

RAISED DOT COMPUTING

Apple II Software for the Blind

**Exhibiting at the Display of
Advanced Technology to Aid the Disabled
Dirkson Senate Office Building
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Raised Dot Computing
310 S. 7th Street
Lewisburg, PA 17837
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RAISED DOT COMPUTING

Raised Dot Computing is in business to serve the needs of blind professionals and to serve the needs of those working with the blind. Raised Dot Computing feels that these needs are best addressed through the knitting together of useful, existing equipment using clever software. Its most widely distributed program is called BRAILLE-EDIT. It can handle text in print, voice, and braille. The development of BRAILLE-EDIT was spurred by the development of the VersaBraille paperless braille by Telesensory Systems, Inc. The VersaBraille allows the user to read, write, or edit electronic braille. It can also be used as a braille computer terminal.

However, when the capabilities of the VersaBraille are combined with the power of the Apple II computer, the result is a very powerful braille word processing system. The program allows a sighted person to enter text on the Apple, translate it into grade two, and transfer the material to the VersaBraille. The program allows a blind person to write on grade two on the VersaBraille, transfer the material to the Apple, translate the grade two into regular print, and then get a well-formatted printout. The program also allows reformatting of text in ways which cannot be done on a VersaBraille. The program also allows a blind person to edit text with the aid of a low-cost voice synthesizer. In a sense the name BRAILLE-EDIT has become a misnomer. Raised Dot Computing also distributes programs to translate from the braille mathematics code into print mathematical equations, a program to train sighted persons in grade two braille, and a program to allow a blind person to write programs with the aid of a Vectra synthesizer.

As these programs have become disseminated, it has become clear that there is a great need not only for quality programs but for information. If a blind professional wants to learn about the Apple computer, what it can do and how to get started on it, there are few sources of information to turn to. Actually, there is a knowledge gap for sighted persons as well. However, a sighted person can just turn on a computer and start poking on the keyboard. A blind person needs special output devices and needs special programs to get those devices working the moment the computer is turned on. The process of getting started can be very frustrating. Raised Dot Computing is trying to deal with this knowledge gap. It supplies Apple computer manuals on VersaBraille tapes (the tapes were prepared using BRAILLE-EDIT). It supplies manuals for its programs in print and on VersaBraille tape. It is coming out with a new set of documentation on disks. Once the computer is turned on, information about the

Apple, the VersaBraille, voice output devices, programming, computer concepts, and BRAILLE-EDIT comes out in the user's choice of screen, print, voice, VersaBraille or paper braille. This system addresses the information needs of blind persons relying just on voice output devices.

EQUIPMENT

The Apple II computer was chosen because of the ease of attaching other devices (such as the VersaBraille, a printer, or voice output equipment) to the Apple, because of the capabilities of the Apple, and because of the amount of software written for the Apple. The Apple has been the computer of choice for communication aids for the disabled. It has also become the computer of choice for the blind. There are other companies and individuals writing text editing and terminal programs for the blind using the Apple.

An Apple II computer, two disk drives, a TV monitor, a printer, and voice output equipment (Votrax Type-'N-Talk or Echo II) costs between \$3,000 and \$3,500. Of course, the exact price depends on your exact choice of equipment and the deal you make with your Apple dealer. Adding a VersaBraille adds over \$7,000 to the cost of the system. If you want a commercial braille printer, it will cost around \$15,000 (there are alternatives to commercial devices, contact Raised Dot Computing for details). Raised Dot Computing will offer advice to anyone writing or calling concerning the purchase of an Apple computer and associated equipment.

DESCRIPTION OF PROGRAMS

BRAILLE-EDIT is a set of programs for the Apple II computer designed to work with the VersaBraille paperless brailier. The programs are very flexible, and have a variety of uses and capabilities. Text can be translated into grade two on the Apple and then transferred to the VersaBraille. Text can be transferred from the VersaBraille to the Apple, translated back from grade two, and then printed out. The translation programs are fast (around 60 characters translated a second), and are fairly accurate. Text can be manipulated in ways that cannot be done on a VersaBraille (global replace, rearrange pages or page boundaries, merge chapters, copy chapters, shift text, etc.). The programs are designed to work with the Votrax Type-'N-Talk or the Echo II voice synthesizer. Program output (the dialogue with the computer) comes in the user's choice of screen, print, voice, or braille. During data entry, text can be displayed on the screen in a braille character set, and the Apple keyboard can be used as a standard 6-key braille keyboard so the Apple acts like an electronic brailierwriter for sighted transcribers. The program can automatically place print page markers at the beginning of each VersaBraille page, as recommended by published guidelines for transcribing books onto a VersaBraille. BRAILLE-EDIT is useful in situations where blind and sighted persons need to communicate through written work. The programs come with a print and a VersaBraille tape copy of the manual. The manuals are also available separately.

Documentation on the whole system (hardware, software and computer concepts) is available on a special set of disks. The documentation comes out in the user's choice of screen, print, voice, VersaBraille or paper braille. In addition, VersaBraille copies of Apple computer manuals are available. I have copies of The Applesoft Tutorial, The Applesoft BASIC Reference Manual, and The DOS Manual.

The 80-column mathematics program is an option to ERVILLE-EDIT. It allows the user to write text and mathematical equations on the VersaBraille and have the material printed up on a special dot-matrix printer. The program "understands" the Nemeth code for writing braille mathematics and can also translate grade two text. Once the chapter is transferred from the VersaBraille to the Apple, the Apple translates the chapter and directs the printer where to put dots on the paper to write up the material. The result is a good printed copy of the text and equations. It is used by a blind mathematics professor to prepare class handouts in calculus. The program can handle virtually all of the Nemeth code.

The Electronic Blackboard program also handles text and equations. It takes its input directly from the Apple keyboard acting like a braillewriter. The material is instantly translated onto the screen. It is intended to help blind persons present text and equations to a sighted audience. The program can store many "screens" of information and can print on a special dot matrix printer.

The Braille Training program teaches and drills sighted persons in grade two braille. Rules and contractions are displayed on the TV screen. At appropriate times, the user is presented with sample text to enter in braille. The Apple keyboard acts like a braillewriter and displays the entered braille cells on the monitor. When the drill has been entered, the computer compares the entered braille with the correct versions, and shows any discrepancies in reverse video. Usually when braille transcribers are trained, it takes a long time to correct drills, so this program shows real promise in improving transcriber training.

The Full Voice program causes the Votrax to pronounce punctuation and control characters. This means that a blind student can learn programming skills with an Apple and a Votrax. Without special software, program listings are incomprehensible through the Votrax voice output system.

CONNECTING A VERSABRAILLE PAPERLES BRAILLER
TO AN APPLE II COMPUTER

by David Holladay

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Abstract

The Apple II small computer connected to a VersaBraille paperless brailier and driven with appropriate software has proven to be an extremely powerful text editing tool for the blind. A program called BRAILLE-EDIT which combines editing in print, voice and in braille will be described. The system includes a translator from regular text into grade two braille and a translator from grade two braille into regular text. A translator for the Nemeth braille mathematics code will also be discussed. In order to widely disseminate this software, documentation has been generated which is accessible in the user's choice of print, voice, or braille.

The VersaBraille

Readers are probably familiar with the Apple II computer, but not with the VersaBraille. The VersaBraille is a portable braille word-processor and computer terminal made by Telesensory Systems Inc. It contains a small braille keyboard, a twenty character braille display, a cassette storage system, and a flexible serial connection. The braille keyboard consists of six keys and a space bar. The user presses a simultaneous combination of the keys to indicate a braille character. The display consists of 120 electronically controlled metal pins which are arranged to form twenty braille characters. Because moving metal pins simulate embossed paper dots, devices like the VersaBraille are called paperless brailiers. The cassette system holds 200,000 characters on each side of a digitally-encoded audio cassette. Text is divided into "pages" of 1,000 characters each, with 200 pages to a side. These pages are grouped into chapters. Any text within a page can easily be edited (character or word changed, inserted or deleted, etc.). The importance of being able to edit braille cannot be overstated. Conventional paper braille can be edited by repairing single characters, crossing out large sections, or starting over.

The VersaBraille has an advanced input/output system. There is an internal editor to alter seventeen different parameters affecting input and output (baud rate, stop bits, duplex, braille translator mode, how control characters are handled, handshake, etc.). In addition, special chapters called overlays on a cassette can hold program segments for the VersaBraille to add new features. These overlays can be stored with the user's custom parameters.

The VersaBraille by itself is an extraordinary machine. It has a large number of editing and interface modes. It has found a wide variety of applications in the home, office, and school. The existence of the VersaBraille has created new demands for tools which bridge the worlds of electronic text for blind and sighted persons.

BRAILLE-EDIT

BRAILLE-EDIT is an enhanced text editing program for the Apple II computer. It is designed to work with the video screen, voice output synthesizers, inkprint printers, braille printers, and the VersaBraille paperless brailier. When you use BRAILLE-EDIT, you give it a "configuration". This is a short name which tells the program how you want the input and output. If you enter SCREEN, the computer will send output to the video screen. If you enter VOICE, all program output will go to a voice synthesizer. If you enter VB (or another abbreviation), then the input and output will go through the VersaBraille. This means that the same program disk can be used by both blind and sighted persons.

One of the basic functions of BRAILLE-EDIT is to transfer chapters (files) between the Apple and the VersaBraille. There are two grade two braille translators built into BRAILLE-EDIT. Grade two is an abbreviated form of writing in braille. For example, the word receive is written rcv, a k by itself means knowledge, and there are special characters for and, with, of and for. One translator takes regular text (from key entry or from a textfile) and generates grade two braille. The grade two chapter can then be printed on a braille printer or transferred to the VersaBraille. Grade two material can also be transferred from the VersaBraille to the Apple. On the

Apple the reverse grade two translator takes the file and turns it into regular text for editing, printing, or transfer to another text processing program on the Apple computer. Several users of BRAILLE-EDIT are blind professionals who have to co-author documents with sighted coworkers. They use BRAILLE-EDIT to move from grade two on the VersaBraille to regular text and to another word processor, and back and forth until the document is completed. Another major use of BRAILLE-EDIT is to rearrange material in ways that cannot be done on a VersaBraille (rearrange pages and page boundaries).

BRAILLE-EDIT will handle all ASCII characters, including upper and lower case, all control characters, and all punctuation. All ASCII characters can be displayed on the screen, or voiced, or sent to the VersaBraille. Since BRAILLE-EDIT is character-oriented (rather than line-oriented), it is easy to edit special characters.

It should be noted that the title BRAILLE-EDIT has become a misnomer. It can be used by a sighted person as a text editor. It can be used by a blind person using a low-cost voice synthesizer attached to his/her Apple computer. In fact, the range of persons who can and do use BRAILLE-EDIT makes the preparation of documentation a real challenge. For a long time, I prepared documentation and background material in print and on VersaBraille tape. However, this did not meet the needs of blind users without access to a VersaBraille. I have recently put all my documentation on diskette. Material is accessed by means of a menu and submenus (and occasional sub-sub-menus). The text either can come out to the screen, voice output, inkprint printer, VersaBraille, or braille printer. When a braille device is specified, the text is automatically translated into grade two. Since many of my customers are computer naive, I supply extensive background material. Much useful information about an Apple/VersaBraille/voice output system would otherwise be buried in a pile of highly technical manuals.

I have made arrangements with Apple Computer Inc. to distribute Apple computer manuals on VersaBraille cassettes. Apple has graciously agreed to provide me with the text of their manuals in disk form. I use my program to read in the text and to process it (insert paragraph markers, insert print page indicators, clean up format, etc.), and then translate it into grade two. Then I transfer the grade two files to a VersaBraille cassette. One feature of BRAILLE-EDIT allows me to indicate the start of each print page in the source text in such a way that the

transfer program will put a print page indicator at the start of each VersaBraille page. These print page indicators are the in the same format as recommended by CTEVH in their publication "Guidelines for Transcribing Literary and Music Braille on Paperless Braille Devices". As part of the agreement that I made with Apple, I am selling the tapes at the same price as the print manuals. So far, I have processed three manuals (The Applesoft Tutorial, The Applesoft BASIC Reference Manual, and The DOS Manual).

Equipment for the System

The only required hardware to run BRAILLE-EDIT are an Apple II computer with two disk drives. If voice output is desired, the program runs with the Votrax Type-'N-Talk or the Echo II made by Street Electronics Corporation. If a VersaBraille is used, it should be used with a California Computer Systems asynchronous serial card. The program works with a wide variety of printers. I use the Paper Tiger 460G because of its plotting and proportional spacing capabilities.

Mathematical Typography

Since my wife is a blind mathematics professor at Bucknell University, I have written several programs to meet her needs (and other blind mathematicians). I have written a program which takes a VersaBraille chapter written in the Nemeth mathematics braille code and in grade two braille. The program translates the braille code into print equations which are printed with a dot-matrix printer. The Nemeth code is the standard coding system for mathematical equations (and for physics, chemistry, and some computer science). I had to make some adjustments to the Nemeth code which would be accepted by the program (mostly to eliminate ambiguity). The program handles fractions, complex fractions, hypercomplex fractions, sixteen levels of radicals, Greek letters, German letter, script letters, bold face letters, and a wide variety of special mathematical symbols. Caryn Navy writes out material for her classes in Nemeth code on her VersaBraille. When the material is finished, she cables the VersaBraille to the Apple and gives both devices simple commands. The Apple siphons off a file from the VersaBraille, translates it, and then runs the graphics printer. The printout is then reproduced to make enough copies for all of professor Navy's students. While the methods for handling tabular material and the vertical spacing of fractions could be improved, the system can rapidly spit out handouts in undergraduate mathematics. This year the system will be used by two blind mathematicians to produce research work in topology and group theory.

A variation of the math option to BRAILLE-EDIT is called THE ELECTRONIC BLACKBOARD. It can handle grade two braille and Nemeth braille directly from the Apple keyboard. With the right assembly language program, the Apple keyboard can act just like a Perkins braillewritte keyboard without hardware modification. THE ELECTRONIC BLACKBOARD program was written so a blind teacher could quickly communicate written material with his/her class (using large video monitors). This program has the potential of being adapted (redoing the keyboard entry section) so that severely physically handicapped individuals can manipulate and print mathematical equations. I would also like to write a program that would produce sheet music from music braille for blind composers.

Reference

1. Nemeth, Abraham, et. al., The Nemeth Braille Code for Mathematics and Science Notation 1972 Revision, American Printing House for the Blind, 1980

Other Programs

I have written a program called FULL VOICE which allows a blind person to write programs on the Apple just with the aid of a Votrax Type-'N-Talk. Usually, the Votrax will not pronounce punctuation or control characters. FULL VOICE substitutes characters in the output stream to make this possible.

Another program trains sighted persons in grade two braille. This program uses a combination of high resolution graphics and Perkins style keyboard to make an effective teaching and drilling tool. It has great potential in helping to increase the pool of trained braille transcribers.

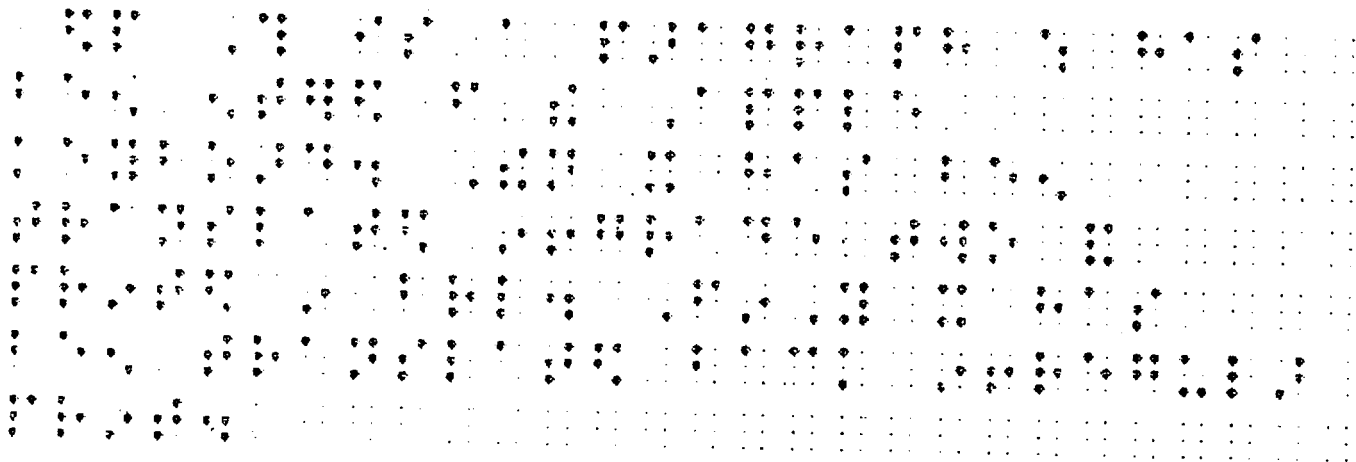
Another project will make low-cost computer driven paper braille printers available.

Conclusion

Raised Dot Computing is committed to providing quality software to blind individuals and to those working with the blind. To connect a VersaBraille to an Apple is easy. All you need is a serial card and a simple cable adapter. But to make the combination something larger than the individual parts requires good software, extensive documentation available in a variety of media, and a willingness to listen carefully to individual needs. My role is to meet these needs, not just to document needs. I welcome all inquiries on any of my projects. I can be reached at (717) 523-6739.

SOFTWARE EXAMPLES

This is a paragraph which has been entered from the Apple keyboard. Then it has been translated into grade two and printed in braille. Finally it has been translated back into regular print.



This is a paragraph which has been entered from the Apple keyboard. Then it has been translated into grade two and printed in braille. Finally it has been translated back into regular print.

MATHEMATICS TRANSLATOR EXAMPLE

Math 202, Prof. C. Navy.

Surface Area (supplement to Section 11.3).

First, a bit more on arclength. The proofs of the arclength formulas depend on

the mean value theorem, as discussed in class. Therefore the formula $L = \int_a^b$

$\sqrt{1+[f'(x)]^2} dx$ requires that $f'(x)$ be continuous on (a, b) . Similarly, the

formula $L = \int_a^b \sqrt{[x'(t)]^2 + [y'(t)]^2} dt$ requires that both $x'(t)$ and $y'(t)$ be

continuous on (a, b) .

Formulas for Surface Area. These require the same continuity assumptions as the arclength formulas.

(1) Revolving the curve $y = f(x)$, $x \in [a, b]$ about the x -axis gives surface area

$$S = \int_a^b 2\pi f(x) \sqrt{1+[f'(x)]^2} dx.$$

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PRICE LIST

These prices are current until Jan. 1, 1983.

BRaille-EDIT (plus manuals) --- \$250

Print BRaille-EDIT manual -- \$5

VersaBraille tape BRaille-EDIT manual --- \$10

Apple Manuals --- \$10 each

Documentation disks --- \$15 (or three blank disks)

Cable adapter required to connect the VersaBraille to the CCS Serial Card --- \$30

Electronic Blackboard program --- \$20

80-column mathematics program --- \$200 (when purchased with BRaille-EDIT)

Braille Training program --- \$200

Full Voice --- \$25 for an individual, \$50 for an institution

EQUIPMENT NEEDED FOR THESE PROGRAMS

The Electronic Blackboard program and the Braille Training program require an Apple two plus with 48k of memory, one disk drive, a TV monitor and an optional graphics printer.

BRaille-EDIT requires the Apple computer, two disk drives, and a TV monitor. A VersaBraille connected with a California Computer Systems 7710D Asynchronous Serial Card and a small male-to-male cable adapter are optional. Voice output equipment is optional. This could be an Echo II (with a 16k RAM card and TEXTALKER Version 1.2) or a Votrax (which requires another serial card plus a different male-to-male adapter cable). The Documentation Disks can work on any BRaille-EDIT system.

The 80-column mathematics program requires the use of the equipment needed for BRaille-EDIT plus a Paper Tiger 460G printer driven through a parallel card.

The Full Voice program is intended for a system with a disk drive and a Votrax voice synthesizer.

Except for what is listed in my price list, I am not selling any equipment. I will gladly answer inquires to assist users setting up their systems.

GETTING MORE INFORMATION FROM
RAISED DOT COMPUTING

Raised Dot Computing has prepared many documents that deal with the use of the Apple II computer by the blind. These materials are available in print or on VersaBraille cassette (if you want the cassette, send a blank cassette or \$5).

Name _____

Address _____

Telephone _____

Occupation _____

I WOULD LIKE INFORMATION ABOUT:

- _____ Using the Apple with the VersaBraille
- _____ Using the Apple with voice output
- _____ Using the Apple with low-cost paper braille output
- _____ Use of BRAILLE-EDIT by blind professionals
- _____ Use of BRAILLE-EDIT by schools
- _____ Apple manuals on VersaBraille cassettes
- _____ Documentation on disk computing in print, voice, or braille
- _____ Using the Apple to train braille transcribers
- _____ Printing mathematical equations from the Nemeth code
- _____ Printing music scores from the braille music code
- _____ Getting Raised Dot Computing to do a custom programming job

The more information that you supply about your situation (what equipment do you have, what are your needs, what are you trying to do) the easier it will be to frame a reply.

Mail this or a copy to: David Holladay
Raised Dot Computing
310 S. 7th Street
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or call: (717) 523-6739



David Holladay
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Lewisburg, PA 17837

BRaille-EDIT is a sophisticated word processing program, allowing the user to write, edit, correct, and print out well-formatted letters, reports, and papers. BRaille-EDIT simplifies the preparation of all printed matter for every user, sighted or blind. Underlining, centering, page numbering, tabular matter, and page design are accomplished with a minimum of effort. Text can be prepared, edited, and formatted entirely in grade two braille and then processed through BRaille-EDIT's grade two back-translator. BRaille-EDIT self-adjusts for the changes in word and line length resulting from the expansion of braille contractions. Blind users can check the format of printed matter prepared by sighted co-workers.

BRaille-EDIT contains a powerful "Global Replace" feature. This allows the user to transform text easily. The user writes a short recipe for the desired changes, and the computer does the rest. The user can write a recipe to quickly search for and fix their most common spelling or braille translation errors, or to insert a long legalese phrase at every appearance of a simple code. Designed with the needs of the blind user in mind, BRaille-EDIT gives complete control over the appearance of the printed page to anyone with a computer.

BRaille-EDIT

A powerful translation and inter-communication tool

BRaille-EDIT contains two powerful translators that bring independence to the blind user. BRaille-EDIT translates from print into grade two (contracted) braille. Sighted people can share information without learning any of the braille transcribing rules. Blind people can get braille translations of any information available to their computer. (See chart below for all the possibilities) BRaille-EDIT also back-translates from grade two braille into print. Blind students and workers can prepare, edit, and proofread their work in braille and then confidently print it out for any sighted person to read. **NOTE:** The braille translations prepared by BRaille-EDIT are quite good. They are not, however, perfect. More accurate braille can be obtained on computer systems substantially more expensive than the Apple II. Any words which cause particular problems can be easily corrected with the "Global Replace" feature. Most users report that they make far more typographical errors than the program makes braille transcription errors. If you are concerned about the braille accuracy, send in up to half a page of sample text. A printed braille copy will be returned for you to judge the translator directly.

INPUT OPTIONS

- BRaille
- VersaBraille
- Microbrailer*
- Cramer Brailer
- Apple keyboard in Braille mode

OUTPUT OPTIONS

- PAPER BRaille PRINTERS
- Cramer Brailer
- RESUS RS14
- Thiel
- LED-120
- LED-15
- Sagen
- MIT Brailleboss
- Diablo/Qume Printer with Dipner Dots!
- IBM Braille typewriter with ETF-80 controller**
- DOTMAN

ELECTRONIC/PAPERLESS BRaille DEVICES

- VersaBraille
- Microbrailer**
- PRINTED "Fax" BRaille
- Braille dots on monitor screen?
- Diablo printer?

NOTES:

- * not fully supported
- ** critical mechanical tolerances involved—may not work on every IBM unit
- 1—Use of a letter quality printer as a braille printer
- 2—sighted transcriber can proofread braille before committing to paper
- 3—can be read by Opaton
- 4—examples: Applewriter, DOCUMENTS, Superscribe II, etc.
- 5—examples: IBM-PC, mainframe computer systems, typesetting compositor files

AVAILABLE FROM
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GRADE II ↔ PRINT
 TRANSLATOR

Braille Oriented Text Files

BRaille-EDIT



SOFTWARE

Print Oriented Text Files

This chart shows the wide variety of input and output devices that BRaille-EDIT software supports. Some are sophisticated, expensive, and off-the-shelf. Others are sophisticated, inexpensive, and do-it-yourself. We can advise you about matching equipment to your needs.

INPUT OPTIONS

- PRINT
- Apple Keyboard
- Kurzweil Reading Machine
- Word Processing Text Files*
- Output from any RS-232 port formatted for printing

OUTPUT OPTIONS

- PRINT
- Monitor screen
- Dot matrix/letter quality printer
- Text files on diskette for other word processing systems
- Text files formatted for input to typesetting front-end systems
- VOICE
- Echo II
- Echo GP
- Cybertalker
- Intex
- Kurzweil SOS
- TSI PROSE 2000
- any serial text-to-speech device like the Votrax Type 'n' Talk

TRADEMARK INFORMATION

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BRAILLE-EDIT is a very powerful and flexible tool. No one person could use all of its capabilities. Over 100 people are now using **BRAILLE-EDIT**, with various equipment, for many different applications:

A writer/researcher/analyst for a large corporation in California shares the writing of reports with a group of people. Previously, he would dictate a rough draft for comment by his co-workers, but could not share in the revision of the next four rough drafts without tying up clerical time.

Now he writes his reports in grade two braille on a VersaBraille, back-translates into print, and sends it to the very sophisticated company-wide word processor. Co-workers enter revisions on the word processor, and they are translated back into grade two for further review.

EQUIPMENT: Apple II, 2 disk drives, VersaBraille, Echo II voice output, and letter quality printer.

A professor of Linguistics in upstate New York prepares his articles for publication without using any braille-oriented devices. The dictation and transcription of technical matter is always troublesome; **BRAILLE-EDIT** has simplified this. He composes and edits his articles using the Apple keyboard for input and the Echo GP to monitor his progress. When the document is perfect, he outputs to an ETF-80 solenoid array that drives an IBM Selectric typewriter. **BRAILLE-EDIT** stops printing and prompts him with coded tones to change typeballs when a special symbol is required.

EQUIPMENT: Apple II, 1 disk drive, Echo GP voice output, ETF-80, Selectric.

The Cranmer Braille is a modified Perkins Braillewriter. It is a braille computer terminal and braille printer for under \$3,000. It is the ideal tool for producing braille in a school setting. Teachers can prepare homework assignments and tests on an Apple computer using **BRAILLE-EDIT**'s word processing features. All this material can then be translated into grade two braille and printed out through the Cranmer Braille. It is possible to produce a print "teacher's guide" that has a print line-by-line equivalent of each braille line. This system enables the teacher in a mainstreamed classroom to provide equal educational opportunity without any knowledge of braille.

EQUIPMENT: Apple II, two disk drives, Cranmer Braille, optional inkprint printer.

Also available from
RAISED DOT COMPUTING

ELECTRONIC BLACKBOARD Software that enables user to prepare text for display on monitor screen or projection TV. Useful for small seminars and large classrooms.

NUMBERS Nemeth Users' Mathematical Braille Effortless Reproduction Software
Adds translation of the Nemeth braille code to **BRAILLE-EDIT**.
Allows display of complex math material on monitor screen.
Supports dot matrix printer for well-formatted printed math equations.

CRANMER BRAILLER Raised Dot Computing is an authorized dealer for this low-cost braille computer terminal and printer, developed at the Kentucky Bureau of the Blind by Tim Cranmer.

BRAILLE TRAINER This software offers transcribers programmed instruction, drills, and feedback. Using the Apple keyboard in braille mode, transcribers can check their accuracy through back-translation.

CUSTOM PROGRAMMING at reasonable rates.

RAISED DOT COMPUTING NEWSLETTER

Raised Dot Computing publishes a monthly newsletter. In addition to news about our software products, there is current information on low-cost braille devices, paperless braille, transcribers and small computers, braille translation, product reviews, hot gossip, and user complaints and suggestions. Many people are working on low-cost computer aids for the blind. The Raised Dot Computing Newsletter is a good way to find out who they are and what they are doing.

Subscriptions are: **\$12 for 12 issues in print**

\$20 for 12 issues on audio cassette

Back issues are available for \$2 each, print or audio.

Please send your name, address, and phone number with your subscription check.

BRAILLE-EDIT

**A sophisticated
word processing program
that enables
blind and sighted people
to work together
in utilizing
the power of micro computers**

Another innovative, low-cost program from

RAISED DOT COMPUTING

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