members feel unable to collaborate on the work, they may engage in more social based discussions instead. Roles within the co-located and remote settings may also affect the types of discussion taking place.

**Prediction:** Together, this suggests that both technological and social perceptions will be lower for remote members and that discussions will vary between co-located and remote members.

### **7.3 Social and technological perceptions**

Clearly, people's use of technology changes over time as they become more experienced with its properties and potential capabilities. As a user's comfort with a technology increases, attitudes towards the technology are also likely to change.

Perceptions towards the group and towards the media used are likely to change as members interact and gain experience of each other and of the technology in computer-supported environments (Burke & Chidambaram, 1999). Social and technological characteristics constrain group interaction and affect members' perceptions, attitudes and behaviours. There are two important sets of attitudes, those relating to social aspects of the group and those relating to the characteristics of the media i.e. technological perceptions.

**Social perceptions:** Cohesion refers to the attraction between group members and feelings of belonging to the group. Satisfaction deals with the overall satisfaction with the process and confidence in group decisions and outcomes. Measures of perceived group processes usually include assessment of collaborative environment, trust and group contribution.

**Technological perceptions:** Short et al (1976) argued that those media which convey greater amounts of verbal and non-verbal information are perceived as being more friendly and convey a more compelling sense of the presence of the communicative partner. Typically social presence is measured as the perceptions people have about their discussions and their relationships to the persons with whom they are communicating (Kraut et al, 1992). Rogers (1986) argues that the effectiveness of communication refers to the extent to which it facilitates mutual understanding and a sense of common ground

(Clarke & Brennan, 1991). A general measure of the usability of the technology was also taken in the form of the System Usability Scale (SUS).

Social and technological perceptions alter at different rates. Burke et al (1999) found that social perceptions, i.e. cohesion, satisfaction and attitudes towards group processes were faster to change and become more positive than attitudes towards the technology. Other studies have reported high social presence perceptions in distributed settings (Gunawardena & Zittle, 1997). Perceptions about the group i.e. social perceptions are likely to be affected by the location of members. Social perceptions or relations may also take longer to develop in technology mediated environments compared to face-to-face settings (Walther, 1995).

***Prediction:*** In group work, social perceptions and technological perceptions are likely to change and develop over time.

In general terms the introduction of technological support has tended to lower social presence among group members (Siegel et al, 1986; Chidambaram & Jones, 1993). However, not all studies have reported negative perceptions of computer support (Cass et al, 1991). The differences in the findings may result from the nature of the technological support and the manner in which it was integrated into face-to-face meetings. Some studies reporting reduced social presence have combined technological support with face-to-face meetings but have used rigid Group Support Systems (GSS) with distinctive procedural structures. In such circumstances face-to-face participants may find that they are not permitted to talk during certain sections of the meeting. This restriction on the naturalness of face-to-face meetings may have negatively influenced perceptions of the computer support. Burke et al (1999) found that the introduction of a less rigid form of computer support, in their study a shared editor, neither enhanced or reduced social presence in audio and videoconferencing.

***Prediction:*** Overall these studies suggest that media will affect social and technological perceptions and that perceptions will be lower in the digital whiteboard conditions.

## **7.4 Description of study**

In this study, the focus is on the partially distributed group. In this situation only some rather than all of the group members are distributed. A group of co-located members may be in a different location from a remote member or team for a number of reasons. A remote member may provide some additional expertise, two separate teams may need to work together on some aspect of a joint project or the group may wish to include a tele-worker. Partially distributed groups may present a different range of problems in terms of communication and information sharing and in terms of group dynamics (Burke et al, 1999).

Few studies have examined naturalistic, flexible media such as the whiteboard in any controlled manner. Group studies often focus on rigid technologies such as Electronic Meeting Support (EMS), which impose structure on the meeting process (Chidambaram & Jones, 1993). This study examines the effect of a much more flexible form of technological support, which places no restrictions on other forms of communication. The main advantage of the digital whiteboard over the traditional whiteboard is that the contents of the whiteboard can be stored and subsequently retrieved. Having such a record could be useful in returning the collective attention of work groups to previous discussions (Elrod et al, 1992).

Previous research into distributed groups has typically involved ethnographic studies of existing groups or involved tightly controlled experimental studies. Experimental studies have often used randomly selected students, carrying out highly prescribed, artificial tasks using structured technology. Both approaches often use short time-scale observations, e.g. a few hours of interaction. In contrast, this study examines a group over the course of an academic semester, meeting regularly to develop a project (in this instance, developing a presentation on a specific topic that requires the inclusion of material gathered through laboratory sessions each week). Unlike ethnographic studies,

some elements of this study have been controlled and students cycle through a series of conditions.

This study aims to examine the effect of media and distribution upon groups of students collaborating to produce an end of term presentation. Groups worked together in co-located and partially distributed settings using a range of media. This study focuses upon a specific collaboration but one that is real and meaningful. The task itself is genuine. This provides the students with a focus but does not specify an approach or seek a single correct answer. This study also takes a longitudinal approach to technology use within groups. Many experimental studies of technology use within groups provide only a snapshot view of events. Longitudinal studies such as this one are valuable in assessing changes and adaptation in attitudes towards technology and the group.

7.4.1 Experimental design and procedure

7.4.1.1 Overview of experiment

Over the course of the study the student groups used a mindmapping exercise to create a presentation for the end of term. The presentation itself was a genuine task contributing to the students’ overall module mark. Therefore the study had to be run as a quasi-experiment. There were four meeting conditions and each group met under each condition twice. At the end of each meeting assessments of members’ social and technological perceptions and information exchanges were made. Table 7.1 contains a section of the original table (1.1) in chapter 1 and shows the features of the technology studied in this chapter.

Type	Sync	Async	Ad-hoc	Organised	One-to-one	One-to-many	Mobile	Fixed	CMC technology
4	•			•		•		•	Shared whiteboard (audio and chat)

Table 7.1 Classification features of the technology studied in this chapter



7.4.1.2 Meeting conditions

Four meeting conditions were used. These are shown in table 7.2. The conditions varied depending on the whiteboard used (either traditional or digital) or the distribution of the group members (either co-located or distributed). In the distributed conditions half of the group members were placed in a separate room. Remote members were kept constant across the study. Remote group members used a Fujitsu stylistic running Microsoft NetMeeting across a wireless LAN to communicate with the rest of the group. NetMeeting’s whiteboard allowed remote members of the digital distributed condition to have a shared representation of the whiteboard on the stylistic. A web cam running through NetMeeting allowed the remote members of the traditional distributed condition to view the board on the stylistic. In the distributed conditions members had audio communication. In addition NetMeeting’s chat facility was offered as a discretionary means of communication. Chat allows text messages to be typed and sent between group members. The transcript of the chat conversation appeared in a dedicated window and was saved.

Media	Distribution	
	Co-located	Distributed
Traditional	Traditional whiteboard everyone in the same room	Traditional whiteboard. A webcam provides distributed members with a remote view of the whiteboard.
Digital	Digital whiteboard everyone in the same room	Digital whiteboard. A stylistic in remote location allows distributed members access to the whiteboard.

Table 7.2 The four different meeting conditions

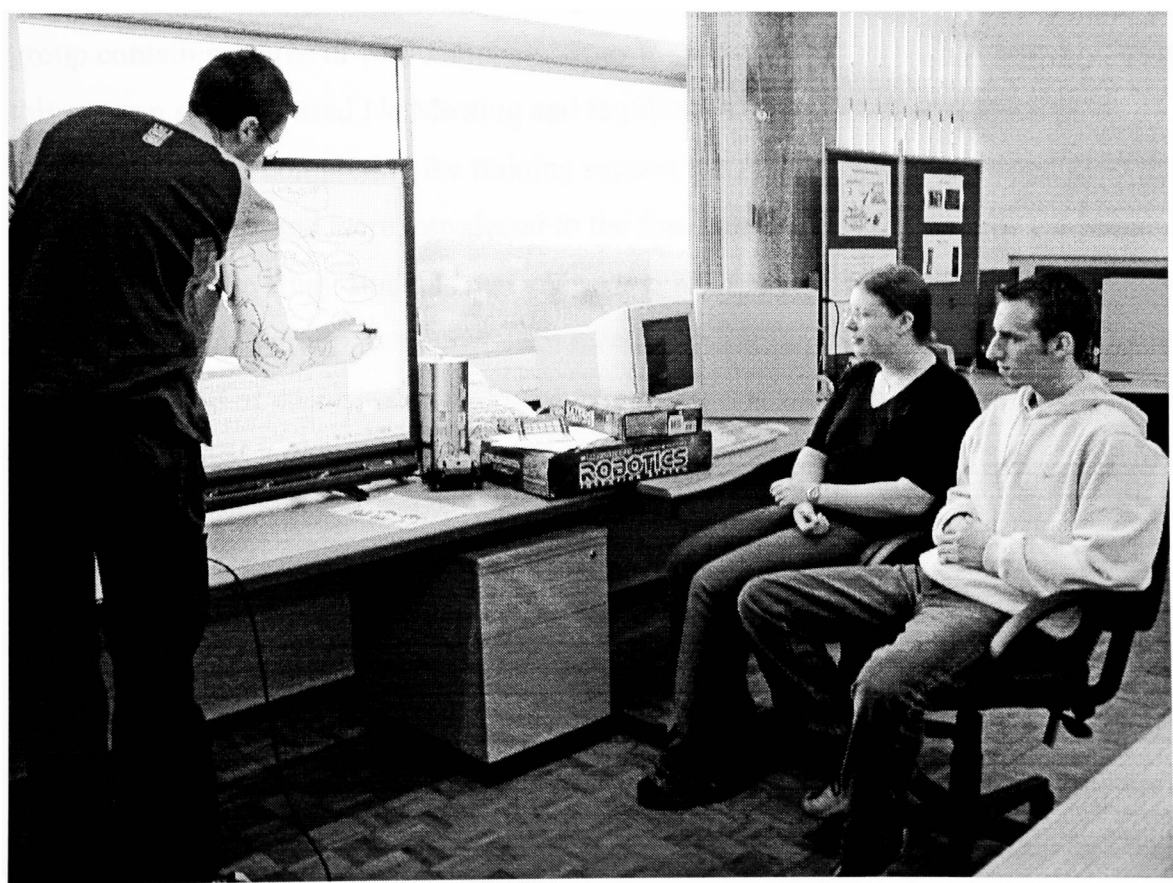
7.4.1.3 Participants

The participants were 1<sup>st</sup> year undergraduate students enrolled on the Interactive Systems course at Birmingham University. Twenty-five students (22 male and 3 female) with a median age of 19 took part in the study. Prior to the study, the students completed an attitudes and experience questionnaire regarding technology use. All the students showed

high levels of technology use and positive attitudes. There were no differences between the groups in terms of technology use and attitudes.



*Figure 7.1 Group of students using the traditional whiteboard*



*Figure 7.2 Group of students using digital whiteboard*

#### **7.4.1.4 Task**

The task was kept constant across sessions. The groups had to create a presentation based on a series of concurrent experiments. The theme for the presentation was personal and ubiquitous computing. The task for each meeting was to produce a set of mind maps that captured the product of that meeting. Every meeting one member was appointed scribe. It was envisioned, for example, that the first meeting would produce a brainstorming mind map around the general concepts. Over subsequent meetings the groups had to incorporate material gathered through the preceding laboratory sessions. The mind map concept is common in educational settings and is a natural whiteboard based task. The mind maps were saved at the end of each meeting and presented to the groups again at the start of the next meeting.

#### **7.4.1.5 Procedure**

During the first session the students arranged themselves into a total of seven groups each group containing three or four members. They then completed a training session. During this session students used NetMeeting and familiarised themselves with the digital whiteboard. Upon completing the training session the students were instructed as to the nature of their task and were introduced to the four meeting conditions. For the remaining eight weeks of the study students met once a week for approximately 20 minutes to work on their task. Each group met under each meeting condition twice. All mindmaps were saved at the end of each session and members completed questionnaires to assess social and technological perceptions and to record information exchanges.

#### **7.4.1.6 Measures**

Social and technological perceptions were measured using scales that have been constructed, validated and well tested in the literature (Burke et al, 1999; Chidambaram, 1996; Burke & Chidambaram, 1999; Chidambaram & Jones, 1993). Copies of the scales are included in Appendix I. Social presence was assessed using a 7-item scale and had an

internal reliability of 0.80 in this study. Communication effectiveness was assessed using an 8-item scale had an internal reliability of 0.83 in this study. Usability was assessed using the SUS scale with a Cronbach's alpha of 0.86. Cohesion was measured using a 7-item scale and had an internal reliability of 0.85 in this study. Processes and satisfaction were assessed with a 5 and 3-item scale respectively and had Cronbach's alphas of 0.76 and 0.75.

Performance, in terms of the presentation, was assessed and marked by the course lecturer. The edit based performance measures were derived through weekly comparison of the groups' mindmaps. For example, Group A's week 2 mindmap was compared with their week 1 mindmap to count the number of edits that had occurred i.e. new words, removed words, new links etc.

Members were asked to indicate the percentage of their meeting they personally had spent on each of the four discussion types and to indicate which types of discussion they had had with each member of the group. The discussion types were:

**Collaborative Work (CW):** Involved working on the actual presentation e.g. combining data and discussing ideas.

**Exchanging Advice (EA):** Involved exchanging advice on work-related topics e.g. how to use the technology and how to get a good mark.

**Socialising (S):** Non-task based discussion

**Emotional Support (ES):** Discussion about a group member's problems.

The author acted as observer during all the meetings. A summary of the predictions is shown in table 7.3. The predictions for perceptions and discussions are based on the literature review in sections 7.1-7.3. The performance predictions are based on Rekimoto's (1998) finding that editing is easier on a digital whiteboard and on Burke et al' (1999) suggestion that groups with higher social perceptions gain higher performance marks.

Perceptions and discussions of the Entire Group		
Media effects	1a:	Media will affect technological perceptions Technological perceptions will be higher under traditional whiteboard
	1b:	Media will affect social perceptions Social perceptions will be higher under traditional whiteboard
	1c:	Media will affect types of discussion
Distribution effects	2a:	Distribution will affect technological perceptions Technological perceptions will be higher under co-located conditions
	2b:	Distribution will affect social perceptions Social perceptions will be higher under co-located conditions
	2c:	Distribution will affect types of discussion
Media x distribution effects	3:	Distribution will have different effects on perceptions and discussions depending on the medium used
Time effects	4a:	Technological perceptions will increase between 1st and 2 <sup>nd</sup> use
	4b:	Social perceptions should increase over the course of the study
	4c:	Discussion types will alter over the course of the study
Comparison of co-located and remote members		
Location effects	5a:	Technological perceptions greater for co-located than for remote
	5b:	Social perceptions greater for co-located than for remote
	5c:	Difference between co-located and remote in terms of discussion types
Performance		
Edits	6a:	Media will affect edits on mindmap (more edits with digital whiteboard)
	6b:	Distribution will affect edits on mindmap (more edits co-located)
Presentation	7:	Groups with higher social perceptions will perform better on presentation.

Table 7.3 Summary of predictions

#### 7.4.1.7 Statistical treatments

Predictions 1-4 and 6 were analysed using the Wilcoxon test, a non-parametric equivalent of the paired samples t-test. Prediction 5 was analysed using the Mann-Whitney test, a non-parametric equivalent of the independent samples t-test. Prediction 7 was examined using the Pearson correlation.

### 7.5 Results

The results are considered in terms of three main effects: Media, Distribution, and Time, together with some associated interaction effects. The main metrics relate to participants' social and technical perceptions and information exchanges, together with some basic measures of performance. Means and standard deviations are shown in tables 7.4-7.8.

	Condition							
	Traditional collocated		Traditional distributed		Digital collocated		Digital distributed	
Social Presence	4.78	(.86)	4.0	(.79)	4.5	(.8)	3.8	(.73)
Communication effectiveness	5.3	(.88)	4.5	(.92)	4.9	(.91)	4.1	(.93)
SUS	82.7	(13.5)	66.2	(12.3)	68.2	(17.9)	62.8	(14.6)
Cohesion	5.7	(.86)	5.4	(.88)	5.6	(.7)	5.3	(.83)
Processes	5.7	(.76)	5.3	(.89)	5.2	(.7)	4.9	(1.1)
Satisfaction	5.5	(1.1)	4.9	(1.2)	4.9	(1.1)	4.2	(1.5)
Collaborative work	55.8	(28.8)	61.8	(28.9)	56.9	(28.1)	55.1	(28.7)
Exchanging advice	21.4	(18.2)	23.2	(22)	24.8	(21.3)	30.7	(24.6)
Socialising	20.7	(24.8)	11.4	(15.1)	11.5	(16.8)	10.6	(15.1)
Emotional support	2.1	(5.5)	3.6	(6.5)	6.7	(16.8)	4.1	(8.6)

*Table 7.4 Means and (standard deviations) for perceptions and information exchanges across the four conditions*

	Condition							
	Collocated (traditional)		Remote (traditional)		Collocated (digital)		Remote (digital)	
Social Presence	4.2	(.85)	3.9	(.64)	3.7	(.56)	3.8	(.94)
Communication effectiveness	4.4	(.99)	4.6	(.77)	4.1	(.99)	4.1	(.87)
SUS	65.2	(14.5)	67.4	(8.9)	59.9	(15.6)	66.5	(12.5)
Cohesion	5.4	(1.0)	5.5	(.69)	5.3	(.82)	5.4	(.86)
Processes	5.3	(.91)	5.3	(.89)	4.8	(1.1)	4.9	(1.0)
Satisfaction	4.8	(1.3)	5.0	(.99)	4.7	(1.5)	4.3	(1.4)
Collaborative work	62.9	(28.9)	60.3	(29.4)	50.3	(29.3)	61.4	(27.4)
Exchanging advice	23.4	(25.2)	22.9	(17.8)	32.8	(25.8)	27.9	(23.4)
Socialising	9.6	(12.7)	13.5	(17.7)	12.5	(17.7)	8.3	(11.0)
Emotional support	3.9	(6.9)	3.2	(6.2)	5.4	(10.2)	4.1	(8.6)

*Table 7.5 Means and (standard deviations) for perceptions and information exchanges for collocated and remote people*

	Total edits		New words		New links	
Traditional collocated	19.6	(15.4)	10.2	(10.0)	5.1	(3.8)
Traditional distributed	15.3	(6.6)	8.9	(4.8)	5.1	(3.6)
Digital collocated	14	(8.2)	6.1	(4.7)	4.3	(2.6)
Digital distributed	12.6	(7.7)	5.7	(2.6)	3.5	(3.8)

*Table 7.6 Means and (standard deviations) for edit performance measures (1)*

	Moved words		Removed words		Removed links	
Traditional collocated	1.1	(2.4)	2.1	(4.7)	1.2	(2.7)
Traditional distributed	0.14	(0.4)	1.4	(2.6)	0.43	(1.3)
Digital collocated	2.9	(2.6)	0.14	(0.4)	0.29	(0.8)
Digital distributed	0.7	(1.3)	1.6	(3.6)	1.1	(3.1)

*Table 7.7 Means and (standard deviations) for edit performance measures (2)*

High presentation mark (>50)	Low presentation mark (<50)
Group G (61)	Group C (49)
Group B (59)	Group D (47)
Group A (58)	Group F (42)
	Group E (35)

*Table 7.8 Group presentation marks*

### 7.5.1 Performance

Two main measures of performance were examined. The first was the number and type of edits on the whiteboards and the second was the mark awarded for the final presentation.

#### 7.5.1.1 Number of edits

Media did not affect the total number of mind-map edits. Of the types of edits reviewed only the number of new words and the number of word moves differed significantly in any of the conditions. The number of new words was greater using the traditional whiteboard in the co-located setting compared to the digital whiteboard in the co-located setting,  $z = 2.2$ ;  $p < 0.05$ . The digital whiteboard (in the co-located setting) was used to move around existing words to a greater extent then the traditional whiteboard (in the co-located setting)  $z = 2.0$ ;  $p < 0.05$  and in the distributed setting  $z = 2.0$ ;  $p < 0.05$ . Distribution had no significant effect on the mind-map edits.



### **7.5.1.2 Presentation**

There was no correlation between higher group perceptions and performance on the presentation. There was, however, a relationship between the total number of edits on the mind-map and the mark for the presentation. When the groups were split depending on their mark into a high group  $>50$  and a low group  $<50$  then there was a significant difference between the two groups in terms of the number of edits. The high group made significantly more edits to their mind-maps during the meetings ( $z = 2.12$ ;  $p < 0.05$ ).

## **7.5.2 Media effects**

### **7.5.2.1 Technological perceptions**

The traditional whiteboard led to higher perceptions of social presence in the co-located condition i.e. traditional co-located versus digital co-located  $z = 2.54$ ;  $p < 0.05$  and in the distributed condition (i.e. traditional distributed versus digital distributed)  $z = 2.07$ ;  $p < 0.05$ . The traditional whiteboard led to higher perceptions of communication effectiveness. This was the case in both the co-located and the distributed conditions  $z = 2.67$ ;  $p < 0.01$ ,  $z = 1.97$ ;  $p < 0.05$ . There was an effect of whiteboard on usability perceptions in the form of the SUS scores. In the co-located condition the traditional whiteboard was perceived as more usable  $z = 4.03$ ;  $p < 0.01$  and in the distributed condition although this was not significant.

### **7.5.2.2 Social perceptions**

There was no main effect of media upon cohesion. However media use did affect both group processes and perceptions of satisfaction. The traditional whiteboard led to higher perceptions of group processes in the co-located condition and the distributed condition  $z = 3.56$ ;  $p < 0.01$ ,  $z = 1.99$ ;  $p < 0.05$ . The traditional whiteboard led to higher perceptions of satisfaction in both the co-located condition and the distributed condition  $z = 2.81$ ;  $p < 0.01$ ,  $z = 2.24$ ;  $p < 0.05$ .

### **7.5.2.3 Discussion types**

There was no effect of media on the amount of collaborative work, exchanging advice, socialising and emotional support discussion types.

## **7.5.3 Distribution effects**

### **7.5.3.1 Technological perceptions**

Co-located conditions led to increased technological perceptions. This was true in both the traditional whiteboard condition and the digital whiteboard condition. Social presence was higher in the co-located conditions than the distributed conditions both for the traditional whiteboard condition  $z = 5.25$ ;  $p < 0.01$ , and the digital whiteboard condition,  $z = 4.55$ ;  $p < 0.01$ . Communication effectiveness,  $z = 4.24$ ;  $p < 0.01$ ,  $z = 4.36$ ;  $p < 0.01$  and usability,  $z = 2.92$ ;  $p < 0.01$ ,  $z = 2.04$ ;  $p < 0.05$ , were all higher in the co-located conditions compared with the distributed conditions.

### **7.5.3.2 Social perceptions**

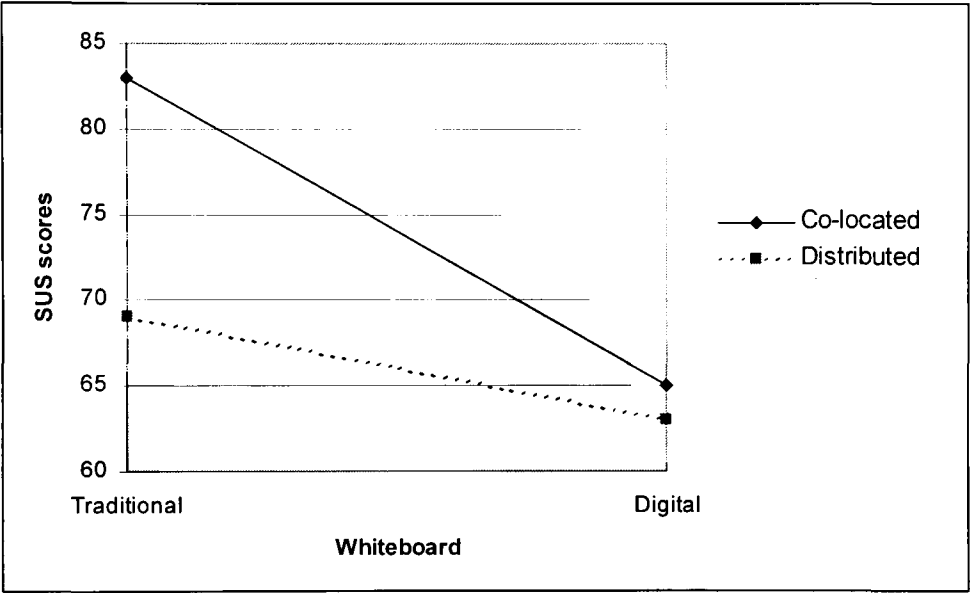
There was no effect of distribution upon cohesion. However distribution did affect the perception of group processes and of satisfaction. Co-located conditions led to increased social perceptions. This was the case in both the traditional whiteboard condition and the digital whiteboard condition. Group processes (traditional)  $z = 2.58$ ;  $p < 0.05$  and (digital)  $z = 1.99$ ;  $p < 0.05$ . Satisfaction (traditional)  $z = 3.31$ ;  $p < 0.01$  and (digital)  $z = 2.76$ ;  $p < 0.01$ .

### **7.5.3.3 Discussion types**

Overall there was no effect of distribution on discussion types. This was the case for collaborative work, exchanging advice and emotional support discussions. Distribution did affect the amount of socialising exchanges. Using the traditional whiteboard under the co-located condition increased the amount of socialising compared to the distributed condition  $z = 2.89$ ;  $p < 0.01$ .

**7.5.4 Media x distribution effects**

There were no interaction effects for social perceptions. There was an interaction effect for one of the technological perceptions, SUS. Figure 7.3 illustrates the different effect of distribution on the traditional whiteboard compared with the digital whiteboard. There is very little effect of distribution on SUS perceptions using the digital whiteboard. Location has a much greater effect on SUS perceptions using the traditional whiteboard. There was a very similar effect of distribution upon the amount of socialising (S) exchanges that occur using the two whiteboards. Once again distribution affects the traditional whiteboard to a greater extent than the digital whiteboard.



*Figure 7.3 Interaction between media and distribution in terms of SUS scores*

**7.5.5 Time effects**

**7.5.5.1 Technological perceptions**

Some technological perceptions did increase between the 1<sup>st</sup> and 2<sup>nd</sup> use of some of the meeting conditions. Social presence increased across all conditions but significantly between the traditional co-located conditions  $z = 2.18$ ;  $p < 0.05$ . Communication effectiveness increased across all conditions but significantly between digital co-located conditions  $z = 2.1$ ;  $p < 0.05$ . SUS scores increased across both co-located conditions but

significantly between traditional co-located conditions  $z = 1.97$ ;  $p < 0.05$  and across traditional distributed conditions  $z = 19.8$ ;  $p < 0.05$ . SUS scores actually fell between the two digital distributed conditions although this was not significant.

#### ***7.5.5.2 Social perceptions***

All of the group perceptions increased over the course of the study. Cohesion and group processes increased significantly  $z = 2.03$ ;  $p < 0.05$  and  $z = 1.98$ ;  $p < 0.05$ . Satisfaction also increased but this was not a significant result.

#### ***7.5.5.3 Discussion types***

The discussion types altered across the study. As collaborative work exchanges increased, social exchanges decreased and vice versa.

### **7.5.6 Comparison of co-located and remote group members**

#### ***7.5.6.1 Social and technological perceptions***

There were no significant differences between the social or the technological perceptions of the remote and co-located group members. Furthermore there were no differences between groups containing a single remote person and two remote people. There were no differences between the different types of discussions. Both co-located and remote people spent a similar amount of time on the four discussion types.

#### ***7.5.6.2 Discussion types***

When discussion types between specific members of the groups were examined, however, differences between face-to-face and distributed discussions did emerge. Figure 7.4 illustrates the percentage of distributed meetings containing the different types of discussions in terms of the location of the two partners. The members were asked to indicate which type of discussions they had had with each of the other group members.

When the partner interaction was face-to-face e.g. between two co-located members or between two remote members, all of the meetings contained some discussion on collaborative work (CW).

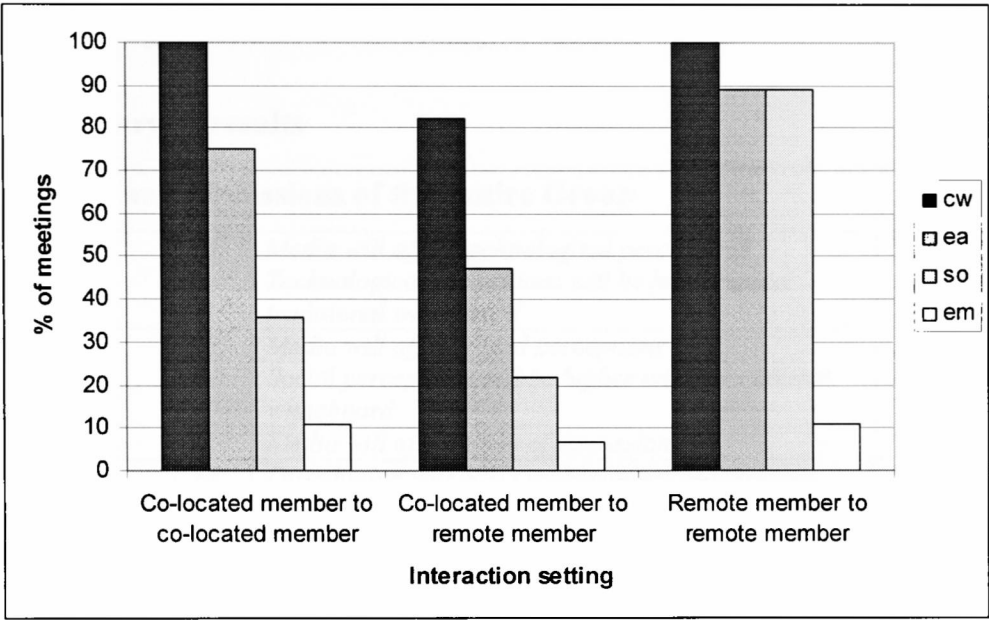


Figure 7.4 The effect of interaction setting on discussion types

The percentage of meetings containing all four discussion types was higher in interaction settings, which permitted face-to-face discussion. Collaborative work, (CW) exchanging advice, (EA) social interaction (S) and emotional support (ES) all suffered across the ether (i.e. in mixed setting interactions when co-located members interacted with remote members).

The percentage of interactions containing discussions on collaborative work (CW) discussions was far higher between co-located members compared to mixed (co-located and remote) members  $z = 2.04$ ;  $p < 0.05$ . More of the interactions between remote members contained social exchanges (S) compared to interactions between co-located members  $z = 3.51$ ;  $p < 0.01$ .

There were two main ‘prescribed’ roles within the groups. The scribe was in charge of writing down the groups’ thoughts and ideas on the whiteboard. The audio controller was

in charge of communicating with the remote group members. In distributed settings having a role, either as scribe or audio controller affected the types of interactions that that member was involved in. Audio controllers were more involved in exchanging advice than the scribes  $z = 2.3$   $p < 0.05$ . In co-located settings, however, there was no effect of having the role of scribe on any of the discussions within the group.

### 7.5.7 Summary of results

Perceptions and discussions of the Entire Group			
Media effects	1a:	Media will affect technological perceptions Technological perceptions will be higher under traditional whiteboard	Supported
	1b:	Media will affect social perceptions Social perceptions will be higher under traditional whiteboard	Partially supported
	1c:	Media will affect types of discussion	Not supported
Distribution effects	2a:	Distribution will affect technological perceptions Technological perceptions will be higher under co-located conditions	Supported
	2b:	Distribution will affect social perceptions Social perceptions will be higher under co-located conditions	Partially supported
	2c:	Distribution will affect types of discussion	Not supported
Media x distribution effects	3:	Distribution will have different effects on perceptions and discussions depending on the medium used	Partially supported
Time effects	4a:	Technological perceptions will increase between 1 <sup>st</sup> and 2 <sup>nd</sup> use	Partially supported
	4b:	Social perceptions should increase over the course of the study	Supported
	4c:	Discussion types will alter over the course of the study	Supported
Comparison of co-located and remote members			
Location effects	5a:	Technological perceptions greater for co-located than for remote	Not supported
	5b:	Social perceptions greater for co-located than for remote	Not supported
	5c:	Difference between co-located and remote in terms of discussion types	Not supported
Performance			
Edits	6a:	Media will affect edits on mindmap (more edits with Digital whiteboard)	Not supported
	6b:	Distribution will affect edits on mindmap (more edits co-located)	Not supported
Presentation	7:	Groups with higher group perceptions will perform better on presentation.	Not supported

Table 7.9 Summary of results

## 7.6 Discussion

Table 7.9 summarises the results. In terms of the perceptions of the entire group, media and distribution affected technological perceptions. Perceptions were more positive under the traditional whiteboard and in co-located settings. Media and distribution also affected social perceptions. Cohesion, however, was not affected by media or distribution. The predictions regarding the comparison of co-located and remote members were not supported. The remote group members had similar perceptions to the co-located members. The results also indicate that attitudes towards media can alter even between the first and second uses.

Using a shared whiteboard in distributed settings led to decreased social and technological perceptions by the group members and was the students' least favourite option. However, all the groups successfully completed their presentations and there were no performance differences between any of the conditions. The results are interesting and suggest that providing existing groups with new forms of groupware may be very different to trying to establish work patterns and a sense of social identity within experimental or newly formed groups. The effect of media, distribution and time are discussed below with particular reference to the high levels of cohesion between group members.

### 7.6.1 Media effects on perceptions and discussion types

Despite reduced social presence and communication effectiveness in the digital whiteboard conditions compared with the traditional, cohesion levels did not differ between the media. Nor did distribution affect the levels of cohesion. Whilst the other social perceptions; group processes and satisfaction, were affected by distribution and media, cohesion levels amongst group members remained resistant. Some social perceptions are intertwined with media and location. The perceptions of group processes and of satisfaction are more related to the groups' efforts under a particular meeting condition. Cohesion remains a more robust concept. Mark et al (1999) noted that being virtually co-located was not ideal for developing working practices or establishing team

identity. If groups, however, already possess a social identity then distribution and media appear not to be such important factors. Such groups are already likely to have insights into each other's working styles and the group task itself. Those who have already established common ground can communicate well even over impoverished media (Olson & Olson, 2000).

#### **7.6.2 Distribution effects on perceptions and discussion types**

As predicted the co-located, face-to-face conditions led to improved technological and social perceptions compared to the distributed settings. Distribution had a more negative impact on the traditional whiteboard than the digital whiteboard. The effect, however, of this impact was not as widespread as predicted. Manipulating the traditional whiteboard so that that it could be used in a distributed setting led to more negative perceptions of usability. The negative impact of distribution was limited in the digital condition possibly by the fact that the medium was not that changed from its co-located form. Students reported some problems with the webcam and this may have led to lower perceptions of usability in the traditionally distributed condition. Interestingly, despite the webcam difficulties, the traditional distributed condition was still perceived as being more usable than the digital distributed condition. In terms of discussion types only distributed socialising was differentially affected by the medium. The percentage of socialising exchanges fell dramatically between the traditional co-located and distributed conditions but was relatively unaffected by distribution in the digital conditions.

#### **7.6.3 Changes in perceptions and discussion types**

Both technological and social perceptions changed over the course of the study. Between the first and second use of the technologies perceptions of social presence, communication effectiveness and usability increased and in many cases the increase was significant. Although some studies (e.g. Burke & Chidambaram, 1999) have noted that perceptions of the technology are relatively inflexible compared to those of the group, this study has demonstrated that perceptions of the technology can alter just as quickly as perceptions of the group. The whiteboards may well present a more flexible media than



the group-writing tool used in Burke & Chidambaram's (1999) study. Another possibility is that the high cohesion levels within the groups meant that members felt comfortable with each other. In turn this enabled them to support and encourage each other to adapt the medium to suit their own needs and to make it more usable. The chat transcripts show that remote people felt able to suggest making changes in use to the co-located members. Social perceptions, including the level of cohesion, also increased over the course of the study.

The discussion types altered over time. The pattern of change appears to be related both to the meeting condition and to the stage of the project. Towards the end of the project, for example, as the groups aimed to finish their presentations the amount of collaborative work discussions increased. There was a decrease in socialising and collaborative discussions during week 4. At this time all groups were engaged in one of the distributed conditions and spent more of their time engaged in exchanging advice discussions e.g. discussing how to use the technology and how to get a good mark.

#### **7.6.4 Being co-located versus being remote**

This study supports the finding of Burke et al (1999) that there are no significant differences between co-located and remote members in terms of social presence and communication effectiveness. Furthermore, both pairs and single remote members showed no significant differences with co-located members or with each other. It has been suggested that the use of a secondary communication channel, for example Chat, compensates for deficiencies in the primary, audio channel and allows distributed group members to form impressions about each other and to bond (Burke et al, 1999; Mark et al 1999). However, in this study although the Chat sessions did contain informal discussions there were no differences between social presence and communication effectiveness scores for groups using Chat compared to groups that did not use the facility.

There were no differences between co-located and remote members in terms of social perceptions either. High levels of cohesion within the groups may mean that the effect of

distribution is simply felt as a group effect and not felt more keenly by the remote members. The nature of the discussion types might also explain why perceptions between remote and co-located members did not differ. In addition to their communications with the co-located members, interactions between remote members were characterised by high levels of socialising and exchanging advice, in addition to collaborative work. In settings with just one remote member the Chat sessions were useful in facilitating discussions between the members. In Mark et al's (1999) study, Chat was used as a side issue to the main audio discussion. It contained separate usually off topic information. The Chat sessions in this study were far more integrated into the overall group communication.

Remote members were also free from the constraints of having a 'role' within the meetings. Being a scribe or in charge of audio communication reduced the amount of socialising and collaborative discussions the member took part in, in distributed conditions, although it did not affect their social or technological perceptions. Whilst the scribe would appear to be in a controlling position, the role can in fact restrict their impact on the product or outcome of the group. This may be because of the extra time and effort involved in incorporating the ideas of remote members. Similar findings have been reported for the group member in control of the mouse or other single input device (Mantei, 1988; Cole, 1995; Abnett et al, 2001). Being the audio controller also reduced social and collaborative discussions but increased the amount of exchanging advice discussions relative to the scribe. In co-located settings, however, there was no effect of having the role of scribe on any of the discussions within the group.

The fact that the remote members did not have the same level of interaction and control as the co-located members over the technology does not seem to have affected their perceptions. The shared representation appears to be sufficient to keep both parties involved in the task and involved with the group. Far from feeling left out, the remote members without specific roles to perform could devote more of their time to thinking up ideas for the project. The division between those with roles and those without, the self appointed 'thinkers', seems to have ensured that everyone felt involved.

In summary, remote members did not feel isolated or uninvolved because of a number of factors. Firstly, there was a strong sense of belonging to the group as a whole. Secondly, the remote people engaged in a lot of social and exchanging advice discussions between themselves. Thirdly the whiteboard provided a shared representation of the task. Fourthly, no roles for the remote people meant more time spent on contributing ideas related to the task. Finally they were active in suggesting how the co-located people could adapt the media.

#### **7.6.5 Performance**

Although the overall number of edits did not differ across media or distribution, an examination of the specific types of edits reveals a number of differences. The number of new words generated was greater using the traditional whiteboard in the co-located setting compared to the digital whiteboard in the co-located setting. Rekimoto (1998) describes difficulties with text entry to digital whiteboards and in this study it was apparent that some students were uncomfortable with writing on the digital board. The students felt happy to move around existing words on the digital whiteboard but less comfortable with the idea of editing a specific word, for fear of losing items altogether. There was no correlation between higher technological or social perceptions and performance on the presentation. Interestingly there was a link between performance and the total number of edits performed during the study period with more edits relating to a better presentation mark.

#### **7.7 The role of shared whiteboards in maintaining community cohesion**

In the first part of this chapter it was shown how groups of students successfully used the shared whiteboards provided to complete the task of creating a presentation. Members' attitudes towards their groups, in particular towards their productivity, were affected by media, time and distribution effects. The underlying sense of cohesion and of community that was felt between members, however, was unaffected by changes in media or the arrangement of group members. In this second part of the chapter the data is examined in

terms of how the students used the shared whiteboards to support the key features of their own communities. The students' use of the audio channel and the Chat facility is examined in detail. What features of the technology made it possible for the students to maintain high levels of cohesion and of community and what features of the technology were adapted to suit their needs and their ways of working together? In particular the flexibility of the technology in terms of adaptation and integration is examined.

### **7.7.1 Student work groups as communities**

Developing a sense of community amongst classmates is seen as important because of a number of benefits that it confers on both individuals and their communities (Haythornthwaite et al, 2000). Moving a cohort of students towards a community (Misanchuk & Anderson, 2001) is a major aim of educators and group project work is seen as one way of achieving this goal. Student groups are well used to sharing and collaborating, a necessary feature if distant technologies are to stand any chance of succeeding (Olson & Olson, 2000). Student groups are also used to using multiple media in work and social tasks (Haythornthwaite, 1998). Student groups are also groups that are likely to maintain a high level of cohesion. Studies involving students allow their collaboration to be viewed as part of the long term and multi-layered relations that occur within communities of students (Mynatt et al, 1997). Whilst the students were concerned with the top-level goal of completing their presentations they are also interested in exchanging personal information, strengthening interpersonal knowledge and building up a stronger social identity. Student work groups are not only task based groups. Their remit is much larger. How they work together on tasks affects their future relations and the development of more multiplex ties. Their social lives are often inextricably linked to their working lives as was demonstrated in chapter 6.

## **7.7.2 Data collection**

### ***7.7.2.1 Scales***

These were used to collect data relating to task and social roles (Appendix I contains details). After each meeting, group members were asked to indicate how much of their time had been spent engaged in various group activities. Seven roles related to the task aspect of the group and six related to the promotion of social interaction. The roles were based on Benne & Sheat's (1948) taxonomy of group roles. Their taxonomy has been used in numerous managerial and academic contexts and has also been applied to the study of computer-supported groups. Zigurs & Kozar (1994) found a similar division between task and socio-emotional roles within computer-supported groups.

### ***7.7.2.2 Chat transcripts***

During the distributed meetings NetMeeting's Chat facility was available to all the groups. The use of the Chat facility was discretionary and the groups made a number of different choices regarding the use of Chat. NetMeeting automatically recorded the transcripts of the Chat sessions. In the analysis, extracts from the Chat transcript are included in their original table-like format.

### ***7.7.2.3 Interviews and observations***

Four of the seven groups were interviewed after the study. Interviews were held in the original group formations and lasted approximately 45 minutes. They were recorded and later transcribed. The interviews covered a number of issues. These included each group's experiences of using the different meeting conditions and the notion of group work. Finally, a series of group specific questions were posed. These related to the use or non-use of the Chat facility and the experiences of the remote group members.

## **7.8 Results**

The analysis of the scales, Chat and interview data is divided into 2 sections

The first examines how the technology was used by the student groups over the course of the eight week study. In the second, these results are then discussed in terms of their implications for the five headings of the community framework. Technological support for the community’s activities is examined before the wider implications of the results are then described in the discussion section.

### 7.8.1 Interactivity

Table 7.10 summarises the use of the Chat facility over the course of the study. Each cell of the table represents a meeting session. The greyed out cells indicate co-located meetings where Chat was not an option. The other cells indicate whether or not Chat was used (Chat or X) and the condition of the meeting either D for digital distributed or T for traditional distributed. It indicates that most groups used the Chat facility at some point during the study. Chat was an option 28 times and was used 14 times, 6 times under the digital distributed condition and 8 times under the traditional distributed condition.

Group	Week of Study							
	1	2	3	4	5	6	7	8
A			X (T)	Chat (D)		X (T)	X (D)	
B			X (D)	X (T)			X (D)	X (T)
C			Chat (D)	Chat (D)		Chat (T)		
D			Chat (D)	Chat (T)				Chat (T)
E			X (D)	X (T)		X (T)		
F				Chat (T)		Chat (T)	X (D)	
G			Chat (D)	Chat (T)				Chat (T)

Table 7.10 Summary of Chat use throughout the study

X = Chat was an option but was not used, D = Digital distributed condition, T = Traditional distributed condition (shaded cells indicate co-located sessions in which Chat was not an option)

Table 7.11 indicates that the co-located and the remote members sent approximately equal numbers of Chat messages across the study as a whole. When each session is examined in detail, however, there is a great deal of variation between the percentage of messages each location contributes to any one session (see table 7.11). In some sessions,

for example, the remote members contributed only 11% of the messages whilst the co-located members contributed 89% of the messages. Table 7.11 also shows that co-located members initiated more of the Chat sessions than the remote members. The use of the two-way audio channel, however, ensured that interactive discussions were maintained.

	Number of messages sent by the different members	% of session messages contributed by the different members	Location of person initiating Chat session (out of 14 sessions)
Remote members	85	11-78%	5
Co-located members	84	22-89%	9
Total	169		

Table 7.11 Summary data for Chat use

### 7.8.2 Integration data

Table 7.12 shows how the groups used a variety of media during their distributed meetings. The audio channel, whiteboard and face-to-face communication were used in all the distributed meetings. Chat was not used by all the groups and was used in more of the traditional distributed conditions compared to the digital distributed conditions.

Condition	Media used			
	Audio	Chat	Whiteboard	Face-to-face
Digital distributed (1)	7/7	3/7	7/7	7/7
Digital distributed (2)	7/7	3/7	7/7	7/7
Traditional distributed (1)	7/7	4/7	7/7	7/7
Traditional distributed (2)	7/7	4/7	7/7	7/7

Table 7.12 Number of groups using the different media under the two distributed conditions

### 7.8.3 Identity

It was noted in section 7.5.5.2 that the groups reported a strong sense of social identity as measured by the cohesion scale. Social identity scores increased significantly over the course of the study  $z = 2.03$ ;  $p < 0.05$ . The groups were also asked to comment directly on

their sense of community. The students reported a fairly high sense of community between group members (mean score 5.2 on a scale of 1-7).

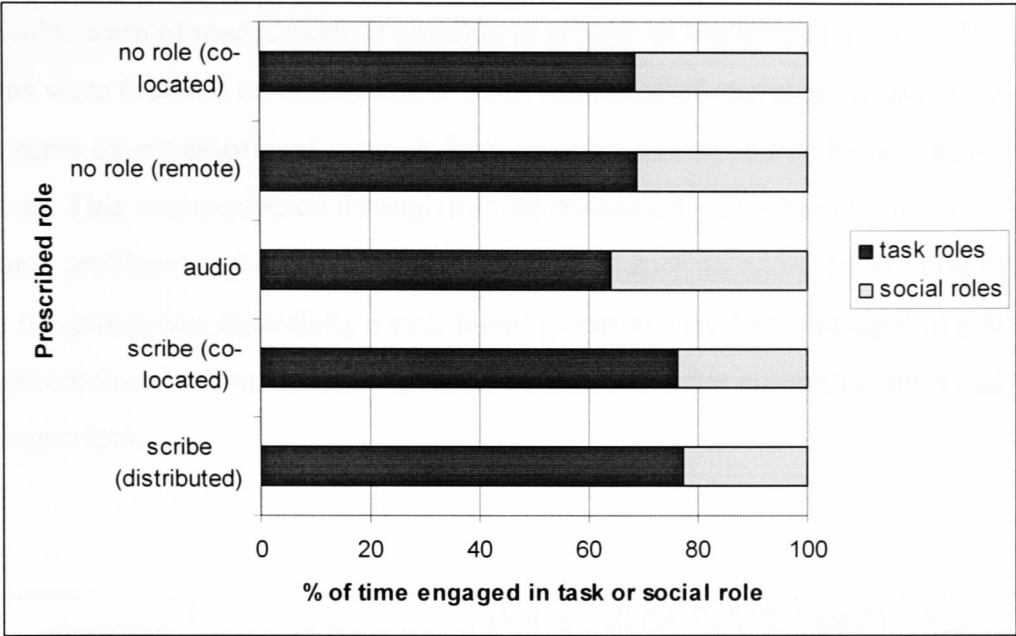


Figure 7.5 Division of time into task and social roles depending on prescribed role

Individual identities were also shaped by the existence of prescribed roles. Figure 7.5 illustrates the overall effect of having a prescribed role on the time spent engaged in different task and social roles within the groups. Scribes spent more time in task roles than other people and audio controllers spent more time involved in social roles. In particular audio controllers spent more time mediating differences and helping the group evaluate its processes.

7.9 Community framework analysis

The results are now discussed in terms of the five headings of the community framework.

7.9.1 Membership component

The results show that the groups maintained a strong sense of social identity. This is easily achieved in the co-located settings using face-to-face communication. Maintaining



these identities becomes especially important in the distributed conditions. The audio and Chat communication were both important and were used separately and in combination.

The combination of media made it possible to engage in multiplex relations. These relations were founded on collaborative work but included exchanging advice, socialising and to some extent emotional support. There was a sense of shared human feeling within the group. This was expressed through mutual assistance with the technology, discussing emotional problems and expressing personal wishes such as saying happy birthday. Whilst the group was essentially a task-based group, the students engaged in a lot of informal communication. This was present in both the audio communication and in the Chat transcripts.

Toshiba 4000CDS	15/02/02	11:44:45	what are all the CrAzY sounds ...pops etc...?
fujitsu stylistic	15/02/02	11:45:12	cardiac arrest
Toshiba 4000CDS	15/02/02	11:45:24	Lol
Toshiba 4000CDS	15/02/02	11:45:56	ok mr comedy genius is there a topic you want to specify

The audio communication was particularly important in maintaining personal and social identities. At the start of a distributed meeting, audio communication often began with a check of the identities of the speakers. Both remote and co-located members wanted to know more about the others condition. Co-located people, for example, wanted to know where the remote people were sitting and what they were doing (in a similar way to asking a mobile phone caller ‘where are you?’) Similarly remote people wanted to know about the division of tasks amongst the co-located members. Audio communication was important in terms of making a personal investment in the community. The audio controller was in charge of communicating with the remote group members. Although they were very involved in the group, this role reduced their actual input in terms of idea generation. The groups felt that not having a prescribed role allowed for more input into

the discussions and the finished product. The scribe often referred to the whiteboard as being “their board” and the pen seemed to be a symbol of dominance.

**(if) “you had control of the pen, you could just write whatever you wanted to, whether or not anyone said it was wrong...(if) you've got the pen you've got the power.”**

Developing a shared history is important for the growth of social identity. During the course of all the distributed meetings, Chat sessions provided a shared record of discussions. Shared history was developed over the course of the study through the use of the mindmaps. These artefacts were jointly created and then saved after each meeting and presented to the groups at the start of the next meeting. This continuity helped bring the group back to their thoughts and provided a shared history of their joint collaborations and efforts. Both the audio and the Chat support group identity through references to the shared mindmaps and to the presentation. The mindmaps themselves were also a key aspect of each group’s social identity. Each group was able to identify their own mindmap and distinguish it from the others.

**7.9.2 Organisation component**

Toshiba 4000CDS	15/02/02	11:05:59	anything to add?
fujitsu stylistic	15/02/02	11:06:11	im just looking
fujitsu stylistic	15/02/02	11:08:22	hearing aids??
Toshiba 4000CDS	15/02/02	11:08:46	explain...
fujitsu stylistic	15/02/02	11:09:16	those really small philips things
fujitsu stylistic	15/02/02	11:09:45	that just fit inside the ear without being seen

Interactivity within face-to-face settings is relatively easy to achieve. Conversations can be monitored and discussions referred to thus making clarifications simple. Within distributed settings interactivity is sometimes more difficult. The Chat sessions, on the whole, were interactive and involved both remote (fujitsu stylistic) and co-located

(Toshiba) members as can be seen in the example above. The chat sessions functioned in a similar way to SMS to in chapter 6 by adding an interactive and social element to the work group.

Table 7.6 showed that there was a lot of variation in the percentage of messages contributed to a session by the co-located and the remote members. This is partly explained by the successful interactivity of messages across media. Co-located members, for example, often asked the remote members a question via the Chat facility. The remote members then answered the question via the audio link.

Interactive discussions were maintained in part through the nature of the group members' expertise. Members with prior experience of using NetMeeting chose to use the Chat facility. Those judged to have the best handwriting were elected scribes and those with the most radio or public speaking experience were invited to be the audio controller. The groups also split the work into sections depending upon different people's domain knowledge and expertise.

Where the discussions displayed interactivity it was possible to note the effect of member control decisions. Although the students had no control over the topic or the type of meeting condition they did have control over how to approach the topic and how to organise their work, the technology and their group. This included choosing a scribe, deciding whether to use Chat, how to use the digital whiteboard and how to include the remote members. Being co-located seemed to convey a sense of control as well. Many co-located members felt in control of the meetings because they were the ones 'dealing' with the technology. Although the remote members did not feel left out there were occasionally interactivity problems.

**“They (co-located people) decided upon 3G as the topic and so removed the old mind map. We (remote people) nearly had a heart attack cos they didn’t tell us beforehand”**

### 7.9.3 Integration

Over the course of the 8 weeks the students used a combination of face-to-face and technology mediated communications. There were a number of key differences between co-located and distributed meetings. During co-located meetings, more talking and less writing occurred and there was far more non-verbal communication such as gazing, nodding and pointing. Table 7.7 showed that during the distributed meetings audio communication was preferred. In general the two main distributed communication channels, audio and Chat, were well integrated. Chat was used if more detail was required, for example, with an unusual spelling or unfamiliar concept. In the distributed conditions co-located members had to be able to integrate face-to-face communication with audio and Chat so that remote members were included in the group's meeting. A common problem that occurred involved the direction of conversations (Mark et al, 1999). Remote people were not always sure whether or not they were being addressed. The groups developed a number of strategies to deal with this problem some of which involved careful integration of the different media. The most simple was to end each question with the name of the intended recipient. The second involved the audio controller whispering when talking to his fellow co-located member to ensure that the remote member did not think the conversation was directed at him. The third strategy involved the audio controller talking loudly during the whole meeting, both into the microphone and to the rest of the group. There were no communication problems in directing the conversation using this running commentary method. Remote members commented on the benefits of being in a pair. This arrangement helped them to integrate the different media more effectively by each choosing a communication medium to control.

The digital whiteboard was an unknown to most of the students. Students talked about it being 'slower' to write on and there were concerns over deleting more information than was intended. Others thought the digital whiteboard would have been more useful with a plug in keyboard. The webcam proved to be temperamental and some of the groups

experienced problems in this respect. In distributed settings co-located people adapted the set-up to suit their needs. One audio controller, for example, picked up the microphone and used it at a stretch so that he could see the traditional whiteboard more clearly. Remote people also made suggestions as to ways the co-located members could use the technology.

fujitsu stylistic	15/03/02	12:29:42	I think its a good idea, every time Steve writes something on the board, you write it in the chat.
fujitsu stylistic	15/03/02	12:32:17	write lower on the paper and bigger

### 7.9.4 Social network

Figure 7.6 shows the social network diagrams for Group G under the four different meeting conditions. The diagrams indicate a close-knit tightly bound group (Wellman, 1997) in which all the communication stays within the boundaries of the group. This pattern is characteristic of small groups. As tightly bound groups grow larger, as in chapter 4, communication patterns diversify and central members develop. Within the groups presented here though it is still possible to see the effect of distribution and of role differentiation on communication patterns and information flow. In the co-located conditions all members are equally connected. When the group is distributed, the audio controller remains connected to all the other group members but the scribe is no longer connected to the remote group members.

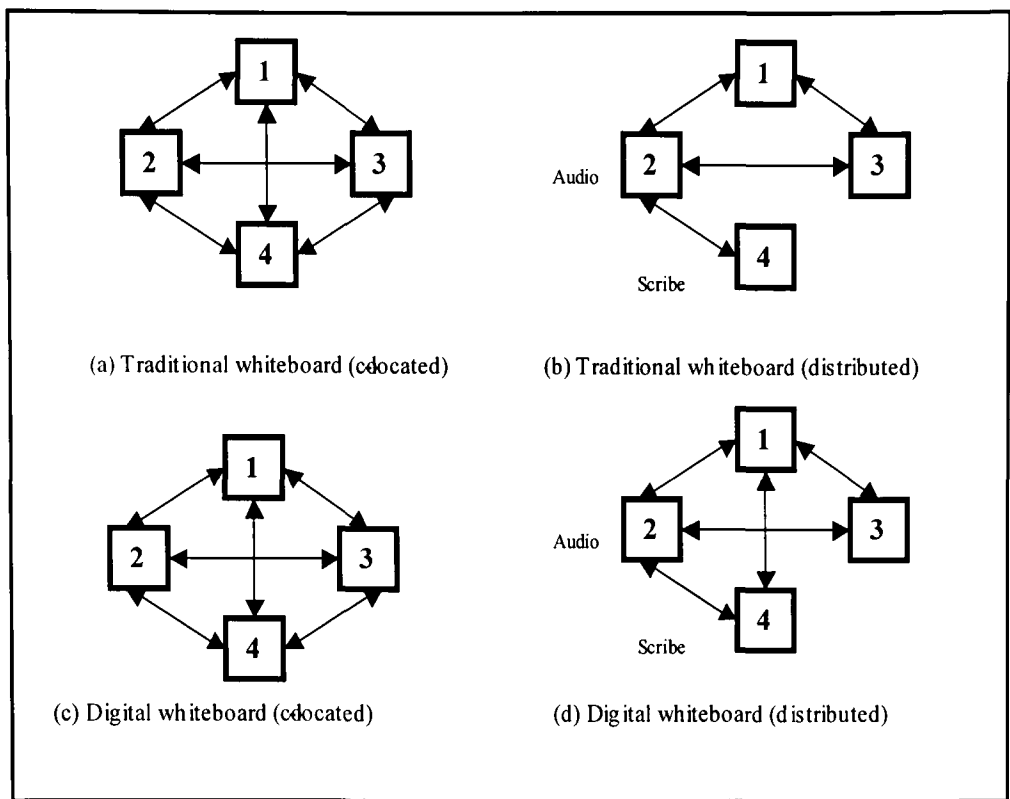


Figure 7.6 Social network diagrams showing group G meeting under each condition

### 7.9.5 Location

During the co-located meetings, the community had a shared location. During the distributed meetings the communications technologies (Chat and audio) served to connect the two physical locations of the group members. When the group members were distributed two of the technologies, the Chat and the whiteboard, provided meeting locations for groups. The Chat transcript and the whiteboard were both shared artefacts, viewable by both co-located and remote members. In this community there is both a sense of a technology-mediated location for the community and a sense of a real, physical location.

### 7.9.6 Summary of the community in terms of the framework

#### Membership component

The community is characterised by a strong social identity with individual members all making a personal investment. Shared history is also important and is developed through jointly produced artefacts via the Chat transcript and the whiteboard contents.

### **Organisation component**

The community is characterised by synchronous interactive discussion. Individual expertise was important in assigning tasks and generating new ideas. Member control was important and differences in control were apparent during the distributed conditions.

### **Integration**

The whiteboard, Chat and audio channel were well integrated. All the technologies were integrated with face-to-face communication as well. Group members integrated and adapted the technologies to overcome problems with, for example, conversation direction.

### **Social network**

The social network pattern for the community shows a closely-knit tightly bound group. The patterns show the effect of distribution and of role differentiation on communication patterns and information flow.

### **Location**

The technology serves to link together two physical locations. It also provides a shared location in the form of the whiteboard and through the Chat facility. The community is characterised by a sense of real, physical location, which is also supported by a technology-mediated location.

## **7.10 Community activities**

Figure 7.7 shows that the members of the student groups engaged in a number of activities including discussing ideas, socialising and exchanging information. The activities are based on Preece's (2000) activities (see 1.6.6.2) and have been expanded on the basis of the results of this study. The shared whiteboard technologies support these activities by providing a shared representation of the writing and drawing surface and by offering synchronous Chat and audio. The technology enhances these activities by

allowing the contents of the whiteboard and Chat transcript to be saved and retrieved and by providing concurrent channels for task and social discussions.

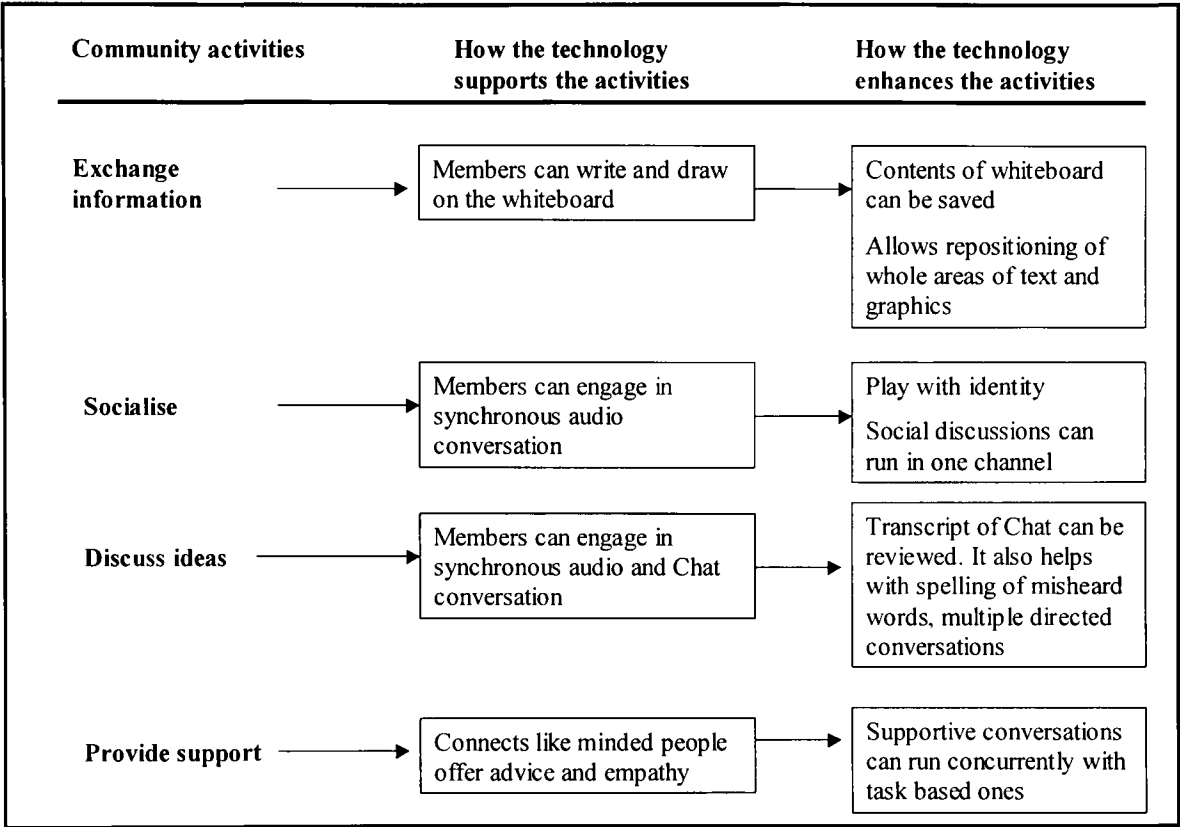


Figure 7.7 How the technology supports and extends the activities of the community members (distributed digital whiteboard)

7.11 Discussion

The results have shown that the students used the shared whiteboard technology to maintain their sense of community. The framework headings have provided a way of assessing the type of community present in this study. The community framework has identified areas affected by the technology in particular in terms of social and individual identities, shared history and member control. In terms of the membership component the community displayed a strong sense of social identity. The shared history of the group in terms of the jointly produced mindmaps was important in this respect. The organisation component of the community was characterised by the presence of individual expertise in



assigning tasks and generating new ideas. Member control was important and differences in control were apparent during the distributed conditions. In terms of integration the group members integrated the whiteboard, Chat and the audio channel. All the technologies were integrated with face-to-face communication as well. The community is characterised by a close knit, tightly bound social network pattern. The pattern shows that most members are directly to one another. It also highlights the effect of prescribed roles on member interaction. The community is characterised by a sense of real, physical location, which is also supported by a technology-mediated location.

A number of factors contribute to the maintenance of the groups' high sense of cohesion and community. As existing work groups the students are already aware of the way other group members work and interact. They adapted the shared whiteboard technology and the set-up of the meeting conditions to match their ways of working. The medium did not define the way in which interactions took place (Kaye, 1995). Use of the audio link, for example, varied depending on how the group operated in terms of a central idea generator or more group-wide discussion. Integration strategies reflect the group's work patterns and allowed everyone to remain involved. In contrast to many Group Support Systems (GSS), the flexible technology in this study allowed the Chat facility and the audio channel to be well integrated and both were integrated with the whiteboard and face-to-face communications. This allowed group members to socialise whilst engaging with the task at the same time. The synchronicity of the media was important in this respect. In some of the groups the social interaction was the driving force behind the use of the Chat facility. The shared representation that the whiteboard permits is enough to keep everyone involved in the project. The remote members did not feel less involved because they could not write on the whiteboard.

**“I think (being able to write on the board) would have only made things more confusing, it would have been a free for all with people writing at the same time and going over each others work. There would have been no communication at all.”**

The groups tended to split the work so that remote members generated ideas whilst the co-located members dealt with the technology. Roles within the group were important

and gave everyone the opportunity to be involved. Contrary to initial expectations the scribe was often the least involved in terms of input to the mindmaps. This fact, however, did not seem to affect the scribes' subjective perceptions regarding control. The scribe still appeared to dominate meetings especially if there were problems with the technology. The group members were interested in one another. Co-located members wanted to know the whereabouts of the remote members. They wanted to know what they were doing, what they could see and who was operating the Chat facility. The remote members were just as interested in the co-located members and asked similar questions.

In terms of the provision of groupware technologies for student groups, providing equal access and control to the technology in distributed settings may not always be the best arrangement. In this study at least, remote people were not negatively affected by the lack of direct access and control and the shared representation appears to be sufficient for them to feel involved. This is a useful finding given that providing equal access and control can lead to problems such as the negotiation of control and handover protocols.

Partially distributed groups can be supported in a number of ways. Developing an initial, high sense of cohesion is important and could be achieved through prior face-to-face meetings. Maintaining and improving this cohesion is possible even across media and location. Flexible technology permitting integration has allowed student groups to successfully work together in partially distributed settings using unfamiliar systems. Multiple channels of communication are important as a way of clarifying problems, supporting social discussion and enhancing a sense of community. Synchronicity is also important in allowing both remote and co-located members to be involved in the adaptation process. Discussion around technological problems can lead to suggestions for improvement from the remote members and action to make the system more usable from the co-located members. In addition to the technological adaptation, the members made use of the synchronistic medium to adapt and modify their ideas. The groups were able to adapt their mindmaps in response to synchronistic input from remote and co-located members.

### **7.11.1 Implications for design**

- Provide multiple communication channels for the group members. Audio is essential but provide sufficient backup. Additional channels encourage social as well as task based discussion
- Groupware systems should allow integration of communication channels, including where possible face-to-face communication
- Provide a shared representation for all group members. Providing equal access and control to the technology in distributed settings may not always be the best arrangement

### **7.11.2 Implications for communities**

- Prior to the introduction of groupware, initial face-to-face meetings could increase the sense of cohesion amongst members
- Technology integration allows a balance between members in terms of roles, input and decision making
- The groupware media should be flexible enough for the student groups to adapt the set-up to complement their established working patterns

## **7.12 Chapter summary**

In this chapter the community framework has been used to characterise the nature of a digital community using unfamiliar technology. The community framework has identified areas affected by the technology in particular in terms of social and individual identities, shared history and member control. As in chapters 5 and 6, the technology supported this digital community in conjunction with face- to-face interactions. The synchronicity of the groupware technology was important in maintaining social and task-based discussions. The shared representation provided was also important and acted as another form of communication channel.

The fact that whiteboards are a relatively unfamiliar technology to the students meant that it was possible to examine how the students' attitudes towards the technology changed over time. Although social and technological perceptions were strongly affected by media and distribution, all the groups successfully used the four meeting conditions to complete the task. There were no differences in terms of performance between the conditions.

Despite being presented with unfamiliar technologies, the student groups were able to integrate and adapt the media to suit their own working practices over the course of the study. The moderately strong sense of community was also noted as an important factor in maintaining a balanced input from the co-located and the remote members.

Links and comparisons to other chapters

## CHAPTER 8

### CONCLUSIONS AND FURTHER WORK

In this final chapter the thesis work is discussed along with considerations for future work. The chapters of the thesis are reviewed indicating where the specific objectives have been met and highlighting the important results. The framework for analysing community in digital domains is reviewed. The classification of Computer Mediated Communication (CMC) systems is revisited and the types of communities supported by each of the four technologies are reviewed. A summary of the final design guidelines is presented and the chapter concludes with issues for further work.

#### 8 Thesis summary and conclusions

The aim of this thesis was to assess the effects of technology upon communities and to characterise community within digital domains. This aim has been achieved and a number of specific objectives have been met. The thesis has identified a number of technologies that are used to support communities and their members. To analyse the effects of technology upon communities a framework was developed and applied to a number of different communities. The role of the various technologies has been studied through the framework. The naturalistic and experimental studies described in this thesis have pointed to the conclusion that communities use a range of technologies in support of their social interaction needs. The framework has allowed a characterisation of community within digital domains and has allowed comparisons to be drawn across technologies and across different community types.

The thesis has verified that digital communities are communities in which people make use of a variety of technologies in support of their communication and interaction needs. The extent of media integration within communities has been explored. The thesis has noted that across a range of different digital communities media integration is an important feature of members' social interactions. It was suggested that current designs, for example of websites, to support digital community

might fail to adequately address the roles and uses of other technologies in the development, management and growth of the community. The design of services and technologies for digital communities should recognise the need for flexible, adaptable and integrated media.

In summary, technology is not just a medium through which communities exist, as is often thought to be the case with online communities, but it can play a supporting role within all kinds of communities, in particular by supporting and extending face-to-face interactions. Rather than technology driving the creation and existence of digital community it is the social interaction needs of community members that drive technology use and technology adaptation.

In this chapter a review of the thesis work is presented indicating where the objectives of the thesis have been met and highlighting the important results. An analysis of the framework follows and its use in relation to the classification of CMC technologies is shown in detail.

## **8.1 Chapter review**

In chapter 1 the context of this thesis was outlined. The thesis work arises from the recognition of the expanding role of technology within communities. It was suggested that technology could play a supporting role within all kinds of communities, in particular by supporting and extending face-to-face interactions. The persistent focus upon online communities and the polarisation of online and offline realms have hindered the development of methods for assessing the effects of technology upon communities in any great detail. There is an ever increasing range of organisational and personal forms of communication technology and groupware. Coupled with the increasing integration between these technologies, a coherent way of examining the role of the technology on the character and activities of communities is vital if appropriate design guidelines are to be developed.

Following a literature review of offline community, the changing notion of community was described with particular reference to the idea of communities as social networks and in terms of community location. Digital community was

introduced as a more appropriate term to describe the interactions between communities and technologies. To verify the concept of integrated digital communities a group of students were asked to produce diagrammatic representations of their communities. The diagrams contained a range of technology and non-technology mediated interactions. The digital technologies included SMS, mobile phones, email, and Internet chat rooms. The diagrams provided support for the selection of technologies to be studied.

In chapter 2 the development of the community framework was presented. The framework was developed as a way of characterising and comparing community in digital domains. The concepts of social network and location were brought forward from chapter 1 as being broad community assessment techniques. The chapter develops three additional headings for the framework: membership, organisation and integration.

In chapters 3-7 the usefulness of the framework as a means of comparing and contrasting different digital communities was demonstrated. The studies also demonstrated the effect of technology use upon community activities. In chapter 3 two Internet based communities were compared. The character of the two communities was found in part to relate to the design decisions made by the community developers. These decisions concerned the technical support of the community and issues surrounding the social interaction between members. Members of both communities, however, had to some extent adapted the technology to suit their own needs and maintain their sense of community and of cohesion. A key finding of the study was that both communities existed beyond their respective Internet technologies. Members used other technologies to communicate, made reference to other technologies within their messages and even met face-to-face on occasion. This concept of technology and media integration was investigated more explicitly in chapter 4. In this chapter web-based interaction was extended through the introduction of text messaging or Short Messaging Service (SMS). Members of the SMS football group successfully combined the context based SMS with the information rich website to discuss football and the World Cup and to take part in two competitions. Involvement and engagement in the tournament increased and members reported moderately high levels of cohesion and sense of community. Combining the

features of SMS with other technologies in this way enabled the formation of a digital community within a limited time span.

In chapter 5, SMS use was examined in more detail within a naturalistic setting. The diary study revealed that SMS is used to support primarily close relations between people who live in relatively close proximity. SMS supports existing friendships and its use within local settings acts as a facilitator of face-to-face interactions. It is also well integrated with other technologies and particularly with face-to-face communications. It was noted in chapter 5 that community members had adapted SMS, using an asynchronous technology in a synchronous manner. In chapter 6 SMS and email were examined and compared within the context of a developing community. In study 1, communication diaries revealed that SMS and email are used in different ways. SMS is an immediate, informal technology that is used to extend work-based relations between classmates to include social interactions as well. Email as a more formal medium is used to maintain relations between the students and the wider community of lecturers and family. The students integrated both technologies into their task and social interactions and a claims analysis revealed interesting features with respect to media use and integration. In study 2, SMS and email were examined in terms of their ability to support students' group work and improve performance. A sample of 64 students was examined in terms of their SMS and email use within the specific context of Java programming coursework. Students were given examples of SMS and email 'best practice'. This led to increased SMS and email use and saw improved performance and team evaluation for originally low SMS and email users.

In chapter 7 students group work performance and social interaction whilst using a more complex form of groupware was examined within a community context. The use of shared whiteboards under a variety of organised meeting conditions was explored. The high sense of cohesion and community were noted as crucial factors in maintaining a balanced input from the co-located and the remote members of the group. The synchronicity of the groupware technology was vital in maintaining social and task-based discussions. The shared representation provided was also important and acted as another form of communication channel. Despite being presented with



unfamiliar technologies, the student groups were able to integrate and adapt the media to suit their own working practices over the course of the study.

This review has indicated where the objectives of the thesis have been met and highlighted the important results. The nature of community within digital domains has been explored and characterised using the framework developed in chapter 2. A number of technologies have been examined across a range of community settings and a variety of different communities have been compared and contrasted using the framework. The extent of media integration within digital communities has been explored and implications for design and for communities have been presented at the end of each chapter.

## **8.2 Assessment and validation of community framework**

All the digital communities have been analysed using the community framework developed in chapter 2. Each heading of the framework is now assessed and the main findings from the studies are presented. Finally its effectiveness as a method for characterising and contrasting digital communities is assessed and the issue of whether the framework has been validated is addressed.

### **8.2.1 Membership component**

The membership component of each community was analysed using measures of identity. In all the studies members reported that a sense of community and belonging exists between members. The studies have shown that identity especially within CMC mediated environments is socially mediated through language use. Social identity was supported through references to shared meanings, experiences and, between geographically close members, through shared places. Personal identity has to be established more explicitly within CMC environments. In online environments there are a number of indicators, which signal a member's identity prior to their message. These include usernames and email addresses. For SMS users the sender's identity is signalled ahead of the text message if the sender's number is stored on the receiver's phone. Reaffirming identity was important for the students using the shared whiteboards. Remote members in particular were keen to know, for example, who

was acting as the scribe. Introductions and the exchange of personal information are also important in digital communities. Personal identity is maintained through the style of language used. In SMS, for example, some members developed very individual styles and abbreviations. Others signalled their identity by choosing not to use common SMS abbreviations. Identity provides a useful measure of the membership component. The expression of personal identity, for example, relates to the development of a sense of human feeling between members. Social identity and thinking of oneself as a member encourages group-wide interaction and the establishment of multiplex relations. Taking part in joint activities and inhabiting a shared location both contribute to the development of a shared history.

### **8.2.2 Organisation component**

The organisation component was analysed using measures of interactivity. Interactivity is important in terms of the organisation of the community. Ongoing engagement in the discussions and with the community is important when the majority of the interaction is technology mediated or when the community is away from a shared location. The type of content that members generate affects the interactivity of the discussions. In chapter 4, for example, opinion based discussions were more interactive than information based messages. In asynchronous communication, interactivity was maintained using design features such as threading and reply templates. Threading proved a useful way of developing coherent discussions. Members of the SMS football group, described in chapter 4, would often search back over several days' worth of messages to reply to an earlier thread. Reply functions within the email list studied in chapter 3 were used in a less consistent manner. Problems with inappropriate headings and poor quoting led, in some cases, to disjointed conversation. In synchronous communication such as audio or Chat channels interactivity is easier to achieve. In chapter 7 it was shown how the student groups developed mechanisms to control the direction of communication to maintain coherent discussions. SMS discussions displayed high levels of interactivity. This was achieved mainly through the use of this medium in an almost synchronous manner.

### 8.2.3 Integration

Although each chapter focused upon the use of one or two specific technologies the results indicated that all the communities studied used multiple media and showed evidence of media integration.

In the existing Internet based communities studied in chapter 3, members would often make use of personal email, telephone or written correspondence to keep in touch, or would make reference to gathering information from books, films, television and radio broadcasts. There was also evidence of their online community interactions being integrated into their offline interactions and vice versa. In chapter 4, the developing digital community had to explicitly integrate the two elements of the SMS-web based system. The two components of the system were used in different but complimentary ways. The community members also engaged a range of other media to support their information gathering.

Chapter 5 examined media integration within existing communities in which interactions are less technology mediated and members are geographically close. Integration was still a prominent feature of this community. SMS was just one way in which community members interacted. Its use was heavily integrated with face-to-face interactions. It was often used to continue discussions started at another time often in another medium or to arrange a swap to another medium such as a voice call. In chapter 6 media integration within a developing community was examined. Over time media integration increased as students used SMS and email to coordinate their work and their social lives. Examples of successful integration were observed. Students would use SMS, for example, to alert one another to the fact that information had been sent via another technology such as email. A claims analysis of media use revealed important issues relating to integration. In chapter 7, the student groups managed to successfully integrate unfamiliar technologies into their working practices to achieve their task aims and support their social interaction needs.

#### **8.2.4 Social network**

In this thesis, examining communities in terms of social networks has provided a useful means of visualising interactions and comparing the effects of technology upon the different communities. Three approaches to the study of social networks have been used. In chapters 4 & 7 a whole network approach was taken. This was used because all the community members were known and the boundaries around the community were established. In chapters 5 & 6 an ego-based approach to social networks was used. This was more appropriate because the boundaries of the communities were not known prior to the studies. In chapter 3 a pseudo whole network approach was used in which a limited sub set of messages from the community was used to represent the whole community.

The social network approach allowed the different communities to be compared and characterised in a number of ways. The social network diagrams showed that information exchanges (social interactions) were constrained by the types of relationships people have, the types of media available and by group norms. These diagrams indicated differences between the digital communities studied. The different technologies underlying the communities have constrained the types of social networks that have developed. This was visible in the Harry Potter communities in chapter 3, within the Interactive Systems community in chapter 6 and in the student work groups examined in chapter 7.

The social network diagrams indicate the effect of relations upon the media used in both work and social based networks. Previous research has noted that in work oriented relations media use is often affected by the nature of the tasks. The results presented in chapter 6 however, suggest that the nature of the relationship appears to be influential even across work-oriented relations. The diagrams also revealed differences in terms of the strength of relations within the digital communities and illustrated how information circulates within the networks. The network patterns, for the web and email mailing list communities in particular, contained central members. A large proportion of network traffic was routed through these people and they were important in generating discussion and responding to individual messages. The

network pattern presented in chapter 7 indicated a close-knit community in which all the messages stayed within the boundaries of the group. The diagrams in that chapter also highlighted the importance of roles within the groups, for example, the role of scribe and audio controller. In chapters 5 and 6 the communities were less tightly knit and many of the messages were exchanged with people outside of the community of interest.

### **8.2.5 Location**

In chapter 1 it was noted that in discussions of technology mediated communication a medium such as the web was more readily associated with connotations of community than a medium such as the telephone. It was suggested that this might be because of the associations of place and location that the web provides. In chapters 3 and 4 the shared online places and the permanent record of the community's interactions provided a distinctive location for the community members. In chapter 7 the student workgroups also had access to a shared location in the form of the shared whiteboard. A shared meeting place provides an area in which a communal memory of the group can be developed. The group's interactions are played out in front of its members allowing involvement in the community's shared history. In online locations, unlike physical community locations it is possible for the community members to remain anonymous. However, even within predominantly online communities members have found other ways of communicating, and of making their personalities and identities known, thus extending the location of the community. Some of these additional communication methods involve offline rather than online interaction. The assessment of communities in terms of their locations has supported the notion that communities do not have to exist only online or offline but often occupy multiple locations spanning the digital-physical divide.

SMS, the main technology explored in chapters 5 and 6 does not provide communities with an online or virtual meeting place. Instead it provides a connection between real locations. SMS connects two real, private locations occupied by community members. It maintains relations between face-to-face contact, and helps to arrange meetings within shared locations such as the pub or a café, in the case of chapter 6 and lectures, labs and the common room in the case of chapter 6. These connections are important

in terms of maintaining the sense of community between face-to-face episodes. They allow members to indicate that they are thinking of one another and reinforce a sense of belonging to the community. Technology, then, does not have to create a new place for a community to exist. Indeed, the studies have shown that members extend the location of online communities in response to their social interaction needs, as highlighted in chapter 3. Different technologies can support the existing location of the community in a number of ways.

#### **8.2.6 Validation of framework**

The framework has been validated through an analysis of five different communities. The framework was developed with the intention of being able to characterise and measure community in digital domains. The framework has been validated in that its five headings do provide a characterisation of community in digital domains. It is also possible to describe individual digital communities using the framework. At a broad level the framework provides a characterisation of a community in terms of its overall location and its overall social network. At a more specific level the framework characterises community in terms of its membership, organisation and integration properties. The framework allows a detailed and specific picture of a community to be developed. The framework has been deployed on a number of different communities and technologies. All the communities have been successfully characterised using the framework. Whilst a number of different methods have been employed in relation to the specific nature of the community, the level of access to the participants and the level of access to the community interactions, all have measured aspects of identity, interactivity, integration, and on a broader scale location and social network. The framework does indeed provide a characterisation of community in digital domains. Furthermore the framework has allowed measures of community in digital domains to be taken in terms of the presence and strength of identity, the amount of interactivity, and the level and make-up of media integration.

#### **8.3 Community activities**

Within the communities studied, members engaged in a number of different activities. These varied depending on the community's developmental stage, its purpose and the

relative location of its members. All communities engaged in information exchange and socialising. Members of some communities spent time making friends or keeping in touch. In communities with geographically close members, a key activity for members was to coordinate and plan events. The technologies supported the activities in a number of ways. Message boards and email systems, for example, allowed members time to compose and edit messages. SMS provided a discreet, private method of communicating. It allowed location based information exchange and socialising through expressive language play. The shared whiteboard environment provided members with a shared representation of the activity and two synchronous channels for communication. The technologies also enhanced the members' activities in a number of ways. The web-based technologies provided increased access to information and people, enabled more interactive discussions and provided additional features such as a calendar and a database. SMS facilitated micro-coordination and the exchange of meta-content. Email enabled the exchange of attachments and provided members with a way of recording ideas. Finally, the shared whiteboards meant it was possible to save and retrieve work. The Chat transcript provided a way of clarifying and verifying discussions and the two communication channels allowed concurrent task and social based discussion. The use of technology within these different communities led to better ways of exchanging information, keeping in touch, planning and coordinating events and socialising.

#### **8.4 Summary**

The community framework has been successful in analysing and comparing different types of digital community and in characterising the nature of community in digital domains. Previous attempts at classifying and characterising digital communities were based around a limited notion of digital community. This framework has been a very useful tool in exploring the concept of integrated digital communities and has allowed an explicit examination of the technological context of the community. It has helped reveal that digital communities consist of more than a single technological domain. They consist of integrated multiple technologies, non-digital resources and interactions that frequently cross the online-offline divide.

The framework has allowed comparisons between communities to be drawn in terms of the five headings of the community framework: Membership, Organisation, Integration, Social network and Location. It has focused attention on how the technologies support the key features of community as well as the members’ activities and sense of community. It has also allowed attention to be focused on the possible limitations of the technologies and therefore where members might adapt the technology to meet their social interaction needs. The framework provides a scheme to guide the study of communities. It focuses attention on the important features of community and thus allows the effects of Human Computer Interaction (HCI) decisions and social interaction decisions to be properly evaluated. In addition it suggests new ways of guiding the design of these two aspects of digital communities.

### 8.5 Digital communities

Type	Sync	Async	Ad-hoc	Organised	One-to-one	One-to-many	Mobile	Fixed	Technology
1		•	•		•			•	Email
2		•	•		•		•		SMS
3		•	•			•		•	Message board, email mailing list
4	•			•		•		•	Shared whiteboard

Table 8.1 Types of digital communities in terms of classification features of computer mediated communication technologies

The original classification of CMC technologies presented in chapter 1 is now re-examined in terms of the generic features of digital communities supported by the different technologies. Table 8.1 summarizes four different types of digital community in terms of their underlying technologies. The characteristic features of the technologies are also shown.

Table 8.2 shows a summary of the digital community types in terms of the five headings of the community framework. The codes in each cell e.g. E-S and SW-I, relate to the guidelines presented in section 8.7. A brief overview of each community type is then presented highlighting the key features of the community and linking the discussion back to the classification features of the technologies. The activities



supported and extended by the technologies are described and an indication of where best the technology supports the community in terms of its developmental stage is given.

FRAMEWORK HEADINGS					
Type	Membership	Organisation	Integration	Social Network	Location
1 Email (E)	<b>E-M</b>	<b>E-O</b>	<b>E-I</b>	<b>E-S</b>	<b>E-L</b>
	Allows development of personal identities  Supports formal and informal relations and discussions	Contains social and task based content. Task content relates to members' particular strengths. Also allows for provided content	Technology integrated with SMS and face-to-face conversations	Contains task based connections with wider members of community  Long distance social relations maintained	Provides a location for transcript or message history of the group
2 SMS (S)	<b>S-M</b>	<b>S-O</b>	<b>S-I</b>	<b>S-S</b>	<b>S-L</b>
	Social identity established through shared references and the act of sending and receiving messages	Content is often reactive and context or location based Emphasis on members greetings and making plans	Technology heavily integrated with face-to-face interactions  Used to arrange swap to another medium	Strong ties between geographically close people  Relationships are of long duration	No 'virtual' location. Links real locations of members and encourages meeting at shared locations
3 Message board (MB)	<b>MB-M</b>	<b>MB-O</b>	<b>MB-I</b>	<b>MB-S</b>	<b>MB-L</b>
	Strong sense of social identity and belonging through group communication. Extending beyond original topic members display personal identity and human feeling	Design features of technology affect the organisation of member content. In terms of topic control and information disclosure	Technology integrated with other media including email, Chat and face-to-face interactions. Other resources integrated including books and television	Ties between physically distant people. Contains central members with a mixture of targeted messages and those directed at whole group	Provides shared online meeting place. History of community documented in this online location
4 Shared white-board (SW)	<b>SW-M</b>	<b>SW-O</b>	<b>SW-I</b>	<b>SW-S</b>	<b>SW-L</b>
	Strong social identity with members making a personal investment. Shared history developed through jointly produced artefacts via whiteboard and Chat transcript	Synchronous interactive discussion. Individual expertise important in assigning tasks and generating ideas	The technology is integrated to allow task and social interaction to occur  Integration supports groups' existing working practices and allows adaptation of media	Close knit with all interaction occurring within group's boundaries	A shared location in the form of the whiteboard and to some extent the Chat transcript Physical location of members also important

*Table 8.2 Summary of digital communities in terms of the community framework*

8.5.1 Overview of digital community types

8.5.1.1 Type 1

Type	Sync	Async	Ad-hoc	Organised	One-to-one	One-to-many	Mobile	Fixed	Technology
1		•	•		•			•	Email

Type 1 communities allow in-depth asynchronous one-to-one communication between members. The ad-hoc use of the technology maintains both weaker more formal community ties as well as stronger ties between physically distant people. This type of digital community supports and enhances face-to-face activities by allowing communication across time and space boundaries, through the provision of detailed information and by allowing attachments containing a variety of multimedia content to be included with the communication. This technology supports the development and management of digital communities.

8.5.1.2 Type 2

Type	Sync	Async	Ad-hoc	Organised	One-to-one	One-to-many	Mobile	Fixed	Technology
2		•	•		•		•		SMS

Type 2 communities are based around mobile technologies allowing communication to take place anywhere, anytime. These ‘always on’ communities are pushing the boundary of asynchronous communication. This type of digital community supports and enhances its members’ activities by allowing micro changes to be made to plans, by letting people know that you are thinking of them and by expressing greetings in a range of quieter and less disturbing settings. This technology supports the management and growth of digital communities.

8.5.1.3 Type 3

Type	Sync	Async	Ad-hoc	Organised	One-to-one	One-to-many	Mobile	Fixed	Technology
3		•	•			•		•	Message board, email mailing list

Type 3 communities have a larger member base and allow one-to-many communication. They exist across time and space boundaries and provide their members with a history of their group discussions. This type of digital community supports and enhances its members’ activities by providing time to compose thoughts and ideas before putting them forward. Provides access to hundreds and thousands of like-minded people, allows easy linking to other media sources. This technology supports the development, management and growth of digital communities.

8.5.1.4 Type 4

Type	Sync	Async	Ad-hoc	Organised	One-to-one	One-to-many	Mobile	Fixed	Technology
4	•			•		•		•	Shared whiteboard

Type 4 communities allow more organised collaboration. Community members are gathered in time if not space and engage in synchronous one-to-many discussion. The discussion is community wide and the group’s history can be recorded. This type of digital community supports and enhances its members’ activities by allowing members to express thoughts and ideas visually as well as communicating via audio and Chat channels. A record of the community’s work and discussions can be saved and retrieved for later use. This technology supports the management and growth of digital communities.

### **8.5.2 A final note on classification schemes**

Classification schemes provide a simple way of comparing technologies. It has been noted, however, that activities and tasks often cross boundaries within classification schemes. It is possible, of course, to classify technologies in different ways. Remote technologies can be used in co-located settings and asynchronous technologies can be used in a synchronous fashion. It is more common to use groupware that normally would be used in a different time or space in the same time or space. Furthermore, over time the introduction of new technologies may lead to modifications of the classification table. Email, for example, in the not too distant future may shift from its current position in the classification table as mobile email devices become cheaper and more widespread. Member adaptation of the CMC classification features was observed in a number of the studies and is discussed in more detail in section 8.6.1.

## **8.6 Integrated digital communities**

The remainder of this chapter focuses on the concept of integrated digital communities. Conclusions from the studies are presented in terms of member adaptation and integration of media.

### **8.6.1 Member adaptation**

Community members themselves are adapting CMC technologies to be used in a more synchronous manner. Mobile phones as a form of personal technology are always carried and are always on. Therefore SMS exchanges, notwithstanding the delays for typing and sending the messages, are used for synchronous communication. In chapters 5 & 6 SMS messages were regularly classified as for immediate use and many messages were part of text messaging sessions or conversations. In chapter 4 responses to alerts and queries were always faster when delivered via SMS compared to via the message board. ‘Goodnight’ messages and ‘thinking of you’ messages are for immediate consumption and are sent in the knowledge that they will be read there and then. The mobility of text messaging makes contact rather than message content very important.

In chapter 3 members of the Site B Harry Potter fan community had adapted the message board to be used as a chat room. This represents the members' social interaction needs driving technology use and is another shift towards using an asynchronous medium in a synchronous manner. To achieve this synchronicity, the members were using the technology in an increasingly organised manner, i.e. by making detailed arrangements to meet on the boards at specific times. In chapter 7 the student groups had adapted the essentially task based technology to support community cohesion and their own working practices. It was notable that in cases where the technology was not flexible enough for member adaptation people stopped using it and sought out alternative technologies.

### **8.6.2 Integration**

In the naturalistic studies of chapters 3, 5 and 6, the use of the focal technology within the communities had to be understood within the context of 'other' technologies that were integrated into the community. SMS and email, for example, often worked in conjunction. SMS was used to alert a member to a relevant email. Text messaging was just one of the ways community members kept in touch and the technology was often concerned with organising face-to-face meetings. In chapter 3 the work on web-based communities pointed to the conclusion that community members would often make use of email, telephones or written correspondence to keep in touch, or would make reference to gathering information from books, films, television and radio broadcasts. In other words, these 'other' technologies are integrated into the community. In chapter 4 an explicit integration of SMS and the web led to the successful development of a short lived digital community. The two components, both separately and in combination, played a role in shaping the group's interactions and the development of the members' sense of community.

In chapters 5 and 6 it was shown that media integration was still a prominent feature of more physically based communities. SMS was just one way in which community members interacted. Its use was heavily integrated with face-to-face interactions. In chapter 7 the shared whiteboards, audio and Chat channels were integrated to provide synchronous discussion between all members. The integration meant that both task based and social discussion could be carried out simultaneously.

Whilst it must be noted that the communities in chapters 3 and 4 were based around 'real world' activities, studies of other, more virtual-based communities suggest that integration in terms of other communication media, if not other information sources, is common. Alt.good.morning (AGM) is a newsgroup without a prescribed topic and with no reference to real-world activities. Patterson (1996), in her study of the newsgroup, noted that AGM is not restricted to Usenet, members also communicate via email, real time chat, snail mail, telephone and increasingly frequent face-to-face meetings. The group has developed a website which contains birthday lists, photo galleries of individuals and groups as well as personal homepages.

The potential for anonymity and escapism within digital communities is far greater than in physical communities. However, it is difficult for even online communities to exist in isolation from other media or from the physical world in which their members live (see also Schiano & White, 1998). Notwithstanding the fact that some members may participate in digital communities in order to escape or to be someone else, systems that support digital communities still need to remain flexible to their members' social interaction needs. This includes allowing the integration of multiple media for information and communication purposes as and when they are required.

## **8.7 Summary of implications and guidelines**

The fact that community members are adapting the technology that they are provided with and integrating their own personal technologies into community activities has implications for the design of technologies and for the communities themselves. One implication is that the tendency to design services or websites to support 'digital community' might fail to adequately address the roles and uses of other technologies in the development, management and growth of the community.

The guidelines below are based on a summary of the implications from each chapter and relate to the development, management and growth of communities. The guidelines are suggestions derived from the data. For example, the finding in chapter 6 that providing guidelines on how to use the technology increased and improved technology use has been included under the development of communities section

within the guidelines. In chapter 3 it was reported in the questionnaire and interview data that discussions were sometimes difficult to follow because of the large number of community members and messages. In the managing communities section of the guidelines it is suggested that breakout groups might enable all members to participate actively in discussions. The relationship of the guidelines to the community framework is indicated by the codes used in table 8.2, for example MB-M to indicate that the guideline relates to message board and membership.

### **Developing communities**

- *Encourage new members to introduce themselves.* (MB-M)
- *Provide starter topics.* Members will develop their own topics as the community develops. (MB-O)
- *Encourage members to swap contact details if they feel comfortable in doing so.* This includes email addresses and mobile phone numbers. (E-M), (MB-M)
- *Provide guidelines on how technologies could be used.* Illustrate examples of best practice in terms of when and where to use the technologies. Provide examples of 'etiquette' in using the technologies. (E-O)

### **Managing communities**

- *Provide members with community feedback.* This might include the number of registered members, the range of countries involved and also details of posting figures. (MB-O)
- *Encourage the development of breakout groups.* This makes it easier for all group members to participate actively in the discussions that maintain the shared values of the community. (MB-S)
- *Provide reminders of community membership.* For example SMS alerts or reminders can reinforce a sense of group membership. (S-M), (S-S)
- *Identify periods when specific technologies are used.* For example students use email more during periods of specific group coursework. (E-L), (SW-L)

### **Expanding communities**

- *Support the integration of technologies within communities.* For example:

- Encourage and facilitate the integration of multiple information sources and multiple communication technologies. (MB-I)
- Incorporating a mobile element to a community via SMS. (S-L)
- Combine technologies so that one acts as an alert to the other. SMS, for example, can direct attention towards an email containing more detailed information or towards a physical or web-based notice board. (MB-I)
- *Support community adaptation.* Ensure that the technology is flexible enough to allow members to adapt it to their own social needs. (SW-I)
- *Introduce new technologies to the community.* The way in which members jointly learn to use the technology aids community cohesion. (SW-S)

## **8.8 Future work**

The thesis identifies three main areas of future work. These are long-term adaptation of community technologies, the provision of new technologies and the issue of inclusive design.

### **8.8.1 Long term adaptation**

Adaptation of the technology to meet members' social interaction needs was a feature of all the studies. In order to understand the process in more detail it would be necessary to set up a long-term study looking at how community members take a new technology and incorporate it into their activities. Unlike the study in chapter 7 it would be important to allow the students to use the technology as they wished, for a variety of purposes, and whenever they wished.

### **8.8.2 New technologies**

The introduction of new technologies in the near future may have implications for the development, management and growth of digital communities. Additionally, changes in pricing structures or availability of applications may make some currently available technologies more appealing. Some mobile phones or PDAs allow access to the Internet. Early studies suggest that owners of Internet enabled phones prefer



stationary (fixed) Internet for communication and content but that mobile Internet is acceptable for commerce applications (Kim, 2001). Only 3% of Internet enabled mobile phone users take advantage of the capability. Only 24% of European mobile phone subscribers say that they would be willing to pay for any mobile applications via their mobile phones (Forrester research, 2002).

With the promise of cheaper broadband Internet access in the UK, applications such as Instant Messaging (IM) are likely to become more attractive. The relatively high cost of permanent Internet access makes IM less attractive to home users in the UK compared with the US (Wakeford & Kotamraju, 2002). On a worldwide basis, Instant Messaging, which allows text-based conversations in real time, is expected to be more popular than email as a method of communication by 2004 (Hardy, 2001). IM is a useful way of supporting informal communication tasks in work settings in terms of negotiating availability and maintaining a sense of connection (Nardi et al, 2000).

### **8.8.3 Access and inclusive design**

In designing new technologies to support communities it is important to consider the issue of access. The interviews in chapter 6 reveal potential problems for students without access to a mobile phone in terms of being excluded from both work based decisions and the social support of the group. James (2001) warns that designers are excluding a variety of populations including the elderly and the disabled. Although the Internet is often promoted as being a great equaliser in terms of providing access to information and resources, access to the Internet itself varies greatly. Only 1 in 250 Africans are online compared to 1 in 2 of North Americans and Europeans (BBC ONLINE, 2002c). Within the UK only 21% of homes described as being in areas of high deprivation have access to the Internet compared to 43% of UK homes as a whole (Ofcom, 2002). For those with access, inclusion progress has included better web browsers for the elderly, the blind and the visually impaired (Zajicek et al, 1999; Zajicek & Morrissey, 2001). The advent of mobile phones has allowed phone-less countries to expand their communications. Only 3% of Africans have mobile phones but they represent 53% of all phone subscribers on the continent (Meek, 2002). Here, the mobile phone has allowed communication between people who for various financial or bureaucratic reasons would never have received a landline telephone.

Inclusion programs for the mobile phone include the development of software to allow deaf people to use mobile phones (Yahoo News, 2002) and the recent development of a SMS system for the blind (BBC ONLINE, 2002d).

## **8.9 Final conclusions**

The main thesis aim of assessing the effect of technology upon the nature of communities and characterising community in digital domains has been achieved. The development of a community framework has allowed a detailed examination of the effects of technology upon communities and their members' activities. Rather than existing solely within a single technological domain, technology enables the formation and development of integrated digital communities. Members integrate and adapt a variety of technologies in order to support the development, management and growth of their communities. Across a variety of technologies and across a variety of communities, technology has been shown to support activities and importantly a sense of community between members. A number of different types of digital community exist. Members of these communities use technology in support of their social interactions needs. Previous designs and guidelines regarding digital community may be using a limited view of community in digital domains. The thesis work presented here has shown that technology must be flexible to the social needs of the community and facilitate multiple media integration. This has led to a number of new implications for the design of technologies and the design of social interact