

Multimedia Tools for Internet Commerce Applications: Usability in a Small Business Context

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Abstract

Earlier studies on Small Business Internet Commerce (SBIC) indicate that small businesses are using the Internet for various business activities. However, few so far have been focused on the use of multimedia tools to support context-rich, highly interactive business activities (eg., online product inspection and negotiation). This paper reports the findings of a preliminary study relevant to the usability of multimedia tools in a small business context. Several criteria have been identified that may have major effect on the suitability of different multimedia tools as facilitators of SBIC. These include, ease of use, platform independence, ready availability and the ability to maintain person-to-person interactivity. However, these criteria could be affected by the communication infrastructure quality (e.g., line reliability) and suitability to the business applications. We propose that further study needs to be carried out to provide a generic evaluation framework for such tools.

Introduction

Current issues in Small Business Internet Commerce

The role of Internet Commerce in the Australian community is expected to assume a far higher profile in the future than that existing currently (Adams, et al., 1997). Regional and rural communities in particular are currently experiencing the closure of many local services, including banks and government agencies (Truss, 1998, Kohler, 1997). This closure of banks particularly, has a significant effect on the traditional patterns which make a community economically viable. (Beal and Ralston, 1997). Apart from noting

inconvenience to individuals and local businesses, (who require frequent banking and incur costs or interest loss with delayed deposits), Beal and Ralston consider the wider effects on the community. As banks facilitate economic activity generally, spending patterns change, reducing turnover and suggesting longer-term business losses and economic depression. From a bank's point of view however, switching to on line services makes economic sense, and a similar business case can be widely made.

The loss of these services is intimately tied to increased use of the Internet or other electronic means of communication, as primary methods of conducting business that would normally have been carried out in person, for example, on line banking (Farmwide, 1998). There is a big difference however between what is technically *possible*, and what is socially or commercially *acceptable*. To effectively realise a business environment in which internet based transactions are normal, trusted and straightforward will require significant social change. To the extent that this may be largely inevitable, there is a specific need to ensure that useable business models are widely understood.

As with large businesses such as banks, small businesses too, have the opportunity to make use of the Internet to conduct business. The relative ease of maintaining a web presence provides advantages for niche businesses or regionally based Small to Medium Enterprises (SMEs) previously only available to large corporations, and the development of e-commerce environments allows these a global scope of operation.

Recent studies on Small Business Internet Commerce (SBIC) have provided better understanding on the impact of the Internet on small businesses. These studies include those of longitudinal action research nature (Barker, 1994; Fuller and Jenkins, 1995; Barker, Fuller and Jenkins, 1997); survey studies on business drivers (Lederer, Mirchandani and Simsand, 1996), usage evolution (Abell and Lim, 1996; Abell and Black, 1997; Sieber, 1996; Fink *et al.*, 1997), multi-method exploration study (Poon and Swatman, 1996; 1997; 1998); studies focusing on International Marketing and Export (Hamill and Gregory, 1997; Bennett, 1997), Advertising (Auger and Gallagher, 1997) and Business Re-engineering (ITI, 1998). The results of these studies indicate that small businesses are indeed a key user group of Internet Commerce. These studies also discover new research issues and some realities of Internet Commerce activities among small business including potential success factors, enablers and barriers of adoption, cultural influence on Internet Commerce strategy, and, sector specific business drivers. All these results indicate the need for research into the impact of next generation Internet Commerce technologies.

Paralleling the development of Internet Commerce technologies are developments in the area of multimedia communications and conferencing - including collaborative work environments and browser plug ins which enable interactions previously restricted to face-to-face situations. These technologies promise more than a compensation for a shifting to an online environment: we argue that SMEs can realistically extend their

capabilities and markets through the strategic deployment of such technologies, and that these capabilities can be further extended, once the relevant usability factors are understood.

Usability issues related to multi-media Internet Business tools

Internet Business should be viewed as being more than electronic cash transactions using the Internet and World Wide Web (WWW). It properly includes the use of multimedia communications tools for such business application areas as inter and intra-business negotiation, virtual exhibitions and conferences, or setting up electronic marketplaces using virtual reality technology. Internet Business thus encompasses Internet Commerce, although the terms are interchangeable in many cases.

Broadly speaking, technology support of Internet Business activities can be described using a two-dimensional framework (see Figure 1). This model encompasses low interactivity, context simple activities such as electronic transaction through to high interactivity, context rich activities such as negotiation support systems. The role of multimedia communications technology is to support the building of negotiation support systems and Computer-Supported Collaborative Work (CSCW). It is the need to explore issues related to these 'high-end' applications that this paper aims specifically to address.

Interactivity

HIGH	Text Based Chat System	Multimedia Audio-visual Group Support
	Text Based e-Mail and Messaging	Graphical Non-interactive Transfer eg., Web Graphics
LOW		HIGH

Context Richness

Figure 1. Electronic Commerce Framework

Multimedia Communications

Hollan and Stornetta (1992) refer to face-to-face communication as providing a richness of interaction seemingly unmatched by any other means of communication. It could be reasonably argued that this "richness" of interaction would be absent in, for example, many Internet Business transactions currently being conducted using technology at the low-interactivity dimension of the Electronic Commerce framework (see Figure 1). Since

we have pointed out that Internet Business should be more than electronic transactions using the WWW and e-mail, then issues resulting from using interactive multi-media tools for inter and intra-business negotiation, virtual exhibitions and conferences, or the construction of electronic marketplaces based on virtual reality need to be addressed.

The addition of audio and video to computer mediated communications has been shown to improve both the *quality* and *user perception* of the communication process. The most noticeable improvement seems to result from the addition of audio, with relatively lesser benefit to be gained from the addition of video (Minneman and Bly, 1991). Apperley and Masoodian (1995) echo these findings, commenting that they found the addition of video to a CSCW exercise resulted in little or no observable difference in group interaction patterns over the use of full audio. Although Olsen et al. (1995) discovered little or no effect on the *quality* of the work produced (by the addition of video), there was a noticeable increase in satisfaction of participants - "...People like to see each other. Video makes them feel more able to communicate with each other, to persuade and resolve issues...". When issues of trust, or personality are critical to outcomes, video capability is likely to be required. However, as it can be expensive, may be unnecessary, or even detrimental if quality is poor, it is important to distinguish its marginal value in small business contexts.

In order to explore how users are likely to respond to the next generation of Internet Business tools, the issue of usability must be closely addressed.

Usability of Multimedia Communications Tools

Usability of computer systems has been well recognised as an important factor in overall system quality (e.g., Carroll, 1995, Hix and Hartson, 1993). Lindgaard (1989) has defined usability as being "...a quantitative, or quantifiable, statement of the ease with which users can accomplish tasks for which a given computer system was designed." For multimedia communications to be a viable tool in Internet Business, the tools must be able to facilitate a high level of Internet Business activities which is likely to be highly interactive and context rich. It is important therefore, that the tools need to be 'usable' such that users will not be bothered by the controlling of, and the adjusting to, such tools, but focus on the interaction process.

Many authors have previously evaluated multimedia communication/video-conferencing applications. The majority of evaluations have concentrated on installation, video/audio quality (DeVoney, 1996, Fosgerau and Ehlers, 1997, Melnitsky, 1997a, Melnitsky, 1997b, Seachrist and Froning, 1997); the place of videoconferencing in collaborative work environments (Apperley and Masoodian, 1995, Gopal, 1994), and the appropriateness of video-conferencing applications as an informal communication tool. (Fish et al, 1992, Fish et al 1993). In view of this, we attempted to synthesise from these studies a set of usability criteria for this project.

Aim of the study

The aim of this study is to identify and investigate the usability issues of group support tools in the high-end Internet Business environment, thereby producing; firstly, a generic usability evaluation framework that can be used when mapping multimedia Internet Business tools to high end Internet Business applications, and secondly, the ability to use this framework as a guide for evaluating future multimedia communication tool design.

Research Methods

In 1998, Murdoch University, in Perth, Western Australia, and the Multimedia Communications Group (MCG) in Glasgow, Scotland, have been involved in a collaborative project to investigate, among other things, the usability factors which apply in realistic global Internet Commerce applications. The purchase of goods and services from SMEs is being investigated within the Tourism and Retail sectors. One particular activity is to investigate how videos of regional beauty spots, nature trails and the like, can be used as an enhancement to the process of selecting travel destinations. To do this, specific business deals need to be negotiated with travel agents, tourist organisations and other service providers that spread over significant distance, sometimes internationally.

The project is divided into three phases. The later phases will be feeding on the inputs and findings from the earlier ones and eventually a consolidated body of knowledge will be attained. These phases are:

PHASE 1 - Identification and selection of the tools to be tested

PHASE 2 - Usability testing with Surrogate Users

PHASE 3 - Usability testing with 'Real' Users

This research design has been chosen with a view to progressively defining a framework for usability evaluation of these tools.

PHASE 1 - Identification and Selection of the Tools

The initial phase of this research has involved the procurement, installation and operation of the tools mentioned below. They were used to communicate between Murdoch and MCG on several occasions, at different times of the day and over Internet links of different bandwidth. It is these experiences that will be used in the development of a draft usability framework that is specific to these application domains. In choosing the tools to be evaluated in this research, we identified three major criteria. They were, cost, availability and relative platform independence.

Cost

Many video-conferencing tools of high quality are available in the market today. However, their relatively high purchase costs may preclude them from the domain of interest, namely small business. An alternative is to contract out booking from video-conferencing centres, perhaps with reciprocal arrangements among interest groups. However, low cost tools have been chosen as the focus of this research.

Availability

The tools should be readily and easily available, and installation should not require professional intervention (i.e., plug and play).

Relative Platform Independence

For multimedia communications to be widely accepted in Internet Business they must be able to function on different hardware/operating system platforms. That is, the user should not be precluded from participation due to the choice of operating platform, nor should the user be required to purchase specialised hardware beyond those which are commonly available.

PHASE 2 - Usability Testing with Surrogate Users

The second phase of the research will involve the use of students as surrogate end-users. This allows the researchers to plan for a level of experimental control that would be difficult to replicate in a real world/real time setting (Galliers, 1991). Since students (for example) use banks, take holidays, and make purchases and consumer decisions like anyone else, they are considered to be a valid population to determine many representative factors. It is intended that this phase will aid in the confirmation of the validity of the draft usability framework developed in the Phase 1.

The design of the usability testing will be designed around a 'scenario based' approach and this involves:

"...a narrative description of what people do and experience as they try to make use of computer systems and applications... (and) ...user-interaction scenarios are a particularly pertinent medium for representing, analysing, and planning how a computer system might impact its users' activities and experiences. î (Carroll, 1995, p. 3)

A series of use scenarios will be designed which will include specific goals for the system to achieve and include metrics for measuring the level of achievement of these goals. These scenarios will address general usability of the tools, rather than their use as facilitators of Internet Business transactions. The testing will take place in a laboratory with both audio-visual recording and system logging of the participants' actions whilst performing the tasks outlined in the use scenarios.

Following the completion of the laboratory session, the participants will be asked to complete certain usability and user satisfaction measures, including the Software Usability Measurement Inventory (SUMI) questionnaire which "...measures how usable a software product is according to the perceptions and attitudes of the users. It produces a set of valid and reliable numbers which are indicators of the usability of the software being rated..." (Porteous et. al., 1993, p1). It is made up of a global scale and five component scales, which measure the user perceptions of *efficiency*, *affect*, *helpfulness*, *control* and *learnability* (Porteous et. al., 1993). Other measures may include, the instrument developed by Macleod and Bevan, (1993) which measures user satisfaction, and Green and Petre's (1996) cognitive dimensions framework which examines design aspects of the interface, in which alternative structures of the front end and the organisation of relevant information can be systematically assessed.

Application domain areas being evaluated include tourism decisions, and the design of customised packages for planned trips. Mortgage choice and bank switching behaviour will be investigated both for commercial and for usability aspects, and the design of useable agricultural information repositories is also planned. These areas are seen as representative of common and likely uses.

PHASE 3 - Usability Testing with 'Real Users'

The third phase of the research will involve the use of the tools in a commercial setting by business people. As with the second phase, use scenarios will be developed that are appropriate to this environment, particularly aimed at further validating the draft usability framework developed in Phase 1 and modified in Phase 2. As this work is currently being planned, more of the research design will be discussed in later publications.

Results to-date

At the time of writing the initial phase of the research has been largely completed. Tool selection and initial testing have been undertaken, though additional tools may be added prior to the commencement of the second phase. Initial planning of the usability testing parameters has begun, and is expected to be completed during the remainder of the academic year.

Tool Selection

CU-SeeMe

CU-SeeMe is a video-conferencing application developed initially by the Cornell CU-SeeMe Consortium. This group's mission is ...

"...the development and distribution of widespread video communication on the Internet and the facilitation of the user experience using this technology." (Cornell CU-SeeMe Consortium, 1996)

The application supports video, audio and text transmission/reception. It supports multiple hosts with the session (known as a conference) being hosted by a 'reflector' site.

CU-SeeMe is available for free download in several (compatible) forms:

- The Cornell University release which is fully featured (Windows and Mac).
- The White Pine release (Windows and Mac) which has a higher level of customisation available than the other releases, though requires registration and payment (the demonstration version will only allow conference participation for 15 minutes).
- Q-SeeMe, which is a port of CU-SeeMe for Linux, and is similar in appearance and functionality to the Cornell University Release.

The Mbone Tools

These tools have been primarily designed for accessing the Multicast backbone (Mbone) but can also be used for point to point communications. The tools evaluated at this stage are vic (video), vat (audio) and nt (text). They have only been evaluated in point to point connections.

The BSCW Shared Workspace System

Basic Support for Cooperative Work is a development of the GMD (Bentley et al, 1995), (Bentley et al, 1997). It is based on

"...the notion of the notation of a shared workspace, a joint storage facility that may contain various kinds of objects such as documents, tables, graphics, spreadsheets or links to other Web pages. A workspace can be set up and objects stored, managed, edited or downloaded with any Web browser. The BSCW system will keep the members of a group informed about each others' relevant activities in a shared workspace"

(Project BSCW, 1998)

In addition to its document handling capacities, the BCSW can also arrange meetings, maintain a mailing list of the participants, display to the user which other members are currently on-line, and can be integrated with CU-SeeMe, providing videoconferencing sessions from the user workspace.

Results of this preliminary investigation are tabulated below (see Fig 2), and have been used as a starting point for the development of the draft usability framework, which will be further assessed and modified during the second and third phases of the research.

<u>Tool/Evaluation Area</u>	<u>Cost</u>	<u>Availability Installation</u>	<u>Platform Independence</u>
CUSeeMe (available for Linux as Q-SeeMe)	Available for free download from multiple sources	Setup Wizard for Windows versions, pre-compiled binaries available for Linux (Q-SeeMe)	Available for Macintosh, Windows (3.x, 95, NT) and Linux operating systems
M-Bone Tools (vic, vat, nt)	Available for free download from multiple sources	Depends on distribution downloaded, but largely as for CU-SeeMe	Initially developed for Unix, but also available for Windows (95 and NT)
BSCW (Client)	Requires WWW browser to access	n/a	Any platform that can operate WWW browser
BSCW (Server)	Available for download from http://bscw.gmd.de	Downloaded as source, compiled using Python (only installed on Linux platform)	Available for Unix OSs and Windows NT

Figure 2 Results of Preliminary Investigation

The tools have been tested in near realistic situations to examine their ability to handle real Internet Business applications. CU-SeeMe and the M-Bone tools have been used to communicate between Murdoch and MCG, and the BSCW (client and server) has been used as a repository for this research, mainly as a storage site for documents, web links and comments regarding those resources.

General Observations During The Initial Phase

CU-SeeMe

The overall utility of this package at any time appears to be dependent (as would be expected) on the overall state of the Internet. For example, performance deteriorates noticeably at the start of the work day in the United Kingdom, which coincides with end of the work day in Western Australia. Immediately prior to the start of the UK work day however, over sessions lasting up to an hour, video quality was acceptable to all those participating, and audio was mostly of phone line quality. The application was trialed using both high speed and modem links, with superior performance noted using the high speed connections, but still allowing a conversation to be carried on using a modem. It was interesting to note that in the public conference sites, whilst supporting all available modes of communication (video, audio and text), video and text appear to be the dominant modes of communication with little or no use of audio.

M-Bone Tools

The quality of both audio and video was superior to that of CU-SeeMe, though as with CU-SeeMe, the quality tended to deteriorate as the amount of Internet traffic in both Scotland and Western Australia increased. The use of these tools did cause some initial problems, even for experienced Windows users. It is suspected that the origin of these tools (Unix/X-Windows/tcl-tk) may be responsible - the Windows versions have inherited much of the X-Windows behaviour.

BSCW

The authors have been using the BSCW as a part of this research. A 'workspace' has been established by the 'workspace administrator', who controls access to it. Membership of the workspace is by invitation from the administrator and access is via user-name and password. Navigation through the workspace is via hypertext links, and did lead to some initial confusion for some users. Documents that are uploaded to the workspace are annotated with an appropriate icon (i.e., MS Word icon for MS Word files). Recorded with the document are comments, modifications and version information. Initially the BSCW server located in Germany was used and resulted in slow access of documents. Installation of a local server at Murdoch resulted in marked improvements.

Conclusion

This paper has addressed the need for multimedia group support tools for the high-end applications of Internet Business. We have discussed the need for further research work on usability evaluation criteria of such tools from both the Internet Business application and user perspectives.

A three-phase project has been design to progressively describe a usability evaluation framework that can be used in the context of multimedia Internet Business applications. This preliminary study motivates a more comprehensive inquiry into the usability issues and suggests new issues to be addressed in the Second Phase. We suggest that in addition additional criteria related to infrastructure quality and the global nature of the application also need to be addressed.

Based on our current findings, we suggest small businesses can consider *right now* using these tools for specific aspects of their business as long as the quality of communication is acceptable.

Further on in this project, we expect to produce a generic framework addressing usability for these tools, thereby aiding in both tool selection and development criteria of multimedia Internet Business tools which are readily available for the use of SMEs participating in Internet Business.

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