The Evolution of Braille:

Can the Past Help Plan the Future?

A three-part article from the Braille Authority of North America

Part 1

Introduction

Braille itself has been instrumental in making possible the integration of blind people into society, and, in turn, this increased integration has driven developments in the use and production of braille. The more integrated that blind people have become, the greater are the demands placed on sources of literacy. Are the literacy tools keeping up?

The purpose of this article is to illuminate the changes in the way braille has been produced and used over the past 50 years and to discuss some of the reasons for and impact of these changes. Clearly there are a number of overarching and complex issues that influence the teaching, learning, and use of braille—teacher shortages, teacher competency, service delivery methods for braille learners, the role of braille in employment, and more. However, this article will focus on the evolution of the communication methods used by braille readers; it will also look at other evolutions that have occurred such as how blind children are educated, the range of available technologies, and the evolution of braille and print.

This article is divided into three parts. Part 1 traces the use of braille as a viable reading medium from the 1960s to the present and takes a close look at how print has changed over the same period. Part 2 discusses the more technical aspects of braille translation, challenges faced by current transcribers of current codes, the need for accurate forward and backward translation with the least amount of human intervention, and the impact of the use of refreshable braille displays. Part 3 discusses the future; it explores the options for change and examines Unified English Braille (UEB) and the Nemeth Uniform Braille System (NUBS) as examples of code unification.

The development of braille and of its use in the United States is a long and fascinating story. The history is well-documented, so it will not be repeated here. This article will begin with a look at the evolution of braille in the United States beginning in the 1960s. First, however, it may be helpful to provide an answer to a frequently asked question: "Print does not change; numbers are numbers, parentheses stay the same, a dollar sign means dollars. So why all this tinkering with our braille?" Let's take a quick tour of the relevant changes that have occurred in print during the last 50 years.

Print Changes

In the early 1960s, print was, believe it or not, quite a different thing from what it is today—not only in terms of its methods of production and distribution, but also in the way it looked. For starters, individuals could produce print either by handwriting or with a mechanical or electric typewriter. Print produced on a typewriter was very symmetrical with rows and columns of characters. The primary tool available for showing emphasis was underlining. In 1961, the first IBM Selectric typewriters had a rotating typeball that could be changed in mid-document, allowing, for the first time, different fonts in the same document. This meant that individuals could produce a document with bold or italicized text, and they began to do so with abandon. Still, symbols that could be represented by typing were limited. If one wanted to place an accent mark over a letter, such as in the word resumé, it had to be done by backspacing over the final e and using an extra keystroke. Multiple copies could only be made using carbon paper or mimeograph machines, and, if a print document could not be hand delivered to its intended recipient, it had to be sent in the mail.

Color and graphics could only be produced by professional printers or publishers using expensive and complex methods, and they were not used in the same way we see today. Classroom textbooks were generally full of text, which was usually meant to be read straight across a column or page.

Beginning in the 1980s, people began to have computers and printers in their homes. At first, the printers created text much as typewriters did—columns and rows. In fact, a common kind of printer at this time was the "daisy wheel" printer, with technology not much ahead of the Selectric typewriter. The daisy wheel had a spinning sunburst of petals, each with a character on its end, and only characters available on that wheel could be printed. Copy machines improved and fax machines became common, so it was easier to reproduce and distribute print documents. Still, although floppy disks for computers could be hand delivered or mailed, paper was key in the distribution of print. Print began to show variations of font and style. Creativity abounded, and people were continually looking for ways to make the print appear “more attractive” to readers.

By the 1990s, the world of print was evolving at a tremendous rate. With laser printers, personal computer users were able to print complex text with multiple character sizes and various fonts and styles on a page. It was even possible for a person to create an entirely new print character if the current range of characters did not happen to include what was needed. People liked what they saw, and the vast varieties of possible print continued to expand. Color print was at first quite expensive for individuals to produce, but became more economical with the introduction of the inkjet printer.

As the possibilities have expanded, the nature of print on a page has become more and more non-linear and with an extensive use of graphics. Today, both K-12 and higher-education textbooks are full of photographs, diagrams, charts,

graphs, boxes, and sidebars presented for visual appeal, and the content necessary to convey the meaning is displayed in a variety of layouts and arrangements on a page. Because technology is so much a part of the daily life of people of all walks of life, the boundaries between what is "technical material" and what is purely literary are increasingly blurred—web addresses, symbols that stand for letters, and even mathematical equations can frequently be found in everyday books and magazines.

Often, written documents never even make it to paper; rather, they are presented and read using computer screens, cell phones, or other electronic devices specifically meant for on-screen reading. For example, in 2008, the Colorado Community College system announced that students could access all their textbooks online for a flat fee. Online textbooks have the advantage of including hyperlinks, definitions, links to additional information, interactive graphics, and much more. Classroom settings in general are much, much more computer-based. Gone are the days of a teacher writing on a chalk board—the teaching demonstrations, the assignments, even the tests are increasingly conducted in an online forum.

Print conventions have changed. For example, there are now many styles of enclosure symbols like parentheses—brackets, curly braces, and angle brackets. Bulleted lists are ubiquitous. Changing technology has made it easier to change font, color, and print size—even within the same sentence—and brought new words into our language, spelled in new ways with capital letters and periods in the middle of words. Plus signs, dollar signs, trademark and copyright symbols, @ signs standing for letters, question marks with spaces on either side run rampant, not just through text messages, but all through everyday magazines and newspapers.

Braille Changes

Before the 1960s, blind children were usually educated in completely separate settings from sighted children, mostly in residential schools for the blind. The main source of leisure reading materials in braille was the Library of Congress. Educational materials were brailled mostly by a few braille publishing houses, using human braille transcribers who wrote each and every word of the material into braille; the number of titles that needed to be transcribed was limited by the fact that blind children attended only a relatively few schools. Most of the teachers who worked with blind students knew how to read braille, and, therefore, could comfortably create braille materials and did not need to rely on a print copy to read the students' materials. Print page numbers were not generally shown in braille books. Outside of the braille publishing houses or schools for the blind with access to braille presses, transcribers could only produce braille by hand, either using a Perkins braillewriter or a slate and stylus. Multiple copies of a document could be produced only using a thermoform machine, which was an expensive and laborious process.

The literary and the mathematics braille codes had generally been developed and then evolved with an eye toward saving space; for example, in order to use fewer cells, the percent sign and units of measurement such as "cup" were always brailled before the number, regardless of the order in print. Part of the role of the braille transcriber was to make the judgment calls that were sometimes needed to decide how to transcribe a given symbol. To save space and use less paper, it was common practice to divide words between lines when there was room for part of a word at the end of a line. This practice required time-consuming consultation of a dictionary to ensure that proper division occurred, and saving space and paper was more valued than saving time. The code for rendering mathematics in braille changed several times during the first half of the twentieth century, and, by 1972, the *Nemeth Code for Science and Mathematics Notation* was the standard.

If a blind person needed to produce something in print, the person either used a manual typewriter, often having written the material in braille first, or dictated the material to a sighted individual to handwrite or type. Reading braille always meant reading from hard copy—primarily paper but also on thermoform plastic.

Many factors in the blindness field began to change in the 1970s. In the educational arena, Public Law 94-142 provided that blind children should be educated in the “least restrictive environment.” An increasing number of blind children had already begun to be educated in the public schools rather than in specialized schools for the blind, and the law accelerated the trend. This shift required many more titles to be transcribed because not every school used the same textbooks, even within the same state, and this led to an increased need for braille transcribers.

The organization responsible for developing the braille code had changed in composition and in name numerous times over the preceding century. In 1976 this group became known as the Braille Authority of North America (BANA), and it included national consumer organizations, braille producers, the Library of Congress, transcribing organizations, and others. While continuing to fine-tune the literary braille code, in the late ‘70s, BANA developed a system that included print page numbers in braille books so that mainstreamed blind students could follow along with the rest of their print-reading class. The system included additional symbols and formats not covered in the literary code, but needed for the meaningful transcription of textbooks used in mainstreamed classroom settings.

To some extent the braille code moved away from specialized practices, such as inserting apostrophes in braille where none existed in print, and more toward giving the reader an accurate representation of print. Library books, magazines, and the like were still transcribed using the literary code. The textbook code was substantially updated in 1997 and is now known as *Braille Formats: Guidelines for Print to Braille Transcription* and numerous conflicts between the literary braille code and braille formats still exist today.

Literary braille provides only one way to indicate a change in font showing emphasis. The one indicator, the italic sign, has to represent italic, boldface, underlined, or colored type. The *Formats* guidelines allow for italic, boldface, and various colors. These are needed when a textbook gives an instruction such as: “Copy the new vocabulary words (shown in italic type) into your notebook and study the review words (shown in boldface type).”

The literary braille code instructs the transcriber to substitute a word for symbols such as + (the plus sign), - (the minus sign), and < (greater than) that are shown in print. *Braille Formats* has braille characters to use for many such print symbols. For example, in a sentence such as "John + Mary = True Love," *Braille Formats* would use symbols similar to but not exactly like those in the Nemeth Code. If literary braille is followed, words "plus" and "equals" would be used for the print symbols. (Part two of this article will discuss the conflicts that can arise when symbols from different BANA codes are considered for adoption into literary braille.)

Print textbooks make use of a variety of enclosure symbols, including parentheses, square brackets, curly brackets (also referred to as braces), angle brackets, and enlarged versions of all of these symbols. The literary code only provides for parentheses and square brackets. *Braille Formats* adds curly braces and angle brackets. In some texts, it is critical for students to know what enclosure symbol is shown in print. Mainstreamed students and employed blind people are expected to be able to produce print similar to that of fellow students or colleagues at work. Their textbooks need to help them prepare for this.

Additionally, to try to ensure greater clarity in the representation of computer-related material that was becoming more prevalent, BANA developed a specific computer braille code. While this made computer programming easier for braille readers, it added a new set of symbols. For even the most casual braille reader of general literary material, symbols from this code abound today in e-mail addresses, web sites, and even the name of common companies such as Amazon.com.

In the 1970s, braille translation software, although still in its infancy, started to become more common, and by the early 1980s, braille embossers were being used by larger organizations. Transcribers could either use six keys on a regular computer to enter the braille by hand or they could insert special codes into a print document to produce the proper formatting. Embossers provided an easier way to make multiple copies, but still, reading braille meant reading hard copy. Electronic braille displays had started to arrive, but they were mostly incorporated into stand-alone products that did not interface with mainstream devices, and most people did not have access to them.

In the late 1970s and the 1980s, the typewriter and the dictation method were still the primary methods for a blind person to produce print. However, in the K-12 education setting, the braille-reading students could often write out their

assignments in braille, and then the special education teacher or transcriber would "interline" the braille, i.e., write print above the braille so that the classroom teacher could read it. Most blind students who grew up during this era never had the experience of being able to read directly-written communication from their classmates (no passing messages, no copying class notes), because most of their classmates were print users who did not know braille.

In the late 1980s, speech output became possible on personal computers, but was far from commonplace. Blind people with access to this technology could check and edit their own typing and could share their work by printing it out onto paper. There was still no way to fill out forms or pay bills without using a human reader, and no way to share documents without printing them first.

Beginning in the 1990s, the further proliferation of the personal computer and the rise of the Internet began changing the nature of the interaction of print and braille and drastically increasing blind people's access to written information. Today, all kinds of print-origin documents are more directly available to braille readers. Now, with various combinations of Internet media, speech output, braille displays, scanning and OCR, braille translation software, and braille embossers, blind people can read, in a matter of moments, virtually anything created by anyone—a pop quiz from a classroom teacher, a popular new book that just came out in stores yesterday, a web page created by someone two minutes ago in France. Job applications, registration forms, order forms, and the like are readily available online, and bill statements are available electronically to everyone. Blind people are accessing the exact same material, in the exact same format as their sighted peers. Braille readers utilize technology to render these materials accessible, not a sighted reader or transcriber. Of course, human readers are still the most efficient means of accessing some information, but the need for them is not as great as in times past. Some online material is inaccessible, but it is now easier than ever for blind people to have direct access.

Refreshable braille displays have become more adaptable to mainstream computers, and note-takers with braille displays are common. These devices allow blind people to read directly what was produced in print by others without the need to emboss onto paper or have someone transcribe it. The very same files or messages that sighted peers access by looking at the screen on their computer or device can be accessed by viewing through a braille display—no other intervention required. Although these displays are quite expensive now, they are in the hands of more and more braille readers, and there is no doubt that cheaper production methods will become available. With braille displays, any number of daily newspapers can be read in braille, no waiting required and no elimination of articles because of limited space in a braille publication. When surfing the web with a braille display, blind people can click on a braille cell using a device, and soon there is another page of braille. Hence, an unprecedented level of access to books of all types in braille is now available. The Gutenberg Library, Web-Braille, and Bookshare have made tens of thousands of titles available electronically, and it is now possible to read these books in braille using

the technology available. Additionally, as optical character recognition technology has improved and the price of scanners has fallen, an electronic version of any print book is within the braille reader's grasp even if it is four o'clock in the morning, and there is no print reader for miles!

The Future is Now

Today, blind people can communicate in writing with classmates and co-workers with the greatest of ease via e-mail, text message, social media sites, or by simply passing files back and forth using a host of methods. The method of writing is not nearly as tied to the method of reading as it was in the past. For instance, someone can type an e-mail using a device with a refreshable braille display, and the recipient can read it in print on his or her cell phone screen, print it onto paper, etc. Likewise, someone can use a cell phone keypad to enter a text message, and, with the right technology, the recipient can read it in braille. This, of course, means that blind students can now produce assignments for their teachers more independently than ever. They can receive the handouts via e-mail or web page, access them directly in braille, and submit the assignments directly, again via e-mail or web page.

Braille translation software interfaces well with more and more mainstream applications. Braille embossers, now more widely available, can produce reams of paper braille. Because the existing technology makes it possible to produce braille more easily, it is often used in cash-strapped education settings by people who are not necessarily knowledgeable about braille itself. On the other hand, the work of knowledgeable transcribers, still extremely important, can be far more efficient with the use of this technology. Translation software and braille embossers, combined with the ability to scan documents and the availability of electronic source files from publishers, has created the potential to greatly speed the transcription of braille books. Transcribers are now able to invest less time in entering text and more time in preparing the proper structure and format books that will be translated. Greater ease of braille production correlates positively with a greater availability of braille textbooks, even in higher education. Thus, the stage is set for quicker, cheaper braille.

Increased technology has aided braille readers in their methods of braille production as well. Besides using a slate and stylus or a braille typewriter, blind people, too, can use braille translation software with a PC to create braille for embossing. Refreshable display devices allow users to type either in six-key Perkins Brailler style or use a QWERTY keyboard to get either uncontracted or contracted braille.

Rather than being paper-based, braille for work and communication is now mostly electronic-based—original documents can be copied infinitely, manipulated, and customized. The same file, with a few keystrokes, can render a document in uncontracted, contracted, or partially contracted braille; with print

page numbers or without them; on narrow or wide paper; and on paper or on a refreshable braille display.

BANA has continued to make minor changes to the braille codes from time to time, most moving braille toward greater similarity with print. For example, the placement of the percent sign and items of measurement was changed to follow print, and symbols such as the copyright and trademark symbol were added. These changes are intended to give the braille reader more accurate information about what is shown in print, and to give the transcriber greater freedom to focus more on issues of formatting the material rather than assuring that each and every word is rendered correctly. Since a human transcriber is not always part of the equation, it becomes increasingly important for our translation software to at least be able to render the words and symbols correctly. That need factors strongly into the code changes as well and will become an increasingly pressing necessity as print continues to evolve.

Since its invention in the early nineteenth century, braille has remained vital to the literacy of people who are blind, and it continues to thrive despite the predictions of some to the contrary. As we have seen, however, until the last 30 years, people who use braille had relatively little direct interaction with print, and read braille that was delivered in a fairly standard way. Now, braille users generally interact directly with print-origin material on a routine basis, and the boundaries between what is in print and what is in braille are becoming virtually nonexistent. In addition, while print has undergone tremendous changes in appearance, delivery, and conventions, the braille code itself has changed relatively little.

We have painted a bit of a rosy picture here about what is possible in theory today with so much access to braille. However, we should make no mistake about it. There are great challenges as well. In the next installment of this article, we will discuss in more detail the workings of BANA; some of the challenges in today's braille production via braille display, translation software, and human transcriber; and the reasons why maintaining the status quo in braille code development in this country will not be a viable option for much longer if braille is to keep up with our changing written language and remain the primary tool for nonvisual literacy.