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The importance of text width and white space for online documentation

Tim Comber
Southern Cross University

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for Online Documentation

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ABSTRACT

This study investigates the importance of text width and passive white space on comprehension, speed of reading and user satisfaction for text displayed on the monitor of a personal computer. Thirteen subjects were tested with 8 different text widths and white space or no white space, 16 conditions in all. The results showed no relationships between the different text widths and white space for reading speed and comprehension but a significant relationship for satisfaction was found. The results suggest that individual differences in reading abilities are more important to reading speed and comprehension than text formats. However for maximum user satisfaction, text should have margins and be between 3 and 5 inches in width. Guidelines based on studies of print media may not be entirely applicable to computer displays. Future studies should investigate longer text passages and interactive help.

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1. INTRODUCTION

1.1. Background

"Human-computer interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them" (Hewett 1992). The presentation of text on computer screens is one aspect of this interaction that requires more investigation.

The Association for Computing Machinery predicts that computers will be used for images, voice, sounds, video, text, and formatted data, all of which can be exchanged via communication links. Electronic and print media will continue to be cross-assimilated. New display technologies are expected to enable very large displays (Hewett 1992).

The computer screen has become an important intermediary between the user and electronically stored information (Rubens and Krull 1988). Online information can take many forms:

- advertising and exhortations to pay for the software (particularly shareware)
- canned demonstrations
- company documents
- data entry and retrieval prompts
- electronic journals
- electronic mail
- electronic newsgroups such as are found on Internet and Compuserve
- entire books
- error and system messages
- full graphics
- full text
- latest changes to the software
- multimedia encyclopedias and other reference material
- online help
- support for interactive tasks
- user manual
- tutorials
- whole text databases such as ABI/Inform and Computer Select.

People that work with computer displays must extract information from the screen according to the demands of the task. Each screen of information must be presented in a manner that helps the reader to process the information (Tullis 1983).

Many users do not consult the paper manuals but instead attempt to operate software by exploration. Grill (in Brockman 1990) found that users said they read the manual thoroughly, but after an average of nine minutes, it was put aside in favour of trial and error.

There has been much research on the presentation and readability of text on computer screens (Mills and Weldon 1987). There are a number of factors that have the potential to affect the ease with which people can extract information from the screen. Such factors as fonts, brightness, page size, windows, and number of characters in the display have been investigated.

One area that has received some attention but has not been resolved is the width of text on the screen. One viewpoint (Mills and Weldon 1987) argues that more information and quicker retrieval is possible with greater density of text on the screen. On the other hand, studies with written text (Brockman 1990) have shown that the wider the text the more effort required by the reader to find the beginning of the next line. This slows reading speed and reduces comprehension.

Too narrow a text width also has problems. Reading speed was reduced when text width was reduced from about 2 ins to 1.67 ins (Brockman 1990).

Graphical interfaces do allow the user to narrow the window to any width but this may not be satisfactory if width and white space are important because:

- The user may not realise that the width of text has an effect on reading.
- Narrowing cramps the screen, increasing the density of text and reducing the amount of "white space". Well designed text screens should have at least 50% white space (Brockman 1990).

1.2. Hypothesis and Objectives

People are increasingly relying on computer screens to provide textual information. Guidelines for design of online documentation base recommendations on research with print media and with earlier studies using what is now outdated equipment. It is necessary to update research and to investigate the effect text width and white space has on user's reading performance.

From the literature search for this thesis, empirical research on white space with computer displays seems to be non-existent. In early computer experiments, white space was given little consideration because the screens could only display a limited amount of text. Modern screens are capable of displays more closely approaching print media.

Expectations of previous research are that text width and passive white space are important to reading speed, comprehension and satisfaction. The purpose of this study is to confirm or otherwise this expectation for computer monitors by investigating if there is a relationship between the dependent variables

- reading speed
- comprehension
- satisfaction

and the independent variables

- width of text
- amount of white space.

1.3. Justification

Current guidelines (Phillips and Crock 1992) frequently suggest that the width of text should be between 40 and 80 characters. This recommendation is based on research conducted in the 1980's using VT100 or similar terminals e.g. (Duchnicky and Kolers 1983; Cherry, Fischer, Fryer and Steckham 1989). Since this research was done the technology has changed dramatically. Rubens (1986) was able to suggest that a typical industrial-grade monitor had a screen 9 inches by 6 inches capable of displaying 80 characters to a line and 24 lines deep. These early terminals were incapable of displaying the different fonts and point sizes of modern terminals and as well were less wide and of much lower resolution. As a consequence the old guidelines are no longer valid.

If line width is proved important then it needs to be expressed as standard measure e.g. picas, inches or centimetres. Line width expressed as number of characters has no relevance to graphical interfaces.

A number of references e.g. (Brockman 1990; Rubinstein 1988 ; Horton 1990) state an opinion that white space is important. One explanation is that an area of white space is needed to reduce visual distraction. This is felt to be less important with online documentation because of the border or frame of the monitor. However another viewpoint is that white space is important to:

- frame sections of text
- break large amounts of text into meaningful chunks
- draw the reader's attention to text items (Horton 1990).

Horton believes that passive white space is not necessary for online documents because the reader:

- already has the monitor frame to separate the text from visual distractions,

- does not need a margin to hold the document while turning pages.

However he does not offer any evidence to support his claim.

1.4. Methodology

1.4.1. Description

Thirteen undergraduates of the University of New England, Northern Rivers volunteered for an experiment on text presentation. The experiment was expected to take between half to one hour.

The independent variables, width and white space, were arranged in a repeated measures, two factors design. The width of the text was varied in 1 inch increments from 2 inches to 9 inches and the text passages had either passive white space or no passive white space. The text passages of approximately 150 words were taken from the "help" files of Microsoft Word 2.0.

The software automatically recorded the time to read each passage of text and the time to answer each set of questions. After reading each text passage, each subject rated readability on a scale from very good to very poor. This gave the satisfaction rating for each screen condition. The rating question was followed by three questions based on the passage just read which gave a comprehension score for each passage.

1.4.2. Statistical Processes

The design of the experiment was based on a treatments-by-treatments-by-subjects, or repeated-measures: two factors, design (Bruning and Kintz 1987). This is a form of ANOVA that allows for the means to be compared for each condition and for the interaction between the conditions. The calculations were carried out using a spreadsheet and the application of the appropriate formulae. The analysis was checked by analysing the summary data using a two factor without replication ANOVA provided by Microsoft Excel 4.0. as part of the analysis tools.

The four main assumptions underlying the use of these statistical procedures are:

1. a normally distributed population
2. independent observations
3. measurements on interval or ratio scale
4. homogeneity of variance

If these assumptions are not valid there is increased probability of making a Type I error i.e. accepting results as significant when they are not (Wright and Fowler 1986). It is reasonable to expect that the population of readers is normal. Subjects were assigned randomly to conditions and the conditions were randomised. The time and comprehension measurements are on a ratio scale though the satisfaction rating is only ordinal. As there are no equivalent non-parametric tests to apply to this experimental design the ANOVA is most suitable.

1.4.3. Justification for the Methodology

Experiment or research design enables the experimenter to answer the research question and exclude rival hypotheses and extraneous variables that could also explain the cause-effect relationship, (Huck, Cormier and Bounds 1974).

This research used the experimental method for a variety of reasons:

- it provided evidence for the importance of the independent variables
- it enabled control of font size, terminal type, lighting conditions, computer type, operating system and interface
- it excluded rival hypotheses particularly fatigue, learning and differences in the text.

The two factor design allows for the investigation of possible interaction effects between variations in width and the presence or absence of white space.

1.5. Definitions

ANOVA stands for analysis of variance, a statistical technique to determine if significant differences of means occur between two or more groups (Zikmund 1991).

Descenders are the part of a character that are below the body of the letter; the part that descends below the line.

Leading is additional space inserted between each line of text.

Legibility is described by Tinker (1969) as designating the "effects of typographical factors on the ease and efficiency of perception in reading." He goes on to define legibility as those factors that together affect ease, accuracy and speed of reading. Another similar definition is given by Gribbons (1988), who states that legibility is the "speed, accuracy and ease of visually receiving and comprehending meaningful continuous text."

Pica is the unit of measurement for line width, approximately 1/6 inch. A four inch line is 24 picas wide.

Readability refers to the ease with which the meaning of text can be comprehended and is measured by means of reading comprehension and reading speed (Mills and Weldon 1987).

Set solid is text without leading.

Size of type is measured in points where the *point* is approximately 1/72 inch.

Speed of reading is the time it takes the reader to read a passage of text. In this experiment it is the time from when the text screen is displayed to the time the left mouse button is clicked.

Text width is defined as the distance from the left border to the right border of a block of text where the text is left justified and right-ragged. This can be arrived at by measuring the block of text directly or by the following formula:

$$W = SW - 2SB - 2F - 2BW - LM - RM$$

where:

W	=	Text Width
SW	=	Screen Width
SB	=	Screen Border Width
F	=	Window Frame Width
BW	=	Background Width
LM	=	Left Margin
RM	=	Right Margin

White space is the blank space surrounding text and objects. *Active white space* is used to organize information by separating chunks of information (Horton 1990). *Passive white space*, outside margins, is used to isolate the text from external distractions. This experiment investigates the effect of passive white space.

x-height is the height of the letter "x" and is used as a comparison measure for different fonts.

1.6. Limitations and Key Assumptions

Guidelines for online documentation recommend left justified text and ragged right margins, e.g.. (Phillips and Crock 1992; Horton 1990).This formatting is also supported by research (Trollip and Sales 1986). Therefore this experiment uses the same format. However this means that there are two different ways to measure line length:

- an average for the block of text
- the length of the longest line in the block of text.

The last alternative, the length of the longest line in the block of text was used because:

- it is easier to calculate the line width and standardize it for different text passages
- it would be impossible to develop passages of text containing exactly the right words to fit the line width
- fully justifying the text would make the lines the same length but would be contrary to recommendations and would result in more blank space between words

- using single lines of text would not simulate real reading conditions for users of online documentation.

Text was chosen from Microsoft help screens to provide a more realistic simulation. To test narrow text conditions and to be able to compare these with wider conditions it was necessary to use small text passages otherwise scrolling would have been necessary to enable the reader to view all the text. This would have affected reading times.

It is assumed that university students represent all computer users in their ability to read and comprehend on screen information. Font type, font size and leading was kept the same across all conditions as each of these may have affected the results. Subjects were all tested on the same brand and model of computers.

1.7. Outline of Report

This report begins with an overview of text presentation and its place in the field of human-computer interaction. The research problem is defined as investigating the importance of text width and white space for readers using computer screens. The results indicate individual differences in reading abilities and preferences are more important to reading text on computer screens than text width and white space. Definitions of key terms are provided in this chapter and a brief summary of the methodology is given. The limitations and assumptions involved are listed.

The presentation of text is researched by many different disciplines including psychologists, typographers, technical writers and information technologists. The history of research in this area does not follow a logical or sequential development. Therefore the literature review is organised under subject headings.

The methodology chapter describes the experimental design, the recruitment of subjects, data collection and treatment. The data is analysed using a repeated-measures, two-factor design or 2 by 8 ANOVA. Graphs of the means provide further information about the results.

The final chapter discusses the failure to reject the null hypotheses for reading speed and comprehension and the importance of the significant result for satisfaction. Further research is indicated to investigate the effect of text width for long text passages, interactive help screens and the use of active white space.

2. LITERATURE REVIEW

2.1. Psychological Processes

2.1.1. Introduction

Reading is described by Noordman (1988) as an activity of information processing that transforms patterns and symbols into an understanding of the text. The same cognitive processes are involved when a user reads online documentation. The reader transforms patterns of light and shadow into meaning.

The ability of the reader to read is affected by the presentation of the text. The study of eye movements, speed of reading, and comprehension provides an explanation of why reading is not a simple or straightforward task.

2.1.2. Eye Movements

Javal (Singer and Ruddell 1985) discovered that when reading the eyes move in jumps that he named saccades. Each saccade lasts about 20 ms. The eyes then fixate on the text for about 240 ms. Finding the beginning of the next line takes about 40 ms.

The fixation period is the only time that the reader can perceive print. As explained by Noordman (1988) only during these stops is information extracted from text though the fixations are often inaccurate, particularly for the first fixation on a new line. Two hundred and ten ms of this period are available for stabilisation and processing of the information; the other 30 ms is required for seeing, (Singer and Ruddell 1985).

The retina is the area of the eye on which the lens focuses images, senses light and begins the analysis of the image (Rubinstein 1988). The centre of the retina is the fovea. This area of the eye is responsible for detailed focusing. The eye is able to "see" over a wide angle but detail is obtained only over a narrow region (about 2 degrees across) called the fovea, (Card, Moran and Newell 1983). At a reading distance of 35 cm the eye can only see, in detail, a circle about 10 mm in diameter. This circle can only contain some letters and maybe a word or two. If the eye remains steady then it cannot see. To see the eyeball must be moved by muscles to bring different areas of interest into focus. Peripheral vision is used for orientation.

Detailed vision is also dependent on contrast. Lateral inhibition enables the retina to detect edges. Circular areas of the fovea react most when the middle receives more light. This effect is not dependent on absolute levels of light but instead requires contrast.

The speed of reading is limited to the ability of the visual system to handle information. Speed can also be affected by screen displays that flicker or vary in intensity. The *critical fusion frequency* (CFF) is the number of flickers per second that will seem to be stable for 50% of all people. People differ greatly in the level of CFF. This effect may explain some of the poor reading results from computer screens reported early in the literature.

Finding the start of a new line is a perceptual problem according to van Nes (1988). The movement to the start of the next line may not be directed quite precisely enough if the angle between the required direction of motion and the direction of the lines is small. These small "eye return angles" occur when the lines are long or the distance between lines is small.

If the point of focus is more than about 30 degrees away from the eye, the head moves reducing the angular distance. At the normal reading distance from a computer screen, about eighteen inches, the eye scans four and a half inches (Brockman 1990).

2.1.3. Limitations on Reading Speed

The reading process could go faster as a word can be seen in about 50 ms. We could read about four times faster than we do. There are two explanations (Noordman 1988):

- The bottleneck is the processing of the higher-order information and not the perception of the visual information. Different methods of text presentation may facilitate the higher-order processes in text understanding.
- Slowness of reading is due to inefficient perceptual processes. Speeding up the eye movements during reading could speed up the process. Eye fixations are quite often inaccurate particularly for the first fixation on a new line.

Other than training the user, there may be ways of presenting text to speed the reading process. Noordman (1988) reports on the rapid serial visual presentation (RSVP) technique. However this method does not appear to be accepted except for displays that have very little space available e.g. advertising banners, cash registers.

2.1.4. Comprehension

Adult readers perceive whole words after each saccade. Readers associate words into verbal relationships across sentences. This is called *chunking*. Comprehension is like solving a problem in mathematics. Text can follow a formula such as question and answer or problem and solution to show the relationship between ideas. The reader then can relate the text to their own requirements.

Comprehension and speed of reading are related but separate functions of reading (Singer and Ruddell 1985). Where readers can identify words automatically most of the effort can be devoted to comprehension.

The ability of a reader to comprehend text is affected by the interaction between external information and memory (Klix, Krause, Hagendorf, Schindler and Wandke 1989). Text comprehension is mostly interpretation.

Fatt (1991) found that word frequency, vocabulary load, and sentence complexity influence the readability of biology texts. Text-related variables such as sentence complexity and vocabulary load were examined in three secondary school textbooks. Content and non-content words, technical and non-technical words, rare and frequent words, and word repetitions were considered.

Predictions based on mean sentence length and number of syllables may not be the cause of textual difficulty in human and social biology texts. Sentence length was not found to be an adequate measure of syntactic complexity. Students judged the language as easy when there was low repetition of technical content words and rare words, when the percentage of technical words was low, or when the percentage of non-technical words was high.

2.1.5. Conclusion

Psychological processes show that the average reader does have limitations in reading speed and the ability to read text. The computer screen needs to optimize conditions to maximise the benefits that a computer can provide in delivering information. However these cognitive studies have been done with slides or print media and may not be applicable to computer displays.

2.2. Theory

Elkerton (1988) offers a task-analytic approach based on the GOMS model of human-computer interaction. This theoretical approach allows online aiding dialogues to be specified using the goals, operators, methods, and selection rules of the computer interface. A fully specified GOMS model provides an opportunity for usability problems to be identified analytically so that aiding dialogues can be implemented effectively based on quantative predictions of performance time, learning rate, and user memory load. The theory can be used to predict improvements in assistance and instructional dialogues without extensive user testing.

The objective of an aiding dialogue is to improve current and long-term user performance with the computer interface. Users are faced with the problem of learning additional interface procedures while still trying to complete their current task efficiently. This approach develops a principled method for the development of online aiding where each component of the GOMS model provides the framework for the aiding dialogue.

Elkerton believes that the research and development of aiding interfaces can be approached using a task analytic approach based on the GOMS model of human computer interaction.

This approach develops a principled method for the development of online aiding where each component of the GOMS model provides the framework for the aiding dialogue. The task-analytic approach permits a quantitative assessment of user interface problems that can be solved with online aiding moreover provides a method for predicting any improvements in usability as a result of the aiding dialogues. However, this approach does not offer solutions for addressing the individual differences of users.

The GOMS model does not offer much insight into the design of text formats except for the principle that minimising the number of actions improves the interface.

2.3. Reading from the Screen

2.2.1. Introduction

As the amount of information in electronic form increases, reading and writing with computers have grown to become increasingly important tasks.

The task of reading can be broken into different categories depending on the task of the reader. Computers are not usually used to read for leisure at present however there are two major types of reading that are important:

1. Reading text to solve future problems i.e. learning
2. Reading text to solve a present problem

Each of these types of reading involves different reading techniques due to the different reading goals. The first involves careful reading and re-reading to gain an understanding of the topic. The second usually involves scanning to find keywords and sections of text relevant to the task in hand. This in turn means that width and white space need to be investigated for both kinds of reading.

The first type of reading, reading to learn, is the sort of reading tested for in the experiment. Usually the sort of text associated with learning is long such as online journals, multimedia encyclopedias, etc. The experiment could be repeated with much longer text passages (at least a number of pages) to test if differences in width and white space are important to this kind of text. It would not be practical to test many widths as the experiment would take too long. A test design using white space, no white space and 5 inch and 9 inch would determine if width and white space are important to longer text passages.

An example of the second type is reading help files. This is generally undertaken to solve a problem raised by some other task. It involves scanning the text looking for key words and looking for information appropriate to the problem in hand.

2.2.2. Reading Computer Presented Text

Belmore (1985) compared reading time and comprehension between paper and computer presented text to provide more information about the differences between the two methods of display. She suggests that the difference in reading time may be because the subjects that read computer text were unfamiliar with the technology.

The subjects were shown eight short passages. The paper version had each passage typed on a single sheet of paper. The computer version used an Apple II Plus 48K microcomputer that displayed 24 lines per screen and 40 characters per line. No passage required more than one screen.

Half the twenty subjects experienced four computer-displayed passages first then the paper; the remainder had paper first. After each passage the subjects were tested for comprehension by answering questions from a sheet.

Belmore found that the subjects took significantly longer to read the computer presented text and scored significantly lower for comprehension. However, it was found that with the paper condition first the difference was reduced for comprehension and reading speed (see Table 1).

	Presentation Mode		
	Computer	Paper	Overall Mean
		Reading Time	
C-P Order	103	79	91
P-C Order	85	89	87
Overall Mean	94	84	89
		Comprehension	
C-P Order	16	58	37
P-C Order	52	69	61
Overall Mean	34	64	49

Table 1: Mean reading time (in seconds) and comprehension (percent correct) as a function of presentation mode and presentation order (Belmore 1985).

The researcher felt that the most reasonable explanation for the poorer performance of the computer-first condition was that the subjects had no prior experience with computers and so were distracted by the technology. However when the subjects were familiar with the task they were more able to cope with the video screen.

This research highlights one of the problems with research with computer terminals - changes in display technology. The computer used in this experiment was only capable of displaying 40 characters per line.

2.2.3. Variations in Reading Performance

Hansen and Haas (1988) present a framework of factors within which variations among user's results can be explained.

Quality and quantity of reading and writing depend upon page size, legibility, responsiveness and tangibility. The four primary and three secondary factors that the authors use to explain the influences that affect people using computers to read and write are:

Primary Factors

- **page size** is the amount of text visible at one time
- **legibility** is the ease with which letters and words can be recognises correctly
- **responsiveness** is the speed of system response to a user's action and has two components: the speed with which the system begins to respond and the speed with which it completes its response
- **tangibility** describes the extent to which the state of the system appears to the user to be visible and modifiable by physical apparatus.

Secondary Factors

- **sense of directness** is the user's degree of feeling that the changes on the screen are a direct result of the user's actions
- **sense of engagement** is the feeling that the system is holding an interesting, and even fascinating, conversation with the user
- **sense of text** is the user's grasp of the structural and semantic arrangement of the text — the absolute and relative location of each topic and the amount of space devoted to each.

The sense of text can be tested by assessing the spatial recall of subjects. Spatial recall is the ability to remember the page and line of specific items. The experimenters studied how spatial recall is affected by viewing a text on the computer screen and on paper. They hypothesised that spatial recall is different viewing text on a computer screen than reading from print.

Ten subjects were used in the experiment, five performing the task on paper and five on the personal computer. A text of a thousand words equivalent to nine pages or screens were given. The text screen was the same size as the paper page and was kept constant. The subjects were asked to place eight sentences from that text in the correct locations on a blank page or screen after viewing the text.

The results showed that readers can recall the location of information more accurately from paper than from a personal computer.

In the following experiment Hansen and Haas (1988) theorised that it would be easier to retrieve information to answer questions from paper than from a computer screen. Subjects were asked to find answers to questions from an 1,800 word text. There were three conditions:

- paper
- advanced workstation
- personal computer (green monochrome monitor) used as a terminal to a mainframe.

There were significant differences between the personal computer and the other two conditions (workstation and paper), which did not differ from one another. The personal computer took twice as long to retrieve information.

Most of the primary factors differed between the two computer conditions leading to better performance from the workstation. The reasons the authors give for the significant difference between the two computer conditions were that the workstation had:

- twice the size page
- serifed font and bold headings
- faster response rate
- scrollbar for moving through the document.

Hansen and Haas followed this experiment with one to isolate two of the factors from their previous experiment—page size and tangibility—and investigate the effect on subject's performance. The experiment compared performance for large and small windows and scrollbar and function keys. The task tested the ability of subjects to read critically to determine the correct arrangement of disordered text.

Results for mean time to complete the task showed paper was better than large windows which in turn were better than small windows. It was found that the method of moving through the text —scrollbar or function keys, made no significant difference.

Every experiment showed that Hansen and Haas performed showed that paper was superior for reading to any computer condition. The workstation results were closer to those of paper than those of the personal computer.

2.4. Learning

The effects of screen size (12 inch or 15 inch) and text layout (well structured or badly structured) on the learning of text when the text was displayed on a personal computer were studied by de Bruijn, de Mul and van Oostendorp (1992). The authors hypothesised that the study of text on a large screen would have better learning performance than when a small screen is used; or, if no difference in learning performance, that subjects need shorter learning times or need to invest less cognitive effort in the learning process. Secondly they suggested that a well-structured text would reduce learning time and cognitive effort.

Fifty-six university students were used in the experiment. A summary and a multiple-choice test were used to measure the amount of information remembered. Efficacy of learning was determined by learning time and by cognitive effort, measured by the performance on a secondary task.

Neither screen size nor text layout had a significant influence on the required cognitive effort or on the degree of learning. There was a significant effect of screen size on time to learn: subjects using a 15 inch screen required less learning time than subjects using a 12 inch screen. Learning performance was the same across both conditions. The subjects favoured a well-structured text more than an ill-structured text but this did not result in better learning, shorter reading time or less cognitive effort.

The authors suggested that more efficient integration processes in constructing the semantic representation are responsible for this reduction in learning time.

Even the length of words can affect the user's perception of text. Campos and Gonzalez (1992) gave subjects a list of pairs of words with one concrete and one abstract noun in each pair. They found that long nouns are more abstract, show less vividness of imagery, and have less meaningfulness than short nouns, although the meaning of words is controlled.

2.5. User Manuals

User manuals are an important text resource for computer users. Wright (1988) discusses the importance of design recommending that manuals should make information easy to find, easy to understand, and sufficient to undertake the task. Readers need to be able to find the information they are looking for and to understand it once found. Design features that make information easy to find are:

- consistency
- signposting
- arrangement.

Information is easy to understand that is:

- simple
- concrete
- natural.

Information sufficient to complete the task is:

- complete
- accurate

- exclusive.

Wright points out that people operating a computer system need the documentation on their screen because this involves a smaller disruption of the ongoing task than does turning to find a page in a printed manual. He also points out the benefits of online documentation:

- documentation can be displayed dynamically
- it can be easier to update online documentation
- online documentation can be made context sensitive.

Online computer documentation is defined by Shirk (1988) as "documentation written specifically for access only by means of a computer terminal". Her taxonomyis shown in Figure 1. It is seen that presentation of text becomes more important as the documentation increases in complexity.

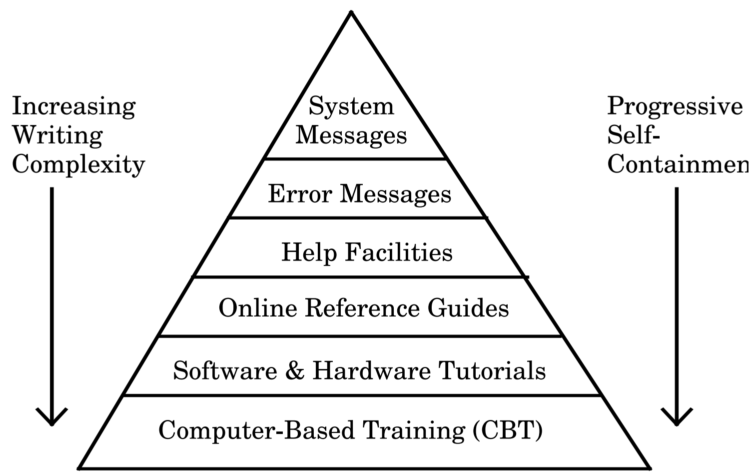

Figure 1: Taxonomy of online documentation (Shirk 1988)

Online documentation is utilised when:

- the paper manual is located away from the user
- the user hopes for a quick fix for the problem
- the paper manual is inadequate or does not provide an answer
- there is no paper manual e.g. shareware
- someone else has the manual
- the software is pirated (a potential purchaser may pirate the software to evaluate it).

2.6. Online Help

Online help is a prominent element of many interfaces for computer systems. At first, the text of online help was the same as the hard copy and was displayed on screen when the user required help. This overwrote the screen the user had been using. Currently online help systems provide a variety of types of help text.

Computer user documentation needs to be presented to the user in a way that facilitates the completion of tasks or the achievement of goals (Helander 1988). It should enable the user to understand and use the software. Online help is not just for novices (Horton 1988); experienced users also require its use.

Cherry, Fischer, Fryer, and Steckham (1989)[1] investigated the effects of the format used to display online help on user performance and attitudes.

The researchers hypothesised that the performance of application programmers on editing tasks would be best with windowed help and worst with full screen help. They also felt that attitudes would be most positive toward windowed help and least positive toward full screen help.

They found that there was no significant performance or attitude advantages for full screen, split screen or windowed help. Instead they observed that the quality of help text is an important factor in determining the effectiveness of an online help system. Comments from participants indicated that:

- there was too much information in help
- the task help unnecessarily repeated the field descriptions
- the paragraph format of the help text made it difficult to find specific information
- subjects could not readily find the information they needed.

In their experiment the help was written in a narrative style with headings followed by one or two paragraphs. The subjects were experienced programmers with IBM PC experience. The computers used were IBM PC XTs. The users spent more time with the split screen and windowed help because they had to scroll through a greater number of help panels and they were able to enter data while the screens were open.

The experimenters do not describe the format of their text apart from saying that it had headings and paragraphs. It is possible that the different conditions cancelled out the effects of different variables such as white space and text width. Another possible problem is that the monitors may have been low quality monochrome or CGA. It is possible that higher quality displays would improve the performance of windowed or split screen text.

[1]This article was first published as part of the 1988 Conference Proceedings of the Society of Technical Communication under a different title-(Cherry, J. M., B.M. Fryer, and M.J. Steckham 1988)

2.7. Presentation Of Text

Presentation of text is important because when searching text the eyes skim over the page guided by such text attributes as characteristic initials and word lengths. Conspicuous symbols, words, or entire fragments of text can draw the eyes (van Nes 1988).

One approach to screen design is to examine many software applications to see if there is a consistent design. A common design geometry indicates that the primary viewing area should be from columns 10 to 60 and from row 4 through 21 (Rubens and Krull 1988).

Kolers, Duchnicky and Ferguson (1981) used measurements of eye movements to assess the readability of CRT displays. A computer controlled the display of text on a television monitor while a television camera recorded eye movements as the subject read the text. The experiment aimed to duplicate the appearance of text as it would appear on a home television. The characters were 7 by 9 dot matrix with descenders and were displayed as light characters on a dark background. The text was displayed at 40 and 80 characters (which resulted in lines of 35 or 70 characters with the same length), single and double spacing, and five scrolling rates.

Twenty 300 word passages were used; each passage was followed by a set of ten questions. The questions were designed to test whether the subject had read the screen as half of the questions could not be answered from the passage.

Twenty texts and twenty conditions were presented to twenty subjects each in a different random order.

The analysis used the following performance measures:

1. total number of fixations to read a passage of text
2. number of fixations per line
3. number of words per fixation
4. rate of fixating including the duration of the fixation and the time the eye took to move from one fixation point to the next.
5. fixation duration
6. total time.

The condition with 70 characters per line resulted in almost double the fixations per line but with fewer total number of fixations, a larger number of words per fixation, longer fixation duration, and shorter total time. There was no significant difference in comprehension.

In their discussion, the authors suggested that because smaller, tightly packed characters require less work for the eyes, lines should be 80 characters rather than 40 characters. They also indicate that if character density is too great, line finding would be difficult.

This research is useful in that it shows that eye movements can be used to determine the legibility of text. It provides evidence that the format of text affects eye fixations and thus reading speed and efficiency. Their recommendation for 80 character lines appears to be the basis of present guidelines e.g. (Phillips and Crock 1992).

However the differences between the text shown to their subjects and that viewed on more recent terminals are quite dramatic. Their experiment used light text on a dark background with also runs counter to normal computer display practice and counter to recommendations (Phillips and Crock 1992). Another point to consider is that the when they refer to 40 and 80 character lines they mean a different size of font not different length of line.

Duchnicky and Kolers (1983) did further research on the readability of text as a function of window size. They used three different line lengths, two different character densities and five different window heights. Each of these variables significantly affected the speed of reading.

Subjects were presented text passages in different formats and allowed to control the scroll rate of the passage interactively. A format that used a higher scrolling rate was considered to improve readability. The experiment used 30cm black and white VT100 display terminals. The display characters were 7 × 9 dot matrix characters with 2-dot descenders. The 40 character full-width lines had 2.1 characters per cm and the 80 character had 4.2 characters per cm. This corresponds to a maximum line length of approximately 7·5 inches or 19 cm. The letter 'M' was 3 mm high for both conditions and 2 mm wide and 3 mm wide respectively.

The text width was divided into two formats, 80 and 40 characters per line, and three conditions:

- full width—78 characters and 39 characters
- two thirds—52 characters and 26 characters
- one third—26 characters and 15 characters.

The largest possible screen was 78 characters by 20 lines and the smallest was one line of 15 characters.

Lines that were either the full width of the screen or two-thirds of the screen showed a mean reading time 25% faster than lines of one-third screen width. When the text was displayed at 80 characters per line, reading speed was 30% faster than for 40 characters per line. Text in four line windows was read as well as text in twenty line windows. Text in one or two line windows resulted in a 9% slower reading rate. Comprehension was found not to vary as a function of window size.

Kearney (1988), in discussing the difference between print and online help, stated that online information had the following features:

- typically a single font
- only high-end monitors able to display graphics
- lines rather than pages
- 24 lines by 80 columns
- typically black and white or few colours
- non-portable terminals.

Improvements in computer technology have negated all of these observations. An entry-level IBM PC computer uses a SVGA screen and future improvements in screen size and resolution can be expected. A consequence of this is that a modern computer can display significantly wider texts with a much greater range of font size as well as font types, as shown by the data in Table 2.

Monitor	Number of dots	Descender	Characters per line	Height and width of 'M'	Max. width of line
VT100	7 × 9	2 dots	78	3 × 2	18·7 cm
SVGA	18 × 24	12 dots	93	5 × 4	25·5 cm

Table 2: Comparison of VT100 and SVGA video displays

The letter 'x' has 18 × 24 dots and the descender for the letter 'y' has 12 dots on a typical VGA screen displaying MS Serif 12 point font. The letter 'M' is 5 mm high and 4 mm wide. With the initial letter capitalised and the rest lower case the line length is 93 characters. The screen can be a maximum of 10 inches or 25·5 cm and with borders and window frames about 9·5 inches or 24 cm. Horton (1990) points out that resolution sets the smallest legible font size. According to Horton low cost monitors have a resolution of 50 dots per inch whereas expensive monitors have 100 dots per inch.

The situation is more complex than this. It is possible for a user to vary the font size and font type when using a graphics interface such as Windows3. It is possible that the greater widths now possible will affect the user more than the limited width of the VT100's. The increased screen resolution (see Table 2) means that the user can read text more comfortably and differences may become apparent that were not visible then.

Another problem with this research is that its prime concern was with the readability of scrolled text. The subjects used a knob to control the rate of screen scrolling. Most current display terminals do not have the facility. It could be made available with software but if it has been done it is very uncommon. In a typical windows system the user can either page through the display or use a scroll bar that moves the text. The scroll bar requires constant user interaction to keep the text moving. Duchnicky and Kolers (1983) suggested that the upward movement of the scrolling text made longer lines easier to read. This effect may not occur where the text is not scrolled for the user. Hansen and Haas (1988) found that the method of scrolling did not affect the mean time to complete a task where the subjects could scroll either by scroll bar or function keys.

Duchnicky and Kolers (1983) report that the two-thirds and full-screen widths produced equal reading times that were 25% faster than the one-third screen condition. It is not valid to extrapolate from this research and say that it does not matter how wide the screen is. A text width that ranges between 12·5 cm and 18·7 cm may, for computer screens, be reasonable for the reader whereas a line of 25·5 cm may not.

Tullis (1981) tested different display formats for a computerised telephone line testing system. He tested four different display conditions:

- Narrative used whole words and phrases and electrical measurements to show line testing results. A single sentence on the first line provided a summary of the test results.
- Structured displayed key information in a frame at the top of the screen. The results of the test were organised into logical categories. Electrical measurements were presented in tables. Data descriptions were reduced or deleted.
- Black-and-white graphics used the same format as the structured condition with a schematic of the telephone line. Various patterns and shapes indicated different aspects of the telephone circuit.
- Colour graphics used the structured format also but replaced shading with colour coding. Each of the eight subjects was trained and tested in ability to interpret the testing results. Questions were asked about the displayed information.

The experiment showed that accuracy did not significantly vary with format. However format did influence response time. Subjects graded the different formats on a scale from excellent to poor. Format was significant for these gradings. Colour graphics was preferred most and the narrative least. Overall the two graphic formats had shorter response times, fewer training exercises, and the subjective assessment of quality was higher. With additional practice the structured format resulted in response times equal to the graphic formats. Tullis recommends that structured information have the following features:

- key information displayed in a prominent position
- data should be logically chunked and each chunk kept separate
- a fixed, tabular format is the best presentation method
- the information should be concise.

Tullis (1983) estimates that, for the Bell System computer system (Automated Repair Service Bureau—ARSB), an additional 55 person-years would be needed to extract information if the time required for each screen was increased by one second. His 1981 study shows that by changing the screen format from a narrative to a structured format, savings in reading time of 3·3 seconds per screen are possible. This is a saving of 79 person-years.

Guidelines for screen presentation often recommend that screen design should minimize the complexity of presentation or maximise the visual predictability. A general technique for measuring the complexity of text presentation was described by Tullis (1983).

Rectangles are drawn around every distinct item on the page. The rectangles do not overlap. Each of these rectangles is an event. These events are used to provide measures of system order and distribution order. System order is a count of the unique widths and heights of each rectangle on the page (Bonsiepe 1968). Tullis argues that the concept of distribution order is more appropriate for computer displays and uses the formula :

$$C = -N\sum_{n=1}^{m} p_n \log_2 p_n$$

where:

C = complexity of the system expressed in bits

N = number of events either widths or heights

m = number of event classes (number of unique widths or heights

p_n = Probability of occurrence of the nth event class (based on the frequency of events within that class)

This formula is based on the work of Shannon and Weaver (1949) and provides a figure for the complexity of the page that can be used to compare different text presentations. Tullis applied this theory to his 1981 research on layout with the following results:

Narrative Format:

22 horizontal distances in 6 unique classes	=	41 bits
22 vertical distances in 20 unique classes	=	93 bits
overall complexity	=	134 bits

Structured Format:

18 horizontal distances in 7 unique classes	=	41 bits
18 vertical distances in 8 unique classes	=	93 bits
overall complexity	=	96 bits

If this theory is valid it should also apply to full text displays; a wider screen display is less complex because there are fewer lines of text on the screen for a given number of words.

2.8. Line Width

One book of guidelines (Document Design Project 1981) suggests for printed documents that too much or too little information on a line can make it harder to read. The best line length is between 50 and 70 characters. This line length is not so short that the reader's eyes must keep jumping from line to line and not so long that the eyes become tired. The length of the line is affected by the font as well as by the number of characters.

Horton (1990) states that longer lines are tiring to read, harder to find the start of the new line, and require more saccades per line.

Most guidelines refer to the work of Tinker and Paterson (1969) when recommending line width. Their influential research on the legibility of print was carried out between 1940 and 1969 when Tinker's book "The Legibility of Print" was published. These experiments dealt with printed material and were intended to provide guidelines for newspaper and book publishers.

The first investigation involved determining just what line widths were in use. They surveyed 1,500 journals and books. The most common line width for journals was near 24 picas or about 4 inches and for books around 21 picas or 3·5 inches.

In an experiment using 10 point type set solid and with 435 readers, Tinker and Paterson found that very short lines of 9 picas (about 1·5 inches) and very long lines of 43 picas (about 7·2 inches) were read significantly more slowly than widths in between. The 43 pica and 9 pica lines were also judged least legible by 224 readers.

In another experiment, the eye movements of the subjects were analysed. The fixation frequency, pause duration, and perception time were significantly larger for both 9 pica and 43 pica lines compared to 19 pica lines. However, they also found that the 43 pica lines had an increased regression frequency of 56·7%. The major problem the subjects had was in finding the beginning of each new line. They hypothesised that this upset the usual reading process and hindered the re-establishment of efficient eye movements for each line.

Their next two studies looked at 12 point type, set solid and with 2 point leading respectively. The first study ranged from 17 to 45 picas. Line widths from 17 to 37 picas were found to be equally legible but line lengths of 41 and 45 picas significantly slowed reading speed. The second experiment also found that the longer lines of 41 picas slowed reading speed as did short lines of 9 picas.

2.9. White Space

White space, the blank areas on the screen, is considered a desirable feature. Gribbons (1988) states that using white space appropriately affects the legibility and attractiveness of text. Horton (1990) classifies white space into active and passive. Active white space serves to organise information whereas passive white space distinguishes information from its surroundings.

Margins are passive white space necessary for people reading paper documents. Margins enable the text to stand out from the other objects in the reader's view and allow the reader to turn pages without obscuring text. Horton claims that margins are not required for screen displays because the window border and screen bezel separate the text from the surrounds. This is also supported by Kearney (1988) who unequivocally states that right and left margins should be eliminated. However, neither author offers any experimental evidence to support their assertions.

Horton (1990) does qualify this observation; information should not be packed too tightly where the user will scan the text. He advocates that text for continuous reading should be condensed based on the work of Tullis (1981) but does not provide any indication of the factor by which it should be condensed. He does believe that active white space is important to separate different parts of the text and highlight relationships. This observation conforms with Tullis's (1981) use of structure to make displays more readable. Structuring text necessarily creates more white space than unstructured text.

Rubens (1986) provides another recommendation for the placement of text. He suggests a ten character margin. Surprisingly Horton advocates this layout even though previously stating that margins were unnecessary for screen displays.

Smith and McCombs (1971), in their paper based research, predicted that readers would prefer a story with extensive white space to a story with less white space. They used four versions of the same story:

- version 1 - low white space, longer words and sentences
- version 2 - low white space, shorter words and sentences
- version 3 - large amount of white space, longer words and sentences
- version 4 - large amount of white space, shorter words and sentences.

The extra white space was made by breaking the text into more paragraphs and using more open punctuation. The hypothesis predicted that readers would prefer version 1 the least and version 4 the most.

The text was set in fully justified 2 inch columns, printed and transferred to slides in side-by-side pairs in all possible combinations. Twenty-four subjects were used. The experiment was divided into three phases. During the first phase, subjects were allowed one second to view the text and then were required to choose which column of text would be preferable to read. For the second phase, the subjects read the same slides for six seconds and were asked to choose based on the appearance and reading ease of the text. They were not told that it was the same text.

The third phase involved each subject reading one of the four versions of the story, rating it on a five point scale for dislike/like, difficult/easy, and boring/interesting. They were then required to answer a ten-question quiz testing comprehension of the material.

The results were arrayed on an interval scale of preference using Thurstone's paired-comparisons technique. This technique involves the assignment of scale values to statements and asking subjects to respond to the statements (Zikmund 1991). The data supported the theory; reader preference improved for the shorter words and sentences and for more white space. The results of the comprehension tests showed no differences between conditions.

This research provides evidence that active white space is important to reading preferences and supports Horton's (1990) contention that active white space helps to organize information. Unfortunately the researchers did not indicate the margins that were used nor did they collect any data on reading speed.

3. METHODOLOGY

3.1. Subjects

Thirteen undergraduates of the University of New England, Northern Rivers volunteered to sit for the experiment. No compulsion in any form was applied to the subjects apart from appeals to their altruism. Sessions were conducted at times to suit the subjects. The subjects were told that the experiment would take between half and one hour.

All subjects had some experience with the operating environment and with the subject matter (Microsoft Word) of the text passages.

Subjects were presented with the following instructions:

- This is not a test of how fast you can go or how well you do. Please act as if you were genuinely consulting help files.
- Take care using the mouse.Do not double click. If you do make a mistake, call me and I will see what I can do.
- After every set of questions there is a screen called next - if you require a rest, stop at this point.
- You will be asked to rate the screen of text - do not base your assessment on the font used.

3.2. Design

The independent variables, width and white space, were arranged in a repeated measures, two factors design. The width of the text was varied in 1 inch increments from 2 inches to 9 inches and the text passages had either passive white space or no passive white space. Thus there were 16 different text passages to be read by each subject. See Figure **Error! Bookmark not defined.** for an example of the 2 inch no white space condition and see Figure **Error! Bookmark not defined.** for an example of the 5 inch white space condition.

Figure 2: 2 inch no white space condition

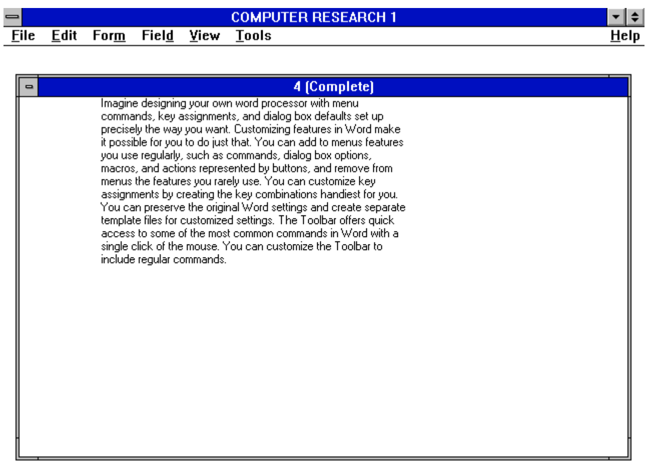

Figure 3: 5 inch white space condition

The text passages were taken from the "help" files of Microsoft Word 2.0. Each passage was edited to fit the 2 inch wide block so that there were approximately 150 words in each passage.

The text passages were presented in random order to balance out learning and fatigue effects. The text was varied for each subject so that no two subjects had the same text for any condition to balance any effects from differences in text.

3.3. Data Collection

The software automatically recorded the time to read each passage of text and the time to answer each set of questions for each subject.

After reading each text passage, each subject was required to rate readability on a scale from very good to very poor. This was done by left clicking the mouse button to select the appropriate option. This gave the "satisfaction" rating for each screen condition.

The rating question was followed by three questions based on the passage just read. The subject was presented with four or five possible answers including a "Do not know" option. Again the mouse was used to register the chosen option. The score for the three questions was totalled and the result stored. This gave a "comprehension" score for each passage.

At the end of the experiment subjects were given the opportunity to record any comments they wished about the experiment. These were stored in a separate file.

3.4. Method of Collection

Introduction

A laboratory experiment was chosen to test the hypotheses and to collect data. An experiment has the advantages of being able to control conditions such as font whilst changing the variables of interest. The software enabled the easy and accurate collection of subject responses and measurement of reading and answering times.

A test instrument was developed to run on IBM PC compatible computers using Windows 3.1 and VGA terminals. Subjects were asked to read a short passage of text and then answer some brief questions about the passage.

Design of Test Instrument

The software was constructed using Objectvision. Objectvision is an object oriented, graphics-based, front end program designed to build simple Windows database applications. Building a program in Objectvision consists of:

- creating forms
- applying rules
- reading from files
- writing to files.

Compared to normal programming environments such as COBOL, C, and Pascal, Objectvision has a number of peculiarities. The important ones to this project are:

- Individual data items cannot be stored or read; only a tuple or row of data.
- Every data field name, every button name and every form name must be distinct as most objects are global. Thus if a button is named "Button A", another "Button A" cannot be created. If "Button A" is copied to another form then it will not only be identical but any changes to the actions for the copy will also change the original. Different objects can have the same name.

- Objectvision dispenses with iteration. Figure 4 appears to show iteration but this is a simplification. The apparent iteration is achieved by a series of conditional statements. This can be seen be referring to Appendix D where the form "Next Screen" controls the order of text screens.
- Objectvision applications are not compiled and there is no series of instructions as there is for standard computer languages.
- If there is a valid value in a data field that is a key to an indexed database file then Objectvision can provide a read link to that database file. For this program, this means that a valid subject id number will mean that the rest of any tuple will also be displayed in any relevant fields. Thus the width codes and screen order numbers are read from database files as soon as a valid subject id is entered.

An overview of the structure of the program can be seen in Figure 4. The structure of the program is very simple.

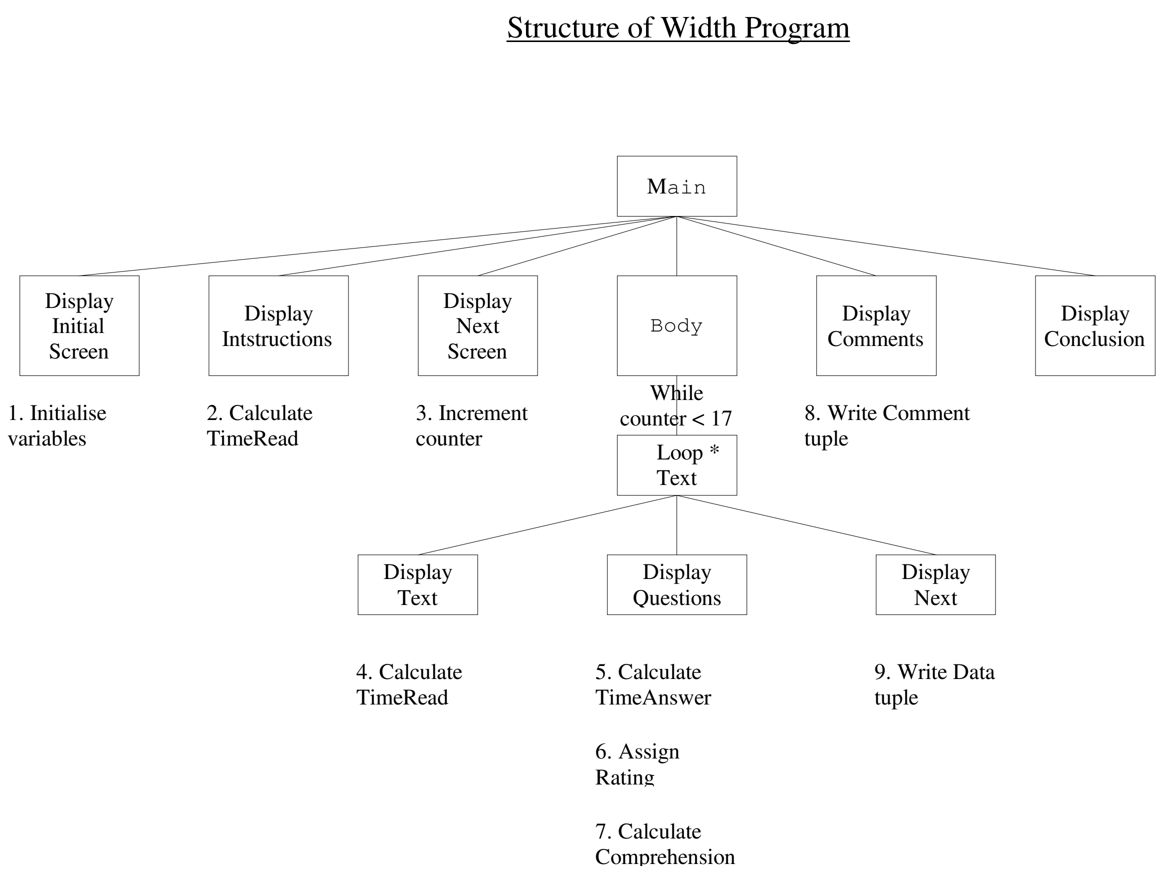

Figure 4: Structure chart for the Objectvision program

When the "Initial Screen" form is opened all data fields are cleared. This is necessary as the program was designed to be used repeatedly. Unless cleared, the data fields would contain and display the previously entered values. Literals are assigned to the variables so that the data file contains the names of the variables, making importing of the values easier. Entering a valid subject id number (hard coded for the first sixteen subjects) automatically locates and reads into the program the correct tuple in the database files for the order of screens and the order of conditions.

When the subject is ready, the "Begin" button is clicked. A check is made to determine if a valid subject number was entered. The program was designed to handle up to fifty subjects with the first 16 subjects to be assigned to different runs. Thus the first 16 versions of the program had the subject id hard coded. When a valid subject id is entered the "Initial Screen" is closed and the "Instructions" form is opened.

On closing the "Initial Screen" the form counter is initialised to 0, a code is assigned preparatory to displaying the next screen, and a starting time for the experiment is assigned.

Opening the "Instructions" form assigns a starting time for reading the form. This data was not used in the analysis. Clicking the mouse anywhere inside the form initialises the form counter, closes the form and opens the "Next Screen"' form. When the form is closed the code for the introduction screen and the time taken to read it are assigned.

On opening the "Next Screen" form, the form counter is incremented. Clicking the button labelled "Next Screen" on the form selects the next form to appear depending on the value of the counter. This also closes the form and assigns the appropriate code for the text condition. When the form is closed the tuple is written to the data file.

The next screen the subject sees is the first text passage. The screens are labelled 1 to 16. This makes it possible to use a database file to control the order of screens. Instead of Objectvision being asked to open a form with a literal as is normally done, the open action is asked to open a variable, Form 1 in this case. The form labelled "1" has text about the template features of Word for Windows. Opening the form assigns the time on the system clock to the variable TimeStart. Clicking anywhere in the window closes the form and selects the form "Template". In Appendix D, this is the page labelled "Text Item - Strip 1 of 1". Closing the form assigns the present time to TimeEnd. Objectvision expresses time as a decimal. The formula:

+86400*(TimeEnd-TimeStart)

converts the time to seconds. This result is assigned to SpeedRead1 initially and then assigned to TimeRead (during program development, each data item was assigned to a separate variable to aid debugging. As this feature may prove useful in the future this was left intact).

The form labelled with the description of the text, "Template" in this case, has the rating and comprehension questions. Opening the form assigns the time to

TimeStart. Clicking the button "End Template" activates a simple decision tree which will not let the user proceed if all the questions have not been answered. If the form has been completed then the code:

```
@IF(@LEFT(Template
1,1)="1",@ASSIGN(Template,1),@ASSIGN(Template,0))
@IF(@LEFT(Template 2,1)="3",@ASSIGN(Template,Template+1),0)
@IF(@LEFT(Template 3,1)="1",@ASSIGN(Template,Template+1),0)
```

strips the numbers from the selected answers and adds the number to the variable "Template" if the answer was correct. The same logic is followed for each different text screen. When the form is closed the time is assigned to TimeEnd and the time to answer the questions, TimeAnswer is calculated as for TimeRead. The comprehension score, "Template", is assigned to score and the satisfaction rating, R_Template, is assigned to ScreenRate.

The program then opens the "Next Screen" as before where the data in the variables TimeRead, TimeAnswer, Score and ScreenRate are written to the data file.

When the counter reaches 17, all the text passages have been viewed and the penultimate screen "Comments" is opened. This screen allows the subject to enter any comments about the experiment. When closed, the comments and the time the experiment took to complete are saved to the comments file. The completion time was not used in the analysis. The final screen thanks the subject.

Appendix D provides more detail of the program design. Most objects within Objectvision can have actions assigned to them and along with the actions decision trees can be constructed. Appendix D shows a subset of the actions and decisions used in this program. This output is generated by Objectvision and unfortunately does not list all the statements associated with the action. Not all of the decision trees have been printed as essentially the same rules are followed each pass of the loop.

Description of Software

The mouse is used to select answers and to continue with the next screen allowing for direct comparisons between the times for each screen as the subject did not have to hunt for different keys. The only typing the subject is required to do is to enter comments at the end of the experiment.

The first screen ("INITIAL SCREEN") is used to verify the subject identification number.

The second screen ("INSTRUCTIONS") provides a standard set of instructions for each subject and gives a standard reading time for each subject.

The third screen ("NEXT SCREEN") appears at this point and after each set of questions. It provides three functions:

- it allows the user a chance to rest so that fatigue is less of a factor
- it provides a more reasonable simulation of real life usage of online documentation
- it increments a counter that controls the order of screens.

The sixteen text screens, detailed in Appendix A together with associated question screens, appear in random order for each subject. Table 3 shows the order of presentation of text screens for the thirteen subjects. The column heading "**Id**" refers to the unique identifier for each subject. The column headings "**1**", "**2**" etc refer to the order in which the screens are displayed i.e. 1 is displayed first and 16 is displayed last. The numbers in the cells refer to the form number. Thus Subject 1 viewed Form 1 first, followed by Form 11 and so on finishing with Form 10. Each passage of text is associated with a form number throughout the experiment e.g.. form 1 has the passage describing templates. Numbers are used to allow Objectvision to display screens in different orders. This information is stored in a database table and accessed by Objectvision.

	Order of Screens - 1 → 16															
Id	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
1	1	11	3	7	9	14	12	16	5	13	15	4	2	8	6	10
2	13	6	5	8	11	14	16	3	15	1	2	7	12	9	10	4
3	14	13	10	16	6	7	2	3	15	12	11	8	9	1	4	5
4	12	15	2	10	9	4	5	1	8	6	14	11	3	7	16	13
5	15	11	13	3	10	7	1	4	16	6	14	2	9	5	8	12
6	7	5	8	3	9	13	11	10	12	6	1	15	4	16	2	14
7	4	5	1	2	8	11	13	6	15	14	9	7	16	12	3	10
8	10	8	7	1	12	5	14	16	15	11	4	3	2	6	13	9
9	4	1	11	7	6	10	13	9	14	12	8	16	3	5	2	15
10	3	6	11	14	15	9	10	7	5	1	8	4	16	13	2	12
11	14	16	13	10	2	11	4	7	5	12	3	9	1	6	15	8
12	10	13	6	2	15	14	1	5	12	16	3	8	7	11	4	9
13	14	11	7	1	4	8	6	12	13	10	16	5	2	3	9	15

Table 3: Order of presentation of text screens for all subjects

For each of the subjects, text width and white space are systematically assigned to a different screen number. The effects of differences in text are then evenly distributed. Each experimental condition is assigned a code:

w = White Space
n = No White Space
2 = 2 inch .... 9 = 9 inch

Thus "w2" is the condition where the text is in a 2 inch wide block, a 1 inch margin on the left and the remainder of the window white space. Similarly "n4" is the condition where the text is in a 4 inch wide block and the window frame is as close to the text as possible i.e. no margins (see Appendix A for the complete program for Subject 1). Table 4 in conjunction with Table 3 shows the order of the assignment of conditions to screens. As before, "**Id**" is the subject number and the "**F**" stands for Form. Thus Subject 1 sees Form 1 first. Form 1 is a "White Space" condition and the text is 2 inches wide. The next screen is Form 11. Form 11 is a "No White Space" condition and the text is 4 inches wide.

	Form Number															
ID	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**	**F9**	**F10**	**F11**	**F12**	**F13**	**F14**	**F15**	**F16**
1	w2	n4	w4	w8	n2	n7	n5	n9	w6	n6	n8	w5	w3	w9	w7	n3
2	n7	w8	w7	n2	n5	n8	w2	w5	n9	w3	w4	w9	n6	n3	n4	w6
3	n9	n8	n5	w3	w9	n2	w5	w6	w2	n7	n6	n3	n4	w4	w7	w8
4	n8	w3	w6	n6	n5	w8	w9	w5	n4	n2	w2	n7	w7	n3	w4	n9
5	w4	n8	w2	w8	n7	n4	w6	w9	w5	n3	w3	w7	n6	n2	n5	n9
6	n5	n3	n6	w9	n7	w3	n9	n8	w2	n4	w7	w5	n2	w6	w8	w4
7	n3	n4	w8	w9	n7	w2	w4	n5	w6	w5	n8	n6	w7	w3	n2	n9
8	w2	n8	n7	w9	w4	n5	w6	w8	w7	w3	n4	n3	n2	n6	w5	n9
9	n5	n2	w4	n8	n7	w3	w6	w2	w7	w5	n9	w9	n4	n6	n3	w8
10	n5	n8	w5	w8	w9	w3	w4	n9	n7	n3	w2	n6	n2	w7	n4	w6
11	w9	n3	w8	w5	n5	w6	n7	w2	n8	w7	n6	w4	n4	n9	n2	w3
12	w6	w9	w2	n6	n3	n2	n5	n9	w8	n4	n7	w4	w3	w7	n8	w5
13	n3	w8	w4	n6	n9	w5	w3	w9	n2	w7	n5	w2	n7	n8	w6	n4

Table 4: Experimental condition associated with each screen

Thus the order of presentation of the text for each subject is given in Table 5. As can be seen from this table, no subject viewed the same order of presentation.

	Screens															
ID	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**	**F9**	**F10**	**F11**	**F12**	**F13**	**F14**	**F15**	**F16**
1	w2	n8	w4	n5	w6	w9	w5	n3	n2	w3	w7	w8	n4	n9	n7	n6
2	n6	n8	n5	w5	w4	n3	w6	w7	n4	n7	w8	w2	w9	n9	w3	n2
3	w4	n4	n7	w8	n2	w5	n8	n5	w7	n3	n6	w6	w2	n9	w3	w9
4	n7	w4	w3	n2	n4	n6	n5	n8	w5	w8	n3	w2	w6	w9	n9	w7
5	n5	w3	n6	w2	n3	w6	w4	w8	n9	n4	n2	n8	w5	n7	w9	w7
6	n9	n7	n8	n6	w2	n2	w7	n4	w5	w3	n5	w8	w9	w4	n3	w6
7	w9	n7	n3	n4	n5	n8	w7	w2	n2	w3	w6	w4	n9	n6	w8	w5
8	w3	w8	w6	w2	n3	w4	n6	n9	w5	n4	w9	n7	n8	n5	n2	w7
9	n8	n5	n9	w6	w3	w5	n4	w7	n6	w9	w2	w8	w4	n7	n2	n3
10	w5	w3	w2	w7	n4	n7	n3	w4	w9	n5	n9	w8	w6	n2	n8	n6
11	n9	w3	n4	w7	n3	n6	w5	n7	n5	w4	w8	n8	w9	w6	n2	w2
12	n4	w3	n2	w9	n8	w7	w6	n3	w4	w5	w2	n9	n5	n7	n6	w8
13	n8	n5	w3	n3	n6	w9	w5	w2	n7	w7	n4	n9	w8	w4	n2	w6

Table 5: Order of Text Conditions for Each Subject

3.5. Treatment of Data

The times for reading and answering questions were calculated in Objectvision as decimal numbers. The results of the time calculations were converted to seconds and rounded to whole numbers.

The data from each subject was saved to a text file. Each text file was loaded into a database program, Microsoft Access, and imported into a single table. The query features of the database were used to re-order the data into a form suitable for analysis. The data was then exported into the Microsoft Excel spreadsheet program for statistical analysis.

4. ANALYSIS OF DATA

4.1. Hypotheses and Null Hypotheses

Expectations of previous research are that text width and passive white space are important to reading speed, comprehension and satisfaction. On the basis of the literature, it would be reasonable to expect that:

1. Comprehension of text increases as the width of text increases until an optimum point is reached, at 5 inches. Thereafter comprehension decreases.
2. Speed of reading increases as the width of text decreases from 9 inches to 2 inches.
3. Readers will experience greatest satisfaction with text that is 5 inches wide and less satisfaction with text that is wider or narrower.
4. Text without passive white space (removing margins) is more difficult to comprehend than the equivalent text with margins.
5. Text without passive white space is slower to read than text with white space.
6. Text without passive white space is less satisfying to read than text with white space.

This study determines if there is a relationship between the dependent variables

- reading speed
- comprehension
- satisfaction

and the independent variables

- width of text
- amount of white space.

The hypotheses and null hypotheses tested are:

1. H_O: The means for width of text and reading speed are equal.
2. H_O: The means for width of text and time required to answer questions are equal.
3. H_O: The means for width of text and comprehension are equal.
4. H_O: The means for width of text and satisfaction with the readability of the text are equal.

5. H_O: The means for passive white space and reading speed are equal.
6. H_O: The means for passive white space and time required to answer questions are equal.
7. H_O: The means for passive white space and comprehension are equal.
8. H_O: The means for passive white space and satisfaction with the readability of the text are equal.

4.2. Results and Discussion

The means and standard deviations for the independent variables are presented in Table 6. Time Read is the time it took for the subject to read the text passage. Time Answer is included as the time it takes a person to answer questions is another aspect of comprehension. Comprehension is the score obtained for questions about the text passage. Satisfaction is the legibility rating given to the text passage just read. This table provides an overview of the results obtained from the experiment.

MEANS AND STANDARD DEVIATIONS FOR INDEPENDENT VARIABLES								
	Time Read		Time Answer		Comprehension		Satisfaction	
Width	M	SD	M	SD	M	SD	M	SD
NO WHITE SPACE								
2 Inch	62.31	29.72	34.85	16.52	2.46	1.13	1.92	0.95
3 Inch	64.31	26.31	36.69	24.14	3.00	1.29	1.77	1.17
4 Inch	68.85	28.98	38.15	19.54	3.00	1.08	1.77	0.93
5 Inch	66.69	23.87	54.38	46.74	3.15	1.21	1.69	1.03
6 Inch	64.08	24.14	32.85	19.65	2.77	0.83	1.92	0.86
7 Inch	68.62	24.53	36.08	20.02	2.38	0.96	1.92	1.04
8 Inch	64.62	29.68	42.69	26.15	3.23	1.30	1.69	0.85
9 Inch	59.62	34.03	35.15	19.51	2.46	1.20	1.77	1.01
WHITE SPACE								
2 Inch	69.00	23.36	37.38	21.26	2.62	1.33	1.92	1.12
3 Inch	69.54	25.00	36.08	26.95	3.38	1.19	1.85	0.99
4 Inch	60.54	18.76	38.00	21.46	3.31	0.63	1.85	0.99
5 Inch	66.00	20.42	37.38	18.49	3.46	1.20	1.69	0.85
6 Inch	58.69	16.97	38.15	15.21	3.23	1.01	1.62	1.04
7 Inch	57.08	17.39	30.54	14.89	3.15	0.90	1.92	1.12
8 Inch	65.69	24.75	33.31	11.98	2.92	0.76	1.85	0.90
9 Inch	62.15	17.60	33.00	11.99	3.08	0.95	1.85	0.80

Table 6: Means and standard deviations for width and white space for reading times, answer times, satisfaction and comprehension

4.2.1. Time to Read Text.

The expectation that text width and passive white space are important to reading speed was not confirmed. The average times that subjects took to read the text passages are shown in Figure 5. The hypothesised curve was not realised. The narrowest screens were not the quickest to read. White space did not necessarily improve reading speed. The 9 inch no white space condition proved almost as quick to read as the 8 inch white space condition.

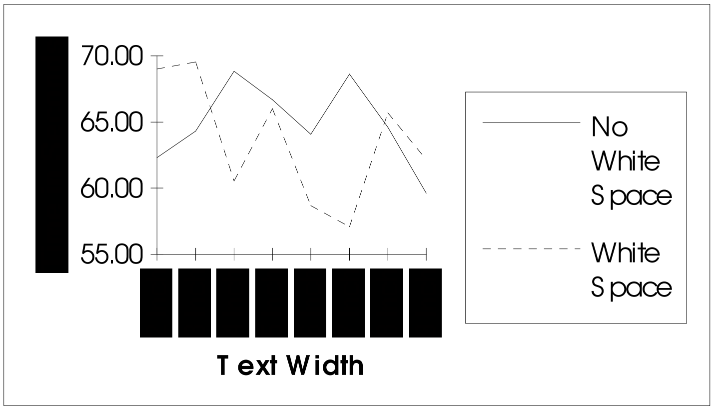

Figure 5: Comparison of average reading times

The summary for the repeated measures two factor design on reading times is shown in Table 7. The results show that there is no significant relationship at the 20% level between widths, white space or interaction between width and white space for reading times.

Time to Read					
Source	SS	df	ms	F	p
Total	118879.50	207			
Subjects	51513.64	12			
White	87.62	1	87.62	0.17	n.s.
Width	936.73	7	133.82	0.41	n.s.
White x Width	1936.34	7	276.62	0.75	n.s.
Error white	6155.07	12	512.92		
Error width	27355.60	84	325.67		
Error white x width	30894.47	84	367.7913		

Table 7: Summary of Analysis of reading times

A possible explanation of the non-significant results for reading time and width can be obtained from cognitive studies of reading which have shown that finding the start of the next line in a normal passage of text can take about 40 ms (Singer and Ruddell 1985). The text passages as used here varied between 7 and 30 lines. This means that the cost in reading time between the widest and narrowest conditions would only be 1 second. The widest screens did not give a result uniformly one second longer than the narrowest screens therefore it can be inferred that differences in the text and reading ability were more important to reading time than the cost of finding the next line.

4.2.2. Answer Times

The answer times also failed to show the expected relationship for comprehension as can be seen from Figure 6. The 7 inch white space condition was the quickest to answer but the 6 inch no white space was almost as quick. Text without white space was not always more difficult to answer.

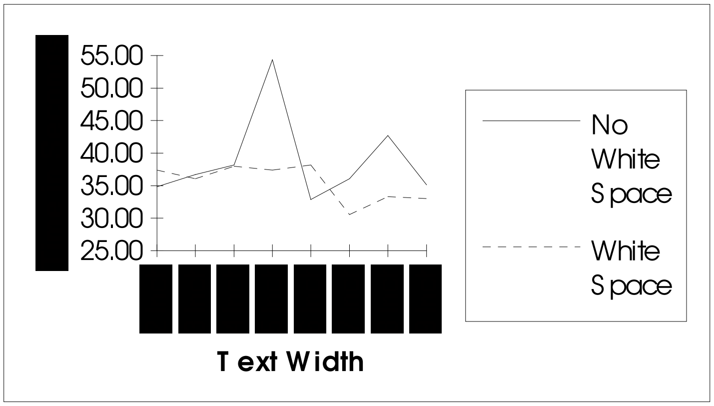

Figure 6: Comparison of average answer times

The repeated measures two factor design was used to test for a relationship between the variables. The summary of the analysis is shown in Table 8. There is no significant relationship at the 20% level between widths, white space or interaction between width and white space for answer times.

TIME TO ANSWER					
Source	SS	df	ms	F	p
Total	101603.10	207			
Subjects	42057.67	12			
White	592.31	1	592.31	2.45	n.s.
Width	2767.92	7	395.42	1.18	n.s.
White x Width	2315.80	7	330.83	1.21	n.s.
Error white	2907.00	12	242.25		
Error width	28032.02	84	333.71		
Error white x width	22930.38	84	272.98		

Table 8: Summary of analysis of answer times

The results for comprehension also show no relationships. The graph in Figure 7 does not show a regular relationship between width and comprehension. White space does not reliably improve comprehension.

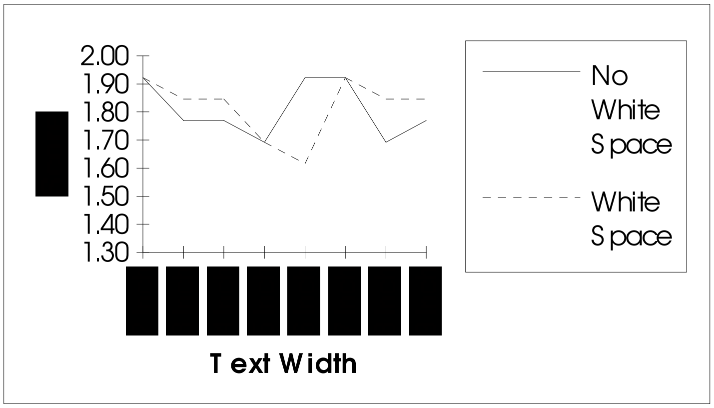

Figure 7: Comparison of average comprehension scores

The repeated measures two factor design was also used to test this relationship. The summary of the analysis is shown in Table 9. There is no significant relationship at the 20% level between widths, white space or interaction between width and white space for comprehension scores.

	COMPREHENSION				
Source	SS	df	ms	F	p
Total	187.69	207			
Subjects	14.63	12			
White	0.00	1	0.00	0.00	n.s.
Width	1.11	7	0.16	0.18	n.s.
White x Width	0.88	7	0.13	0.12	n.s.
Error white	11.68	12	0.97		
Error width	73.45	84	0.87		
Error white x width	85.93	84	1.02		

Table 9: Summary of analysis of comprehension scores

Figure 8 shows that the satisfaction rating appears to slightly improve as text width increases to 5 inches and then drops with the exception of the 7 inch no white space. There does seem to be a consistent preference for white space over no white space. The graph does support the hypothesis that the greatest satisfaction will be with text that is 5 inches wide except for the anomalous 7 and 8 inch no white space conditions.

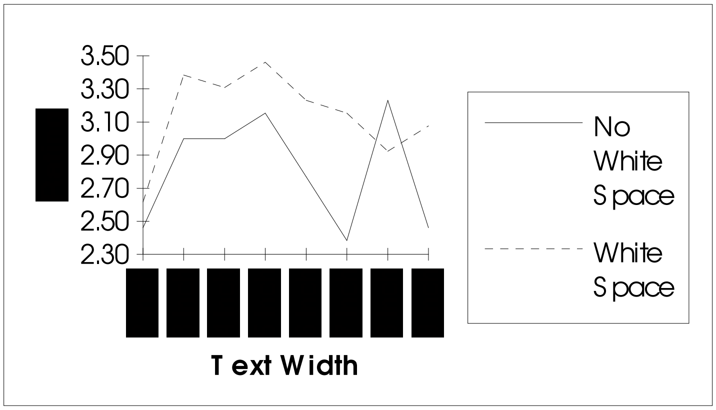

Figure 8: Comparison of average satisfaction rating

Table 10 shows the results of the analysis using the repeated measures two factor design. There is no interaction effects between width and white space. There is a significant relationship at the 5% level between text width and satisfaction and between white space and satisfaction.

	SATISFACTION				
Source	SS	df	ms	F	p
Total	246.88	207			
Subjects	95.32	12			
White	5.89	1	5.89	3.62	<.05
Width	12.38	7	1.77	2.49	<.05
White x Width	4.76	7	0.68	1.16	n.s.
Error white	19.55	12	1.63		
Error width	59.68	84	0.71		
Error white x width	49.30	84	0.59		

Table 10: Summary of analysis of satisfaction rating

4.2.4. Comments by Subjects

The following comments from subjects showed that some did have strong feelings about text presentation:

- Subject 1 "When the text was listed across the page in a lengthy form, my eyes had to move more then what was comfortable to read off the screen."
- Subject 9 "The smaller boxes with a few lines were hard to read, also hard to read were the long narrow boxes. The more squarer the box the easier it was to read."
- Subject 10 "The text which I found best to read were the ones in narrow vertical columns and a large box around the outside of the screen. The one which I found hard to read were long horizontal ones with a box encasing the text tightly."
- Subject 13 "The narrow texts are a real pain in the butt, so are the wider ones."

These attitudes were reflected in the graphs and analysis and provide confirmation of the significance of the statistical results for satisfaction. The remaining subjects did not feel strongly enough to record comments about text presentation.

5. Summary and Conclusions

5.1. Introduction

The results do not support the hypotheses that text width and passive white space are important to reading speed and comprehension where text passages are short and displayed on a computer monitor. However, satisfaction increases for text as it approaches 5 inches and is greatest for the white space condition.

The effects of fatigue, learning, and differences in text were controlled for by varying the order of presentation and assignment of text to different conditions. The computers and monitors used were identical and ran identical software. The subjects viewed the text under very similar conditions. Therefore it appears that individual differences in reading abilities are more important to reading speed and comprehension than text width and white space. The presentation does affect the attitude of the user to the legibility of the text.

5.2. Findings About Hypotheses

Width Of Text And Reading Speed

Kolers, Duchnicky and Ferguson (1981) reported improved reading speed for 80 character lines against 40 character lines. However, when they refer to 40 and 80 character lines they mean a different size of font not different length of line. They examined actual line width in another experiment, (Duchnicky and Kolers 1983), where they found that full and two-third width lines were read 25 % faster than one-third width. Their results may have been significant because the combination of low screen resolution and narrow width may have made the text in the one-third condition very difficult to read.

Tinker and Paterson's work (1969) tested line length for print media and found that wide and narrow lines were slower to read. It seemed reasonable to expect that reading a modern computer display would be comparable with reading print and show the same differences. One possible explanation is books can be held by the reader at any angle whereas a computer monitor is usually vertical. This may affect reading times. Another explanation is that, despite improvements in screen display technology, a computer monitor still cannot be compared directly to print media.

Width Of Text And Comprehension

This experiment failed to prove a relationship between width and comprehension. This result disagrees with Hansen and Haas (1988) who listed the increase in page size as leading to better learning performance from the workstation. They did not test for the effect of different page size on the one computer. The other factors in their list could have caused the difference in results.

The experiment agrees with de Bruijn, de Mul and van Oostendorp (1992) where comprehension was found to be not affected by different screen sizes. They did find that learning time was affected by screen size. However an examination of the details of the experiment shows that both monitors displayed 80 characters per line so that the experiment investigated different numbers of lines on the page not page size. They also used a number of pages of text.

Kolers, Duchnicky and Ferguson (1981) also found that comprehension was not affected by differences in text presentation as did Cherry, Fischer, Fryer, and Steckham (1989).

Width Of Text And Satisfaction With The Readability Of The Text

The significant result for width of text and satisfaction was not supported by the experiment of Cherry, Fischer, Fryer, and Steckham (1989). They found no significant attitude advantages for full screen, split screen or windowed help. Participant's comments indicated that the quality of the help text was an important factor in determining the effectiveness of an online help system for their experiment. It appears from the authors' comments that there were many features of the help text that the subjects were not happy about. These problems may have led to the difference in results.

Tinker and Paterson (1969) also reported that subjects judged medium length lines as being more legible.

Passive White Space And Reading Speed, Comprehension Satisfaction

The literature search for this thesis showed that white space has had very little investigation. Often it is included in studies as part of some other variable without being specifically mentioned. For example in the study of de Bruijn, de Mul and van Oostendorp (1992), well-structured text was described as:

- having paragraph headings in the left-hand margin
- reasons, features etc numbered
- left hand margin a maximum of 28 characters
- a text line of 52 characters
- paragraphs separated by a blank line.

Thus there are two types of white space included in this study: active white space between paragraphs and passive white space in the left-hand margin. They did agree that comprehension had no effect and that satisfaction was significant.

Tullis (1981) did find a significant difference in response times and satisfaction when using structured text. This provides partial corroboration of the findings that white space is more legible than no white space. However structured text includes both active and passive white space. Tullis' results may have been significant because of increased spacing between items or only because of margins. This highlights the need to be precise when describing text formatting.

Smith and McCombs (1971) also found that the white space or no white space had no effect on comprehension and had a significant effect on satisfaction.

The most likely reasons for the lack of interest in white space are:

- difficult to measure
- often expressed as something else e.g. leading, margins
- often expressed as part of something else e.g. well-structured text
- difficult to define
- inferred from some other variable e.g. measurements of text density imply corresponding white space
- until recently white space was not readily achievable on a normal computer monitor.

Summary

Table 11 and Table 12 summarise the results reported in the literature for research on text width and white space compared with the results for this study. The column headings for the dependent variables show the variable name and result. For each study either the variable was not reported, a similar result was found (agree) or a different result (disagree) was reported.

Comparison of Research on Width			
Study	Reading Speed no effect	Comprehension no effect	Satisfaction significant effect
This research	agree	agree	agree
Cherry (1989)	not reported	agree	disagree
de Bruijn (1992)	not reported	agree	not reported
Hansen (1988)	not reported	disagree	not reported
Kolers (1981)	disagree	agree	not reported
Kolers (1983)	disagree	agree	not reported
Tinker (1969)	disagree	not reported	agree

Table 11: Comparison of results reported in literature for width

Comparison of Research on White Space			
Study	Reading Speed no effect	Comprehension no effect	Satisfaction significant effect
This research	agree	agree	agree
de Bruijn (1992)	not reported	agree	agree
Smith (1971)	not reported	agree	agree
Tullis (1981)	not reported	not reported	agree

Table 12: Comparison of results reported in literature for white space

5.3. Conclusions About the Research Problem

In this study the results failed to prove a relationship between the dependent variables reading speed and comprehension and the independent variables width of text and amount of white space. There is evidence of a relationship between satisfaction with the legibility of the text and width and white space. The graph of the means indicates that the middle widths are preferred to the extremes and that white space is generally preferred to no white space

Three conclusions can be drawn:

1. Guidelines that specify text width for short text passages displayed on a computer screen can not categorically state that a given width is ideal.
2. White space is only important when satisfaction is important for readers of short text passages displayed on a computer screen.
3. It appears that individual differences in reading abilities and preferences are more important to reading speed and comprehension for text on computer screens than text width and white space.

Guidelines that attempt to specify a text width need to indicate that different widths do not seem to affect reading speed or comprehension. Different widths do seem to affect user attitudes. Thus if screen space is critical such as for portable computers, cash registers etc then text width can be changed without detriment to reading performance. At the other extreme where user satisfaction can be critical e.g. multimedia displays, information kiosks, program tutorials etc, the text should be a medium width and there should be margins. It is suggested that where user preferences are important, text should have margins and not be too wide or narrow but, if the needs or capabilities of the system preclude formatted text, then there will no detriment to reading performance.

5.4. Implications

It was predicted on the basis of prior research with computers and paper that text width and white space would be important to readers of computer displayed text.

This research indicates that guidelines specifying an exact width for text on computer displays may be erroneous. It appears the text can be varied between 2 inches and 9 inches in width with no detriment to reading performance. However, there is evidence that width is important to the user and where other considerations are not important text should be formatted to a 5 inch width.

Similarly passive white space in the form of margins does not seem to be necessary. This means that at least for short text passages the text can fill the window or indeed the entire screen allowing for more text to be displayed at one time and reducing the need for scrolling. Again if there are no other restrictions then text should be formated with margins. Where screen space is critical, margins may not be necessary but the usere will be less satisfied with the appearence of the screen.

Messages to the user can be displayed in a window that can be designed to fit the program. For instance if a wide but short message window is necessary then there will be little detriment to reading performance. Likewise if text needs to be displayed in a narrow column then this can also be used. This does not imply that "help" text could be treated in the same way (see section 5.6. Further Research).

5.5. Limitations

The subjects were assumed to reflect the population of computer users. However, it is possible that more experienced or less experienced computer users could produce different results. The small sample size must also be considered a limiting factor.

There exists the possibility that text width could be more important where the text is displayed on top of the task such as where a user consults a help program. In this experiment there was no background task to be performed.

It is also possible that longer text passages such as found in electronic journals or online databases may still exhibit differences with wide or narrow text. This type of text involves different reading strategies' i.e. the reader does not scan the text looking for key words.

This experiment only investigated passive white space in the form of margins at the sides and bottom of the text. A top margin was not used because it would have reduced the amount of text in the narrowest conditions to a trivial length. Active white space was not investigated for the same reason.

5.6. Further Research

Initially this research could be repeated using the same experimental tool but with a larger sample and with different user types; novice vs experienced for example. A survey could be easily incorporated into the software to distinguish between different user types or potential subjects could be classified into different user types prior to the experiment.

Active white space still needs to be investigated. This type of white space can be created by increasing leading and by giving headings and key words more white space around them. Active white space is claimed to make text more legible and it may impart more meaning to text and make it easier for a reader to scan when looking for keywords. It could be expected that as subjects expressed higher satisfaction with passive white space they would also prefer more active white space.

Text width and white space may be more important where the text is used to solve a problem rather than for providing information for unknown questions. There needs to be further research to determine if text width, active white space and passive white space affect the performance of a subject using interactive help.

In conclusion there still needs to be research into the effects of differences in passive white space and width where the text is long and where the text is part of an interactive help function. There also needs to be research into the effects of active white space to determine if it is important to readers. Active white space needs to be investigated for short text passages, long text passages and interactive help.

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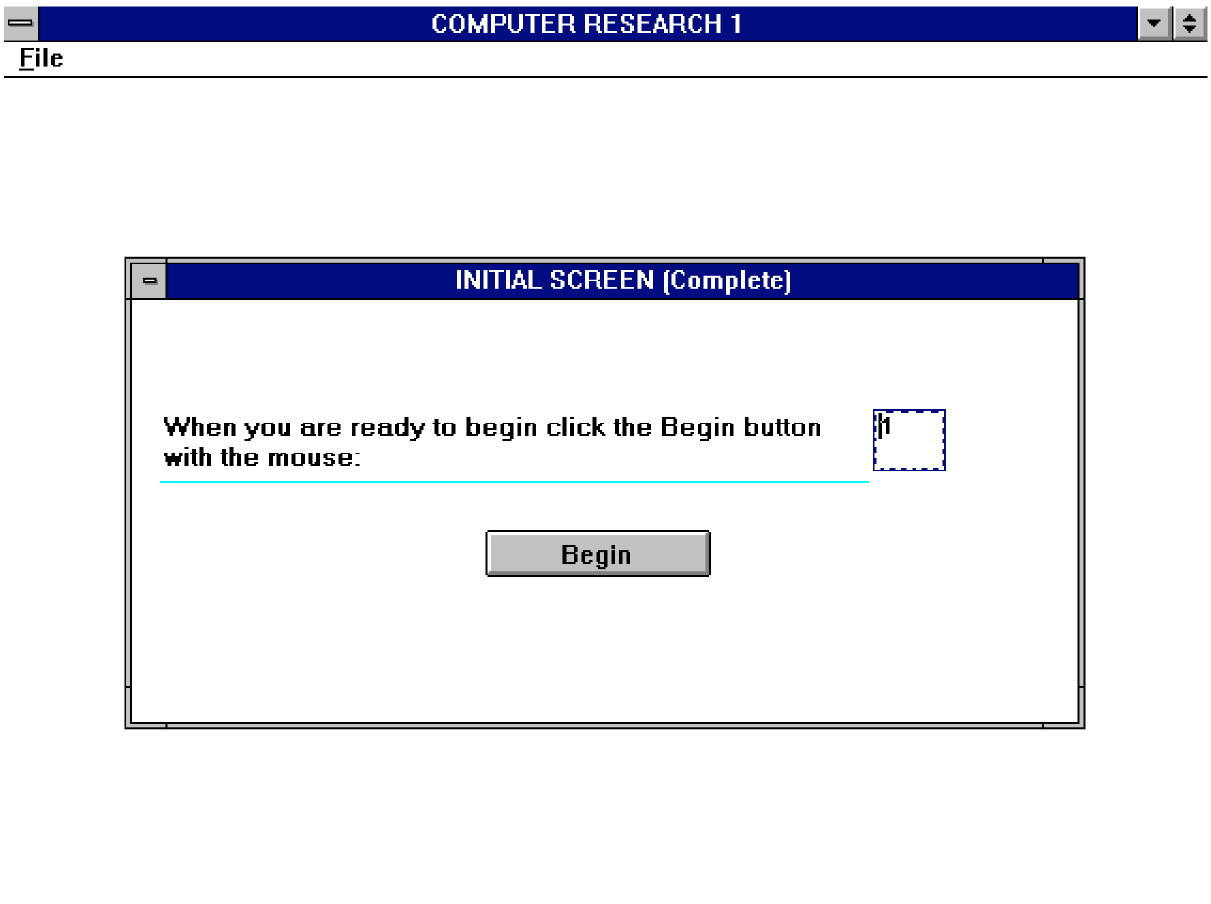
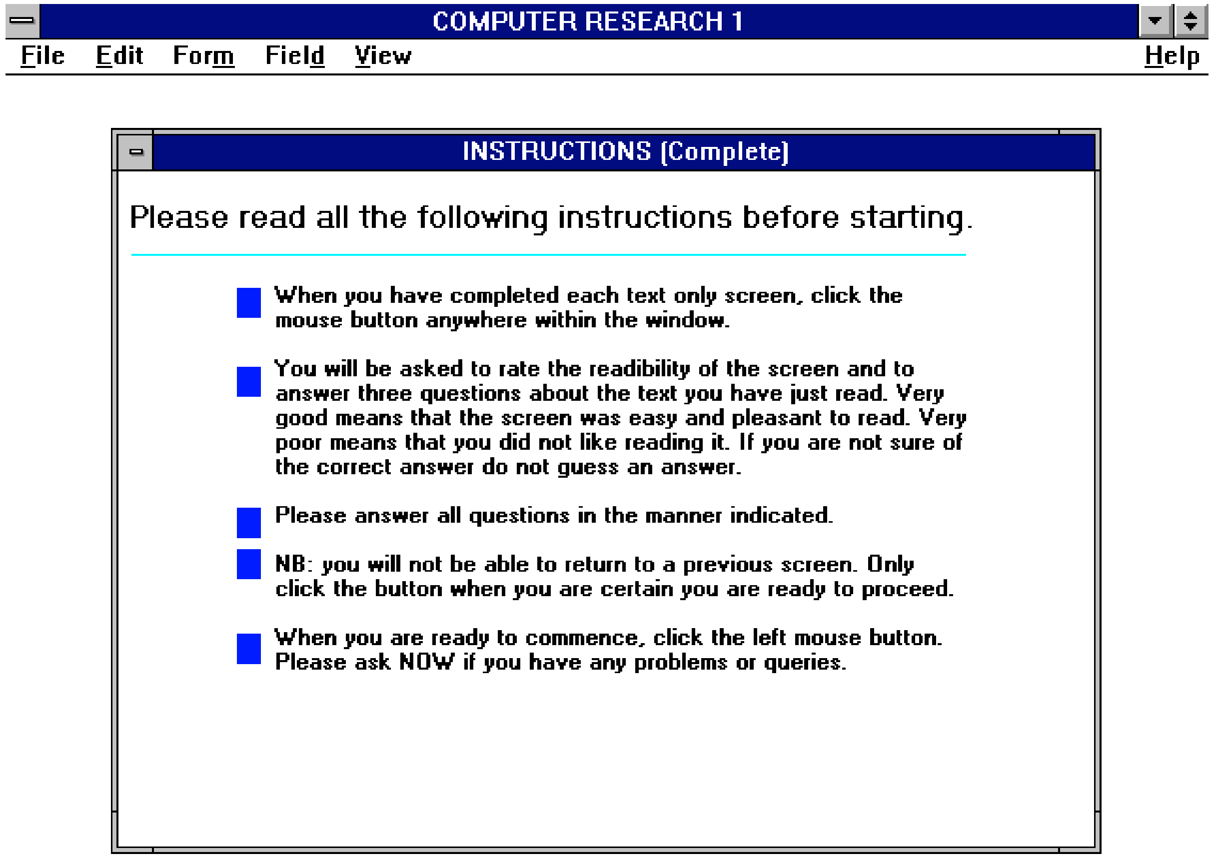
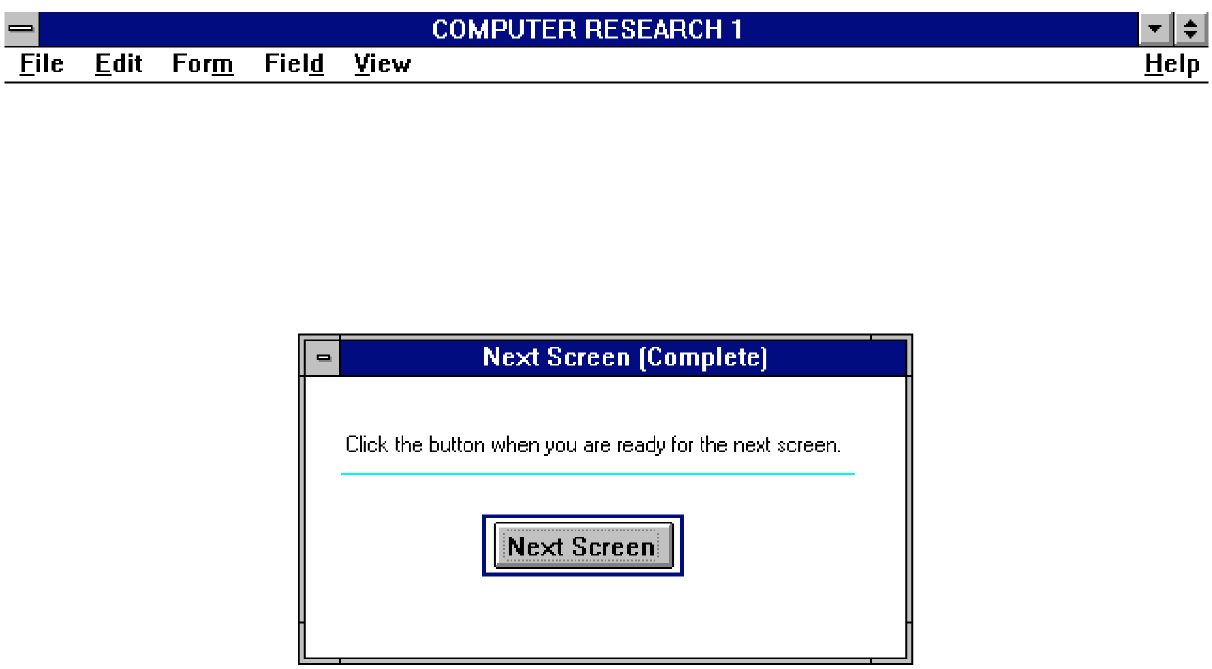
APPENDIX A - EXPERIMENT FOR SUBJECT 1

ID	Form Number															
	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16
1	w2	n4	w4	w8	n2	n7	n5	n9	w6	n6	n8	w5	w3	w9	w7	n3




COMPUTER RESEARCH 1
File Edit Form Field View Help
INSTRUCTIONS (Complete)
Please read all the following instructions before starting.
When you have completed each text only screen, click the mouse button anywhere within the window.
You will be asked to rate the readibility of the screen and to answer three questions about the text you have just read. Very good means that the screen was easy and pleasant to read. Very poor means that you did not like reading it. If you are not sure of the correct answer do not guess an answer.
Please answer all questions in the manner indicated.
NB: you will not be able to return to a previous screen. Only click the button when you are certain you are ready to proceed.
When you are ready to commence, click the left mouse button. Please ask NOW if you have any problems or queries.


COMPUTER RESEARCH 1
File Edit Form Field View Help
Next Screen (Complete)
Click the button when you are ready for the next screen.
Next Screen

COMPUTER RESEARCH 1

File

1 (Complete)

A template provides a time-saving pattern to shape a final document or to customize Word for a particular type of document. Word comes with a variety of templates to help you get started; you can modify or create your own templates. In Word, a document template can contain the following elements. Text and graphics that are the same in every letter, memo, or report. Word inserts the text or graphics automatically when you create a new document. Styles that contain standard formatting for all of your paragraphs, including the fonts and type sizes you want. Glossary items that contain standard text and graphics you insert, such as a company logo or address. Macros that can automatically perform editing and formatting tasks for you.

COMPUTER RESEARCH 1

File

Template (Complete)

Rate the readibility of the screen you have just read	5. Very poor
What is a template?	1. A pattern
What contains the standard formatting?	1. Do not know
What can be inserted automatically using templates?	1. Text or graphics

End Template

COMPUTER RESEARCH 1

File

11 (Complete)

In Word, a paragraph is any amount of text and/or graphics and the paragraph mark that follows it. You can control the appearance of a paragraph with paragraph formatting features. For example, you can change the alignment of a paragraph, indent an entire paragraph, or indent only the first line. Word stores the formatting instructions for the paragraph in the paragraph mark. When you start a new paragraph by pressing the ENTER key, Word copies the paragraph mark and carries with it the formatting instructions. If you delete, copy, or move a paragraph mark, you delete, copy, or move the formatting as well. It is a good idea to display paragraph marks as you work, so you do not accidentally delete the paragraph mark that contains the formatting for the paragraph.

COMPUTER RESEARCH 1

File

Paragraph (Complete)

Rate the readibility of the screen you have just read	3. Fair
What is a paragraph?	3. Text, graphics and paragraph marker
Where are formatting instructions stored?	2. In a template
Why should you not delete the paragraph formatting mark?	2. Paragraph will be deleted

End Paragraph

COMPUTER RESEARCH 1

File

3 (Complete)

As you work on a document, Word breaks pages automatically every time you fill a page with text or graphics. These automatic, or soft, page breaks appear as a dotted line. As you edit and change formatting, Word recalculates the amount of text on the page and adjusts any soft page breaks. Word repaginates automatically whenever you do the following; print your document, choose the Page Layout, Repaginate Now, or Print Preview command, compile an index or table of contents. The manual, or hard, page breaks that you insert yourself appear as a heavy dotted line. You can insert page breaks manually whenever you want to force a page break at a particular spot -- for example, before a large picture.

COMPUTER RESEARCH 1

File

Page (Complete)

Rate the readibility of the screen you have just read	2. Good
What is a soft page break?	2. A dotted line
Why do you insert a page break?	2. To format the page
What indicates a hard page break?	4. Do not know

End Page

COMPUTER RESEARCH 1

File

7 (Complete)

Footnotes are notes of reference, explanation, or comment. With Word, you can easily add footnotes of any length to your document. Format footnote text just as you would any other text and add pictures and graphics. You can print footnotes at different locations in your document and customize footnote reference marks and footnote separators. Word can automatically renumber footnote and reference marks whenever you add, delete, or move footnotes. You can view footnotes in your document in two ways: page layout view shows you the placement of footnotes on each page, and print preview gives you a reduced view of how the document will look when you print it. Annotations are initialed comments that an author or reviewer adds to a document. Each reviewer's initials appear in the document in hidden text.

COMPUTER RESEARCH 1

File

Footnotes (Complete)

Rate the readibility of the screen you have just read	2. Good
How long can footnotes be?	3. Do not know
How are footnotes renumbered?	2. Automatically
What are annotations?	2. Annual diary entries

End Footnotes

COMPUTER RESEARCH 1

File

9 (Complete)

When you start Word, a blank document appears, ready for you to start typing. A blinking vertical bar called the insertion point indicates where text will appear when you type. Unlike using a typewriter, you do not have to start a new line when you reach the right margin -- Word automatically wraps text to the next line. You press the ENTER key only when you want to start a new paragraph. You can delete characters to either the left or right of the insertion point. Most of your documents will contain more text than you can see at one time. To view parts of a document that you cannot see, use the mouse or press keys to move the insertion point. You can display scroll bars along the right and bottom edges of document windows. When you want to change something, you first mark what you want to change.

COMPUTER RESEARCH 1

File

Typing (Complete)

Rate the readibility of the screen you have just read	2. Good
What indicates where text will appear when you type?	3. An insertion point
When should you press the ENTER key?	2. Do not know
Where on document windows can scroll bars be displayed?	2. Along the top

End Typing

COMPUTER RESEARCH 1

File

14 (Complete)

Using a Word table to arrange text and numbers in columns is much easier than setting up columns using tabs. Think of a table as rows and columns of boxes, called cells, that you can fill with text and graphics. The only thing you cannot insert into a table is another table.Text wraps within each cell of a table, so you can easily add or delete text without mixing up the columns. You can format the contents of a cell the same way you format characters and paragraphs. If you select multiple cells and apply formatting, the formatting applies to all selected cells. If you decide that you do not want text to be in a table, you can convert an entire table or selected rows into paragraphs, or separate each row into a paragraph with the contents of each cell in each row separated by tabs or commas.

COMPUTER RESEARCH 1

File

Table (Complete)

Rate the readibility of the screen you have just read	3. Fair
What can you not insert into a table?	3. A paragraph
How can you format the contents of a cell?	2. The same as any other text
What can a table be converted to?	2. Text

End Table

COMPUTER RESEARCH 1

File

12 (Complete)

Line numbers, numbered headings, and bulleted or numbered lists are common requirements for many documents. Word provides three different types of numbering; line numbers, used in documents such as legal documents or scripts in which you need to refer to specific lines, outline numbers, which provide different ways to number a hierarchy of headings, list numbering and bullets, with which you can turn a series of paragraphs into a numbered or bulleted list. If your document contains only one section, Word applies line numbers to the entire document. Word usually counts every line in a section, except those lines in footnotes, tables, headers, and footers. If you do not want Word to include certain lines in its count, you can cancel line numbering for selected paragraphs. Line numbers only appear on screen in print preview.

COMPUTER RESEARCH 1

File

List (Complete)

Rate the readibility of the screen you have just read	2. Good
When can you see line numbers?	3. In page layout view
Which parts of the text will Word not give line numbers to?	3. Do not know
How many different types of numbering does Word provide?	3. Seven

End List

COMPUTER RESEARCH 1

File

16 (Complete)

You can create a document that includes information created in another application and then link the two documents together. By copying a selection from a source document and pasting it into a destination document you are working on, Word will update the destination document any time the information changes in the source document. When you create links in your document, you can specify how frequently you want to update the information. Unless you specify otherwise, Word updates the information automatically whenever the source document changes. You can create a document that includes information such as charts, graphics, and spreadsheet data created by other applications. You can embed objects.

COMPUTER RESEARCH 1

File

Link (Complete)

Rate the readibility of the screen you have just read	1. Very good
How do you link 2 documents together?	2. By using the Link command
What is required to embed objects?	2. Support for Windows or object embedding
When do you use embedding instead of linking?	2. When using a different application

End Link

COMPUTER RESEARCH 1

File

5 (Complete)

Word can automatically merge lists of information with standard text to create unique versions of documents such as form letters, mailing labels, and legal documents. Merging documents typically involves three steps: prepare the text that varies in each version. This variable information is usually organized in a separate document called a data file, type a main document that contains the text that you want to be identical in each printed version, field codes within the text tell Word where to insert the appropriate information from the data file, perform the merge operation to combine the variable information with the standard text to print. You can use the Record Selection dialog box and/or special instructions in a main document to use information from the data file conditionally.

COMPUTER RESEARCH 1

File Edit Form Field View Help

Merge (Complete)

Rate the readibility of the screen you have just read	2. Good
What tells Word where to insert information from a data file?	3. Merge codes
What can Word automatically combine with standard text?	3. Mailing lists
What can you use to enter information conditionally?	2. Special instructions

End Merge

COMPUTER RESEARCH 1

File Edit Form Field View Help

13 (Complete)

Characters are letters, punctuation marks, numbers, symbols, and special marks, such as * and @, that you type as text. Character formatting determines how characters appear on screen and in print. With character formatting, you can; change the font and point size of characters, add emphasis to characters by applying formats such as bold, italic, and underline, adjust the space between characters to make them more readable or create special effects, add color to characters, hide text so you can include information in your document that you don't want to print, such as notes or comments, change the case of characters eg lowercase to uppercase letters, repeat character formatting quickly using a key combination. You may want to use the Style feature for consistent formatting.

COMPUTER RESEARCH 1

File Edit Form Field View Help

Char (Complete)

Rate the readibility of the screen you have just read	1. Very good
What are characters?	2. Text
What do you use to repeat character formatting?	2. Key combination
What feature allows for consistent character formatting?	2. Glossary

End Char

COMPUTER RESEARCH 1

File Edit Form Field View Help

15 (Complete)

Word groups commands by function on menus at the top of the Word window. For example, the File menu contains commands to open, print, and save your documents. Some commands, such as the Close command, perform an action as soon as you choose them. Other commands, such as the Search command, ask you to provide information to carry out the command.Windows are the panels in which you view and work on documents. Each document that you open appears in a separate document window. You can have up to nine windows open at one time. The window you are currently working in -- the window containing the insertion point or where you select text -- is called the active window, and the document you are working on is called the active document.

COMPUTER RESEARCH 1

File Edit Form Field View Help

Menu (Complete)

Rate the readibility of the screen you have just read	2. Good
How many windows can you have open at once?	3. Nine
How are commands grouped?	3. Alphabetically
What is the name of the window you work in?	3. Do not know

End Menu

COMPUTER RESEARCH 1

File Edit Form Field View Help

4 (Complete)

Imagine designing your own word processor with menu commands, key assignments, and dialog box defaults set up precisely the way you want. Customizing features in Word make it possible for you to do just that. You can add to menus features you use regularly, such as commands, dialog box options, macros, and actions represented by buttons, and remove from menus the features you rarely use. You can customize key assignments by creating the key combinations handiest for you. You can preserve the original Word settings and create separate template files for customized settings. The Toolbar offers quick access to some of the most common commands in Word with a single click of the mouse. You can customize the Toolbar to include regular commands.

COMPUTER RESEARCH 1

File Edit Form Field View Help

Macro (Complete)

Rate the readibility of the screen you have just read	3. Fair
What makes it possible for you to design your own word processor?	4. Customizing features
What offers quick access to the most common commands?	4. Do not know
What features can be removed from Menus?	3. Optional features

End Macro

COMPUTER RESEARCH 1

File Edit Form Field View Help

2 (Complete)

You can use the bookmark feature in Word the same way you do in a book -- as a placeholder, and more. For example, you can use bookmarks to identify any amount of text, not just a particular insertion point. You can also use bookmark names in fields and have the field perform an action using the text at the bookmark. By combining bookmarks and fields, you can make three kinds of cross-references in a document: a page number cross-reference, a cross-reference to text, and a sequence number cross-reference. Word automatically generates these references when you print the document. You can use bookmarks to; mark a place in a document you want to find quickly, mark a passage you want to work on, insert text marked as a bookmark in another document.

COMPUTER RESEARCH 1

File Edit Form Field View Help

Bookmark (Complete)

Rate the readibility of the screen you have just read	4. Poor
What is the bookmark feature used for?	3. Marking an insertion point
How do you make cross-references?	3. By combining bookmarks and page numbers
What can bookmarks be used to identify?	3. Any amount of text

End Bookmark

COMPUTER RESEARCH 1

File Edit Form Field View Help

8 (Complete)

To work on a document, you must first open and display it. You can add and edit text, change appearance of the document, and print. You must save it to store the version of the document you see on your screen in a file. When you start Word, a blank document opens in a window; you can then start typing. You can use a template that contains the standard text and formatting that you routinely use for certain documents. To continue work on a document stored on a disk, you open the document using the Open command. If you have recently worked on the document, you may be able to open it again by choosing it from the bottom of the File menu, where Word lists the four documents you most recently opened. You can open more than one document at a time and move between documents.

COMPUTER RESEARCH 1

File Edit Form Field View Help

Doc (Complete)

Rate the readibility of the screen you have just read	1. Very good
How do you work on a document?	3. Open and display it on screen
How many documents that were most recently opened are listed?	2. Four
To continue working on a document stored on disk which command do you use?	1. Open

End Doc

COMPUTER RESEARCH 1

File Edit Form Field View Help

6 (Complete)

You can use the Sorting command to quickly arrange text alphabetically or numerically. Word can sort an entire document or any portion of it you select. You should save your document before you use the Sorting command. You can then close the document without saving changes and reopen it in its original, unsorted form. You can cancel a sort. Word sorts text alphabetically or numerically based on the farthest left character in the selection. You can choose to sort the text in ascending or descending sequence.You can also sort alphanumerically (by numbers first, then letters). With this method, paragraphs or lines beginning with punctuation marks come before all others, those beginning with numbers come next, and those beginning with letters come last.

COMPUTER RESEARCH 1

File Edit Form Field View Help

Sort (Complete)

Rate the readibility of the screen you have just read	3. Fair
How does the sort command arrange text?	4. Alphabetically or numerically
What should you do before sorting?	3. Do not know
In an alphanumeric sort what comes first?	2. Numbers

End Sort

COMPUTER RESEARCH 1

File Edit Form Field View Help

10 (Complete)

Hanging indents separate a number or bullet before a paragraph from its text, making items in a list easier to see and scan. When you add numbers or bullets to paragraphs in a list, you can automatically format the paragraphs as hanging indents. You can also use the ruler or shortcut keys to quickly create a hanging indent without numbering or adding bullets to the paragraphs. To create a hanging indent: Select the paragraph or paragraphs you want to format with hanging indents, if the ruler is not displayed, choose Ruler from the View menu (ALT, V, R), hold down the SHIFT key. Drag the cursor to the position you want to indent all the lines after the first line. Select the paragraph or paragraphs you want to format with hanging indents. To reverse the indent, press CTRL+G.

COMPUTER RESEARCH 1

File Edit Form Field View Help

Indent (Complete)

Rate the readibility of the screen you have just read	3. Fair
Why would you use hanging indents?	2. Make items in a list easier to see
How do you reverse the indent?	2. Press Ctrl + R
How do you create a hanging indent?	2. Select the Indent button

End Indent

COMPUTER RESEARCH 1

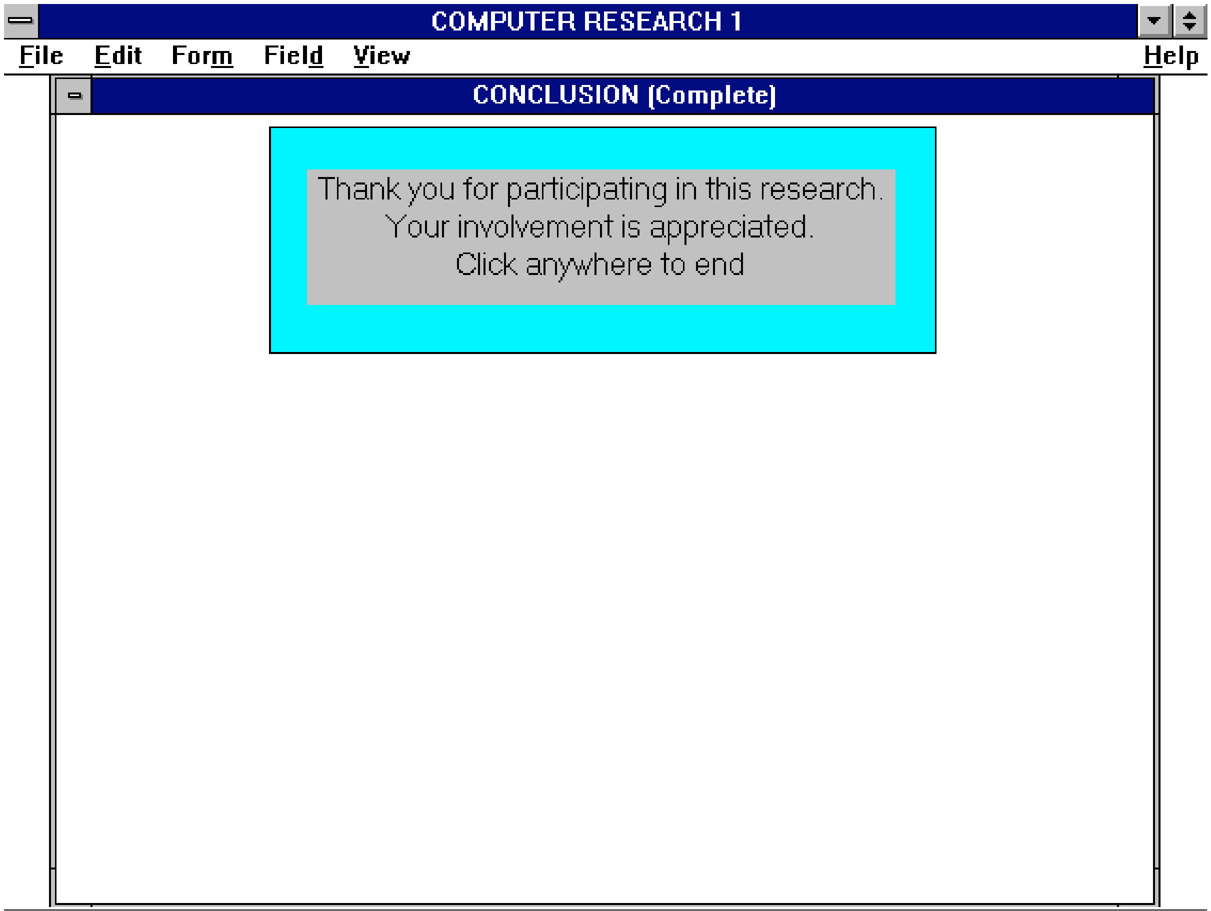
File Edit Form Field View Help

COMMENTS (Goal)

Please type in any comments you may have about this experiment.
For example:
Were the explanations clear?
Were you able to read the text easily?
Did you have any problems?

No Comment

Next....


COMPUTER RESEARCH 1
File Edit Form Field View Help
CONCLUSION (Complete)
Thank you for participating in this research.
Your involvement is appreciated.
Click anywhere to end

APPENDIX B - RESULTS

Raw Data

Subject Number	Screen Code	Time Read	Time Answer	Screen Rating	Compre-hension Score
1	n2	61	36	2	1
1	n3	39	42	3	0
1	n4	81	26	5	2
1	n5	60	22	2	2
1	n6	73	27	4	0
1	n7	51	19	4	3
1	n8	41	41	4	1
1	n9	50	45	5	3
1	w2	45	76	3	0
1	w3	56	24	4	3
1	w4	59	24	3	0
1	w5	71	19	5	2
1	w6	77	25	4	1
1	w7	49	33	5	1
1	w8	53	23	5	2
1	w9	61	34	2	0

Subject Number	Screen Code	Time Read	Time Answer	Screen Rating	Compre-hension Score
2	n2	39	15	4	3
2	n3	49	27	5	1
2	n4	49	21	4	2
2	n5	44	33	3	1
2	n6	44	46	2	2
2	n7	41	24	4	1
2	n8	57	25	3	1
2	n9	46	25	5	2
2	w2	58	19	4	2
2	w3	46	23	2	2
2	w4	56	27	4	3
2	w5	72	36	3	3
2	w6	46	29	4	1
2	w7	45	18	5	2
2	w8	44	17	4	1
2	w9	47	35	2	1

Subject Number	Screen Code	Time Read	Time Answer	Screen Rating	Compre-hension Score
3	n2	83	27	3	3
3	n3	98	50	3	3
3	n4	101	49	3	2
3	n5	95	32	4	3
3	n6	60	44	3	1
3	n7	94	72	4	2
3	n8	90	58	2	3
3	n9	73	36	4	2
3	w2	95	51	3	2
3	w3	73	29	4	2
3	w4	164	51	2	2
3	w5	91	31	2	3
3	w6	54	27	3	3
3	w7	103	27	2	3
3	w8	106	110	4	0
3	w9	100	39	3	2

Subject Number	Screen Code	Time Read	Time Answer	Screen Rating	Compre-hension Score
4	n2	103	23	2	3
4	n3	116	16	2	2
4	n4	37	38	1	2
4	n5	68	24	2	2
4	n6	95	23	2	2
4	n7	81	31	1	2
4	n8	103	25	2	1
4	n9	72	17	3	0
4	w2	85	27	2	3
4	w3	65	29	2	2
4	w4	76	14	2	3
4	w5	81	23	2	3
4	w6	42	27	3	2
4	w7	46	22	3	1
4	w8	60	26	2	3
4	w9	84	14	1	3

Subject Number	Screen Code	Time Read	Time Answer	Screen Rating	Compre-hension Score
5	n2	84	29	3	2
5	n3	112	41	2	2
5	n4	74	29	4	3
5	n5	64	56	3	3
5	n6	63	58	4	3
5	n7	141	44	2	1
5	n8	70	39	3	3
5	n9	56	56	3	0
5	w2	112	40	4	2
5	w3	120	98	4	0
5	w4	80	56	3	2
5	w5	67	39	4	2
5	w6	139	36	3	1
5	w7	73	53	3	3
5	w8	68	44	4	2
5	w9	75	40	3	3

Subject Number	Screen Code	Time Read	Time Answer	Screen Rating	Compre-hension Score
6	n2	88	76	2	2
6	n3	40	58	2	1
6	n4	90	98	2	2
6	n5	91	51	2	0
6	n6	78	42	2	2
6	n7	108	103	2	0
6	n8	113	93	2	2
6	n9	75	76	1	2
6	w2	85	95	1	2
6	w3	93	54	3	3
6	w4	51	57	2	1
6	w5	76	60	2	2
6	w6	61	68	2	2
6	w7	68	86	1	2
6	w8	58	42	3	2
6	w9	64	45	1	2

Subject Number	Screen Code	Time Read	Time Answer	Screen Rating	Compre-hension Score
7	n2	53	24	3	2
7	n3	42	33	2	3
7	n4	61	19	2	1
7	n5	61	27	2	2
7	n6	46	36	2	2
7	n7	73	37	2	2
7	n8	73	20	1	3
7	n9	55	25	1	0
7	w2	36	17	2	3
7	w3	48	19	2	2
7	w4	40	19	2	1
7	w5	32	31	1	1
7	w6	22	30	2	2
7	w7	36	37	3	2
7	w8	39	21	3	2
7	w9	34	40	2	2

Subject Number	Screen Code	Time Read	Time Answer	Screen Rating	Compre-hension Score
8	n2	53	34	2	0
8	n3	90	36	3	3
8	n4	56	24	2	2
8	n5	86	20	4	3
8	n6	56	47	3	0
8	n7	83	30	4	3
8	n8	42	34	4	2
8	n9	35	34	3	0
8	w2	71	34	3	2
8	w3	81	68	2	2
8	w4	89	51	3	0
8	w5	42	21	3	2
8	w6	51	22	3	3
8	w7	46	31	3	2
8	w8	44	39	3	1
8	w9	44	27	3	2

Subject Number	Screen Code	Time Read	Time Answer	Screen Rating	Compre-hension Score
9	n2	103	71	3	2
9	n3	66	31	3	3
9	n4	63	35	4	1
9	n5	54	44	1	1
9	n6	72	27	4	2
9	n7	61	29	3	1
9	n8	117	109	4	2
9	n9	64	85	3	2
9	w2	55	38	2	3
9	w3	78	22	4	1
9	w4	51	37	5	2
9	w5	66	26	3	3
9	w6	63	41	4	1
9	w7	61	39	1	0
9	w8	39	58	3	0
9	w9	95	41	4	2

Subject Number	Screen Code	Time Read	Time Answer	Screen Rating	Compre-hension Score
10	n2	49	69	4	1
10	n3	79	52	4	3
10	n4	79	41	4	2
10	n5	62	29	4	1
10	n6	48	49	5	2
10	n7	60	36	5	2
10	n8	83	92	4	1
10	n9	54	38	5	3
10	w2	67	82	4	2
10	w3	93	44	3	3
10	w4	57	23	4	3
10	w5	61	181	4	0
10	w6	34	80	4	0
10	w7	81	54	4	1
10	w8	58	25	3	2
10	w9	83	29	3	0

Subject Number	Screen Code	Time Read	Time Answer	Screen Rating	Compre-hension Score
11	n2	31	15	2	3
11	n3	40	24	4	1
11	n4	54	26	3	2
11	n5	39	20	3	2
11	n6	41	20	4	3
11	n7	37	14	4	3
11	n8	28	17	4	2
11	n9	29	25	3	2
11	w2	27	20	3	3
11	w3	25	23	1	0
11	w4	47	19	3	3
11	w5	31	19	2	2
11	w6	31	15	1	2
11	w7	84	26	4	2
11	w8	25	21	2	3
11	w9	48	24	1	1

Subject Number	Screen Code	Time Read	Time Answer	Screen Rating	Compre-hension Score
12	n2	55	21	3	2
12	n3	47	27	4	0
12	n4	37	64	2	0
12	n5	113	18	4	0
12	n6	33	17	5	2
12	n7	31	20	4	3
12	n8	32	22	4	2
12	n9	39	26	3	2
12	w2	34	29	4	3
12	w3	42	27	3	1
12	w4	43	30	4	2
12	w5	41	34	4	0
12	w6	64	32	3	1
12	w7	41	22	3	2
12	w8	41	29	5	2
12	w9	60	23	3	2

Subject Number	Screen Code	Time Read	Time Answer	Screen Rating	Compre-hension Score
13	n2	74	32	4	1
13	n3	57	32	2	1
13	n4	52	21	3	1
13	n5	69	18	3	3
13	n6	68	17	1	2
13	n7	64	30	1	2
13	n8	58	37	2	2
13	n9	87	20	1	1
13	w2	82	24	2	2
13	w3	78	23	4	2
13	w4	56	28	2	3
13	w5	60	30	5	2
13	w6	60	17	3	3
13	w7	75	18	3	3
13	w8	69	28	1	2
13	w9	65	33	4	2

Comments by Subjects

Subject 1 "When the text was listed across the page in a lengthy form, my eyes had to move more then what was comfortable to read off the screen."

Subject 2 "The explanations that i was given were easy to understand and to follow. some of the text that i was given however proved to be a bit straining upon the eyes for you had to look close to understand the words. There were no problems that I could see."

Subject 4 "The explanations outside the test texts were clear. The text itself was hard to read because of the size of the characters, and the long sentences. The punctuation was not very good. Readability was not good. I generally had to read everything twice before it sank in, but that could have been due to some noise around me, making concentration difficult."

Subject 6 "I assume the ""explanations"" were the textual descriptions contained in each window being assessed. My answer would be not always. The lack of formatting of text made it difficult to read."

Subject 7 "I think it would have been easier to read if the text had been displayed with line and a half spacing between each line. The really wide columns are hard to read. White space around the text makes it easier to read too. Explanations were clear and I didn't have any problems. Some of the results may not be based on my reading of the text as I have some knowledge of some Word functions already, and not others."

Subject 8 "Explanations were clear. Text was fairly easy to read. Didn't encounter any real problems."

Subject 9   "Some explanations were a bit hard to understand, those that used command refferences i.e.. press Ctrl C, V, then drag this to somewhere etc. Maybe you could have told on which item to pull down from the menu bar at the top of the screen. Overall it was well presented and easy to understand and use. The explainations were sufficient for a unfamilliar user to get a hold on what to do and the different functions available for use. The smaller boxes with a few lines were hard to read, also hard to read were the long narrow boxes. The more squarer the box the easier it was to read."

Subject 10   "The explanations were clear, and I think are good for the topic being discussed.   The text which I found best to read were the ones in narrow vertical columns and a large box around the outside of the screen. The one which I found hard to read were long horizontal ones with a box encasing the text tightly. I had no real problems except in remembering all of the details of the text but if I was in need of hearing about the topic being discussed I would have paid closer attention. I think if the line spacing were a bit geater the text would also have been easier to read. Overall I think the content of the material was very good. I even learnt something about Word which I didn't know before."

Subject 12   "There may be a bias in question 1 : I did not at first realise that the four menu selections where related to the four questions on the left hand side. Also at first it was not clear that I should read the text in order to answer the questions, I thought I was just going to be asked about style, layout, font, etc."

Subject 13   "The explanations to perform the experiment were clear. The text was horrible but that was consistent so did not cause any problems. I found that for the screens I found difficult to read I read the text two or three times because I was unable to remember what it said. For those that were easy to read I only read them once. Consequently I found that I could remember more about those paragraphs that were hard to read than thse that wwere easy to read. Some were easy to answere the questions regardless of how hard the paragraph was to read because of my basic to good knowledge of word. I did not find any of the different formats excellent to read. I personnally find those menus that have some space between the top of the window and the beginning of the text easier to read that those used here. I found myself not understanding or reading the first line. The narrow texts are a real pain in the butt, so are the wider ones. Although the wider ones are easier to comprehend than the narrow ones."

APPENDIX C - CONSENT FORM

The University Of New England - Northern Rivers

Name of Project: **Presentation of Online Documentation**

You are invited to participate in a study of the presentation of text on computer screens. We hope to learn more information about the interaction between people and computers in the area of text presentation.

If you decide to participate, we will ask you to run a computer program. The program will present you with instructions, different screens of text, ask questions about the text and finally ask for some information about your attitutdes and feelings. The total time for the experiment is not expected to exceed one hour.

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission.

If you decide to participate, you are free to withdraw your consent and to discontinue participation at any time without prejudice.

If you have any questions, we expect you to ask us. If you have any additional questions later, Dr John Maltby (203724) or Tim Comber (203119) will be happy to answer them.

You will be given a copy of this form to keep.

Consent

I have read the information above, and agree to participate in this study. I am over the age of 18 years.

Name of Subject: ....

Signature of Subject:

....Date: ....

Independent Witness: ....

Signature of Witness:

....Date: ....

Signature of Researcher:

....Date: ....

APPENDIX D - OBJECTVISION DECISION TREES