Affective Gesture Fast-track Feedback Instant Messaging (AGFIM)

by

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KEYWORDS

Affective Gesture, Fast-track feedback, Co-presence, SIMPLE, Multiparty texting, SMS, Instant Messaging, Wireless, MobileIP, Handheld Device

ABSTRACT

Text communication is often perceived as lacking some components of communication that are essential in sustaining interaction or conversation. This interaction incoherency tends to make text communication *plastic*. It is traditionally devoid of intonation, pitch, gesture, facial expression and visual or auditory cues. Nevertheless, Instant Messaging (IM), a form of text communication is on the upward uptake both on PCs and on mobile handhelds. There is a need to *rubberise* this plastic text messaging to improve co-presence for text communications thereby improving synchronous textual discussion, especially on handheld devices.

One element of interaction is gesture, seen as a natural way of conversing. Attaining some level of interaction naturalism requires improving synchronous communication spontaneity, partly achieved by enhancing input mechanisms. To enhance input mechanisms for interactive text-based chat on mobile devices, there is a need to facilitate gesture input. Enhancement is achievable in a number of ways, such as input mechanism redesigning and input offering adaptation. This thesis explores affective gesture mode on interface redesign as an input offering adaptation. This is done without a major physical reconstruction of handheld devices.

This thesis presents a text only IM system built on Session Initiation Protocol (SIP) and SIP for Instant Messaging and Presence Leveraging Extensions (SIMPLE). It was developed with a novel user-defined hotkey implemented as a one-click context menu to “fast-track” text-gestures and emoticons.

A hybrid quantitative and qualitative approach was taken to enable data triangulation. Results from experimental trials show that an Affective Gesture (AG) approach improved IM chat spontaneity/response. Feedback from the user trials affirms that AG hotkey improves chat responsiveness, thus enhancing chat spontaneity.

DECLARATION

I declare that *Affective Gesture Fast-track Feedback Instant Messaging (AGFIM)* is my own work, that it has not been submitted before any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged as complete reference.

Full name A. Kayode Adesemowo Date 10 Nov 2005

Signed

ACKNOWLEDGEMENTS

To the one who granted wisdom and knowledge to think, reason and understand.

To my lovely wife for her lovable, enduring support!

To my colleagues too long to list, I doff my hat – Anita and Vuza, two lovable personalities that keep you firing on.

Bill, Lean your support are spot-on.

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GLOSSARY

3G	Third Generation
3GPP	3rd-Generation Partnership Project
ACM	Association for Computing Machinery
AF	Affective Feedback
AG	Affective Gesture
AI	Artificial Intelligence
AP	Access Point
API	Application Programming Interface
ASR	Automatic Speech Recognition
CA	Conversational Analysis
CMC	Computer Mediated Communication
CPIM	Common Profile for IM
CSCW	Computer Supported Collaborative Work
CVE	Collaborative Virtual Environment
F2F	Face to Face
FAIM	Facial Affect IM
HCI	Human Computer Interface
HDI	Human Device Interaction
HIM	Haptic IM
HLD	High Level Design
I/O	Input/Output
IEE	Institution of Electrical Engineers
IETF	Internet Engineering Task Force
IM	Instant Messaging
IMPP	IM and Presence Protocol
IMS	IP Multimedia Subsystem
IP	Internet Protocol
IR	Iteration Research
IRC	Internet Relay Chat
KIM	Kinetic IM
LCS	Live Communication Server

MBMS	Multimedia Broadcast and Multicast Services
MIT	Massachusetts Institute of Technology
MS	Microsoft
MSRP	Message Session Relay Protocol
MUD	Multi-User Domain, or Multi-User Dimension
NGN	Next Generation Network
PC	Personal Computer
PDA	Personal Digital Assistant
PPC	Pocket PC
RDP	Remote Desktop Server
RTC	Real Time Communication
RTF	Rich Text Format
SIMPLE	SIP for Instant Messaging Leveraging Extensions
SIP	Session Initiation Protocol
SMS	Short Messaging System
SR	Survey Research
TFT	Thin Film Transistor
TIMP	Tipic IM Platform
TTS	Text to Speech
UA	User Agent
UCT	University of Cape Town
UML	Universal Markup Language
URI	Uniform Resource Identifiers
UWC	University of the Western Cape
VR	Virtual Reality
WLAN	Wireless LAN
WM	Windows Messenger
XMPP	Extensible Messaging and Presence Protocol

Chapter 1 INTRODUCTION

Traditional voice telephony and applications are on the decline on both fixed and mobile networks[1]. This can be attributed to the high cost of voice talk, need for data services, and the convergence of telephony and IP networks. Text communication is on the uptake and more innovative services are being explored on mobile networks with texting [4],[51]. Yet, text communication is perceived as lacking some components of communication that are essential in sustaining interaction or conversation [69]. It is plastic because text communication is devoid of intonation, pitch, gestures, facial expression, visual or auditory cues. Nevertheless, Instant Messaging (IM), a variant of text communication, is on the upward uptake both on PCs and on mobile handhelds [35],[50]. As a result, there is a need to rubberise this plastic text messaging for co-presence conversation on a packet network (IP mobile or Internet) thereby improving synchronous discussion.

This thesis argues that text chat interaction could be improved by extending co-presence in text communication. Co-presence is offered by text presence itself, IM awareness capability and its features offerings. Thus, if extension or amendment is made to one or more of these IM features' such as its interface or input offering, text chat spontaneity in IM could be improved. An element of interaction, gesture, is seen as a natural way of doing things. This thesis does not compare text communication with natural communication gesture(s). Rather, it tries to import elements of natural communication gesture into plastic text communication. Attaining some level of interaction naturalism for text communication requires improving synchronous communication spontaneity, partly achieved by enhancing input mechanisms. To enhance input mechanisms for interactive text-based chat on mobile devices, there is a need to facilitate gesture input. Enhancement can be achieved in a number of ways, such as input mechanism redesigning [51] and input offering adaptation. This thesis explores affective mode as an input offering adaptation on handheld devices without a major physical redesign of mobile devices or its interfaces. As a result, it examines ways of enhancing ubiquitous anytime anywhere text-based communication [4].

[1] Tim Kelly, Broadband: Application and Content, Policy and Strategy trend, Issue 7, A publication of Strategy and Policy Unit of ITU, 2003

This thesis presents a text-only IM system built on Session Initiation Protocol (SIP) and SIP for Instant Messaging and Presence Leveraging Extensions (SIMPLE). It was developed with a novel user-defined Hotkey that provides a one-click context menu for "fast-tracking" text-gestures and emoticons [1],[2],[3]. The hotkey input mechanism acts as a one click Affective Gesture (AG) that attempts to represent instant Face-to-Face (F2F) expressive gesture [20]. Facial expression provides an important spontaneous parallel channel for emotional and social display of communication. Drawing on the premise that text communication possesses expressive discourse with some degree of presence level (co-presence, awareness), Affective Gesture Fast-track Feedback Instant Messaging (AGFIM) seeks to show that text communication can be enhanced with one-click AG fast tracking of text hotkey and emoticon gestures. Thus, IM co-presence [24] capabilities that are already entrenched in its text oratory expressive discourse [25], awareness and limited turn-taking and sequencing are extended further.

A hybrid quantitative and qualitative approach was applied to experiment with users. Firstly, quantitative logging of hotkey usage was instrumented into the IM system. In addition, pre and post trial Computerised Self-Administered Questionnaires (CSAQ) [5]:p259 were used to collect users' feedback (usability and usage). Test trials were conducted in two iterations in line with a one-group pre-test-post-test experimental study [5]:p215. Feedback from the initial trial was incorporated into IM redesign and running of the second trial. Two qualitative approaches were implemented. Short unstructured focus group review sessions helped to triangulate observed and questionnaire findings. Lastly, test trial participants were closely observed in the initial trial while loosely observed in the structured second trial.

Results show that an Affective Gesture approach improved IM chat spontaneity/response rate. Feedback from the user trials affirms that the AG Hotkey improves chat responsiveness to some degree, thus enhancing chat spontaneity. The degree of IM chat spontaneity improvement is greater for computer techies classified as "early-adopters" and much less for "non-techies" who represent the bulk of typical users.

1.1 Background

Traditionally, the supporting framework of interaction has largely influenced choice of medium of conversation. Within an aware mode space, conclusive discussions are coordinated by context, precinct and dyadic interaction coherency within an aware mode space [57], [69]. There is a large body of work examining communication modes and their relative effects on task performance especially in the field of Computer-Supported Cooperative Work (CSCW). Many of these have looked into appropriateness of Computer Mediated Communication (CMC) media. Donath et al. attributes text excellent discourse qualities as a critical element of CMC uptake [18]. They also pointed out that fundamental to CMC technology is the textual persistence of online conversation. With skill, text can be quite expressive, Donath et al said [18]. However, they concur that as a conversational medium, the austerity of text can be detrimental. Connell et al. explored the social psychological perspective to study the effectiveness of different media of communication and how they influence interactions in social groups and organisations [13]. Riva and Galimberti on the other hand put CMC in a social interaction context [57]. CMC with its noted limitations has persisted and continues to gain ground as a mode and mediuma of communication, especially Short Message Services (SMS) [32]. IM, a variant of text communication, continues on the rapid uptake [35]. In the last two years, effort has been made in enhancing mechanisms for the IM medium. This is seen in pockets of short papers emerging. Some have suggested kinetic typography [7], Virtual Reality [12], handwriting and imaging [21], while El Kaliouby and Robinson proposed facial affect analysis [20]. Interoperability has been an issue of concern as well. Protocols such as SIMPLE [11], and eXtensible Messaging and Presence Protocol (XMPP) have stepped up to address interoperable medium [67]. Common Profile for IM (CPIM) and IM and Presence Protocol (IMPP) are acting as frameworks for messaging standards [30],[46].

3rd-Generation Partnership Project (3GPP) is addressing messaging standardisation with a service reference, Multimedia (Messaging), Broadcast and Multicast Services (MBMS) [8]. Rather than channelling research in MBMS, interest is shifting to multimodal (Interaction, Media and Communication). The use of multiple modalities such as speech, gesture, sound and graphics opens a vast world of

possibilities for Human Device Interaction (HDI). Multimodal systems exploit digitised natural gesture technologies to support novel forms of human actions and interaction. Bourguet has observed these novel forms span aural, tactile, visual, graphical and even music notes [9]. IM does fit as a social space and place for human actions and interaction. IM multimodal interests include: human-human communication, interaction engagement, multi-modal interaction (including verbal, gestural, aural and graphical interaction) and accessibility [9].

The trend of communication networks, be they Next Generation Networks (NGN) or Third Generation (3G) mobile networks is towards mobility. Services as well as devices require mobility. One key element is mobile devices [4],[45]. Mobile devices are characterised by their limited screen real estate and restricted user input-output [43]. Therefore, novel ways of HDI need to be explored beyond the present input paradigm [37]. While mobile devices are continually being redesigned and optimised, text messaging on data-centric networks requires extension of co-presence capability.

Text communication co-presence extension is essential because future mobile communication is not just about evolving technology and its adaptation thereof. Future mobile communication is about personal interaction with technology in use, of technology available and technology being developed [37]. It is in the interaction!

One element of interaction is gesture, which can be viewed as a natural way of doing things. Attaining some level of interaction naturalism requires improving synchronous communication spontaneity, partly achieved by enhancing input mechanisms. To enhance input mechanisms for interactive text-based chat on mobile devices, there is a need to facilitate gesture input. Enhancement is achievable in a number of ways, such as input mechanism redesigning and input offering adaptation. This thesis explores affective mode as an input offering adaptation on handheld devices without a major physical or interface redesign of handheld devices.

1.2 Motivation

People just want to communicate anytime, anywhere, anyhow. Traditionally, this has been done on mobile networks by voice. However, voice telephony is expensive especially in most developing countries. Though Internet telephony has reduced trans-national call costs to nearly that of a national call, it has not yet permeated

developing countries due to bandwidth limitations and non-supportive government regulations.

Text communication with its inherent noted limitations is on the ascendancy across all network types, more especially on mobile networks. SMS is widely used despite the fact it does not provide guaranteed delivery. IM on the other hand, provides awareness and presence feeling similar to a voice call. This is because parties in a chat have knowledge of others' 'activity'. IM has brought improvement to the limitations of traditional text communication through gestures, awareness, turn taking, and sequencing. Different studies have tried to explain the uptake and recommend enhancements. Yet, they often refrain from presenting reasons why text messaging prevails despite its perceived lack of interaction coherency.

It is worthwhile investigating text linguistic and discourse metaphors to explain text presence. This presents a fresh insight into understanding text communication, especially IM. Abstracting out text presence from awareness is essential in investigating co-presence and social presence in text communication [60],[55]. Thus, feature add-ons to text communication tools such as IM could be developed to address its inherent limitations. A close look at different approaches of feature add-ons to IM can help identify enhancements to both text presence and text communication tools as shown in Table 1. This thesis therefore looks at an IM system as a communication medium rather than just a communication tool.

IM System	Element	Enhancement
Kinetic Typography IM [7]	Text Presence	Text effect
Reality VR IM [12]	Virtual Reality	VR tie-in to text
Facial Affect IM [20]	Affective Gesture	Facial affect add-on
Haptic IM [61]	Text presence	Tactile vibrating effect
Amigo [21]	Text Presence	Calligraphy, Free styling
HubbubMe [34]	Aural	Sound id add-on to text

Table 1 Add-on Enhancements to IM Systems

Aside from text presence and awareness capability enhancement, it is essential to develop a text communication system with open standards and protocols. Standardisation of SMS communication is one of the contributing factors to its ubiquitous usage. IM systems therefore also need standardisation of text messaging and communication transport. Thus, like SMS, IM deployment requires an open protocol environment such as SIP and XMPP for communication transport [67]. Text

messaging standardisation is being addressed by CPIM and IMPP. This thesis has therefore prototyped an IM on SIP as an open development and deployment protocol platform.

1.3 The aim of this thesis

F2F conversation has reigned supreme as medium of choice for conversation at all levels and across domains [41]. Voice conversation in conference calls has proven effective as well. Though text communication has not been a medium of choice, it has persisted. Therefore, it is worth knowing what capability text messaging has to offer for effective turn-taking conversation. To provide an answer, there is a need to affirm through literature that text presence exists in text communication in itself. The question is, does text communication possess subtle expressive discourse and if so, how does it facilitate communication?

In providing answer, IM needs to be viewed as a communication medium and space rather than a communication tool because IM co-presence draws largely from IM's properties and capabilities. One-click text-gesture fast-tracking is propose in this thesis as a means of enhancing text communication further. An inference therefore is in what ways can text communication be facilitated. This thesis therefore suggests presence indicators, awareness and facilitated text-gesture input such as the novel AG text hotkey. With text presence and co-presence affirmed, the presence level in an IM System could be extended further.

Other areas to be explored are:

- Use of AG mode hotkeys and emoticon gestures to ease interaction spontaneity in text communication.
- IM based on an open protocol such, as SIP (SIMPLE) to ease the interoperability barrier, noting that this is a limitation in uptake on handheld/mobiles.

In the context of this thesis, online presence relates to who is online or not-online in the IM social space whilst presence indicators tells of what interlocutors' actions are [3].

With the background of limited input/output space on handhelds, this thesis therefore proposes that IM standards of typing economy typography and emoticons

can be extended with on_click user-defined hotkeys to improve chat spontaneity, thereby enhancing text communication conversation.

1.4 The Affective Gesture Fast-track Feedback Instant Messaging

Affective mode as an input offering adaptation on handheld devices is explored as a way to enhance input mechanisms for interactive text-based chat on mobile devices. AGFIM runs on open standard Session Initiation Protocol (SIP) platform. It is a text-only IM client, developed with SIP and uses SIMPLE to communicate text messages. It works as typical Instant messaging client would. When AGFIM is started, the instant messenger registers with a SIP server. Upon successfully registration, the pre-defined hotkeys are populated and stored in memory. The buddy list is shown as a TreeNode on the main user interface. AGFIM is now listening and displaying status changes of buddies. It is ready to initiate a chat session or accept a chat session invite. If a chat session is started or an invite received, a chat interface is opened on the screen. The hotkeys in memory are loaded to the chat interface on a contextmenu that resembles the MSN messenger toolbar. In the same vein, the Emoticons are loaded on the toolbar menu. The Microsoft MSN-like toolbar provides a placeholder for the Hotkeys and Emoticon dropdown menu as well as AG→in-line and profile switching combo box. When the chat window is fully loaded, a chat session is ready for sending messages to and fro. In the case of a chat initiated by the user, a default message is sent to the receiving party inviting him to a chat session. The message construct textbox is enabled when there is a reply and communication commences to and fro. Where it is an incoming chat request, the user simply accepts and a chat session is set up.

Within an IM chat session, when the Hotkey or Emoticon button is clicked on the toolbar, the hotkeys (or emoticons) are displayed in a dropdown menu. Upon selection, they are sent immediately when in AG mode. However, in in-line mode, it is first inserted inline into the compose textbox until the send button is hit. At the end of a chat session, the chat history is saved in rich text format to the user's folder. Figure 17 shows a screen shot of the user-defined Affective Gesture Hotkeys on the dropdown menu.

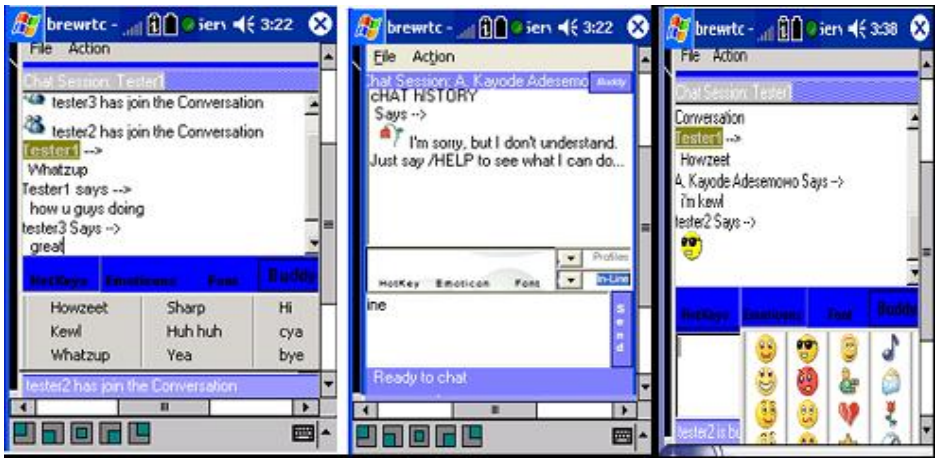


Figure 1 The AGFIM Chat Interface

The screen shot of text chat shows the user-defined Affective Gesture Hotkeys in the left-most picture. The Emoticons on a context-menu are shown on the right hand side, while the updated toolbar is shown in the middle picture. On the toolbar is the placement of the AG to in-line and Profile switching combo box.

1.5 Thesis Outline

The next chapter critically reviews text communication literature by discussing related work and analysing four main issues to consider in AG fast-tracking on handhelds: IM services and interoperability, co-presence, handhelds mobile constraints, and IM fast tracking feedback. The way forward is also proffered.

Chapter 3 presents the methodology for the experimentation, where the research approach and AG details are discussed.

The system design of the overall IM environment as well as the AG hotkey mechanism is presented in Chapter 4. Topics covered are technical requirements for the experimentation, design decisions, high-level design and implementation details.

Experimental design and layout are discussed in Chapter 5. It details initial and main trials covering participant selection, experimental environment, participant tasks, and data collection.

User trial results and analysis are addressed in Chapter 6. Pre and post trial questionnaire results are tabularised, followed by data analysis. It concludes with a discussion of the thesis findings.

The thesis concludes in Chapter 7 and a future line of research is suggested.

Chapter 2 AFFECTIVE GESTURE IN IM

In order to situate the novel Affective Gesture Hotkey and Emoticons within handheld Instant Messaging, the motivation for text pervasiveness needs to be established. These are found in the presence properties in written text itself and of IM environment co-presence and its awareness capability. These are then positioned within the mobile domain considering its limited screen real estate and restricted input/output mechanisms. Four areas of interest are therefore discussed: IM services and interoperability, co-presence, handheld mobile Human Computer Interface (HCI) issues, and IM fast-track feedback mechanisms.

2.1 Essence of facilitation

Essence of facilitation draws from the limitation of text. Despite text chat interaction features, it still lacks dyadic interaction coherency [69]. O'Neill and Martin pointed out the limitation in control on turn positioning - turn-taking [51]. Affective interaction spontaneity was also found lacking by El Kaliouby and Robinson, as well as Bodine and Pignol [7],[20]. Yet, text presence in itself is found in the speech oratory of text and action descriptors [25]. Donath et al. attribute text presence to its discourse qualities [18]. Besides its excellent discourse qualities, text presence in CMC can be traced to the history of on-line conversation technology itself. Textual interfaces were the norm when email, newsgroups, chat-rooms and MUDs were developed. Text is highly adaptable - given the basic alphanumeric keyboard, people can assemble discourses on any topic. Discourse assembly aids technitalk - the use of the special lexicon related to text communication. With skill, it can be quite expressive [18]. Text expressiveness has been put to great use in different text communication tools especially IRC and SMS, and now IM. This expressiveness is a factor to text communication pervasiveness, which has not been looked into properly when examining text communication as a media for conversation. Text presence or rather presence in written text is rooted in the expressiveness of text, which is further discussed under Text Presence in section 2.3.1.

2.2 IM Services And Interoperability

Much work has examined several modes of communication and their effects on task performance. Many of these have looked into the appropriateness of CMC media. In the last two years, efforts have been made in enhancing mechanisms for the IM medium, as seen in pockets of short papers.

2.2.1 Instant Messaging

Instant Messaging has emerged as a popular medium of communication over the Internet and mobile networks. A presence and instant messaging system allows users subscription and notification of changes in each others' state. Such a system also enables users to send each other short instant messages [16]. A presence protocol defines the interaction between presence service, presentities, and watchers. Presence information is carried by the presence protocol. An IM protocol defines the interaction between IM service, senders, and instant inboxes. Instant Messages (text messages) are carried by the IM protocol [16]. Presence is defined by Day et al. (2000b) as a means for finding, retrieving, and subscribing to changes in the presence information (e.g. "online" or "offline") of other users [17]. They also define Instant Messaging as a means for sending small, simple messages that are delivered immediately to online users. Voida et al. extends further to say IM allows user to share ideas across long distances almost instantly and that IM also provides lightweight indications of awareness through user controlled status prompts and activity cues [73]. The definition of Instant Messaging by Day et al. (2000b) would rather be suitable for text messaging [17]. To engage IM systems in the context of this thesis, the fusing together as pointed out by Voida et al. is essential [73]. IM systems in this thesis therefore relate to a communication medium rather than a communication tool [2].

2.2.2 IM as a Communication Medium

The medium of IM supports near-synchronous communication among two or more parties [73]. Conversation occurs at near synchrony in an environment with fluid and rapid exchanges. O'Neill and Martin defined the IM mode of communication as a quasi-synchronous channel [51]. This draws from the fact that delivery of IM text messages is near-instant. IM protocols such as SIMPLE and XMPP now support

session mode messaging that provides a synchronous channel [67]. Nevertheless, IM systems remain quasi-synchronous [51] or near-synchronous [73] when we consider macro delay: with either or both parties temporarily away or distracted from the IM interface [26]. Yet, a synchronous channel remains available between both parties. O'Neill and Martin state that IM applications tend to primarily support messaging between two participants, however, text chat applications can support multiple participants [51]. Traditional two party IM chat has evolved into a multi-party paradigm [51].

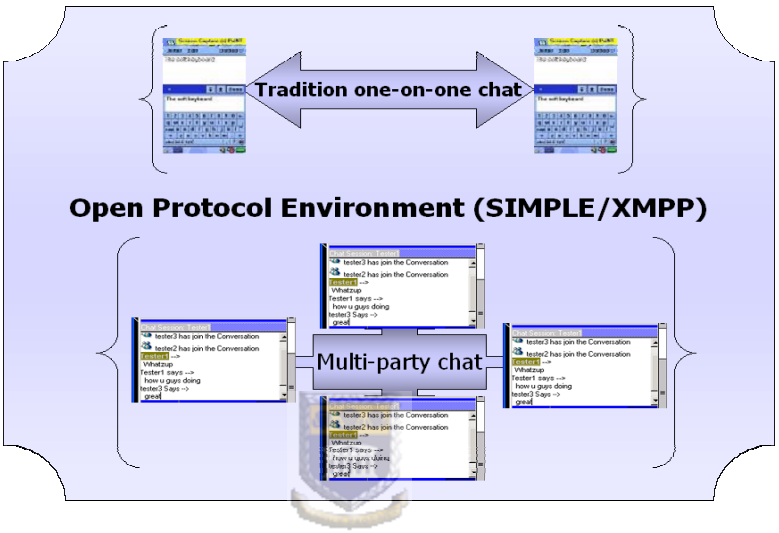


Figure 2 Single and Multi-Party Chat layout

Traditional two-party chat session in the upper section of the diagram is now supported in multi-party chat as shown in the lower part of the diagram.

This shift has occurred with open protocols such as SIMPLE and XMPP. Proprietary IM protocols also offer support. Parties in an IM chat, the Imessagees, are now able to initiate and communicate with more than two persons at a given time. Moreover, Imessagees can also engage in multiple IM conversations at the same time.

2.2.3 Messaging Services Review

In 2003, Muller et al. reported about IM adoption and its steep uptake in the business world, stating:

> "In an influential paper, Nardi et al, summarized the state of knowledge about IM prior to 2000. Since then IM has become even more commercially important, with estimates of over 100,000,000 users as of 2000 and over 12,000,000 business users as of July 2000. A recent business survey listed nine major IM providers". [49]

There exists much literature on IM outlining its emergence, importance, characteristics and relevance. Herbsleb et al. (2002) and Isaacs et al. (2002b) looked at IM in the workspace [29],[35]. There is a common agreement that IM is being entrenched in teenage culture. Farmer concurs saying IM is a technology that has been embraced by the information age younger generation especially in their online communication whether on a PC or on mobile (Laptop, PDAs, Cell phones) [22]. The Pew Internet & American Life Project report that teens are generally intense users of instant messaging technology, and use it and other online spaces and tools, to play with and manage their online identities. (http://www.pewinternet.org/report_display.asp?r=36). Research is thereby being focused on IM adoption in the work environment and for social interactivity. Contributing factors are inherent IM features of co-presence and multimodality. IM inbuilt features help improve some of the traditional text communication limitations (gestures, awareness, turn taking, and sequencing). The evolution of text messaging, from paging to highly deployed Short Messaging Service (SMS) and then to synchronous IM [70], albeit quasi-synchronous [51], follows a trend of being interactive and co-presence centric [32].

Joe Hildebrand, Jabber's chief architect states in an article in ACM Queue [30],

> "Instant messaging (IM) has become nearly as ubiquitous as e-mail, in some cases - on your teenager's computer, for example - far surpassing e-mail in popularity. But it has gone far beyond teenagers' insular world to business, where it is becoming a useful communication tool. The problem, unlike e-mail, is that no common standard exists for IM, so users feel compelled to maintain multiple accounts - for example, AOL®, Jabber, Yahoo®, and MSN®".

From this statement, one of the limiting factors of IM adoption and usage can be deduced as non-interoperability.

2.2.4 IM Protocols Interoperability

Applications of presence and Instant Messaging currently use independent, non-standard and non-interoperable protocols developed by various vendors. XMPP and SIP/SIMPLE are two protocols presently under discussion within the IETF to address

the issue of interoperability. These two protocols provide text message transport mechanism as well as a presence framework. Of note is 3GPP adoption of SIP. Interoperability goes beyond just IM system communication medium transport. It encompasses transparent text messaging across multiple protocols. Text messaging format and structure across multiple IM protocols should be transported, received and processed seamlessly. Other protocols such as CPIM and IMPP are addressing universal text messaging structure and transformation. CPIM is helping to gel messaging protocols together. It provides an abstraction framework for text messaging interoperability and mapping. The CPIM specification defines a number of operations to be supported and criteria to be satisfied for inter-working between diverse IM protocols [54]. The intent is to allow a variety of different protocols such as SIMPLE inter-working through gateways to support cross-protocol messaging that meets the requirements of RFC 2779 [17]. The IMPP (IETF Working Group - http://www.ietf.org/html.charters/OLD/impp-charter.html) goal is to define a standard protocol so that independently developed applications of Instant Messaging and/or presence can interoperate across the Internet. Thus, standardised protocols and data formats will help build a cohesive Internet-scale messaging system capable of end-user presence awareness/notification, IM, user authentication, message integrity, encryption and access control.

Development of framework, vocabulary and structure models for IM systems by CPIM and IMPP would help facilitate development of a suite of protocols to provide IM services [16]. This appears to be so as SIP has been positioned as an IM protocol capable of initiating and transporting XMPP based messages [67]. This degree of interoperability will go a long way to ensure that IM systems provide a high degree of transparency and co-presence to support ubiquitous conversation. However, interoperability aside, co-presence is also factored into asynchronous and synchronous communication.

Caveat

A lot of comparison between Jabber XMPP and SIP/SIMPLE has become distorted. It is important to emphasize that this represents a fundamental misunderstanding of SIP and its role in communications. As its name makes

clear, Session Initiation Protocol is just a protocol, not an application. Jabber, on the other hand, stands as the main application based on the XMPP protocol, and is in fact its major propagator. Sources voicing this confusion have normally analysed immature products designed exclusively for SIP and now blame functional limitations on the protocol rather than the application itself. Though Jabber might be a more 'mature' product than most implementations of SIMPLE, work is still in progress on both as the two protocols continually evolve.

Tang and Begole believe that encouraging nearly asynchronous communication by XMPP would cause IM to lose the awareness of conversational engagement and the ability to anticipate conversational utterances [70]. They state "although the XMPP does not preclude sending a message one character at a time, the header and XML formatting of the message would dwarf the one-character content". Tang and Begole therefore advocate that IM platforms need to allow the use of a text-oriented streaming protocol – similar to those for audio and video streaming – for enriched, synchronous text messaging. SIMPLE in session mode [46] is completing work on its Message Session Relay Protocol (MSRP) to support this and maybe even as a pipe for others such as XMPP.

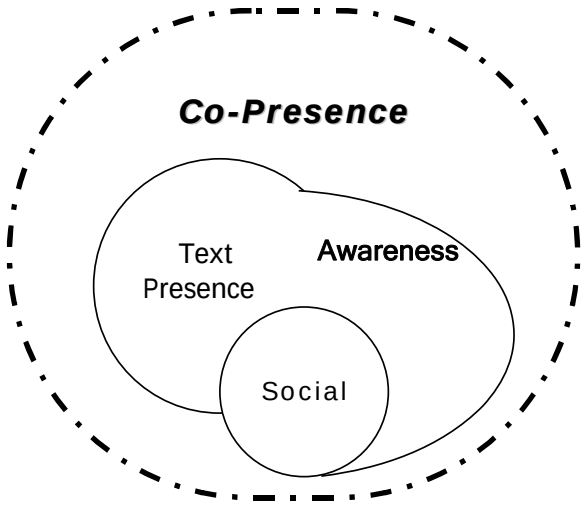


Figure 3 IM Co-Presence Concept

IM System as a communication medium has co-presence capability with its inherent offerings: Text presence, Awareness and social presence.

This background and caveat on IM leads to discussion on co-presence within text communication. IM has been positioned as a communication medium encompassing

both the text messaging and the awareness capability, both of which are part of its co-presence offerings. Inherent co-presence features in IM are shown in Figure 3. They contribute to IM system support for chat spontaneity. Thus, it is able to provide extended support beyond traditional CMC text communication limitations.

2.3 Co-Presence

Social presence as presented by Riva and Galimberti is "*the user's perception of the ability of the means of communication to marshal and focus the presence of communicating subjects*" [57]. It could also be defined as the extent to which a medium is perceived as sociable, warm, sensitive or intimate when used for interaction with other people. Daft and Lengel defines "*media richness as the ability of the means of communication to interlink a variety of topics, render them less ambiguous, and enable users to learn about them within a given time span*" [14]. The definition of social presence forms the basis of co-presence. In light of Short et al's definition, the term *social presence is" the degree of salience of the other person in a mediated communication and the consequent salience of their interpersonal interactions"* [64]. Short et al. define social presence in relation to a medium, describing it as an attitudinal dimension of the user, a mental set towards the medium and as the subjective quality of the communication medium. Short et al. also describe a social presence theory for analysing mediated communication, from which it can be said that communications media vary in their degree of social presence, and that these variations are important in determining the way individuals interact. Rettie in her study of four communication media (IM, text messaging (SMS), email, mobile call) affirms this variation while bringing a new concept of connectedness [55]. She views the concept of channel-connectedness as similar to social presence, yet not equivalent. Social presence is related to the perception of the other participant while connectedness is an emotional experience [56]. IM brings out this difference out well than any other text messaging platform. Imessagees could be connected without conversation and still be non-obstructive. Connectedness is therefore a variant of awareness – subjective awareness *[62]*. On the other hand, an Internet web-cam tied-in into an IM system conveys social presence but not connectedness, which would just be *mutual awareness*.

In light of Short et al.'s concept of a virtual environment, social presence relates to the social model as part of the non-self [64] when IM is considered as a communication medium. Text communication, more specifically an IM system, can be viewed as a communication medium rather than a communication tool or tele-operable entity. IM's inherent offerings allude to its co-presence capability as reflected in Figure 3. Imessagee are parties in an IM chat. They have presence knowledge of not only of themselves (oneself) but also of others (non-self) in the chat medium. A social presence is formed around them *within and without* presence sense. In Figure 4, social presence is embedded in awareness with connectedness abstracted out [56]. Connectedness still tends more toward being in connection with other people (Imessagees) than with just the object (medium).

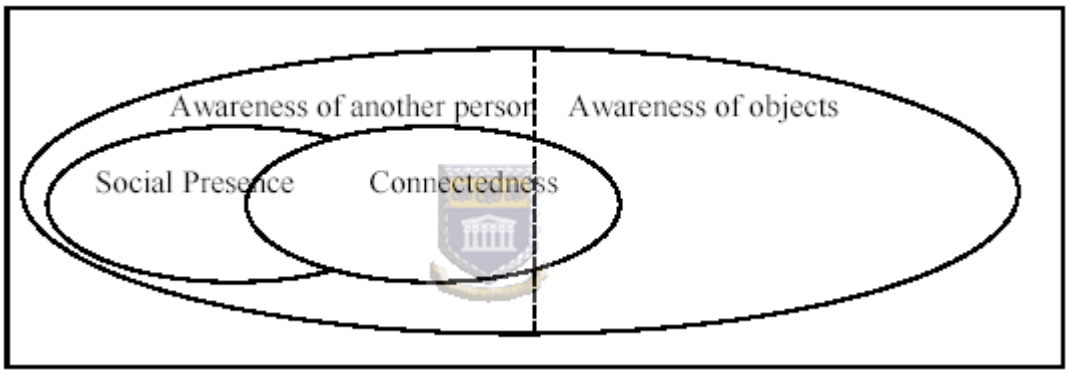


Figure 4 Connectedness abstractions

Connectedness does not imply awareness of the other person. For example, a stored text message in a mobile phone evokes the experience of connectedness without awareness of the presence of that person. Diagram reference from [56].

Abstracting one step further, social presence, and text presence could be entwined into awareness. These three now become elements of IM co-presence as shown in Figure 3. Entity and communication environment relationships in CMC can be grouped into three as in Table 2.

Firstly, there is Tele-operation, a Human → Machine relationship within a remote environment. Next is Tele-presence that situates a person in a remote place (Human → Place), also within a remote communication environment. Third is Co-presence, the interest of this thesis being Human → Human (remote) in a collaborative communication environment as shown in Table 2 [75]. Imessagees' engagement and

interaction with IM awareness brings out the co-presence offering of IM in the context of this thesis.

Tele-operation	Human → Machine	(remote)
Tele-presence	Human → Place	(remote)
Co-presence	Human → Human	(remote)

Table 2 CMC Entity and Communication Relationship.

The Human → Machine (remote) relationship is teleoperation, Human → Place (remote) is called telepresence and the Human → Human (remote) relationship is co-presence. In each, people feel as if they are 'actually' present in a different place or time.

Rosenberg explains the tele-presence attribute of a tele-operable entity [59]. In rephrasing, it could be said that, *the ultimate goal of these efforts is to produce a transparent human link.* Thus, *a user interface through which information is passed so naturally between operators within an open environment that the user achieves a sense of presence within their 'site'.* With respect to text communication, *the notion of co-presence so deduced, narrows down to the online presence and interlocutors' awareness*. This notion of co-presence Laurel relates as "being there while being here" [42]. Co-presence gives knowledge of the surrounding (environment), activities within the surrounding and co-ordination of action(s) within the surrounding. If we consider this site as a social space and place as do Harrison and Dourish [28], the IM medium has a user interface (IM User Agent) through which information (context data) is passed naturally between operators (Imessagee) within an open environment such as SIP/SIMPLE. Adesemowo and Tucker positioned this IM user interface as a form of HCI [2], which offers interactive input elements that varies across implementations. In the basic form, text could be entered into a textbox, which they then 'post' as text message [73]. A copy of the ongoing conversation is displayed while the session lasts giving a connectedness feeling. This is typically lost when the conversation window is closed. Some IM user interfaces allow for persistence chat history ensuring greater connectedness even when offline.

2.3.1 Text Presence

While noting that the field of linguistics is beyond the scope of this thesis, it helps to situate the co-presence paradigm [72]. The oratory of written text itself, which is embodied in the meta-linguistic awareness of text, gives its presence effect [25].

According to Gelléri in his thesis on linguistic study of a semi-synchronous text communication, the Internet Relay Chat (IRC), some salient features of IRC continuous adoption are the speech orality of text and action descriptors in use (not present in synchronous F2F communication) [25]. These are embedded in the meta-linguistic awareness [57] as one of the six linguistic functions (expressive, connotative, phatic, denotative-referential, poetic, metalinguistic) that Jakobson linked with the six physical components of communication – sender, message, receiver, context, code, and contact denotative-referential to establish the intention of the communicative act [36].

There seems to be a great deal of incongruity between the medium of IRC and its primary purpose. As opposed to F2F communication, where messages are simultaneously accompanied by certain verbal and non-verbal cues conveyed on extra parallel channels, IRC only relays typed text, excluding all other auxiliary channels of communication. Thus, communicants on IRC *cannot* make any use of intonation, pitch, gestures, facial expressions or any visual/auditory cues that are intrinsically present in other forms of F2F interaction. From this perspective, one might conclude that IRC is quite an unsuitable medium for interpersonal communication and for forming personal relationships.

Its unsuitability notwithstanding, Gelléri states its popularity and rapid adoption:

> "IRC enjoys great popularity among people from all over the world, who use the medium primarily for casual conversations or "chatting"… personal presence on IRC is shown and reinforced by means of "saying something", i.e. participating in a conversation by typing lines of texts and sending them off to make the utterances appear on the other participants' screens. Those who do not type anything are mostly ignored and have no influence whatsoever on the conversation(s)" [25].

Apart from signalling in-group status, IRC jargon also increases the efficiency of electronic conversations by speeding up interaction through abbreviations [25]. In IRC, these abbreviations are acronyms, slang, and "technitalk" that make up a special lexicon related to IRC, the Internet, and other areas of computer technology (see Table 3). This foregoing discussion has shown that the linguistic attributes of text

express a presence feeling. A mix of online presence avatars and cues entity offering extends the presence feeling (co-presence) further in an IM system.

IRC term	Type	Meaning
RE	Slang	hello again, welcome back
LOL	Acronym, slang	laughing out loud (to express laughter)
ROFL, ROTFL	Acronym	rolling on the floor laughing (to express laughter)
ASL	Acronym	age, sex, and location (asking for personal information)
MSG	Technitalk	(to send/receive a) private message
BRB	Acronym, slang	(I will) be right back
NP	Slang	no problem (in response to "thank you")
LO	Slang	hello
OMG	Acronym	Oh, my God! (exclamation)
WTF	Acronym, technitalk	What the fuck! (exclamation)
lag	Slang, technitalk	(to have) a slow connection, delay
kick	slang	to remove a user from the channel
chanop, op	technitalk	channel operator
ping	technitalk	to check the speed of network between two computers
Ppl, pple	technitalk	people
bot	technitalk	robot

Table 3 List of frequent abbreviations

Above is a list of some frequent abbreviations, acronyms, and other items of the jargon adapted from [25] (for a more extensive list, see Appendix B). It is of note that there is a fluid line of classification in type as there is clear overlap.

Within the context of [57], 'co-presence of utterances' is typical of the communicative exchange. This is when two interlocutors are able to influence each other's actions, and regulate the nature of their communication through some form of feedback of contextual data. Text presence, cues (emoticons, Hotkeys, other add-ons) and awareness (Buddies status and info, buzzing, IsTyping) are typical types of

feedback. In the reality IM (Figure 9 on page 30), users "buddy" surf, in that they are able to discover and follow on which of their friends are watching a given content stream [12]. Some context data feedback elements are shown in Table 4.

Feedback Element	Description
Text Presence	Text typography is used to create a text feedback effect
Cues	Online indicatory elements
Emoticons	Typewritten 2D or 3D clip of a facial expression or icon image
Hotkeys	Pre-defined or user-definable text
Buddies	Online likeable or un-likeable pals
buzzing	Give a call to alert buddy of being online
IsTyping	Indicator shown to IMessagee that chat party is busy typing

Table 4 Context definition of some feedback Elements

Thus, text presence contributes to the expressive discourse leading to a meaningful conclusive conversation. Text chat spontaneity is enhanced when conversation flows in a near natural pattern or reaches a meaningful conclusion.

While facial expressions provide an important spontaneous channel for the communication of both emotional and social displays, IM co-presence [42] capabilities are entrenched in text's oratory expressive discourse [24], awareness and limited turn-taking, sequencing and other add-on features such as emoticons and hotkeys. Online chat environments still tend to miss key ingredients that we take for granted in physical world chat – social context, reality and parallel feedback cues. Awareness is a very important part of online presence [12], [71]. Extensions made to IM interfaces and awareness enhancements extend online presence to include activity and interest.

2.3.2 Awareness

The term "awareness" on dictionary.reference.com has the definition below:

n 1: having knowledge of; "he had no awareness of his mistakes"; "his sudden consciousness of the problem he faced"; "their intelligence and general knowingness was impressive" [syn: consciousness, cognizance, cognisance, knowingness] 2: state

of elementary or undifferentiated consciousness; "the crash intruded on his awareness" [syn: sentience]

Thus, the noun 'awareness' generally has two broad meanings: state of elementary or undifferentiated consciousness and, of direct relevance to this thesis, is having knowledge of – synonymous to consciousness, cognizance, and knowingness. This is also seen at www.wordreference.com.

Beyond the oratory text presence, IM co-presence is further enhanced by its awareness capability. Cadiz et al. (2002) rightly pointed out the emergence of the word "*awareness*" in CSCW, noting its definition as "*understanding of the activities of others, which provides a context for your own activity*" [10]. Cadiz et al.'s awareness definition helps situate and narrow down the dictionary.com definition. Applied to IM, awareness helps to ease interaction through user-awareness of interlocutors, for example with buddies and other built in GUI features that show awareness state.

In his critical review of *the problem with awareness* in CSCW, Schmidt noted that awareness evolved as a placeholder for elusive practices of taking heed of what is going on around in the setting, to which awareness seems to play a key role in cooperative work [62]. However, this is not able to explain the failure of high fidelity technologies such as voice and video offered by Collaborative Virtual Environments (CVE) in cooperative work settings. This leads to *adjective* qualifications of awareness such as general awareness, peripheral, background, and passive [19],[62].

Awareness introduction to IM by Nardi et al. is taken as an instance of 'awareness' [50]. It is said that 'awareness' is only meaningful if it is referred to a person's consciousness of something. In the CSCW context, this consciousness refers to some special category of mental state existing independently of action but to a person's being or becoming aware of something. Presence on the other hand is more subjective. It lies within and relative to the environment rather than awareness, which is independent, in this context. Thus, 'awareness' is an integrated aspect of practice and must be investigated as such, a conscious exercise [62].

Awareness in IM is diverse, and depends on the features employed and the actions of actors. It comprises background, passive, reciprocal and peripheral awareness [19], [62]. Awareness conceived as a consciousness of the social context in an IM system

gives background awareness of who is 'around' as seen in Buddy list features. The complementary displaying and monitoring helps actors to monitor and be monitored appropriately, which leads to mutual or peripheral awareness. In monitoring, attention is drawn with actions such as buzzing, status changing, IsTyping and usage of other add-on features. Therefore, an IM aware system provides a material environment that is infinitely rich in cues (avatars, presence, info, features, intuitive, ease of use) that allows interlocutors to align, integrate, manage their activities and effectively cooperates within their space, either stationary or mobile [33].

The SUN Awarenex project extends the ConNexus desktop awareness information portal to wireless handheld devices [68],[71]. It is an IM and awareness prototype. Awarenex demonstrates additional real-time awareness information useful for initiating contact and negotiating conversation [71]. Bellotti and Bly's findings show that 'workers' local mobility often means that they are not near their computer desktop [6]. Consequently, all the tools that help manage communication, such as coordination and awareness in the desktop are ineffective whenever the user is mobile. In an increasingly world of mobility, it is essential to develop collaboration tools that enhance co-operation, presence, spontaneity and coordination in a mobile social space and place. Despite their need and importance, mobile devices possess inherent constraints: essentially, small screen space estate and input/output limitations [43]. These always have to be taken into consideration to develop usable collaboration tools/media.

2.4 Handheld Mobile Constraint

With the emergence and impact of mobile communication devices, mobile computing is on the rise and spawning new application domains. Data-centric Next Generation Networks (NGN) will owe their success to data services and ubiquitous networks [45]. We have seen a phenomenal success of text messaging with mobile phone users especially SMS in Europe [32][55]. Nevertheless, rapid uptake of IM and other text messaging on mobile handhelds is limited by screen real estate and input/output (I/O) mechanisms [71].

2.4.1 Limited screen real estate

The handheld/mobile device screen real estate limitation is obviously not by choice, but simply by factors that are inherent in its design. Moreover, as Lumsden and Brewster affirm, regardless of desktop users being typically stationary and mobile users in motion, mobile and wearable devices have limited screen real estate coupled with a restriction of traditional input and output capabilities [43].

Mobile device screen estate has evolved over the years from one line, two line and multi line mobile displays (seen in pagers and 2G handsets) to grayscale Thin Film Transistor (TFT) trans-reflective screens found on a Personal Digital Assistant (PDA) and 2.5G mobile devices. Newer appealing screens found in 3G phones, smartphones and PDAs are coming to match desktop display in full colour, but still suffer smaller screens. However, they now come in bigger sizes and views than earlier mobile devices.

2.4.2 Restricted user I/O

Mobile text input rests within two competing paradigms: pen and keyboard based input [44]. We might ask, why not just apply the QWERTY keyboard to the mobile paradigm since there exists an inherent familiarity on desktops. Early devices such as the HP100LX and HP200LX demonstrated that a miniature QWERTY keyboard could be adapted to mobile computing. However, they still suffer from bulkiness and unwieldy touch-type size ratio [44]. Foldable full size QWERTY keyboards are attachable to some handhelds and smartphones. To reduce bulkiness, the idea of a QWERTY fabric keyboard has been experimented with, as well as a virtual keyboard that occupies little or no space more than a cloth wrapping for the devices [52]. Smart Fabric keyboard (http://www.elektex.com/flash/app_computer.shtml) is an experimental wearable computing proof-of-concept in-progress at the MIT Media Laboratory (http://web.media.mit.edu/~rehmi/fabric/index.html). Stowaway (http://www.thinkoutside.com/) drew from this and released the foldable QWERTY originally for Palm, which has been subsequently deployed by other handheld manufacturers. Virtual on-screen soft keyboards are already in use, while virtual laser keyboards are being touted (http://www.vkb-tech.com/technology/foursteps.asp).

One-hand input mobile devices are being revisited in QWERTY keyboard text input, such as the RIM Blackberry, Sony Erickson 910i and Palm Treo.

2.4.3 Mobile devices stylus/pen-input paradigm

MacKenzie and Soukereff provide an interesting view on the mobile input paradigm [44]. They pointed out that the Kay and Goldberg Dynabook Project has come a long way from earlier simple "selecting and annotating" to handwriting recognition [38]. The Apple Newton MessagePad's poor handwritten pen computing (www.everymac.com/systems/apple/messagepad) has been improved upon with the advent of Palm's Graffiti, which simplifies character recognition. From an initial soft keyboard only supporting text entry, Windows CE has improved further with Jot handwriting (http://www.cic.com/products/jot/) and now Microsoft Transcriber (http://www.microsoft.com/windowsmobile/downloads/transcriber.mspx) providing enhanced recognition. Singer shows that Palm is also embracing Jot in Graffiti 2 [65]. However A. J. Cross Company's Crosspad (http://www.cross.com/) offers a technology vastly improved and rapidly being deployed across mobile operating system as Digital Inking, which is bringing us closer to the paper-pen paradigm - inking technology.

In the data-centric mobile smartphone and pager domain, small one hand QWERTY keyboards exist for text input such as implemented by Blackberry (RIM), and PageWriter (Motorola). Mackenzie reports on Matias and colleagues' work on a half QWERTY keyboard, which allows an industrial worker to enter text with one hand while busy on another task with the other [44], [47].

The advent of cellular telephony, and specifically SMS, placed a need for effective text entry that has been achieved with the 12-key telephone keypad. As the mobile network becomes more data-centric, extension of the keypad has been put to use in various ways (see Table 5). Such ways include multi-tap, two-key and predictive one-key non-ambiguous Predictive Text (T9) by Telgic referenced in [44].

Other predictive input techniques such as Darragh et al.'s Reactive Keyboard [15], Masui's POBox and Lewis' predictive soft keyboard are also analysed by Mackenzie [44]. T9 and text dictionary are implemented in mobile handhelds (Pocket PC and mobile devices) by default. Another input mechanism of interest not employed and

outside the thesis scope is speech recognition (TTS and ASR) that is always 'about to emerge'. However, as ASR engine matures, this will be an area of keen interest. [31].

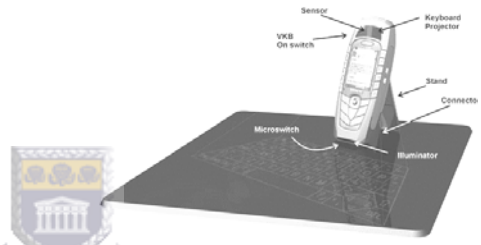
QWERTY Keyboard 	**One-hand QWERTY** 
Foldable Keyboard 	**Fabric Keyboard**   
Virtual on-screen (soft keyboard) 	**Virtual Lazer keyboard** 
One-hand Mini Keyboard 	**Handwriting Transcriber** 

Table 5 Sample of handheld device input mechanism

The table gives a pictorial view of some of the QWERTY keyboard discussed in sections 2.4.2 and 2.4.3.

The restricted user I/O technologies are of importance as they could be employed to help facilitate entries. ASR could help ease volumes of text typing while TTS lessens reliance on small screen gazing. Inking, a freehand technology on handheld, will go a long way in improving spontaneity of text conversation if it is able to provide a natural, intuitive way of text input and expression. Ways to lessen impact of the 'images' generated on the network bandwidth also need to be looked into.

2.4.4 Facilitated gesture input – streamlining focus

Facilitated gesture input needs to be defined in context, as this thesis *does not attempt to present the best or most appropriate mode of input on mobile devices*. Interest lies in *looking for ways to facilitate existing gesture input for users' interaction and conversation spontaneity*. Therefore, the IM social context, in which the techniques are to be deployed, must be taken into consideration [43]. Two areas to consider are gesture-based text input and essence of fast-tracking. Different forms of mobile gesture input have been experimented with, such as the Mankoff and Abowd's Cirrin interface, Perlin Quikwriting and Venolia's T-Cube that are all reviewed in [44]. However, gesture-based text input of interest to the Pocket PC domain are Reactive Keyboard (predictive input technology), Transcriber and Inking technology discussed above. Whilst these three supplement text input, inking could be tied to a facilitated on_draw send feedback in the same manner as on_click hotkeys could be handled.

The set of natural and effective gestures in the context of interaction – the tokens that form the building blocks of the interaction design – may be very different from mobile devices to desktop computers [31]. The real power of the next generation of interaction techniques will only be fully harnessed when the mobile motion contextual factors are taken into consideration and interaction techniques are designed appropriately [43]. Device-based gesture text input such as predictive and reactionary input technology do not form the focus for this research. Rather, a contextual multimodal gesture approach has been taken. The area of importance is the gesture enhancement made to IM chat on a limited input entry, small screen space handheld. Interest is not in how effective IM measures against F2F or audio discussion.

2.5 IM And Fast-Track Feedback

One way of designing interaction techniques appropriately is with effective multimodal interaction and accessibility [9]. For this, a trade-off has to be made between rich and thin clients in the mobile space. While a thin client ensures ubiquitous access, a rich client provides enhanced features, albeit hindering portability. However, platforms such as .NET and Java go a long way in easing this.

The Sun Lab Instant Messenger, (SLIM) was built as a thin client (http://research.sun.com/projects/slim/) whilst the AT&T Hubbubme, as a rich client [34]. Both provide adequate functionality as an IM system on PDA and even richer features on desktop.

Researchers working on text communication tool feature extensions have opted toward *redesigning chat interface* [51] in an attempt to address observed limitations in text communication. Other indirect variations include scripted chat [23], which uses a lead line script for structured online interaction. Facilitated gesture input mechanisms have been put to use in varying degrees. A lot of work on chat interface redesign involves a multimodal approach, which includes menu extension, facial affect, kinetic, haptic, and aural feedback.

2.5.1 Addressing Text Chat noted limitations

Awareness	Feedback	Interfaces
Awarenex [71] – subtle awareness cues	Reality VR IM [12] – IM tie-in to social event	FAIM [20] – Facial Affect gesture add-on
Buddy List	Haptic IM [61] - Tactile vibrating feedback	KIM [7] – dynamic typography text effect
Buzzing	HubbubMe [34] - Aural Sound id feedback	Amigo [21] – text handwritten free styling.
IsTyping	IsTyping	Amigo - Imaging
Buddy Status – online, offline, busy, away…	AGFIM – Affective Gesture handling of hotkeys and emoticons	
Emoticons	2D or animated 3D emoticons is number of IMs	
IM open Protocol	HotKeys	

Table 6 IM co-presence enhancement elements

IM awareness capability and interfaces are extended to enhance co-presence. The table shows approaches taken in enhancing co-presence in IM.

In redesigning the chat interface, facilitated gesture input mechanisms have been put to use in varying degrees. Different innovative ways that have been explored are summarized in Table 6 under three main categories: Awareness, Feedback and interface redesign. IM awareness capability and interfaces are extended to improve

input mechanisms thereby enhancing co-presence. Various implementations will be discussed in this section showing how text chat limitations are being addressed.

2.5.2 Types of Text Chat Redesigning

The Typography-based Kinetic IM (KIM) is built on a text typography engine, a system that changes text appearance over time, as a new form of expression due to its ability to add emotional content to text [7]. KIM builds upon applications for rendering and editing kinetic typography effects. It seeks to address several design issues that sprang from integrating kinetic typography and IM (see Figure 5).

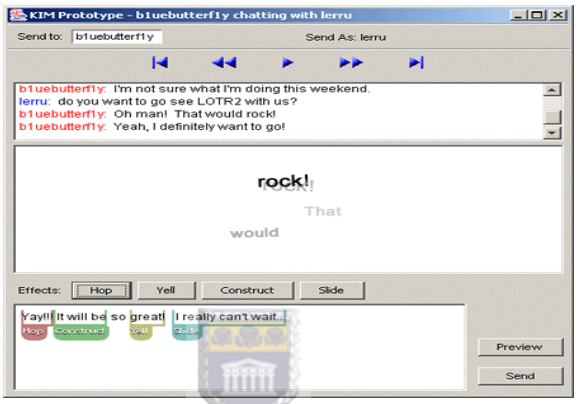


Figure 5 KIM - The Kinetic IM Interface

The KIM interface shows a chat session. It uses the Java/Swing toolkit to build on Kinedit, a kinetic typography engine that allow effects to be applied to text such as "rock" in the screenshot.

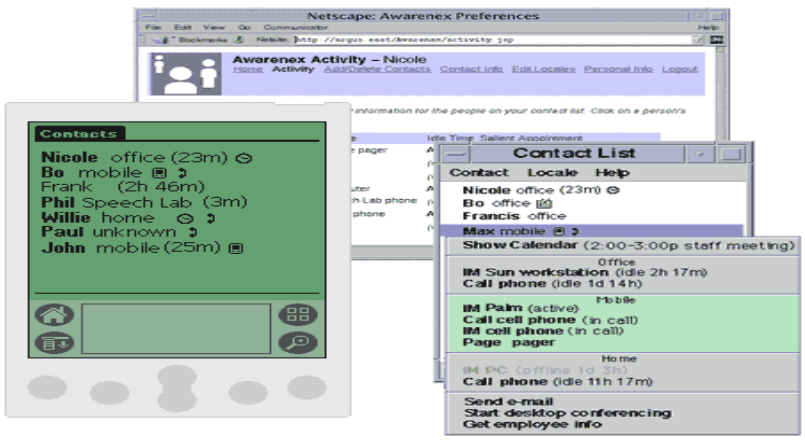


Figure 6 Sun Microsystem Awarenex

Awarenex is a device awareness-and-communication application designed to help distributed work groups stay in contact with each other, even when they are mobile. It shows awareness infomation such as users status (incall, idle…), last activity timing and device tracking (mobile, office…).

The desktop-based ConNexus was extended to the mobile domain as Awarenex, which nicely integrates multiple mobile devices [71]. It provides subtle awareness cues, but it mainly supports intended rather than opportunistic interactions (see Figure 6).

On the other hand, AT&T HubbubMe shown in Figure 7, was designed to support awareness, opportunistic conversations, and mobility. It employs TTS to provide sound id cues (earcons) in addition to default Palm Graffiti text input [34].

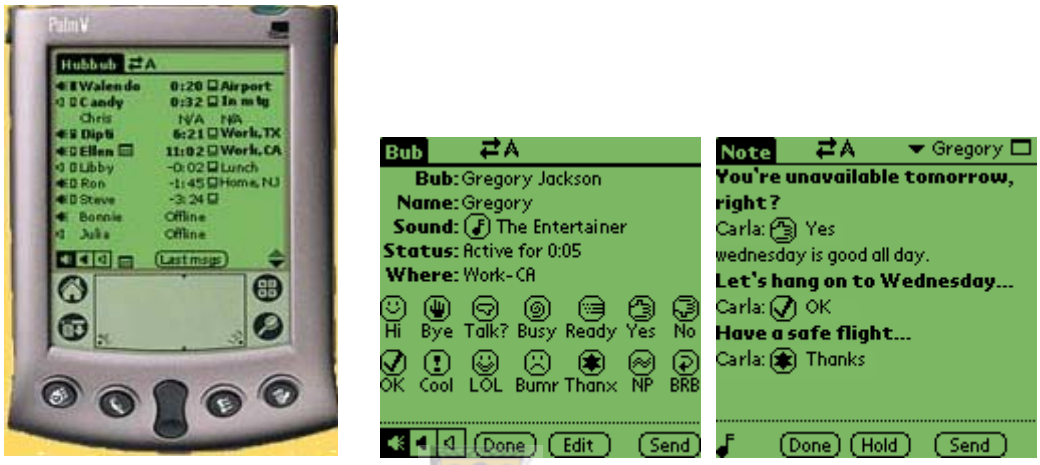


Figure 7 HubbubMe Bub and Message screens on the Palm

Buddy list and presence offer awareness and impromptu chat. Buddy's sound ID alert (Hi, Bye, Talk…) shown to the right allows users to select and hear a tune knowing who is there. The sound ids are short strings of notes that have meaning, akin to typical voice chat gesture.

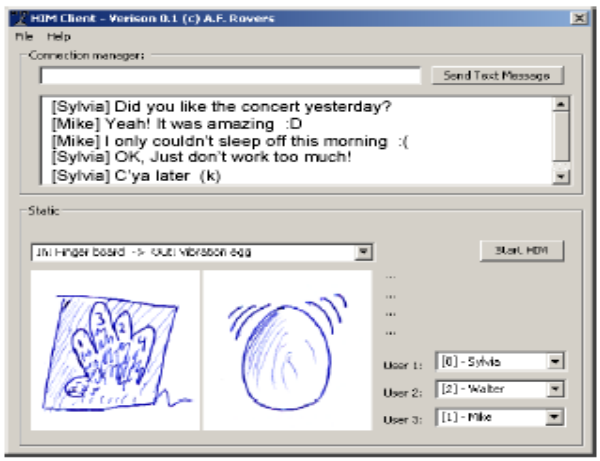


Figure 8 HIM: Haptic Instant Messenger

In the chat between Mike and Sylvia, hapticons are used now and then to express special feelings. For example: Mike uses the big-smile-emoticon :D to express his enthusiasm. This hapticon generates an appropriate haptic effect at Sylvia's site: for example a fast vibration with increasing amplitude burst that ends abruptly. Similar, the dislike-emoticon :(generates a more aggressive signal consisting of three abrupt pulses of high amplitude. The kiss-emoticon (k) results in a signal that feels good: a vibration that increases in frequency while decreasing the amplitude.

The Haptic IM Figure 8 employs the "touch" sense of emotions to offer haptic communication by allowing users to send messages (hapticons) enriched with haptic effect [61].

Reality IM draws on the concept of Bulletin Board to inject virtual reality into IM chat within a social context [12]. The IM chat session revolves around an event (Golf course in this case) as in Figure 9.

Figure 9 A reality IM application.

The IM session on the right featuring a play-by-play sports service is synced on a play-by-play basis to the real-time golf stream on the left. As events occur on the left, the IM window on the right automatically updates with those events. The system also allows users to interact with the real-time stream. In the example above, the user is given the opportunity to guess how well the current player is going to perform.

El Kaliouby and Robinson's Facial Affect IM (FAIM) is based on MSN Messenger 6.0's user-defined picture [20]. FAIM analyses a participant's facial affects in real time and arguments the dialogue with an emotive character representing them. MSN Messenger's static user picture is replaced by an animated graphic drawn by the animator that is powered by the Affective state manager (see Figure 10). The state manager is built on the facial affect analyser to provide a simulation of facial emotional state.

These desktop based IM systems attempt to address text communication limitations with mechanisms that could easily be moved to the handheld domain. However, they need to take into consideration interaction and mobility issues. Most IM available on handhelds (MSN, Rivotek, and AOL) taps into facilitated provisions the operating system offers, such as predictive text input and clicking. IM such as Hubbubme [34] extends facilitated input further with sound IDs using Text-to-Speech features.

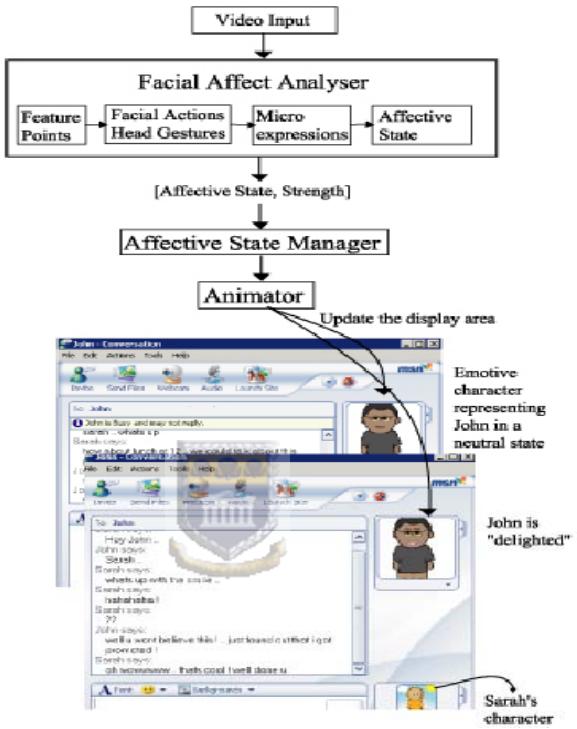


Figure 10 FAIM schematic and Interface Diagram

A schematic diagram shows how FAIM works. It follows Sarah and John through three different stages of a conversation. John starts with his character displaying a neutral state (screenshot in the background). During the conversation, John gets an email from his manager at work informing him that he just got promoted. John is delighted with the news. The facial affect analyzer picks on this expression and sends it to the affective state manager, which records a change in affect and informs the animator module. The animator in turn picks a smiley version of John's character. John's display area gets updated (screenshot in the foreground).

The Viktoria Institute Amigo wireless image based IM allows free-form images as well as handwriting to be sent between people (see Figure 11). Running on HP Ipaq H3630, Amigo takes advantage of iPAQ's touch sensitive displays, transcribing and inking technology of mobile devices [21].

Extensions to predictive text facilities include 'My Text' available in IM such as MSN Messenger (Pocket PC version) that offers users pre-defined text in a

conversation. However, MSN MyText is not very dynamic. It lacks on-the-fly editing when in a conversation and on-the-fly sending as MyText selected is inserted inline into the text box before sending.

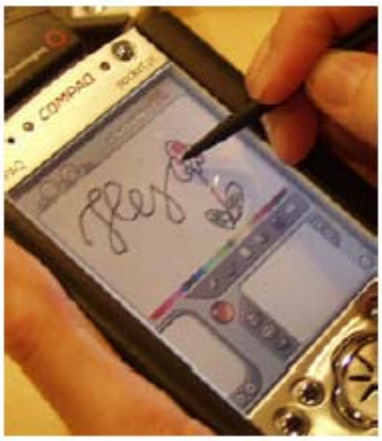


Figure 11 Text free styling and image drawing in Amigo

The awareness interface contains a contact list that shows the users currently online on Amigo, and is used to initiate new sessions. The messaging interface contains the drawing area, incoming message area, smiley archive, drawing tools and history archive. This mode also contains a list of the user's current chat partners, making it possible to switch between active sessions.

2.6 Related Work Summary

The need to facilitate text communication draws from the limitation of text. Yet, in spite of noted inherent limitations of the text communication medium, such as lack of turn taking control and affective interaction spontaneity, the oratory of written text in itself is a contributing factor often taken out of the equation. Text expressiveness has been put to great use in different text communication tools including IM. This expressiveness is a factor of text communication pervasiveness, which has not been looked into properly when examining text communication as a media for conversation.

The medium of IM supports near-synchronous communication among two or more parties. This enables exchange of rapid fluid text messages back and forth. SIP/SIMPLE and XMPP are two IM protocols that provide session rendezvous and transport of data. They also enhance interoperability of IM clients that standardise on their protocols. Efforts are ongoing to integrate both, allowing seamless messaging across domains. Beyond session and transport, other types of interoperability are essential. Text messaging format, structure and syntax framework require

standardisation. CPIM and IMPP are protocols and guidelines being developed to address this.

Interoperability promotes a sense of connectedness and awareness of others beside the fluid exchange of text. Inherent co-presence features in IM include text presence in itself, social presence and awareness. Social presence can be seen as the feeling or perception of other Imessagees in an IM chat/system, while awareness is having a conscious knowledge of other IM users. An IM aware system provides cues that allow Imessagees to align, integrate, and manage their activities and effectively cooperate within their space and place far better than other text communication media like IRC and SMS.

The deployment and use of IM on mobile handhelds suffer from small screen real estate and limited I/O mechanisms. Re-engineering the physical input mechanism such as reactive, predictive, and gesture affect input techniques could enable enhancement to handhelds. The inputs are capable of facilitating gesture input for users' interaction and conversation spontaneity. Yet, facilitation can also be achieved within a social context by redesigning chat interface. Table 1 outlines some of the add-on enhancement features that an IM System while Table 6 summarises some of the redesign of IM chat interface to enhance its co-presence offering. The set of natural and effective gestures in the context of interaction are different for mobile devices than for desktop computers. The same is also true of text communication and other media like F2F and voice. Therefore, interaction techniques within a mobile domain must take into cognizance the mobile contextual factors. Device-based gesture text input need not necessarily be the only option. In fact, this thesis looks at a contextual multimodal gesture approach to aid chat spontaneity.

AG handling of Hotkeys and Emoticons (as are other enhancing chat features) can help in better understanding how to build text-based communication medium. The novel AG Hotkeys extends the MyText feature with dynamic editing and sending on the fly by selecting from the drop down context menu.

Chapter 3 METHODOLOGY

Earlier discussion of IM in section 2.2.2 and social presence in section 2.3 shows that IM can be viewed as a communication medium and space rather than just a tool. This helps explain how IM provides co-presence based on its inherent features, properties and capabilities.

Most IM related research has taken an ethnographic approach based on analysis of server logs [49]. Conversational Analysis (CA) is also carried out especially for a small audience study [51]. Yet, others have sought answers to their research questions by considering IM chat interface reconstruction. This normally involves introduction of extended features in the redesign of an IM chat interface to improve IM's features or capabilities.

This thesis draws largely from chat interface enhancement to develop an AG enhanced SIP based IM system. The research approach incorporates a hybrid quantitative and qualitative approach. Quantitative usage of hotkeys was logged with code instrumented into the IM system. In addition, pre- and post-trial Computerised Self-Administered Questionnaires (CSAQ) were used to collect users' usability and usage feedback based on their experience with the IM enhancements (AG hotkeys and emoticons). Feedback from an initial trial was incorporated into an IM redesign, and a subsequent trial. Two qualitative techniques were also implemented. Short unstructured review sessions with focus groups helped to triangulate findings from logs and questionnaires as well as from observation during trials. This quantitative and qualitative crossbreed method attempts to compensate for any result analysis limitations.

3.1 Research Question

It has been stated while defining social presence and in rephrasing Rosenberg [59], that IM can be viewed as a communication medium and space rather than just a tool. Discussion of IM in 2.2.2 and definition of social presence in section 2.3 helps explain how IM provides co-presence based on its inherent features, properties and capabilities. Higher uptake of IM on Mobile/Wireless networks requires some

extension on two fronts: platform and feature capabilities. For platform, there is a need for an open communication protocol such as SIP (SIMPLE) for transport and for text messaging format, structure and syntax. A common Smiley Dictionary framework for interoperability should be handled as a part of text messaging syntax. Feature capabilities revolve around input/output limitations and multimodal enrichment, an area that rests within the chat interface reconstruction domain. Of *main concern* is facilitated text gesture input. Thus, the proposed on_click Affective Gesture (AG) emoticons and on-click user-defined AG (text) Hotkeys help address facilitated input.

F2F conversation holds forth as the medium of choice for making conversation at all levels and across domains [41]. Voice conversation, either dyadic or in conference call, has also proved effective. They both provide turn-taking and parallel awareness cues to sustain interaction. It is essential to know what capability text messaging has to offer for effective turn-taking conversation. To provide an answer, there is a need to address text presence within text communication via the expressive discourse of text itself. The question then is, does text communication possess expressive discourse and if so, how does it facilitate communication? Thus, this thesis seeks to show that one-click text-gesture (AG) fast-tracking enhances text communication further.

The research question can then be presented as, "Given that text communication possesses expressive discourse with some presence level, the thesis explores the efficacy of one-click editable text-gesture fast-tracking to improve co-presence via chat spontaneity." In other words, can a fast-tracked Affective Gesture improve chat spontaneity? A related question regards presence levels. How can an IM system be extended further with presence indicators, awareness and facilitated text-gesture input, specifically in a wireless handheld domain? Also, can emoticons handled as AG ease interaction spontaneity in text communication? The thesis therefore suggests presence indicators, awareness and facilitated text-gesture input such as the novel AG text hotkey.

Secondary areas to be explored include using Hotkeys and emoticons as AG to enhance interaction spontaneity in text communication. Platform interoperability as highlighted earlier is an area of improving IM co-presence. Non-standardisation of

applications or services is a limitation to uptake on handheld/mobiles. The Reality IM [12] gives a pointer to creating services with IM. IM services such as the Distribution List and Chat Bot built around SIP/SIMPLE, relates to the need for open standard protocol. Thus, IM systems based on open protocol such as SIP (SIMPLE) should ease interoperability barriers.

In the context of this thesis, online presence (Awareness) relates to who is online or not-online in the IM social space, whilst presence indicators are indications of what interlocutors' actions are. With the background of limited input/output space on handhelds, this thesis therefore proposes that IM typing economy typography and emoticons can be improved with one-click user-defined hotkeys and emoticons. Discussions in the Literature Review have taken a critical look at the presence level in text communication expressive discourse itself. In order to explore the research questions, effort has been taken to code a SIP (SIMPLE) based IM system with the AG hotkey mechanism, set up a small collection of handhelds running the software over a wireless LAN (WLAN), and carry out user trials with a hybrid quantitative and qualitative approach to data collection.

3.2 Research Approach

Most IM system related research has taken an ethnographic approach based on analysis of server logs [49]. The ethno-methodological approach has proved effective for large subject groups or large log conversational data [35],[49],[50],[51],[70]. In some instances, a Conversational Analysis (CA) has been done [51] especially for a small audience study.

Others have pursued their research questions by considering IM chat interface reconstruction, which normally involves introduction of extended features in the redesign of an IM chat interface. This redesign O'Neill [51] tagged *Redesigning Chat Interfaces* in an attempt to address text chat problems with particular reference to Smith et al. (2000) work on text chat's *lack of control over turn position* [66]. An instance is Fabersjö's Amigo project [21]. Another is El Kaliouby and Robinson's Facial Affect IM (FAIM) at University of Cambridge discussed earlier [20]. In this approach, a small user base is normally sufficient to validate the feature extensions, an approach taken in this thesis.

Farnham's et al.'s timed task completion of structured text chat provides an interesting dynamic to determine how well participants follow and contribute to structured subject discussions [23]. This approach, though subjective, is quite suitable for Collaborative Virtual Environments (CVE) or CSCW-CVE hybrid experimentation. Timed-tasks suffice in a within and without experimentation, with single data source. However, for a small participant and short period experimentation, data triangulation of multiple data is adequate. Loose task completion employed in this thesis encourages participants to explore the IM system features.

For this thesis, quantitative instances of Hotkey usage are noted with logging instrumented into the IM system. In addition, pre and post chat CSAQ's [5] were used to collate users' usability and usage feedback based on their experience with the IM communication enhancement (AG Hotkeys and Emoticon). The Pre-trial questionnaire captures participants' IM background knowledge and introduces the AG feedback concept. Feedback from the initial trial was incorporated into the IM redesign and running of the second trial. The post-trial questionnaire provides feedback on the AG Hotkeys and emoticons introduced in the IM experiment.

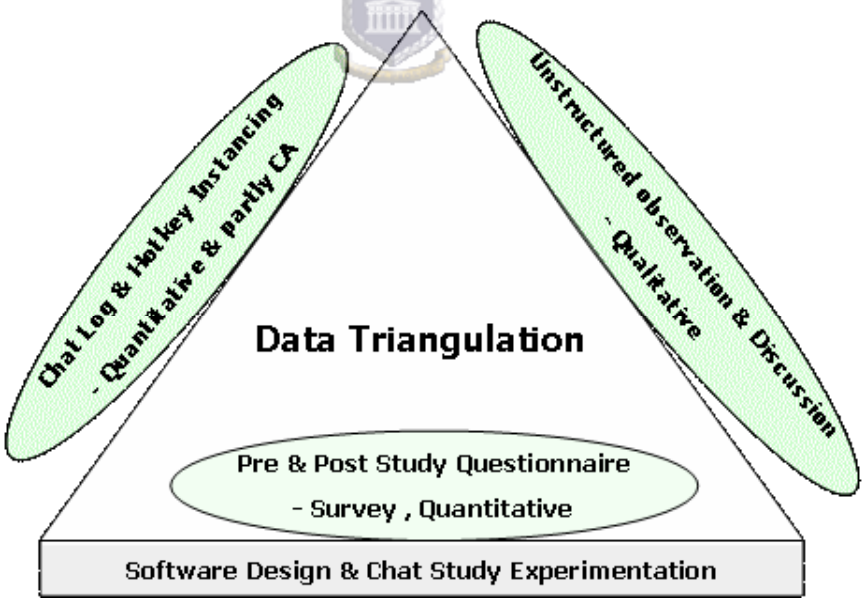


Figure 12 AGFIM Data Triangulation leg

The legs of data triangulation are pre and post trial questionnaire (survey, quantitative), unstructured observation and discussion (qualitative), and automated logging of text chat triangulating the base software design and testing by chat study group (experimentation).

Two qualitative approaches were implemented. Short unstructured review sessions with focus groups help triangulate observed and questionnaire findings. Test trial

participants were also closely observed in the pre trial while loosely observed in the post trial. These two provide qualitative metrics [5]. This quantitative and qualitative crossbreed method should compensate for result analysis limitations.

The process above follows a two level iteration following on the work of Kock [40]. This two-level iteration, though capable of further iteration, was sufficient as multiple sources of data were triangulated (see Figure 12). Test trials were conducted in two iterations (initial and final) in line with one-group pre-test-post-test experimental study [5]:p215. It must be noted that though iteration noted as two level, should the first and second trial run of the initial trial be separated, then, the iteration level can be referred to as three.The small study group was a consequence of limited handheld hardware availability.

3.2.1 Research Steps

Kock illustrates four major types of research approaches: Experimental, Survey, Case and Action Research (AR) [40]. Babbie and Mouton put forward six design types: Experiments, Surveys Research (SR), Qualitative, Participatory Action Research (PAR), Evaluation research and Unobtrusive research [5]. Following restraints in basing his methodology as purely AR, Kock put forward a method used in his research that factored iterating any of the main research methods (especially AR). This is termed Iteration Research (IR) and is conceptualised in Figure 13. It enables quick prototyping, testing, refinement and sufficient enough to validate the research hypothesis. Iteration is well established in solving numerical computation problems and is capable of converging to a root solution. This thesis follows this approach, sets the iteration level for software refinement and users' trials to two.

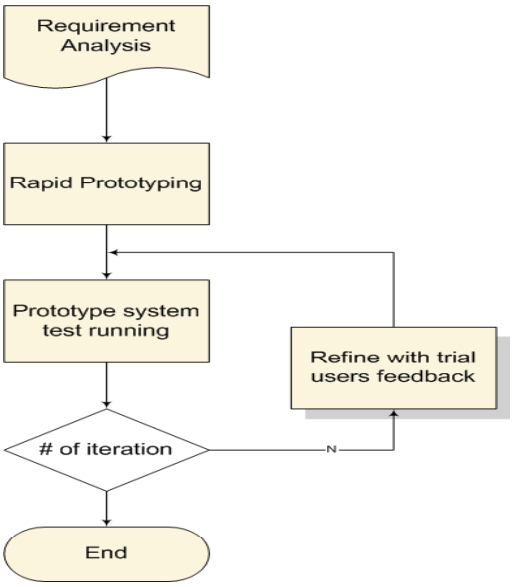


Figure 13 Iteration Research: Two level iteration

The Iteration Research in this thesis entailed close participant observation and in-depth interviews from Survey Research. IR in this thesis uses questionnaires to get feedback, while the iteration level (set to two) for software design and trial is pre-determined up front rather that iterating to an accepted improved system.

3.2.2 Software Development

A SIP User Agent (UA) was developed to learn how AG Hotkeys and Emoticons can enhance IM in the mobile and wireless domain. On-click Emoticons and user-defined Hotkeys are aligned on an IM chat window toolbar based on MS Windows Messenger. The software provides the interface through which participant test the efficacy of the AG feature. Detailed design of the SIP UA IM is explained in Chapter 4. In line with IR, users' feedbacks from the first trial were incorporated into a second level of software development used for the second trial.

3.3 Experimental Design

Trial participants are expected to be mobile with induced text input limitation by design (device capability) and/or posture (mobility). Experiments were conducted with mobile participants, for whom a WLAN was put in place.

3.3.1 Related Experimentation

Grinter and Elridge's text-messaging study was of interest because of its small audience size though they studied SMS text messaging [27]. They recruited ten paid teenagers who either owned or shared a mobile phone. The three-way approach taken

by them began with a pre-study questionnaire to learn about the teenagers' accessibility to communication technologies, including landline telephones and computers, as well as to elicit background information on mobile phone use in general. Secondly, they employed detailed logging with detailed information on text messages sent and received over fifteen consecutive days. Thirdly, they used a discussion group that allowed them to get explanations about patterns observed in the logs, and addressed some of the inherent weakness of relying on logs and questionnaires exclusively. This type of study approach represents classical data triangulation [5].

In a similar pattern, Farnham et al., with a larger group of 65 participants, first asked respondents to fill in a background questionnaire to elicit background information. This was followed by a system feature introductory session including a typing test to bring participants up in typing speed, before conducting the text-messaging trial. They then began the within and without chat sessions (regular and structured) [23]. In Farnham et al (2000), oral discussion session was held with the participants after their trial [23]. However, this was done away with. Participants were simply requested to fill in an open-ended overall comment in the post-chat questionnaire about their chat session experience with respect to usability, feedback, and features.

Drawing from their experience, coupled with having a much shorter test (logging) period as well as the need to cut down on qualitative CA, these approaches [23], [27] have been adopted with some modification. This thesis employs questionnaires (pre-trial and post-trial including a general overall comment session at the end), server and client side logging, short unstructured review sessions with focus groups and observation of participants in the two trial sessions (initial free form and final structured trial session). Each form of data collection is discussed in depth below.

3.3.2 Questionnaire

Noting that the hypothesis is not testing normative usage of emoticons but rather the AG usage of emoticons and most especially user-defined Hotkeys, the quote below was used from El Kaliouby and Robinson's FAIM paper, to ask a set of questions on the usefulness and effectiveness of features introduced:

> "Although emoticons are quite useful, they provide a very limited means of expressing emotions. They do not capture the dynamics underlying the emotional processes and have to be explicitly inserted in-line by the user, removing the spontaneity of affective interactions" [20].

The quote was adapted in the pre- and post-study questionnaire to elicit feedback on the usefulness of hotkeys and emoticons. In the post-trial questionnaire, it was further adapted to compare typical and AG emoticon usage.

Pre-Trial Questionnaire

The Pre-trial survey questionnaire elicits background information on IM messaging in general. Some questions capture whether or not responders have used IM before, how long they have been using IM and which IM client/systems they use most often. Further questions determine if users have used a PDA before and if they have, what IM clients they used on the PDA. Other questions address features of IM including IM features made use of, features likes/dislikes and a feature wish list. An introduction to the AG emoticon and user-defined Hotkeys was presented to which they rated in terms of relevance or necessity. See Appendix C for the questionnaire.

Like [23] and [27], the pre-trial questionnaire provides an understanding of the nature of participants, in this case, their exposure and experience using IM and PDAs, and whether by chance they have been introduced to AG before. This baseline helps to draw conclusions on their experience from using the enhanced feedback introduced in the trial sessions.

Post-Trial Questionnaire

The Post-trial questionnaire examines participants' experience with using IM on handhelds. It also provides feedback on the AG Hotkey and Emoticon introduced in the IM trial.

The questionnaire concludes with an open-ended overall comment on their trial chat session (structured) experience and wish list. Unlike Farnham et al. [23] that used a concluding discussion with a focus group, the optional ending question was included in the post-study questionnaire to solicit overall experience and general feedback on the IM system. The final post-study questionnaire is in Appendix D.

3.3.3 Logging – Server and Client Side

An area of interest is in knowing if participants will be able to follow and contribute to a structured subject discussion or just lurk in the system. In order to determine this, data captured from the post-chat questionnaire and the server/client conversational logging was used to find out how much the AG features (Hotkeys and emoticons) were used. Engagement of the AG features in terms of how many times hotkeys and emoticons were used and how often Hotkeys edited would give an indication of how much these one-click AG features enhance text communication in an IM system.

The software was instrumented to log Hotkey tags to a rich text file. On exit out of a conversation, a client side conversation log was saved to each participant home folder in rich text format and date stamped. Prefixing hotkey placement with [Hotkey:] would afford a quantitative and qualitative CA with the ability to track and count instances of Hotkeys usage in a conversation. Qualitative examination of hotkey and emoticon placement within a conversation would be useful for future qualitative CA when logged content is examined to extract conversation patterns and feature usage.

3.3.4 Focus Group

Short unstructured review sessions with focus groups help to triangulate findings from logs and questionnaires as well as observations during trials. In the initial trial, test trial participants were closely observed. Afterward, a short discussion session allowed further aligning Pre-trial questionnaire data and trial feedback with the respondents. Bugs were reported and suggestions made on improvements to the software that were fixed in the second iteration. Participants were loosely observed in the final structured trial. A short informal discussion was carried out to elicit feedback on system features and session experience.

3.3.5 Trials

Two trials ensure an exhaustive testing of the AG features by the study groups. Having the trials in two phases also provided for lessons learnt and feedback from the initial trial to be incorporated into the final trial.

Initial Free Form Trial Session

A trial chat session, with participants drew from the pre-trial survey, tests the AGFIM system. The trial was conducted with two groups, techies and non-techies, to provide a platform for comparison. The study groups are made up of a small number of participants. The non-techies group comprised of four non-Computer Science females drawn from one of the residences at the University of the Western Cape (UWC). The second group of five comprised Computer Science majors: four Masters and one Honours student. Close observation was made of the participants in the two groups to monitor the trial [5]:p293. This qualitative observation was essential in the unstructured free form trial. After the trial, each group is to fill in the post-trial questionnaire. A short discussion session allows further aligning Pre-trial questionnaire data and trial feedback with the respondent. This also addresses reported bugs in the software. The AGFIM System setup and experimental setup is detailed in Chapter 5.

Structured Trial Session

Farnham et al. used a Lead Line Script in a timed task-based Structured Chat Environment [23]. A more structured un-timed chat session in line with Farnham et al. was carried out with paid participants who made extensive usage of the AGFIM system. The structured chat sessions involves specific Menu feature actions (changing Hotkey to suit one's style), starting a conversation and completing a task with a Distribution List Bot (IM buddy), adhoc dyadic chat and group chat sessions. The Distribution List bot is coded with specific help instructions to set up a Distribution List, create and chat in the chat room. The task list for the structure can be found in Appendix A. A structured (task based) chat session was chosen to ensure that each participant was able to make use of the IM system and its features. This is also partly because of the multi-location nature of the trial. Thus, monitoring of the trial session was by simple observation [5]:p293.

3.4 Methodology Summary

Revisiting the research question that presupposes that text communication possesses expressive discourse with some presence level, does one-click editable text-

gesture fast-tracking improve co-presence via chat spontaneity? In other words, can a fast-tracked Affective Gesture improve chat spontaneity? Secondly, how can an IM system be extended further with presence indicators, awareness and facilitated text-gesture input, specifically in a wireless handheld domain?

To provide an answer, a SIP-based IM was developed with functionality to learn how AG hotkeys and emoticons would enhance IM in the wireless domain. A two-level iteration approach affords the ability to quickly prototype, test, and refine the AGFIM. One benefit of this approach is being able to refine and make informed decisions and changes in the software development cycle and architectural design. This will be seen in the next chapter. Moreover, test trials were conducted in two iterations in line with one-group pre-test-post-test experimental study, which is valuable in the absence of a control group [5]:p215.

Data collection comes from multiple sources and incorporates both qualitative and quantitative data to triangulate the small chat study group results. The legs of the triangulation are pre and post trial questionnaire (survey, quantitative), unstructured observation and discussion (qualitative), and automated logging of text chat with hotkeys. This triangulation provides a means to determine if the one-click editable AG does improve chat spontaneity. The AGFIM software design and the users' trial act as the test bed to see how an IM system can be reconstructed to enhance IM co-presence. The quantitative and qualitative crossbreed method compensates sufficiently for any methodological limitations. The triangulation of results is essential to align pre- and post-trial questionnaire feedback with the other data sources. Data triangulation makes up for limitations of small focus groups and a short experimental period. This triangulation provides the means to determine if the one-click editable AG can improve chat spontaneity.

Chapter 4 AGFIM SYSTEM DESIGN

The literature review showed that improvement in the naturalness of text communication with respect to IM chat spontaneity enhancement takes on two fronts: platform and features. On the platform side, there is a need for an open, standard communication protocol and common text messaging structure, mapping and syntax. Secondly, reconstruction of the chat interface has been explored as a way to facilitate text gesture I/O. This chapter presents an IM system with on_click Affective Gesture (AG) emoticons and on-click user-defined AG (text) Hotkeys that facilitate text gesture input. Taking a closer look into the AGFIM system design, a high-level overview of the software development is presented in this chapter. Ideal scenarios for 3G Mobile networks and native Pocket PC PDA applications are discussed with respect to the proxy WLAN network and the simulated Terminal Services coded for this thesis.

4.1 High Level Project Overview

The visual overview in Figure 14 shows that a AGFIM SIP client User Agent (UA) runs on a handheld and connects via a wireless mobile link to an IP-based SIMPLE network where SIP co-ordinates clients' messaging sessions. Three types of SIP servers were deployed for interoperability: Microsoft's LCS, VOCAL on Linux (http://www.vovida.org/) and Siemens' SCSProxy. All three were used to test interoperability while LCS was used for the actual trial.

A handheld-based AG Fast-track Feedback IM was developed to carryout the experiment. Pocket PC handhelds connect to a SIP server over a Wireless LAN (WLAN) as shown in Figure 14 and run the AG Feedback IM (AGFIM). Standard IM text features were supported with additional features. These include user-definable text Hotkeys shown in Figure 15. They are written to XML and loaded into memory as a dataset of two-level hotkey history. There is AG on-the-fly sending as well as switching between AG and traditional in-line text. IM runs via a message session setup and coordinated by SIP as shown in Figure 15, the architectural layout. The text

only IM was built on the IETF open standard SIP/SIMPLE, using Microsoft Real-time Communication Library (RTCClient).

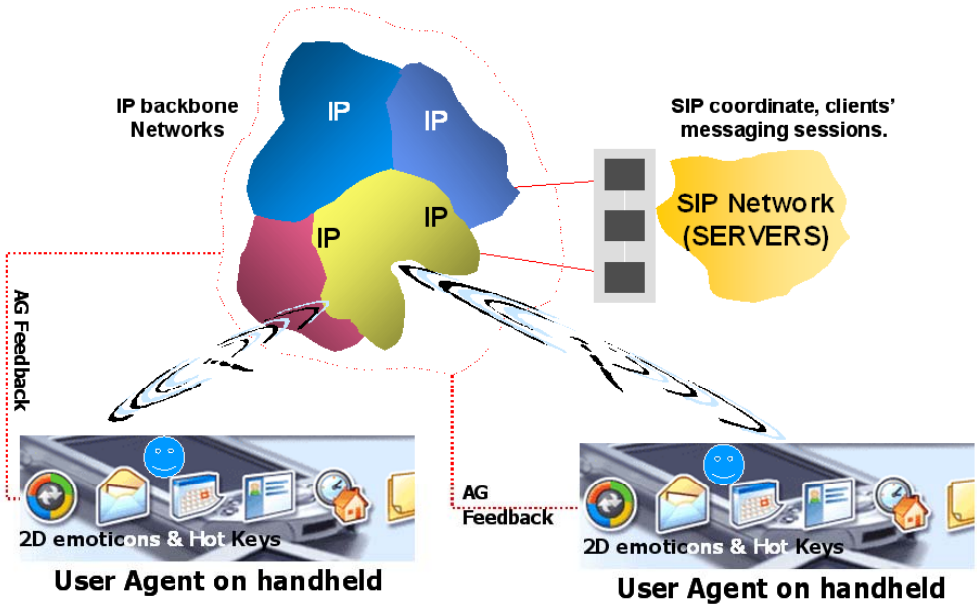


Figure 14 AGFIM Visual Overview

AGFIM SIP client (User Agent) IM application running on a handheld through terminal service connects via a wireless mobile link to the IP-based SIMPLE network where SIP co-ordinates clients' messaging sessions. User-defined Hotkeys and limited 2D emoticons used for expressive gesture are deployed to achieve fast track co-presence feedback.

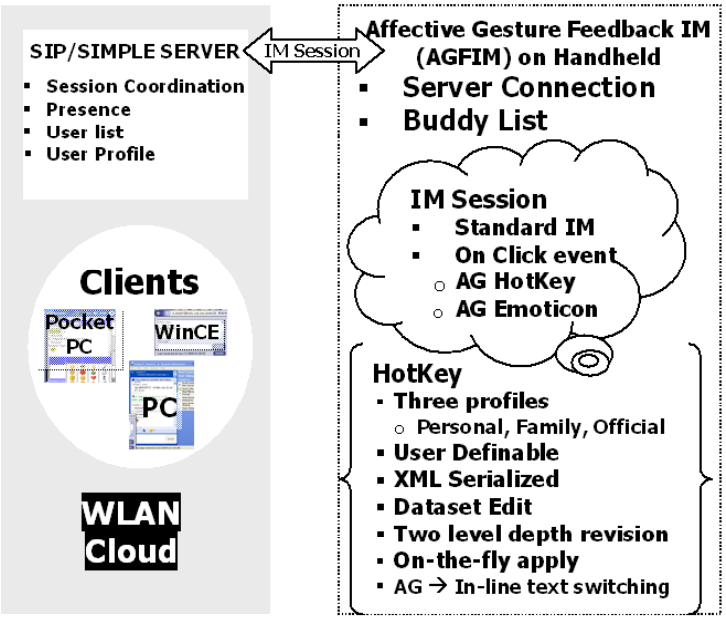


Figure 15 AGFIM Architecture Layout

AG Feedback IM (SIP UA) runs on handhelds through terminal services, connects over a WLAN to a SIP/SIMPLE Network that coordinates sessions. Hotkeys are serialized into XML files and loaded into memory as Datasets. Users profiles (buddies) are stored on the SIP server and written to XML on the client.

4.2 Development

4.2.1 User Requirement (UR)

This section describes the requirements for an AGFIM system from the point of view of carrying out the methodology to answer the research question. The AGFIM application should run on any Win CE based handheld, connected to any RFC 3261 compliant SIP Server via any MobileIP linked network where an open, interoperable IM system coordinates sessions. Text messaging is to be done in real time. Users must be able to interact at the same time, peeping into others activity, knowing when others are actively typing and be able to make comments on the fly. The system should integrate with an existing campus network through a wireless LAN. Users require an open text messaging system that allows multiple parties to interact and communicate together in a synchronous space. They must be able to roam effortlessly and transparently across the network to cater for the fluidity of people's movement throughout the day. The system should be simple to deploy and intuitive to use, devoid of much complexity.

The following is required of the system:

- Enables real-time communications between users.
- Allows Imessagees to know instantly if other users are available.
- Register with any SIP RFC 3261 compliant server.
- Initiate an IM session with another user on the network simply with the user agent.
- Exchange text only messages with the other user.
- Invite other users to a chat session.
- Keep tabs on other users by being aware of their session state.
- Send a user-definable short text reply (feedback) on the fly.
- Send emoticons on the fly.
- Switch between AG and in-line text mode for Hotkeys and emoticons.
- Save a session chat log on the client side. The log should show context placement of hotkeys and emoticons as shown in the preview window during chat session.

4.2.2 Development Process

Software Development

AGFIM was built on the IETF open standard SIP/SIMPLE using Microsoft Real-time Communication Library (RTCClient). The SIP platform was chosen because SIMPLE extends SIP for IM session in two modes: page and session. In session mode, SIP handles the rendezvous and hands over transfer to the Message Session Relay Protocol (MSRP).

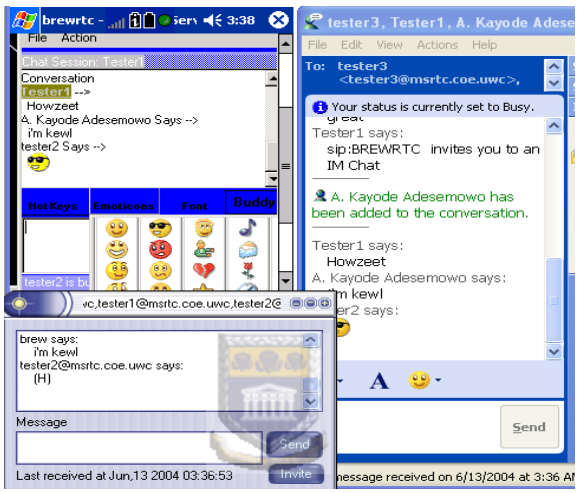


Figure 16 SIP User agents (UA) Text Chats

Text chats between three different UAs (Windows Messenger, MSR Portrait and our text-only SIP UA). The text only AGF IM shows AG Emoticons.

The text only messaging SIP User agent (UA) interoperates with other SIP clients such as MS Windows Messenger (WM) and Portrait as shown in Figure 16. They all connect to MS Live Communication Server (LCS) and to Vovida VOCAL server.

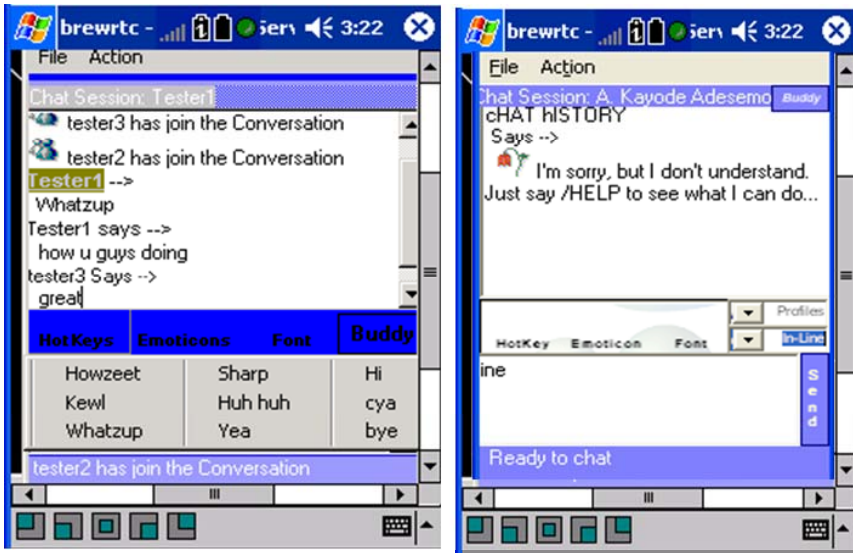


Figure 17 The Affective Gesture SIP UA

The AG Feedback IM: Screen shot of text chat on a handheld shows the user-defined Affective Gesture Hotkeys. The left side shows a snapshot used for first trial while the right hand side is the second iteration updated version used for final trial.

User-defined text Hotkeys are shown in Figure 17. Emoticons used for expressive gesturing were implemented as on-click events to provide AG fast-track feedback. A Microsoft MSN-like toolbar provides a placeholder for the Hotkeys and Emoticon dropdown menus as well as AG→in-line and profile switching combo box. Event driven IsComposing progress trackers allow other parties to know who is composing a messaging, thereby enhancing turn taking in a conversation.

One area of importance is the gesture enhancement made to an IM chat on a limited input entry, small screen space handheld and not how effective IM measures against real F2F or audio discussion, as shown in the top row of Figure 18. Features such as emoticon and user-definable hotkeys are the chat interface enhancement that enables feedback and comments to be made at near instant make. Overlapping the AG feedback mechanism and co-presence awareness feature is the IsTyping event that provides instant feedback on the co-user's status. Awareness is implemented by a buddy list on the main window shown in Figure 19.

<table>
<tr><td>AG User-defined HotKey</td><td colspan="2">AG Emoticon</td><td>IsTyping Event</td><td>Online Presence</td><td>Buddy List</td></tr>
<tr><td colspan="3">Affective Gesture Fast-track Feedback</td><td colspan="3">Awareness Co-Presence</td></tr>
<tr><td colspan="3">Page-mode / Session MSRP Messaging</td><td>Info</td><td colspan="2">Presence</td></tr>
<tr><td>Media : Message</td><td>Invite</td><td>Ack</td><td>Ok</td><td colspan="2">Subscribe, Watcher</td></tr>
</table>

Figure 18 AG Fast-track hierarchical layer

A hierarchical layer view shows the AG Feedback and Awareness Co-presence framework. On the top row sit enhancement implementations. The first two rows shows standard SIP and IM features, while on the third row is the introduction of AG and demarcation of awareness. IM presence and AG features shown in the top row sit on top of these two mappings.

2D and 3D Emoticons are IM standard defined shortcut keys similar to ANSI character set key codes. These shortcut input keys are translated into 2D emotion/gesture icons, which are also presented as clickable menu options. User Defined Hotkeys are definable preferred gestures tied to on_click events and dialing buttons. For a PDA-inclined handheld, they are available as onscreen stylus clickable context menus.

Event Driven Online Awareness indicates event programming (on_click and on_keydown events) triggered and display on a status bar while the other party is composing a message. Online Presence points to another party coming online or offline as well as active duration period. Other events handle are status states changes. Buddy List is a traditional IM explorer favourite list enabling presence tracking.

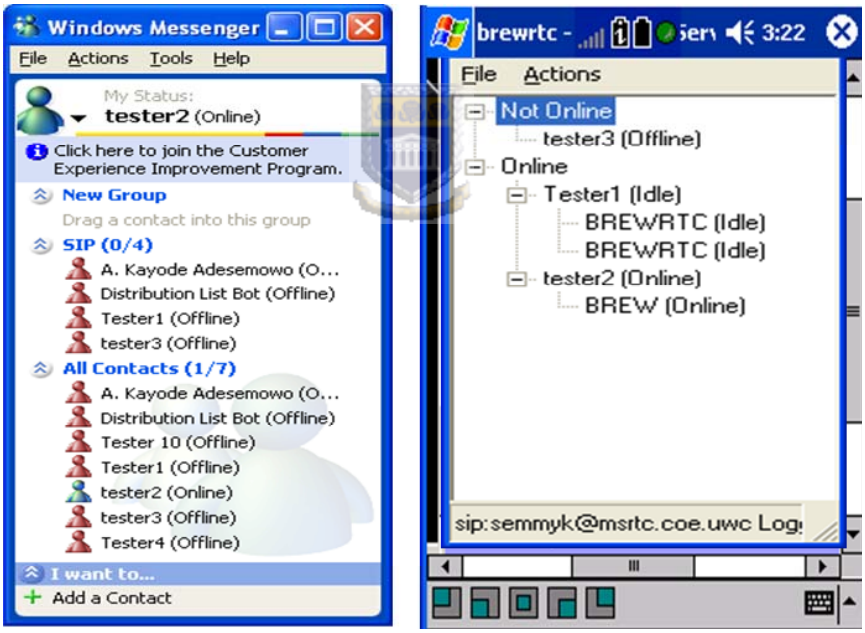


Figure 19 Main Window Buddy List

The AG Feedback IM: Screen shot of the main window showing buddy list on tree nodes, giving an indication of who is on or offline, as well as on which device they are logged on.

For this research, online presence, (Awareness) relates to who is or is not online in the IM social space. It points to another party coming online or offline as well as active duration period. Presence indicators are indications of what interlocutors' actions are, such as IsTyping.

Technical Development Challenges

Overcoming the technical difficulties with WLAN and terminal services was quite challenging. After the initial prototype was developed, the Siemens Loox PDAs were delivered. At this stage, it was discovered that the RTCClient API are lacking in the version of the Pocket PC operating system running on them. A workaround was done, wherein the SIP client runs natively on a server and connection made from the PDA via terminal services, thereby being able to run the AGFIM on a PDA. Experience with the AGFIM found this workaround to work effectively, though the terminal service buckles under high load. Section 5.1.2 describes the terminal service workaround in detail. The fast prototyping and iterative approach afforded the possibility of developing an IM effective for testing thesis hypothesis. The challenges faced and experience gained, are discussed in Chapter 5.

4.3 High Level Design

4.3.1 High Level Abstraction

The High Level Design (HLD) of the AGFIM system is shown in Figure 20. The UML schematic representation of the HLD shows only major classes from the design of the IM. The main class (RTCPresence) implements the IRTCPresenceUI interface. Other classes call methods from and provide services to this interface. The form of the RTCPresence class is the main window for the program that displays the buddy list, status changing, hotkey editing and IM chat invitation. RTCPresencecore, the core of the SIP functionality, handles all RTCClient functionality (initialization, event handling and session). When there is an IM chat invite from the main window, an IM session is set up by RTCPresencecore and opens the IM chat window. On page load of the chat window, hotkeys are loaded into a context menu. RTCIM is the class that co-ordinates all IM interface chat sessions. Hotkey loading, editing and profiling are done in RTCHotkey. The main classes are discussed further in the next section.

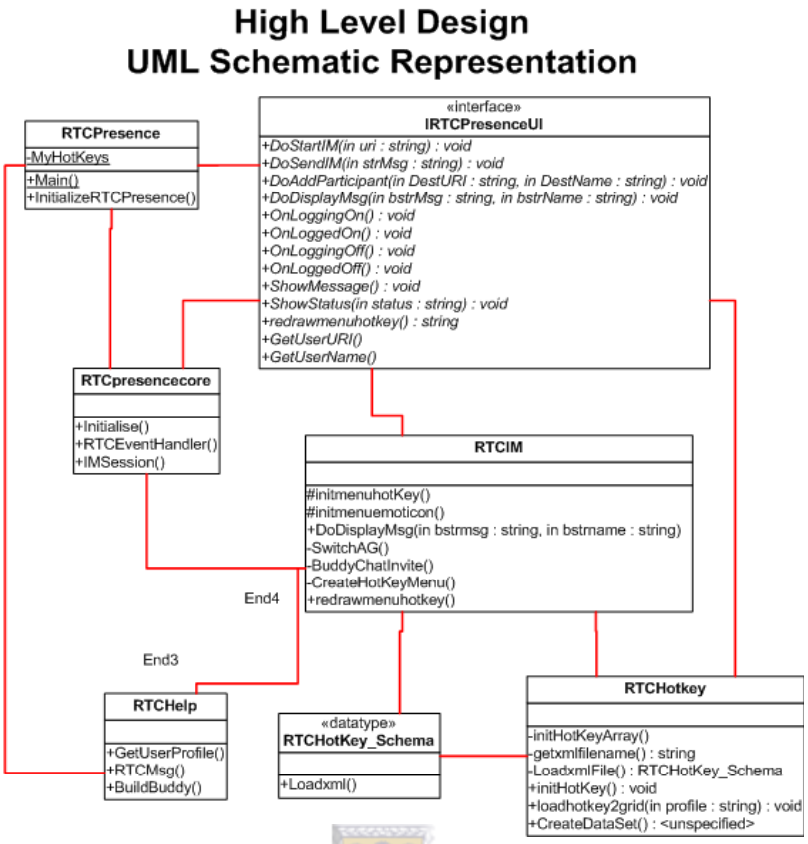


Figure 20 High Level Design of main classes

The UML schematic representation of the HLD shows only major classes outlaying the design of the IM. The main class (RTCPresence) implements the IRTCPresenceUI interface to which other classes followed. RTCPresencecore handles all rtcclient functionalites (initialization, event handling and session) while RTCIM is the IM interface co-coordinating IM chat. Hotkey loading, editing and profiling are done in RTCHotkey.

4.3.2 High Level Classes

IRTCPresenceUI

This is the UI interface, which defines how the RTCPresenceCore module will send presence information to UI modules. It comprises of the following methods that provide functionality to other classes and acts as interface to the main class – RTCPresence.

void ClearBuddyList();

void RemoveBuddy(IRTCBuddy2 buddy2);

void UpdateBuddy(IRTCBuddy2 buddy2);

void DoStartIM(string uri);

void DoSendIM(IRTCSession2 session , string strMsg);

```
void DoAddParticipant(IRTCSession2 session, string DestURI, string DestName);
    //Use to invite additional participant to ongoing IM Session
void DoDisplayMsg(string bstrMsg, string bstrName);
void OnLoggedOff();
void OnLoggingOff();
void OnLoggingOn();
void OnLoggedOn();
void CloseUI();
void ShowUI();
AuthData ShowAuthDialog();
void ShowMessage(string message, string caption);
void ShowStatus(string status);
void redrawmenuhotkey(ArrayList MyHotKeys);
string GetUserURI();
string GetUserName();
```

RTCPresence

This is the main class, which implements the IRTCPresenceUI interface. It is the starting point for the program. The SIP client stack and logon process are initialised from the main method. Hotkeys are only initialised after SIP registration is successful. It utilises the RTC platform presence functionality. It provides methods for the UI to set local presence, add, remove, or populate a buddy. It also sends messages to UI if there is new presence information. The AGFIM application icon in the taskbar is handled in the class by the TrayIcon() method.

RTCPresencecore

This is the core class of the SIP protocol function call. It instantiates a SIP client and handles all SIP related calls. The class implements event delegates, to listen and handle SIP procedures. Events are sent to this procedure - RTCEventHandler() - and then appropriate event methods are called depending on which event is received. It calls an appropriate procedure to handle each type of event. OnMessagingEvent() is the procedure for receiving Messaging events. When in a chat session, it receives all messaging related events, processes incoming messages, determines if it's a message status (IsTyping) or actual message coming through, and adds appropriate add-ons

before sending to the RTCIM class where it calls the DoDisplayMsg overloaded method.

Similarly, OnSessionStateEvent() listens to SIP session routines as defined in the SIP protocol and calls appropriate methods to handle each event such as the session start, session registration, and session end. Other event delegates subscribed to are Buddy, RTCClient (Main client itself), Profile, Registration, Participant state and Info events.

RTCIM

This class handles all IM messaging functionality. It is called from the main window either from the Action menu or context menu that pops up when a buddy is right clicked. Initmenuhotkey() and initmenuemoticon() initiate creating and populating a Hotkey and emoticon arraylist for the contextmenu, respectively. The chat window then displays as shown in Figure 17. The Hotkey and Emoticon contextmenus are tied in to the toolbar and pop up when clicked. Sitting on top of the toolbar, but not tied-in together, are two combo boxes that handle Profile selection and AG to in-line switching. AG→in-line switching is tied to the cmbSwitchAG() combo box selected method. Display of text messages in rtf are handled by overloaded DoDisplayMsg() method. FileSavertf() builds the rtf stream written to a file by SaveFile() method. When the chat history is saved to a rich text file, the rtf formatting is preserved allowing actual emoticon image, placement and hotkey placement (prefix with Hotkey: text) to be viewed.

RTCHotkey

This class handles User Defined Hotkeys. It initiates the HotKey ArrayLists, gets the XML file, and loads the Hotkeys to a dataset using the XML schema defined in RTCHotKey_Schema class. The Hotkeys, depending on the profile selected, are loaded into a DataGrid on the Profile form interface. Changes made are written back to XML file using the defined schema. The Hotkeys on the IM chat interface (contextmenus) are updated along with the Arraylist static in global memory (RTCPresence()).

RTCHotKey_Schema

This dataset loads the Hotkey into memory from the XML file using the schema defined. It is called by Loadxml() method in RTCIM or RTCHotkey class.

RTCHelp

This class provides static methods to handle RTC error messages. It is also the class used to build the Buddy list, get buddies' and device properties and get other SIP properties.

Deployment

The AGFIM was packaged with an Installer using MS Visual Studio 2003 Setup and Deployment tool. The project outlay is as shown in Figure 21. This allows AGFIM to be installed on a PC, however, it does not install the RTCClient API dll file nor handle checking for RTCClient API dependency.

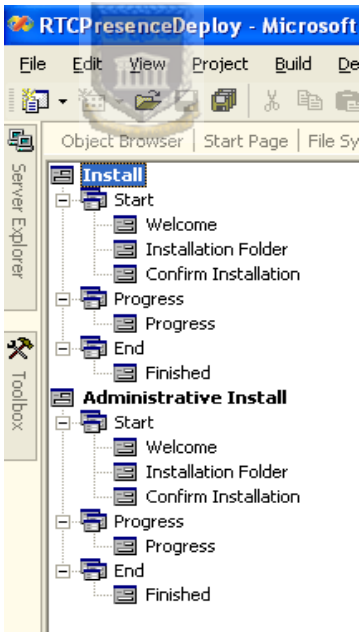


Figure 21 AGFIM Installer Setup Project

The AGFIM solution was packaged as a binary product using MS visual studio setup and deployment tool.

4.4 System Design Summary

An ideal environment for testing the AGFIM would be handhelds running on a 3G mobile network and native Pocket PC PDA. However, a WLAN network was used as

a proxy 3G network. Using Terminal Services, a workaround was made to running AGFIM natively on the handheld, providing the look and feel of a PDA application.

The HLD shows that AGFIM has a main class – RTCPresence() – that implements the RTCPresenceUI() interface. This abstraction ensures modularity and function calls are handled effectively. It also allows for rapid prototyping and feature enhancement.

When AGFIM is started, the RTCPresence class constructor instantiates RTCClient(), which is a SIP client class by calling InitializeRTCPresence() that calls RTCpresencecore() class. SIP internal system calls are made as defined in RFC 3261 and implemented by the RTCClient API. The RTCpresencecore() class uses RTCEventHandler() to process SIP internal calls. When the SIP client successfully registers with a SIP server, the RTCHotkey() class is called to instantiate and populate the static HotKeys ArrayList within the RTCPresence class. Function calls are made to RTCHelp() to get buddy list and populate TreeNode on the RTCPresence user interface. AGFIM is now listening and displaying status changes of buddies. Moreover, it is ready to initiate a chat session or accept a chat session invite. If a chat session is started or invited, RTCIM() loads a chat interface and populates the Hotkey contextmenu on page load from the global HotKey ArrayList in RTCPresence(). It also instantiates and loads the Emoticon menu. In the case of a chat session initiated, DoStartIM() is called to create a session and DoAddParticipant() invites the user to the session created. A message is then sent to the invitee. At this stage, the RTCEventHandler is actively listening and processing incoming messages within its OnMessagingEvent().

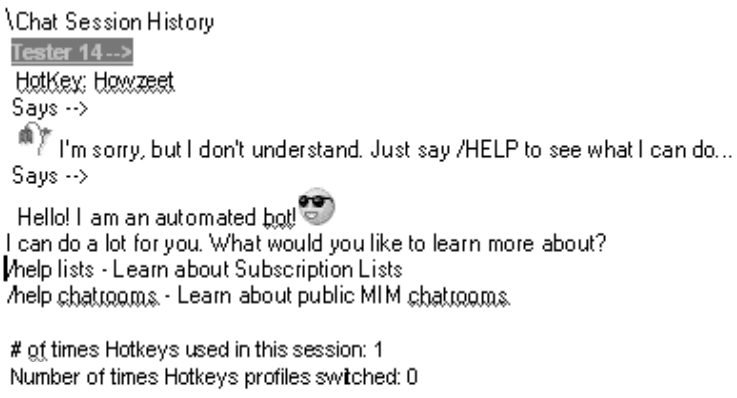


Figure 22 Snapshot of a log file

The chat log file shows placement and instances of hotkey usage. The number of times of profile switching is also noted.

Within an IM chat session, when a Hotkey is click/selected in the context menu, it is prefixed with HotKey: and sent immediately when in AG mode. However, in in-line mode, it is first inserted inline into the message compose textbox until the send button is hit. This ensures that the hotkey usage is captured and logged appropriately as shown in Figure 22. Each time the profile is changed, say from Personal to Official or Family, the profile counter is incremented. On file save, this is appended to the chat history as shown in Figure 22.

The AGFIM runs on open standard SIP platform, and capable to carry out the experimental trial presented in the next chapter. It has its chat interface reconstructed in order to explore text gesture I/O facilitation using on_click (one click) Affective Gesture emoticons and user-defined AG text Hotkeys.

Chapter 5 EXPERIMENTAL IMPLEMENTATION

This chapter presents a detailed experimental implementation that is based on the methodology discussed in Chapter 3 and the software described in Chapter 4. Experimental trials in two iterations took place in July/August and October 2004 with participants drawn from University of the Western Cape community.

5.1 Design and Deployment Trade-off

Two trade-offs were made to resolve platform and development concerns using alternate yet effective solutions.

5.1.1 Platform Deployment Dilemma

At the time of the trial, 3G was not readily available in South Africa[2]. A workaround was the setting up of a wireless LAN network (shown in Figure 23) as a proxy for a mobile 3G network. The mapping of the WLAN network to the Computer Science department layout is as in Figure 23. Note this is not drawn to scale. WLAN roaming across multiple Access Points (AP) produce similar dissociating, re-associating, binding, handshake effects to what would be obtainable on a 3G network. Moreover, SIP roaming behavior in both WLAN and 3G networks is similar. A mixed Cisco Aironet 1200 and Dlink DWL-900AP+ Access Point WLAN network was deployed. Clients (Notebooks, PDAs, Desktops) connect to the 802.11b WLAN network. The SIP Servers connect to the WLAN network via a Cisco PCI WLAN card for the Desktop and Cisco Cardbus for the Sony Vaio notebook.

[2] Vodacom has since deployed ist 3G network in collaboration with Vodafone of UK. MTN, which has rolled out its EDGE network has, recently rolled out its 3G-network beginning of the third quarter of 2005.

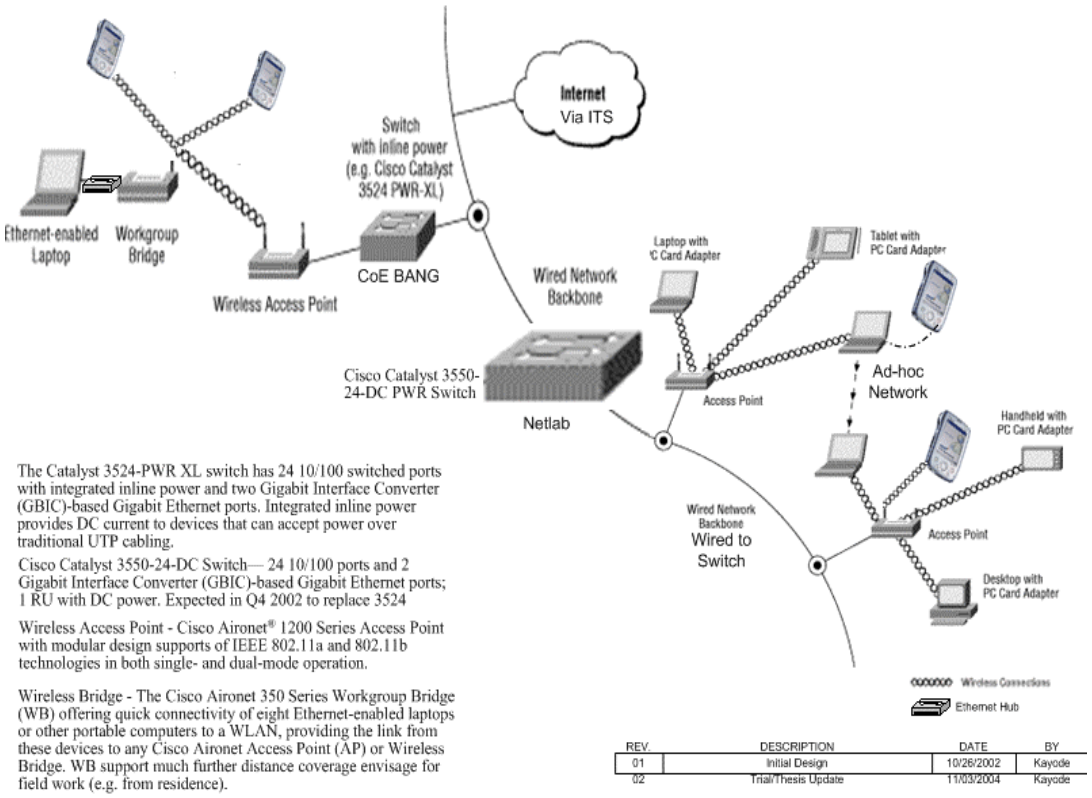


Figure 23 Telkom/Cisco CoE WLAN Network Design

Two WLANs were set up, one in BANG Room another in NETLAB for the Pre-Trial experiment. A third WLAN was added in Yellow Submarine for the experiment Trial.

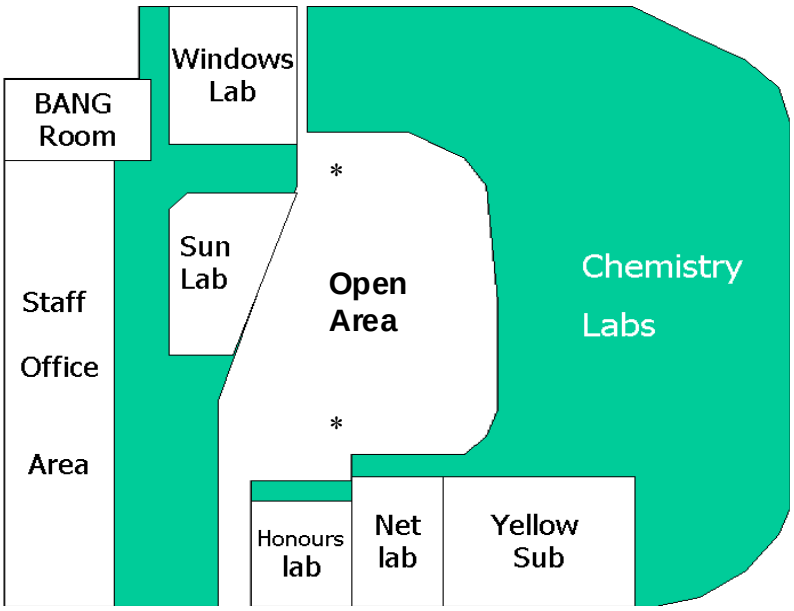


Figure 24 Layout of Computer Department

*The * indicates the smoking points used by participants at the computer science department.*

5.1.2 Development Design Dilemma

The MS RTCClient API provides the rich functionality required to build a SIP based IM that meets the IM development requirements. An IM for Windows was built on the RTClient API. This was envisaged to be easy to port over to a WinCE.Net based Pocket PC (PPC), as it uses same API calls. However, the API was not included in PPC 2003.

While Jabber supported the interoperability and has an open-source development forum to its advantage, it fell out partly because it was not an IETF standard[3] as yet. Nevertheless, SIP was used because it is adopted by 3GPP and is an integral part of IP Multimedia Subsystem (IMS). SIP/SIMPLE and Jabber were discussed under Messaging Services in the literature review. The Jabber implementation explored was Jabber Server deployment (Tipic IM Platform, TIMP) and Client (TIPIC) plug-in to provide the fast-track extension for Jabber Client. However, this was stalled because the Loox PPC lacks Java runtime by default and support was not forthcoming on installing a mobile Java runtime.

5.1.3 Out of the Dilemma

Though there exist many SIP stack offerings from third parties, most of them lack callable APIs, documentation and some are too costly (www.sipcenter.org). The option of building a SIP stack protocol from the SIP RFC specification would take too much effort and be beyond the scope of this thesis.

Faced with the limitations of the SIP/SIMPLE stack on Windows Mobile, a terminal service approach was employed. Figure 25 taken from TechNet shows how terminal services work. The AGFIM runs on the server within each users' profile. With a preliminary trial demonstrating feasibility, terminal services were deployed for the experiment trial. The ability of a user to select five screen positions (top left, top right, lower left, lower right and center screen) provided the ability to center-screen the IM application on the PDA. This gives the IM user a look and feel of working on the PDA as shown in Figure 26. This approach also affords having a single repository for the server side logging system.

[3] The XMPP core has been approved by IETF as *Proposed* Standard on 29th January 2004. Available online at http://www.jabber.org/ietf

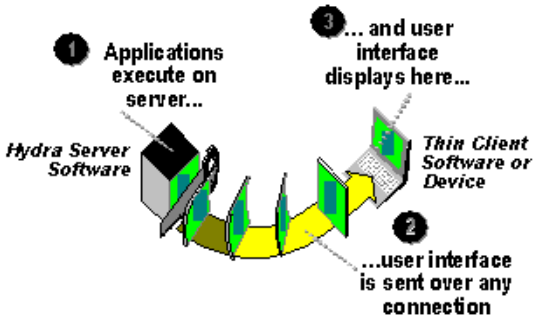


Figure 25 How Terminal Server Works

The terminal server architecture comprises three components. The Terminal Application Server hosts the application, while the thin client displays the application to a remote user. Remote Desktop Protocol (RDP), an implementation of International Telecommunications Union's (ITU) T.120 protocol uses a network connection such as TCP or UDP to transmit data to and fro. http://www.microsoft.com/technet/archive/termsrv/evaluate/featfunc/tsarch.mspx

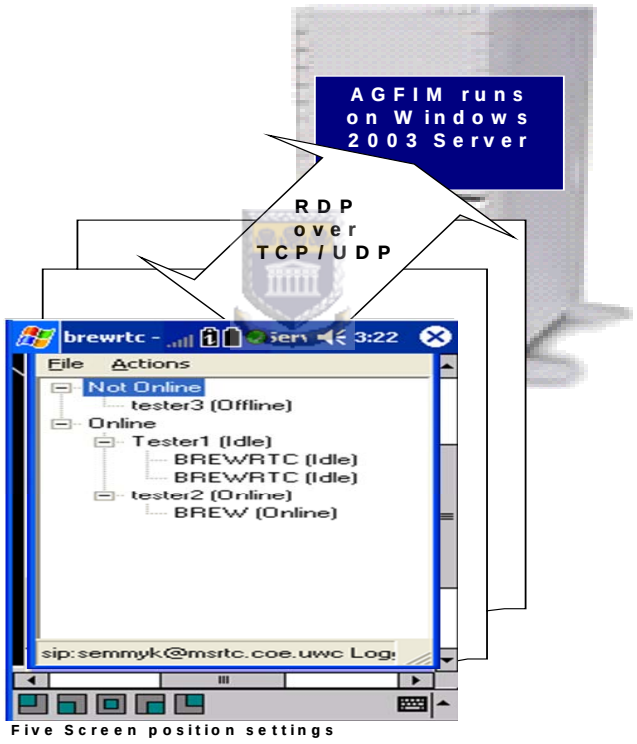


Figure 26 AGFIM Terminal Service Archtecture

The AGFIM, which runs on the server within each users' profile, is relayed using RDP to the terminal thin client on the PDA. The user can select five screen positions: top left, top right, lower left, lower right and center screen. This provides the ability to center-screen the IM application on the PDA, giving the IM user a look and feel of working on the PDA.

5.2 Initial Trials

An initial trial was conducted in July/August 2004 with two groups of participants classified as non-techies and techies. The final trial was carried out in October 2004

with a group of twelve IT-savvy participants. All participants for both trials were drawn from the University of the Western Cape community.

As stated earlier in section 3.2, other researchers have pursued their research questions by considering IM chat interface reconstruction, which normally involves introduction of extended features in the redesign of an IM chat interface. The first part of this trial is a usability trial, which introduced the AG feature and experimental setup to a non-techie group. The next trial consolidates on experience learnt to make available the AG feature for testing by the techies refers to as early adopters.

A pre-study Questionnaire was devised (as discussed earlier in Section 3.3.2) and made available online using the free Survey Console facility (www.surveyconsole.com). Thirty-four people were e-mailed to fill the online pre-trial questionnaire. Out of the twenty-three respondents, three were outside the University of Western Cape: one at University of Natal, another working in Johannesburg and third at Howard University, USA. The four non-techies were selected subject to their availability for trial and co-location in the same university residence. On the other hand, the five techies were carefully selected because of their proximity to the BANG lab and their level of computing skill that would enable them to conduct the trial effectively.

5.2.1 First Trial Run – Late Adopter

Overview of purpose of Trial

This trial was the first step to expose the experimental network to real users. One aim was to determine the impact of multiple users on the terminal service and wireless network. It was also a phase one usability test of the AGFIM software.

Participant selection/grouping

The trial chat session participants were drawn from respondents from the pre-trial survey. The non-techies (representing late adopters) comprise of four non-Computer Science females drawn from one of the residences of the University of the Western Cape (UWC). Two of them were unfamiliar with IM and one had not used IM at all. There was no clear cut criteria for selection, however, it is logical to draw typical users rather than power users [5]:pp212. Moreover, all four participants resided in the same university residence making it easy to gather them together.

Experimental environment: Network, equipment, and software

A WLAN was set up in room U27 of the Hector Peterson Residence of UWC. The non-techies were positioned in the room and were 'static' for the duration of the trial lasting about two hours. Accounts were created on a Sony Vaio running Windows Server 2003 Terminal server. The IM software was installed in each participant's profile on the server. IM logs to capture chat sessions were placed in individual profiles on the server as well. This client side log occurs when a chat session window is closed. The date stamped log contain session conversation in rich text format along with all emoticon graphics captured and was saved to each participant's IM log home folder.

The SIP server (MS LCS) was started and confirmed to be listening on port 5060. The IM archiving service was started on the server as well as the required MS SQL 2000, which logs IM chat to a database in addition to the client side logging. SIPLogger, a MS LCS diagnostic tool, was started to monitor the SIP service on the server.

The compiled AGFIM was placed on the server and a link provided from each user's desktop. A bat file was written to automate instantiating the Automated Bot[4] downloaded from MSDN site.

Task

A brief introduction was given to the participants to demonstrate the AGFIM system and user interface after. They were then encouraged to try it out at their own pace. This ensured they familiarised themselves with PDA usage. Thereafter, participants were asked to start a terminal session from their handheld to the server. On connection, they ran the AGFIM, which had been carefully designed to fill the PDA screen, thus having a normal PDA application look-and-feel. The IM starts and prompts for login to the SIP server, for which they used an account allocated to each participant. On login, they familiarised themselves with the system features exploring its menu. They then added contacts to their 'buddy' list, one of which includes the Automated Bot account, Dlist. An IM session was started with the intelligent agent (bot) UA that had been coded to function as a distribution list and chat room [53]. The bot offers on-screen help (keyword) and guides participant to successfully

[4] Available: http://msdn.microsoft.com/library/default.asp?url=/library/en-us/dnrtcclnt/html/use_rtcapi.asp

accomplish the task of creating a distribution list and chat room. The success and failure of this task will be discussed under results and analysis. Thereafter, the project coordinator initiated a multiparty chat session among participants adding everyone to an IM session. The multiparty chat further enabled participants to use the IM system features further. Neither a lead topic nor any discussion type was suggested to them. On completion of their trial session, a short follow-up discussion was held with each group. Three of the participants used PPC PDAs while one participant was on a Sony Vaio notebook. The process was also carried out for the group of techies later on.

Data Collection

Data collection was multifold. Each of the participants had filled out an online pre-trial questionnaire. Their chat session was closely observed and instances of hotkey usage recorded from their IM chat log. However, because this group was unable to use the PDAs effectively, and thus the IM system, there was no point filling out the post-study questionnaire. According to Babbie and Mouton, they were not competent enough to answer the survey questions [5]:pp236. Moreover, only one of them could manage to interact with the automated bot.

Discussion of Trial

The trial proved inconclusive. Participants struggled to use a PDA. The concept of stylus usage and soft keyboard was strange. However, they found it to be interesting and were willing to try it out. The AGFIM worked fine and displayed on the PDA terminal screen, however, it crashed with additional logins. This was however fixed (temporarily) by placing the AGFIM application inside an individual profile. The solution implemented in later trial created an installer for AGFIM and installed as an application on the terminal server. One other observation was that the terminal service slowed down dramatically with more than three users logged in. For the next trial, the server had to be fine turned for performance. The experiment could have lasted longer, but all of the participants were too tired to carry on further. The experiment started at about half past ten in the evening. This is not a good time especially for a non-techie group. By and large, this first phase was an eye opener on how to conduct further trials.

The inability of the non-techies to use the PDAs effectively was fundamental to their inability to test the system appropriately. They experienced lots of difficulties in

engaging the PDAs. This valuable feedback revealed the requirement of a more intuitive help system for non-techies who represent typical late-adopters.

The feedback from the short discussion held with the group after the trial session revealed some of the limitations as noted above. One of the non-techies indicated a need to have the trial run for longer period such as a week which would allow the participant to become accustomed to the PDAs. A Microsoft pen was given to each participant.

5.2.2 Second Trial Run – Early Adopter

Overview of purpose of Trial

This trial is the second phase of the initial trial run to test the functionality of the AG with users. With experience from the first attempt, it aimed to carry out a more in-depth usability trial with the techies.

Participant selection/grouping

The trial participants were drawn from respondents from the pre-trial survey. The second group of five referred to as "early adopters" were drawn from Computer Science graduate students, one female and four males. They comprised four Masters and one Honours student. They were all familiar with IM functionality although one of them does not use IM normally. As with the first group, there were no clear-cut criteria for selection. They were primarily selected based on availability and enthusiasm. However, one reason for grouping them together was that they were all at ease and familiar with one another, and this would facilitate chat interaction between them.

Experimental environment: Network, equipment, and software

A WLAN was set up in the Masters BANG room with limited coverage within the department. Wireless signal extends to the smoking bay, a meeting point for three of the participants to chat from. Unlike the first group, the early adopters started off from same location, the BANG research room, but were allowed to move around and relocate to other locations in the Computer Science department (still within the WLAN coverage though).

The terminal server, AGFIM, and automated bot software setup was similar to the first group trial outlined above.

Task

A brief introduction was given to the participants with the purpose of demonstrating the AGFIM system and user interface. They were instructed to test out the PDA cut and paste, stylus handwritten and soft keyboard input, system navigation and WLAN setup procedure. This followed on feedback from first trial and was aimed to level non-uniformity in capability of participants, similar to Farnham et al who subjected participants to a short typing test to bring them up to speed on text chatting [23]. Thereafter, they were encouraged to try out features at their own pace.

Much of the task procedure followed the first group's. This group however had time at their liberty. To ensure that they carried out the task, loose observation was made [5]:pp293. The coordinator sent text messages as necessary to guide the participants on next task. Four of the participants used PPC PDAs, with two sharing. One participant was on a Sony Vaio notebook.

Data Collection

Data collection for this group was multifold as for the first group. The main difference was the completion of actual task by some and completion of the post-trial questionnaire. At the end of the four hours trial, all participants were brought back to the BANG room to complete the post-trial questionnaire. This helped to correlate the pre-trial survey. A short 10-minute informal discussion session thereafter gave the opportunity to align pre-trial questionnaire data and post-trial feedback on AGFIM usability. Bugs in the IM software were reported and views on possible system improvements were given. These reported bugs were fixed for the next iteration – Final trial.

Discussion of Trial

This trial lasted the whole day and progressed much further than that of the first group's. Being Computer Science students, they were able to master the PDA input mechanisms much better. The AGFIM worked fine and displayed on the PDA terminal screen with no repeated crashes. However, when the wireless signal was low, it crashed or the terminal service lost connectivity and stopped. As noted with the first group, and despite fine-tuning, the terminal service slowed down dramatically with four users logged in. With heavy traffic, the server actually becomes non-responsive and unusable. It had to go through a reboot process, thereby disrupting the

trial for a while and inconveniencing the Sony Vaio user. The performance degradation (non-scalability of the server beyond five concurrent users) is a limitation of the terminal service running on a low-end computer. For the next trial, the terminal server would have to be moved to higher capacity system.

The early adopters group made some suggestions on the IM features. One of them suggested traditional in-line and AG emoticon handling with ability to switch between the two modes. Another pointed out hotkey profiling would enable large array of pre-defined and thus user-definable text hotkeys to choose from.. There was comment on the chat interface being dull and suggestions made on revamping to present a more appealing user interface. Each one of them was given a Microsoft/SADeveloper T-Shirt after filling the post-trial questionnaire.

5.3 The Test Bed – Final trial

5.3.1 Overview of purpose of Trial

This is the main experimental trial for the thesis. It draws from the experience of the first trial, especially the second group of early adopters. Farnham et al.'s work covered in section 3.3.5 illustrates the need for a structured chat environment [23]. A structured but non-timed chat session was carried out with paid participants who made extensive usage of the AGFIM system. The task list for the structured chat trial (see Appendix A) was chosen to ensure that each participant was able to make use of the IM system and its features. Changes were made to the pre- and post-trial questionnaire. In order to incorporate this and enable advanced features, paid subscription was made to the online survey website (www.surveyconsole.com), which resulted in enlarged respondent based and extended questionnaire questions.

5.3.2 Participant selection/grouping

The purchased survey solution handled more respondents than the free service, with a limitation of twenty-five respondents. Another reason for paid subscription is the need to extend number of questions beyond a cap of twenty. One hundred and ninety-four (194) people including all from the initial trial, were e-mailed to fill in the extended online pre-trial questionnaire. These people were drawn from the research co-ordination mailing and friend list. Out of the sixty respondents, thirty-eight were

outside the University of Western Cape: one based in Canada, four in the USA, five in UK, fifteen in Nigeria and thirteen in other locations in South Africa.

Twelve people were selected for the trial, comprising eleven males and one female: ten Computer Science Masters and one Honours, with one Management Honours student. There was no clear-cut criterion for selection. Four out of the five "early adopter" from the initial trial second group were chosen because of their experience with the system, while the rest were chosen based on availability and willingness to participate. One of the early adopters was unavailable for the final trial. Fifty Rand was paid in addition to Microsoft pens and SADeveloper community 2005 calendars given to each participant upon trial completion (after filling post-trial questionnaire and returning of PDAs). The PDAs were on loan from Bridges.org (http://www.bridges.org).

5.3.3 Experimental environment: Network, equipment, and software

Experimental setup for the final trial followed an approach similar to the initial trial set up, except that there was no notebook user. Feedback from the initial trial was analysed and incorporated into the re-design of the AGFIM. The AG → in-line switching feature was added. This allows chat users to switch between AG mode text sending and in-line text placements within text chat compose textbox before sending. Another feature added to AGFIM was increasing number of text Hotkey profiles to three – Personal, Family and Official. Chat users were able to edit on-the-fly and switch between the three profiles. Bugs were fixed to allow AGFIM to create IM sessions and send messages when connected to other SIP servers such as Vovida VOCAL, thus enabling full interoperability. The participants are situated in two locations in the Computer Science department. The WLAN was extended to include coverage for the Yellow Submarine Masters lab. Network diagram in Figure 23 shows coverage from Netlab, further extended with an adhoc repeater AP placed in the Yellow Submarine lab. Figure 24 shows the Computer Science department layout.

An HP mini Server in the Netlab was configured as the Terminal Server. This was to take the load away from the MS LCS SIP server on the Sony Vaio. Accounts for terminal service logon reside on the HP server while SIP accounts reside on the SIP server. This was done because there was not enough time to configure a single sign-

on. The AGFIM was compiled and packaged as an installer. Thereafter, it was installed as an application on the HP Server.

5.3.4 Task

Unlike the initial trial, the participants were introduced into the experiment informally. No formal introductory session was held with all participants at the same time. The reason for the experiment and task to carry out was explained to them. Tasks were streamlined from the initial trial, as shown in Appendix A.

After familiarisation with the PDA, (a weekend of familiarisation was allowed for), they logged in to the terminal service with their assigned username and password. The terminal service logon process was configured to start the AGFIM program on logon. They then logged into the SIP server with the assigned account, which is same as terminal service login. Their SIP uri is assigned username@msrtc.coe.uwc. On login, they were requested to explore the menu system and change the Hotkeys to suit their individual style. After this, they start IM, add and click on the Distribution Bot List (Dlist). The Dlist guided them through the process of creating a distribution list and chat rooms by following on screen help. Though everyone attempted setting up a chat room, a chat discussion was to occur only in one chat room. On exit of the IM chat, the session was saved to the IM log folder in each user's profile. The participants filled in the online post-trial questionnaire afterwards.

5.3.5 Data Collection

Data collection was multifold as in the initial trial second group. IM sessions were logged showing instances of hotkey usage and AG→inline switching. Loose observation was made as part of the qualitative observation. An informal adhoc discussion was held with participants at their convenience to correlate feedback data and observation.

An area of interest is to know if participants were able to follow and contribute to the structured subject discussion, or just lurking in the system. In order to determine this, data captured from the post-trial questionnaire and the server/client conversational logging was used to find out how much of the AG features (Hotkeys and emoticons) were used. Engagement of the AG features in terms of how many times Hotkeys and Emoticons are used, how often Hotkeys were edited to suit

individual gesture style and discussion subjects would give an indication of how much these one-click AG features were used to possibly enhance text communication in IM.

5.3.6 Discussion of Trial

Unlike the initial trial, participants made extensive usage of the HFFIM system. The PDAs were given out on a Friday for participants to get accustomed to the PDA all through the weekend. The trial began the following Monday with the AG→in-line switching not enabled. Network connectivity and system usage difficulties were quickly resolved. By Wednesday, a new version of the AGFIM was released with AG→in-line switch enabled and a more appealing user interface. The trial ended on Thursday. Participants moved at their own pace to complete the Dlist bot task. Chat with other users was up to each individual. Aside from ongoing dyadic discussions, all participants were invited to a central conversation. This central chat session is in line with Farnham et al [23] but was not timed. Post-trial questionnaires were then filled online after a short informal discussion on their experience with the trial. Informal discussion was made after the post-trial questionnaire for some because of availability.

Feedback from participants was analysed, which is discussed in the next chapter of results and analysis.

5.4 Experimental Implementation Summary

This chapter presented a detailed experimental design for the initial and final trial. In setting up the experimental trial environment, two trade-offs were made to resolve platform and development concerns using alternate yet effective solutions. One is the use of WLAN as a proxy 3G and terminal services to connect to the server and presented the AGFIM on the handhelds with a PDA look and feel.

The trials took place in two different locations. The first was in a university residence where a group of four non-computing students tested the IM system. To wrap up the initial trial, five Computer Science students tested AGFIM in the Computer Science department (layout shown in Figure 24). Lessons were learnt from this initial trial and were incorporated into the final trial. Twelve paid participants

were selected to extensively try out AGFIM, which was refined with inputs from initial trial participants. The two trials were observed and data collected via chat logging, pre- and post-trial questionnaires and feedback sessions with focus groups. The results are presented and analysed in the next chapter.

Chapter 6 AFFECTIVE GESTURE RESULT

Data collection comes from multiple sources and incorporates both qualitative and quantitative data. AGFIM was developed with hotkey and other feature enhancements to the chat interface. Logging of chat sessions was integrated into the code (for the final trial) enabling full tracking of hotkey usage. This software was used as a base for the initial and final trials where participants gave interesting feedback that was helpful in reshaping the thesis and drawing conclusions from results obtained. These are presented in this chapter along with a discussion on the effectiveness of the AGFIM in improving chat spontaneity. The triangulation of results is essential to align pre- and post-trial questionnaire feedback with the other data sources. Data triangulation makes up for limitations of small focus groups and a short experimental period. This triangulation provides the means to determine if the one-click editable AG does improve chat spontaneity.

6.1 Questionnaire Results

Complete results from pre and post trial questionnaires, for both trials, are summarised in Appendix C and Appendix D, respectively. This section addresses several questions in detail.

6.1.1 Baselining

Pre-Trial Questionnaire	* Not Asked	Initial Trial (23)	Final Trial 2 (60)
Do you own or use a PDA??	Yes	82.61%	92.88%
How long have you use IM?	>2yrs	36.00	57.81
Have you used Handhelds (PDA's/Palm) before?	Yes	38.10	61.40
Does your PDA IM client offer "My Text" feature?	Yes	*	36.36
Post-Trial Questionnaire	* Not Asked	Initial Trial (04)	Final Trial (12)
Do you own or use a PDA??	Yes	82.61%	25.00%
If Yes, how often do you use the IM to chat	Often	*	33.33

Table 7 PDA and IM usage

Respondents were asked if they had used a PDA and or IM before. Table 7 shows that just three of the participants (25%) actually own or had been using a PDA before the trial (both initial and final). It is essential to have an understanding of what impact

handheld input/output limitations have on the trial participants. The feedback in the pre-trial questionnaires shows higher percentage figures than the post trials. From the baseline data of PDA and IM usage, it might be that the respondent's inexperience influenced their interpretation of the set of questions asked of them.

6.1.2 Perception

A set of questions captures respondents' views on the extent handheld input/outputs limitations might be a constraint and cause difficulty in using IM. Also, in this section is a comparison of some pre-trial feedback to show how respondents view the "My Text" Hotkey AG feature. This perception, though not of high statistical value, helps in the discussion of results later in this chapter.

Handheld I/O Constraint

Pre-Trial Questionnaire * Not Asked		Initial Trial (n=23)	Final Trial 2 (n=60)
What would you perceived as RESTRAINTS/DIFFICULTIES in using IM on handheld. If any.			
Screen size	Definitely will be/ Definitely will not	20.00/10.00	30.19/13.21
Mobile KeyPad?	Probably will be/ Probably will not	5.26 / 26.32	35.85 / 9.43
Mini QWERTY keyboard?	Definitely will be/ Definitely will not	5.88 / 23.53	14.29 / 18.37
OnScreen Soft Keyboard?	Probably will be/ Definitely will not	11.76 / 29.41	20.75 / 20.75
Handwriting Recognition?	Definitely will be/ Definitely will not	5.26 / 26.32	14.81 / 25.93

Table 8 Handhelds input/output restraint perception

In the pre-trial questionnaire for the initial trial, 35% of respondents responded "might or might not" to the effect of screen size as a concern on handhelds, while 20% said "Definitely will be" and 10% responded "Definitely will not". However, in the final trial, there is a shift toward screen size being a concern as "Definitely will be" increases to 30.19% as shown in Table 8. Two factors could contribute to this. Most of the initial trial participants took part in the final trial pre-trial questionnaire. Their experience with the handhelds in the previous trial might have influenced their change of perception. Secondly, a larger number of the respondents for the final trial were already exposed to PDAs and engaging their cell phones for data communication. Another area to note is the perception on mobile keypads. Most of the respondents normally used their phones for SMS, and had thought it should not and is not so much a constraint for them. However, when engaging in synchronous IM communication, text input from the keypad comes to the foreground, as responses

are required much faster, unlike SMS. 31.58% of the pre-trial affirmed, “Definitely will be a problem/restraint”, while 26.42% affirm so for the final trial’s pre-trial questionnaire. Responses to the other three input types tend toward recognising them as an enhanced input type, thus the higher percentage of “Definitely will not” or “Probably will not”. Though handhelds, especially smartphones and PDAs, are increasingly incorporating these enhanced input mechanisms (mini QWERTY keyboard, onscreen soft keyboard, and transcriber), the traditional input mechanism still remains a keypad. It is noted that for an onscreen soft keyboard, a balanced 20.75% responded in the final trial “Probably will” or “Probably will not”, as a shift to the initial pre-trial which none said “Definitely will be a problem/restraint”. The gradual shift is similar to the mobile keypad issue and could be associated with the perception of the onscreen keypad being easier until actually tried in the initial trial.

Would a user-defined "My Text" Hotkey AG feature be helpful in your IM chat?

	Pre Trial Questionnaire	Initial Trial (n=23)	Final Trial (n=60)
1	Definitely will be helpful	57.14	45.45
2	Probably should help	28.57	30.91
3	Not sure would be helpful	9.52	5.45
4	Probably would not be helpful	0.00	1.82
5	Definitely will not be helpful	0.00	0.00
6	Don't know	4.76	16.36

Figure 27 “My Text” AG Hotkey usefulness question

The pre-trial questionnaire shows respondent responses to their view of how helpful the Hotkey feature would be. On the left is the result for the initial trial and on the right, the final trial. This question was preceded by a definition of AG and “My Text”. There was a noticeable decline in “definitely will be helpful”.

User-defined “My Text” Hotkey

Pre-trial questionnaire respondents gave an indication that a user-definable text Hotkey might be useful in IM chat. In Figure 27, 57.14% of respondents said “Definitely would be helpful” from the initial pre trial questionnaire and 45.45% from

the extended survey. None of the respondents in either pre- or post-, said it "Definitely will not be helpful", however a chunk of 16.36% in the pre-trial questionnaire for the final trial said they "Don't know".

Did you find the user-defined text Hotkey AG feature to be helpful in your IM chat?

Final Trial post trial Questionnaire (n=12)

1 Definitely Very helpful
2 Yes - Helpful in some ways
3 Think so – bit of help
4 No – Don't think it's of much help
5 Not at all

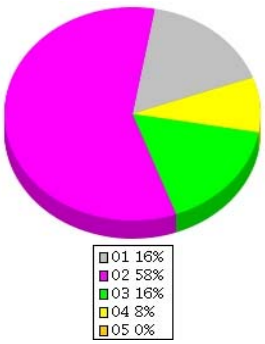


Figure 28 Post trial "My Text" AG Hotkey usefulness question

The post-trial questionnaire for the final trial shows respondent responses aligning with initial trial results shown in Figure 27, though there was a decline in "Definitely Very Helpful". None of the respondents in both (pre and post) said it would not be helpful.

6.1.3 "My Text" Hotkey AG

Pre-trial questionnaire results (see Table 9), indicate that an Affective Gesture approach might improve chat responsiveness. A 41.82% "Probably should help" response from the larger final trial shows likely usefulness of AG mode. This was confirmed in the post trial for the final trial with a 58.33% "Yes, Helpful in some ways" response while none of the participants said it was not useful. With reference to Table 9, 58.33% of the final trial participants found the AG form of using a text Hotkey to improve their IM chat response rate to some extent. This is against the 38.18% that responded in the pre-trial for the final trial that they would definitely prefer the AG mode of sending a text Hotkey and 32.73% for AG emoticons. Relating to the AG mode of sending Emoticons, a third of the participants think it is a good concept with 41.67% affirming, "Yes to some extent". None said it was not.

6.1.4 AG → Inline Switching

One of the early-adopters in the initial trial suggested AG → traditional in-line text switching feature. The final trial post-trial questionnaire was amended to capture switching amongst participants.

Pre-Trial Questionnaire * Not Asked	Trial 1 (n=23)	Trial 2 (n=60)
My Text" Hotkey sent/use as Affective Gesture		
"Definitely will be helpful"	*	45.45
"Probably should help"	*	41.82
"Definitely will not be helpful"		0.00
HotKeys sent as one time click AG rather than traditional in-line	(none think definitely will not)	
"Definitely will Prefer AG"	*	38.18
"Probably worth testing/trying out"	*	43.64
"Prefer to stay traditional in-line text"	*	5.45
Emoticons sent as one time click AG rather than traditional in-line (AS IS)		
"Definitely will Prefer AG"	35	32.73
"Probably worth testing/trying out"	55	47.27
"Prefer to stay traditional in-line text"	5	1.82
Post-Trial Questionnaire * Not Asked	Trial 1 (n=5)	Trial 2 (n=12)
Did you find the user-definable text Hotkey Affective Gesture helpful in your IM chat?		
"Definitely Very Helpful"	25.00	16.67
"Yes, Helpful in some ways"	75.00	58.33
"Think so, bit of help"	0.00	25.00
Does the AG form of the Text Hotkey improve your IM chat spontaneity/response rate?		
"Definitely, it really improve"	25.00	16.67
"Yes, to some extent"	50.00	58.33
"No, Not quite sure"		8.33

Table 9 Hotkey usefulness in Pre- and Post- Trial Results

It was found, as reflected in Figure 29, that this switching capability was not only welcomed by participants but also helped in determining the usefulness of the AG hotkeys. Five of the final trial twelve participants think it offers flexibility in improving their IM chat spontaneity. They found the AG worthwhile and useful for the IM chat with 41.67% sometimes switching and 16.67% hardly switching from AG to in-line because they find no practical need for them to switch.

6.1.5 Alignment to El Kaliouby and Robinson's Quote

El Kaliouby and Robinson's quote on emoticons [20], as discussed in section 3.3.2, was used to solicit from the participants the usefulness of emoticons "as is" and AG mode of engaging hotkeys and emoticons as shown in Table 10. The questions drilled down into the AG mode of sending messages and the effect thereof.

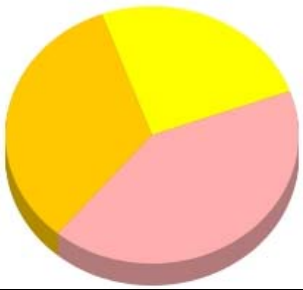
Does the Switching capability offer flexibility in improving your IM chat spontaneity/response rate?		
Post-Trial Questionnaire	Final Trial (n=12)	* Not Asked in initial trial
"Definitely, it really improve"	25.00	
"Yes, to some extent"	33.33	
"Think so, kind of depend"	41.67	
How often do you switch between AG and in-line text mode whilst in a conversation?		
"Always, To suit type of conversation"	16.67	
"Sometimes"	41.67	
"Few Occasion"	25.00	
"Hardly switch, practically no need to"	16.67	

Figure 29 Post trial AG → inline switching

Switching capability within an IM chat offers flexibility to a certain extent, though it depends on the context of the messaging session.

Post-Trial Questionnaire	Initial Trial (5)	Final Trial (12)
"Although emoticons are quite useful, they provide a very limited means of expressing emotions. They do not capture the dynamics underlying the emotional processes, and have to be explicitly inserted in-line by the user, removing the spontaneity of affective interactions" - R. E. Kaliouby & P. Robinson, FAIM @ IUI, 2004. Using the Quote Above for the next three questions ...		
Emoticons are quite useful	%	
"Definitely, Useful"	50.00	41.67
"Yes"	25.00	50.00
"Think so"	25.00	8.33
"Not at all useful"	0.00	0.00
Captures emotions dynamics		
"Definitely Captures"	25.00	25.00
"Yes"	50.00	50.00
"Think so"	25.00	25.00
Leaves Affective Interaction Spontaneity intact		
"Definitely remain intact"	0.00	8.33
"Yes"	25.00	58.33
"Think so"	75.00	33.33
"Affective interaction spontaneity remove	0.00	0.00

Table 10Aligning to El Kaliouby and Robinson Quote on Emoticons

Participant view on emoticon is in alignment with El Kaliouby and Robinson position of emoticons limited capability of expressing emotions.

Participants were asked two sets of questions to comment on the quote. One captures how much they think about emoticons in general, and the second, to what degree they concur with the quote based on their experience with AGFIM. Table 10 shows that participants' orientation before the trial aligns towards El Kaliouby and Robinson's quote.

In Table 11, there was a noticeable shift in participants' interpretation of El Kaliouby and Robinson's position on the effect of Emoticons in a chat session. None of the participants strongly concur to the fact that AG Emoticons captures emotions dynamics. Nonetheless, 75% affirm "Yes" to AG Emoticons capturing emotions dynamics. One factor might be the avoidance of positive extremes as shown by Watson et al. [74], who pointed out that questionnaire respondents at times tend to avoid the extremes of 5-points scales. Thus, appending "concur" to the question asked in the final trial might have contributed to the respondent answering in direct relation to the quote and avoiding the extremes. Within the extremes of strongly concur and do not concur, it could be said that AG emoticons are found useful and because emotions dynamics are captured to an extent, they are capable of leaving interaction spontaneity intact, thus being able to improve synchronous communication.

From your experience using both user defined text hotkey and emoticons as AG in the HFFIM chat system, what is your view relating to above quote? - Kaliouby: FAIM @ IUI 2004		
AG Emoticons are quite useful	Initial	Final
"Definitely" (Initial) / Definitely Strongly concur" (Final)	25.00	16.67
"Yes"	50.00	41.67
"Think so"	25.00	33.33
"Not at all"	0.00	0.00
AG Emoticons Captures emotions dynamics		
"Definitely" (Initial) / Definitely Strongly concur" (Final)	25.00	0.00
"Yes"	50.00	75.00
"Think so"	25.00	16.67
AG Emoticons leaves Affective Interaction Spontaneity intact		
"Definitely" (Initial) / Definitely Strongly concur" (Final)	25.00	20.00
"Yes"	25.00	50.00
"Think so"	50.00	20.00
"No" (Initial / " No Do not concur (Final)	0.00	10.00

Table 11 Concurring to El Kaliouby and Robinson Quote after trial

The table shows that after testing the AG feature, there was a noticeable shift in reasoning with El Kaliouby and Robinson's position on the effect of Emoticons in a chat session. None of the participants strongly concurs to AG Emoticons capture emotion dynamics, but most feel that it does.

6.1.6 Usefulness of AG

There was an agreement on usefulness of AG in general as shown in participants' responses in Figure 30 and summarised in Table 12. A 66.67% "Yes" to usefulness of using both user-defined text Hotkeys and Emoticons illustrates AG usefulness. AG Hotkey and Emoticons improve chat responsiveness, as 63.64% "Yes" to they capture emotions/chat dynamics and 63.64% "Yes" to they leave interaction spontaneity intact. It is of note that none said "No" nor "Not at all".

From your experience using both user defined text hotkey and emoticons as AG in the HFFIM chat system, what is your view relating to above quote? - Kaliouby: FAIM @ IUI 2004

They are very useful

Final Trial post trial Questionnaire (n=12)

1 Definitely They do
2 Yes
3 Think so
4 No – They do not
5 Not at all

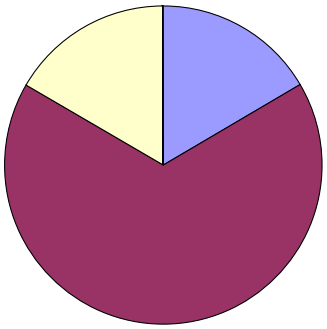


Figure 30 AG Hotkey usefulness in AGFIM

Post-Trial Questionnaire	Initial Trial (4)	Final Trial (12)
From your experience using both user defined text hotkey and emoticons as AG in the HFFIM chat system, what is your view relating to above quote? - Kaliouby: FAIM @ IUI 2004		
They are very useful		
"Definitely" (Initial) / "Definitely, They do" (Final	50.00	16.67
"Yes"	25.00	66.67
"Think so"	25.00	16.67
"No" (Initial) / "No They do not" (Final)	00.00	00.00
"Not at all"	00.00	00.00
They captures emotions/chat dynamics		
"Definitely, They do"	25.00	9.09
"Yes"	50.00	63.64
"Think so"	25.00	27.27
They leave Affective Interaction Spontaneity intact		
"Definitely, They do"	50.00	18.18
"Yes"	0.00	63.64
"Think so"	50.00	18.18

Table 12Post trial AG Hotkey and usefulness response in final trial

The post-trial questionnaire for the final trial shows respondent response aligning with initial trial result on usefulness of hotkeys (Table 9). There was a shift from "Definitely" to simply "Yes, Helpful in some ways". None said it would not be helpful.

6.1.7 Open-ended comments

Participants gave some interesting feedback in the closing post-trial open-ended responses. There was the idea of allowing users to draw their own images of emoticons to suit their conversations i.e. people use different signs of communication when shaking hands or saying goodbye for example. This reinforces the findings of AMIGO [21], a wireless image based IM that provided similar functionality (see section 2.5.1). Another comment was "I think the system is fine but the screen dynamics of the PDA takes away from the enjoyment of the application". It has been stated earlier that AGFIM was rendered on the PDA with the look and feel of a native application via terminal services. This does impact on the screen dynamics, although compensated for with near full screen display and a five positional screen selection: top left, top right, bottom right, bottom left and center.

	Initial	**Final**
Pre	n=23 19 used IM before, only 8 used handheld Mobile keypad ranked high as I/O restraint 55% would love to try out AG emoticons 57.14% perceived AG hotkey as helpful	n=60 92.98% have used IM before, 37# > 2years Handhelds used by 35 of participants 16 respondents sees screen size definitely a problem with 35.85% believing keypad a restraint 25 respondents thinks "My Text" hotkey will definitely be useful AG "My Text" Hotkey perceived to be useful by 25.25%
Post	n=4, n=5 All of n=5 used PDA before 75% edited their Hotkeys but 50% used None sees AG→Inline switching as not useful 50% believe AG emoticons useful and 50% think it leaves chat spontaneity intact None observe AG features as not useful 50% affirm AG features improves chat responsiveness	n=12 A third always and another third sometimes edit their Hotkeys Half sometimes use Hotkey in conversation AG hotkey found useful and improves chat by seven participants. A third affirm to switching improving chat Switching during chat sometimes by 5# 50% think Emoticons are useful 75% affirm "Yes" to AG Emoticons capturing emotions dynamics Two-third say AG features are useful Chat affective interaction left intact reported by 63.64%

Table 13Questionnaire findings summary

This table summarises the key findings from the questionnaires. The results affirm to AG features (Hotkeys and Emoticons) capable of improving chat responsiveness.

Other interesting feedback included, “Maybe the active gesture can pop up big on the screen and zoom out for certain gestures, like a ‘lol’ can pop up big and be almost like a real person laughing out loud, or something to that effect.” The kinetic IM (KIM) [7] adds emotional content to text by rendering and editing kinetic typography text effects (see section 2.5.1). Some are comfortable with the AGFIM system AS IS – “I don’t have any problem with the way it currently operates … I think the AGFIM system was developed very well”.

Table 13 shows highlights of key findings from the questionnaires. Comments in the open-ended questions shows that AG mode of sending Hotkeys and Emoticons, coupled with AG→In-line switching and hotkey editing, is capable of leaving interaction spontaneity intact and improving chat responsiveness.

6.2 Automated Data Collection

When a chat window is closed (On_Page exit), the chat session history is formatted as rtf and saved to a file in rich text format in the user’s profile. The SIP URI and time stamp is appended to the file name for easy review. Some of the log files were checked to see if hotkeys were used, and if AG → in-line switching was done as claimed by participants in their post-trial questionnaires. While Hotkey placements are noted in some of the log files checked, a thorough conversational analyses was not done.

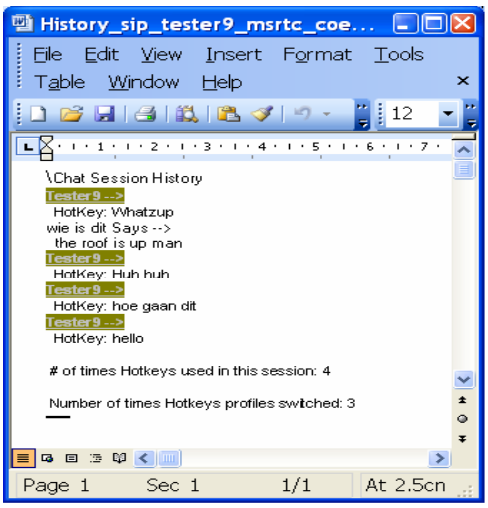


Figure 31 Chat Log file

An example of chat session history logged in rich text format. Hotkeys was used four times while Hotkeys profile switching was made three times.

Scanning through the conversation log for the final trial (see Figure 31), few of the user logs indicate switching away from AG to inline text. A number of hotkey usage instances were recorded. A few users completed creating the distribution list and chat room with the automated bot (see Appendix E). This affirmed engaging the Bot in text chat. However, one completed the tasks without using a hotkey or profile switching. In another log, a hotkey was used only once while the profile changed thrice. Nevertheless, the AG mechanism found more usefulness with text than with emoticons. Findings from scanning of the log files show that Hotkey usage and switching aligns with results from the questionnaire as in Table 14. However, there seem to be discrepancies on this issue with respect to the questionnaire. In the questionnaire, none of them said they never switched. However, one of the logs shows that at least one of the participants did not switch at all in all of their chat sessions.

One challenge faced with the log is in the coding of the AGFIM itself. The file save function was tied to On_Page exit of the chat interface form. However, whenever the Terminal server becomes unresponsive or in most cases when a terminal session is lost due to low or loss of wireless signal, the chat session is lost. In those scenarios, there is no firing of the On_Page exit method and thus, the chat sessions are not written to log files.

Automated Data Collection	Final Trial	
Number of participants logs checked	12	
Total number of logs checked	30	
Hotkeys editing done by participant	-	
Logs with Hotkeys used	11	36.67%
Number of times Hotkeys used	17	
Logs files with profile switching	4	13.33%
Number of times Hotkeys switched	10	
Number of times Emoticons used	11	
Number of completed chat room	3	
Number of Distribution List created after chat room	1	
Number of logs without hotkeys or switching	19	

Table 14Summary of Log Files Analysis

From the analysis of log files shown in Table 14, the log files affirm that a large proportion of the participants used the AG Hotkey feature in their chat and some were able to create a chat room and distribution list. They also put the hotkeys and AG → in-line switching to meaningful use in their chat. This is apparent because handheld design limitations were brought close to negligible factor for the final trial by allowing the participants time to acclimatise to the PDAs as well as being IT-savvy.

6.3 Focus Group Feedback

Discussion held after each trial session with the participants, for the final trial, was in ad-hoc mode. A session involved two or three participants in the focus group at a time. Interesting feedback was noted on the functionality of AGFIM and areas of improvement. Most of the improvement areas were covered in section 6.1.7 under open-ended closing responses of the final trial post-trial questionnaire. In the initial trial, one of the early-adopters had suggested AG → traditional in-line text switching feature. This was built into AGFIM for the final trial and was found to be useful. Recommendations were made to extend this further. Final trial participants made comments on the user interface and offered many ways to make it more appealing. The context-menu for the Hotkey and Emoticon selection panel often extends beyond the primary window frame (see Figure 16 and Figure 17). This out of screen activity necessitates that users scroll down and then sideways to the right to select desired Hotkey or Emoticons. Secondly, IM chat windows overlap one another. This overlapping makes multiple chat sessions difficult to manage.

The impact on trial participants was minimised by allowing the users to select from the bottom left of the terminal service screen navigation panel as shown in Figure 32. Thus, the terminal window view shifted to the Windows Start menu and its status panel, and from this the desired chat window selected. Following this, the center positioning is selected which gives a near-full view of the IM chat session interface. For the final trial, the context menu was redesigned into 4x4 rather than initial 3x5 matrixes, to ensure that emoticons do not overstretch. The hotkey matrix was reduced to 3x3, to allow the drop-down menu accommodate the hotkeys in one single panel view.

Figure 32 IM Chat Interface Context Menu Screen

The chat screen to the left shows the emoticon layout on the context menu and the right side the hotkey. Both context menus are MSN-like drop down context menus. The navigation area on the terminal screen allows five areas of the windows screen to the selected.

Most of the participants indicated that they found the AG worthwhile and useful for the IM chat. A more intuitive chat interface design would have allowed them to engage the AG further. Developing AGFIM as a native handheld application would help in tapping into some of the handheld OS features that ensure a more suitable application to be developed. The final version of AGFIM introduced in the final trial was found to be more user intuitive than earlier version, as it received some positive comment.

6.4 Trial Observation

In the first trial, the first group of non-techies faced a myriad of difficulties in getting the IM to work. It was observed that the participants rather engaged in chitchat, needed to be reminded and were subtly persuaded to get along with the task for the trial. On each occasion that they get stuck, rather than calling for assistance, they would rather take time to discuss amongst one another. Some of the problems they faced have been highlighted. Their computing knowledge was greatly tasked but they were able to get through. The most computer savvy would rather go alone and check her mail or chat on Yahoo messenger. She was on a notebook unlike the rest on

PDAs. It was noted that when someone logged in, the next person crashes out when attempting to start AGFIM. This was temporarily fixed by placing the AGFIM in an individual profile. The solution employed in the final trial was to create an installer to install AGFIM as an application on the Terminal server. Another observation was that the terminal service slowed down and crashed intermittedly when loaded with three concurrent users. The server was fine-tuned for the second trial for the techies. None of them could chat effectively nor create a distribution list or chat room with the intelligent bot.

In the second trial, the participants were enthusiastic to try out AGFIM features. They took the PDA with them to the smoking area to try and chat. Most of them were not following the task as laid out in the experimental procedure (see Appendix A). Thus, they too were reminded to carry out their task as required. In the second group of techies (early adopters), two of the participants completed the task of creating a chat room, while all of them were seen modifying and using the hotkey feature. Unlike the first trial, the Terminal server only slowed down considerably on third person login, however, with heavy traffic, it became unresponsive and unusable. At such times, the terminal server is restarted, inconveniencing the notebook user, on whose notebook the server was based.

For the final trial, observation was loosed compared to the initial trial. It was noted that some of the participants were able to create a chat room and distribution list. Some were seen trying to edit their hotkey list, which was not noted in the logs. Participants in the Yellow Submarine lab were having difficulties connecting to the terminal server and when they did, could not sustain their connection. This problem was narrowed down to the Access Point in the Yellow submarine lab not working properly. The Access Point in the Netlab provided wireless coverage, which was weak in Yellow Sub. The radio module was fixed and the IP configured for same subnet. Some one-on-one chat sessions were noted as ongoing. Some participants were not carrying out the task and had to be persuaded to do so. Overall, the participants' level of engagement generally was satisfactory.

6.5 Discussion

In all of the data sources, AG text communication found more usefulness in text than in emoticon. The degree of IM chat spontaneity improvement is greater for computer techies classified as "early-adopter" and much less for non-computer users representing typical users. Conclusions could not be drawn as to why the non-techies could not use the AG IM system at least to a functional level. Would this be the limitation of handhelds (small screen space and limited input facilities) or the ineffectiveness of the AG features? Is it a combination of both? Or would it rather be their inexperience with handhelds?

Has AG been able to provide chat input mechanism to improve spontaneity, thus enhancing text communication input? There is no clear-cut answer to this; however, AG is poised to be a mode of interaction especially in multi-modal systems such as IM. Using IM as a case study, further research would be required. Further work would determine if AG features would enhance text communication for a typical non-techie user despite handheld input constraints [44]. One of the techies pointed out the essence of having a dual gesture input that offers the user a choice of which mode to use: either AG Hotkeys and Emoticons or traditional text in-line. The switching was incorporated into the final trial, and it proved to be effective, though limited, in the experimental trials. Switching might help in a subjective within and without experiment. The two categories would have to be grouped together in an extended trial. Encouraging results from the early adopters tends to show that enhancement to IM such as AG features are on track to improving text communication spontaneity. With IM increasingly popular in the social space, other users are expected to play "catch-up" with the early adopters. SMS has already demonstrated this by its usefulness in meeting the need to communicate cheaply and easily, even if it means communicating in text with tiny displays. Ahonen also reasons along this line when he discusses finding the killer 3G application that usefulness is in *meeting a need*! [4]. Text communication is in the interaction!

6.6 Affective Gesture Result Summary

The experimental trial was carried out by a small user base and collates data from multiple sources, incorporating both qualitative and quantitative data. The focus of

the trial was to assess the effectiveness of Hotkey and other feature enhancements in the AGFIM chat interface in improving chat spontaneity. Logging of chat sessions was integrated into the code (for the final trial) enabling tracking of Hotkey usage. AGFIM software was used as a base for the initial (first and second) and final trials where participants gave interesting feedback that was helpful in reshaping the thesis and drawing conclusions from results obtained.

Data Source	**Main Findings**
Questionnaires	None sees AG→Inline switching as not useful 50% believes AG emoticons useful
Initial Trial	None observe AG features as not useful 50% affirm AG features improves chat responsiveness
Final Trial	A third always and a third occasionally edit their Hotkeys Half sometimes use Hotkey in conversation AG hotkey found useful and improves chat by seven participants. Two-third, say AG features are useful
Automated Logging	30 Log files checked 36.67% files with Hotkeys used, 17 Hotkeys recorded used 13.33% log files had Hotkey profile switching Hotkeys profile switching done 10 times Emoticons used 11 times in log files
Focus Groups	AGFIM system bugs highlighted and fixed Areas of improvement noted Chat interface more appealing Context menu fits into main chat interface Chat window overlapping (Multi tab suggested) AG→In-line switching suggested. Incorporated into final design and useful in IM chat
Trial Observation	System unresponsiveness affects trial and users' performance Wireless signal loss crashes chat and no record of chat log Some of the participants did edit their Hotkey list

Table 15Triangulated Data Summary

Data triangulation makes up for limitations of small focus groups, short experimental period and provides a means to determine if the one-click editable AG does improve chat spontaneity. Results from the multiple data sources shown in Table 15 do not provide a clear-cut answer to affirming AG has been able to provide chat input mechanism to improve spontaneity, thereby enhancing text communication input. However, AG has provided a pointer and is poised to be a mode of interaction especially in multi-modal systems such as IM. Using IM as a case study, further research would be required. Further work would determine if AG features would enhance text communication for typical late adopter despite handheld input constraints [44]. Nevertheless, the user-definable text Hotkey in AG mode has proved effective in the trials conducted.

Chapter 7 CONCLUSION

Chat interface reconstruction, specifically introducing AG hotkeys, has come out of this thesis as a way of enhancing chat responsiveness, thereby improving co-presence. The presence level in written text itself alludes to text communication pervasiveness and spontaneity. This area has not received enough attention in the study of text communication medium. Unresolved handheld IM chat usage and enhancement issues from the open discussion have given pointers to areas of future research interest.

7.1 Findings

A salient element of multimodal interaction is ubiquity. Developing IM on an open protocol such as SIP/SIMPLE is a way of enabling ubiquity allowing for wider adoption. AGFIM was developed on SIP/SIMPLE and interoperability tested with multiple SIP servers and SIP UAs. Due to coding limitations, AGFIM was constrained to connect to a SIP proxy server. Thus, peer-to-peer connection between AGFIM and other SIP UA was impossible and not carried out. Nevertheless, AGFIM was tested with multiple SIP proxy servers. Beyond adoption, intense and greater usage requires mechanisms to enhance chat interaction. Noting that IM is primarily text based [51], though other multi-modal interactions (verbal, gestural, aural and graphical) are increasingly integrated [9], text input can be naturalised as much as possible following cues from F2F conversation. The AG mode of sending text is able to convey *extra parallel channels* where gesture simultaneously accompanies messages. Other verbal and non-verbal cues such as the use of intonation, pitch, gestures, facial expressions or any visual/auditory cues that are intrinsically present in other forms of F2F interactions could be provided in an IM system, though at a much more limited extent than with F2F. Traditional choice of medium of conversation, which has largely been influenced by context, precinct and dyadic interaction coherency, supports a framework of interactive conclusive discussion within an aware mode space [57],[69].

This interaction incoherency typically lacking in text communication, tends to make text communication *plastic*. AGFIM provides a platform to *rubberise* this plastic text messaging to improve co-presence for text communications thereby improving synchronous textual discussion, especially on handheld devices.

One element of interaction is gesture, seen as a natural way of doing things. Attaining some level of interaction naturalism requires improving synchronous communication spontaneity, partly achieved by enhancing input mechanisms. This element of interaction in communication media can be explored in an IM medium [2]. The multimodal approach to the IM medium and chat interface reconstruction taken in the research was exploited and the novel AG introduced. Findings in this thesis have shown that AG is an interaction mode is worth considering in text communication. AG could be applied to other multimodal interactions.

While development continues on handheld physical input-output design [44], innovative ways of providing chat input mechanisms such as AG to enhance interaction would help in text communication improvement and uptake on mobile handhelds. Further research would need to be carried out in multimodal interaction using IM as a case study.

Data triangulation was enabled by the hybrid quantitative and qualitative approach taken. Results from experimental trials show that an Affective Gesture (AG) approach improved IM chat spontaneity/response rate slightly. From the pre-trial questionnaire, it was found that AG approach might likely improve IM chat spontaneity/response rate. The post-trial questionnaire results, focus group and discussion affirm this. Feedback from the user trials affirms that the AG hotkey fairly improves chat responsiveness, thus enhancing chat spontaneity. AG text Hotkey did give chat users an immediate response (synchronous affective feedback) capability. In a similar fashion, traditional handling of emoticons as in-line text entry could be done in AG mode, thus, being able to enhance chat feedback. Improving interaction capability in text chat could assist further uptake of IM on handheld. Enhanced input mechanisms for handheld IM systems are expected to increase co-presence between handheld users and their desktop-based counterparts while in a synchronous discussion.

7.2 Future Work

Engaging AG in other multimodal interaction (verbal, gestural, aural and graphical) needs to be explored further. Hubbubme [34] introduced usage of aural gestures, which could be extended further as TTS/ASR matures. An IM incorporating text, aural, verbal and gestures would find applicability in the Softbridge [26] being developed for the Deaf community in South Africa, more so with its planned support of SIP-based real-time connectivity for both text and voice.

The use of machine learning to train a more robust adaptive intelligent agent (bot) UA would enable automated testing. This would provide a more intuitive Distribution List and Chat room implementation for participants to engage in. Extensions could be made to the text hotkey profiling presently limited to three profiles: Personal, Official, and Family. An area of machine learning (AI) applicability is in profiling and AG switching: self-adaptive sensors running on the handhelds [31] could be used to achieve Profile and AG → in-line text switching. Wiring up sensors to facial affects [20],[48] could provide an intuitive, adaptive profile switching fitting users mode and theme. Emoticon authoring in similar fashion to hotkey profiling could be added to IM. Others are using inking technology to allow handwritten text messages and images to be sent on-the-fly as AG extending Amigo [21].

In all of the future work, a suggestion received by presenting this work abroad requires exploration: utilising an extensive robust trial with hundreds of teenagers. Nevertheless, rather than targeting teenagers only as representative of early adopters, people in their early twenties should be considered as well. An extensive trial involving high school, technikon and university students would accomplish this. Moreover, a large-scale deployment and participant trial would enable a more complete ethnology study. It would also be worthwhile to expand trial participation to at least twenty participants and extend duration to at least two weeks. A multi-location experiment, allowing participants to roam across sites with multi (WLAN, 3G…) wireless connectivity would also be a worthwhile test bed to explore.

Further work is required to run the AGFIM natively on a handheld rather than with terminal services, as done in the trials. This limitation impaired user acclimatisation with the program outside the experimental WLAN coverage. A multimodal interface incorporating the AG approach to sound IDs, facial affect, handwriting and imaging, and other types of sensing would be interesting areas to explore.

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APPENDICES

Appendix A. Experimental Procedure

Many thank for taking the time out to take part in our Instant Messaging experiment.
This experiment seeks new ways of text input in to enhance IM spontaneity.
You will be required to fill a questionnaire similar to the Pre-trial questionnaire you have filled earlier.

A. Kayode
for AG Feedback IM Experiment team

Click Start, Program, Terminal Services
Server IP is : 172.16.49.210 172.16.48.154
Login Detail: username and password assigned to you

Click on RTCPresence
Server Name: brewrtc 172.16.49.210 172.16.152.133 172.16.48.154
Sip uri : username@msrtc.coe.uwc
Username: msrtc\username assigned
Password: as assigned

Explore Menu
- File, Action
- Change Hotkey to suit your style

Start IM
- Click on Distribution Bot List
- Follow help instruction to set up a Distribution List
- Follow help to set up a chat room

Though everyone attempt setting up chat room
Discussion will occur only in one chat room to be designated.
Click on File, Save

Kindly fill out the online Post-trial Questionnaire

Many thanx

A. Kayode

Appendix B. IRC Related Acronyms

SOME IRC RELATED ACRONYMS AND JARGON

AFK	Away From Keyboard
Aka	also known as
ASAP	As Soon As Possible
B4	Before
BAK	Back At Keyboard
BBL	Be Back Later
BBS	Be Back Soon
BRB	Be Right Back
BTW	By The Way
CU	See you
CUL	See You Later
CUL8R	See You Later
CYA	See you
EOF	End Of File
F2F	Face to Face (real-life)
FAQ	Frequently Asked Questions
FTF	Face To Face (real-life)
FYI	For Your Information
<G>	Grin
GIGO	Garbage In Garbage Out
HAK	Hugs And Kisses
IAC	In Any Case
IC	I See
IMHO	In My Humble Opinion
IMNSHO	In My Not So Humble Opinion
IMO	In My Opinion
IOW	In Other Words
IRL	In Real Life
J/K	Just Kidding
KBD	Keyboard
L8R	Later
LOL	Laughing Out Loud
LTNS	Long Time, No See
MOM	Moment... (from telex jargon)
MOTD	Message Of The Day
MOTSS	Member Of The Same Sex
MUD	Multi User Dungeon
MYOB	Mind Your Own Business
OBTW	Oh, By The Way
OIC	Oh! I See
OTOH	On The Other Hand
OZ	Australia
PLS/PLZ	Please (from telex jargon)

POV	Point Of View
PPL	People
RE	Hello again
RL	Real Life (as opposed to IRC or the Net)
ROFL	Rolling On Floor Laughing!
ROTF	Rolling On The Floor
ROTFL	Rolling On The Floor Laughing
RTFM	Read The Friggin' Manual!
RTFM	Read The F***ing Manual!
RTFM	Read That *Fine* Manual
RTFMA	Read The Friggin' Manual, Again
RYFM	Read Your F***ing Manual!
RYS	Read Your Screen
SnailMail	The U.S. Postal Service or PTT Post
SUP	What's up?
THANX	Thanks
THX	Thanks
TLA	Three Letter Acronym
TNX	Thanks
TTUL	Talk To You Later
TTYL	Talk To You Later
UL	Urban Legend
w/o	without
Wassup	What's up?
WRT	With Regard To
WTH	What the Heck
WYSBYGI	What You See Before You Get It
WYSIWYG	What You See Is What You Get

Appendix C. Pre Trial Questionnaire

Pre-Trial Questionnaire	* Not Asked	Trial 1 (23)	Trial 2 (60)
Have you use Instant Messaging (IM) before?	Yes	82.61%	92.88%
How long have you use IM?	>2yrs	36.00	57.81
Have you used Handhelds (PDA's/Palm) before?	Yes	38.10	61.40
Does your PDA IM client offer "My Text" feature?	Yes	*	36.36
What would you perceived as RESTRAINTS/DIFFICULTIES in using IM on handheld. If any.			
Screen size	Definitely will be/ Definitely will not	20.00/10.00	30.19/13.21
Mobile KeyPad?	Probably will be/ Probably will not	5.26 / 26.32	35.85 / 9.43
Mini QWERTY keyboard?	Definitely will be/ Definitely will not	5.88 / 23.53	14.29 / 18.37
OnScreen Soft Keyboard?	Probably will be/ Definitely will not	11.76 / 29.41	20.75 / 20.75
Handwriting Recognition?	Definitely will be/ Definitely will not	5.26 / 26.32	14.81 / 25.93
Would a user-defined "My Text" Hotkey feature be helpful in your IM chat?			
“Definitely will be helpful”		57.14	45.45
“Probably should help”		28.57	30.91
My Text" Hotkey sent/use as Affective Gesture			
“Definitely will be helpful”		*	45.45
“Probably should help”		*	41.82
“Definitely will not be helpful”			0.00
HotKeys sent as one time click AG rather than traditional in-line		(none think definitely will not)	
“Definitely will Prefer AG”		*	38.18
“Probably worth testing/trying out”		*	43.64
“Prefer to stay traditional in-line text”		*	5.45
Emoticons sent as one time click AG rather than traditional in-line (AS IS)			
“Definitely will Prefer AG”		35	32.73
“Probably worth testing/trying out”		55	47.27
“Prefer to stay traditional in-line text”		5	1.82

Table 16Pre-Trial Questionnaire Result

Pre-trial questionnaire results are summarized showing differences between initial and final trials. Percentage of response does not add up to 100%, as they are selected results.

Appendix D. Post Trial Questionnaire

Post-Trial Questionnaire	* Not Asked	Trial 1 (5)	Trial 2 (12)
Do you own or use a PDA??	Yes	100.00%	25.00%
If Yes, how often do you use the IM to chat	Often	*	33.33
If Never, does your PDA has network/Internet connection?	None	*	100.00%
The AG IM you just tested offers you an on-screen editable text hotkey menu.			
Did you edit your Text Hotkey List?			
"Always, To suit type of conversation"		25.00	16.67
"Sometimes"		75.00	33.33
"Edit, but not update in chat window"		0.00	33.33
"Try to edit, but cumbersome to use"		0.00	16.67
How often do you use the text HotKey whilst in a conversation?			
"Always, To suit type of conversation"		25.00	16.67
"Sometimes"		50.00	50.00
"Few occasion"		25.00	16.67
"Hardly use"		0.00	16.67
Did you find the user-definable text Hotkey Affective Gesture helpful in your IM chat?			
"Definitely Very Helpful"		25.00	16.67
"Yes, Helpful in some ways"		75.00	58.33
"Think so, bit of help"		0.00	25.00
Does the AG form of the Text Hotkey improve your IM chat spontaneity/response rate?			
"Definitely, it really improve"		25.00	16.67
"Yes, to some extent"		50.00	58.33
"Think so, kind of"		25.00	16.67
"No, Not quite sure"		00.00	8.33
The AGFIM chat allows switching between AG and traditional in-line text			
Does the Switching capability offer flexibility in improving your IM chat spontaneity/response rate?			
"Definitely, it really improve"		*	25.00
"Yes, to some extent"		*	33.33
"Think so, kind of depend"		*	41.67
How often do you switch between AG and in-line text mode whilst in a conversation?			
"Always, To suit type of conversation"		*	16.67
"Sometimes"		*	41.67
"Few Occasion"		*	25.00
"Hardly switch, practically no need to"		*	16.67
Your Emoticons were sent as Affective Gesture on the fly rather than traditional method of inserting in-line into your text message before sending.			
Do you think this improves/enhance your IM chat response rate?			
"Definitely, it really improve"		25.00	16.67
"Yes, to some extent"		25.00	41.67
"Well, think it's a nice concept."		50.00	33.33
"No, Not quite sure. Not a nice concept"		0.00	8.33
"Not at all"		0.00	0.00
Post-Trial Questionnaire		Initial Trial (4)	Final Trial (12)
"Although emoticons are quite useful, they provide a very limited means of expressing emotions. They do not capture the dynamics underlying the emotional processes, and have to be explicitly inserted in-line by the user, removing the spontaneity of affective interactions" - R. E. Kaliouby &			

P. Robinson, FAIM @ IUI, 2004. Using the Quote Above for the next three questions ... Do you think		
Emoticons are quite useful		
“Definitely, Useful”	50.00	41.67
“Yes”	25.00	50.00
“Think so”	25.00	8.33
“No”	0.00	0.00
“Not at all useful”	0.00	0.00
Captures emotions dynamics		
“Definitely Captures”	25.00	25.00
“Yes”	50.00	50.00
“Think so”	25.00	25.00
Leaves Affective Interaction Spontaneity intact		
“Definitely remain intact”	0.00	8.33
“Yes”	25.00	58.33
“Think so”	75.00	33.33
“Affective interaction spontaneity remove	0.00	0.00
From your experience using emoticons as Affective Gesture in the AG IM chat system you just tested, will you concur with the above quote? - Kaliouby: FAIM @ IUI 2004		
AG Emoticons are quite useful		
“Definitely” (Initial) / Definitely Strongly concur” (Final)	25.00	16.67
“Yes”	50.00	41.67
“Think so”	25.00	33.33
“Not at all”	0.00	0.00
AG Emoticons Captures emotions dynamics		
“Definitely” (Initial) / Definitely Strongly concur” (Final)	25.00	0.00
“Yes”	50.00	75.00
“Think so”	25.00	16.67
AG Emoticons leaves Affective Interaction Spontaneity intact		
“Definitely” (Initial) / Definitely Strongly concur” (Final)	25.00	20.00
“Yes”	25.00	50.00
“Think so”	50.00	20.00
“No” (Initial / “ No Do not concur (Final)	0.00	10.00
From your experience using both user defined text hotkey and emoticons as AG in the HFFIM chat system, what is your view relating to above quote? - Kaliouby: FAIM @ IUI 2004		
They are very useful		
“Definitely” (Initial) / “Definitely, They do” (Final	50.00	16.67
“Yes”	25.00	66.67
“Think so”	25.00	16.67
“No” (Initial) / “No They do not” (Final)	00.00	00.00
“Not at all”	00.00	00.00
Post-Trial Questionnaire	Initial Trial (4)	Final Trial (12)
They captures emotions/chat dynamics		
“Definitely, They do”	25.00	9.09
“Yes”	50.00	63.64
“Think so”	25.00	27.27
They leave Affective Interaction Spontaneity intact		
“Definitely, They do”	50.00	18.18

“Yes”	0.00	63.64
“Think so”	50.00	18.18

Table 17Post-Trial Questionnaire Result

Post-trial questionnaire results are summarized showing differences between initial and final trials. Percentage of response does not add up to 100%, as they are selected results. Open-ended responses are not included; however they are discussed in section 6.1.7.

Appendix E. Chat Log showing completed chat room task

\Chat Session History
dlbot Says -->
I'm sorry, but I don't understand. Just say /HELP to see what I can do...
dlbot Says -->
Hello! I am an automated bot!
I can do a lot for you. What would you like to learn more about?

/help lists - Learn about Subscription Lists
/help chatrooms - Learn about public MIM chatrooms
dlbot Says -->
Hello! I am an automated bot!
I can do a lot for you. What would you like to learn more about?

/help lists - Learn about Subscription Lists
/help chatrooms - Learn about public MIM chatrooms
dlbot Says -->
Subscription Lists can be used to send notifications on an event. I can manage these lists for you. The following commands are available:

/CreateList [name] - Create a new event list
/RemoveList [name] - Remove an event list
/JoinList [name] - Subscribe to a list.
/LeaveList [name] - Unsubscribe from a list.
/Notify [name] [message]- Send a list notification with the message you specify.
/Lists - See all available lists.
/MyLists - See what lists you are a part of.
/ListInfo [list] - See the owner and subscribers of a list
/SetSecurity [listName] [level (0-2)] - Sets the security level for a list. 0 means that only the owner is allowed to do operations. 1 means that only members of the list are allowed to perform operations. 2 means that anyone can perform an operation.
dlbot Says -->
The following lists are available: sadev , smy , xolisa
dlbot Says -->
I'm sorry, but I don't understand. Just say /HELP to see what I can do...
dlbot Says -->
Chat Rooms are public Multiparty IM sessions that anyone can join. The following commands are available:

/CreateChat [name] - Create a new chatroom
/EndChat [name] - Close a chat room
/JoinChat [name] - Join a ChatRoom.
/ListChats - List all the current chat roms.
dlbot Says -->
The available chat rooms are .
dlbot Says -->
The available chat rooms are .
dlbot Says -->
I'm sorry, but I don't understand. Just say /HELP to see what I can do...
dlbot Says -->
Hello! I am an automated bot!
I can do a lot for you. What would you like to learn more about?

/help lists - Learn about Subscription Lists
/help chatrooms - Learn about public MIM chatrooms
dlbot Says -->
Chat Rooms are public Multiparty IM sessions that anyone can join. The following commands are

available:

/CreateChat [name] - Create a new chatroom
/EndChat [name] - Close a chat room
/JoinChat [name] - Join a ChatRoom.
/ListChats - List all the current chat roms.
dlbot Says -->
The available chat rooms are .
dlbot Says -->
I've created the chat room [elroy].
dlbot Says -->
The available chat rooms are [elroy].
dlbot Says -->
Sorry, but the chat room [elroy]
doesnt' exist or you are already a participant.

Information Agent has left the Conversation
dlbot Says -->

I'm sorry, but I don't understand. Just say /HELP to see what I can do...
dlbot Says -->

Chat Rooms are public Multiparty IM sessions that anyone can join. The following commands are available:

/CreateChat [name] - Create a new chatroom
/EndChat [name] - Close a chat room
/JoinChat [name] - Join a ChatRoom.
/ListChats - List all the current chat roms.
dlbot Says -->
The available chat rooms are [elroy].

# of times Hotkeys used in this session: 1

Number of times Hotkeys profiles switched: 3