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ABSTRACT

Described is a project which produced the book, In Darkness, to explore the use of DOTSYS III (a braille computer translation program) and to demonstrate the use of BRAILLEMBOSS (a braille page printer designed to emboss braille at similar or faster rates than teletypes) as a means of producing Grade II braille output. Explained are successive production stages, including the creation of an input data file, translation, brailling, and the use of the Howe Press paper-tape driven, automatic sterotype. Included is a log reflecting the timing of actual operations during the initial experimental use of the DOTSYS-BRAILLEMBOSS system. Direct output of the project is said to include a BRAILLEMBOSS produced copy of In Darkness; a set of sterotype plates for press embossing of In Darkness; and a significant amount of experience with DOTSYS III installed in a commercial time-shared computer system, the BRAILLEMBOSS, and the automatic sterotype. It is recommended that additional projects be planned to develop better instructions for input typists, to test input instructions, to provide general cost data under simulated operating conditions, and to test a rebuilt automatic sterotype which would use modern solid state logic similar to that used in the BRAILLEMBOSS. (GW)

Transcription of
In Darkness
via
DOTSYS III
and the
BRAILLEMBOSS

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INTRODUCTION - Braille Research and Development at MIT

A long term goal of the "blindness" community has been to make braille as accessible and timely as print. To assist in reaching this goal, MIT has since the early 60's been working on both computer translation of braille and braille output devices suitable for personal and production use.

One of the earliest results of this work was DOTSYS, a Grade II braille computer translation program. It was developed for the IBM 704-7094 series of computers and written in FAP (Fortran Assembly Program). The version used at MIT produced generally acceptable Grade II braille but did not contract lower signs. DOTSYS (DOTSYS I) is no longer used as the computer for which it was written is no longer available to the general MIT community.

The original DOTSYS program was the initial program at the American Printing House for the Blind where it has been improved and updated as well as rewritten for a somewhat newer computer. Thus the original DOTSYS was usable with a limited class of computers, now obsolete.

If DOTSYS is to fulfill its goal of making braille accessible and timely as print, it must be capable of being used on many computers, not restricted to those of a certain size or of a single manufacturer. For this reason DOTSYS II was written in COBOL (COmmon Business Oriented Language) to test a new algorithm for braille translation. While DOTSYS II did not produce tactile braille, it demonstrated that a high quality Grade II braille translator could be written in COBOL, which is available on many computers with sufficient core storage regardless of manufacturer,

be it IBM, Honeywell, Digital Equipment Corp., Burroughs, etc.

DOTSYS II was expanded and updated into DOTSYS III, the present Grade II translator available at MIT. The specifications of DOTSYS III were jointly developed by the Sensory Aids Evaluation and Development Center, the Braille Project of the Atlanta (Ga.) Board of Public Education and the MITRE Corporation. DOTSYS III exists in several forms, each varying primarily in details of output format and types of output device used. Machine readable copies of DOTSYS III have been furnished to approximately twelve organizations or individuals and the program is in routine use at several locations.

Another result of braille development at MIT is the BRAILLEMBOSS, a braille page printer, best visualized as a receive-only teletype (RO TTY) that produces braille instead of inkprint. The BRAILLEMBOSS characteristics are such that it can be connected to a computer directly or via communication lines. Thus it can be used as a braille producing output device, either locally or remotely.

The BRAILLEMBOSS was initially conceived as a braille computer output device to be used to produce Grade II braille. However, in the majority of installations to date it has been used as a tool providing the blind programmers with time-sharing computer access. As such it is being used in at least five companies, colleges or federal agencies as a computer terminal for a blind programmer, systems analyst, or mathematician in their routine day-to-day interaction with a computer. In these applications the BRAILLEMBOSS makes the blind fully competetive with sighted persons with respect to computer access.

As a computer terminal the BRAILLEMBOSS can also provide the blind

access to computer-based data banks, thus opening up a wide range of jobs in serving the public. Opportunities include hotel, motel, or transportation reservations, credit or account checking, inventory control, taxpayer or social security accounts or a host of other situations where computer based data must be used. The BRAILLEMBOSS presents factual information to the blind employee, just as the sighted receive the printed word or TV screen displays.

DOTSYS III, the BRAILLEMBOSS and In Darkness

One purpose of producing this book, In Darkness, has been to explore the use of DOTSYS III in the production of braille in an environment different from that of a braille press or agency devoted to production of braille for a limited clientele.

Another reason for producing In Darkness was to demonstrate the BRAILLEMBOSS as a means of producing Grade II braille output. This effort also demonstrated that the braille output can be produced remotely from the computer. With the BRAILLEMBOSS and a teletype used together as a remote time-sharing computer terminal, Grade II braille can be produced wherever a telephone is available.

INPUT DATA FILE CREATION

To use the computer to produce braille with DOTSYS III the first step is the creation of the input data file. This "file" represents the text material to be translated in a form that the computer can use. The "file"

must also contain instructions to the computer to enable paragraphing, tabulation, poetry format and other special formats to be used where necessary to produce good quality braille.

Two of the most common equipments for input file creation are the keypunch and the Model 33 or 35 teletype. These devices do not have the lower case alphabet in their character set. Therefore the input file must also contain capitalization information for DOTSYS III. The capitalization indicators are a single equals sign (=) for initial capitalization and two equal signs for solid capitals.

If an input device with upper and lower case character set is used, a pre-processing program can be written to further simplify the input data file preparation by eliminating the capitalization and paragraphing commands. Other control symbols are available and can be used as necessary. These include forcing a new line or a new page when not called for in the orderly progression of text. A Grade switch control character permits DOTSYS III to produce Grade I braille.

If the input material already exists in a computer readable form, the input data file can then be prepared by using an input pre-processor. The pre-processor program must be written to convert the format control symbols used in the existing input material to those required for DOTSYS III.

A teletype was used as the input device for In Darkness. The input data file was created and stored in the computer disk memory using a powerful editor system. The editor permits direct input, merging or appending text material already stored in the computer files. It also permits the operator to change a character or characters and insert or delete lines as desired.

In producing In Darkness the greatest part of the total terminal time

used was spent in creating the input file and then editing to remove typographical errors. The input terminal time, not including the time used for correction, was 2 1/2 times longer than that required to produce the braille on the BRAILLEMBOSS, following computer translation.

TRANSLATION AND BRAILLING

Translation follows the completion of an accurate input file. Within the IDC* time-sharing computer system used for In Darkness two optional ways of performing the translation exist. One way sends the output to the BRAILLEMBOSS immediately as it is translated. The other way stores the output in an output data file which is then read out on command to the BRAILLEMBOSS at a later time. This method permits multiple copies or local storage using punched paper tape or other media without multiple translation computer costs.

The computer operating system is designed to use "Executive" (EXEC) files to chain together the commands necessary to tell the computer what to do, when to do it and where to locate all the files and programs necessary to produce the braille. Two EXEC files were used. The first, when called, produces immediate braille; the second produces deferred braille. Each has a role in the production of braille by time-sharing computer. Immediate braille is useful when small quantities are involved or very rapid response is desired.

For several reasons deferred braille was used for the most part for In Darkness. First, the output data file can be braille proofread and edited to remove errors not discovered in the input file. Secondly, doing

*Interactive Data Corporation, 486 Totten Pond Road, Waltham, Mass. 02154

the translation off-line at night reduces the cost. In our case the actual computer time charge was reduced by one-half of the regular cost and there was no "connect time" charges since a terminal is not connected. The translation was also performed in less "clock" time since there was only one user of the system at that particular time. This also reduces the possibility of computer troubles ("crashes") ruining the translation.

The deferred braille also helps minimize difficulties due to telephone line or terminal troubles. For example, if there is no sufficient paper in the BRAILLEMBOSS (or a "broken pack" i.e. a discontinuous paper form) then the translation would have to be stopped at an immediate point. To restart, the precise point in the input file where the incomplete page started must be determined and the translation restated with the appropriate braille page number. With the deferred braille the embossing can be stopped and restarted after the problem is corrected. The restart point is rather easy to find since generally 26 computer lines are stored for each page (25 lines) of braille. The 26th line is the new page command.

A punched paper tape copy of the braille version of the book was required for use with the automatic sterotype (see below). A 2000 foot roll of tape is not long enough to contain the entire book so one has the "broken pack" problem. The deferred braille allowed the amount of readout to be controlled so that manageable lengths of punched tape could be produced.

The final translation took 746 seconds of computer time. The brailling of the 258 pages of text took approximately nine hours. A paper tape consisting of five segments was produced at the same time.

STEROTYPING

The Howe Press paper-tape driven, automatic sterotype was employed for the press braille version of In Darkness. This sterotype was made early in the days of computer braille, and has had minimal use in the automatic mode and little recent use in any mode. The unit has been moved recently and suffered some damage in shipment. In conjunction with Howe Press tool room personnel, the SAEDC staff readjusted and repaired the sterotype.

The sterotype uses relay logic. The relays are of open construction and can accumulate contact contaminants when not used. Some difficulties arose due to dirty switch, relay, and relay socket contacts. Even with maintenance not all of the problems were resolved. The sterotype has a "personality" but was usable with tender loving care. Several parts, including two cams, broke. Obtaining or making new parts added considerably to the total time involved in using the sterotype. When the sterotype was performing correctly it produced about 6 1/2 plates (13 pages) per hour. At this rate some 22 hours would be involved in preparing the plates for In Darkness. Under the actual operating conditions some 80 hours were consumed in plate preparation.

LOG

Jan. 5, 1972	Purchase order written.
Feb. 1	Started creating input file.
Feb. 8	Started section by section translation of input file.
Feb. 18	Started section by section proofreading of braille.
March 1	Completed input file to the input file.
March 1	Completed first translation.

March 23	Completed first proofreading.
March 24	Completed input file correction.
March 24	Final translation.
March 28 & 29	Read out of deliverable braille copy.
March 30	Started proofreading final copy.
April 6	Completed proofreading final copy.
April 7, 10	Edited and read out corrected pages.
April 12	Delivered text to Howe Press for binding.
May 22	Input for title pages and preface material.
May 23	Translated and read out title pages and preface material.
May 25	Delivered title pages and preface material.
June 19 thru Aug. 18	Prepared and corrected sterotype plates.

The above log reflects actual operations during the initial experimental use of the DOTSYS-BRAILLEMBOSS system and includes of course a learning experience. An organization dedicated to both single copy braille and sterotype plate production could operate in a considerably different fashion. A typical log for a committed organization might be as follows:

Day 1	Start creating input file.
2	Start section by section translation.
2	Start section by section proofreading.
5	Complete input to input file.
5	Start input file correction.
6	Complete first translation.
6	Complete first proofreading.
8	Complete input file correction.

10	Complete final translation.
11	Complete correction and embossing of corrected pages.
11	Deliver BRAILLEMBOSSed copy.
15	Complete sterotype plates.

This log is based upon first priority scheduling of people with appropriate skills. These skills are 1) computer input, 2) braille proofreading, and 3) computer output/BRAILLEMBOSS operation/sterotype operation. A possible time schedule divided into tasks is given in Appendix I.

Another example of producing braille using DOTSYS III and the BRAILLEMBOSS was done on the material of Appendix II, i.e. TDS #2, The BRAILLEMBOSS, A Braille Page Printer. It took 59 minutes to type in the material, to proofread it, and to correct the input file. It then took 21 minutes to translate and emboss it. The braille report is 6 1/2 pages and costs $30.66 for computer time.

PERSONNEL

The work was supervised by Vito A. Proscia and George F. Dalrymple. Evelyn Welch performed the input typing, visual proofreading, and input file correction. Mary Elliot of the National Braille Press did the braille proofreading of the BRAILLEMBOSS produced copies. The BRAILLEMBOSS operation was done by Norman L.J. Berube and George F. Dalrymple. Paper tape and computer output file editing as well as sterotype repair and operation were also done by George F. Dalrymple. Sterotype adjustment and repair were done by John Kovich, Robert Scott, and Frank Staples of the Howe Press. Bertha Kasetta of the Howe Press proofread the sterotype plates.

SUMMARY AND RECOMMENDATIONS

The direct output of this project is

1. A BRAILLEMBOSS-produced copy of In Darkness.
2. A set of sterotype plates for press embossing of In Darkness.
3. A significant amount of experience with DOTSYS III installed in a commercial time-shared computer system, the BRAILLEMBOSS, and the automatic sterotype.

We recommend that two or three more books be embossed in braille using this technique.

The next book effort would be used to develop better instructions, i.e. a "cook book," for the input typist. These instructions would include the Howe Press conventions for preface, about the author, author notes and the title pages. This book would also provide an opportunity to train another input typist.

The following book (and any additional ones) would serve to test the input instructions and to give general cost data under simulated operating conditions.

We further recommended that the paper tape operated automatic sterotype at Howe Press be rebuilt using modern solid state logic similar to that used in the BRAILLEMBOSS. This will eliminate the relay difficulties that arise from intermittent use and otherwise increase the sterotype reliability to more acceptable levels.

The experience gained by the regular staff of the SAEDC, supplemented by proofreaders, has demonstrated that the existing computer program, DOTSYS III, and the BRAILLEMBOSS can produce good quality computer translated braille.

The overall national production and timely availability of braille would be improved if regional computer braille production facilities were established to supplement the work presently being done by the American Printing House, the many volunteer agencies and the braille libraries. These regional facilities could be either new organizations or extensions of existing braille agencies.

We recommend that steps be taken to organize such regional facilities; the MIT SAEDC stands ready to help train staff, provide programs and equipment, and otherwise facilitate this expansion of the national braille resources.

APPENDIX I

Schedule for the Typical Log

Day	Type	Input Correct	Proof	Proof Read	BRAILLEMBOSS/ Sterotype Operation
1	6				
2	2		4	4	3
3	6				4
4	3		3	3	
5	3	1	2	2	2
6			6	6	1
7		6			
8		3			
9			6	6	6
10			6	6	4
11			3	3	6
12					6
13					6
14					6
15					6

Assumptions:

9 pages per hour text input.
1/2 hour braille out per hour of input.
3/4 hour proof per hour of input.
1/2 hour correction per hour of input.
6 production hours per day.

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BRAILLEMBOSS

A Braille Page Printer

The M.I.T. BRAILLEMBOSS[1] is a braille page printer designed to emboss braille at similar or faster rates than teletypes. The BRAILLEMBOSS accepts electrical braille-coded signals from a variety of sources and in turn produces braille pages. When operating continuously, it produces a page of braille every 1.6 to 2.0 minutes.

The BRAILLEMBOSS lines are 38 cells long. Each page has 28 lines with 25 lines for braille and 3 blank lines for the top and bottom margin. The paper used by the BRAILLEMBOSS is 100 pound-basis manila fan-folded sprocket-drive paper. When the sheets are separated and the sprocket drive strips are removed at the perforations, each sheet is a standard 11 x 11 1/2 inches.

The heart of the BRAILLEMBOSS is the embossing heads, each head contains 6 embossing pins in the braille cell configuration and an interposer pin beneath each embossing pin. These heads are fastened to a chain and so arranged such that one head is always supported under the platen, a steel female die containing 38 braille cells.

Each embossing pin is spring loaded upward. If an interposer pin is held in, then the corresponding embossing pin produces a dot when struck by the platen. If the interposer pin is out, the corresponding spring loaded embossing pin is merely forced down by the platen and no dot is made.

Each interposer pin is controlled by a selector bar. There are 6 selector bars, one for each dot, with 3 on each side of the head. Each selector bar is parallel to the head support track and is controlled by a solenoid (250 ma @ 40 volts). When a solenoid is energized, the corresponding interposer pin in the active head is held in.

The heads are positioned by both a support track and a tooth that engages the escapement rack. The tooth is held against the rack by a spring driven by a torque motor. This combination supplies a constant force to keep the tooth engaged.

The escapement rack is composed of two one-half pitch racks displaced by one pitch length. The rack shuttles back and forth at right angles to the head track and is driven by an eccentric. Each time the rack moves from one side to the other the head advances one cell. When the active head is in the last cell location, it closes an end-of-line switch used in the Carriage Return logic.

BRAILLEMBOSS , A Braille Page Printer (cont'd.)
page two

The platen is supported by two pivoted arms and driven by cranks at both ends of the cycle shaft. The rack is also driven by an eccentric geared at one-half speed to the cycle shaft. The cycle shaft is driven by a 1/20 horsepower motor through a cycle clutch. Each time the cycle clutch solenoid is pulsed, the cycle shaft makes one revolution. The platen goes through one cycle, from top to emboss position, and back to top, while the rack moves from one side to the other side each time the cycle shaft revolves.

The fan-fold sprocket-drive paper is supported by two paper tractors mounted close to the head track and platen but on the output side. The paper tractors are driven by a Ledex Digimotor. Each time the Digimotor is pulsed (5 amps @ 40 volts), it advances the paper on braille line. A page register is also a part of the paper drive and provides one switch closure per page to enable a new page command to be accurately executed.

The emboss sequence is as follows. The electronics determine from the signals that a braille cell is to be embossed. The cycle clutch is pulsed and the appropriate selector bars are energized. The embossing is performed as the platen reaches the bottom of it's excursion, the selector bars are released and the head is advanced as the platen reaches the half way point on it's upward travel. The space sequence is identical except that selector bars are not energized. When the active head is in the last (38th) cell, at the time the selector bars are released, an automatic line feed signal is generated. This provides an automatic carriage return at the end of the line. The paper is advanced and the next head becomes the active head in the first cell position.

The Carriage Return function is controlled by a flip-flop. When the Carriage Return flip-flop is set, a self-clocking series of cycle-clutch pulses are generated and the heads are stepped around. The automatic line feed signal when in the last cell resets the flip-flop and stops the heads such that the active head is in the first cell location. The Line Feed signal pulses the line feed Digimotor.

The End-of-Page function is also controlled by a flip-flop. When the End-of-Page flip-flop is set, a self clocking series of line feed pulses are generated to step the paper. When the paper is stepped to the first line position on a page, the page register switch resets the End-of-Page flip-flop.

The electrical signals for the BRAILLEMBOSS are derived from three principal sources, manual (including a keyboard), a paper tape reader[2], or a translator[3]. The manual modes are uses primarily for test or limited addition to braille from other sources. The translator allows other devices such as model 28 or 35 teletypes, an IBM 2741, a card reader or similar devices to supply the electrical signals. A three connector adaptor has been made to permit paper tapes in other codes than brailler codes to drive the embosser through the appropriate translator.

1) MIT BRAILLEMBOSS Specifications. SAEDC August 1969 with latest revision.
2) Friden Model SP-2 Paper Tape Reader.
3) ONE-CELL Translators, BRAILLEMBOSS Interface Units. SAEDC, TDS No. 8.

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BRAILLEMBOSS APPLICATIONS

The M.I.T. BRAILLEMBOSS[1,2,3] is an automatic braille printer operated by electrical signals derived from one of many possible sources. It can operate at speeds compatible with many computer terminals. The Model 3 BRAILLEMBOSS produces high quality braille of standard literary format. When operating continuously, it produces a page of braille every 1.6 to 2.0 minutes.

The most common BRAILLEMBOSS application to date has been as a time-sharing computer terminal. As such it has made several blind professionals more productive and has helped them work more nearly at their potential. For this use the BRAILLEMBOSS is connected in parallel with the page printer of an existing computer terminal. This arrangement permits the terminal to be used by either the blind user or his sighted colleagues.[4] It also reduces the complexity of the BRAILLEMBOSS by not requiring an internal keyboard or data modems. The BRAILLEMBOSS can be used with any computer that uses 110 Baud ASCII console typewriter or terminals.

The BRAILLEMBOSS has been demonstrated as an output device for a computer data base system, the Internal Revenue Service (IRS) Integrated Data Retrieval System (IDRS). As such it provides a blind Taxpayer Service Representative (TSR) with access to the complete IDRS data base. Most of the TSR interaction with the taxpayer is done over the telephone. In most cases the blind TSR functions as well as his sighted co-workers and the taxpayer has no knowledge that he is dealing with a blind TSR. This demonstration has shown that the BRAILLEMBOSS, operated as a computer terminal permits the blind to fill a variety of public service jobs requiring interaction with a computer data base. These jobs include reservations of all types, i.e. airlines, rental autos, hotels, motels, etc; credit and account information; and inventory control.

The initial use of an earlier version of the BRAILLEMBOSS was the production of single copy (or a few copies) of computer translated Grade II literary braille. In this application, a typist unfamiliar with braille can produce Grade II braille merely by typing plain English text, including a few easily learned format control characters, into the computer. Such a system has been demonstrated at Perkins School for the Blind in Watertown, Massachusetts by William Greiner.[5] This system consisted of the BRAILLEMBOSS, Model 35 TELETYPE, braille translation program DOTSYS,[6] and an IBM 7094 timesharing computer at MIT known as CTSS. Applications for this mode of operation include public schools with blind students and agencies producing a limited number of braille copies. In both cases the computer translated braille increases the number of people capable of preparing braille to include those who are not expert Braillists.

A new and more versatile Grade II computer translation program, DOTSYS III[7] has been written. DOTSYS III is written in COMOL and as such can be made available on a large number of computers including but not limited to time-sharing systems. DOTSYS III and the BRAILLEMBOSS has been used to produce a braille book, In Darkness, for the Library of Congress.[8]

Another application of the BRAILLEMBOSS is the short run production of braille materials using punched paper tape as the storage medium. The BRAILLEMBOSS has provision for a paper tape reader, Friden SP-2, as an input device. The punched paper tape for demonstrations has been prepared by several means. One demonstration project used tape punched on a modified Perkins Brailler by an expert Braillist.[9]

BRAILLEMBOSS APPLICATIONS (con't.)

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Another method of preparing paper tape is by typing on a special TELETYPE converted by Mr Ray Morrison. Grade I braille tapes can be prepared by any typist, but an expert Braillist must be used to produce Grade II braille tapes. Still another method of generating tapes is by computer.[10] Each of these methods has been used and has been proven useful for particular applications.

Twenty (20) BRAILLEMBOSS units have been produced at the Center with the support of the John A. Hartford Foundation. Earlier developmental work was supported and continuing demonstrations are supported by the Social Rehabilitation Administration of the Department of Health, Education, and Welfare.

References:

1. Final Report to John A. Hartford Foundation, "Development of a High-speed Brailler System for more Rapid and Extensive Production of Informational Material for the Blind," SAEDC, September 29, 1970.

2. M.I.T. BRAILLEMBOSS Specifications. SAEDC, August 1969 (with later revisions as applicable).

3. BRAILLEMBOSS, A Braille Page Printer. SAEDC, TDS No. 2.

4. Lichstein, M.L., Braille Computer Output. (M.I.T.-SAEDC). August 1969.

5. Greiner, W.E., "Development of a Braille System for Classroom Use." (S.M. Thesis, M.E. Department, M.I.T.). February 1968.

6. DOTSYS, A Braille Translation Program. SAEDC, TDS No. 3.

7. Interactive Braille. SAEDC, TDS No. 11.

8. "Transcription of In Darkness via DOTSYS III and the BRAILLEMBOSS," SAEDC, November 7, 1972.

9. The American Revolution, A Short Run Braille Pamphlet Demonstration. SAEDC, TDS No. 7.

10. Conversion Table, Inches to Millimeters: A Braille Computer Generated Mathematical Table. SAEDC, TDS No. 10.

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GFD:ss

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INTERACTIVE BRAILLE
Remote computer translated Grade 2 Braille

A person with typing skills but with a minimum knowledge of Braille can produce a high quality Grade 2 Braille with ease and dispatch, using the Interactive Braille System. The necessary components of the system are:

(1) A time-sharing computer with DOTSYS3 stored in it.
(2) A teletype or other time-sharing computer terminal.
(3) A BRAILLEMBOSS attached to the teletype.

It is not necessary for the computer to be located at the same place as the terminal and BRAILLEMBOSS.

The BRAILLEMBOSS is a Braille page printer[1,2] used to produce the output. DOTSYS3 is a version of DOTSYS III modified to use the BRAILLEMBOSS[3] as output unit.

The material to be brailled is typed into the computer and stored in a data file. The material is typed in almost as it is written in normal inkprint. The teletype has only upper case so a control character is required to tell DOTSYS3 when to capitalize. A single equal sign (=) is typed preceding each word to be initial capitalized, two equal signs before each word to indicate that the word is solid capitals. Most punctuation is typed in directly.

Additional format control characters are required to tell the program when to start paragraphs, when the typist demands a new line to start not in the regular progression of text. Other format control symbols are used to indicate headings and titles. The most used symbols and format controls are listed on a single sheet (see over).

Some training is necessary for the typist to learn to create and manipulate the data files in the computer. This training can be accomplished in a few hours using manuals prepared by the time-sharing computer people.

After the input file is created, proofread and corrected if necessary, the computer is told by a single typed in command to produce the Braille. The computer translates the material and will either store the Braille to produce multiple copies or the computer can immediately output the Braille to produce only one copy.

This is essentially the system used at the National Braille Press and demonstrated there on January 31, 1972.

This Interactive Braille System is designed to be used in places where skilled Braille transcribers are not available, such as in a public school system with a few blind students enrolled. It can also be used in an agency environment to supplement the existing skilled transcribers or to free them from the relatively simple literary Grade 2 Braille to more specialized Braille which is more demanding of their skills.

1. BRAILLEMBOSS, A Braille Page Printer, SAEDC TDS #2, August 4, 1970
2. Final Report to John A. Hartford Foundation, "Development of a High-speed Brailler System for more Rapid and Extensive Production of Informational Material for the Blind," SAEDC, September 29, 1970.
3. Gerhart, Millen, and Sullivan, "DOTSYS III, A Portable Program for Grade II Braille Translation," MITRE MTR 2119, May 14, 1971.

BRAILLE CONTROL AND FORMAT CODES DOTSYS III on IDC 360/67 WITH TELETYPE AND BRAILLEMBOSS TERMINAL (029 KEYPUNCH)

Capitalization

= for initial capital of following word
== for all capitals of following word

Italics (Shift 0 TTY)

underscore (_) before each word for one, two or three words
two underscores before four or more word italics, and
one underscore before last word

Ordering Italics, Capitals, Accent, Delineator

Force possible illegal contraction

/_ before and _/ after letters

Prevent contraction

$/ within the letters to be contracted

Quotes

" may be used for both left and tight if no quotes within a quote is used
$" for left double quote within a quote
$"R for right double quote within a quote
$' for inner opening quote
$'R for inner closing quote

Accent Mark

](Shift M) TTY (12, 11, 0, 5, 8, Keypunch)*

Brackets

<for a left bracket [
>for a right bracket]

Short Syllable Sign	$SV
Long Syllable Sign	$LV
End of Poetry Foot Sign	$FT
Caesura Sign	$CS

* To obtain accent control symbol on keypunch hold down Mult Punch key and strike &, -, 0, 5, and 8 keys before releasing. The Mult Punch key automatically keypunch to numbers mode. Do not release the Mult Punch key until all are struck.

Null Symbols	$/ Null replacement symbol generally used to prevent contraction
Forced Blanks	$B
Termination Symbol	$T
Paragraph	$P
New Line	$L
Skip Multiple Line	$Slnnb (2 digits + blank) skip nn
New Page	$PG
Tabs	one tab $TAnnb (start at position nn) multiple $STABmLnn (set tab m at position nn) L for left justification, R for right justification D for decimal justification $#m before each item to be tabulated
Titles	$TLS before and $TLE after each title produces centered title on each numbered page
Heading	$HDS before and $HDE after for centered one line headings
Poetry	$PTYS before and $PTYE after all poetry text
Octal Braille	$OCTaabbccdd for 4 codes Allows individual braille cells to be inputed arrangement dot 1 = 10, dot 2 = 20, dot 3 = 40 dot 4 = 1, dot 5 = 2, dot 6 = 4
Computer Braille	$CPBxxxx will print 4 codes each represented by graphic x in the computer braille code (ASCII to one-cell)
Letter Sign	+
Self Checking	The symbol $SCON$/$/$/$/$/ is used to turn self-checking on and $SCOFF is used to turn self-checking off. Delineator is ^ (circumflex, ShiftN) on TTY, or | (vertical bar) on keypunch.