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Voice control in a graphical user interface environment:
Human factors implications

Tommaso D'Ippolito, B.Sc. (Hon)

A thesis submitted to
the Faculty of Graduate Studies and Research
in partial fulfillment of
the requirements for the degree of
Masters of Arts

Department of Psychology
Carleton University
Ottawa, Ontario
January, 1997

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and Research acceptance of the thesis

Voice control in a graphical user interface environment:
Human factors implications

submitted by Tommaso D'Ippolito, B.Sc. (Hon)
in partial fulfillment of the requirements for
the degree of Master of Arts

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1997

Abstract

A within-subjects experiment compared voice vs. manual input to control a word processing application in a graphical user interface (GUI) environment. An off-the-shelf speech recognition system for the Apple Macintosh was used by 12 practiced subjects to control MS Word 5.1a. The 2 input modalities were compared on 14 mutually exclusive tasks, in terms of completion time, ease of use, errors, and choice of input. The goal was to determine for which task groups voice input was superior, and for which manual was superior. Voice was faster, easier and preferred for tasks that had an easy and meaningful voice command, tasks that only had a manual menu item counterpart, and hands-busy tasks. Voice and manual input were equal for selecting icons. Voice produced more errors when the voice command was placed in a hierarchy. Design principles are offered for integrating voice into existing GUI applications.

Acknowledgments

I would like to express my sincere thanks and appreciation to several individuals who helped me in the process of completing this study.

To Dr. R. F. Dillon, who served as my faculty advisor, friend, colleague, and inspirational role model. His continued direction and guidance, willingness to meet around my schedule and almost limitless proof readings were instrumental in arriving at the final draft presented here. Thanks Dick for putting up with me all these years.

To Dr. J. Wood, who has been a co-advisor, colleague, and friend for many years. Her many helpful comments and suggestions, assistance with the analyses, and fresh outlook on the study were invaluable and greatly appreciated. Thank you for returning to Carleton and being that extra ingredient that Dick and I needed to resolve every issue.

To my parents, Ugo and Lea D'Ippolito, who always encouraged me to keep at it, even in the darkest times when completion seemed an unreachable goal. Their support and understanding throughout the years has always been appreciated.

To all my volunteer subjects, who invested a large part of their personal time and effort over several months to become proficient with speech recognition.

Finally to my close friend, Bernard Q. Etzinger, who constantly kept reminding me that "no one likes a quitter."

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Voice control in a graphical user interface environment:

Human factors implications

This study was undertaken to determine the conditions under which voice control as a method of interaction with a computer application with a graphical user interface would result in better performance and greater user satisfaction than interaction with a mouse and keyboard. Performance with voice and manual controls was measured in terms of task completion times, ease of use ratings, error scores, and quantitative choice. To obtain this data, a speech recognition interface was added to an existing graphical user interface and subjects were tested on predetermined, scripted tasks using a popular word-processing application, Microsoft Word.

Speech Recognition Deployment

Speech recognition as a means to interact with a computer has met with limited public acceptance. Speech is a viable alternative input medium for interaction between humans and computers because it is the easiest, fastest and the primary communication medium between humans, yet it is rarely used (Baecker & Buxton, 1987; Beuk, 1989; Van Nes, 1988). Progress in the field of speech input is being made, but it is slower than optimists had originally predicted and much work remains to be done (Jacob, Leggett, Myers, & Pausch, 1993; Vossen, 1991). As computing power steadily increases and price decreases, it has become feasible to inexpensively equip computers to recognize speech (Baecker & Buxton, 1987; Sanders & McCormick, 1987; Smarte, 1989). A few years ago, this could only be accomplished by adding external peripherals or special internal digital signal processing cards that performed hardware-based speech recognition to existing computers. However, an ever increasing number of new desktop computers are being sold with built-in speakers, microphones, and very powerful fast processors that allow software-based speech

recognition (Schmandt, 1994). Yet the successful deployment of speech recognition applications for these computers has been slow or at best "...limited to certain situations in which voice offers unique advantages over visual interfaces or in which no other interface modality was practical" (Schmandt, 1994, p. 268).

An example of a successful specialized speech recognition application is Northern Telecom's Traffic Operator Position System-Voice Services Node (TOPS VSN); a system that uses speech recognition to automatically handle collect and alternate-billed telephone calls deployed by Michigan Bell (Simson, 1989). Its success can be attributed to the fact that the only other inexpensive interface modality available to the user would be to enter dual-tone multi-frequency (DTMF) commands, if a touch-tone telephone is available. Alternatively, the user could choose to deal with a human operator and be assessed a surcharge of \$1.20 to \$1.48 (US dollars) for operator assisted credit card calls (Simson, 1989). This is just a limited custom application. Clearly the potential for adding speech recognition capabilities to present and future desktop computing environments is huge.

In the last decade, computers with a graphical user interface have employed tools to perform tasks that in the past could only be issued from a command line. These tools include: menus, quick keys, direct access icons, form filling in modal and non-modal dialog boxes, and direct manipulation (Baecker & Buxton, 1987; Jacob, Leggett, Myers, & Pausch, 1993). The research presented here attempted to determine the effectiveness of voice recognition in typical tasks that use such tools. It also attempted to discover any differences between general categories and subcategories of tasks performed in a typical application with a graphical user interface.

Jones, Hapeshi and Frankish (1989) offered some very general guidelines for speech recognition interfaces. However, in most cases they were only able to make expressions of general concern (e.g., speech will only be useful for certain types of tasks, speech provides advantages when combined with other tasks but only if they are non-verbal, speech

command syntax should be carefully designed, etc.) and did not have direct evidence for some of the issues discussed. They called for a more empirical approach, especially where the guidelines were insufficiently precise (see Jones et al. 1989, for a discussion).

The objective of this study was to formulate an informal set of design principles about where speech input is desirable, where it speeds up performance, and where it improves a graphical user interface. In addition, it was also important to determine the circumstances or tasks where manual controls were superior and the tasks where speech recognition and manual controls were equally effective.

Speech Recognition System Concepts

Speaker-dependent vs. speaker-independent recognition. The difference between speaker-dependent recognition systems and speaker-independent recognition systems is that speaker-independent systems recognize any user while speaker-dependent systems only recognize the speech of users whose voice templates have been trained and stored (see Hapeshi & Jones, 1988; Sanders & McCormick, 1987; Schmandt, 1994). A speaker-dependent speech recognition template is trained by having each user repeat several specific sample utterances to match the words in the system's vocabulary. The exact number of samples varies from system to system and is recommended by the manufacturer. Full template training can take many hours and can get quite tedious for users even for relatively modest vocabularies of 500 words or so (Hapeshi & Jones, 1988). A speaker-independent recognition system in theory needs no training. This is true for speech recognizers with small or limited vocabularies of 10 to 20 words (Schmandt, 1994). However, "...true speaker-independence of intermediate or large vocabulary systems is probably not a practical proposition since a degree of template training or adaptation will always be necessary" (Hapeshi & Jones, 1988, p. 256).

A third type of speech recognition system that has emerged in the past few years is a speaker-adaptive system. A speaker-adaptive system is a combination of a speaker-dependent system and a speaker-independent system in that it can accommodate a new user without requiring that every word in the system's vocabulary be trained by the user (Schmandt, 1994). Adaptive systems do not require the training of the full vocabulary but rather extrapolate from an initially trained subset of templates coded for basic speech phonemes that then adapt to the user as the speech recognition system is used (Hapeshi & Jones, 1988).

Isolated-word, connected-word or continuous-speech recognition. The most common type of speech recognition systems is an isolated-word system. Isolated-word systems require that the speaker sets off each utterance or word with a full pause. A connected-word system allows users to speak short series of words or phrases before fully pausing. However, each word in the string must be enunciated accurately and separately with no coarticulation from surrounding words. A continuous-speech system lets users speak long strings or sentences of speech without pausing between words or groups of words. A continuous-speech system approximates natural speech (see Sanders & McCormick, 1987; Schmandt, 1994). Isolated-word systems are best suited for command and control interfaces where the user is using speech to issue commands that control an application, because commands are usually no longer than one or two words. However, for dictation applications a connected-word or more desirably a continuous-speech system is required.

Size of vocabulary. Current speech recognition systems can be generally categorized as having a small, medium, or large size vocabulary. Small systems typically have vocabularies less than 200 words and have been available since the 1980s. Medium sized recognition systems (200 to 5,000 words) are available now and are still being developed using the same algorithms once used for small systems but running on faster processors. Large vocabulary systems typically can recognize between 5,000 to 10,000 words, and

some exist which well exceed the 10,000 word level. For example, IBM Voice Type has a vocabulary of over 30,000 words (IBM, 1996). The problem for large vocabulary systems is: (a) the computational power required for the pattern matching algorithms increases as a function of the vocabulary size, (b) as the number of words that are capable of being recognized increases so does the likelihood that the system will find some words similar and misrecognize them. Schmandt (1994) believes that the computational limit is not that serious because microprocessor power is always increasing. However the increase in more similar sounding words being available for recognition is serious and will only be solved with advanced recognition techniques. A related problem with large vocabularies is users have difficulty in recalling commands and syntax. Something must be done to help with the memory load for users.

Types of errors. Most actual users of speech recognition systems rarely achieve the recognition accuracy rates that are claimed by manufacturers (Hapeshi & Jones, 1988; Schmandt, 1994). The types of errors that typically occur when using speech recognition systems can be classified into three categories (adapted from Schmandt, 1994):

1. Rejection. This error occurs when the user speaks a word that is in the system's vocabulary but it is not recognized. Probable cause of this error is extraneous environmental noise, poor template training, poor speaker articulation or inconsistencies in the user's voice.

2. Substitution. This error occurs when the user speaks a word from the system's vocabulary and the system recognizes another word. Probable cause is words in the system's vocabulary that sound similar. This is problematic with large vocabularies.

3. Insertion. This error occurs when extraneous words are recognized in response to external stimuli such as the user coughing, clearing their throat, sneezing or even talking to someone else in the room or on the telephone, as well as keyboard clicks, telephone rings, creaks from desk chairs, or someone else talking.

Errors can usually be reduced greatly if the recognition vocabulary is carefully selected, environmental acoustics are controlled, and users are trained to speak clearly and consistently as well as practice using the system before any real application of speech input is attempted (Hapeshi & Jones, 1988; Schmandt, 1994).

Advantages of Speech Recognition

A number of broad advantages have been claimed regarding the use of speech recognition. It is generally held that speech input is faster than typing, and that speech provides an alternative response channel to the normally overloaded visual/manual approach (Martin, 1989; see also Simpson, McCauley, Roland, Ruth, & Williges, 1985; Jacob, Leggett, Myers, & Pausch, 1993).

In a survey of studies that compared speech input devices with keyboards, Martin (1989) rejected the claim that speech recognition is faster than typing. Yet, Martin (1989) found that speech did improve efficiency when users' hands and eyes were busy at other tasks such as in a multimodal interface where commands are entered through a variety of modalities, for example, mouse clicks, single key presses, typing full-words, and speech. Martin (1989) also reported that many of the improvements in efficiency that speech input produced disappeared when the "hands-busy" component of the task was removed suggesting that speech was providing an additional response channel to the visual/manual channel that was being overloaded.

In addition to the applied surveys, Martin (1989) reported psychological research that tended to support one theory of human information processing:

This theory states that a person's information processing capacity is not a single reservoir [*sic*] allocated in graded amounts to simultaneously performed tasks.

Rather, processing capacity seems to be drawn from multiple resources. According to the multiple resource theory of attention (Kinsbourne & Hicks, 1978; Wickens,

1980), the brain modularizes the processing of different types of information. When different tasks tap different resources, as manual movements and speech are thought to do, then much of the processing can go on in parallel, not interfering with the other. When the tasks tap the same resource, interference between the tasks occurs and processing slows. (pp. 358-359)

Many interactive computer tasks have a high cognitive load, and are susceptible to interference from competing activities. Graphical user interface tasks typically tend to tap the same resources, for example, moving the cursor with the mouse, followed by entering commands with the keyboard or through menus. These are all visual/manual tasks. Different sensory modalities utilize different resources, and processes that use different modalities are less susceptible to interference than those using a common modality (see Wickens, Sandry, & Vidulich, 1983). Speech input in a computer interface may minimize the likelihood of competition. "For example, while tracking a moving target on a display [using a mouse to select text or graphics, for example], you are more likely to be able to perform a simultaneous verbal/audio task than another visual/manual one" (Baecker & Buxton, 1987, p. 210). Adding speech input to a graphical user interface should improve performance because it does not compete with mousing or typing.

Other claimed benefits of using speech include: a reduced workload, increased worker satisfaction and cooperation; a reduced distraction from the job at hand, and increased productivity (McLeod, 1988). Current technology has already demonstrated that the use of speech provides greater operator mobility (i.e., the operator need only be close enough to speak to the machine), and ease of operation. However, the validity of these claims depended largely on the user population characteristics and the nature of the task studied (McLeod, 1988).

The purpose of my study was not to probe the underlying theoretical cognitive principles of why speech may be faster than typing. I was interested in determining whether or not speech input could outperform mouse and keyboard input for controlling a graphical user interface, particularly trying to establish specific task types that were naturally suited for speech input. This type of information would be valuable in developing design principles for the effective integration of speech recognition into the highly visual user interfaces in use today and in the future.

Applied Research

Many studies compared existing speech recognition devices to keyboard input devices with contradictory results. For example, in a study that looked at editing programming code, Leggett & Williams (1984) found that subjects were able to finish more tasks using a keyboard, as opposed to speech, but keyboard entry produced more errors. Another study that compared the speed and accuracy of speech and typed entry of command and control inputs for an operating system, found that speech input was faster, produced fewer errors than keyboard input and was the preferred method of most subjects (Poock, 1982).

In a study that observed professional secretaries issuing a few simple layout commands, for example, center, new line, capitalize, while dictating a prepared text from paper, Van Nes (1988) reported some interesting results for speech input commands vs. manual input commands. Mean time for correctly entering text-units was significantly lower using speech input than manual input but speech input error rates were much higher. Voice commands were preferred to manual commands by 10 of the 12 subjects tested despite their high error rate. However, Van Nes (1988) pointed out that two factors must be carefully taken into account when considering the preference ratings. Subjects were already using speech for content input in both the voice command and manual command treatments. A simulated speech recognition system (i.e., the experimenter was acting as the

recognizer in another room away from the subject) was used and subjects did not have to deal with the same utterance being misrecognized more than once.

Recently, studies have investigated the feasibility of using speech input to replace the mouse for navigation and menu selection in a graphical user interface (Darken, 1994; Zajicek & Rose, 1993). A study by Zajicek and Rose (1993) replaced mouse actions with speech input for navigating the cursor to a target object using different strategies and tested a small number of people with hand control disabilities. Button actions were simply replaced by the words "click", "double", and "release." Cursor navigation was accomplished in one of two ways. In one technique, a grid was superimposed on the screen. The user spoke the coordinates of the target area. The grid was toggled on and off, and the number of squares on the grid were also varied with voice. In the second technique the user directed navigation through use of commands such as "up", "down", "left", "faster", "stop", etc. Zajicek and Rose (1993) reported that speech input could be used successfully for navigation in a graphical user interface, but that neither voice strategy for navigation could be presented as the best.

Current Study

Applied research in the area of speech recognition has demonstrated that sometimes speech input is faster than manual input, sometimes it is not. Furthermore, research has shown that sometimes speech input is less prone to errors than manual input, sometimes it is not. In addition, it has been reported that under some circumstances, speech input is preferred by users.

There are possible reasons for the contradictory results. First, subjects who were tested with speech input often were not proficient using speech recognition technology or the actual application they were asked to control. Second, speech input may be superior to manual input for some task but not others in the same application.

This study addressed these issues. First, all subjects were proficient on the application used, and all subjects received extensive practice using speech recognition to control the application before being tested. Second, the approach undertaken to measure speech recognition performance in the existing graphical user interface attempted to determine the optimum allocation of voice control vs. manual control to different task types rather than assuming that speech was equally effective for all tasks. The major thrust of the current study was to look at tasks separately.

Speech recognition should not be limited to custom applications, or replacing visual interfaces for certain circumstances or special users, rather it should be fully incorporated into most computer systems across a full range of applications benefiting all types of users. However, like all modes of computer interaction, speech recognition has advantages and disadvantages that must be understood to design an effective user interface.

Factors that affect input performance. Whether voice or manual input was superior (i.e., faster, easier, less error prone, and the preferred input choice) for a certain task was hypothesized to depend on four general factors.

The first factor is the number of key presses, actions or voice commands required to complete a task. A task with a one-word voice command will be better than its three key, quick key combination or menu selection counterparts.

The second factor is the distance required to travel to perform the task. If the user's hands are busy doing something else, like typing, and they have to reach for the mouse to pull down a menu or click on a toolbar, then the distance to travel would determine speed and ease of responding. Voice input does not depend on spatial distance to travel.

The third factor is difficulty in remembering a command. Difficult to remember commands include cryptic quick key combinations, a rarely used menu item, and a voice command with a non-meaningful or unnatural name. A voice command that requires a hierarchy of responses might also be difficult to remember. While voice commands and

quick keys need to be recalled, menus can be scanned looking for the appropriate command. Having to rely on command recall often leads to slower task completion times and greater number of errors.

Type of error recovery is the fourth factor. How easy it is to recover from an input error (if the wrong voice command or the wrong manual command has been chosen) will affect performance.

Considering these four factors, speech input was hypothesized to be superior for issuing a command that had an easy, familiar and meaningful name. For example, consider the command "double space." Conceivably it is quicker and easier to say double space, rather than perform the cognitive translation of the intention into the cryptic quick key combination "Command Key + Shift Key + Y", or find and click on the icon that represents double space on a toolbar.

It was also hypothesized that speech input would outperform manual tasks that are available only as menu commands because of the distance to travel involved with manual input. For example, it should be faster and easier to say "header" than it is to use the mouse to move the cursor to the "view" menu, pull down the menu, and select the "header" command. This also led to the hypothesis that voice input would generally outperform manual input for hands busy tasks. For example, if the user has just selected text with the mouse and now wishes to perform a command on the selection, the user is more apt to achieve superior performance with voice input because they do not have to use the mouse to move the cursor to a menu or the toolbar or return their hand to the keyboard to select a quick key combination.

On the other hand, manual input was hypothesized to be better for selecting icons on a toolbar when the icons don't have familiar names. For example, commands such as "no space before paragraph" or "left-aligned paragraph," do not have familiar command names but can be represented graphically as an icon. Many people have their own idiosyncratic

names for such actions and, some don't have a name for them at all. Users quickly learn what the icon represents. It is more difficult to remember an awkward voice command, especially if it is rarely used, or placed in a hierarchy. It was also hypothesized that voice input would be inferior for hierarchical voice commands, especially if the menu and menu item voice combination was an unnatural one. For example, subjects who want to say "select all" but are required to say "edit" first, will not be satisfied with the command.

It was hypothesized that speech and manual input might be equally effective for commands that have familiar, meaningful names and a short, easily remembered quick key combinations. In this situation, subjects would be able to utter the command just as fast as others issue the command using a quick key.

Thus, it was hypothesized that users would perform better, and prefer using voice input for some tasks, but they would also perform better and prefer manual input for other tasks. Our goal was to determine the tasks where voice input was superior, how it could be improved if it was inferior and acknowledge the tasks for which voice input would not be superior.

Method

Design

The basic design was a single factor, within-subjects experimental design with three experimental conditions. One condition stipulated that only voice input could be used to issue commands; the "voice" condition. A second condition required that only mouse and keyboard command input be used; the "manual" condition. The third condition allowed either input method to be used; the "choice" condition.

Under the voice condition, commands were issued using speech recognition. Exceptions were those commands where the subject was required to enter text, select text or move the cursor. These commands were excluded because entering text, selecting text, and moving the cursor were clearly superior using manual input, and impractical with the speech recognition system that was used. We did not want to force subjects to use voice input for things it was clearly inferior at, and thus influence their perception of how good or bad voice is. The mouse and keyboard commands could not be turned off during the voice condition. However, under the manual condition, speech recognition was turned off. All subjects were tested under all conditions on predetermined word processing tasks.

Subjects

Twelve volunteer subjects participated in the study. At the beginning of the study, eight were considered expert Apple Macintosh users and four were intermediate users. Among the eight expert Macintosh users, six were expert users of Microsoft Word 5.1a, and two were considered intermediate users. Of the four intermediate Macintosh users, three were intermediate users of Microsoft Word 5.1a, and the other was a novice. Nine of the subjects were graduate students or faculty members at Carleton University. Three were employees of Bell-Northern Research Ltd.

Every subject participated in 20 or more hours of unsupervised practice over a period of approximately two to four months prior to testing. All subjects became proficient with Microsoft Word 5.1a for the Macintosh during the self-practice part of the study and achieved a baseline readiness prior to formal testing. All subjects also became proficient with speech recognition to control the application and passed a baseline readiness test before formal testing.

Training The Speech Recognition System

We used a Voice Navigator II speech recognition system (Articulate Systems Inc. [ASI], 1990). This was a speaker-dependent, isolated-word recognition system with a medium sized vocabulary of approximately 600 words. All subjects had to create individual voice template files by training their voice to the commands in the recognition system's vocabulary. This involved having each subject train each command by saying it three times and then verifying that the machine understood the command. The voice training process was supervised by the experimenter. As recommended by the manufacturer of the speech recognition system, voice templates were trained in several sets of 30 to 40 commands. This avoided having the subjects fall into a monotone or having their voice become fatigued during training, and helped ensure that the subject would sound the same during training and normal use. Total template training time for subjects varied from one to three hours.

Commands Trained

All subjects trained the default Microsoft Word names for commands e.g., bold, 10 point, scroll up, page up, empty trash, etc. These command names were provided as part of ASI's standard voice recognition template for using the Voice Navigator II with Microsoft Word 5.1a (ASI, 1990). Most commands were top level (i.e., they were available for recognition when the voice system was in its normal top level state).

However, some commands were hierarchical (i.e., they were only available for recognition after the menu name the command belonged in was spoken and recognized). For example, the command "select all" was placed in the "edit" menu hierarchy so subjects had to utter "edit" and then say "select all" in order to perform a select all task. All hierarchies were determined by ASI. Hierarchies followed the arbitrary rule that rarely used commands without easy common quick key combination or toolbar items were placed in a voice hierarchy (ASI, 1990). Meaningful names were also developed (by the researcher) for commands that were available in the form of icons or buttons with no default or standard name on the interface, e.g., double-space, superscript, etc. The full list of commands that were available as icons or buttons and had meaningful names developed for them is presented in Appendix A. Individually customized names were not used. The use of standard command names was thought to aid recall because subjects would see the same command names when they pulled down menus with the mouse and opened dialog boxes. The use of standard command names also facilitated testing because the experimenter would be expecting the same command from all subjects without being concerned about idiosyncratic use by different individuals.

Subject Practice Using Speech Recognition

Most subjects already had considerable experience using Microsoft Word 5.1a with a mouse and keyboard prior to the study. All Carleton University subjects were given access to an Apple Macintosh IIsx computer equipped with the Voice Navigator II peripheral speech recognition system, and encouraged to use it for all their Microsoft Word needs over a 2 to 4 month period. Subjects from Bell-Northern Research Ltd. were given a Voice Navigator II to use at work. Their Macintoshes ranged from a PowerBook Duo 280C to a Power PC 8100. Speech recognition accuracy did not vary among Macintosh models because all digital signal processing takes place on the Voice Navigator II itself (ASI).

1990). Subjects used Microsoft Word with voice control for their word processing tasks as much as possible during the self-practice period. The experimenter also provided training modules, shown in Appendix B, consisting of document editing tasks which were intended to familiarize subjects with the use of voice commands while word processing. The modules closely resembled the style of the formal testing scenarios and covered most facets of Microsoft Word's functionality. These modules were completed at the subjects' own pace.

All subjects spent a minimum of 20 hours using speech recognition with Microsoft Word during the self-practice period to qualify for inclusion in the study. This time included personal word processing as well as time spent on the training modules. Subjects kept a log of time spent, and problems encountered using voice control. The researcher periodically checked subject logs to ensure compliance and address problems with voice control. Informal performance assessments of voice control were performed with the training modules so that improvement in difficult areas could be facilitated by the experimenter. This information was also used to identify tasks that should be tested during formal testing.

Formal Testing Tasks

All subjects were required to reach a baseline performance level using Microsoft Word with voice control and without voice control before being tested. Subjects had to obtain a performance score of 85 percent correct responses on both the voice input and the manual input baseline tests, presented in Appendix C, before being formally tested.

Once a subject had spent a minimum of 20 hours practicing and had attained a score of 85 percent on both baseline tests, they took the formal test. All testing was performed on an Apple Macintosh IIsx computer equipped with a Voice Navigator II at Carleton University using the same template files the subjects had trained and practiced with. Each

subject modified three test documents that were prepared by the researcher. One document was modified using voice input, another document was modified using manual input, and the third document was modified using whichever input method the subject wanted for each task in the test document.

Each document required identical modifications or editing tasks to be performed. For example, each document had two tasks that involved changing the point size of some text. However, these modifications were required at different times in each document, and the contents of each document were different. One document was a ReadMe file from Microsoft, another was a magazine article, and the third was part of a newsletter. The test documents are presented in Appendix D.

Presentation order of documents with voice and manual treatments was totally counterbalanced to control for any order and document effects. Table 1 illustrates the counterbalancing methods for the three treatments and the three documents. For example, subject one had to edit Document A in the manual condition first, Document B in the voice condition second, and Document C in the choice condition third. While counterbalancing of documents did include the choice treatment, counterbalancing of conditions did not. The choice treatment was always presented last to all subjects and was not used to measure task completion times, ease of use ratings, and error scores across the specific command groups. The choice treatment was only used to determine the type of input, manual or voice, actually preferred by subjects when they were free to choose.

Subjects were given an instruction script for each test document, shown in Appendix E, that led them through the formal tests one by one. The instructions for each document were scripted so that every subject performed the editing modifications in the same way and order for a particular document. This facilitated the measurement of performance because the experimenter always knew what part of the document the subject was working on, and which command was required at that point. The formal tests took approximately 45 to 90

Table 1.

Counterbalancing of Conditions with Test Materials

Subject	Condition and document		
	First test	Second test	Third test
1	manual with A	voice with B	choice with C
2	manual with B	voice with A	choice with C
3	voice with A	manual with B	choice with C
4	voice with B	manual with A	choice with C
5	manual with B	voice with C	choice with A
6	manual with C	voice with B	choice with A
7	voice with B	manual with C	choice with A
8	voice with C	manual with B	choice with A
9	manual with A	voice with C	choice with B
10	manual with C	voice with A	choice with B
11	voice with A	manual with C	choice with B
12	voice with C	manual with A	choice with B

minutes to complete, depending on the subject.

Word Processing Tasks

The formal tests included tasks and commands that are representative of capabilities found in word processing applications with a graphical user interface. The goal was to determine what types of tasks were affected by voice recognition in terms of performance and preference. An a priori task analysis, in combination with the information collected by

the researcher during the subject self-practice sessions, was used to establish the task categories that were tested during formal testing. All available Microsoft Word commands were first divided into three general categories, pointing tasks, non-pointing tasks and dialog boxes. This categorization takes into account hands busy, eyes busy situations. Pointing tasks required users to have one hand on the mouse at initiation while non-pointing tasks did not, so generally their hands remained on the keyboard. The initial categorization made it possible to determine how having a hand already on the mouse or not at task initiation effected the use of menus, quick keys, or toolbar buttons vs. voice input.

Pointing tasks. This general category included commands that required that something be selected or pointed to on the screen with the cursor before the task was performed, e.g., making text bold, or inserting a section break. This can be interpreted as all tasks that were generally acting on something selected in the document. To select text or point at something, a user needed to have one hand on the mouse at task initiation. This was considered a hands busy task.

Non-pointing tasks. This general category included commands that did not require that something be selected or pointed to with the cursor before the task was performed, e.g., printing, paging up, or opening the header. This can be interpreted as all tasks that were generally acting on the document as a whole. Users generally had their hands on the keyboard at task initiation time for the tasks in this category. This was considered a hands free task.

Dialog box tasks. This general category included commands that required the selection or de-selection of options inside a dialog box, regardless if those commands acted on something selected (i.e., pointed at first) or not. Commands used to open the dialog box in the first place could be either pointing or non-pointing tasks depending on which way the user opened the dialog box, that is, from a menu item or a toolbar button with the mouse or with a quick key combination. No attempt was made to control whether or not a subject had

one hand on the mouse or not at task initiation for this category of tasks because we wanted users to perform as they normally would. Dialog boxes tend to slow user performance in a graphical user interface because the user has to use the mouse to select the options inside. Making this a separate category made it possible to determine if speech input would make a difference in a traditional hands busy, eyes busy trouble spot characteristic of all graphical user interfaces.

Specific task groups. The three general categories were further subdivided into 11 specific task groups that were mutually exclusive, testable and analyzable. Group membership was determined by the different ways a specific command could be issued in the current Microsoft Word interface, and which general category it belonged to. The rationale to subdivide was to see if speech input in a sub-category with many manual ways to issue a command (e.g., menu item, quick key combination, and toolbar button) would differ from a sub-category with fewer manual ways (e.g., menu only). Table 2 presents the 11 specific task groups, their defining characteristics, and the commands available in the respective groups. For example, Group 1 included commands that belonged to the pointing task general category that were available as a menu item, had an associated quick key, and a toolbar button. Commands from Group 1 included bold, cut, copy, paste, page break, italic and underline.

It was realized as the data was analyzed that three of the 11 specific task groups (Group 5, 6 and 7) could be further split into top level voice commands and hierarchical voice commands. As mentioned previously, top level voice commands could be issued by speaking their name when subjects were at the top level of the interface, which was the usual case. The hierarchical voice commands, created by ASI, followed the hierarchy of Microsoft Word's menu structure. Subjects spoke the command's menu first then the actual command name. For example, Group 5 was sub-divided into Group 5 T, Group 5 H, Group 5 commands that are top level voice commands, and Group 5 H. Group 5 commands that are

Table 2.

Mutually Exclusive Specific Task Groups

Group	Availability	Commands
Pointing tasks		
1.	menu, quick key, or toolbar	bold, cut, copy, paste, page break, italic, underline
2.	menu or quick key	repeat, plain text, clear, section break, character, paragraph, section
3.	quick key or toolbar	left align, right align, center, justify, superscript, subscript, double space
4.	menu or toolbar	border, change case, insert table
5.	menu only	point (e.g., 10 point, 12 point, etc.), table layout, table cells, font (e.g., Helvetica, Times, etc.), thesaurus
Non-pointing tasks		
6.	menu, quick key, or toolbar	open, print, save as, replace, spelling, save, undo, redo, print preview, close window, show/hide paragraph markings
7.	menu or quick key	page setup, quit, select all, find, go to, ribbon, ruler, document
8.	menu only	header, footer
9.	direct manipulation buttons	page up, page down, close
Dialog box tasks		
10.	modal dialog boxes	open, save as, page setup, print, table, footnote, character, paragraph, section, document, border, table cells, table layout, change case
11.	non-model dialog boxes	find, replace, spelling

hierarchical voice commands. Thus, 14 specific task groups presented in Appendix F were created. Nine of the specific task groups were top level voice groups and five were hierarchical voice groups. Group 2 and 4 already consisted entirely of hierarchical voice commands before groups 5, 6 and 7 were sub-divided.

Commands Tested

Not all available commands that were trained were evaluated in the formal tests. Appendix F also describes the commands tested, and when they were tested in each script. For example, Group 3 is a subset of the pointing tasks category which includes commands that are available as a quick key and a toolbar button. Commands in this group included left align, right align, center, justify, superscript, subscript, and double space. However, only left align, right align, center, and double space were tested. This sampling of commands assumes that testing all the commands in Group 3 is not necessary to verify the general effect of voice input on the type of commands found in that group. Similarly, sampling assumes that it is not necessary to have the subjects perform formal tests in all dialog boxes in Microsoft Word to determine how speech recognition performs relative to manual input for selecting parameters in dialog boxes. The most commonly used dialog boxes were tested.

Measures

The formal performance testing sessions were scored for ease of use rating, errors, and quantitative choice during actual testing. Sessions were video taped for scoring of task completion times and review of all measures at a later date.

Task completion time. Time to complete each task was scored only in the voice and manual conditions. For example, it might take a subject 5.1 seconds to make some selected

text in the test document bold in the manual condition, but only take 3.3 seconds to perform the same task in the voice condition.

Ease of use rating. Perceived ease of use for each task was recorded only in the voice and manual conditions. A 6-point Likert scale was used where ease of performance ratings ranged from 1 (extremely difficult) to 6 (extremely easy). For example, a subject might give the print preview command an ease rating of 6 in the manual condition but give it only a rating of 2 in the voice condition. The Likert Scale ease ratings are shown in Appendix G.

Error scores. Two types of errors could be committed in the manual condition. A recall error was scored when the subject used the wrong command for the task, realized that error, then corrected herself. A hint error occurred when the subject did not know what command was required and had to be given a hint by the experimenter to complete the task.

Three types of errors were scored in the voice condition. Recall errors and hint errors were defined as in the manual condition. Hierarchy errors were special cases of recall errors that occurred only in the voice condition and could only take place in a hierarchical task group. A hierarchy error was scored when a subject forgot the hierarchy of the speech recognition vocabulary when issuing a command. For example, to issue the command "select all," a subject first had to utter the name of the menu it was in, "edit", and then say the command "select all." If the subject failed to say the name of the menu before the command, then the speech recognition system would do one of two things. It would either reject the subject's utterance and do nothing, or, worse, it would perform a substitution from the recognizer's vocabulary and recognize an incorrect command. A hierarchy error was only scored if the subject forgot to say the name of the menu before saying the actual command name. For example, if the required command was "edit > select all" and the subject just said "select all" that would be counted as a voice hierarchy error. Saying the wrong menu name first (which very rarely occurred) or the wrong command name, after the correct menu name was said, would count as a regular voice recall error. Hierarchy

errors were scored because the subject forgot that a hierarchy was required in the speech interface, which they had reached baseline competence on. Eleven such hierarchical commands, which are presented in Appendix F, were tested in each test document during the formal tests.

Machine errors. A recognition error by the speech recognition system was not counted as a subject error. For example, assume the proper command to perform a task is "helvetica." If the subject correctly said this command, but the recognizer rejected the utterance or substituted for it, then this was not a subject error, but a machine error. The focus was to investigate human factors implications for the future when speech recognition error rates will approach zero percent. Therefore, we attempted to ignore the imperfections of the system we used. The machine errors were recorded separately, and removed from task completion times by reviewing the session videos. For example, if a subject in a task had to issue the command helvetica four times before the recognizer correctly understood and performed the command, the task was deemed to be completed upon the first utterance of helvetica and not the fourth when the machine actually understood it. Task completion time, for a command was the exact time it took to issue the first correct utterance not the time it took the recognizer to understand it.

Quantitative choice. In the choice condition, the method of command input the subject chose for each task when given the choice between manual input and voice input was recorded. Some subjects chose to use manual or voice input exclusively for most tasks, while others mixed both inputs throughout this condition. During this final experimental condition it became apparent with which of the 14 specific task groups subjects preferred to use voice input, and with which they preferred to use manual input.

Results

A series of completely within-subjects two way factorial analyses of variance (ANOVA) were performed in which the independent variables were mode of input (voice or manual) and type of task. Two between-subjects independent variables, style (whether the subject was a menu user or quick key user) and order (whether the subject was tested in the voice condition or the manual condition first) were considered. While one significant interaction was found involving each of these effects, they were not interpretable and did not influence the interpretation of the within-subjects effects of primary concern. Thus, the decision was made to report analyses based solely on the mode of input and type of task independent variables. The dependent variables were task completion time, ease of use rating, error scores, and whether, when given the choice, subjects chose to perform tasks with voice or manual input.

When the sphericity assumption was violated, the Huynh-Feldt Epsilon correction was used to adjust the degrees of freedom to compensate for the violation. An alpha level of .05 was used for all statistical tests.

In each test script, one task could be performed with either a "Cut" command or a "Clear/Delete" command which came from different task groups. It was not possible to unambiguously attribute the command to a specific task group, so the subjects would have varying number of scores in the two groups. This task was omitted from the analyses.

Task Completion Times

A series of analyses evaluated the time to complete tasks with voice and manual input. In the first analysis, the two within-subject independent variables were Input (voice vs. manual) and general task categories with three levels (pointing, non-pointing, and dialog boxes). There was a significant Task main effect, $F(2, 22) = 127.03$. $p < .001$. Mean task

completion times for tasks of pointing (4.8 s) and non-pointing (4.6 s) were equally fast, but dialog box tasks took considerably longer (13.8 s). Dialog box tasks took longer because each required a number of commands to be issued within the dialog box, while other tasks only required one or two commands to be issued. There was no main effect of voice vs. manual input, but there was a significant Input by Task interaction, $F(2, 22) = 4.17, p = .029$, which is shown in Figure 1. Mean task completion time in seconds is shown on the vertical axis with the three general task categories of pointing, non-pointing, and dialog box tasks on the horizontal axis. The voice condition is plotted with hollow bars, and the manual condition is plotted with solid bars. Standard errors are indicated on all bars. Simple main effects comparing voice vs. manual input for the different tasks were calculated. For pointing tasks, voice input (4.2 s) was faster than manual input (5.2 s), $F(1, 11) = 4.85, p = .05$. There were no significant differences between voice and manual input for non-pointing tasks, and for dialog box tasks, both $F_s < 1$.

To understand the specific tasks in detail, a second analysis was performed with the two within-subject independent variables being type of Input (voice vs. manual) and type of Tasks broken into 14 levels. As previously defined in Table 2 of the Methods section, the original 11 task groups were further divided because some of the 11 groups contained both top level and hierarchical voice commands. Thus 14 task groups, described in Appendix F, were created with five being hierarchical voice task groups and the other nine being top level voice task groups.

The sphericity assumption was violated for the second analysis. There was a significant Task main effect, $F(1.63, 17.90) = 11.30, p = .001$, with the mean task completion times for Specific Tasks ranging from 1.6 seconds to 17.7 seconds. Group 11 Top (non-modal dialogs) tasks took a long time (17.7 s) because they included spell checking a number of words which often took more than a minute and increased the mean time for this group. There was no main effect of type of Input. There was a significant

Figure 1. Task completion time as a function of input and general tasks.

* $p < .05$.

Input by Task interaction, $F(5.98, 65.73) = 4.88, p < .001$, which is shown in Figure 2. Mean task completion time in seconds is shown on the horizontal axis with the 14 specific task groups on the vertical axis. The general naming convention used for the task groups includes three components: (1) group number from Table 2, (2) whether the group consisted of top level or hierarchical voice commands, and (3) an example of one of the commands in the group. For example, Group 5 Top (helvetica) means Group 5 from Table 2 (pointing commands available as menu items only) that are top level voice commands, with an example being "helvetica." Group 5 Hierarchy (format > table layout) means Group 5 from Table 2 that are hierarchical voice commands, with an example being "format" followed by "table layout." Appendix F provides a complete description of all 14 task groups.

In addition to showing the means, Figure 2 shows an asterisk next to pairs that are significantly different at the .05 level. Table H1 in Appendix H lists the mean task completion times with their F values and probabilities for each task group. Voice and manual responding were not significantly different for 10 task groups. For those groups with significant differences, voice responding was faster than manual responding in three task groups (Group 1 Top, 5 Top, and 8 Top) and slower in one (Group 7 Hierarchy).

Voice input was faster for pointing tasks (Group 1 Top) when the speech command was at the top level while the manual command required a choice among a menu, a quick key, and a toolbar item. Voice input was also faster for pointing tasks (Group 5 Top) and non-pointing tasks (Group 8 Top) when the speech command was at the top level while the manual command was available only as a menu item.

On the other hand, voice input was slower for non-pointing tasks (Group 7 Hierarchy) when the speech command was in a hierarchy compared to manual input where a menu item and a quick key were available. This may be because the command in this task group (edit > select all) had a difficult to remember and difficult to say voice sequence or

Figure 2. Task completion time as a function of input and specific tasks.

* $p < .05$.

subjects expected the "select all" command to be at the top level.

Ease of Use Ratings

After each task, subjects were asked to rate how easy it was to perform the task. A series of analyses evaluated the ease of use with voice and manual input. In the first analysis, the two within-subject independent variables were Input (voice vs. manual) and general task categories with three levels. There was a significant Task main effect, $F(2, 22) = 19.21, p < .001$. Mean ease ratings on a 6 point Likert scale (where 6 is extremely easy to use and 1 is extremely difficult to use) for pointing tasks (5.35) were equivalent to non-pointing tasks (5.14) while dialog box tasks (4.70) were rated slightly harder to use. There was no main effect of voice vs. manual input, and there was no significant Input by Task interaction.

To understand the tasks in detail, a second analysis was performed with the two within-subject independent variables of types of Input and types of Tasks using 11 levels of tasks. Only 11 levels of specific tasks were available because no data were recorded for Task Groups 4 Hierarchy, 5 Hierarchy, and 7 Top, since every command in these groups launched a dialog box that was then worked on by the subject. Launching a dialog box and performing some task inside it was treated as one task by the subject, but it was actually two tasks. I did not want to break the subjects' flow and ask them to rate the ease of the command used to launch the dialog box. Ease of use was recorded at the end of these tasks, and referred only to the work performed in the dialog box, resulting in no scores for Task Groups 4 Hierarchy, 5 Hierarchy and 7 Top. These groups were removed from this analysis.

The sphericity assumption was violated for this analysis. There was a significant Task main effect, $F(5.30, 58.31) = 8.57, p < .001$, with the mean ease rating ranging from 4.55 to 5.69 (on a 6 point Likert scale). There was no main effect of type of Input, but

there was a significant Input by Task interaction, $F(5.71, 62.76) = 7.52, p < .001$, which is shown in Figure 3. Mean ease rating, using the 6 point Likert scale, is shown on the horizontal axis with the 11 task groups on the vertical axis. Figure 3 also indicates which simple effect pairs are significant at the .05 level by placing an asterisk beside them. Table H2 in Appendix H lists the mean ease of use ratings for voice and manual input with their F values and probabilities for each task group.

Voice and manual input were not significantly different for seven task groups. For those groups with significant differences, voice input was rated easier to use than manual input in two task groups (Group 1 Top and 5 Top) and harder to use in two others (Group 2 Hierarchy and 7 Hierarchy).

Voice input was rated easier to use for pointing tasks (Group 1 Top) when the speech command was at the top level while the manual command required a choice among a menu, a quick key, and a toolbar item. Voice input was also rated easier to use for pointing tasks (Group 5 Top) when the speech command was at the top level while the manual command was available only as a menu item.

On the other hand, voice input was rated harder to use for pointing tasks (Group 2 Hierarchy) when the speech command was in a hierarchy with an easy to remember and say voice command sequence such as, format > section, compared to manual input where a menu item and a quick key were available. Voice input was also rated harder to use for non-pointing tasks (Group 7 Hierarchy) when the speech command was in a hierarchy with difficult to remember and say voice command sequence such as, edit > select all, compared to manual input where a menu item and a quick key were available.

Figure 3. Ease of use as a function of input and specific tasks.

* $p < .05$.

Error Scores

Two analyses of variance were performed on error scores. Mean errors per attempt were calculated for all manual recall errors, voice recall errors, and voice hierarchical errors in each task group¹. Voice hierarchical recall errors (i.e., forgetting a command's hierarchy structure) were only possible in task Group 2 Hierarchy, 4 Hierarchy, 5 Hierarchy, 6 Hierarchy, and 7 Hierarchy. Thus the first analysis considered only those five task groups. The two within-subject independent variables were Error Type (manual recall errors vs. voice recall errors vs. voice hierarchical errors) and the five hierarchical tasks.

The sphericity assumption was violated for this analysis. There was no main effect for the five hierarchical tasks and no main effect of type of error. There was a significant Task by Error Type interaction, $F(3.34, 36.76) = 4.52, p = .007$, which is shown in Figure 4. Mean errors per attempt are shown on the horizontal axis with the five hierarchical task groups on the vertical axis. Manual recall errors are plotted with solid bars, voice recall errors with hollow bars, and voice hierarchical recall errors with hatched bars.

Simple main effects comparing mean errors per attempt for error type at the different tasks were calculated. The sphericity assumption was violated for all comparisons except Group 4 commands. The results are presented in Table H3 in Appendix H. Mean errors per attempt for the different error types with their F values and probabilities are listed for each hierarchical task group. Figure 4 also indicates which simple effect pairs are significant at the .05 level by placing an asterisk beside them. The only significant simple effect was for Group 7 Hierarchy.

¹ Manual and voice hint errors were not included in the error analyses because it was impossible to determine whether the subject needed a hint because (a) the subject understood the question asked in the script but could not remember how to accomplish the task or, (b) the subject did not fully understand what the question in the script was asking because of poor wording. Overall the mean number of hint errors per attempt was small, 0.04 for voice commands, and 0.02 for manual commands.

Figure 4. Errors as a function of input and hierarchical tasks.

* $p < .05$.

Multiple comparisons using Scheffé's S procedure at $\alpha = .05$ indicated that voice hierarchical errors (1.17) were higher than manual recall errors (0.0), and voice hierarchical errors were higher than the average of voice recall and manual recall errors (.17). No other multiple comparisons were significant. For Group 6 Hierarchy, the difference between voice recall errors per attempt and voice hierarchical errors per attempt was large, but marginally non-significant $F(1.06, 11.70) = 4.11, p = .064$, due to extreme variability.

A second analysis of variance was performed with Error Type (manual recall errors vs. voice recall errors) and the nine top level Task Groups, because voice hierarchical errors could not be committed in top level task groups. The sphericity assumption was violated for this analysis. There was a significant Error Type main effect, $F(1, 11) = 7.04, p < .022$, with the mean errors per attempt for manual recall and voice recall being 0.03 and 0.05, respectively. There was no main effect of Task and no significant Task by Error Type interaction.

Choice Analysis

In the last phase of the experiment, subjects were asked to perform tasks with their choice of voice or manual input. One analysis of variance was performed for the Choice condition with the one within-subject independent variable of types of Tasks using 12 levels of specific task groups. Only 12 levels of tasks were used because it was possible to choose voice input, manual input and a mixture of the two in Group 10 Top (modal dialogs) and Group 11 Top (non-modal dialogs). In most cases, a dialog box task required a number of actions to be performed inside a dialog box. Since many subjects switched between using voice input and manual input inside a dialog box, it was impossible to calculate a pure voice and manual choice percentage score for dialog box tasks. Dialog box task groups were removed from the analysis.

For the remaining 12 task groups, the mean percentage that voice input was chosen in a task group was determined. For example, a score of 75% indicated that the subjects chose voice input 75 percent of the time for a task. The null hypothesis was that subjects would have an equal preference for each task, or score 50%. An analysis of variance to determine if the mean is different from 50% was then run. The test based on all tasks was significant, $F(1, 11) = 17.42, p = .002$, indicating that voice and manual input were not used equally. Over all tasks, voice was chosen 70% of the time while manual was chosen 30%. There was also a significant Task main effect, $F(11, 121) = 3.07, p = .001$. The Task main effect is shown in Figure 5. The percentage of time voice input was chosen is shown on the horizontal axis with the 12 specific task groups on the vertical axis. Mean percentage of times voice was chosen ranged from 41.7% in Group 6 Hierarchy to 100 % in Group 8 Top. Voice input was chosen more than 50% of the time in every task group except Group 5 Hierarchy, 6 Hierarchy, and 7 Hierarchy.

The significant task types main effect was followed up with individual single sample *t*-tests to discover if the percentage that voice input was chosen differed significantly from 50%. The results are presented in Table H4 of Appendix H. Percentage voice input chosen with their *t* values and probabilities are listed for each task group. Figure 5 also indicates which task group had *t* values significant at the .05 level by placing an asterisk beside the group. The percentage that voice input was chosen was not significantly different from 50% for six task groups. Voice input was the preferred choice over manual input in the six remaining task groups (Group 1 Top, 3 Top, 5 Top, 6 Top, 8 Top, and 9 Top).

Voice input was the preferred choice every time the speech command was at the top level except for Group 7 Top. Voice input was the preferred choice for pointing tasks (Group 1 Top) and non-pointing tasks (Group 6 Top) when the manual command required a choice among a menu, a quick key, and a toolbar item. Voice input was preferred for pointing tasks (Group 3 Top) when the manual input required a choice between a quick key

Figure 5. Preferred voice input choice as a function of specific tasks.

* $p < .05$.

and a toolbar item. Voice input was preferred for pointing tasks (Group 5 Top) and non-pointing tasks (Group 8 Top) when the manual command was available only as a menu item. Voice was also preferred for non-pointing tasks (Group 9 Top) when the manual command was available as a direct manipulation icon on the window.

Interestingly, voice input was not the preferred choice for any task groups which had the voice commands in a hierarchy.

Discussion

It was hypothesized that voice input would result in superior performance over manual input for some tasks in a graphical user interface but not others. The goal was not to make broad, sweeping statements about the utility of speech input as others have done (see Baecker & Buxton, 1987; Jacob, Leggett, Myers, & Pausch, 1993; Jones, Hapeshi & Frankish, 1989; Martin, 1989; McLeod, 1988). Rather, we were interested in looking at tasks separately, theorizing that voice input would be superior for certain types of tasks that are typically found in applications with a graphical user interface. The results supported this general hypothesis. There were differences in tasks which is indicated by the Task main effect present in the analyses involving the task completion time, ease of use, and preferred choice dependent variables.

Easy and meaningful command names. It was hypothesized that voice input would be superior for issuing commands that had an easy, familiar and meaningful name regardless if their manual input counterparts were quick keys, menu items or toolbar buttons. Out of the 14 specific task groups, voice input was found to be faster in three task groups, namely Group 1 Top, 5 Top, and 8 Top; easier to use in two groups, Group 1 Top and 5 Top; and the preferred input choice in six groups, Group 1 Top, 3 Top, 5 Top, 6 Top, 8 Top, and 9 Top. Voice input was also no more prone to errors than manual input for any of the above task groups which all had easy and meaningful names. Examples of command names from these groups are: bold, cut, copy, center, double space, helvetica, 12 point, open, print, replace, header, page down, and close (refer to Appendix F for a complete listing of command names tested in each group). These results support the original hypothesis that voice input will be superior to manual input if the voice commands have easy, familiar and meaningful names.

Menu commands. It was hypothesized that speech input would outperform manual input for tasks that are only available as menu items. Three such groups existed out of the 14 task groups that were analyzed, Group 5 Top (a top level pointing task group), 5 Hierarchy (a hierarchical pointing task group) and 8 Top (a top level non-pointing task group). The results strongly support this hypothesis. Voice input was faster in Group 5 Top and 8 Top, easier to use in Group 5 Top, and the preferred input choice for Group 5 Top and 8 Top. Error rates for voice vs. manual input for these task groups were comparable. Therefore, it can be said that voice input was at least as good as and usually superior to, selecting commands from menus. Examples of commands from these groups were: helvetica, 10 point, format > table layout, and footer.

Hands busy tasks. It was hypothesized that voice input would generally outperform manual input for hands-busy tasks. In this study, pointing tasks were considered hands-busy tasks. Voice input was significantly faster than manual input for the pointing tasks general category. In addition, by looking at the 14 specific task groups, it can be shown that voice input was superior in many of the six task groups that belonged to the pointing task general category. Voice input was faster and easier in two task groups, Group 1 Top and 5 Top. It was also the preferred input choice in three task groups, Group 1 Top, 3 Top, and 5 Top. Voice input did not produce more errors than manual input in any of the six task groups that belonged to the pointing tasks general category. These results also support the claims of others that speech input improves efficiency for hands-busy tasks (see, Jones, Hapeshi & Frankish, 1989; Martin, 1989; Jacob, Leggett, Myers, & Pausch, 1993).

Difficult and non-meaningful iconic command names. It was hypothesized that voice input would be inferior to manual input for selecting iconic-button commands from a toolbar especially for voice commands with difficult or non-meaningful names. The results do not support the hypothesis that manual input is better for iconic commands. No task

groups that consisted only of iconic commands existed, because iconic commands always had a menu item or quick key counterpart. However, two task groups (Group 3 Top and 9 Top) consisted of icons and quick keys. It is reasonable to assume that in these groups most users would tend to know the icons better than their quick key alternatives because they primarily had obscure key combinations (e.g., "double space" whose quick key combination is "Command Key + Shift Key + Y"). Results showed that subjects could click on the icons just as fast as they could say them, found voice just as easy and error free as manual input, but they significantly preferred to use voice input for Group 3 Top and 9 Top. This preference is surprising because some of these iconic commands had voice command names that could be considered difficult or awkward (e.g., left align, and right align).

Hierarchical voice commands. It was hypothesized that voice input would be inferior to manual input when the voice commands were hierarchical, especially if they had difficult or awkward names. The results showed that voice input produced problems for users only when the commands were hierarchical. Out of the five hierarchical task groups analyzed, voice input was slower for task Group 7 Hierarchy, harder to use for Group 2 Hierarchy and 7 Hierarchy, and produced significantly more voice hierarchical errors than manual recall errors as well as the average of manual recall and voice recall errors for Group 7 Hierarchy. Voice input also produced considerably more voice hierarchy errors than voice recall and manual recall errors for Group 6 Hierarchy but these results were marginally non significant. Interestingly, voice input was not the preferred input choice for any of the five hierarchical task groups. Voice input might have been so inferior for Group 7 Hierarchy (when compared to the other hierarchical groups) because, besides being a hierarchical group, it also had a voice command name that was unnatural to say (i.e., edit > select all) compared to an easy and familiar quick key combination (i.e., Command Key + A). It was not as natural and easy to say as the commands in Group 2 Hierarchy, 4 Hierarchy, and 5

Hierarchy (e.g., format > character, insert > section break, format > border, insert > table, and format > table layout). However, Group 6 Hierarchy which also had a difficult to say voice command name (i.e., file > print preview) had an obscure and difficult quick key combination (i.e., Command Key + Option Key + I) as well. Poor performance with this quick key combination could explain why voice hierarchy errors in this group were marginally non significant. Although the results indicate that voice input is inferior when the voice commands are hierarchical, three of the five hierarchy groups had only one command tested in each of them (Group 5 Hierarchy had "format > table layout", 6 Hierarchy had "file > print preview", and 7 Hierarchy had "edit > select all"). The results could be idiosyncratic to these three commands. However, due to the strength of the evidence presented here against hierarchical commands, and much anecdotal comments from subjects regarding their dislike of hierarchies, it is safe to say that poorly worded, unnatural sounding voice hierarchical commands are inferior.

User Interface Design Implications

What does all of this mean for the integration of speech recognition into graphical user interfaces? Obviously, one cannot just map the existing menu, quick key, iconic command manual interface to a voice interface and expect the best. Special design considerations have to be taken into account.

Number of key presses. Clearly voice input is superior when it comes to reducing the number of key presses or actions required to perform a command or task. Quick key combinations would be second, but only if the user's hands were already on the keyboard. Iconic toolbar commands and menu items would be last. It takes time and coordination to move your hand to the mouse to pull down a menu or find and click on an icon. Executing a quick key command also takes time, unless the user already has hands on the keyboard.

Distance required to travel to perform the task. Voice input was shown to be superior when the user's hands were busy doing something else, like typing, and they had to reach for the mouse to pull down a menu or click on a toolbar. There is no travel distance with voice input. Quick keys would again place second, but that depended on where the subject's hands were at task initiation. If one hand was on the mouse selecting something then quick keys did not help much.

Voice input would outperform manual input, as far as reducing the number of key presses and task travel distance, for tasks and applications that have a high hands-busy component (i.e., tasks that cause the users' hands to leave the keyboard often). For example, voice input for command and control would improve performance for draw and paint applications, CAD/CAM applications, editing tasks such as the ones studied in this research, desktop publishing, inventory checklists, etc. Any application that requires the user to constantly select items on screen using a mouse or similar pointing device and then issue control commands would benefit from using voice input to issue the commands.

Difficulty in remembering commands. All voice and quick key commands had to be recalled. Menu items and iconic commands could be recognized. This is a potential problem for voice input because it puts a load on user memory, especially if the voice commands themselves do not sound natural. Menu commands would rank first in ease of remembering, followed by iconic commands. Quick keys and voice input would rank last. Once a difficult quick key is learned it becomes part of the user's muscle memory but most users do not learn difficult or obscure quick key combinations. Obvious quick keys such as "Command Key + B" for bold, or "Command Key + C" for copy are easy. However, the number of easy possibilities is limited by the number of letters in the alphabet and the arbitrary use of the command, control, and option keys as modifiers. Even the dedicated quick key users in the study were just as fast or faster with voice input as they were with quick keys for commands that had a meaningful voice command. On the other hand, many

subjects complained that some of the voice commands that they were asked to use were not worded the natural way they would say them (e.g., "left align" instead of "left justify" was thought to be contrived by some, as was "format > table layout" and "edit > select all"). The goal is to provide meaningful, easy to remember and easy to say voice commands. This undoubtedly should be more possible than providing easy, obvious quick key combinations because of the keyboard constraints mentioned above. It seems likely that many people would use easy voice commands to supplement easy quick keys.

Other comments expressed the subjects' general dislike of having to remember which commands were at the top level and which were in the menu hierarchies. Many subjects commented that they felt some hierarchies were arbitrary and hindered them. For example, the majority of subjects complained about "edit > select all" in that some could not remember that it was in the edit hierarchy and others questioned why was it in a hierarchy at all. Having the additional memory task of remembering if, and which, commands were in a hierarchy was a problem. Subjects knew select all, but made voice hierarchy errors because edit was required before it could be said. Other hierarchies, such as "format > border" did not cause problems, had comparable performance with manual input and were not considered arbitrary by the subjects. Was this because the border command did not have a quick key in the manual interface thus subjects were accustomed to selecting it from a menu and therefore thought it appropriate for it to be placed in a voice hierarchy as well? Or could it be that "format > border" was more natural to say or as some subjects put it, "formed an English phrase" that was easy to say and easy to remember?

The speech recognition system allowed hierarchical commands to be said with a very short pause between the menu and menu item. Subjects did not have to wait for the menu to pop down before saying the menu item as long as they enunciated properly and allowed no coarticulation in the menu-menu item voice sequence. Many subjects learned this and could issue phrase-like commands such as "format > border" with no problems. Use of

hierarchies (or vocabulary subsetting) has been one technique used by many manufacturers to minimize machine recognition errors and improve performance for command and control applications because fewer similar sounding commands are available at the same level (Schmandt, 1994). By reducing the number of commands available at a top level and placing them in hierarchies, machine recognition rates improve dramatically. However, as the results show, if the hierarchies are arbitrary or poorly worded, improved machine recognition rates are offset by increased user hierarchy errors and low satisfaction.

Error recovery. Although this user interface aspect was not looked at empirically, it would seem that it should be just as easy to recover from a voice input error as from a manual input error. It is speculated, based on informal observations and anecdotal comments, that the added burden of having to remember hierarchies, would place error recovery for voice input behind that of manual input. When a hierarchical error was committed, the speech recognition system would often substitute a totally different command than the one intended, and subjects found themselves having to first correct or undo the hierarchy error and then perform the original task. Many subjects also complained about becoming very frustrated and disoriented in the user interface after committing a voice hierarchy error because they would not know in which part of the voice hierarchy they were and would have to go back to the top level and start again. Recall errors were just as problematic, because when subjects forgot a command, it was not a simple matter of just scanning menus until the desired command is recognized. They had to try to remember the wording of the required command.

Design Guidelines

The results of the current study, based on looking at tasks separately, and the anecdotal comments collected from the subjects throughout the study allowed for the development of design guidelines or principles for future voice input interfaces. Without

looking at tasks separately in a graphical user interface these design guidelines would lack validity. This study also demonstrates that studies that look at speech recognition generally and make broad "voice better or worse than manual" claims are not very useful. The design guidelines are presented below.

1. Easy and meaningful command names. Voice input commands should have names that are common, easy to remember, natural to say, and meaningful. The command names do not have to necessarily be short. This study demonstrated that even long command names such as "double space" were just as successful as short ones like "bold" because they were easy and meaningful. The goal is to let the user say exactly what their intended action is in plain language.

2. Use voice for hands-busy tasks. It has been claimed for years that voice input is highly advantageous in tasks that have a high hands-busy component. This study reconfirmed this. Every effort should be made in the interface to provide voice commands as alternatives or to supplement existing manual commands for all tasks or commands that are hands-busy.

3. Difficult and non-meaningful command names. Do not provide cryptic or unnatural voice commands that do not match the intended actions in the graphical user interface. If iconic commands are to be represented in the voice interface, names should be developed for them that adhere to the first design principle of providing easy and meaningful command names. If a meaningful name cannot be developed, or there are many possible alternatives, allow the user to pick or create their own name, including alternatives. Do not force your design bias on the user.

4. Minimize hierarchical voice commands. Provide as many commands as possible at the top level of the interface, minimizing the use of hierarchies to improve machine recognition. Two solutions are currently used by most manufacturers. First, they place voice commands at the top level that are meaningful for the user and not easily confused by

the recognition system. For example, Voice Type (IBM, 1996) went from using the voice commands "start dictation" and "stop dictation" that were often confused by the machine to "begin dictation" and "stop dictation." A second solution that is used frequently is to change the order of command sequences that are confused by the machine. For example, "page up" and "page down" could be changed to "up page" and "down page," which is fine for the machine but not natural for the speaker and thus violates design principles 1 and 3. Realistically, both solutions are of limited scope in large vocabulary systems. There are only so many ways to say the same thing. In systems with thousands of voice commands, there are bound to be some similar sounding commands that the machine will confuse regardless of how they are worded. However, as recognition techniques improve this may become a thing of the past.

If hierarchies are required to improve machine speech recognition, make sure that they are well designed and naturally form a hierarchy (e.g., format > document). The user should not have to think about what commands are in a hierarchy or not. The hierarchy-command sequence name should be as common and as natural as saying the command at the top level. Today's speech recognition boards do not require long pauses between words (some require none). Do not make the user pause through a hierarchy command by making it unnatural to say. For example, "format > border" is a good hierarchical voice command, "file > print preview" is not. Use hierarchies judiciously, do not place popular or often used commands in them, and design them for the user and the task at hand, not the machine. Making them as natural sounding and as easy to remember as possible and not basing them on poorly designed menu systems may also help.

5. *Customizable voice commands.* Allow users the ability to customize the way they say a voice command. Customizable voice commands allow users to call a command by a name that they will be comfortable with and find easy to remember. For example, if the

command is "left align", but the user wants to say "left justify", allow it to be trained. The training should be made as easy as possible.

Allow users to have redundant commands in case they forget a command, or use synonyms as most speakers of a language are apt to do. There is no reason for a manufacturer to arbitrarily force their command naming scheme on users for something as natural as speech. The system should recognize words that are synonyms and give the user a choice of making them represent the same action, easily without using awkward editors. For example, users should be able to access a header with the commands (header, open header, show header, and view header).

Also allow users to control what is placed in a hierarchy and what is not. If users build the hierarchy themselves, they might remember commands better than having to learn an arbitrary hierarchy, designed by a software writer. Easily customizable, redundant voice commands and control of what goes into hierarchies should greatly reduce recall errors, decrease task completion time and provide greater user acceptance.

6. Easy error correction. No matter how well designed the voice interface is, errors will occur. More has to be done to provide an easier way to recover from voice errors. Schmandt (1994) suggests that carefully designed vocabulary subsetting (i.e., better hierarchies), confirmation strategies (either explicit or implicit), providing additional recognition information (i.e., reporting the next best match or words that the system is currently confusing together), echoing back commands (so that well formed and recognized commands that are not what was intended can be stopped), and providing multiple backtracking or undoes could seriously improve speech input error recovery.

Designing better hierarchies are covered under design principle 4. However, if hierarchies are used, providing feedback on which part of the voice system a user is currently in is another way to recover from a hierarchy error, or, better yet, prevent errors from occurring. Asking for confirmation before performing a command with grave

consequences is also a good idea. However, if the command was issued with voice input then it might be better if the confirmation is provided through the audio channel and not just a textual warning box. Some subjects commented that when they were issuing commands with their voice they would ignore or not entirely read any warning boxes presented to them on the screen. They claimed they were in a verbal/audio mode of responding and expected the computer to act accordingly.

Providing additional recognition information and echoing back commands could be very obtrusive to most users although it might improve voice input error recovery. Providing multiple undoes, especially if it is much easier and better to recover from common voice input errors such as substitution (very common with hierarchical errors) and insertion would also be very advantageous.

Conclusion

Speech recognition can be fully incorporated into most computer systems across a wide variety of applications. Many users can benefit from the advantages that speech input provides. Speech recognition systems are getting more powerful every year and more computers are shipping with it direct from the manufacturers. More and more applications will soon try to add speech input to their existing interfaces. The current study demonstrated that voice input can be successfully added to a common widely used application in a graphical user interface without adversely affecting user performance. However, before adding speech recognition to an application with a graphical user interface, a task analysis looking at mutually exclusive tasks should be performed. Integration of voice input into the application's existing user interface can be optimized by following the above design principles. The existing menu structure or nested command sequence of the application may not be appropriate for voice input. Speech recognition interfaces have to be designed and not just retrofitted to an existing graphical user interface

to optimize user performance. Voice input should supplement and improve the current performance achieved in the existing graphical user interface. It should not be simply considered an alternative for custom purposes or special users.

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Appendix A

Meaningful Voice Input Names Used for Iconic Commands

Iconic Command	Voice Command
left align
center
right align
justify
single space
double space
superscript
subscript
show paragraph
hide paragraph
Click Here -->	page up
Click Here -->	page down

Appendix B

Training Modules

Practice Document 1

555 Some Street • Someplace, USA 55555

1/16/97

Jean Tanner
236 Promotion Place
Champagne, New York 12345

Dear Jean Tanner:

As I'm sure you are aware from your frequent travels aboard Blue Sky Airlines, we produce a quarterly magazine for our passengers to read while in flight. As editor of Blue Sky's publications, I am inviting you to be our Spring Spotlight Traveler.

If you agree to be a Spotlight Traveler, you will receive two complimentary, round-trip tickets to anywhere Blue Sky flies, as well as four, first-class upgrades to use on any flights during the coming year. We will also send you our special Spotlight Traveler card. This card entitles you to preferred service and to special tour packages offered throughout the year only to Spotlight Travelers.

Our booking agents tell us that you fly Blue Sky in the company of Vincent, the orangutan from the popular television show. Would you be willing to be interviewed and to pose for some photos, preferably with Vincent? We'd love to publish this story in our fifth anniversary special issue of the magazine.

I would like to schedule the interview for a time that is convenient for you. I will call you during the coming week to discuss the details with you. If you have questions before then, please feel free to call me at (555) 555-6543.

Congratulations, Jean!

Sincerely,

Julie Gabor
Editor
Blue Sky Airlines

SELF-PRACTICE SCRIPT ONE

SUBJECT INSTRUCTIONS:

Perform each task in this script in the order that they are presented. Do not skip ahead.

- Note: before you start, make sure that the 1st Mac is also turned on.
- **use your voice** to control the application, you can perform each task any way you like unless specifically told to use a certain command.
- if you have problems ask me for help.
- take your time.
- time spent will count towards your 20 hours.
- if you are asked to perform a task which you have not yet trained with your voice, please train it.

TASKS:

-
1. • Ask the computer for the **time**.
- Write it down in the box provided:

-
2. • Open the Chooser.
- Click on AppleShare, and connect to the "1st Mac"
 the password is: CURE

-
3. • Open the Sound control panel.
- Set the sound level to one higher than it currently is
- Close the Sound control panel.

-
4. • Launch Microsoft Word
- Open the Word file:
 Practice Document 1
 It can be found on:
- on the Desktop Folder
 in the folder: *DO NOT DELETE*
 in the sub-folder: Practice Session 1

5. • Save **Practice Document 1** as: **Practice1.your name**
on this Macintosh on the **desktop**
 in the folder: Finished Practice

6. • Open the Word file:
 Practice Script 1
 It can be found on:

on the Desktop Folder
 in the folder: ***DO NOT DELETE***
 in the sub-folder: Practice Session 1

7. • Save **Practice Script 1** as: **Instructions.Temp**
on this Macintosh, on the **Desktop**

8. • Switch back to the Finder
 • Ask the computer to Show All the applications that are currently running.
 • Now hide all other applications so that only the desktop (Finder) is visible.

9. • Select the icon for the 1st Mac IIx (you must use your mouse for this)
 • Disconnect from the 1st Mac IIx (i.e., put it away)

10. • Switch back to Microsoft Word
 • Make sure you are looking at the Practice Document, it should be called:
 Practice1.your name

11. • Find the following graphic and text in the **Practice Document**:

555 Some Street • Someplace, USA 55555

- Use Copy and Paste to change the address to:
3500 East 53rd Street • New York, NY 51234
- Copy the address from **Instructions.Temp** (the document you are reading) and paste it into the **Practice Document**

-
12. • Go back to the file: **Instructions.Temp**
- Close it.
Do not quit Microsoft Word.
You should still have your **Practice Document** open.

-
13. • Use the Find dialog box to italicize all occurrences of the word "Blue Sky"
- **Do not** italicize the word Blue Sky in the logo.

-
14. • Use the Replace dialog box to change all occurrences of "Jean Tanner" to:
"Michael Jackson"

-
15. • Do Not use Find or Replace for this task, use any other method to:
Make all occurrences of the words "Spring Spotlight Traveler" and "Spotlight Traveler" **boldface**.

-
16. • Use any method to change the telephone number in the last paragraph to:
(212) 565-6543 and make it **boldface**

17.
 - Change the name "Julie Gabor" at the bottom of the letter to:
"Lisa Marie Presley"
 - Italicize it

18.
 - Make the address under the logo:
Geneva font, 12 point , bold and underline it.

19.
 - Make the "To:" address in the letter (i.e., Michael Jackson's entire address):
14 point
 - Make the city in that address:
All Caps

20.
 - Move the date at the top of the letter to the right margin
i.e., right justify it.
 - Make the date:
helvetica font and bold it

21.
 - Use cut and paste to move the 2nd paragraph in the letter under the 3rd paragraph.
i.e., the 2nd paragraph really should be the 3rd paragraph

22.
 - Spell check the new business letter
 - Correct all spelling mistakes.

23.
 - Save it
 - Print a copy.

24.
 - Quit Word

- 25.
- Drag **Instructions.Temp** to the trash
 - Empty the trash
-

- 26.
- Open the folder: **Finished Practice** on the desktop
 - Create a new folder inside it and call it: ***your name Practice***
move the practice document you just created (**Practice1.*your name***) into it.
 - Close all windows on the desktop
-

- 27.
- Open the Sound control panel.
 - Set the sound level to one lower than it currently is
 - Close the Sound control panel.
-

- 28.
- Ask the computer for the **time**.
 - Write it down in the box provided:

-
- 29.
- Log your practice time in your self practice log.
 - **Thank you.**

Practice Document 2

Encyclopedia International Employee's Handbook

Welcome

Welcome to Encyclopedia International. This training notebook is designed to give you a general introduction to the company. We hope it will answer many of your questions, but please don't hesitate to ask about anything not covered.

Orientation

Your group assistant will enroll you in an employee orientation session on the first Monday after you begin work.

At orientation, you'll learn some of the general policies of EI. You'll also be asked to complete some forms for the Benefits and Insurance office. And you will be introduced to your guide for the day—most often a member of your department. All new employees receive a special gift during orientation as well, so be sure to attend!

Checklist for the First Day

During your first day, you will meet the people you'll be working with, and become acquainted with the EI facilities and procedures. Your guide will help you complete the checklist below.

Meeting Your Manager

During your first day at work, you'll get to meet your group manager. You'll want to get to know this person. He or she is the person who keeps things moving smoothly, coordinating projects and people assigned to your group.

Tour

The EI campus is proud to boast five new buildings in addition to the original offices constructed in 1981. In addition to the office buildings, there now are an on-site printing facility and shipping area. Employee facilities now include two dining halls and a day care center. During your first day, you'll get to see EI's excellent facilities for yourself.

Getting Equipment

At EI, we try to provide the equipment you need without delay. During your first day, the group assistant will show you your office and help you find the equipment and supplies you will need. If we overlook anything, don't hesitate to ask your group assistant for what you need.

Questions About

This section of the handbook covers some of the subjects new employees frequently have questions about. The sections are brief, explaining generalities. You can find more information on all of these topics in the Training Notebook.

Office Supplies

Your group assistant can help you get any office supplies that you need. Most are available on request, but there may be a delay of up to two days for special requests such as hanging file folders. If you need office equipment or furniture, talk with your group manager about putting in an order. EI wants to make your work life as comfortable as possible.

Insurance and Benefits

EI offers a good package of medical and dental insurance. In addition to stock options, EI offers a savings plan that matches up to 7 percent of an employee's contributions after the first six months of employment.

Vacation, Personal Leave, and Sick Leave

All employees are entitled to two weeks of paid vacation each year during the first three years employment. This increases to three weeks per year after three years, and to four weeks per year after nine years.

Employees also are entitled to one-half day of paid sick leave per month. Any unused sick leave at the end of a year is kept on account for the coming year.

In addition, EI offers an excellent maternal and paternal leave plan, and a day care center in Building 5 is open to employees' infants, toddlers, and preschoolers. Enrollment is on a first-come, first-served basis. For details, see your group assistant.

SELF-PRACTICE SCRIPT TWO

SUBJECT INSTRUCTIONS:

Perform each task in this script in the order that they are presented. **Do not skip ahead.**

- **Note:** before you start, make sure that the 1st Mac is also turned on.
- **Use your voice** to control the application, you can perform each task any way you like unless specifically told to use a certain command.
- if you have problems ask me for help.
- take your time.
- time spent will count towards your 20 hours.
- if you are asked to perform a task which you have not yet trained with your voice, please train it.

TASKS:

-
- 1.
- Ask the computer for the **time**.
 - Write it down in the box provided:

-
- 2.
- Open the Chooser.
 - Click on AppleShare, and connect to the "1st Mac"
the password is: CURE

-
- 3.
- Open the Sound control panel.
 - Set the sound level to two higher than it currently is
 - Close the Sound control panel.

-
- 4.
- Launch Microsoft Word
 - Open the Word file:
Practice Document 2
It can be found on:
on the Desktop Folder
in the folder: *DO NOT DELETE*
in the sub-folder: Practice Session 2

5.
 - Save Practice Document 2 as: *Practice2.your name*
on this Macintosh, on the desktop
in the folder: Finished Practice in your folder, which should be called: *your name* Practice.

6.
 - Select all the text in the practice document.
 - Make it all 10 point, and New York font.

7.
 - Open the Page Setup dialog box.
 - Change the document's orientation from portrait to landscape.

8.
 - Switch back to the Finder
 - Ask the computer to Show All the applications that are currently running.
 - Now hide all other applications so that only the desktop (Finder) is visible.

9.
 - Select the icon for the 1st Mac IIx (you must use your mouse for this)
 - Disconnect from the 1st Mac IIx (i.e., put it away)

10.
 - Switch back to Microsoft Word
 - Make sure you are looking at the Practice Document, it should be called:
Practice2.your name

11.
 - Find the main title of the **Practice Document**:
Encyclopedia International Employee's Handbook
 - Center it,
 - Remove the underline,
 - Make it 18 point and Helvetica font,
 - Leave 3 blank lines underneath the newly formatted title.

12. • Place your cursor on the 3rd blank line below the title.
- Insert a table there.
It should have **2** columns and **2** rows in it.
-
13. • Make the **1st** column of the newly created table **1.3** inches wide.
- Make the **2nd** column of the newly created table **8.7** inches wide.
-
14. • Find the word: "Welcome", cut it and paste it into the [1st column, 1st row] of the table. (**NB:** all the words you will be asked to find will appear in sequential order starting at the main title).
- Cut the paragraph that immediately followed the word "Welcome" and paste it into the [2nd column, 1st row] of the table.
-
15. • Find the word: "Orientation", cut it and paste it into the [1st column, 2nd row] of the table.
- Cut the two paragraphs that immediately followed the word "Orientation" and paste them into the [2nd column, 2nd row] of the table.
-
16. • Select the first column.
- Make it boldface, Helvetica font, 12 point, and color the text white. (Hint: you must use the Character dialog box to change the color).
-
17. • Keep the first column selected.
- Give it 100% shading. (Hint: use the border dialog box for this)
-
18. • Select the entire table.
- Give it a border around the whole table and between the rows. (Hint: refer to the finished document to see how this should really look).

- 19.
- Leave 2 blank lines underneath the new table. You might have to cut some blanks to achieve this.
 - Select the sub-title: "Checklist for the First Day".
 - Make it bold, Helvetica, 12 point, and expanded (by 3 points). (Hint: use the Character dialog box for this).
-
- 20.
- Locate the paragraph directly below the sub-title: "Checklist for the First Day".
 - Leave 2 blank lines underneath the paragraph.
-
- 21.
- Place your cursor on the 2nd blank line you just created.
 - Insert a table there.
 - It should have **2** columns and **3** rows in it.
-
- 22.
- Make the **1st** column of the newly created table **1.5** inches wide.
 - Make the **2nd** column of the newly created table **8.5** inches wide.
-
- 23.
- Find the words: "Meeting Your Manager", cut it and paste it into the [1st column, 1st row] of the table.
 - Cut the paragraph that immediately followed the words: "Meeting Your Manager" and paste it into the [2nd column, 1st row] of the table.
-
- 24.
- Find the words: "Tour", cut it and paste it into the [1st column, 2nd row] of the table.
 - Cut the paragraph that immediately followed the words: "Tour" and paste it into the [2nd column, 2nd row] of the table.
-
- 25.
- Find the words: "Getting Equipment", cut it and paste it into the [1st column, 3rd row] of the table.
 - Cut the paragraph that immediately followed the words: "Getting Equipment" and paste it into the [2nd column, 3rd row] of the table.

- 26.
- Select the first column.
 - Make it boldface, Helvetica font, and 12 point and remove the underline.
-
- 27.
- Keep the first column selected.
 - Give it 10% shading.
-
- 28.
- Select the entire table.
 - Give it a border around the whole table and between the rows. (Hint: refer to the finished document to see how the finished product looks).
-
- 29.
- Insert a page break below the new table, and remove all the blank lines between the page break and the sub-title: "Questions about."
 - Select the sub-title: "Questions About."
 - Make it bold, Helvetica, 12 point, and expanded (by 3 points).
-
- 30.
- Locate the paragraph directly below the sub-title: "Questions About".
 - Find the words "Training Notebook" at the end of the paragraph and make them bold.
 - Leave 2 blank lines underneath the paragraph.
-
- 31.
- Place your cursor on the 2nd blank line you just created.
 - Insert a table there.
 - It should have 2 columns and 3 rows in it.
-
- 32.
- Make the **1st** column of the newly created table 1.7 inches wide.
 - Make the **2nd** column of the newly created table 8.3 inches wide.

- 33.
- Find the words: "Office Supplies", cut it and paste it into the [1st column, 1st row] of the table.
 - Cut the paragraph that immediately followed the words: "Office Supplies" and paste it into the [2nd column, 1st row] of the table.
-
- 34.
- Find the words: "Insurance and Benefits", cut it and paste it into the [1st column, 2nd row] of the table.
 - Cut the paragraph that immediately followed the words: "Insurance and Benefits" and paste it into the [2nd column, 2nd row] of the table.
-
- 35.
- Find the words: "Vacation, Personal Leave, and Sick Leave", cut it and paste it into the [1st column, 3rd row] of the table.
 - Cut the three paragraphs that immediately followed the words: "Vacation, Personal Leave, and Sick Leave" and paste them into the [2nd column, 3rd row] of the table.
-
- 36.
- Select the first column.
 - Make it boldface, Helvetica font, and 12 point.
-
- 37.
- Keep the first column selected.
 - Give it 10% shading.
-
- 38.
- Select the entire table.
 - Give it a border around the whole table and between the rows. (Hint: refer to the finished document to see how the finished product looks).
-
- 39.
- Spell check the document
 - Correct all spelling mistakes.

- 40.
- Refer to the finished document provided in the binder.
 - Add or cut any blank lines until your document matches it.
-

- 41.
- Save it
 - Print a copy.
-

- 42.
- Quit Word
 - Close all windows on the desktop
-

- 43.
- Open the Sound control panel.
 - Set the sound level to two lower than it currently is
 - Close the Sound control panel.
-

- 44.
- Ask the computer for the **time**.
 - Write it down in the box provided:
-

- 45.
- Log your practice time in your self practice log.
 - **Thank you.**

Practice Document 3

FilmWatch Division Marketing Plan

Introduction

The Trey Research FilmWatch Division represents Trey's best opportunity to dominate market research for the film industry. This new Trey division will be one of the first research organizations devoted exclusively to quantitative research and analysis for motion picture producers. We see two main target markets:

- Producers who want to test the appeal of actors, actresses, locations, and so forth prior to filming.
- Film companies who want to test the effect of different endings for films that have already wrapped.

FilmWatch has already gained high visibility with the hiring of Marla Jenkins as marketing director. (Marla's work in producing the final ending used in a recent movie resulted in a revenue increase of about 42 percent—an achievement written up in more than two dozen articles by the general business and film industry trade press.) We intend to parlay the PR already won into contractual alliances with several major film production companies.

FilmWatch offers two key advantages for motion picture producers:

- Objectivity and the ability to quantify results
- Expertise in consumer research and analysis

In the past, research on the Q factor for actors and actresses was done primarily by market research firms hired by those same actors' and actresses' publicity agents. Results were often skewed because of the way questions were framed or because of the types of film clips that were shown. (In one case, an actor's publicity agent presented a Q rating that had been generated using participants exclusively from the actor's hometown.)

Trey has already earned a solid reputation as THE company to consult for information about consumer spending habits vis-a-vis food items, magazines, and small home appliances. Within two years, we expect FilmWatch to have that same reputation in the area of motion picture-related consumer spending habits.

There will be a formal presentation and discussion of the marketing plan and backgrounder within the next month. Following a review of this material, individual and group plans for advertising and PR should be developed and then coalesced into a final version of the marketing plan.

Objectives

These are objectives to be realized within six months to one year of the official launch of FilmWatch as a separate division. In some cases, the objective should be achieved before FilmWatch is spun out:

- Market Perception of the Division

FilmWatch should be perceived by the market and by the film industry trade press as the “authority” in motion picture research. Reach them with the concept of “Know It’s a Winner Before the Premiere.”

- **Studio Account Sales**

Have two of the top ten studios sign retainers with FilmWatch within the next six months. Have ten of the top twenty-five independent studios signed within eighteen months.

Long-Term Market Share Projections

Over the next three years, FilmWatch has the potential to earn up to 40 percent market share domestically and 45 percent internationally. The spreadsheet and charts below illustrate our predictions.

Projected Growth of Trey FilmWatch

Company	Current Share	Share in 3 Yrs
Largest competitor	55%	30%
Second largest competitor	25%	20%
Third largest competitor	20%	10%
Trey FilmWatch	0%	40%

Positioning

Since Trey already has a reputation as the premiere consumer market research firm, we can focus positioning for FilmWatch around our ability/record for delivering results at the box office. Positioning here is targeted primarily at producers; secondary positioning is aimed at theater owners (“The FilmWatch name means box office success”).

***** last page of document *****

Current Share

Share in 3 Year

FilmWatch Marketing Plan

SELF-PRACTICE SCRIPT THREE

SUBJECT INSTRUCTIONS:

Perform each task in this script in the order that they are presented. **Do not skip ahead.**

- **Note:** before you start, make sure that the 1st Mac is also turned on.
 - **Use your voice** to control the application, you can perform each task any way you like unless specifically told to use a certain command.
 - if you have problems ask me for help.
 - take your time.
 - time spent will count towards your 20 hours.
 - if you are asked to perform a task which you have not yet trained with your voice, please train it.
-

TASKS:

1. • Ask the computer for the **time**.
- Write it down in the box provided:

-
2. • Open the Chooser.
- Click on AppleShare, and connect to the "1st Mac"
 the password is: **CURE**
-

3. • Open the Sound control panel.
- Set the sound level to one higher than it currently is
- Close the Sound control panel.
-

4. • Launch Microsoft Word
- Open the Word file:
 Practice Document 3
 It can be found on:
- on the Desktop Folder
in the folder: ***DO NOT DELETE***
in the sub-folder: Practice Session 3

5.
 - Save Practice Document 3 as: *Practice3.your name*
on this Macintosh, on the desktop
in the folder: Finished Practice **in your folder, which should be called:** *your name Practice*

6.
 - Make sure that your cursor is placed somewhere on the first page of the document.
 - Open the document's "Header" window. Hint: you want to *view* the header.
 - Delete (or cut) the entire contents of the Header window.
 - Close the Header window.

7.
 - Switch back to the Finder
 - Ask the computer to Show All the applications that are currently running.
 - Now hide all other applications so that only the desktop (Finder) is visible.

8.
 - Select the icon for the 1st Mac IIx (you must use your mouse for this)
 - Disconnect from the 1st Mac IIx (use your voice for this)

9.
 - Switch back to Microsoft Word
 - Make sure you are looking at the Practice Document, it should be called:
Practice3.your name

10.
 - Make sure that your cursor is placed on the first line of the document.
 - Open the Format Menu then the Section window.
 - Make sure that the "Different First Page" option under the Header/Footer box is checked.
 - Close the Format Section window.

11.
 - Change the title, "FilmWatch Division Marketing Plan" so that it is:
 - Bold
 - Helvetica
 - 18 Point
 - Centered

12.
 - Change the heading, "Introduction" so that it is:
 - Bold
 - Helvetica
 - 14 Point
 - left aligned

13.
 - Select the title "FilmWatch Division Marketing Plan," and the heading "Introduction" together.
 - Open the Format Paragraph window.
 - Make sure that the "Spacing before paragraph" is set to 24 pt.
 - Apply the changes you just did, and close the Format Paragraph window.

14.
 - Select the 2nd and 3rd paragraph under the heading "Introduction"
 - Open the Format menu, then the Style window.
 - Select the style: "list"
(Note: you will have to use the mouse to select the indicated style from the choices presented, everything else should be done with your voice)
 - Apply the changes you just did, and close the Format Style window.

15.
 - Locate the 4th line in the 4th paragraph on page 1. It should read:
than two dozen articles by the general business and film industry trade press.)
 - Place your cursor between the word "press." and the ")"
 - Insert a footnote there. (The command is: Insert_Footnote)
 - When the footnote window comes up, just say OK.
 - Type in the following text for the footnote reference:
For reprints, see Dave Newell.

(Note: when typing you might want to "deactivate" Voice Control)

- 16.
- Select the two lines:
 - Objectivity and the ability to quantify results
 - Expertise in consumer research and analysis
(they are right underneath the 5th paragraph on page 1)
 - Open the Format Style window.
 - Select the style: "list"
 - OK the changes you just did, (this will close the Format Style window).
-
- 17.
- Locate the 5th line in the 8th paragraph on page 1. It should read:
that had been generated using participants exclusively from the actor's hometown.)
 - Place your cursor between the word "hometown." and the ")"
 - Insert a footnote there.
 - When the footnote window comes up, just say OK.
 - Type in the following text for the footnote reference:
Carl Simpson, as described in our company newsletter.
-
- 18.
- Make the footnote section of the document window disappear.
Hint: the command you issue is the same command that you would say to view the footnote section in the first place, (i.e., Footnotes)
-
- 19.
- Select the heading, "Objectives"
(it should be near the top of page 2)
 - Open the Format Style window.
 - Select the style: "heading 1,h1"
 - OK the changes you just did, (this will close the Format Style window).
-
- 20.
- Select the line:
 - Market Perception of the Division
(it should be the 2nd paragraph underneath the heading "Objectives")
 - Open the Format Style window.
 - Select the style: "list"
 - OK the changes you just did.

- 21.
- Select the 5th paragraph underneath the heading "Objectives"
 - Open the Format Style window.
 - Select the style: "indent para,ip"
 - OK the changes you just did.
-

- 22.
- Select the heading, "Long-Term Market Share Projections"
(it should be near the middle of page 2)
 - Make sure it is:
 - Bold
 - Helvetica
 - 14 Point
 - left aligned
 - and not italicized
-

- 23.
- Locate the sub-heading, "Projected Growth of Trey FilmWatch"
 - Select all of the following text underneath the sub-heading:

Company	Current Share	Share in 3 Yrs
Largest competitor	55%	30%
Second largest competitor	25%	20%
Third largest competitor	20%	10%
Trey FilmWatch	0%	40%
 - Convert the selected text to a table.
(Hint: you want to insert a table in place of the text, the command is: Insert...Text_to_Table).
The table should have 3 columns and 6 rows in it and the "Convert From" setting should be: "Tabs Delimited."
-

- 24.
- Now you have to customize (or format) each cell of the new table.
 - Select the first column, set it's width to be: 2.06 inches.
 - Select the second column, it's width should be: 1.25 inches.
 - Select the third column, it's width should be: 1.13 inches.

- 25.
- Select the first row of the table.
 - Use the format border window to give the first row a single line border on the bottom of the row. (Refer to finished document in the binder to see how this should look).
-
- 26.
- Select the entire table.
 - Use the format table cells window to set the Row height to be "at least" 13 pt.
-
- 27.
- Select all the percentages in the table.
(e.g., 55%, 30%, 25%, etc.)
 - Center them
-
- 28.
- Place your cursor on the second blank line below the table, be careful not to select it.
 - Insert another table here, it should have 1 row and 2 columns.
Hint: the command to use here is: Insert...Table.
 - Make the first column 2.81 inches wide and the second column 3.25 inches wide.
-
- 29.
- Use "Page_Down" to go to the last page in the practice document.
 - Find the "Current Share" diagram (refer to finished document to see how it looks).
 - Select the entire cell the diagram is in. Copy it, and use Page_Up to go back to the table you just created.
-
- 30.
- Paste the diagram in the first column, first row of the table.
 - Go back to the last page, copy the "Share in 3 Years" diagram and paste it into the second column of the table.
-
- 31.
- Go to the very end of the document and find the following line:
FilmWatch Marketing Plan
 - Copy this line, open the footer window of the document and paste it just above the page number already in the footer.

- 32.
- Select the line you just pasted into the footer.
 - Open the Format Style window.
 - Select the style: "footer"
(Note: refer to finished document to see how the footer should look. All text in the footer should be using the style, "footer")
 - Apply all changes and close the Format Style window.
 - Close the footer window.
-

- 33.
- Find the sub-heading, "Positioning" and make sure that it's style is: heading 1, h1.
 - Find the paragraph directly below "Positioning" and make sure it' style is: paragraph,pr.
-

- 34.
- Select everything immediately following the paragraph below "Positioning", i.e., everything on the last page of the document, including the page break line.
 - Delete it.
-

- 35.
- Spell check the document
 - Correct all spelling mistakes.
 - **Note:** if the footnotes window remains open after spell-checking, close it.
-

- 36.
- Go to the top of the document, and put the document in the **page layout** view.
Hint: the page_layout command is in the **View** menu.
 - Refer to the finished document provided in the binder.
 - Add or cut any blank lines until your document matches it.
-

- 37.
- Open the **print_preview** window, and use **page_down** and **page_up** to look at each page of the document.
 - **Close** the print_preview window, **save** the document and, **print** a copy.

- 38.
- Quit Word
 - Close all windows on the desktop
-

- 39.
- Open the Sound control panel.
 - Set the sound level to one lower than it currently is
 - Close the Sound control panel.
-

- 40.
- Ask the computer for the **time**.
 - Write it down in the box provided:

-
- 41.
- Log your practice time in your self practice log.
 - **Thank you.**

Practice Document 4

ARBOR REPORT

Arbor Footwear Vol. II • No. 12 • Dec. 5, 1991

Robot added to work force Employee News

Soccer team wins!

Congratulations to the Arbor Footwear soccer team! They took first place in the recent city competition. Special thanks to team captain Bruno Martin (manufacturing), who told a TV reporter, "Great shoes are part of a sound strategy."

Writing contest winner

Maria Selva took second place in the city's humorous essay contest. Co-workers encouraged her to write down the stories she tells on break time. Her winning story, "I wasn't born to ski," was their all-time favorite, told while they were signing the cast on her leg.

Wedding bells

Best wishes to Thomas Bendel (women's dress shoe division) and Isabelle Mendel (administration), who married last Friday night. For fun, co-workers prepared a hyphenated name plate for Isabelle's

office door. It reads: "Dr. Isabelle Mendel-Bendel."

New baby

Arbor Footwear delivered our traditional welcome-to-the-world booties to celebrate the birth of Jeanne Loren. Parents Bernard and Helene Loren (men's dress shoes) report that Jeanne has her father's eyes and her mother's feet.

These are your Articles for this edition

Start Article 1

Foot Facts The children's shoe division walked away with this month's production award, exceeding their production goal by 7 percent!

End Article 1

Start Article 2

End Article 2

Start Article 3

Our athletic shoe division took a step toward the twenty-first century this month when it purchased a robot to assist with manufacturing. The robot threads shoelaces into track shoes at an astounding rate of speed. Human co-workers report that the robot is pleasant to work with and "doesn't complain much." In fact, the robot doesn't talk at all. Nicknamed "TongueTied" by his co-workers, the 5' 6" tall robot was originally programmed to whistle as he worked. Fellow workers soon voted to shut off this function. Does

TongueTied make any noise at all now? Supervisor Paul Martin reports, "At the end of the day his hydraulic system decompresses and he sort of sighs."
For Martin's fortieth birthday, workers dressed the robot in a company T-shirt and a party hat. It gave TongueTied so much personality that Martin left him that way.

Autographs, anyone?

TongueTied, our company robot, seems to have a competitive side to him. As a publicity gimmick, market-ing entered him in a nation-wide computer games contest last week. Along with 1,200 kids, ages 9 to 14, TongueTied competed for top scores on arcade computer games. TongueTied rolled away with not only top honors, but the world-record score for all three games.

Although all prizes went to the humans, the company sponsoring the contest created a special plaque for TongueTied to commemorate his win. And what did the kids think of their automated competitor? They had nothing but admiration for his quick reflexes.

As top scorer in the contest, TongueTied will have his name displayed in arcades around the world, along with the names of the top five human contestants. Marketing modified its sales strategy for our juvenile athletic footwear to capitalize on the robot's newfound celebrity status. Marketing director Veronique Caspary announced in a televised press conference yesterday that TongueTied will soon begin autographing each pair of high-tech track shoes that he laces.

Will celebrity status change our mild-mannered TongueTied? He already lost a day of work while he practiced signing his name. Program-mers say his natural writing is "rather flamboyant." They're trying to tone it down to fit on the side of a shoe.

NM

End Article 3

Start Article 4

On the move

Facilities reports that our new administration wing is almost complet. The sound of hammering has finally given way to the dull thumps of the carpet layers. By the first of next month, departments should be relocated as indicated on the map.

End Article 4

Start Article 5

Small volunteers needed

We need babies less than a year old to home test our experimental Polar Baby Booties. Anne Gabor in our research and development department reports, "Our goal is to keep their tootsies toasty to 40 degrees below." Contact Anne if you know of a small, barefoot volunteer.

End Article 5

SELF-PRACTICE SCRIPT FOUR

SUBJECT INSTRUCTIONS:

Perform each task in this script in the order that they are presented. **Do not skip ahead.**

- **Note:** before you start, make sure that the 1st Mac is also turned on.
 - **Use your voice** to control the application, you can perform each task any way you like unless specifically told to use a certain command.
 - if you have problems ask me for help.
 - take your time.
 - time spent will count towards your 20 hours.
 - if you are asked to perform a task which you have not yet trained with your voice, please train it.
-

TASKS:

1. • Ask the computer for the **time**.
- Write it down in the box provided:

-
2. • Open the Chooser.
- Click on AppleShare, and connect to the "1st Mac"
 the password is: CURE
-

3. • Launch Microsoft Word
- Open the Word file:
 Practice Document 4
 It can be found on:.
- on the Desktop Folder
in the folder: *DO NOT DELETE*
in the sub-folder: Practice Session 4
-

4. • Save Practice Document 4 as: *Practice4.your name*
- on this Macintosh, on the desktop
in the folder: Finished Practice in your folder, which should be
called: your name Practice.

5.
 - Make sure that your cursor is placed near the top of the first page of the document.
 - Put the document in **page layout** view.
Hint: the page layout command is in the **view** menu

6.
 - Switch back to the Finder
 - Ask the computer to Show All the applications that are currently running.
 - Now hide all other applications so that only the desktop (Finder) is visible.

7.
 - Select the icon for the 1st Mac IIX (you must use your mouse for this)
 - Disconnect from the 1st Mac IIX (use your voice for this)

8.
 - Switch back to Microsoft Word
 - Make sure you are looking at the Practice Document, it should be called:
Practice4.your name

9.
 - Make sure that you are looking at the masthead (i.e., the big title that says, "Arbor Report) at the very top of the document.
 - Locate the following text:
Vol. II • No. 12 • Dec. 5, 1991.
 - Change the date to today's date, (i.e., you have to type it in).

10.
 - Leave your cursor on the date.
 - Open the Format menu, then the Style window.
 - Select the style: "name/vol"
(Note: you will have to use the mouse (or arrow keys) to select the indicated style from the choices presented, everything else should be done with your voice)
 - OK the changes you just did, to close the Format Style window

- 11.
- Go to the second page of the document. This is where all the articles for this edition of the newsletter are kept.
 - Find the first article (it is labeled Article 1).
 - Select everything between the headings: "Start Article 1" and "End Article 1" and copy it. Do **NOT** copy the headings themselves.
-

- 12.
- Go back to the top of the document and locate the 1x3 table located underneath the dateline.
 - Paste Article 1 into the **2nd** column of that table.
 - Go back to the second page of the document and locate the 2nd article.
-

- 13.
- The second article is actually a graph.
 - Select the entire graphic between the headings: "Start Article 2" and "End Article 2" and copy it. Do **NOT** copy the headings themselves.
 - Go back to the table at the top of the document where you just pasted in the "Foot Facts" article (i.e., Article 1).
 - Paste Article 2 into the **3rd** column of that table.
-

- 14.
- Locate the heading:
Robot added to work force
 - Select the word: Robot.
 - Open the Format Style window and change it's style to: **heading 1**
 - OK the changes.
-

- 15.
- Go to the second page of the document.
 - Find the third article.
 - Select everything between the headings: "Start Article 3" and "End Article 3" and copy it. Do **NOT** copy the headings themselves.

16.
 - Go back to the top of the document and locate the heading:
Robot added to work force
 - Place your cursor in the first column underneath that title.
 - Paste the third article there.

17.
 - Use Find to locate the following sentence in the third article:
TonqueTied competed for top scores on
 - Place your cursor between the word "top." and the "scores"
 - Put a page_break there.

18.
 - Refer to the finished document that is provided in the Practice Binder.
 - Use the print_preview command to look at your document.
Note: print_preview is in the file menu.
 - Make sure that the "Robot added to work force" Article looks the same in your document as it does in the finished product. (That is, make sure you pasted the article in the correct location and put the page break in the right spot).

19.
 - Find the column that is titled: **Employee News**
 - Locate the article: **Soccer team wins!** (it should be the first article in that column).
 - Locate the name: **Bruno Martin** in the article and **bold** it.

20.
 - In the **Employee News** column.
 - Locate the article: **Writing contest winner.**
 - Locate the name: **Maria Selva** in the article and take the **italics** off and **bold** it

21.
 - In the **Employee News** column.
 - Locate the article: **Wedding bells.**
 - Locate the names: **Thomas Bendel** and **Isabelle Mendel** in the article and make them **Helvetica** font and **bold** them.

- 22.
- In the **Employee News** column.
 - Locate the article: **New baby**.
 - Locate the name: **Helene Loren** in the article and make it **Helvetica** font, **10 point** and **bold**.
-
- 23.
- Go to the third page of the document.
 - Find the fourth article.
 - Select everything between the headings: "Start Article 4" and "End Article 4" and copy it. Do **NOT** copy the headings themselves.
-
- 24.
- Now go to the bottom of the first page of the document and locate the 1x3 table (there should be a floor plan diagram in the 2nd column of the table).
 - Paste Article 4 into the **1st** column of that table.
 - Go back to the third page of the document and locate the 5th article.
-
- 25.
- Select the entire article between the headings: "Start Article 5" and "End Article 5" and copy it. Do **NOT** copy the headings themselves.
 - Go back to the table at the bottom of page one of the document where you just pasted in the "On the move" article (i.e., Article 4).
 - Paste Article 5 into the **3rd** column of that table.
-
- 26.
- Place your cursor anywhere on the title: **Small volunteers needed**.
Note: this is the title of the last article you pasted in
 - Open the Format menu, then the Style window.
 - Select the style: "Sidebar head"
(Note: you will have to use the mouse (or arrow keys) to select the indicated style from the choices presented, everything else should be done with your voice)
 - OK the changes you just did, to close the Format Style window

- 27.
- Make sure that your cursor is placed near the top of the first page of the document.
 - Put the document in **normal** view.
Hint: the normal command is in the **view** menu
-
- 28.
- Go to page 2 of the document. I want you to use the **Go_To...** command in the **Edit** menu for this.
 - Select the title: **These are your Articles for this edition** and everything immediately following it on pages 2 and 3.
 - Remove the selected text by issuing a clear command.
-
- 29.
- Spell check the document
 - Correct all spelling mistakes.
-
- 30.
- Go to the top of the document, and put the document in the **page layout** view.
 - Refer to the finished document provided in the binder.
 - Add or cut any blank lines until your document matches it, you should only have 1 **page**.
-
- 31.
- Open the **print_preview** window, and use **page_down** and **page_up** to look at each page of the document.
 - **Close** the print_preview window, **save** the document and, **print** a copy.
-
- 32.
- Quit Word
 - Close all windows on the desktop
-
- 33.
- Ask the computer for the **time**.
 - Write it down in the box provided:
-
-
- 34.
- Log your practice time in your self practice log.
 - **Thank you**.

Appendix C

Baseline Tests

BASELINE SCRIPT ONE VOICE CONTROL READINESS

SUBJECT INSTRUCTIONS:

- You are being evaluated to determine if you have reached baseline readiness for **voice** control in Microsoft Word.
- Perform each task in this script in the order that they are presented.
- **Do not skip ahead.** Wait for the experimenter to tell you to proceed.
- **Use your voice** to control the application at all times.
- All commands should be trained for **Voice Control** by now.
- Take your time you, speed is not considered a baseline criterion.

- **Ready?**

1.
 - Skip to the next screen of text by using your voice.
-

2.
 - Place a solid single line border around this entire table.
-

3.
 - Make this entire line appear in SMALL CAPS.
-

4.
 - Change this document's set up so that it prints in a landscape orientation.
-

5.
 - Save this document as: **Voice.your first name**
on the desktop of this Macintosh.
-

6.
 - Make this entire line boldface.

7. • Place a page break immediately following the arrow (↑) beneath this task.

↑

8. • This is a paragraph. Change the spacing before (i.e, above) the paragraph to 10 pt.

9. (A) Center these three lines,
(B) Change their font to New York,
(C) And change their size to 18 points

10. • See the words "That wasn't so bad" on the next line.

That wasn't so bad

- Make the words start from the left margin

11. • Make this line appear all in UPPERCASE letters.

12. • Find any other occurrence of the word "Beetlejuice" in this document

13. • Spell check this document.

14. • Change the header of this document to say:

Baseline Voice Test - *your name*

15. • Copy the words "D'Ippolito, 1989"
-

16. (A) Place a footnote at the end of this line.
(B) Paste the words you previously copied in the footnote section.
(C) Close or hide the footnotes section.
-

17. • Place this document in the page layout view.
-

18. • Select everything in this document.
-

19. This is the palce where all the bad spellers of the world untie. But hey i'm just rambling on because I just want you to spell chekc the docuement to get some practice. Okay here goies. We are looking for multiple killer Windows hackers -- people who have in-depth knowledge and esperience writing applications that fully exploit the capabilities of the Microsoft Windows application environment. Writtern your own Windows TCP/IP stack or PPP implementation? Hacked low-level DOS/Windows memory management and device driver functionality? Built complex Windows applications that interoperate with a variety of datatypes and user interface mechanisms? Drop me a line.

BASELINE SCRIPT TWO (WINDOWS ICONS MENUS POINTERS) CONTROL READINESS

SUBJECT INSTRUCTIONS:

- You are being evaluated to determine if you have reached baseline readiness for **WIMP** control in Microsoft Word.
 - Perform each task in this script in the order that they are presented.
 - **Do not skip ahead.** Wait for the experimenter to tell you to proceed.
 - **Use the mouse, menus, quick keys or buttons** to control the application at all times.
 - You should know where to find all commands in the interface by now.
 - Take your time you, speed is not considered a baseline criterion.
 - **Ready?**
-

1. • **Skip** to the next screen of text.
-

2. • There is a document stored on the desktop named "Junk"
 (A) Open it from within Microsoft Word
 (B) Now close it without saving any changes.
-

3. • This task is in a table that contains 1 row and 3 columns.
 (A) Remove the third column
 (B) Now make this column (i.e., the 2nd column) 6.5 inches wide
- (Remove this column not just the text)
-

4. • Cut the words "Right Now!" and paste them at the end of this sentence,
-

5. • Save this document as: **WIMP.your first name**
 on the desktop of this Macintosh.

6. • Underline the words "So far so good"

7. • Place a **section break** immediately following the arrow (↑) beneath this task.

↑

8. • This is a paragraph in a table, that really does not mean anything at all. It was just used to illustrate single spacing, you should make this paragraph **double spaced**.

9. • Now its time to create a new table.
• The table should be placed on the third blank line following this table
• And should have 3 rows and 3 columns

10. • Now select the table you just created.
• Put a double line border around the table and a single line border at the bottom of each row

11. • Change every occurrence of the word "hackers" in this document to the word "boneheads"

12. • Spell check this document.

13. • Find any other occurrence of the word "Jupiter" in this document.

14. • Change the footer of this document by replacing the following line:
"Computer Users Research & Evaluation Laboratory"
With the abbreviation : "CURE Laboratory"
-
15. • Italicize this entire line.
-
16. • Undo what you just did in the previous task.
-
17. (A) View this document in the print preview mode.
(B) Now close the print preview window.
-
18. • Make this line start from the right margin.
-
19. • Print page four of this document.
-
20. This is the palce where all the bad spellers o f the world untie. But hey I'm just rambling on because i just want you to spell chekc the docuement to get some practice. Okay here goes. We are looking for multiple killer Windows hackers -- people who have in-depth knowledge and experience writing applications that fully exploit the capabilities of the Microsoft Windows application environment. Written your own Windows TCP/IP stack or PPP implemenation? Hacked low-level DOS/Windows memory management and device driver functionlaity? Built complex Windows applicaitons that interoperate with a variety fo datatypes and user interface mechanisms? Drop me a line.

Appendix D
Test Documents^{A1}

^{A1} Test Documents B and C were presented to subjects in a landscape orientation. To fit them into this manuscript, they are shown here in a portrait orientation.

Test Document A

I'm making my computer easier to use so I can be more productive:
Confessions of a utilities junkie

Richard F. Dillon
Computer User Research and Evaluation
Department of Psychology
Carleton University

The editors have asked me to pass on my experiences with three MS Windows utilities that attempt to improve the Windows environment. In the process, I offer some thoughts for people writing utilities software, and for people looking for utilities.

You've seen the Apple anti-ads on TV? Two guys are at their PC. They have a number of MS DOS and Windows manuals open. They search through the manuals.

"Try C, colon, back slash, Windows."

They look through the manuals some more.

"Maybe if we connect to LPT2?"

They look through the manuals some more.

A co-worker walks by. "What are you guys doing?"

"We're making the computer easier to use." "So we'll be more productive."

"You've been here for two days. If you make it any more productive we'll go out of business."

Every time I see the ad, I look around my office at home to see where Apple hides the camera.

"Dick Dillon, This is your life."

You see, I spend a considerable amount of time trying to make my Windows environment on a 33 Mhz 486 clone more productive. An incredible amount of time. An incredible, depressing amount of time.

I'll state my conclusion, based on almost two years experience using Windows 3.0 and 3.1, right up front. In my opinion, plain vanilla MS Windows 3.1 is not worth using. Add some decent utilities to it, and it is in the same league as a Mac in terms of ease of use.

(This article is not a comparison of Macs and PCs. It does not address lots of relevant issues -- like relative cost, ease of adding devices, availability of quality software and hardware, etc. Parenthetically, I can say that the process of adding some (not all) software/hardware to Windows is comparable in difficulty to what we just went through when we networked all our lab Macs under Ethernet, including Telnet software to connect to the University UNIX system and Novell software to connect to the Social Science Faculty network. If, in a

moment of weakness, you consider doing either of these activities, seek professional help -- from a psychiatrist. No human should have to go through either of these perverse, distasteful activities.)

But I digress. I was saying that a few utilities can make Windows a very nice environment. The three utilities I discuss here are Norton Desktop for Windows, Hewlett Packard Dashboard, and hdc PowerLauncher. All can be had for under \$100 -- the cheapest is PowerLauncher at about \$70.

The problem stems from a decision by Microsoft to divide Windows activities into two separate, equally inept, programs -- File Manager and Program Manager. ProgMan is used to organize applications into meaningful groups (roughly, similar to folders on the Mac) and launch applications. FileMan allows for keeping track of, and generally dealing with, all files including applications and documents. FileMan has a barebones visual tree. These two programs offer the minimum of program and file management capabilities. The arbitrary distinction between the two is confusing to novices and annoying to experts.

Norton's Desktop

Windows became usable when I added Norton's Desktop. This is a real bargain for the grab bag of over 20 loosely integrated applications. Where it really shines is shown in the figure. Drives appear as icons that can be double clicked, or used for drag and drop activities. Files in the file manager (documents or applications) can be dragged to the desktop where they appear as icons, and can be launched by double clicking. The icons I display tend to come and go as I change from project to project. On my system, I currently have 20 icons including 5 PowerPoint documents that I have been working on. There is a printer icon that you can drag a document to for printing.

You can have file managers open for as many drives as you want, including multiple copies of the same drive.

The file manager is embellished with buttons (with real words, not undecipherable icons) for file operations. The buttons can easily be changed to provide direct access to any command on the menu. How easy? Open the Button Bar dialog box from the Configure Menu, select a menu item from the scrolling list that displays all menu items, then click on the button you want to assign that command to. The only way to do it that would be easier would be to allow you to drag an item from the menu to a button. Hmmm, I wonder.... Nope!

One of the most useful buttons is View which gives a quick (really quick) look at the contents of any file. There are viewers for a large number of popular applications. You can either select a file, then press the View button to get an extension of the file manager window with the view displayed, drag the selected file to the Viewer icon to get a full screen window, or select View from the File menu. I use View constantly.

Filter

Another of my favourite buttons is Filter. Over the years, I have always had filters for looking at particular types of files, but I have rarely used them because they were such a nuisance to use. In Norton Desktop, just press the Filter button, then click the radio button for the filter you want -- All files, Programs, Documents. Alternatively, in typical Norton fashion, you can also use a drop down, scrolling input box that keeps the last few filters you have used. Neat.

Play with the Norton Copy and Move commands to see some great examples of "organized functionality." Everything you could want in the middle of a copy or move command is provided at the click of a mouse. Among the other utilities that come with Norton Desktop, I find SuperFind, a fast, easy to use find command, to be invaluable. There is also diagnostic software, and file recovery software, plus other interesting things. To summarise, I consider Norton Desktop essential.

hdc PowerLauncher

The second utility I want to tell you about is hdc PowerLauncher. This powerful little utility puts the toolbar shown in the figure at the top of your screen. From the PowerLauncher tool bar, you have some remarkable capabilities. It will let you set up to 64 virtual screens that you can instantly get at with a mouse click. I've never used more than three virtual screens.

Unfortunately, for many people, including me, PowerLauncher is not the answer. The icons are small (on my 1024 by 768 17 in. display) and non-intuitive. The biggest problem is that PowerLauncher is fairly difficult to learn to use and tailor to your needs. Indeed, as the ad says, I spent well over two days making my computer more productive with PowerLauncher. And I can't remember how to do all those things. Maybe "can't" is too strong. I "won't" remember how to do all those things. I'm not working in Windows to remember a lot of details -- I'm working in windows so I can avoid remembering a lot of details. I get really offended when a company designs a utility, to make me more productive, that takes two days to learn, and that requires me to dig through manuals and remember lots of details. To me, this is counterproductive.

I had a similar experience last year with a virtual screen program called Wide Angle. I got the first version of it, and loved it (except for a few bugs). When I got the upgrade, it was so much more sophisticated, that I spent two days learning how to be more productive by saving myself fractions of a second switching virtual screens. It stayed on my computer for a week before I tossed it out. That's about how long PowerLauncher lasted. I wish computer magazines that rave about these types of programs would tell you how much you have to learn to use them effectively, and how complex the manuals are. If you are the type of power user who is into details, and if you are interested in trying PowerLauncher, you can borrow mine.

Hewlett Packard Dashboard

HP's DashBoard, the final Windows productivity utility I'll discuss, is similar to PowerLauncher. It takes up more screen space, and is not tucked out of the way as well as PowerLauncher is. It is not as powerful, but it is a heck of a lot easier to learn and use. Single-click an icon to launch the application. (As an old time Mac user expecting to double click to launch an application, I find I frequently launch applications by mistake.) To get an icon on the Dash Board, simply drag a file from the file manager and drop it on the floating Dash Board. (It's about time someone finally did this.) To tailor the Dash Board, simply click on the wrench (tool?) icon. You get a well-designed dialog box, and you can figure out 80 to 90 percent of what you want to know by experimenting without a manual. I usually turn off the performance meter that is the main element that gives the utility its dash board look. I find it doesn't give me any information of value.

For a number of years, I wanted virtual screens. You can run Dash Board with 3, 5, 7 or 9 screens. Click on the representation of the screen you want to instantly move to it. When preparing handouts for my stats class, I often run SPSS for Windows full screen in one screen, a calculator in another, and a full screen word processor in a third. If you shrink DB to an icon, it shows the screens on the icon. Click on the tiny screen area you want to switch. This live icon approach was stolen from Wide Angle. You can either have DB always float on top so screens are always a single click away, or let it go to the background where you can retrieve it with an assigned function key. Working in this mode, another screen is two clicks away. I find both modes quite handy.

Dash Board, although not as flexible as PowerLauncher, lets you put Windows main menus on the Dash Board. You can also get at all ProgMan application groups for direct launching from Dash Board. These are shown as tabbed folders on your dash board. A little mixing of metaphors here, but it seems to "work."

One shortcoming I have with Dash Board is that I can't seem to turn off its print manager, and one of my word processors can't write to a postscript file if a print manager is running. Unfortunately, I have not figured out any way to get Dash Board to launch the Norton file manager rather than Windows FileMan.

One of the good things about Dash Board (and PowerLauncher) is that they coexist well with Norton's Desktop. Norton Desktop does the job by itself, but Dash Board adds a little. Everything considered, Dash Board is a keeper. In the next release, the challenge for HP will be to maintain its ease of use when new features are added. I'll bet they can't do it.

I have a pretty usable system with the combination of Norton Desktop and Dash Board. But I've been looking at ads for the soon-to-be-released PC Tools for Windows. It seems to do everything Norton's Desktop does. It also claims to allow 32 character file names in addition to DOS' 8.3. Now there's something I've wanted for a long time! I can probably find a few days when it

comes out to make my computer easier to use -- so I can be more productive, of course.

Test Document B

UI Digest Number 60

28 Oct 1994

Editor: Dick Penn

Contents:

- 1) CD-ROM Development (Course,LA,Jan)
- 2) User-Oriented Interface Design (Course,LA,Jan)
- 3) Typing Injury FAQ
- 4) Context in User Interfaces (Ottawa,Nov 16)
- 5) Social Science Information Technology (Amsterdam,Dec)
- 6) HFES VR SIG proposed
- 7) Mobile & Location-Independent Comp'g (Ann Arbor,MI,Apr)
- 8) Disney's Magic Carpet Ride
- 9) Software Reusability (Seattle, WA, April)
- 10) M.Sc. in Ergonomics, Lulea, Sweden
- 11) MCC Advanced Telecommunications (Tour,Nov 5-Dec 18)
- 12) New Web Server
- 13) Synapse -- Hot New CDROM Digizine Shipping
- 14) Text entry with numeric keypads (and Q and Z!)
- 15) Working On a GUI (Vancouver,BC,Nov 8)
- 16) WWW to replace Notes???
- 17) Review of ACM Multimedia Conference :-)

1) CD-ROM Development (Course,LA,Jan)

Marcus Hennessy, mhenness@unex.ucla.edu

On January 17-20, 1995, UCLA Extension will present the short course, "CD-ROM Development Workshop: From Multimedia Publishing to Data Archival", on the UCLA campus in Los Angeles. The instructors will be Dr. Ash Pahwa, CD-ROM Strategies, and Ms. Jeannine Parker, consultant/writer and president-elect of IICS. This course addresses the development of a CD-ROM application, provides CD-ROM technology aspects, and emphasizes the steps required to create a useful application. It also provides a brief overview of multimedia content, design, production, and business issues. Because multimedia is the combination of computer data, image, audio, and video, the technical details of these data types are explained. Image, audio, and video are storage-intensive data types, and without compression, it is difficult to use them in any real-world application.

2) User-Oriented Interface Design (Course,LA,Jan)

Marcus Hennessy, mhenness@unex.ucla.edu

"User-Oriented Interface Design: Process and Product", on the UCLA campus in Los Angeles. The instructors will be Penny Bauersfeld, Human Interface

Design Consultant, Kathleen Gomoll, Human Interface Design Consultant, and Laurie Vertelney, User Interface Designer, Apple Computer. Each participant will receive a copy of the text, "Software By Design", by Penny Bauersfeld, and extensive course notes. The most important element of learning how to design interfaces is to actually build an interface. This class provides hands-on experience in interface construction, including task analysis, techniques for visualization and rapid prototyping, user testing and design iteration.

3) Typing Injury FAQ

Dan Wallach, <http://www.cs.princeton.edu/grad/dwallach/>

New files in the typing-injury archive... chord-keyboards -- Bob Rosenberg ... pain-discussion -- The New Zealand Department of Labor talks about what pain is, how to deal with it, and what to respond when somebody says "it's all in your mind"... exercise-discussion ... voice-comparison -- Jeff DeIPapa briefly compares all the different voice-recognition systems... speed-kills -- Tom Ensminger emphasises why we need to type slower... footswitch.doc... footswitch-sources ... pointing-devices... dragon-vs-kurzweil

4) Context in User Interfaces (Ottawa, Nov 16)

Dr. Marcell Wein, wein@iit.nrc.ca

Interaction with a computer system involves the issuing of commands, either as a sequence of point-and-click operations in window-oriented interfaces or as lines of text in traditional (command-line) interfaces. Decisions that users make are based on their understanding of the current state or context and of some desired goal. How do they know the context? What happens when they lose that information? Knowledge of the context is fundamental to ease of use as well as to the comfort and satisfaction level in working with a particular system.

5) Social Science Information Technology (Amsterdam, Dec)

Sebina Heida, gamma.post@gamma.rug.nl

WORKSHOPS ... * Structural Equation Modeling * Scaling * Experimentation and Observation * Content and Text Analysis SESSIONS ... * Social Network Analysis * Statistical Computer Applications * Innovative Educational Systems * Decision Challenges and the Role of Knowledge * Brain Research and Task Performance * Psychological Assessment * Content and Text Analysis * Simulation * Computer-Assisted Data Collection * Neural and Self-Organizing Networks * Visualization

6) HFES VR SIG proposed

Ron Maurant, maurant@meceng.coe.neu.edu

For those out there who are members of the Human Factors and Ergonomics Society (HFES), there is a Virtual Reality Special Interest Group (VR SIG) forming within the society. It is hoped that we may eventually become a full-fledged technical group (TG) with the associated rights and privileges (e.g., our own program at the annual conference). The first meeting of this group will be held during the HFES Annual Conference next week in Nashville.

7) Mobile & Location-Independent Comp'g (Ann Arbor, MI, Apr)

Jim Rees, Jim.Rees@umich.edu

The Second USENIX Symposium on Mobile and Location-Independent Computing will provide a major opportunity for researchers and practitioners in this rapidly growing field to exchange ideas and present results of their work.... mobile computing has become [a hot] topic, with the size, cost, and power requirements of the equipment going down. The FCC has announced a plan to auction radio spectrum for use of mobile devices, and the Internet Engineering Task Force (IETF) is in the process of standardizing protocols for mobile TCP/IP, including roaming capabilities. Mobile computers are the fastest growing segment of the PC market, airlines are scrambling to provide network connectivity on board, and terminal rooms at computer conferences routinely provide network taps for users who bring their own computers.

8) Disney's Magic Carpet Ride

The newsgroup sci.virtual-worlds

[rave reviews on this new VR ride at Epcot]... You are flying on a magic carpet through a small city in the desert. The graphics are WONDERFUL, it really looks like you're inside the Aladdin movie. But the most incredible thing is the quality of the characters animations: the market is full of people doing their business, a small guy fights with a camel which doesn't want to move, other people promote their goods, moving and talking aloud, there's a guard with a sword who will try to get you. Technically I think they've squeezed the Onyxes they're using. The HMD is custom made, CRT based, full color, made in carbon fibre...What impressed me most about the demo was not the excellent graphics and animation, but the user interface: Controls: The user sits on a sort of motorcycle-like arrangement, but with a sort of flexible bar in front instead of handlebars. This is intended to represent the front edge of the flying carpet. If you look down in the virtual world, you can see your hands (well, actually, Mickey Mouse's hands) gripping the edge of the carpet. Steering is very natural... The helmet seemed somewhat standard, but with something that impressed me... Users would strap on a sort of skullcap *before* donning the helmet... The helmet would just *snap* onto the skullcap....

9) Software Reusability (Seattle, WA, April)

Mansur Samadzadeh, samad@a.cs.okstate.edu

SSR'95 is the 1995 biyearly Symposium on Software Reusability that is conducted in affiliation with the International Conference on Software Engineering (ICSE-17). The objective of this symposium is to provide a forum for academics and practitioners in the areas related to software reusability to exchange research results, development activities, and application experience reports.

12) New Web Server

<http://www.euro.net/innovation/WelcomeHP.html>

A new Web service for professional Web users. Information Innovation, the publishers of The Web Word, have launched their own Web server. We aim to be the place where professionals come to use the Internet to find and use information about: - Resources on the Internet. - Modern Management Techniques and Technology. - The International Financial Industry. This is a service of Information Innovation, a company founded on the principles of continuous business innovation in the field of information technology.

16) WWW to replace Notes???

Discussion from comp.groupware

---I've heard that a number of global companies are beginning to experiment with the use of Mosaic and Web Servers to distribute information over existing secure wide area networks.

---This is true: there are now thousands of Web Servers and the number is growing daily - spreading from the universities to corporations. Anyone with a Windows 3.1 PC and a connection to the Internet can put up a Web Server with very little effort, time or expense.

---Are Mosaic and Web Servers the poor person's version of Lotus Notes?

---Time will tell, but we believe so. Lotus Notes is old, complicated and expensive software with enormous programming and maintenance expenses - web servers promise a lot of freedom. Are Mosaic and Web Servers the poor person's version of Lotus Notes?

---Mosaic & WWW - a poor man's Notes?? IMHO - No Way!! It took Lotus years to not perfect groupware but make big bucks out of it. The interface is ... poor; the database part is flat files - an insult to database folks _AND_ users...

The contents of this compilation are the opinions of the authors, and do not represent their organizations or BNR.

For details, look at one of these servers

--- b.ott.car.lab2 -- OK10 server -- Shareware -- UI Info --

--- anonymous ftp: -- 47.116.11.92 volume: UI_Digest --

Dick Penn dpenn@resudox.net +1 613 763 4458

Test Document C

Additional Information about Microsoft Word for the Macintosh

This document is one of several files that come with Word for the Macintosh version 5.1 to provide complementary or late-breaking information as a supplement to the standard Word documentation. The Installor program installs these documents in the Word folder on your hard disk.

See	For information
Word 5.1 ReadMe	Available since publication of the books in the Word package, and for information about changes made between Word version 5.0 and Word version 5.1
Conversion Information	About file conversion limitations and specialized conversion options
Formula Glossary Information	About the Formula glossary in the Glossaries folder
Page Layout Glossary Info	About the Page Layout glossary in the Glossaries folder
Mailing Labels ReadMe	About the mailing labels stationery documents in the Mailing Labels folder in the Sample Documents folder

This document includes information about the following:

- General notes about using Word commands and options
- Improvements in Word for the Macintosh version 5.1
- Documentation Updates

General Notes

Using the Toolbar and the Bullet, Addresses, and Create Envelope commands

The Toolbar is a separate module from the main Word program. Because the Bullet, Addresses, and Create Envelope commands are also part of this module, you must install the Toolbar to use these commands. Word stores addresses that you store with the Addresses command in the Word Toolbar Prefs file. You may want to make a backup copy of this file to avoid losing stored addresses in the event a problem occurs with your computer or hard disk. If your Macintosh is running System 7 software, the Word Toolbar Prefs file is stored in the Preferences folder in the System folder. If your Macintosh is running System 6 software, the Word Toolbar Prefs file is stored in the System folder.

Note: Unlike the Ribbon and Ruler commands on the View menu, a check mark does not appear next to the Toolbar command when the Toolbar is displayed.

Avoiding unwanted drop-cap formatting

The Drop Cap command inserts a frame around text that it formats as a dropped capital letter, or "drop cap," and also inserts a new paragraph mark with the frame. This new paragraph inherits formatting from the paragraph that originally contained the drop cap, which can sometimes lead to unwanted results. For example, if you use the Drop Cap command to create a drop cap for a paragraph with a border, the drop cap also will have

a border. In this case, you could use the Border command (Format menu) to remove the border, or create the drop cap for a paragraph before you apply border formatting to it.

Observing unexpected color changes while using Microsoft Graph

Because of the way the Macintosh manages colors between applications, colors may change on a color monitor when you use Graph to edit a chart in Word. When you quit Graph and return to Word, the chart regains its original colors.

Inserting characters using the Symbol font

To easily insert a character using the Symbol font, choose the Symbol command from the Insert menu. Then choose the Symbol font from the Font menu and select the character you want in the Symbol dialog box.

Increasing available space on the Word menu bar

You can increase the amount of space available on the Word menu bar by selecting the Use Short Menu Names check box, a View option in the Preferences dialog box (Tools menu). This option is especially useful if you have a monitor with a screen that is less than 13 inches wide.

Printing white text on a black background

If you want to print white text on a black background, choose Print from the File menu, and then select the Color/Grayscale option button.

Improvements in Word version 5.1

This section lists improvements to Word that are not described in the *What's New in Microsoft Word Version 5.1* manual.

Saving hard disk space when installing Word

Word version 5.1 provides two installation options, Minimal and PowerBook, to make it easier to install Word in a configuration that requires a minimal amount of space on your hard disk. The ReadMe Before Installation file lists the files that are installed with these options, as do the comments at the bottom of the Customize dialog box in the Installer program.

Subscribing to an edition and updating a subscriber

You can specify the format you want to use for a subscriber by using the Subscribe With list box in the Subscribe To dialog box. The default format is Best Format, which varies according to the edition format and system considerations, such as the amount of available memory. Other choices include Formatted Text (RTF), Unformatted Text, and Picture.

When you update a subscriber, you can maintain character and paragraph formatting you have applied to the subscriber by selecting the Keep Subscriber Formatting Changes check box in the Subscriber Options dialog box.

Updating a link

When you update a link, you can maintain character and paragraph formatting you have applied to linked text by selecting the Keep Link Formatting Changes check box in the Link Options dialog box. For example, if you apply right alignment formatting to a linked paragraph and then update the link, the paragraph will remain right aligned.

Moving a document to a different computer

In Word version 5.0, fonts sometimes changed when you moved a document from the computer on which it was created to a different machine. In Word version 5.1, this problem has been corrected.

Moving Word to the Macintosh desktop

In Word version 5.0, some commands did not function properly if Word was moved from the original installation folder and placed on the Macintosh desktop. In Word version 5.1, this problem has been corrected.

Using the Grammar command on some Macintosh models

In Word version 5.0, using the Grammar command sometimes caused Word to quit unexpectedly when running on the Macintosh Plus, SE, Classic, Portable, and PowerBook™ 100 models. In Word version 5.1, this problem has been corrected.

Documentation Updates***What's New in Microsoft Word Version 5.1*****Page 2 Default Buttons for All Screens**

When you display the default Toolbar horizontally on a 9-inch screen, the Toolbar has five more buttons than shown in the illustration in the "Default Buttons for All Screens" section. The Toolbar also contains the Border, Font Up, Font Down, Find File, and Replace buttons.

Page 34 Using Cut, Copy, and Paste to Edit Movie Frames

You cannot use the Cut command to cut frames from a movie.

Microsoft Word User's Guide**Page 6 Readability Indexes That Word Uses**

The Grammar command does not use the Gunning Fog Index.

Appendix E
Test Scripts^{A2}

^{A2} Scripts were presented to subjects in a portrait orientation with one question per half page (8.5" x 5.5").

VOICE CONTROL EXPERIMENT • TEST SCRIPT A

• ISSUE 1.0 •

Thank you for taking the time to participate in our study.

There are **no right or wrong answers**. It is your honest opinion that is of concern to us.

For each task you are asked to perform, please **read it carefully** before trying to perform it.

When performing a task which requires a dialog box, be sure to close the dialog box when done (unless the specific task instructions tell you otherwise).

After each task, **please wait** until told to proceed to the next one by the experimenter. This is so the experimenter has time to record all measures and observations for each task.

Remind experimenter to START video

1.
 - Open the document:
1-Test File, located on the **Desktop**

2.
 - Store this document as '**your name**' **test A** on the **Desktop**

3.
 - Make the following 2-line title at the top of page 1 **double-spaced**
I'm making my computer easier to use so I can be more productive:
Confessions of a utilities junkie

4.
 - (A) locate the following lines of text below the title on page 1:
Richard F. Dillon
Computer User Research and Evaluation
Department of Psychology
Carleton University
 - (B) make them start from the right margin

5. • Change the point size of the following 2-line title to 14
- I'm making my computer easier to use so I can be more productive:
Confessions of a utilities junkie.
-

6. • Show me what is written in the Header then close the Header.
-

7. • Select all text in the document.
-

8. • Change the font of the selected text to Times.
-

9. • Eliminate the entire **last row** of the table on page 1.
-

10. • Make the outside box, around the table on page 1, a **thick** line.
-

- 11.** • Skip to the next screen of text.

- 12.** • make the following line of text, **boldface**

"Dick Dillon, This is your life."

- 13.** • Skip back to the previous screen of text, and click once anywhere in the document.

- 14.** • Locate the NEXT occurrence of the word:

experts

- 15.** • (A) select the **blank line** below the word: "experts"
• (B) replace the blank line with a page break.

- 16.** • (A) view the document in the **print preview** window and make sure that the following line starts on a new page:

Norton's Desktop

- (B) then close the **print preview** window.
-

- 17.** • Center the sub-title:

Norton's Desktop

- 18.** • (A) Select the **2nd** paragraph directly beneath the sub-title:
Norton's Desktop

- (B) Make it *italic*
-

- 19.** • Skip ahead to the next screen of text.
-

- 20.** • (A) locate and select the sub-title:
Filter

- (B) make the title **small caps** and **expanded**, **apply** the changes **first** then close the dialog box.
-

- 21.**
- (A) Open the Header of the document.
 - (B) Change the right margin setting to **5.5** inches and close the Header.
-

- 22.**
- (A) select the paragraph directly below the sub-title:
Filter
 - (B) change the **spacing before** the paragraph to **10 pt**, **apply** the changes, then change the **spacing after** to **5 pt**, and exit the dialog box.
-

- 23.**
- (A) locate and select the words:
Play with the Norton Copy and Move commands
 - (B) underline it.
-

- 24.**
- place a **section break** on the **blank line** above the sub-title:
hdc PowerLauncher
-

- 25.**
- center the sub-title:
hdc PowerLauncher
-

- 26.** • Show me what is written in the Footer, then close the Footer
-

- 27.** • (A) in the sub-title:
hdc PowerLauncher
- (B) make the word **PowerLauncher** appear all in UPPERCASE letters.
-

- 28.** Skip ahead to the next screen of text.
-

- 29.** • Insert a (1 column X 3 row) table directly below the sub-title:
Hewlett Packard DashBoard
-

- 30.** • (A) select the entire 1st paragraph that appears below the new table:
- (B) **cut** it and **paste** it into (row 1, column 1) of the new table.
-

- 31.**
- (A) select the next paragraph directly below the table
 - (B) **copy** it and **paste** it into (**row 2, column 1**) of the table.
-

- 32.**
- (A) select the entire **3rd row** of the table
 - (B) give that row a **25%** shading.
-

- 33.**
- Eliminate the entire 1st **paragraph** that appears below the table
-

- 34.**
- (A) now select the following words on the first line below the table:
DashBoard, although not as flexible as PowerLauncher
 - (B) change their point size to **14**, (and then de-select them).
-

- 35.**
- Spell check the document.
 - (When finished, click once anywhere in the document).
-

- 36.** • Put the document into a **Landscape** orientation.
-

- 37.** • Change every occurrence of the word **Mac** to the word **Macintosh**.
-

- 38.** • Print the document.
-

THANK YOU !
THE END • SCRIPT A

Remind experimenter to STOP video

VOICE CONTROL EXPERIMENT • TEST SCRIPT B

• ISSUE 1.0 •

Thank you for taking the time to participate in our study.

There are **no right or wrong answers**. It is your honest opinion that is of concern to us.

For each task you are asked to perform, please **read** it **carefully** before trying to perform it.

When performing a task which requires a dialog box, be sure to close the dialog box when done (unless the specific task instructions tell you otherwise).

After each task, **please wait** until told to proceed to the next one by the experimenter. This is so the experimenter has time to record all measures and observations for each task.

Remind experimenter to START video

1.
 - Open the document:
2-Test File, located on the **Desktop**
-

2.
 - Insert a **(1 column X 4 row)** table on the second blank line at the top of the document.
-

3.
 - (A) select the line:
UI Digest Number 60 28 Oct. 1994 Editor: Dick Penn
 - (B) copy it and paste it into **(row 2)** of the new table.
-

4.
 - (A) select the entire table of contents beneath the original line:
UI Digest Number 60 28 Oct. 1994 Editor: Dick Penn
 - (B) cut it and paste it into **(row 3)** of the table.
-

5.
 - (A) select the entire **4th row** of the table
 - (B) give that row a **25% shading**.
-

- 6.** • Eliminate the following line which appears below the table:

UI Digest	Number 60	28 Oct. 1994	Editor: Dick Penn
-----------	-----------	--------------	-------------------

-
- 7.** • Eliminate the entire **1st row** of the table

-
- 8.** • Skip to the next screen of text.

-
- 9.** • Store the document as "**your name**" **test B** on the **Desktop**.

-
- 10.** • Show me what is written in the Footer, then close the Footer.

-
- 11.** • (A) select the sub-title:
1) CD-ROM Development (Course, LA, Jan.)
• (B) make it *italic*
-

- 12.** • Select all text in the document

- 13.** • Change the font of the selected text to **Helvetica**.

- 14.** • (A) select the word "**Design**" in the sub-title:
2) User-Oriented Interface Design (Course, LA, Jan.)
• (B) make it appear all in UPPERCASE letters.

- 15.** • Skip ahead to the next screen of text.

- 16.** • Put the document into a **Portrait** orientation

- 17.** • Place a **section break** on the blank line above the sub-title:
3) Typing Injury FAQ

- 18.** • Change the point size of the sub-title:
3) Typing Injury FAQ to **10.**
-

- 19.** • Center the sub-title:
3) Typing Injury FAQ
-

- 20.** • Show me what is written in the Header, then close the Header
-

- 21.** • (Click anywhere in the document)
• then locate the next occurrence of the word:
HFES
-

- 22.** • (A) select the **blank line** above the sub-title:
HFES VR SIG proposed
• (B) replace the blank line with a page break.
-

- 23.** • (A) view the document in the **print preview** window and make sure that the following line starts on a new page:

HFES VR SIG proposed

- (B) close the print preview window.
-

- 24.** • (A) select the sub-title:

6) HFES VR SIG proposed

- (B) change it's point size to **14**
-

- 25.** • (A) select the article that appears under the sub-title:
6) HFES VR SIG proposed

- (B) change the **spacing before** the paragraph to **10 pt**, **apply** the changes, then change the **spacing after** to **5 pt**, and exit the dialog box.
-

- 26.** • Make the following line of text, **boldface**
7) Mobile & Location-Independent Comp'g (Ann Arbor, MI, Apr.)
-

- 27.** • Skip ahead to the next screen of text.
-

- 28.** • Center the sub-title:
8) Disney's Magic Carpet Ride
-

- 29.** • (A) Open the Header of the document.
- (B) Change the right margin setting to 5.5 inches and close the Header.
-

- 30.** • The Disney article is in a table. Select it and make the outside box around it a **thick** line.
-

- 31.** • (A) select the following by-line (above the Disney article):
The newsgroup sci.virtual-worlds
- (B) underline it.
-

- 32.** • (A) select the Disney by-line again:
(i.e., The newsgroup sci.virtual-worlds)
- (B) make it start from the **left** margin.
-

- 33.** • Skip back to the previous screen.
-

- 34.**
- (A) select the sub-title:
6) HFES VR SIG proposed
 - (B) make it **small caps** and **expanded**, **apply** the changes **first** then close the dialog box.
-

- 35.**
- the article that appears below the following title:
6) HFES VR SIG proposed
- is single-spaced, make it **double-spaced**
- (When finished, click once anywhere in the document to de-select).
-

- 36.**
- Change every occurrence of the word **Web** to the word **WWW**.
-

- 37.**
- Spell check the document.
-

- 38.**
- Print the document.
-

THANK YOU !
THE END • SCRIPT B

Remind experimenter to STOP video

VOICE CONTROL EXPERIMENT • TEST SCRIPT C • ISSUE 1.0 •

Thank you for taking the time to participate in our study.

There are **no right or wrong answers**. It is your honest opinion that is of concern to us.

For each task you are asked to perform, please **read it carefully** before trying to perform it.

When performing a task which requires a dialog box, be sure to close the dialog box when done (unless the specific task instructions tell you otherwise).

After each task, **please wait** until told to proceed to the next one by the experimenter. This is so the experimenter has time to record all measures and observations for each task.

Remind experimenter to START video

1.
 - Open the document:
3-Test File, located on the **Desktop**

2.
 - Change every occurrence of the word **Macintosh** to the word **Apple**. (Remember to close the dialog box when you finish).

3.
 - Store this document as '**your name**' test **C** on the **Desktop**.

4.
 - Put this document into a **Portrait** orientation.

5.
 - Select all text in the document.

6.
 - Change the font of the selected text to **Helvetica**, then de-select.

- 7.** • Make the outside box, around the table on page, 1 a **thick** line.
-

- 8.** • Make the following text on page 1 **double-spaced**
- General notes about using Word commands and options
 - Improvements in Word for the Macintosh version 5.1
 - Documentation Updates
-

- 9.** • Skip to the next screen of text.
-

- 10.** • Show me what is written in the Header then close the Header.
-

- 11.** • change the point size of the title: General Notes to 14.
-

- 12.** • make the following line of text, **boldface**
Using the Toolbar and the Bullet, Addresses, and Create Envelope
commands
-

- 13.** • Skip back to the previous screen of text.

- 14.** • Locate the next occurrence of the word:
Observing

- 15.** • (A) select the **blank line** above the word: "observing"
• (B) replace the blank line with a page break.

- 16.** • (A) view the document in the **print preview** window and make sure that the following line starts on a new page:
Observing unexpected color changes while using Microsoft Graph
• (B) close the **print preview** window.

- 17.** • (A) In the sub-title: "Observing unexpected color..." locate the word "**Graph**" and select it
• (B) make **Graph** appear all in UPPERCASE letters.

- 18.** • Show me what is written in the Footer, then close the Footer.

- 19.** • Skip ahead to the next screen of text.
-

- 20.** • center the sub-title:
Improvements in Word version 5.1
-

- 21.** • (A) select the two line paragraph immediately below the sub-title:
Improvements in Word version 5.1
- (B) change the **spacing before** the paragraph to **10 pt**, **apply** the changes,
change the **spacing after** to **5 pt**, then close the dialog box.
-

- 22.** • (A) locate and select the sub-title:
Saving hard disk space when installing Word
- (B) make it start from the left margin
-

- 23.** • Skip ahead to the next screen of text.
-

- 24.**
- (A) locate and select the sub-title:
Documentation Updates
 - (B) make the title **small caps** and **expanded**, **apply** the changes **first** then close the dialog box.
-

- 25.**
- place a **section break** on the **blank line** above the sub-title:
Documentation Updates
-

- 26.**
- (A) locate and select the line:
What's New in Microsoft Word Version 5.1
 - (B) change it's point size to **14**
-

- 27.**
- Insert a (2 column X 3 row) table directly below the line:
What's New in Microsoft Word Version 5.1
-

- 28.**
- (A) locate and select the line:
Page 2 Default Buttons for All Screens
 - (B) **copy** it and **paste** it into (**row 1, column 1**) of the table you just created.
-

- 29.** • (A) select the paragraph directly beneath the original line:
Page 2 Default Buttons for All Screens
- (B) **cut** it and **paste** it into (row 1, column 2) of the table.
-

- 30.** • (A) locate and select the line:
Page 34 Using Cut, Copy, and Past to Edit Movie Frames
- (B) underline it.
-

- 31.** • (A) select the paragraph directly beneath the line:
Page 34 Using Cut, Copy, and Past to Edit Movie Frames
- (B) make it *italic*
-

- 32.** • (A) select the entire **1st column** of the table
- (B) give that column a **25%** shading.
-

- 33.** • eliminate the entire **3rd row** of the table
-

- 34.** • Now eliminate the following line which appears below the new table.
- Page 2 Default Buttons for All Screens**
-

- 35.** • Center the sub-title:
- Microsoft Word User's Guide***
-

- 36.** • (Click anywhere in the document)
- Spell check the document
-

- 37.** • (A) Open the header of the document.
- (B) Change the right margin setting to 5.5 inches and close the header.
-

- 38.** • Print the document.
-

THANK YOU !
THE END • SCRIPT C

Remind experimenter to STOP video

Appendix F

Commands Tested in Each Specific Task Group

Group	Description	Question number		
Pointing tasks				
Group 1 T	Top level voice/menu, quick key, button	Script A	Script B	Script C
1A	bold	12	26	12
1B	cut and paste	30	3	28
1B'	copy and paste	31	4	29
1B''	cut (or use task 2D) ^a	(33)	(6)	(34)
1C	page break	15	22	15
1D	italic	18	11	31
1E	underline	23	31	30
Group 2 H	Hierarchical voice/menu and quick key	Script A	Script B	Script C
2A	format > character ^b	20	34	24
2A'	format > character (or use task 4B)	(27)	(14)	(17)
2B	format > paragraph	22	25	21
2C	insert > section break	24	17	25
2D	edit > clear (or use task 1B'')	(33)	(6)	(34)
Group 3 T	Top level voice/quick key and button	Script A	Script B	Script C
3A	center	17	19	20
3A'	center	25	28	35
3B	double space	3	35	8
3C	right align, left align, left align	4	32	22

table continues

^a Some test questions could be correctly performed by either of two tasks (e.g., Task 1B'' or Task 2D could be used for questions 33, 6, and 34 of Scripts A, B, and C respectively).

^b The > symbol indicates that the subject had to say the menu name followed by the menu item name.

Group	Description	Question number		
Pointing tasks				
Group 4 H	Hierarchical voice/menu and button	Script A	Script B	Script C
4A	format > border	10	5	7
4A'	format > border	32	30	32
4B	format > change case (or use task 2A')	(27)	(14)	(17)
4C	insert > table	29	2	27
Group 5 T	Top level voice/menu only	Script A	Script B	Script C
5A	Times, Helvetica, Helvetica	8	13	6
5C	14 point, 10 point, 14 point	5	18	11
5C'	14 point	34	24	26
Group 5 H	Hierarchical voice/menu only	Script A	Script B	Script C
5B	format > table layout	9	7	33
Non-pointing tasks				
Group 6 T	Top level voice/menu, quick key, button	Script A	Script B	Script C
6A	close window	6	20	10
6A'	close window	21	29	37
6A''	close window	26	10	18
6B	open	1	1	1
6C	print	38	38	38
6E	replace	37	36	2
6F	spelling	35	37	36

table continues

Group	Description	Question number		
Non-pointing tasks				
Group 6 H	Hierarchical voice/menu, quick key, button	Script A	Script B	Script C
6D	file > print preview	16	23	16
Group 7 T	Top level voice/menu and quick key	Script A	Script B	Script C
7A	find	14	21	14
7B	page setup	36	16	4
7D	save as	2	9	3
Group 7 H	Hierarchical voice/menu and quick key	Script A	Script B	Script C
7C	edit > select all	7	12	5
Group 8	Top level voice/menu only	Script A	Script B	Script C
8A	header	6	20	10
8A'	header	21	29	37
8B	footer	26	10	18
Group 9	Top level voice/direct manipulation	Script A	Script B	Script C
9A	page down	11	8	9
9A'	page down	19	15	19
9A''	page down	28	27	23
9B	page up	13	33	13
9C	close	16	23	16

table continues

Group	Description	Question number		
Dialog box tasks				
Group 10	Top level voice/modal dialogs	Script A	Script B	Script C
10A	border dialog	10	5	7
10A'	border dialog	32	30	32
10B	change case dialog (or use task 10C')	(27)	(14)	(17)
10C	character dialog	20	34	24
10C'	character dialog (or use task 10B)	(27)	(14)	(17)
10D	table dialog	29	2	27
10E	open dialog	1	1	1
10F	page setup dialog	36	16	4
10G	paragraph dialog	22	25	21
10H	save as dialog	2	9	3
10I	table layout dialog	9	7	33
Group 11	Top level voice/non-modal dialogs	Script A	Script B	Script C
11A	find dialog	14	21	14
11B	replace dialog	37	36	2
11C	spelling dialog	35	37	36

Appendix G

Ease of Use Likert Scale Definitions

How **easy** was it to perform the task?

Very Difficult	Difficult	Slightly Difficult	Slightly Easy	Easy	Very Easy
1	2	3	4	5	6

Appendix H

Simple Main Effect Means for all Significant Interactions

This appendix presents the results of the simple effects calculated for the significant Input by Task interactions found for task completion times, ease of use ratings, and error scores. The results calculated for the significant Task main effect for percentage voice input chosen are also presented.

The means, for each dependent variable (time, ease and error), along with their F values and probabilities are listed for each task group in Table H1, H2 and H3.

Table H4 shows the results of the individual t-tests run on the percentage voice input chosen for each task group.

Table H1.

Simple Main Effects of Task Completion Times for Each Task Group

Specific Task Group	Mean (seconds)		<i>F</i> ^a	<i>p</i>
	Voice input	Manual input		
Group 1 Top (bold)	3.0	4.4	8.67	.013*
Group 2 Hrchy (format>character)	6.8	5.8	1.05	.328
Group 3 Top (center)	1.9	2.4	.79	.393
Group 4 Hrchy (insert>table)	4.7	6.0	1.08	.322
Group 5 Top (helvetica)	1.5	4.9	35.91	<.001*
Group 5 Hrchy (format>table layout)	7.6	7.9	.03	.871
Group 6 Top (print)	3.9	5.2	1.22	.292
Group 6 Hrchy (file>print preview)	6.9	3.7	2.54	.139
Group 7 Top (page setup)	2.7	5.8	4.36	.061
Group 7 Hrchy (edit>select all)	11.1	5.9	12.06	.005*
Group 8 Top (header)	2.3	4.3	18.01	.001*
Group 9 Top (page up)	1.3	1.8	1.54	.240
Group 10 Top (modal dialogs)	10.6	9.2	4.27	.063
Group 11 Top (non-modal dialogs)	17.8	17.7	.00	.961

^a Degrees of freedom were 1 and 11 for all *F* tests.* *p* < .05.

Table H2.

Simple Main Effects of Ease of Use for Each Task Group

Specific Task Group	Mean		<i>F</i> ^a	<i>p</i>
	Voice input	Manual input		
Group 1 Top (bold)	5.83	5.44	5.54	.038*
Group 2 Hrchy (format>character)	4.17	5.33	10.17	.009*
Group 3 Top (center)	5.60	5.48	.67	.429
Group 5 Top (helvetica)	5.89	5.03	10.89	.007*
Group 6 Top (print)	5.67	5.58	.13	.723
Group 6 Hrchy (file>print preview)	4.25	4.92	2.59	.136
Group 7 Hrchy (edit>select all)	4.08	5.67	12.29	.005*
Group 8 Top (header)	5.03	4.81	1.11	.315
Group 9 Top (page up)	5.81	5.56	.94	.352
Group 10 Top (modal dialogs)	4.6	4.49	.41	.536
Group 11 Top (non-modal dialogs)	4.97	4.72	.70	.421

^a Degrees of freedom were 1 and 11 for all *F* tests.

* *p* < .05.

Table H3.

Simple Main Effects of Errors for Hierarchical Task Groups

Specific Task Group	Mean errors per attempt			<i>F</i>	<i>p</i>
	Manual recall	Voice recall	Voice hierarchy		
Group 2 Hrchy (format>character)	.10	.06	.23	1.86 ^a	.197
Group 4 Hrchy (insert>table)	.19	.08	.08	1.26 ^b	.304
Group 5 Hrchy (format>table layout)	.50	.25	.00	2.83 ^c	.099
Group 6 Hrchy (file>print preview)	.00	.17	1.25	4.11 ^d	.064
Group 7 Hrchy (edit>select all)	.00	.33	1.17	5.30 ^e	.028*

^a Degrees of freedom = 1.20 and 13.18. ^b Degrees of freedom = 2 and 22. ^c Degrees of freedom = 1.51 and 16.62. ^d Degrees of freedom = 1.06 and 11.70. ^e Degrees of freedom = 1.35 and 14.84.

* $p < .05$.

Table H4.

T-tests for Percentage Voice Input Chosen for Each Task Group

Specific Task Group	Percentage voice input chosen	<i>t</i> ^a	<i>p</i>
Group 1 Top (bold)	83.33	3.73	.003*
Group 2 Hrchy (format>character)	64.5	1.83	.095
Group 3 Top (center)	68.75	3.00	.012*
Group 4 Hrchy (insert>table)	74.3	2.04	.067
Group 5 Top (helvetica)	91.67	5.00	<.001*
Group 5 Hrchy (format>table layout)	50.0	.00	1.00
Group 6 Top (print)	72.67	2.55	.027*
Group 6 Hrchy (file>print preview)	41.7	-.56	.586
Group 7 Top (quit)	69.6	1.88	.087
Group 7 Hrchy (edit>select all)	50.0	.00	1.00
Group 8 Top (header)	100.0	? ^b	*
Group 9 Top (page up)	76.7	2.91	.014*

^a Two-tailed tests, degrees of freedom were 1 and 11 for all *t*-tests. ^b The standard deviation is 0, analysis could not be performed.

* *p* < .05.

Appendix I
Informed Consent Form

Informed Consent Form

Present Study: Voice Control in a Graphical User Interface Environment.

Research Personnel. The following people are involved in this research project and may be contacted at any time: Tom D'Ippolito (Principal investigator, 788-2600 ext. 6628), Dr. R.F. Dillon (Thesis supervisor, 788-6629).

Should you have any ethical concerns about this study, please contact Dr. L. Paquet (Chair, Department of Psychology Ethics Committee, 788-2600 ext. 2692) or Dr. W. Jones (Chair, Department of Psychology, 788-2600, ext. 2648).

Purpose. This study will determine the conditions under which controlling a computer word processing application by speaking to it will result in better performance and greater user satisfaction than controlling it with a mouse and keyboard.

Task Requirements. You will perform 20 hours of unsupervised practice, at your own pace, using speech recognition with the word processor. For practice you need only to work on your own documents on the word processor provided you use speech recognition. e.g., edit/write reports, letters, memos, etc. For testing, you will edit three documents under three conditions: voice control only, mouse and keyboard control only, and choice of control. You will also be asked to fill out a questionnaire.

Duration and Locale. The voice template training session will last approximately 1.5 hours. Practice will last as long as it takes you to reach 20 hours of using the word processor with speech recognition, and the experimental session will last about an hour. Template training, unsupervised practice and testing will take place in Room 314 of the Social Science Research Building, Carleton University if you are a Carleton graduate student or in your office if you are a NT/BNR employee.

Potential Risk/Discomfort. There are no potential physical or psychological risks in this experiment.

Anonymity/Confidentiality. The data collected in this experiment is confidential. All data is coded so that your name is not associated with the data. The coded data is made available only to researchers associated with this study.

Right to Withdraw. You have the right to withdraw from the experiment at any time.

Signatures

I have read the above description of the Voice Control in a Graphical User Interface Environment study and understand the conditions of my participation. My signature indicates that I agree to participate in the experiment.

Participants Name: _____ Participants Signature: _____

Researcher Name: Tom D'Ippolito Researcher Signature: _____

Date: _____