CONSIDERATION OF SCANNING KEYBOARD AND TEXT PREDICTION IN THE CONTEXT OF ACCESS TO TELECOMMUNICATIONS SERVICES

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Telecommunications, scanning keyboard,
predictive systems

ABSTRACT
This paper discusses a pilot investigation of text communication as an element of interaction mediated by a broadband telecommunication system. This study is part of a wider investigation being undertaken by the EEC RACE IPSNI II project. The focus of the study was to determine the merit of commonly available assistive input techniques used by non-speaking people with additional motor impairments affecting their ability to type. The specific techniques employed were an on-screen scanning alphanumeric selection system and word prediction software. Whilst these systems did enable some severely impaired users to communicate, the conversation took over 8 times as long as those between able-bodied subjects (untrained typists using a keyboard) for equivalent conversations. This result suggests that a scanning text selection method could cause excessive expense for users seeking to undertake real-time text-based communication over broadband telecommunications networks.

INTRODUCTION

The RACE IPSNI II project is a Pan-European collaborative research project investigating the issues governing the accessibility of broadband multimedia services by people with special needs. One focus within the project is concerned with the problems faced by non-speaking people as they seek to be involved in multimedia conversations and collaborative activities. The service that is central to these activities is the video-telephony service. As these users will have difficulty contributing speech to the conversation, the video-telephone could be enhanced with the addition of a text telephone service [3]. As many non-speaking users may have additional motor impairments, the text telephone would need further enhancement for these users. One element of the project is to isolate techniques that would enable these users to exchange text in real time and to expose the issues that are peculiar to telecommunications text exchange [4].

The first techniques investigated were an on-screen scanning keyboard system and a word prediction system. The underlying hypothesis was that because the scanning keyboard system introduces a delay whilst the cursor scans to the required character, the conversations are longer, and therefore incur higher telecommunications call charges. An additional concern was that the number of keystrokes or movements involved in making the scanning selection would be higher than selecting keys from a keyboard, depending on the scanning array layout. For this reason, word prediction [1,2] was added to attempt to reduce the time and effort involved in typing words. The goal of the investigation was to find the magnitude of the time difference between keyboard typing and scanning keyboard typing, in the context of bilateral conversations over a multimedia network as time on-line is the principle factor governing the cost of utilisation of telecommunications services.

EXPERIMENTAL METHOD

An emulated text telephone service was constructed to operate between two Macintosh computers which were situated in separate rooms. A script was provided for a conversation between a patient and a doctor's receptionist to arrange an appointment. The information to be exchanged was given, but the subjects were free to express themselves as they wished. The conversation succeeded when the information had been exchanged. In order to ensure that the information was not learned, it was changed between experiments. The receptionist remained the same throughout the experiments and conducted their part of the conversation using a conventional keyboard. Six able bodied subjects conducted three conversations with this receptionist. This was followed by a series of experiments involving a subject with cerebral palsy. The following three conditions were compared: Keyboard typing, scanning keyboard typing and scanning keyboard plus prediction.

RESULTS

All the conversations were successfully completed in that the required information was exchanged. The time taken for the conversations is shown in table 1 below. This shows that the conversations took 8.38 times longer when the scanning keyboard was employed than when a conventional keyboard was employed. Prediction contributed to a reduction in conversation time of over 26% when used with the scanning keyboard

	Conversation Time (Hrs:Min:Secs)	Patient Typing Time (Hrs:Min:Secs)	Contribution of "Patient" to Conversation in time
Conventional Keyboard (able-bodied)	0:9:27	0:3:13	35%
Scanning Keyboard (CP.)	1:19:12	1:02:39	79%
Scanning Keyboard + Prediction (CP.)	0:58:08	0:48:04	83%

Table 1 - Conversation Times

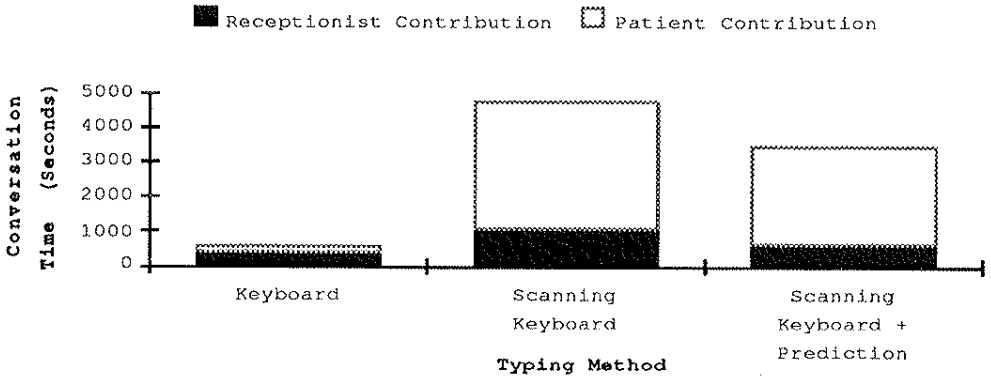

Figure 1 - Conversation times showing contribution of patient and receptionist.

Table 1 and figure 1 reveal that the increase in conversation time is due predominantly to an increase in time taken by the "patient" subject.

	No of Words in Conversation	No of Characters in Conversation	Typing Rate (Characters per Second)	Keystrokes per Character
Conventional Keyboard (able-bodied)	78	433	2.25	1.06
Scanning Keyboard (CP.)	37	186	0.050	4.33
Scanning Keyboard + Prediction (CP.)	33	185	0.066	2.53

Table 2 - Typing Statistics

Table 2 above reveals the cause of this increase in time. The number of words generated by the "patient" when employing the scanning keyboard, both with and without prediction, was about 50% of the number employed when using a keyboard. The data presentation rate, however, as measured in characters per second, is 2.2% of the keyboard rate when employing a scanning keyboard, and is 3.0% of the keyboard rate when employing a scanning keyboard and prediction.

There is a 3.7 times increase in keystrokes per word when the scanning keyboard is used compared with the keyboard. This fell to an increase of 2.4 times when prediction was employed with the scanning keyboard, representing a saving of 42% in keystrokes/word over the scanning keyboard used alone.

CONCLUSIONS

This study confirmed the difficulties faced by people for whom scanning keyboards are the preferred or only viable text input device. The use of a word predictor was found to make some improvement in the typing rate, and a major improvement in the effort involved in typing.

A number of strategies could be pursued to address the situation exposed in this pilot study. In the first instance, an alternative input device involving direct selection should be investigated, and additional conversation assistance techniques should be employed. For example, eye gaze tracking has been investigated by the project and other techniques are currently being reviewed.

In addition a realistic call cost structure should be negotiated with telecommunications service providers in recognition of the protracted conversation times that characterise the type of interaction investigated in this study. Alternatively, a text telephone based on transmission of packets of text, a type of interactive e-mail, could be investigated. In this case blocks of text would be created with no call connection in place, and then connections made whenever a text block is ready for transmission. [5]

Unless solutions are found to the time/cost problem users may find themselves increasingly isolated as they and their callers are unable to meet the high call charges and callers are unwilling to do so.

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ACKNOWLEDGEMENT

This work was funded under the CEC RACE programme. Their support is gratefully acknowledged, as is the contributions made by colleagues and students at the MicroCentre, University of Dundee and friends at Upper Springlands, Perth, Scotland.