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**CSCW in New Zealand:
A Snapshot**

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1 Introduction

This report has been produced as one of the outputs of the FoRST funded project “Improved Computer Supported Collaborative Work Systems” which is currently running in the Department of Computer Science at the University of Waikato.

Its aim is to give a snapshot of the uses of and possibilities for Computer Supported Collaborative (also Co-operative) Work (also Working) (CSCW) within New Zealand. In order to take this snapshot we followed a simple procedure:

First, a report introducing CSCW was sent to approximately 40 individuals within various organisations in New Zealand. This was done to ensure that each of them had some idea what CSCW is. This introductory report appears as section 2 below;

Second, after allowing some time for reading on the part of the people to whom the report was sent, a telephone interview was conducted. An example form giving the structure of the interview is given in appendix A together with an outline of the responses in appendix B. The outcomes of the interviews are summarised in section 3 below;

Thirdly, on the basis of the telephone interviews, several organisations were invited to take the interview further in the form of a short visit. The aim of the visit was to see what use of computers was already made and to explore further the ways in which CSCW might be used within the organisation. A summary of these visits is given in section 4;

Finally, the required snapshot was delivered by the writing of this report, and in the final section below we summarise our findings on the state of CSCW in New Zealand today.

2 An Introduction and Survey

2.1 What is CSCW

CSCW, as its name suggests, is comprised of systems in which computers assist a group of people to work together. There are two main areas of application in this field; collaboration, and communication. Collaboration is the process of a number of people working together on one product, and each effectively contributing to that product. Communication, on the other hand, is the process of a number of people transferring ideas and information to each other quickly and effectively. Generally in a CSCW system, both of these are present, and the boundaries between them are often blurred.

Two distinguishing characteristics in co-operative work are the location of the participants, and the time at which they participate (Rodden 1992). These can be used to classify the various methods and approaches to co-operative work into four categories, as shown in Figure 1. However, some applications are designed to work identically regardless of one or both of these considerations, so these categories should not be considered distinct and independent. They do, however, present an indication of the variety and versatility of these methods.

	Same Time	Different Times
Same Place	Same Place, Same Time Face to face interaction Like a meeting Easy to communicate	Same Place Different Times Leaving messages for others Like a bulletin board Less hardware requirements
Different Places	Different Places, Same Time Remote conversation Like a telephone Needs special safeguards	Different Places Different Times Email and News-groups Like memos or internal mail systems File sharing systems

Figure 1 The four categories of co-operative work

In each of these categories, computers can be used to assist in both collaboration and communication. Since computers are now an established part of most organisations and businesses, and a large amount of work is now done on computers, traditional methods of creating and conveying information are becoming less and less effective. Also with the rapid growth of the Internet, communicating through computers can prove to be both efficient and economical. The purpose of this document is to outline the usefulness and the potential of this technology to the organisations and businesses of today.

2.1.1 Collaboration

The primary role of computers in collaboration is in the use of collaborative editors. The idea of a collaborative editor is that a document can be worked on by several people together, regardless of whether they are in the same room or on opposite sides of the world. While the first and most obvious use of this type of system is for editing text, the same principle can be applied to anything from a spreadsheet to a blueprint. In theory, anything that can be edited by a single person on a single computer, can be edited by any number of collaborating users at the same time.

In many cases this would create mayhem if all the users were able to edit exactly the same part of the document at the same time, as the system may have to arbitrarily decide which changes should take effect, and ignore the changes of the other. Consequently, most collaborative editing environments are equipped with safeguards to ensure that the group is co-operating rather than conflicting. Often these safeguards entail denying users the ability to change the same part of the document that another user is working on until that user has finished with it. In cases such as text editing the part may be an entire paragraph, yet in the case of a drawing package it is often only a single line or shape that would get 'locked' in this way.

Another great advantage of collaborative editing is that the participants are not required to work on the project at set times. Each user could work on the project at their own pace, and the most up-to-date version would always be presented to them. This would enable each person to work to their potential and yet benefit from the contribution of the group.

Collaborative editing systems, often allow the users to work in much the same way regardless of whether other users are beside them in the room, on the other side of the world, or not even there at all. This means that the individual potential of the participants need not be inhibited in order for them to co-operate. In fact, it is more often the case that their potential is synergetically increased by their ability to work together.

The scope of co-operative editing is only bounded by what can be done on computers. To evaluate the potential benefits of co-operative editing tools to any organisation, one only needs to consider how often work is done on a computer that should involve the contributions of

more than one person. Anything of this sort could effectively be done using collaborative editing methods, allowing large groups to contribute to a single task without even having to leave their offices.

2.1.2 Communication

In order for a group of people to co-operate effectively it is absolutely essential that they be able to communicate effectively. Conventional methods of communication are in many cases inappropriate for the type of computer related information that is likely to be shared. When a group is working collaboratively on computers, telephone conversations and fax messages, in particular, do not fulfil these communication requirements.

As an example, suppose two people were working on a single document and one wanted to direct the attention of the other to a particular part of the document. It would be slow, and error prone for them to describe that part of the document over the phone or with a fax message. It would be much more natural for them to be able to point to that part of the document on their computer in such a way that the same part of the document will be indicated on the other person's computer.

The technique described above is known as telepointing, and is a common feature of collaborative editors, but is essentially a communication tool. This is demonstrative of the blurred distinction between collaboration and communication. A collaborative editor would be inadequate and confusing if it failed to incorporate communication methods such as telepointing, or at least displaying where in the document each user is working.

However, conventional and natural methods of communication such as speech and, in some cases, gesticulation are certainly irreplaceable and a valuable part of a co-operative environment. They help to create a more familiar environment for conversation, and thus are more pleasant to work with. Because of this, many computer supported co-operative environments incorporate these styles of communication.

In most cases communication becomes a trivial problem if the participants are in the same room at the same time, as this enables them to communicate naturally without the need for computer support. In this setting, computers can be used to enhance the quality of the communication by making information easily available, and providing support for displaying and demonstrating information.

Communication becomes a much more crucial part of a co-operative system if the users are in a different room, a different town or even a different country. It is mandatory in these situations to implement some support for conversation. The simplest but the least intuitive way to do this is to support a textual message sending system between the users. A more elegant solution is to have a headset for each user, that enables them to talk freely but keeps their hands free.

Gesticulations and facial expressions can also be transmitted by means of video cameras, though research has shown that this has little effect, if any at all, on the quality of work produced (Masoodian 1995). On the other hand, other research (Olson 1995) suggests that video support greatly improves the satisfaction of the participants, and this would certainly be an advantage.

In the case that the users are working at different times, communication becomes a system of notes, messages and documentation. Email is a simple and wide ranging example of this, in which each user can send messages and documents to other users via their computer. It is often helpful to have specific support for notes and messages incorporated into an application. In a collaborative editor, for example, it is useful to be able to attach comments and notes to selected parts of the document, to be read by other users when they modify those parts.

2.1.3 Summary

This section has given an overview of the computer supported co-operative work systems that have been and are being developed. There are two basic characterisations of techniques and applications. Members of the group can be in the same place or in different places, and they can work at the same time or at different times. Sometimes either or both of these factors can have little effect on the system and the way it is used, but usually the separation of the users by time or distance means that special provisions need to be made.

The two components of a co-operative environment are collaboration and communication. Each is necessary to ensure that the participants can work effectively. Collaboration without

communication would lead to a poorly structured patchwork result. On the other hand, communication without collaboration would make it difficult to get much work done at all, and each individual's work would constantly need to be distributed amongst the group, unnecessarily wasting time and resources.

It is important to realise that, although any organisation that uses computers and requires co-operative work can benefit from CSCW techniques, the system should be tailored to each organisation, and that techniques that are vastly beneficial for one organisation, or even to one project, may be cumbersome and inefficient for another. The following section gives an overview of some practical situations in which CSCW techniques have proven effective.

2.2 CSCW in Practice

The purpose of this section is to outline the broad range of co-operative support tools currently available, and to demonstrate some of the possible uses of these tools in practical situations. In no way does this section cover all the possibilities available in this vast field, nor does it endeavour to describe all the organisations that could benefit from each tool, but hopefully it is enough to give some indication of the practical uses and versatility of computer supported co-operative work.

2.2.1 Message Systems

These are systems by which participants can send messages to one another via their computers. Email is the simplest and most widespread example of this and another common example is a bulletin board system. Within a particular organisation, there are often formal message systems, in which a process is made up of actions each of which has an associated message. Participants can interact on a routine level through message systems, and they are often used to regularise and document processes that may otherwise be vague.

A production firm might use a message system approach to keeping track of a job's progress. This may involve specific message forms and documentation, which would all be stored in a central computer for quick retrieval. In large organisations departments may use message systems to co-ordinate their actions with other departments, and thus maintain up-to-date information on matters relating to that department. Less formal message systems can be used to convey arbitrary information, which would enable employees to draw on the knowledge of one another.

A lot of documentation that is traditionally done through internal forms and memos can be better handled by a message system. This eliminates the need for large archives for storing transaction records, as this could conveniently be stored on backup tape drives or some other system. Also the time and resources consumed in sending internal mail, and in duplicating or retrieving relevant information, could be greatly reduced by implementing a computer based system.

2.2.2 Collaborative Editors

The collaborative editor is one of the fundamental tools of computer assisted collaboration. As was said previously, any documents, diagrams or other material that have several people involved in their creation, could better be created using a collaborative editing tool. Since the interdependence of these documents varies from case to case, the division of a document into separate parts, and the size of these parts, is very case dependent. A flowchart editor may be as extreme as to have each node of the diagram as a separate part, while a text editor may divide only as far as chapters.

Once the document has been appropriately partitioned, the collaborative editor will ensure that only one user is given access to change a specific part at any specific time, while all users are always given access to view any part they choose. More complex systems may also allow the users to be individually restricted as to the parts they can change and perhaps even the parts they can see. It is necessary for each user to be aware of what the other users are doing and what they have done, and also to be able to communicate to them effectively about the document, though this is often not completely implemented as part of the editor system.

A common feature of many collaborative editors is the ability for the program to record the interdependencies between parts of the document. It can then use this information to inform the participants when other parts of the document are changed in a way that may affect the part they

are working on or responsible for. Safeguards of this type can help to keep the group cohesive and focused on the overall task.

Software companies are likely candidates for collaborative editing, as programs are usually already broken down into parts ideal for the editor. Also, it is common for groups of varying sizes to be working on the same program, which can make it difficult to ensure that everyone has the up-to-date version. Furthermore most of the hardware requirements are likely to already be present in a software company.

Other organisations that are likely to benefit greatly from this tool are publishers. Written publications such as magazines and books are the obvious candidates for collaborative editing as these are typical examples of groups of workers together endeavouring to produce a document. Single articles could be effectively co-authored within such a system, the editors could work effectively with the authors, and the layout artists could interact with each other to refine and focus their efforts. This would also enable authors to have a more holistic view of the publication, and consequently suit their own work to it better. Media organisations such as television and radio are also likely to benefit since programmes, scripts and other documents are often co-authored, and subject to change from various people at any time.

Of course any organisation that produces reports or documents that are co-authored, such as a research institution, or a management branch of a large business, can benefit from collaborative editors. However editors in themselves would not be particularly useful unless provision was made for appropriate and effective communication methods.

2.2.3 Meeting Room Systems

The main difference between Meeting room technology and a lot of other co-operative work technology is that in this case the participants are usually expected to be all in the same room. It is common for each user to have a terminal, and also for there to be a larger display at the front of the room, visible to all participants. This type of layout can be seen in Figure 2

The primary purpose of this environment is for group decision making. Information is readily available to each participant via their terminal, and any ideas or suggestions can be demonstrated on the large display for all to see. Individual ideas can be brought together in this context, and combined to produce results that reflect the ideas and opinions of each member of the group. The layout is similar to that of a conventional meeting room, which supports casual interaction, and the computer support improves the speed at which ideas can be communicated, understood and revised

In many cases the decision making process in these meeting rooms will be structured, and supported by decision making techniques and software. This software would support such actions as group voting, demonstrative modelling, and decision analysis. The overall structure of the meeting still varies from case to case, depending on the requirements.

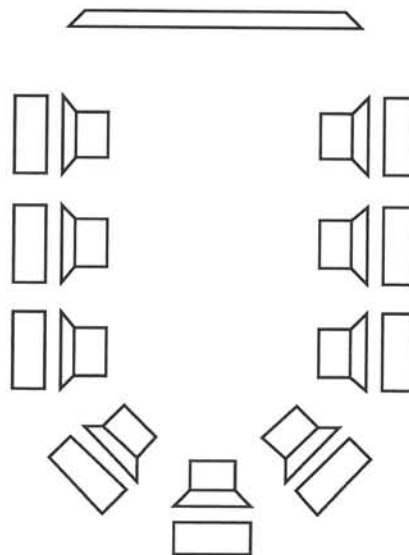


Figure 2 The plan of a typical electronic meeting room

Clearly the management departments of large organisations would benefit immeasurably by such a system. It would speed up the decision making process, and the availability of information would mean participants would be better informed, leading to more appropriate decisions. Communication in the meeting would be easier, and each persons understanding of the ideas of the other participants would be improved. This system would be unlikely to detract anything from a conventional meeting, while its benefits are clear.

In the design stages of a product, document or other collaborative work, the group decisions that need to be made, would be enhanced and improved by this setting. For instance, suppose two suggested designs of a product were being considered. Computer modelling and simulation techniques would no doubt produce valuable information about these suggested designs, and the flexibility of the system would mean that modifications could easily be made, and new suggestions could be experimented with even before a design was decided upon. In many cases the actual work in question can be brought into the meeting, scrutinised, and modified if necessary, by the entire group.

Since those involved in a project can participate, in this way, in the design of the project, they are likely to have a more holistic view of it, and how the work they are doing fits into it. This will inevitably strengthen and improve the co-operative nature of their work, and also enable each person to make better informed decisions for the project as a whole.

2.2.4 Conferencing Systems

There are two main types of conferencing system available; the traditional news-group based, asynchronous textual conferencing system and the synchronous real-time conferencing system which includes the more modern multimedia desktop conferencing. The common element in these is the establishment of a communications forum in which ideas can be discussed and knowledge can be shared.

The traditional conferencing system consists of a selection of topics, and, under each topic, a list of entries, comments and articles that have been submitted on that topic. They are similar to message systems except that messages are addressed to a topic rather than to specific people. Each user specifies a list of topics that are relevant or interesting to them, and the system will keep them updated on all new entries that any user submits to that topic. They can read any of these entries that others have submitted, and send replies that everyone listed for that topic will receive. In this way, conference style conversations can develop, each with a focus on a specific topic, leading to a useful information resource.

Real-time conferencing differs in that the discussion takes place synchronously. This is more like a phone party line, where the previous system was more like a 'letters to the editor' section of a magazine. Often these will have a specific focus, such as the scheduling of meetings or the design of a product. In this way they are often a hybrid between a meeting room system, and a collaborative editing environment. On the other hand it is often convenient and beneficial to be able to connect with one or several other people for informal discussion.

Desktop conferencing is the latest style of real-time conferencing to develop, and is the style of communication that is often used to support collaborative work from different locations. It incorporates multimedia into conferencing to provide such facilities as video links and audio links between participants in the conference. Often the applications or windows on one user's screen can be transmitted to other users. This is similar to collaborative work environments, although here the emphasis is on communication.

Any organisation in which several people are likely to be interested in the knowledge and information of others can benefit from various conferencing techniques. Newsgroup conferences can be used to build up a knowledge base for the business, a useful tool for reference. This enables people to quickly get answers to their questions, and gather knowledge from their co-workers, while maintaining an informal and relaxed setting for discussion.

Real-time conferencing and desktop conferencing are particularly useful, as mentioned earlier, to people participating in group work, or in a situation where people are accountable to one another. By keeping the participants in touch with one another, projects can be refined and focused, and the group can be more united in purpose and in view. This will inevitably lead to faster progress, and more precise results.

The other major benefit of this style of communication is that nobody is required to leave their work environment in order to interact with other workers. Consequently information will be easily at hand to the participants, and suggestions can be immediately applied and tested.

Thus the information process will not only be simpler but more efficient, and groups will be able to solve problems faster and more effectively.

2.2.5 Summary

The four types of computer supported co-operative work tool described above are in no way a complete list of the available technology in this area. However they do give a broad view of the range of co-operative work systems, and give some insight into the vast benefits of these systems to organisations that perhaps had not in the past considered computers to be so relevant and useful to their style of work.

The drawbacks of CSCW tools are mostly in the time and resources required to set up such a system. However most businesses today have a computer in almost every office. It is quite possible that these resources are not being used to their full potential, and that they could be used to better support co-operation. In most cases the benefits of a computer supported co-operative environment will vastly outweigh the drawbacks, and such a system may be what is necessary to keep an organisation on the leading edge.

Another important point to remember is that no co-operative work system suits every organisation. Since the needs of every organisation are different, the CSCW system ideal for each is likely to be different. It should be remembered that these ideas are not so much an application that can be bought and installed on any office computer system, but an approach and an attitude to exploring the use of computers in interaction between people.

The field of computer supported co-operative work is a diverse one, and clearly a field that has a lot to offer to organisations of today. While research and development can demonstrate the potential of today's technology, it remains the task of the organisations to explore this potential and to catch a glimpse of the future.

3 Phone interviews

3.1 The Method

In order to evaluate the relevance of CSCW to the wide variety of businesses and organisations in New Zealand industry, it was decided first to send a version of the previous section to a selection of forty organisations in Auckland, Hamilton and Wellington. This was accompanied by a covering letter explaining this part of the research project, and requesting their involvement in it. Before sending this mail, each of the businesses was contacted to determine the person to whom it was most appropriate to send the mail.

About a week after the mail was sent each of the organisations was phoned to discuss their further involvement in the research. We had a twenty minute phone interview planned, which we could conduct immediately with some of the contacts to whom we had sent the mail. Others were busy and made later appointments, and several were unable to participate. In the end, thirty-two organisations participated in the phone interview.

The purpose of this interview was twofold. Primarily it provided information that would enable us to decide which organisations it would be beneficial to conduct face-to-face interviews with, and also it provided data that gave some indication as to the attitudes of New Zealand businesses towards this research. Consequently, the information obtained had to be recorded in a way that was useful to both of these aims.

The plan of the interview is shown in Appendix A. Rather than as a questionnaire, we used it as a quick way of recording information, and certainly had no intention of simply asking every question, one after the other. Rather, we wanted the questionnaire to form the basis of a structured conversation. Because of this, a significant amount of information was recorded as notes and jottings on these plans, but the crux of the replies is given in appendix B. As a result the data obtained from these phone interviews is of a more qualitative than quantitative nature.

It is interesting to note that, though the information was freely given at the time of the interview, when we later wrote to each company explicitly asking for their permission to use their name in the report, several refused. This was even though they had answered our questions over the phone, knowing nothing more about us than what we had said when the interviewer introduced himself. Other anonymous companies are those from whom we got no answer when we asked for permission to use their names.

3.2 The Results

The size of the organisations varied greatly across the selection, from businesses such as Carter Holt Harvey that employs a staff of eleven thousand, to Company A, a graphic design company that is operated by a partnership of two. Of the thirty-two organisations interviewed, almost half of these had more than a hundred personnel, six of which had over a thousand personnel.

Despite this vast range of sizes, every interviewee considered computers to be essential to the operation of their organisation, and well over half considered computers to be essential to the management of the organisation. The two most common uses of computers in these organisations were word processing and accounting, followed by data management and product design.

Over three quarters of the organisations interviewed had local area networks. Ten of these had wide area networks to different cities, and half the organisations were connected in some way to the internet. Consequently it does not come as much of a surprise that email was twice as popular as conventional memos, although the most common forms of communication were still meetings, discussions and phone conversations.

Although this information might suggest that these organisations clearly stand to benefit from new methods of human-computer interaction, the opinions of some of those interviewed tend to suggest otherwise. Some interviewees suggested that there was no real need in their business for computer assisted collaboration, and consequently that any software of this nature would be superfluous to their requirements. It was also felt that a new development that does not fulfil a need soon becomes a distraction or a 'toy'.

On the other hand, many interviewees saw a need in their organisation for something of this nature, though it would be absolutely necessary to tailor the system to their requirements. The main interest of those interviewed was in collaborative editors for various tasks from report writing to product design. Another tool that was considered by many to be potentially helpful was an internal news-group conference system. Several others considered enhancements to their email system to be a wise step to take in improving the quality of communication in the business, while some considered video conferencing to be of relevance to their organisation.

On the subject of more general co-operation, many businesses had existing computer support for co-operative tasks. This support was generally in the form of software to aid group control and work distribution, such as Microsoft Project or Novell Groupwise. It was often the case that one person would be ultimately responsible for a process and delegate parts of that to other individuals. This led to less of a need for collaborative techniques as people generally work independently on separate parts of the project.

Also in many cases the email system was quite advanced. In some cases it was used to track processes in the business, and standard electronic forms were passed back and forth as alerts to changes in the state of a job or process. In other cases the email system had been integrated into the work environment, so that messages could be left within an application if necessary. This was typically done using software such as Lotus Notes.

Well over half of the people interviewed were certain that one or more of the new techniques emerging in CSCW would be useful to their organisation. Just under half expected organisations in their field to incorporate these ideas into their operation in the future. However three-quarters of those interviewed suspected that there would be a certain level of resistance to change in this area, as is not uncommon with any new ideas. It was also suggested that collaborative editors in particular are likely to meet with resistance, as users may be hesitant to lose complete control of their work.

In general the impression given by the phone interviews was that there was a significant lag between new technology becoming available and that technology being used. This delay is largely due to resistance to change. Many of the businesses were unreceptive to collaborative software, often because they had developed other ways to operate that eliminated the need for collaboration. Though it may have still been true that their business would benefit from collaborative approaches, the changes that would need to be made to their general practice would be prohibitively expensive or disruptive.

On the other hand, there were businesses whose style of practice would lend itself more directly to collaborative techniques. If these new techniques are likely to catch on, it will be these businesses that are the forerunners. Software only becomes useful if it is designed to

fulfil an existing need. Therefore any collaborative groupware developed would have to be tailorable to the needs of each specific business.

As a result of these conversations, the businesses that were selected for the next stage of the research were intended to give a cross sectional view of the various needs and requirements of this nature, from a range of different organisations. By exploring these needs better it would be better understood what should be incorporated into a CSCW system.

4 Face-to-Face Interviews

From the results of the phone interviews it was decided to conduct face to face interviews with the following organisations:

- Air New Zealand
- Avery Architects
- EIC
- Environment Waikato
- Gallagher Group
- Hamilton City Council
- HortResearch
- Taupo District Council
- TVNZ
- Company B, an electricity supply company
- Waikato Times

The interviews occurred in the three week period from the 30th January until the 16th February. Unfortunately, Hamilton City Council and Avery Architects were unable to participate in interviews at that time for various reasons.

The representatives of the nine remaining organisations were able and willing to participate in this stage of the research. The plan of the interview was essentially divided into three parts. First we intended to investigate the existing computer systems and the general methods of practice of the organisation in more detail. This was to be followed by discussion of the various techniques of CSCW and also include a short demonstration. Finally we planned to explore the usefulness of CSCW to the organisation in more depth, which would hopefully lead to a better understanding of the requirements and limitations of such a system.

Apart from this rough guideline, the meetings were relatively unstructured, allowing for free discussion of each organisation, and the relevance of this research to it. The interviews were recorded on tape and the tapes were later summarised in note form

The demonstration was carried out on two PC laptops each running Linux and each with an ethernet card installed. This meant that they could be networked together easily. Linux was chosen because it was considered to be a robust version of Unix on which Groupkit could be run. Since both of the programmers involved in this research were familiar with Groupkit, it seemed like this would be the most sensible platform on which they would be able to develop suitable software for a simple demonstration.

The two main applications that were developed for this demonstration were collaborative editors. One was a text editor and the other was a simple graphics editor. As well as these, several existing groupware applications were also used. These included a note editor and a text chat facility. These would hopefully present a clear picture of the uses of CSCW in collaboration and in communication.

The following sections summarise the content of the meetings and briefly outline the areas in which CSCW could be of relevance to the organisations.

4.1 Air New Zealand

Air New Zealand currently have two computer systems. The older of the two is a mainframe-based reservation system that dates back to the seventies. As well as this there is a network of PCs, most of which are running Microsoft (MS) products. Amongst these are MS Mail, which is used for most of the company's electronic communication, and MS Schedule Plus, which is used for scheduling meetings and appointments. There is also an email system in the mainframe, but this is not incorporated into the MS Mail system on the PC network.

An area of interest for Air New Zealand is in the presentation of documents and written material so that it is easily available to others in the organisation. One partial solution that has been trialed in this area is an application called Grapevine. This application provides two collaborative tools, one of which is a newsgroup system. The other tool is a document distribution system in which people can register interest in various subjects, and then when a document is submitted to the system its subject can be determined and the document can be sent to those interested.

Another step that Air New Zealand is taking towards document sharing is experimenting with HTML. They have set up a network of internal web sites that can be used to access documentation. Netscape is used to access this documentation, but this system has the disadvantage that it is a time consuming process to convert documents to hypertext format. One alternative is to develop a hypertext editor and viewer that can be used to write documentation in hypertext in the first place. Then it is a small step to make this system collaborative so that changes can be viewed immediately, and so that documents do not have to be broken up further in order to be modified by several people.

This would speed up the process of writing documentation as no conversion would need to be done, and work could be shared without concern for different versions floating around. Currently there seem to be few commercial hypertext editors, let alone collaborative ones. Consequently a commercial software company would have to release software in this area before Air New Zealand would be prepared to use it.

4.2 EIC

EIC is a graphic design company. They specialise in continuous tone colour prints which are mostly scanned in from photographs, modified and retouched, and then printed to paper, film, slides or transparencies. High detail work is done on Silicon Graphics workstations, but much of the lower detail work is done on Macintoshes.

Due to the open plan of the office, and the fact that most of the work in EIC is done on an individual basis, there is little need for collaboration or communication software within the business. However there seemed to be more of an opportunity to use CSCW techniques to involve the customer in the design process.

Currently for the customer to participate in the design process, they either receive the image on disk and discuss changes over the phone, or travel to the offices of EIC to view the image and discuss it. The problems with each of these techniques are that they tend to be costly and time consuming. It is often infeasible for the customer to visit the offices of EIC, and it can be difficult to discuss an image over the phone without visual aid.

CSCW offered a possible solution to this problem. The suggestion was that the customer would be sent a copy of the image, together with a tailored groupware application. This would enable them to connect computers with someone at EIC. Then with the aid of a telephone, the client could discuss the image with the staff member and be able to visually demonstrate their ideas through the computers.

Rather than giving the client complete control to edit and modify the image, the intention was to enable the client to express their intentions better through the use of pointers, circles and other indicative tools. In this way the client could clearly suggest areas where they are dissatisfied with the product, or where it does not fulfil their requirements. Depending on the connection speed, EIC could transmit low resolution images, to give a preview of the suggestions that are being made. In this way, the conversation is likely to be more productive, and the product is more likely to be what the client wants.

Such a system depends on several factors. First the client needs to have the hardware to link up to the computers at EIC, either over a modem or over a more dedicated link, and so consequently the software needs to be able to handle a wide variety of hardware. Secondly these ideas will inevitably take time to catch on, and it may be difficult for a graphic design company to pioneer these strategies. Finally, it may prove to be more inhibiting than beneficial for the client to be too involved in the design process as they are likely to be less knowledgeable in the area of graphic design

4.3 Environment Waikato

Environment Waikato is a local government organisation responsible for maintaining and preserving the resources and environment. Part of this process is the generation and maintenance of statements of policy. These plans document the governing of such things as land and transport or coastal areas.

These policy statements each go through a rigorous updating process approximately every five years. This involves breaking the document down into sections which then may be distributed amongst up to eight people. These people then will rewrite and update the sections of the policy document. Once each section is completed, the sections are brought back together into a single document. This statement of policy is then sent to the public who are free to submit their suggestions, alterations and modifications to that document. With these suggestions taken into consideration, the policy is again broken into sections, and rewritten.

This is the main area of the work that Environment Waikato does that seemed to be able to benefit from CSCW techniques. Currently the work on the policy statements is done asynchronously, and it seems reasonable that a significant part of the process could be sped up by incorporating more synchronous techniques.

It was suggested that a significant amount of time could be reduced by eliminating the need to reformat the document once it had been rewritten. This would be achieved by the use of a collaborative editor that kept material in the appropriate format. Cross-referencing is also a necessity in this information, and something that is not particularly well supported by existing software.

Ideally a collaborative editor should enable several users to modify documents and information in a hypertext environment. In this way, cross-references could be maintained and checked by the system, and information would be easily obtainable by those concerned

Also this would simplify the process of making this information available to the public as it could easily be made into pages on the web once it was already in hypertext format. Another way in which this information could be made readily available would be to load it onto a CD in which case the information would be easily retrievable and secure.

Another great advantage would be if work could be done away from the office without the information stored there becoming outdated. This means having connection facilities to the collaborative editor so that a remote-user can connect to the system and transmit any changes they make. In this way the document stored on the server can stay as up to date as the copy of the information stored on the remote-user's computer.

This hybrid of information support and collaboration software would clearly have to be robust and secure before it could be used in a setting such as Environment Waikato, but this type of software seems to be the most viable application of CSCW to their work.

4.4 Gallagher Group

The main product of this organisation is fencing and security systems. Within the organisation the area that is most likely to benefit from CSCW is research and development. Various research projects are led by project leaders, but can include staff from manufacturing, marketing and management, as well as people from the research and development group.

Clearly, with this group structure, in which groups can contain people from all over the site, there are benefits of other methods of communication than face-to-face. Email already fulfils this to a certain extent, as everyone concerned has an email account and access to a computer. Despite this it is still only a secondary method of communication, and most discussion is still done in person.

Another method of communication that could be quite useful to Gallagher Group is through newsgroups. Different topics could be established to cover the various areas of knowledge that are relevant to each person's work. Then common questions would only need to be answered once, and the general knowledge and experience of the organisation could be recorded and referred to. However Gallagher Group may not be large enough to establish an effective newsgroup system in itself. Another possibility is to incorporate a selection of the Internet's newsgroups into the local system to give a wider audience while still maintaining internal records

The other opportunity for this research is in involving the customer in the discussion of the project that is being done for them. The customer is most commonly international, which

makes their involvement in the project expensive and difficult. With effective use of conferencing techniques, it could be possible to involve the customer in the meetings and discussion of the project. This would inevitably improve customer satisfaction. However there would certainly need to be limitations to the involvement of the customer. It would be unproductive to involve the customer in the more routine parts of a project, and there are perhaps parts of the organisation, or trade secrets, that the customer should not be involved in.

Due to the cost and hardware requirements of videoconferencing, this style of communication may be only feasible with larger or more regular clients. However desktop conferencing may, in many situations, be a better method of communication and certainly a more cost effective one. However it seems that desktop conferencing has not been used by industry for customer involvement in the past, and is unlikely to be used for this in the future unless either the customer requests it or an industry takes the initiative.

4.5 HortResearch

HortResearch has three main centres; Ruakura, Mt Albert and Palmerston North. As well as this there are thirteen minor centres. All of these are connected by a wide-area network that runs over leased lines. The main use of this network is for communication, and specifically for email. Although the use of the email system is still informal and unstructured, it is still a standard method of communication around HortResearch

There is a definite opportunity in HortResearch to make use of a computerised scheduling system. Not only would this be used to arrange appointments with staff across the whole of HortResearch, but it could also be used to book equipment and facilities and thus improve their use. Another benefit of email could be the development of an EDI or Electronic Document Interface. This would handle such things as timesheets and stock requisitions, consequently improving the speed of the process, and eliminating the cumbersome paper trail.

As part of the operation of HortResearch, bids need to be written. These are often lengthy documents, which request funding for proposed new research fields. Generally a bid will be overseen by a programme leader, but will often have several people involved in writing it. Currently this is achieved by breaking the document into sections and giving each section to a separate person. Unfortunately, this leaves the programme leader with the often lengthy task of combining it all together in a single bid.

This seems to be an ideal situation for a collaborative editor. The entire bid could be stored in a central location and constantly updated as various people work on their section. Since the collaborative editor would be standard, there would be no more concern from variations in software. Also, the formatting of the document could be built into the editor to some extent, hopefully reducing the workload at the end.

Conferencing has less relevance to HortResearch. There has been some experimentation with videoconferencing, most interest coming from the marketing and management side of the organisation. The main perceived advantage of videoconferencing is a reduce in travel costs. However this was expected to be an advantage of installing the wide-area network in the first place, while the actual result was an increase in travel as people's awareness of what was happening at other sites was increased.

It seems that the communication systems that use the wide-area network need not be particularly developed. Most of the communication that needs to occur can be done over email. Perhaps the introduction of a textual 'chat' facility may fill in the gaps in this system, but it seems that more advanced conferencing would be filling a nonexistent need.

4.6 Taupo District Council

The main event to have occurred recently in the computer department of Taupo District Council was the installation of their new PC network. Before this, the main uses of the PCs were for word processing and spreadsheet editing. With the introduction of the network, the first priority was to establish an email system and get people comfortable with it.

The best offer of CSCW and related software to the Council is to reduce and perhaps even eliminate the paper trail that occurs whenever documents or information need to be passed around. The potential is to handle various types of formal or informal documentation over the email system. In some cases this raises the issue of security, as many forms of documentation need to be impossible to forge.

There was also interest in the idea of group editing, though it is not so common for several people to have an equal claim to a document. More common is for one person to be producing a document and want contributions and input from others. Currently this is done by passing around printouts and disks. Although this could be significantly reduced by effective use of the network, collaborative techniques would make it easier for suggestions to be made and for work to be discussed, and also overcome the problem of different versions appearing.

Naturally the first priority is to have the network fully installed, and educate people on how to use it effectively. However once this is done, it is likely that more advanced communication and collaboration software will be considered, such as that described above.

4.7 TVNZ

In the last couple of years TVNZ has set up a network, not only within their building, but nationally. This is used primarily to run Novell Groupwise, an integrated system that allows emailing, sending messages and scheduling across the network. This system allows a user to see when another user receives or opens mail, and also enables them to request a reply within a certain time. The scheduling system allows any person to see whether someone else is busy at any time. This can greatly simplify the process of planning meetings and appointments.

News groups have recently been developed as part of Groupwise, but are not currently implemented in TVNZ although they could be useful. Another application that TVNZ would be interested in having as part of the existing system is a textual conferencing facility. This would hopefully reduce the amount of casual conversation that occurred via email. This would inevitably reduce the size of people's personal mail archives which are often padded with casual messages. Also a textual conferencing facility would make it easier for groups to discuss their work informally without calling a meeting or, in many cases, travelling large distances. Also this style of communication is generally easier and less intrusive than a phone call, as it is easier to talk to anyone, without requiring their undivided attention, and easier to establish a conversation with several people.

It appears that there is a clear need for collaborative editors in TVNZ. Many products, both textual and graphical, require the work of several people, and perhaps the involvement of more. In these situations a collaborative environment in which groups could develop or discuss their work would be ideal. This collaborative ability would best be incorporated into the work environment, in a similar way to Novell Groupwise. This would ensure that collaboration could occur in any context, which would make the process of collaboration more intuitive.

TVNZ is limited, however, by the availability of software on the commercial market, as they could only implement such a system if it was developed to a commercial level. So to a certain extent they are waiting for a software company to release software with this potential.

4.8 Company B

The major changes that have occurred in Company B in the recent past have resulted from the electricity board's privatisation. They have recently begun to act less like a government organisation and more like a business. Consequently, customer satisfaction is now more of a concern than it ever was before and they are quite interested in ways to improve the services available to the customer, or 'value added services' as they are called.

Most of these value added services are involved with improving the efficiency of the business, or improving the quality and quantity of information provided to the customers. Both of these areas seemed to be able to profit from groupware.

The area in which this research could be used to improve the business's efficiency is in process refinement and information transfer. Typical processes such as fault fixing or creating a new account would be documented by standard email forms which would enable the necessary information to travel quickly around the various departments, while maintaining security, integrity, and accountability. This documentation could then also be archived for historical reasons.

Because the transfer of information is electronic, it is reasonably reliable and cost effective. Also the information can be presented interactively, as might be necessary if a reply or an acknowledgment was necessary for a particular message or document. Also the same information could be sent immediately to various people without the need for copying or for people to wait for others to be finished with the document.

The other area in which the potential usefulness of CSCW was evident was in the provision of information to the customer. Although most of the customers are local to the city in which Company B is based, the travel costs still limit the frequency of interaction with the client. Also, with the recently competitive electricity market, it is quite likely that some future customers will not be local.

This produces the opportunity for conferencing techniques to improve the information service available to the customer. With the aid of desktop conferencing, discussion with the customer can be as frequent as the customer wants. These discussions can be enhanced by graphs and diagrams of the customer's current electricity usage and charges. By making the system interactive, various pricing options could be graphically presented, and discussed. This would improve the customer's ability to make informed decisions, and consequently improve customer relations.

Another advantage to Company B of implementing desktop conferencing and perhaps video conferencing is that this will simplify communication with the business's foreign owners. Although most decisions are made by the local business, it is often necessary to confer with these owners, in which case conferencing may reduce travel costs while still allowing those concerned to communicate effectively.

4.9 Waikato Times

As a regional newspaper, Waikato Times receives most of its revenue from advertising and the remainder from newspaper cover price sales. The main interest of a newspaper like Waikato Times is in producing a relevant and informative newspaper as quickly as possible. Because of this, there is not much use for collaborative tools that involve discussion and that may consequently slow down the process.

However to some extent Waikato Times is already using semi-synchronous collaborative software. The current system allows several people to work on a single page of a newspaper at once, although there is only very limited indication to each person as to the modifications that others are making. This is achieved by having a controlling page file which contains the names of stories on that page and placement information for them. For each story a text file is then written which contains the text of the story. This means that various people have access to various parts of the page at the same time, though only one person can edit a story file or the page file at any time (though others can observe the page file while it is being changed).

Editing of the articles and stories is believed to be best done asynchronously, since there is usually a single author of an article, and a single subeditor of any particular article, at any one time, there seems little need for collaborative software.

In general it seems that synchronous collaboration is not suitable for a newspaper such as the Waikato Times. This is mainly due to the trade-off in efficiency and accountability that is lost by incorporating these techniques. Since work is generally done independently, it is unsurprising that there is not much need for synchronous collaborative software.

On the other hand, desktop conferencing was seen as a more useful tool for communication, as ideas and suggestions could better be made without having to visit one another in person, though it was suggested that perhaps these collaborative techniques would better suit a magazine or a smaller newspaper where time is not such an issue. The system referred to above already has an electronic message component which allows for discussion between staff.

4.10 Conclusion

The most obvious conclusion to draw from these interviews is that different businesses have vastly different perceptions of what CSCW is and vastly different requirements that they believe CSCW can fulfil. Consequently the potential benefits of CSCW to these businesses are very different. This suggests that the best way to develop a system to meet their various requirements is to develop a highly flexible and tailorable system that can be modified to suit specific needs.

Despite this diversity, there were some points that emerged as common to several of the businesses. Many considered CSCW as an opportunity to further involve their client in their work, or to improve the way in which the client was involved. The main disadvantage with this is that the client would have to install suitable hardware and software, and be able to operate it, though the pertinency of this problem varies from case to case.

The most common form of CSCW used by these businesses stemmed from email systems, which it seems are now a standard part of businesses. The use of email varied, however, from one business to another. Several were interested in developing systems by which administration could be done by email, and many were also interested in developing message systems that were in the work context, such as Lotus Notes. Some were interested in process control systems that operated over email and enabled processes to be accompanied by documentation that travelled over the network and ensured that information was received and processed.

Some businesses were interested in collaborative editors and desktop conferencing tools. However, it was the general impression that it would be better for these possibilities to be incorporated into their existing software than for new software to be developed. It seemed that the easiest way to accomplish this would be to somehow incorporate collaborative techniques in the platform that the software was being run on, and for this to enable collaboration in that software.

As well as this there was a certain amount of interest in the other areas of conferencing, though this interest was very limited in the case of videoconferencing. Several businesses believed that a text 'chat' facility would be useful, and others considered that newsgroups would be beneficial.

In general it seems that businesses in New Zealand are interested in exploring CSCW further, but are reluctant to make any large steps as there is only limited software available on the market. In some cases, techniques such as collaborative editing would be superfluous to their requirements, but in general it seems that the tools being developed will find their way into industry more and more in the future.

5 Conclusions

The intention of this paper was to fulfil the requirements of some of the objectives of our project. These entailed assessing the field of CSCW to evaluate the existing research areas, and then to observe the use and potential use of CSCW in a variety of businesses and organisations in New Zealand.

The second section explained the four main areas of research: message systems, collaborative editors, meeting room systems and conferencing systems, as well as distinguishing between collaboration and communication, both of which are fundamental aspects of CSCW. The following sections revisit these areas and summarise the benefits within each that CSCW might provide.

5.1 Message Systems

Of the four areas listed above, perhaps the most common in industry are message systems. It is becoming a standard for large businesses, and some smaller ones, to have a PC on virtually every desk and a network connecting them together. The most common next step is to install an email system. However it is less common for businesses to use these email systems for much more than casual conversation or unstructured messages.

However, there are businesses that have taken their email systems further. Some are developing EDIs (electronic document interfaces) for electronically processing documents such as timesheets, stock requisitions or process documentation systems, where information regarding a process could be sent between departments in standard forms. This enables each department to follow its progress and complete its part more efficiently and effectively.

Another area in which some email systems are more advanced is in their context. These systems enable the user to add a message into the work they are doing, be it on a word processor or a graphical package. This is done in some cases using software such as Lotus Notes, though this style of software is certainly limited without the ability to collaboratively share these documents

The other main development that businesses seem to be interested in is scheduling systems, which are generally no more than a shared storage of appointment information, but in many cases, such as in Novell Groupwise, they are implemented as part of the message system.

There are also several businesses that expressed an interest in developing their email systems further in these areas, though it was often the case that the existing software was too expensive, or difficult to install, or that there was no suitable software available to meet their requirements.

5.2 Collaborative Editors

The greatest difference between collaborative editors and the three other areas of CSCW research is the apparent lack of software to support collaborative editing. It seems that the only software in this area is research material, and this has a tendency to be unreliable and not particularly useful. This is especially unfortunate given that many businesses expressed an interest in this type of software and some considered it to be precisely what they needed to improve their efficiency .

While the intended implementation and use of this type of system varies considerably from business to business, the basic underlying requirement is the same—an environment in which it is possible to view or modify one another's work subject to certain security considerations. The main perceived advantage that this type of system would have over a file sharing system is that there would be no old versions, and the work that was viewed would always be up to date, and reflect any changes that its authors were making.

Often the lines between collaborative editing and desktop conferencing are blurred and this seems to be the case with the interests of many of the businesses. It seems ideal to make such things as telepointers and in-context note systems a part of the collaborative environment, so that the system to co-author work could be used to discuss it too.

In this way a document could be submitted to several people for proof-reading, and they could simultaneously read it and note suggestions on the document itself by using a contextual message system. Then this would avoid time-wasting as an error would only need to be found by one person, and then the others would see that it was recorded. Also the modifications could be made immediately by the author or authors and be visible to those proof-reading the document

The other commonly recurring situation in which this kind of system would be particularly useful is when a large document needs to be broken down and worked on by a group of people. This system would enable the work to be done simultaneously without needing to split the document into separate parts. This would eliminate the, often lengthy, process of restoring the full document once the work had been done, and, if need be, enable the authors to view each other's progress and thus work more as a team.

Several businesses expressed an interest in a slightly different system that integrates collaborative editing and viewing, so that a document can be stored in a format such as hypertext, easily viewed by many, and modified without lengthy conversion processes. The viewing side of this has been developed extensively with respect to the World Wide Web. However there seemed to be little or no software for editing hypertext, and certainly a lack of collaborative hypertext editing software.

Once again the major drawback in this area seems to be the lack of available software of a commercial standard. Most of the organisations that were involved in this research are very reluctant to use software that has not been developed commercially. This is partly due to the unreliability of research software, along with no guarantee of support or upgrades to the software. Consequently it would be unlikely for any businesses to seriously consider collaborative software until it emerges on the commercial software market.

5.3 Conferencing

As was mentioned previously, the lines between simple text conferencing and message systems are often blurred, and the lines between desktop conferences and collaborative editing are also often blurred. Videoconferencing, as far as our survey is concerned, was not often considered a useful tool. The general opinion is that it would provide a little help to people with little computer experience, but that in most situations it is a superfluous feature that has been fashionable for some time, but never seen as necessary, especially considering its often expensive hardware requirements.

Many businesses see desktop conferencing as an innovative way to involve the customer or client more in the development of their product. Without having to leave their desk, a business can present the customer with a draft or overview of the work that is being done for them, and the customer can then discuss changes or areas in which they are not satisfied. Because this can be cheaper and more convenient than visiting the customer or having them visit you, the discussion can be more frequent, which can ultimately lead to greater customer satisfaction.

Textual conferencing is seen by some businesses as a useful tool to complement existing internal communication methods. The perceived advantages of this method are that it is cheap, simple to use, unintrusive and makes it possible to hold group discussions over long distances without the need for special support. Also this can alleviate the strain that is often placed on email systems when used for conversation.

As mentioned in the previous section, desktop conferencing can provide the opportunity to proof-read one another's work with few problems, as well as the ability to discuss changes and suggestions while looking at the work concerned.

There is also notable interest in the newsgroups style of holding conferences. One perceived advantage of this type of system is that groups of people can be collected together by subject rather than by work context and so be able to provide one another with fresh insights. Also, common questions only need to be asked once and then recorded in the system for future reference. In this way the general knowledge of the participants can be recorded. Also the asynchronous way these systems work ensures that nobody is plagued with technical questions.

5.4 Meeting Room Systems

This would perhaps be the area of CSCW about which there is the least enthusiasm. It seems that the concept of setting up a computer supported meeting room is unnecessary in most situations. The investment of space and money that such a system entails is clearly a large disincentive. If there is the need for a presentation or a demonstration in a meeting, then suitable hardware can be obtained and temporarily placed in the meeting room for that occasion.

There is very little experience with meeting room software such as minutes or agenda support. To a certain extent meetings are seen as an opportunity to get out from behind a desk and discuss things in a natural (and hence not computer supported) way. The only interest in computer support in a meeting is to allow remote participation of people who might benefit from it.

6 Conclusion

Having surveyed several companies within New Zealand and asked them, in more or less detail, about their current and planned uses for CSCW we clearly see one dominant fact. There is a vast gap between the aims of research in CSCW and the provision of commercial software to support CSCW.

This is, of course, unsurprising. However, two things need to be borne in mind. The people we talked to can see a point to much of the software currently being developed in research labs and clearly have useful ideas about how it could be used to enhance their businesses were it available. They have also adapted the most widespread and basic tool, email, to stand-in for the wished for but missing systems. Putting these two facts together lead us to the conclusion that, once email is firmly enough entrenched (which point may already have been reached), moving companies to newer, more elaborate and more expensive systems will become difficult.

Apart from making the current situation clear to us, another effect of this research has been to enlighten businesses and organisations as to the potential of CSCW research and what it has to offer them. Perhaps this might make their demands for products sooner rather than later more insistent and so mean that the time lag from research lab to commercial production will be shorter.

Finally, we have to be honest about the role of CSCW in the organisation we know best—the University. While use of newsgroups and products like Netscape mean we probably make far more use than the people surveyed here of computers for interaction with others, we also rely on email to carry on what CSCW we do engage in. We have adapted our ways of working in exactly the same ways as the companies whose time was so generously donated in the compiling of this report, so any implied criticism of them applies equally to us.

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Appendix A

Appendix B

