DECUS PROCEEDINGS

SPRING 1966

PAPERS AND PRESENTATIONS

of

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*Abstracts Only

PREFACE

This 1966 Spring Symposium was a first in several ways. It was the first three-day meeting; one day devoted to biomedical applications and two days for general applications, and the first time DECUS was sole host. The meeting was a combination of papers, information discussion sessions and demonstrations.

At the Laboratory for Computer Science, Massachusetts General Hospital, demonstrations were held on: the Hospital Computer Project System, Telcomp, on-line information storage and retrieval, and use of the PDP-7 in a hospital application. The demonstrations were very interesting and informative. Informal discussions were held during the biomedical session on topics such as: A-D conversion problems, on-line data processing, display techniques, and laboratory data processing. A question-and-answer period took place during the general session where a panel of DEC experts were available to answer questions on hardware and software problems. Simultaneously, a PDP-6 software discussion was sucessfully taking place in a separate conference room. Attendees at the PDP-6 session commented favorably on its effectiveness and planned to hold another such meeting at the Fall DECUS Symposium. During the afternoon of the third day, a members meeting was held were the subject of changing DECUS software policies was discussed. Members were asked their opinion on whether DECUS should consider advertising software for sale in DECUSCOPE and accept papers on such for presentation at meetings. No definite decision resulted.

This proceedings depicts another first in that it is the first published under our new procedure where each author is responsible for the preparation of his paper for publication.

Each symposium acts as a stimulus for continued participation in the users group and new ideas for improving meetings and the users group as a whole.

Our thanks to all speakers and participants in the symposium with special acknowledgment to our fine Chairmen, Dr. G. Octo Barnett of Massachusetts General Hospital and Professor Donald A. Molony of Rutgers University.

COMPUTER AIDS TO THE HANDICAPPED - THE PDP-8 AS A BRAILLE TRANSLATOR *

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ABSTRACT

This paper reports on work being done at Project MAC of the Massachusetts Institute of Technology which makes computer translated Braille equivalent of a Teletype machine has been used to translate English text into Grade I and Grade II Braille.

The M.I.T. Brailler, as it is called, is a machine which can emboss Braille cells at a rate of 10-15 characters per second. This machine, coupled through a special interface on the PDP-8 makes high quality Braille text available to the user of the computer, and to blind users of M.I.T.'s time-sharing system. The PDP-8 can also be connected to the outside world via a Dataphone link, thus supplying Braille translator from remote locations.

The Braille Language

In 1826 a Frenchman named Louie Braille came across a method that a French military general had invented for sending and receiving messages at night. Braille developed this method into a system for embossing paper with a series of dots so that blind persons could read through the use of their sense of touch. Since that time the use of Braille has become widespread in the United States and elsewhere, and two basic forms of Braille have developed. These two forms are known as Grade I and Grade II Braille. This paper will discuss some of the problems involved in translating English text into these two grades of Braille through the use of a small computer, and it will describe the work being done at M.I.T.'s Project MAC which is making computer translated text available to the blind.

The translation of English text into Grade I Braille is fairly straightforward, and, with only a few exceptions, it simply requires the substitution of the Braille equivalent for the characters in the English text. One of these exceptions, for example, is the use of the numeral sign before a string of numbers. The Braille symbols for the digits are identical to some of the letters, and in order to avoid confusion, a numeral sign has to be used to indicate that the string of characters which follow the numeral sign is a number. Another exception to the rule is the on-to-many translation of certain graphics.

The equals sign, for instance requires two symbols of Braille for its representation, and the percent sign requires three. Despite these special cases, the translation can be done very easily by a small computer, and the translated text would look like the top portion of Fig. 1.

Grade II Braille, on the other hand, is much more complex and contains many contractions and special rules. The bottom portion of Fig. 1 illustrates some of these features. Notice, in the first word of the sentence the capital sign still remains, but the entire word "this" has been contracted to a single Braille symbol. "Is" and "grade" are identical in the Grade I and Grade II translations, but "first" and "Braille" have been contracted. Also, "not" has its own abbre-

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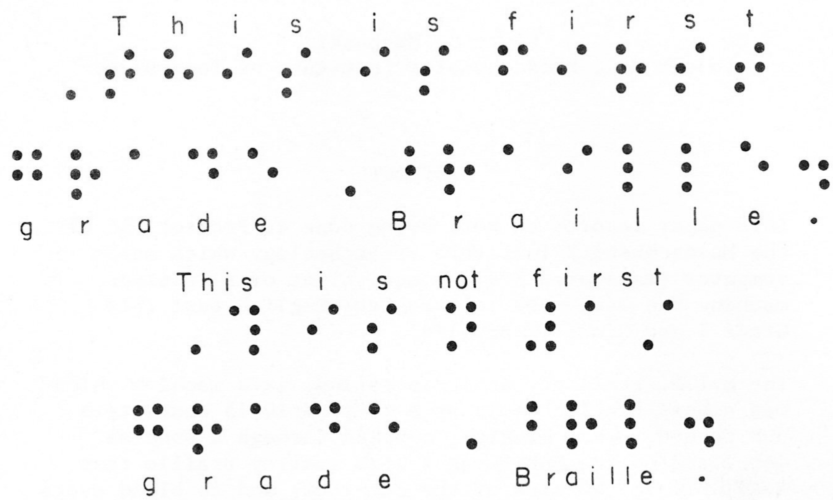

Figure 1 Samples of Grade I and Grade II Braille Translation

viation.

A problem which arises in Braille translation, as with many other mechanical translation schemes, is the context sensitivity of the translation. The letters "th" have an abbreviation in Braille when used in a word such as "mother". The "th" combination also appears in sweetheart, but the use of the "th" contraction in this case is illegal. A computer program which would handle a majority of these cases and still fit into the 4K of memory in the PDP-8 was written by Fred Luconi at M.I.T. [1]

The M.I.T. Brailler

Needless to say, without some means of embossing the translated Braille on paper, the translation itself is not very useful. There have been a number of attempts to emboss Braille through the use of computer controlled equipment, primarily through the modification of standard line printers. During the past few years, however, several groups at M.I.T. have been developing a Braille embosser which is almost the equivalent of a standard teletype machine.

The original design of the M.I.T. Brailler was done by Daniel Kennedy at M.I.T. under the guidance of Professor D.M.B. Baumann. [2] Adding to the original design, R. Amstrong built a housing for the embosser so that the Brailler could be used as a remote terminal.[3] The Sensory Aids Development and Evaluation Center helped to test the mechanical operation of the embosser, and the author, under the direction of Professor E.L. Glaser, helped to checkout the electronics' interface between the Brailler and the PDP-8 and write whatever test and maintenance programs necessary to assure proper functioning of the machine.

This work was sponsored by the Advanced Research Projects Agency of the Department of Defense, and by the Vocational Rehabilation Administration of the Department of Health, Education and Welfare.

This Brailler can now emboss 10-15 characters a second, and programs exist which will accept input from the teletype and translate the English text into Grade I and Grade II Braille. There is also a program which will receive signals from the Dataphone connected to the PDP-8 and turn these teletype signals into Grade I Braille. The Brailler is shown in Fig. 2.

The Brailler and Real-Time Translation

One of the main reasons why the Brailler was designed as an equivalent for a Teletype unit is to allow the Brailler to be used as part of an on-line communications terminal. Figure 3 illustrates the use of the Brailler and the PDP-8 in this type of situation. The Brailler is completely controlled by the PDP-8, and all translation is done by the small computer. The PDP-8 connects to the

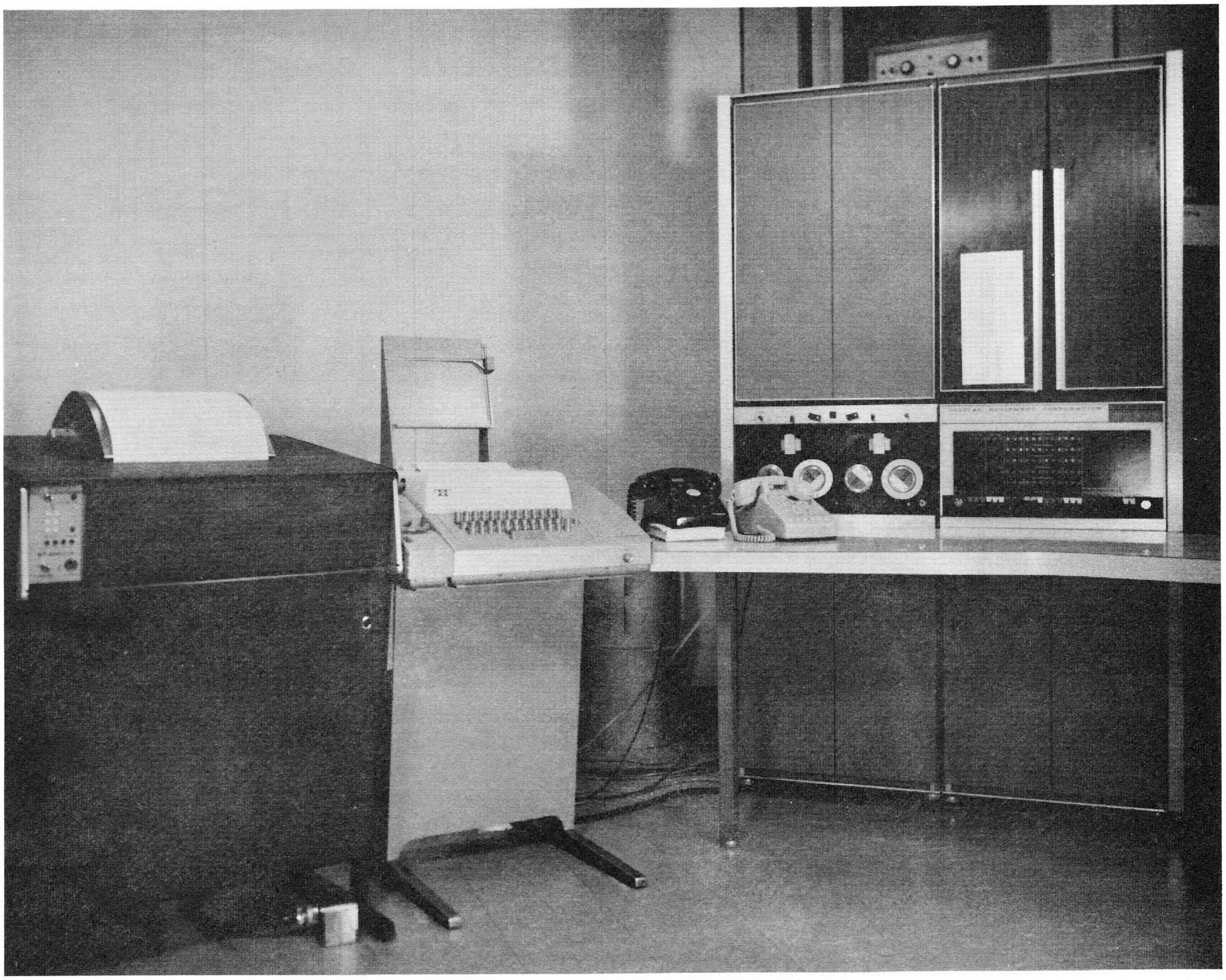

Figure 2 The M.I.T. Brailler and PDP-8 Computer

M.I.T. time-sharing system through a standard Dataphone set, and the only information which is exchanged between the 7094 computer and the PDP-8 is standard English text. The PDP-8 acts as a small satellite processor in this case, taking the output from the 7094 and converting it into a form suitable for a blind programmer. This system allows blind people to enjoy the benefits of time-sharing, and it also allows the Brailler to make translations of text which is being entered from remote locations in the system.

Uses for the Braille Translation System

The computer based Braille translation system described above has a number of interesting applications. First, of course, is the ability to produce readable Braille without use of a skilled translator. Any skilled typist can generate documents in Braille through use of the PDP-8 and the Symbolic Tape Editor program. The error-free paper tape of the document can be given to the Braille translation program thus producing the completed document. Copies of this document can be made merely by running the paper tape through the translation program again.

The ability to convert to a time-shared computer system was mentioned above. Besides the normal benefits of time-sharing, there is one feature in the time-shared system which is especially suitable for use with the Brailler. This special feature is the ability to generate and annotate Braille manuscripts. Correcting and editing a Braille document can be very difficult, due to the fact that writing in the margins and squeezing in extra lines is not permitted. The manuscript editing programs eliminate

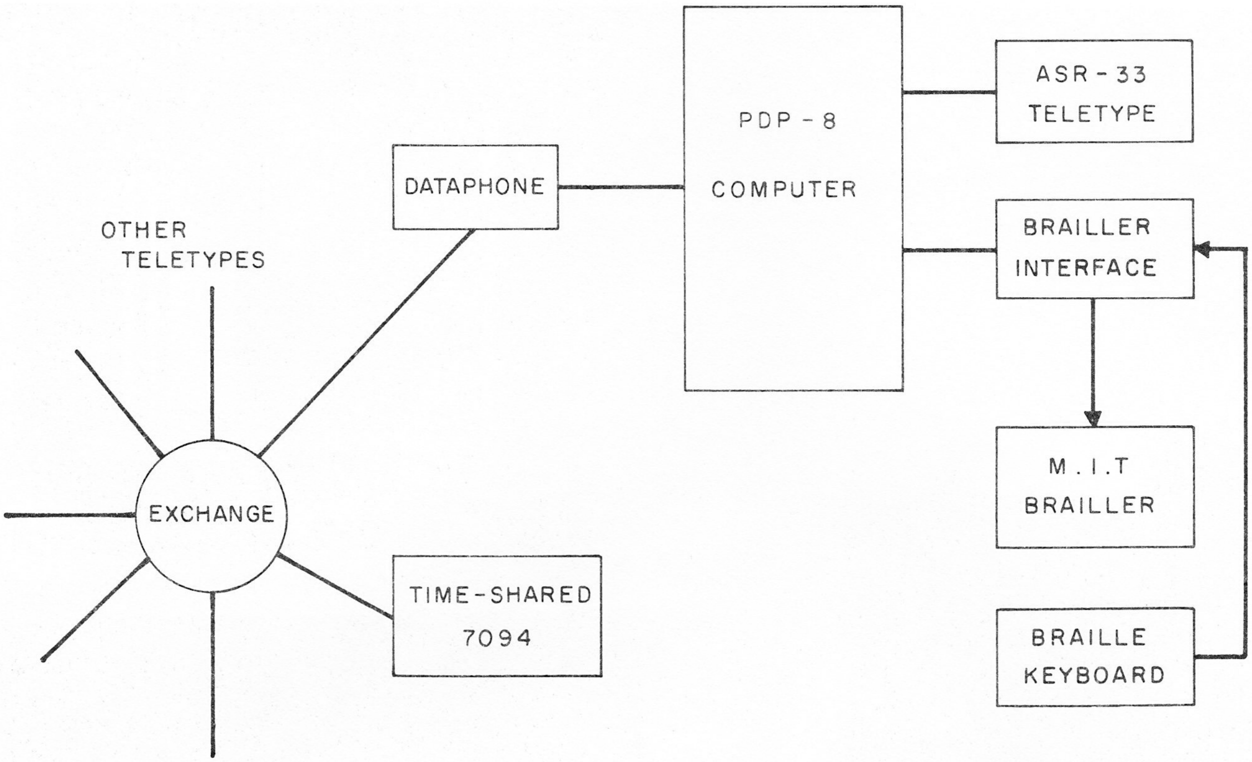

Figure 3 Block Diagram of Braille Translation System

these restrictions and provide all the conveniences of electronic editing.

With the increasing availability of documents in machine sensible form (on paper or magnetic tape) the work involved in preparing the manuscript for translation has been eliminated. At Project MAC the research group working on the new Multics time-sharing system has virtually all of its internal documents on paper tape, and this tape can be converted directly into Braille text. This greater availability of text will undoubtedly open new opportunities for blind people, especially in the computer field where machine sensible text is quite common.

Future Plans and Summary

The next addition to the Brailler system will be a special Braille keyboard. Although many blind people know how to type well, the task of writing in English and reading in Braille has been found to be rather annoying. To overcome this problem a special Braille keyboard has been designed and is about to be tested on the Brailler. This keyboard is similar to those used on standard Braille typewriters, and allows the user to emboss Braille without removing his fingers from the keys.

We look forward to increasing and improving our translation capabilities, and hope that in the near future we will have programs available to translate most common sources of text. We are interested in knowing about other Braille translation efforts, and are willing to attempt translation of documents for those who need them if these documents are available on tape or in some other suitable form.

Automatic Braille translation schemes, such as the one reported here, will probably become more widespread in the future as an aid to the handicapped. Today there are 415,000 legally blind people in the United States, and over 100 of these are already involved in the field of computers. The greater availability of documents will undoubtedly help these people lead more productive and satisfying lives.

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