Eight-dot Braille

By Judy Dixon

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BANA's Position

There are numerous examples, both historic and modern, in which the six dots of the traditional braille cell have proven inadequate for a particular task. Enterprising inventors, teachers, and braille users have sought to expand the possibilities of the braille cell by increasing the number of dots from six to eight. These expansions have resulted in a cell that is two dots wide and four dots high. Instead of the 63 possible dot combinations in a six-dot cell, an eight-dot cell yields 255 possible dot combinations. Typically, the dots of the eight-dot braille cell are numbered 1, 2, 3, 7 downward on the left and 4, 5, 6, 8 downward on the right.

BANA recognizes that eight-dot braille systems have proven to be extremely useful, particularly in the technical areas such as mathematics and the sciences. While BANA currently has no official codes that incorporate eight dots, BANA plans to closely monitor all developments in the area of code extensions involving additional dots and will continue to assess their utility through its technical committees.

This paper will provide an overview of eight-dot braille, its historic uses and modern developments.

Historic Uses of Eight-dot Braille

As the use of braille evolved throughout the world, there have been at least three instances where an eight-dot "braille" cell has been used for a special purpose. In each of these cases, several eight-dot braille slates were developed to enable users of the special code to write the eight-dot code in addition to reading it.

Abreu. An eight-dot code was introduced in Spain for the purpose of reading and writing music notation. It was named for its creator, Gabriel Abreu, a blind music teacher. The Abreu code was officially recognized by the Royal Spanish Conservatory of Music and Oratory in 1855 to be "an appropriate system for teaching music to the blind" and the author was granted royal patent rights (Aller, 1990).

Virtually unknown outside Spain, the Abreu system was extremely popular among its users because it evolved much more quickly than the tactile form of music developed by Louis Braille. The braille music system of the nineteenth century only covered the basics of music notation. The foundation of the more complete modern braille music code, "Braille Music Notation," was not published until 1929.

Using eight dots with their 255 possible combinations, this code permitted the writing of all of the musical signs in addition to text. The four upper dots of the cell represented the musical note while the four lower dots represented the duration of the note sound. When text was present, the letters were represented in the bottom part of the cell and the upper part was only used for music signs. As is common in print music, Abreu placed each syllable of text next to its corresponding note. This arrangement was not always possible in the braille music system.

Many music scores were published in the Abreu eight-dot code. The Abreu system was used in the National School for the Blind in Madrid, as well as in other regions of the country, from 1856 to well into the 1950s. While some material still exists today, a sixdot braille music code was officially adopted in Spain in the early 1950s.

Stenographic Code. Another example of eight-dot braille was used in Austria and West Germany in the mid-twentieth century. This was a shorthand code used by blind stenographers.

In 1943, the Deutsche Einheitsstenographie, a six-dot stenographic code was first published. In 1952, this code was extended by the Deutsche Verhandlungsstenographie, a seven-dot stenographic code in former East Germany. In the same year, a group of blind stenographers headed by Werner Castritius, proposed an eight- dot version for Austria and West Germany. The final version of the eight-dot stenographic code was published in 1961. This code was widely used into the 1980s but has been slowly replaced by computer-based stenographic methods.

Tenkanji and Kantenji. Tenji, the system of standard Japanese braille in use since 1890 does not permit the direct brailling of the Japanese Kanji, the Chinese characters that are used in the modern Japanese logographic writing system. It was generally thought that access to these characters could bring blind people closer to mainstream print used by sighted Japanese people thus facilitating communication and a common understanding about their language (Dasgupta, 2002). However, with over 10,000 kanji in common use, devising a braille code to represent this form of print was a formidable task.

In the 1950's, Taiji Kawakami, a sighted teacher at a school for the blind in Osaka, developed kantenji, an eight- dot code to represent kanji. This code used the upper two dots of the cell to indicate that it was a kanji character and in two or three cells, constructed the braille characters to reflect the visual appearance of the original kanji.

In 1966, Sadao Hasegawa, a blind teacher at a school for the blind in Tokyo, created a six-dot braille system for brailling kanji called tenkanji. Hasegawa's six-dot code took a very different approach from that of Kawakami. Each kanji character in six-dot tenkanji occupies three or four braille cells. Each character begins with a kanji indicator and is constructed from among several elements (semantic, phonetic, and so forth) of the character in an effort to avoid confusion with other characters. The selection of which elements to use to represent a character was based largely on the frequency of the word in everyday language.

Modern Developments in Eight-dot Braille

The introduction of computer-based technology into our everyday lives has had a profound effect on the options available to braille users. In the early 1970s, braille embossers became available from Triformation Systems, Inc. that were capable of embossing eight-dot braille. "Triformation embossers added a seventh and eighth dot to the braille cell, thus expanding the braille code into an eight-bit code that could display 256 combinations...." (Cranmer, 2000 p.154). While these were not the first machines capable of embossing braille, they were the first known units that could produce an expanded version of the North American ASCII-Braille Code.

ASCII (the American Standard Code for Information Interchange), the basic character code used by computers is a seven-bit code consisting of 128 characters (0-127). It is composed of uppercase and lowercase letters, numbers, punctuation marks, a few special symbols, and some control characters. ASCII has 95 printable characters. To represent ASCII in six-dot braille, with only 64 combinations (including the space), the ASCII values between 96 and 127 (lowercase letters and a few punctuation marks) had been mapped to the corresponding symbols between 64 and 95 (uppercase letters and a few more punctuation marks), making upper- and lowercase letters and several pairs of punctuation marks indistinguishable when represented with a single braille cell. When more dots are available, the addition of dots seven and/or eight to some of the characters yields a unique braille symbol for each ASCII value. With these new embossers, the 95 printable ASCII characters could be represented by a single cell each. Additional cells are not needed to represent uppercase letters, the full array of punctuation marks or other ASCII symbols that have no representation in literary braille.

In the expanded North American ASCII-Braille code, the uppercase letters retain their original form and are usually structured by adding dot seven at the bottom-left of the cell. This strategy generally worked well because it did not require the user to learn a completely new braille code.

Having braille embossers capable of representing unambiguous text was a great boon to many blind people who were then finding employment in the burgeoning field of computer programming. But for the next ten years, eight-dot braille produced from a computer continued to be the exclusive province of computer programmers and the like.

It was not until the introduction of refreshable braille displays and their use to read a computer screen that the use of eight-dot braille became more widespread among average braille users. Early refreshable braille displays, such as the Digicassette, the VersaBraille, and the Microbraille were all six-dot displays. These devices were initially developed for reading material stored in memory or on removable media. But as refreshable braille displays began to be used interactively with a computer screen, six dots proved again not to be enough to work efficiently.

Again, more than six dots were needed to represent the printable characters of the ASCII character set. With the introduction of the IBM PC, an extended version of the ASCII character set was developed that included 256 characters. The additional 128 characters were mostly mathematics, graphical, and foreign characters but since braille embossers and braille displays already had eight dots, they were easily able to represent the entire range of the new eight-bit character set.

By the late 1980s, most refreshable braille displays had eight dots per cell and used eight-dot braille codes that varied slightly from country to country. In addition to representing characters, the presence of the additional two dots per cell allowed the display to show highlighted or otherwise enhanced items and enabled the user to determine the location of the computer cursor or the mouse pointer without obscuring the underlying character. There is, however, still no accepted standard for eight-dot braille in the United States.

Some believe that advances in computer technology may negate the need for an eight-dot braille display. Eight- dot braille became the norm for refreshable braille displays because it could provide a one-to-one representation of the computer screen, particularly in the 1980s and early 1990s, as refreshable braille devices became common in the professional world. But the computer screen of the day was a regular grid of evenly spaced characters on evenly spaced lines. More recently, the development of proportional fonts, the graphical user interface, and numerous character sets that are not limited to eight bits means that much of the benefit of the eight-dot braille concept has been somewhat mitigated. It is conceivable that braille displays of the future may return to the use of six-dot cells, reducing cost and complexity. However, the additional advantages of the enhanced display possibilities, a convenient method for displaying a cursor, the display of various text attributes, and so forth, have so far resulted in the continued production of refreshable braille displays with eight-dot cells.

And what has happened with braille embossers? Although most braille embossers of today can be configured to produce eight-dot braille, the common practice is to use refreshable braille displays to interact with the computer and emboss in six-dot braille. In general, embossed text does not lend itself as well to eight-dot braille. There is no real space saving with each line of a page occupying 33 percent more space than a six- dot line and there is much greater opportunity for confusion among similar looking characters. In most situations, embossed text is needed in contracted literary braille.

Continuing Developments with Eight-dot Braille

Eight-dot Braille and Science. In the mid-1990s, another extension of six-dot braille was undertaken by The Science Access Project at Oregon State University. In an effort to make braille and print more directly equivalent without the need for any intermediate processing, a set of fonts called Dotsplus was developed. Dotsplus includes six- and eight-dot fonts. The six-dot font presents text similar to traditional uncontracted braille. The eight-dot font presents most two-cell characters of the six-dot font as single cells. For example, in the eight-dot font, uppercase letters, which in six-dot braille are shown with the letter in one cell preceded by a dot six in a cell by itself, are shown as the letter with an added dot seven in the bottom left corner of the eight- dot cell.

In both fonts, punctuation marks and the symbols of math, science, accent marks on letters, etc. are shown as small graphic symbols very similar to their print equivalents. These fonts allow for a straightforward rendition of math and science material. The same document can be read by a blind person when embossed on a special embosser or by a sighted person when printed or viewed on a computer screen.

Eight-dot Braille and Mathematics. Another relatively recent project has undertaken the task of developing an eight-dot code for mathematics. Under the auspices of the European Union, the LAMBDA Project's goal is to develop an efficient system for blind people, especially students, to read mathematics with a refreshable braille display and synthetic speech. LAMBDA is an acronym for Linear Access to Mathematics for Braille Device and Audio Synthesis. Still in development, the LAMBDA Code is based on MathML, and, through its editor, is presented in a linear format for access with braille and speech. Because it uses an eight-dot braille cell, all of the operators and common symbols are represented by single characters. The elements of the LAMBDA code will be customized for the various countries for which it is intended. This customization will make the braille characters chosen and the language used as familiar as possible to each country's residents.

Eight-dot Braille Standards

In recent years, versions of an eight-dot character set have been documented by standard-setting bodies.

Unicode. In the context of defining symbols, in addition to musical, mathematical and technical symbols, the Unicode standard beginning with version 3.0 (September

1999) has defined 256 eight-dot braille patterns.
They can be found in the Unicode range u+2800 to u+28ff. They are included in Unicode only as symbols, as the Unicode Standard encodes only their shapes but not their meaning. The association of letters to patterns is left to other standards.

ISO. In 2001, the International Standards Organization (ISO) released a standard defining the characters for eight-dot braille for Latin-based character sets. ISO/TR 11548 parts 1 and 2 are entitled "Communication Aids for Blind Persons: Identifiers, Names and Assignation to Coded Character Sets for 8-dot Braille Characters". This standard specifies the assignment of eight-dot braille to Latin alphabet 8-bit code tables. As stated in the standard, it is "intended to be used by experts and manufacturers of 8-dot braille input and output devices, interfaces and software for data exchange."

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