Communicating in the Dark: An Analysis of Braille

Ever since its invention, Braille has been a significant milestone in education for the blind. Named after its creator, Louis Braille, it is a tactile system of writing in which characters are represented by patterns of raised dots that are identified through touch. These raised-dot patterns are generated using a Braille Cell, a rectangle comprised of six dots.

Louis Braille, who was completely blind by the age of five, created the Braille code (Figure 1) by significantly modifying a system designed by artillery captain Charles Barbier de la Serre, a system which he had helped test. Before this, education for the blind, including that which Louis Braille was taught, involved reading Roman letters in relief, a system created by Valentine Haüy (Javier Jime´nez, et al., 2009).

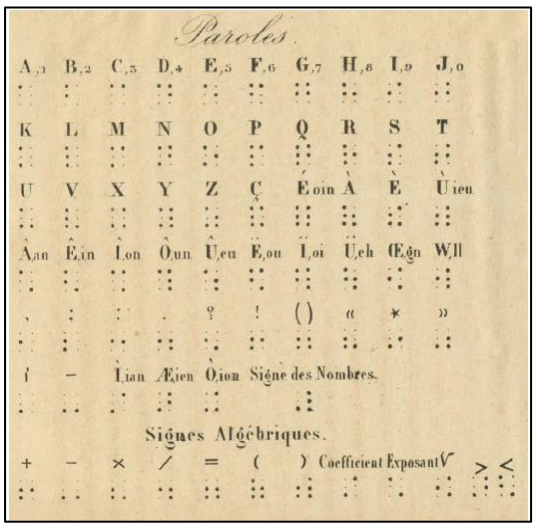


Figure 1: Original Braille system, 1856 (Javier Jime´nez, et al., 2009)

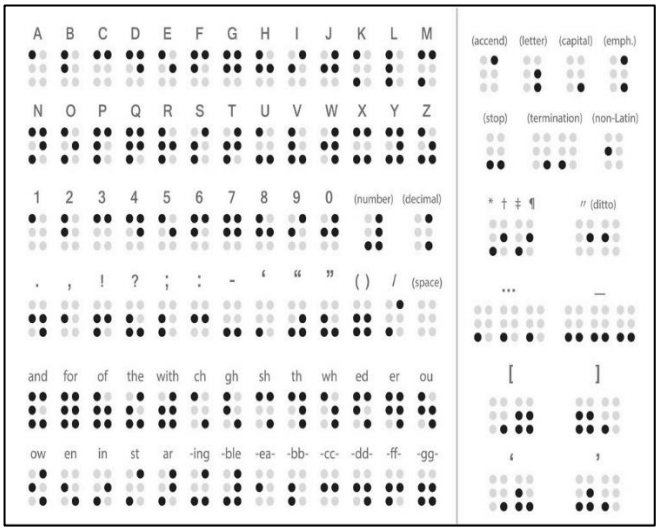


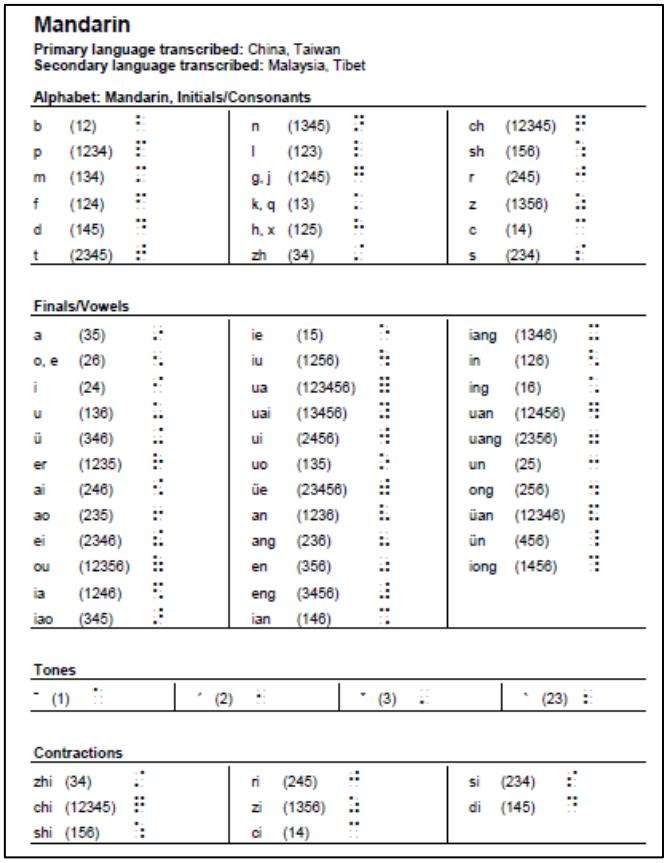
Figure 2: Present Day Braille (2018)

In his lifetime, Braille had published two editions of his writing system, one in 1829 and another in 1837. In his 1837 version, Braille improved as well as simplified his system. Over the years, successors of Braille have contributed to other additions and modifications to the Braille system. This includes the addition of a sign used to signify the following character as a capital letter, significant modifications to mathematical signs, and even the addition of the letter ‘w’ (which was originally not present in the system as ‘w’ was used for imported words in French) *(Javier Jime´nez, et al., 2009)*. Such changes have contributed greatly to the present day system of Braille (Figure 2).

In March 1950, a consensus was reached on a uniform version of Braille to be used as the universal system for reading and writing for the visually impaired in all languages during a UNESCO general conference. However, the adaptation of Braille for some languages was more difficult than others (Javier Jime´nez, et al., 2009). This was especially since some

languages made use of diacritics or special characters to signify a specific sound or pronunciation. The properties of Braille characters were such that they did not allow the use of diacritics overlapping other characters. This made it difficult to use Braille for languages that used pronunciation to distinguish between heteronyms (words spelt the same but pronounced differently and with different definitions). The presence of different alphabetic systems also further complicated matters since the version of Braille available at the time made use of Roman alphabets. Braille characters would hence need to be adapted to represent these differing aspects of the various languages.

For example, tonal languages such as Mandarin required characters to distinguish between the various tones. As seen in Figure 3, there are four braille characters created to express the different tones, which appear as diacritics when writing using Hanyu Pinyin, the Romanisation system for standard Chinese. These characters are to be written behind the character representing the consonant or vowel the diacritic is meant to code for. This is demonstrated in the example given in the World Braille Usage publication (Figure 4), where the red square highlights the character representing the tone appearing over 'a' in 'cǎodì' while the Braille character before that represents 'ao'.



Mandarin

Primary language transcribed: China, Taiwan
Secondary language transcribed: Malaysia, Tibet

Alphabet: Mandarin, Initials/Consonants

b	(12)		n	(1345)		ch	(12345)	
p	(1234)		l	(123)		sh	(156)	
m	(134)		g, j	(1245)		r	(245)	
f	(124)		k, q	(13)		z	(1356)	
d	(145)		h, x	(125)		c	(14)	
t	(2345)		zh	(34)		s	(234)	

Finals/Vowels

a	(35)		ie	(15)		iang	(1346)	
o, e	(26)		iu	(1256)		in	(126)	
i	(24)		ua	(123456)		ing	(16)	
u	(136)		uai	(13456)		uan	(12456)	
ü	(346)		ui	(2456)		uang	(2356)	
er	(1235)		uo	(135)		un	(25)	
ai	(246)		üe	(23456)		ong	(256)	
ao	(235)		an	(1236)		üan	(12346)	
ei	(2346)		ang	(236)		ün	(456)	
ou	(12356)		en	(356)		iong	(1456)	
ia	(1246)		eng	(3456)				
iao	(345)		ian	(146)				

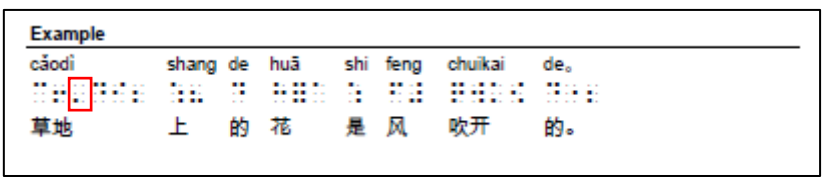
Tones

¯ (1)	´ (2)	ˇ (3)	` (23)

Contractions

zhi	(34)	ri	(245)	si	(234)
chi	(12345)	zi	(1356)	di	(145)
shi	(156)	ci	(14)		

Figure 3: Mandarin Braille Chart (UNESCO, 2013)



Example

cǎodì	shang	de	huā	shi	feng	chuīkai	de。
草地	上	的	花	是	风	吹开	的。

Figure 4: Example provided for Mandarin Braille (UNESCO, 2013)

As such, for every language Braille was adapted for, a single standard Braille code was created to suit each language's properties and needs. Updated Braille codes were last published by UNESCO as the third edition of the 'World Braille Usage' publication, released in 2013 (UNESCO, 2013). A Braille adaptation of the IPA chart (Figure 3) was also published along with these Braille codes.

IPA Braille Charts (IPA Revised to 2005)

The following charts originally appeared as the appendix to Englebretson, Robert. 2009. "An overview of IPA Braille: an updated tactile representation of the International Phonetic Alphabet." *Journal of the International Phonetic Association*, 39: 67-86. They are reprinted here by permission of the secretary of the International Phonetic Association.

Consonants (Pulmonic)

	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive											
Nasal											
Trill											
Tap or Flap											
Fricative											
Lateral fricative											
Approximant											
Lateral approximant											

Consonants (Non-Pulmonic)

Clicks		Voiced implosives		Ejectives	
	Bilabial		Bilabial		Examples:
	Dental		Dental/alveolar		Bilabial
	(Post) alveolar		Palatal		Dental/alveolar
	Palatoalveolar		Velar		Velar
	Alveolar lateral		Uvular		Alveolar fricative

Figure 5: Section of IPA Braille Charts (UNESCO, 2013)

Present day methods of producing braille can be split into two different categories: mechanical and electronic. Mechanical methods include the use of a slate and stylus (Figure 4) which is similar to pen and paper methods, and a Braille Writer (Figure 4) which functions similar to a typewriter (Braille Writing Devices, 2020). Electronic methods would refer to refreshable braille displays or a braille terminal that is used to read text on computers (Refreshable Braille Displays, 2020).

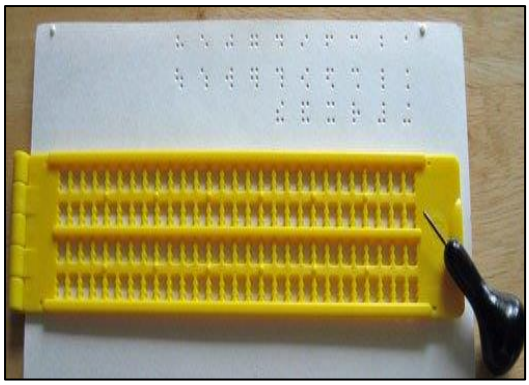


Figure 6: Slate and stylus (Paths to Literacy)

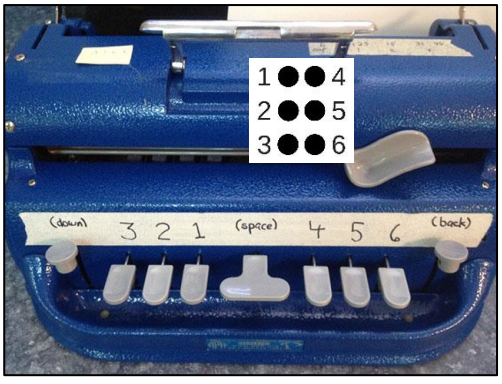


Figure 7: Braille Writer (Beginners Guide to Braille)

Despite the accessibility granted to the visually impaired for reading and writing by Braille, it is still not largely used by visually impaired readers. According to a 2017 annual report by the American Printing House for the Blind, only a mere 7.8% of students legally considered blind used Braille as their primary reading medium (Figure 6).

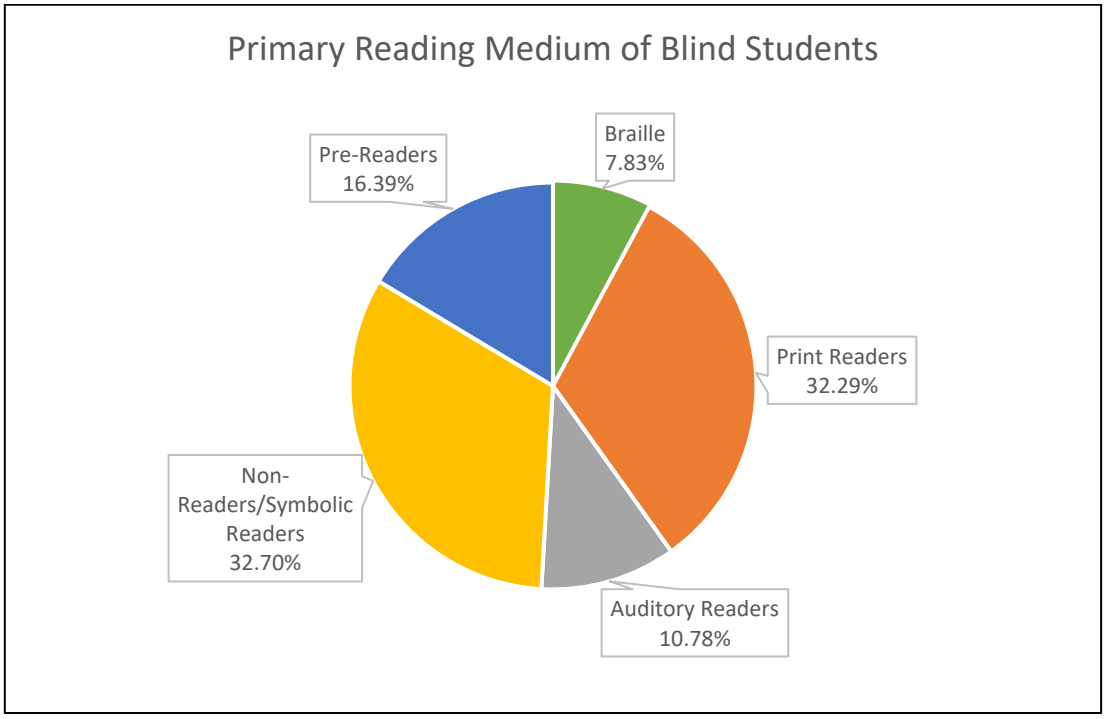


Figure 8: Statistics taken via National Federation of the Blind (Blindness Statistics, 2019)

Over the years, this limited use of Braille as a primary medium by the visually impaired has been accounted to various factors including the difficulties and inefficiency of the Braille code itself, and even the advancement of technologies such as text-to-speech readers that users may find more efficient and easier to use. As broached by multiple studies, learning Braille can be plagued by various challenges, including minor issues such as losing a page when reading using Braille (Tobin & Hill, 2015) or more major issues such as varying tactile acuities of users (the keenness of their sense of touch) (Khochen-Bagshaw, 2011). Other nuances in writing such as italicization, bolding, and other ways of emphasis are also rather hard to replicate in Braille, though not impossible since characters do exist to signify these (it would still have to be learnt, however, expanding the complexity of Braille further). These are easily eliminated when using text-to-speech or other such technologies (Tobin & Hill, 2015).

However, at the same time, it has been noted that technology has helped improve and promote the use of Braille. In a study done by Martiniello, Wittich, and Jarry (2018), it has been shown that technology is being incorporated into the teaching of Braille by instructors and that there is an evident perception that technology supported Braille learning carried learning and motivational benefits. There are also multiple studies that highlight the importance of Braille in the education and literacy of the visually impaired (Khochen-Bagshaw, 2011; Massof, 2009), as well as its impacts on employment (Ryles, 1996).

Research done by Ryles (1996) found that visually impaired persons who were taught to read Braille had significantly higher employment rates than those who were not taught to

read Braille or did not use Braille as their original reading medium. In another instance, Massof (2009) noted in his article that visually impaired persons who used screen-reading technology instead of learning to read would be considered illiterate, having not learned to read. While magnified print was a plausible substitute for Braille, Massof pointed out that the speed of reading would depend on the type of visual impairment and could prove to be not as useful in the future. Users of Braille on the other hand were able to read at speeds comparable to a regular person reading print. Like Ryles, Massof found higher employment rates tied with Braille users than users of alternate reading methods like magnified print. In his article, he stated that unemployment among magnified print readers was at 77% compared to 44% among Braille users. Approximately 30% of Braille users also had advanced degrees compared to only 13% of magnified print readers (Massof, 2009).

True to this fact, Braille seems to have made society more inclusive to the visually impaired, with Braille being found in several public spaces such as in elevators and on various signs. As noted in several studies, Braille has allowed for far more independence in areas of education and employment for the visually impaired, who as a social group were previously marginalized and thought to be unable to work or support themselves independently (Javier Jime´nez, et al., 2009).

Evidence of this social and financial independence (of the visually impaired) can be found in statistics provided by the National Federation of the Blind. Evident from their report, a vast majority of visually impaired persons have attained a higher level of education (Figure 9) with more than 60% of visually impaired persons having attained a high school diploma or higher in 2016 (Blindness Statistics, 2019).

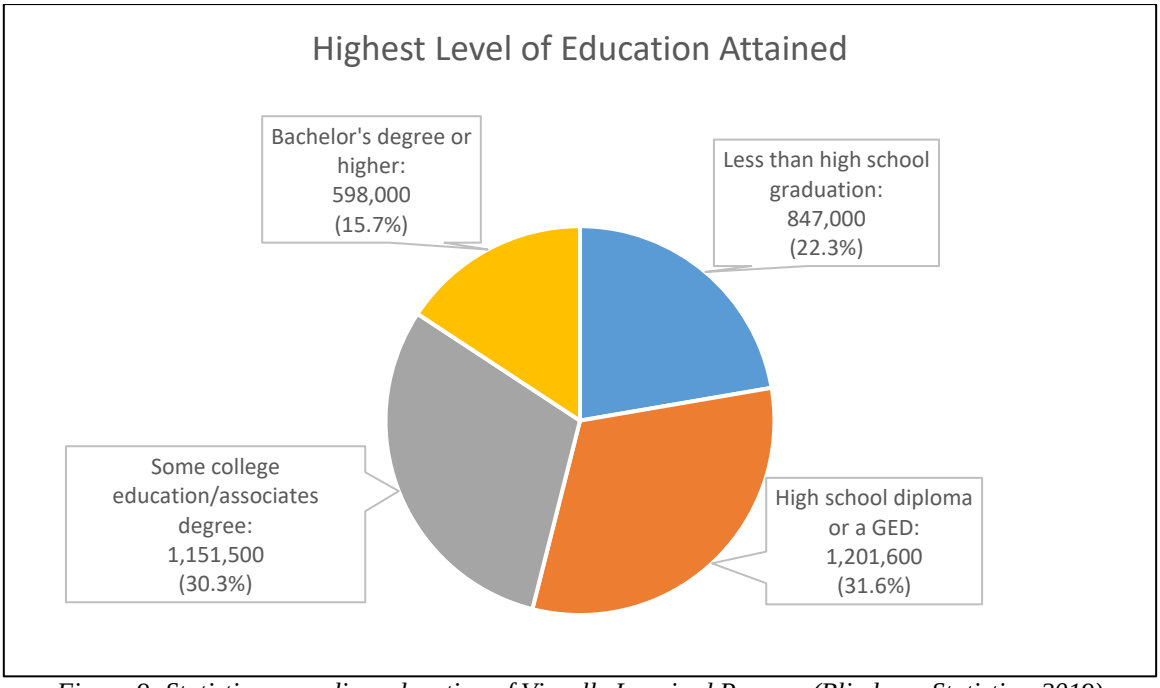
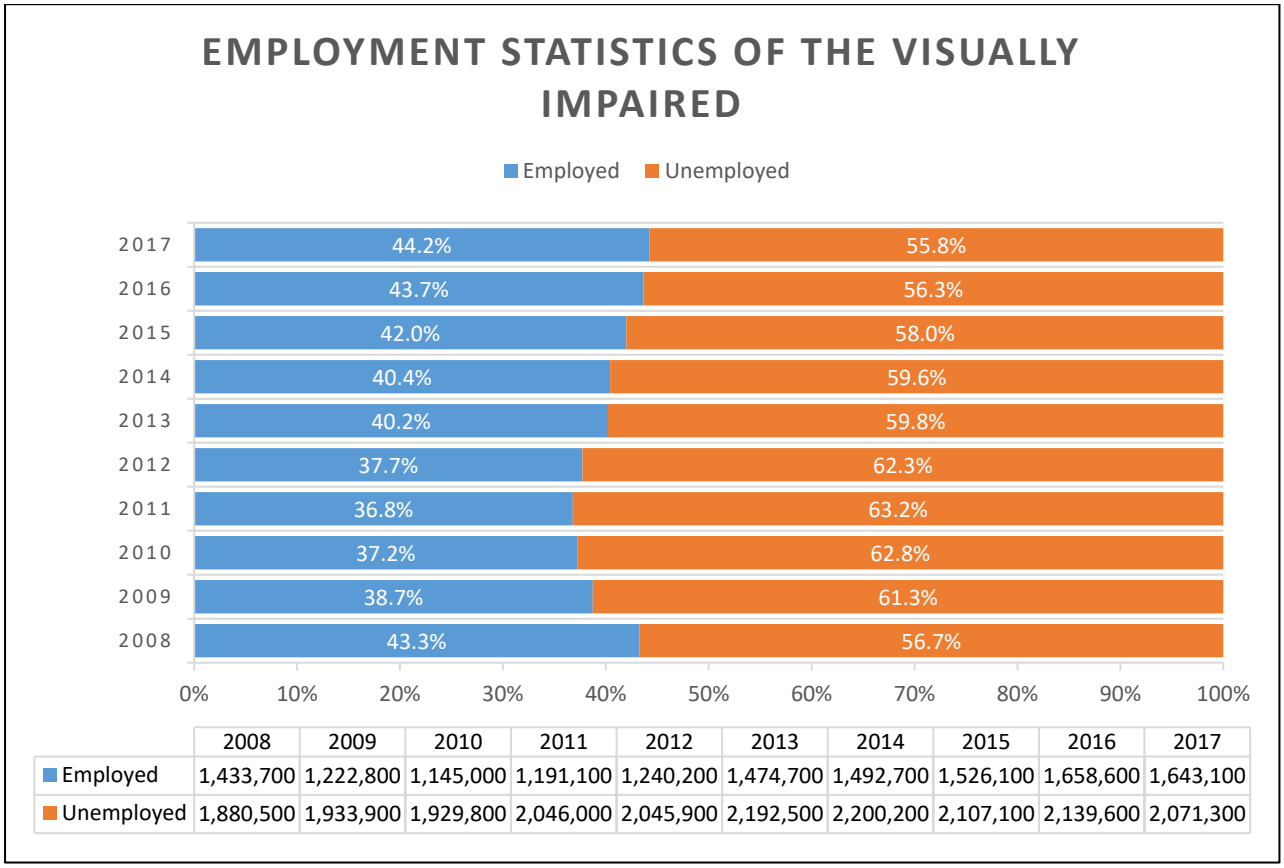


Figure 9: Statistics regarding education of Visually Impaired Persons (Blindness Statistics, 2019)

This further extends to the area of employment, which can be seen as being synonymous with the level of education attained. Disability statistics by Cornell University found that 44.2%

of persons with visual disabilities were employed in 2017, an increase from 43.7% in 2016 (Figure 10).



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Employed	1,433,700	1,222,800	1,145,000	1,191,100	1,240,200	1,474,700	1,492,700	1,526,100	1,658,600	1,643,100
Unemployed	1,880,500	1,933,900	1,929,800	2,046,000	2,045,900	2,192,500	2,200,200	2,107,100	2,139,600	2,071,300

Figure 10: Employment Statistics of Visually Impaired (Cornell University, 2018)

While Braille seems to have had a significant effect on society, it has had little effect on language itself. This is because Braille, being a code, is adapted to the languages it is used for rather than vice versa. However, it can be said that Braille has enabled a new form of communication in the form of tactile writing. Although it was certainly not the first, the first being embossed Roman alphabets proposed by Valentine Haüy, Braille is at present a more popularly known and used form of tactile writing. It has enabled communication of words through the sense of touch rather than sight and hearing as most other forms of communication has done before it.

When comparing Braille to both speech and text, it shares more common aspects with text than it does with speech, especially in terms of the seven features introduced by Crystal (2006). Braille, as with text, is space-bound rather than time-bound, immediately revisable, and contrived. However, unlike both speech and text, Braille is neither face-to-face nor visually decontextualized. Even though Braille is a written code, like text, it does not have much opportunity for various extra-linguistic components. While Braille does have characters for typographical emphasis such as bolding, italics, and underlining, it does not allow for much else. Other extra-linguistic components available in text such as images, font styles, and even different colouring is not evident when using Braille.

Braille is also only in part socially interactive. Similar to writing, it can read at preferred paces and be used to record as well as communicate concepts. However, Braille does not allow for relational comparisons between objects in the form of tables and other similar methods. However, this does not mean Braille is completely void of being graphically rich. While Braille does not allow for tables, graphs, fonts, and styles that make writing graphically rich, it still does allow for punctuation, capitalisation, and even spatial organisation, making it to some extent graphically rich.

In conclusion, Braille, as a medium of communication, offers more accessibility to the visually impaired. Despite its low rate of use and perceived difficulties in acquiring the skilled use of Braille, research has evidently shown that Braille is a more advantageous form of writing for the visually impaired as compared to other alternatives. With such supportive research as an aid, the past several years have seen the vigorous promotion of Braille. Even technological advancements, once considered the enemy of Braille, are now being used to help promote its use as well as integrate its use into digital devices available today, such as computers. Technology is also being used to help reduce the inconvenience previously faced by Braille users through the creation of more efficient and less space-consuming tools. With such efforts, it is possible to see Braille re-emerging as a stronger medium of communication over time.

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