A CRITICAL EVALUATION OF THE HISTORICAL DEVELOPMENT OF THE TACTILE MODES OF READING AND AN ANALYSIS AND EVALUATION OF RESEARCHES CARRIED OUT IN ENDEAVOURS TO MAKE THE BRAILLE CODE EASIER TO READ AND TO WRITE

by

Pamela Lorimer

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ABSTRACT

Part 1 is an evaluative history of the various embossed codes evolved so that blind people could become literate, from 1786 when the first embossed book was produced. The early codes used in France, Britain, and America are described, reasons given for the need to review the code from time to time and the on-going need for co-operation between English speaking peoples to maintain uniformity in the use of braille. Evaluation has taken account not only of the conditions of the times during which the codes were used, but also of the findings of research carried out during the present century.

Part 2 includes evaluations of some of the major works included in the mass of research that has been carried out on braille reading. An introduction to the psychophysical aspects of the tactile system is followed by an account of the effect of elements of the braille code on accuracy, comprehension and rate of reading and attempts to increase the slow rate of braille reading. The final chapter gives information concerning on-going research, and reasons are given for the continuing value of the use of braille which is now being helped and challenged by technological invention.

DEDICATION

To John

ACKNOWLEDGEMENTS

My late husband, John, who was visually impaired, was a braille enthusiast who spent much of his life as a teacher and researcher of the braille code, and was also Vice-chairman of the Braille Authority of the United Kingdom. I worked for many years as his colleague, so my first appreciation must be for all that we learned together.

Dr M.J. Tobin, Director of the Research Centre for the Education of the Visually Handicapped, Birmingham University, first made the suggestion that this thesis should be written. I have much appreciated his enthusiasm for the subject, his high standard, and ready encouragement as my supervisor.

My study has, by its nature, involved extensive reading, and I have received willing help from librarians at the School of Education, Birmingham University; the Reference Library at the Royal National Institute for the Blind, London; the National Library of Scotland, Edinburgh; la Bibliothèque Valentin Haüy, Paris; and the Reference Library at Perkins School for the Blind, Massachusetts. In addition, I thank the curators of le Musée Historique de l'Institut National des Jeunes Aveugles, Paris; le Musée Valentin Haüy, Paris; and the birthplace of Louis Braille at Coupvray.

Mr. W. Poole (Chairman) and members of the Braille Authority of the United Kingdom have generously lent me their archive collection of minutes of meetings and other papers dating from 1902, and I have also been receiving current copies of minutes of their committee meetings during the past four years. This privilege has enabled me to gain much added interest and insight into the contents of official publications that cover the period.

I am grateful for permission given by the Association Valentin Haüy pour le Bien des Aveugles for the reproductions of photographs which occur in pages 14, 17, 39, and 47, and by Mr. James Stratton, Phillips, Son and Neale, auctioneers, London, for the reproduction of a photograph on page 56. The very clear diagrams which occur on pages 31, 57, and 71 were made by Mrs. Jennifer Whittaker.

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LIST OF ACRONYMS

AAIB	American Association of Instructors of the Blind
AAWB	American Association of Workers for the Blind
BANA	Braille Authority of North America
BAUK	Braille Authority of the United Kingdom
BFBA	British and Foreign Blind Association
BFBS	British and Foreign Bible Society
ICEB	International Committee on English Braille
NUTC	National Uniform Type Committee
RCEVH	Research Centre for the Education of the Visually Handicapped
UBC	Uniform Braille Committee

INTRODUCTION

1. PARAMETERS OF THE STUDY

2. SOURCES, WITH PARTICULAR REFERENCE TO PART 1

3. THE BRAILLE CODE

4. TERMINOLOGY

1. PARAMETERS OF THE STUDY

Once it was recognised that those who were impaired in one or more of the senses could have the remaining senses trained, special programmes became possible and literature became available following this trend. Some examples follow.

Pritchard's "Education and the Handicapped, 1760-1960" (1963) is wide ranging, both in terms of history and in the variety of impairments for which there has been educational provision. The work is divided into three periods: experiment - institutional education; transition - school board classes; growth - advances in education. The book provides a valuable overview and includes helpful lists of official papers, books, and articles.

Hurt's "Outside the mainstream" (1988), details the growth of educational provision for children with special needs. His work includes references to the report of the Warnock Committee (1978), which among other suggestions recommended an initiative to bring handicapped children into the mainstream of education.

Chapman's "Visually impaired children and young people" (1978), is more specific, for within the range of visual impairment she includes some short references to braille, and in more detail some of the recommendations of the Vernon Report (1972) concerning the teaching of braille based on a survey carried out by Williams in 1971.

All these publications were concerned with special education, whereas the present work studies in detail the embossed codes which are the means to education, employment opportunities, and leisure reading and writing by blind people. References to the history of literacy of the blind have occurred from time to time in general works on living conditions and education emanating from America. So far, there has been no detailed evaluation of the history of embossed codes, nor of the many researches carried out in endeavours to find ways of making the braille code easier to read and to write. This work attempts to fill that gap.

2. SOURCES, WITH PARTICULAR REFERENCE TO PART 1

When a new embossed code was evolved its author explained its raison d'être, the elements of which it was composed and the rules of usage. Such primary sources are invaluable, but in extolling the virtues of their codes some authors have tended to be slightly biased in their opinions. Evaluation has therefore taken into account contemporary writings, the apparent success or failure in use and findings of modern research.

Nearly all these primary sources are still available in libraries and museums concerned with the blind, but embossed examples of the earlier codes have become more rare. Since its first adaptation from the French version into the English language the braille code has undergone several changes. Complete official versions of these changes are available as well as proceedings of conferences, and access has been granted to the official committee minutes of the British and Foreign Blind Association followed by those of the Uniform Type Committee later known as the Braille Authority of the United Kingdom. Together they cover the years between 1868 and the present day.

3. THE BRAILLE CODE

Braille is the embossed code most in use today and is the best so far devised for touch reading, but it is constantly being reassessed in endeavours to make it easier to read and to write. This motif can be recognised throughout these pages and reasons are given where appropriate for such changes seeming necessary. It is not a cryptic code, but is another kind of orthography, conveying the same meanings in a punctiform medium, but its configurations bear no resemblance to the shapes of inkprint letters. Any literary material, including foreign languages, can be transcribed into braille, there is a shorthand version, and mathematics, music and chess moves may also be adapted to the medium.

The characters of the braille code are formed from a matrix of dots, known as a cell, which are arranged in two parallel columns of three dots. Sixty-four patterns ($2^6 = 64$) are possible; 63 are used for signs and the remaining one which has no dots is used to separate words. The characters are read from left to right and are arranged in lines analogous to the visual reading display, and format devices such as headings and the use of paragraphs are also used. In comparison with inkprint braille is a very slow medium and it covers a lot of space and so books are bulky.

Two versions of the English literary code are used at present. In Grade 1 each sign corresponds with a print symbol. More competent braillists usually prefer to use a contracted form known as Grade 2. Because only 63 configurations are possible, most of them have multiple meanings assigned to them according to their positions in words and so many rules are necessary; their uses are different in many respects from those of inkprint, and so a terminology has evolved which needs to be known for a complete understanding.

4. TERMINOLOGY

Cell: the 3 x 2 matrix, which is the basis of braille, is arranged as follows:

⠿

Character: any one of the 63 combinations of dots that can be contained within the braille cell.

Letter Sign: a sign representing a print alphabet letter.

Composition Sign: a braille sign which has no direct print equivalent.

Grade 1 Braille: Grade of braille in which each print symbol has a single braille equivalent.

Grade 2 Braille: Braille in which all the rules of contractions are observed.

There are several methods of contracting braille and by their use recognition of groups of letters can be enhanced, space is saved and the rate of reading is increased:

Alphabet Word Signs: signs representing letters can also represent words if they appear with a space on either side of the character; to aid memory most of them represent specific words starting with the same letter, e.g. C for Can, H for Have, V for Very.

Group Sign: a contraction which represents a group of letters.

Composite Contraction: a contraction consisting of more than one cell.

Sequence: two or more words appearing without an intervening space.

Shortform: an abbreviated word which has some letters omitted. There is a specific set of such words which may be shortened in this way.

PART 1

A CRITICAL EVALUATION OF THE HISTORICAL DEVELOPMENT OF THE TACTILE MODES OF READING

CHAPTER 1

VALENTIN HAUY (1745-1822)

1. ATTITUDES TOWARDS THE BLIND
2. THE INFLUENCE OF DIDEROT (1713-1784)
3. VALENTIN HAUY 1745-1822
4. LA FOIRE ST. OVIDE
5. AIMS
6. THE FIRST PUPIL
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8. THE INSPIRATION
9. THE FIRST SCHOOL
10. PUBLICITY
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13. WRITING

1. ATTITUDES TOWARDS THE BLIND

The alphabet came into use approximately three thousand years ago, not instantaneously but over many years, and its use was probably spread by the Phoenicians during their Mediterranean trading voyages (Jean, 1987, English translation - Oates, 1992, p.51). By contrast, a tactile version of the alphabet which could be read by blind people was not invented until just over two hundred years ago (Haüy, 1786) and a means of writing was not evolved until 1821 (Pignier, 1859, p.14). This late development of a means to literacy was caused in part by technological problems but largely by a lack of understanding of the needs and capabilities of those lacking the major sense of sight. Because blind people often appeared helpless it was not realised that the remaining senses could be trained.

In a sighted world it seems that the blind must adapt in order to be accepted, but for progress to be made those with sight have their part to play too, for "it is only in the context of a society where at least the rudimentary needs of blind persons are reasonably taken care of that a new ideology can emerge, one that insists that the larger society no longer use their handicap as a pretext to isolate them from the society of sighted persons" (Lukoff and Cohen, 1972, p.4).

Monbeck (1973, p.23) considered that "the general treatment (to be distinguished from portrayal) of blind people in the western world falls into three historical phases: treatment as liabilities, as wards, and as members of society", and added the qualification that there were no historical periods in which blind people were uniformly portrayed. When such people were regarded as "liabilities" or "wards" it was the more likely that history should record little of their lives, with the result that such references as there are are patchy and brief giving little general account of living conditions for those concerned.

An early famous example of providing for the blind as wards occurred in Paris in 1254 when Louis IX set up the Congregation and House of the Three Hundred, usually referred to as the Quinze Vingts (French, 1932, p.47). It was probably built on an older foundation and there are various theories, none substantiated, as to why the number of inmates was always exactly three hundred, nor for which category of blind people it was first intended - possibly returning soldiers blinded during a tour in Egypt, or to help some of the many blind people in Paris (ibid. pp.48-49).

2. THE INFLUENCE OF DIDEROT (1713-1784)

In the sighted world in Europe during the thirteenth and fourteenth centuries there had been a renaissance of interest in thought and creative art of the classical age, and by the eighteenth century "there was a considerable body of advanced thinkers in France imbued with new and revolutionary ideas on religion, science, history, society, and anxious to spread the enlightenment of which they believed themselves to be the possessors" (Cobban, 1957, Vol.1, p.86).

Amongst these thinkers was Diderot who was responsible for editing an "Encyclopédie" which was to contain "all knowledge and be a work of propaganda for the new ideas" (ibid., p.86). The first volume was published in 1751 and it contains nearly two pages written by Diderot about the blind. [A copy kept open at the relevant pages, may be seen in the Musée Historique at l'Institut des Jeunes Aveugles, Paris.] The account demonstrates Diderot's specific interest in seeking to understand how the human brain can function when without the sense of sight. For this purpose he had paid several visits to discuss with and make observations on Saunderson, a blind professor of mathematics at

Cambridge University. By contrast, Diderot also made observations on a poor blind man living at Puiseaux in France (1773, p.74) where "it was about five in the afternoon when we came to the blind man's house, where we found him hearing his son read from raised characters".

3. VALENTIN HAUY 1745 - 1822

Valentin Haüy lived in Paris during the second half of the eighteenth century. He was born in Picardy in 1745, and completed his education in Paris where he attended the university. With his knowledge of languages, he earned his living by helping business men with translations of foreign correspondence, and he specialized in deciphering old manuscripts in French and foreign languages and was interested in foreign codes (Henri, 1984, p.25). He carried out some translations for Louis XVI, and eventually became a master and subsequently a professor at the Bureau Académique d'Ecriture (ibid., p.30), which had been founded by the king. This was a prestigious appointment and his interest in communication was invaluable for his future work in helping the blind to become literate.

He was six when the first volume of the "Encyclopédie" was published, but as he grew up he was likely to have known and been influenced by evidence of the New Thinking appearing in books, articles and also in letters in the Journal de Paris. For example, in 1784 when Haüy was about to begin his great work of systematically educating blind pupils for the first time, he sent a letter to the Journal on 30th September (ibid., p.48) in which he wrote "... c'est à celle de Monsieur Diderot imprimée en 1759, que je suis redevable de l'idée d'un plan d'éducation à l'usage des aveugles" (sic). In 1760 the abbé de l'Epée opened the first school for the deaf and dumb, where Haüy gave practical help in teaching the pupils the manual alphabet and also to speak.

4. LA FOIRE ST. OVIDE

With such an interest and also practical experience in helping children with a major disability it is not surprising that Haüy was deeply distressed by a spectacle which he witnessed in 1771 at la Foire St. Ovide. Twelve blind men from the Quinze Vingts had been hired to entertain the crowds: "They were dressed up in ugly gowns and long pointed hats and wore huge cardboard spectacles without lenses on their noses. They were set in front of a desk with music and lights and produced a most monotonous sound, for the singer and the violins and the cello all followed the same musical part. ... behind their leader they placed a peacock's tail, fully spread, and on his head a Midas headdress." (Haüy, 1800, pp.9-10.)

The onlookers were highly diverted, but Haüy understood the utter humiliation of the performers, and the spectacle reinforced his determination to help bring purpose to the lives of blind people. He described (ibid. p.10) how for 12 years [13 according to the dates] he worked late at night to earn more money and even contracted debts in order to set up the first educational establishment for blind workers.

5. AIMS

In April 1784, the Journal de Paris announced the arrival in the capital of a young blind musician from Austria named Mlle. Maria von Paradis (Henri, 1984, p.45). Besides her musical ability which drew crowds to listen, she made copies of her music by means of pricks on paper rested on a soft surface. She also had a small printing press for correspondence with the sighted, with which she used pica fount (Haüy, 1786, trans. 1793, p.20). Unfortunately no record exists of the details of its construction (Levy, 1872, pp.315-318). Haüy endeavoured to find out all he could about her innovative means of communication, so he had several meetings with her and was much encouraged by her ready interest in his project to help the blind. "The aim we had before us was the following: to rescue the blind from that distressing and even dangerous burden which idleness creates; to help them find a means of livelihood in pleasant and easy tasks; to insert them into society; to comfort them in their misfortune and, it is above all, by collecting the results of their efforts in workshops and museums ..." (Haüy, 1800, p.11).

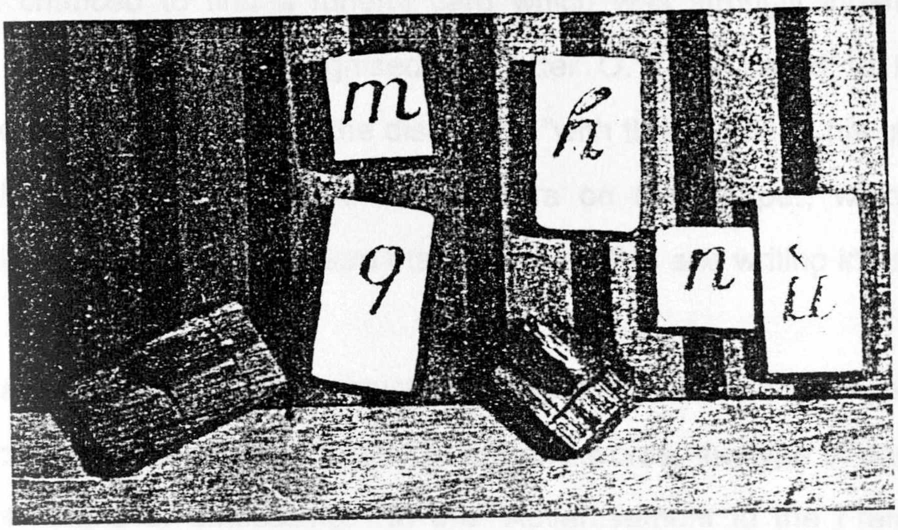
6. THE FIRST PUPIL

Henri (1966, p.12) described how Haüy selected his first pupil. He gave a silver coin to a young beggar who was sitting by the church porch of St. Germain des Prés, only to have the coin returned by the beggar who thought the giver had mistaken it for a coin of lesser value. This action led Haüy to draw conclusions about the young man's character and also his keen sense of touch perception. The beggar was Francois Lesueur, aged 17, whose daily earnings were taken home to support an elderly father, his mother and five younger brothers and sisters (de la Sizeranne, authorised translation from second edition by Lewis, 1893, p.61). At first, Lesueur spent half his day being taught by Haüy who recompensed him for lost earnings, and soon he was learning full time, resulting in the unusual situation of the teacher paying the pupil (ibid. p.61).

7. FIRST ATTEMPTS TO PROVIDE A MEANS OF READING

Haüy (trans.1793, p.12) was aware that "various but ineffectual experiments had been tried to provide a means of reading". Historically these seem to have been attempted in isolation. Guillié (trans. 1819, p.105) described how in the sixteenth century letters cut in wood were "sunk or made hollow, on which account the fingers were unable to trace the forms of the letters unless they were very large." In 1575 Rampazetto of Rome taught people to read by letters carved in relief on thin wooden tablets (ibid., p.105). The disadvantage of this system was that the letters were immoveable and a fresh tablet was required for each page. In 1640 Pierre Moreau, a notary of Paris, devised a system of moveable letters cast in lead (ibid., p.106), but the great expense prevented him continuing with the project. The idea of having separate type so that the letters could be reused was a definite advance.

Galliod (1828, Notice Historique sur l'établissement des Jeunes Aveugles, mss., p.1) described letters and numbers "carved in relief on the upper surface of wooden tiles and a protuberance on the underside which kept each tile in place in the vertical troughs cut out of a rectangular board" (Musée Historique and Musée Valentin Haüy). The following illustration demonstrates the uneven heights of the tiles which might have caused deciphering problems when used for reading on such a board.



Embossed tiles used by Haüy to teach reading and mathematics.

Henri, 1984, p.72.

Haüy (trans., 1793, p.12, footnote) believed that "It is without doubt by these means that the blind man of Puiseaux, of whom M. Diderot speaks in his letter to a friend p.8 taught his son to read". On the other hand Guillié (trans.1819, p.108) states that the blind man used letters of wood kept together by a metal bar threaded through the "tails" on the backs of the letters.

Though Haüy used such wooden characters when he first began teaching (Henri, 1984, p.49) he regarded such methods as "gross and imperfect utensils" which "only presented to the blind the possibility of attaining and enjoying the pleasures and advantages of reading without affording them the proper means of acquiring them" (Haüy, trans. 1793, p.12). The days of being able to read continuous embossed prose in books were still in the future.

8. THE INSPIRATION

Galliod (1828, mss., pp.1-2) described the exact moments when a means of literacy for the blind was first discovered. "One day, close by Haüy's desk, Lesueur chanced to find a funeral card which was strongly indented on the reverse side, where he recognised the letter O." He called to Haüy, who, understanding the potential of the discovery, "with the handle of his quill pen and with a little pressure, traced the characters on thick paper, which his pupil immediately recognised; this gave the idea of reading and writing in relief".

We know nothing of how Haüy must have experimented with the size and shape of the configurations, the spacing of letters and words, the type of paper and the technical means of embossing. In the "Advertisement to the French Edition" mentioned by Haüy (undated, trans. Blacklock, p.221), there is reference to appendices including "the Examples (sic) of the forms of the several operations in printing, which may be executed by the blind".

Lesueur proved to be intelligent and keen to learn, and by November 1784, he could "read an Extract de la vie de Saunderson" (sic) printed in relief for his use, make phrases from dictation, calculate and recognise embossed musical signs (Henri, 1984, p.51). Haüy had been fortunate in his first pupil but he needed more proof of the success of his project.

9. THE FIRST SCHOOL

La Société Philanthropique had been set up in 1780 (ibid., p.44). It was "an organisation composed of such benevolent persons as may be moved by a union of their efforts and their means to aid the poor and suffering" (de la Sizeranne, trans. 1893, p.55, from first notice of the society). In 1783 it was decided that specific groups of needy people should be supported including "twelve children of poor artisans, blind from birth or soon after" (ibid., p.55). Haüy used them to try out his methods further and the Société "satisfied with our first trials, they designed to intrust (sic) us with the care of these unfortunate people" (Haüy, trans., Blacklock, 1793, p.32).

At first Haüy educated the children in his own home, but when numbers grew he opened "a school for both sexes and instructed them with the help of his pupil" [Lesueur] (de la Sizeranne, trans., 1893, p.63). The accommodation again proved inadequate, so with the help of la Société Philanthropiqe, he was installed at No. 18, rue de Notre Dame des Victoires in February 1786 (Henri, 1984, p.57). This may be regarded as the official opening of l'Institut des Jeunes Aveugles, the first educational establishment for the blind. Henri (1966, p.134) considered that "the originality of Haüy's undertaking lay in the opening where a general education was available to all victims of blindness, to girls as well as boys, and no longer reliant on the privileges of good families or intelligence". For those who could not benefit from such instruction, Haüy intended to provide craft instruction leading to a trade rather than leave such people neglected and feeling unacceptable to the community.

10. PUBLICITY

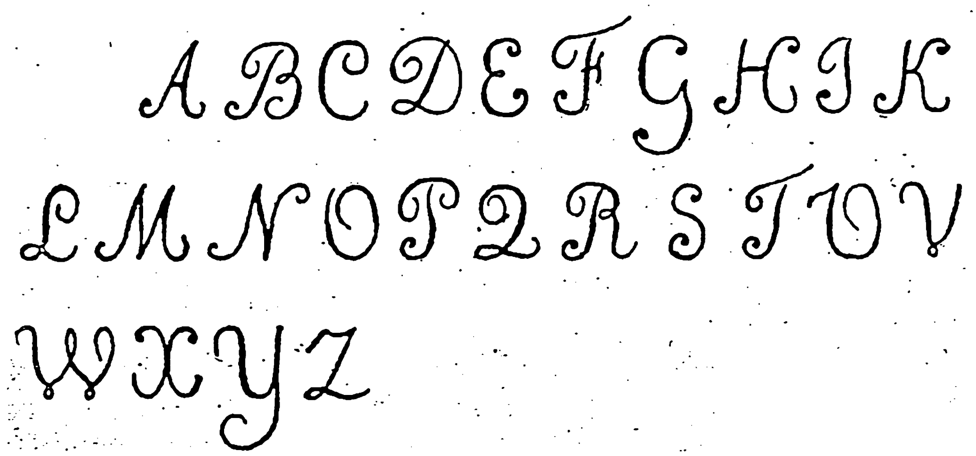
To help with the much needed financial backing, Haüy arranged for public demonstrations of the pupils' work. Some onlookers were impressed by what they saw and heard, but others accused Haüy of charlatanism. He responded by writing "l'Essai sur l'Education des Aveugles" (1786) in which he stated his aims, countered some of the criticisms and explained his methods.

The publicity Haüy needed for the school to flourish was given further encouragement when he and his pupils were invited to Versailles at the Christmas season, 1786, to give demonstrations of their achievements before the royal family (de la Sizeranne, trans. 1893, p.66). A copy of Haüy's "Essai" was presented to the king who promised support, with the result that it became fashionable to contribute towards the cost of the school.

11. HAUY TYPE

Haüy not only provided craft work for those for whom it was most suited, but his methods for educating Lesueur were developed for those who could benefit. He used upper and lower case script, choosing this form deliberately because he considered that it would be an easier mode for teaching writing. He had taught orthography to the sighted for many years and samples of his correspondence (e.g. Henri, 1984, p.29) show that he included the fashionable, more complicated capital letter signs.

He needed to reduce the embossed shapes to their simplest forms for tactile reading. He kept the lower case letters fairly simple, but the capital letters were still very complicated as shown in the following illustration.



Capital letters in Haüy type.

Henri, 1984, p.72.

Haüy's mistake was to consider that because a letter is easy to interpret by the eyes, there should not be too much difficulty in using only slightly adapted shapes to interpret by touch. To help with recognition, he made the letters much larger than those used for inkprint resulting in very bulky books. Guillié (trans.1819, p.111) made improvements influenced not only by his own sighted opinion, but by consultation with some of the ex-pupils of the school.

12. PRINTING

The processes carried out by Haüy's pupils of composing, adjusting and impressing when producing embossed books were similar in many respects to those used at that time for inkprint books (Haüy, trans. 1793, p.12). The main differences were that the type was specially cast in the form in which letters would be read instead of being in the reverse pattern, and the paper used was very thick, needing greater pressure in the press. It was dampened before being placed over the tray of type, then covered with several thick pieces of flannel before pressure was applied. A very sturdy press was required for this work.

For material to be read by both blind and sighted people, "Haüy Noire", was provided in which the embossed letters were emphasised in black; "A parchment tympanum smeared with ink was put gently on top of the sheet of paper and under the flannel before pressing took place" (Galliod, 1828, mss. p.4).

13. WRITING

Haüy attempted to teach writing to his pupils. Paper was placed on a fairly soft surface, such as leather or sheets of newspaper, and, "using a pen of iron, the top of which was not split, and with which writing without ink, and supported with a strong paper, they produce upon it a character in relievo which they can afterwards read, in passing their fingers along the elevated lines on the back of the page" (ibid., p.10). The paper was kept in place by a wooden frame, and the catgut strings were stretched horizontally at intervals down the frame to help keep the lines straight [Musée Valentin Haüy]. It was a slow and difficult method and only found feasible by a few students who had previously had vision.

14. FOUR CRITICISMS ANSWERED

At a time when many people were illiterate, education of the blind was regarded as superfluous and Haüy received criticism concerning his aims (Haüy, trans., 1793, pp.14-17), though he did not specify by whom the remarks were made. Many public demonstrations of the pupils at work were given in order to gain publicity and financial support so he was likely to hear opinions from the onlookers on such occasions. Wisely, he met these criticisms with direct replies (ibid.), for at that time the school depended entirely upon public support.

"*The elevation of your characters will doubtless be very soon depressed and of consequence no longer be perceptible to the blind by touch*". Haüy replied (ibid., p.14) "our pupils distinguish a typographical character by feeling, which may elude even a microscopic eye ... they read a series of words, after the elevation of the letters is depressed". Teachers of braille today find that beginners are liable to depress the dots until a light touch becomes habitual, and the early stages of a reading scheme may need replacement because newly embossed pages give better results. Haüy's volumes of embossed alphabet letters were very expensive and time consuming to produce so it is possible that he did not wish to face this issue.

"*Your books are too voluminous*". Henri (1984, p.59) quotes dimensions of Haüy volumes given by Guilbeau (1907):
"Page 20 x 27 cm; 11 lignes de 24 'lettres'."

Haüy replied (1793, trans. p.14) that embossed printing was in its infancy. In fact, Haüy, like many others before and since, thought that large letters would be easier to read. Guillié (director of the school 1814-1821) wrote (trans. 1819, pp.108-109) "The letter founders who fifty years ago cast the first letters in lead, made them larger than was necessary always supposing that they would be more easily recognised than those ... which we use now. Experience has since proved that it is not the size, but the perfection of form of these letters which helps the blind to distinguish them ..." It took many years for these words to be fully understood.

In his Essai (trans. 1793, p.14) Haüy suggested that "a judicious abridgment" would help overcome the problem of volumes that were excessively large and he proposed the development of a system of contractions. In 1787 he began printing some books using a system of dashes and dots above or below the line to indicate where some of the more frequently occurring letters had been omitted. For example:

vowel with upper dash	$\bar{a}$	$\bar{e}$	$\bar{\imath}$	$\bar{o}$	$\bar{u}$
	an	en	in	on	un
	(or vowel followed by an m)				
vowel with lower dash	$\underline{a}$	$\underline{e}$	$\underline{o}$		
	au	eu	ou		
consonant with lower dot	$\underset{\cdot}{b}$	$\underset{\cdot}{c}$	$\underset{\cdot}{d}$	etc.	
	bb	cc	dd		
other selected examples	$\underline{d}$	$\bar{q}$	$\dot{q}$		
	du	que	qui		

The use of such contractions appeared in "Catéchisme du Diocèse de Paris" printed in 1787 (a facsimile of page 97 appears in Henri, 1984, p.60). The method did not help the main problem of identifying letters, and was likely to have made perception even more difficult because the reading finger would have had to move up or down to perceive the extra symbols and at times may not have registered their presence. Haüy seems to have discontinued using this device and his successor did not repeat the experiment.

"*... your blind read slowly, and the spirit of the most animated composition will evaporate beneath their fingers, while the words are languidly pronounced without energy and without emotion.*" Haüy explained (ibid, p.15) that his pupils were bound to read more slowly than the sighted because they could only perceive one letter at a time. He considered that with frequent practice in the use of his proposed contractions they would proceed with "greater quickness". He added a comment which showed an attitude that was to be very prevalent among the well-wishers who encouraged codes for the blind in Britain some 50 years later, "Let them find this exercise an effectual remedy against that intolerable melancholy which corporeal darkness and mental inactivity united in the same person are too apt to produce".

"*But what good purpose will it serve to teach the blind the letters? Why instruct them in the art of printing books for their particular use? They will never be able to read ours. And from the knowledge which they will require by reading, will any considerable advantage result to society?*" (ibid., pp.15-16). Not surprisingly considering Haüy's ideals for the blind, the questions show how little understanding there was of the needs of those without sight. In answer to the last point of the question, he reminded them (ibid., p.16) of the blind man of Puiseaux whom Diderot once saw teaching his sighted son to read. He added that the teaching of a blind person to read provided him with "the dearest prerogative of intellectual existence".

15. 1791-1801

While Haüy was seeking to get his school firmly established and was demonstrating the achievements of his pupils in public, the political clouds were gathering preliminary to the deluge of the French Revolution. He had already reached the climax of his career, and had he lived in more settled times his work would probably have continued quietly and with less challenge. Fewer funds might have been forthcoming once his aims and methods were no longer a novelty and it became less fashionable to give support to the less fortunate. Those who had helped the blind in anticipation of them becoming self-supporting, would probably come to realise that Haüy's method was indeed slow and not possible for all. Even so, the idea of education of the blind, both intellectually and manually, seemed to have come to stay.

As the events leading to the horrific stages of national revolution gathered speed there was a real danger that with financial support dwindling as his benefactors became emigrés fleeing for safety overseas, the school might be closed. Haüy realised that at all costs his work must survive even though there was the possibility that with his radical thinking as well as his royal acclaim, he might himself be compromised.

Haüy seems to have made no attempt during these years to make any educational improvements, possibly because he was constantly harassed by other matters. Food and fuel were often in short supply, and the situation was not improved when the school was nationalised in 1791 for the government had no money to spare (Henri, 1966, p.18). There was an uneasy alliance with the school for the deaf and dumb during 1791-6, a move which was psychologically unsound because the needs for both handicaps are so different and require very different training.

In 1793 Haüy became Secretary to the Committee of the Revolution in the district of the Arsenal, a position which brought him many enemies and he even found himself in prison on three occasions (Henri, 1984, p.106, footnote). He took a leading part in a grand ceremony sponsored by the Committee of Public Safety specifically in "support of the unfortunates", and for this participation he was later to be taxed with terrorism (de la Sizeranne, trans. 1893, p.72). He also joined a new cult known as Theophilanthropy which came to be regarded with derision because of excesses of symbolism and sentiment (ibid., pp.76-86).

16. NAPOLEON AND L'INSTITUT DES JEUNES AVEUGLES

The school for the blind was included in Napoleon's review of education throughout France. Haüy's optimistic efforts to ensure education and employment for many of his blind pupils had been disappointing, and his record of changing allegiance in efforts to sustain his school was disastrous for his reputation. In desperation he wrote three "Notes" to the authorities in his defence (1800), the third specifically described in more detail his work of educating the blind. In conclusion, he wrote (ibid., p.16) "... if this establishment is destroyed ... I shall rebuild it".

Napoleon was not impressed. Haüy was dismissed and the pupils were sent to form an annexe at the Quinze Vingts where they were taught mainly craft subjects (Dufau, 1852, p.7). Meanwhile, Haüy kept his word. He had been granted a small pension (Henri, 1984, p.124) yet he opened a small establishment for "blind workers" (ibid., p.124). It was not to flourish long because of an unexpected request.

17. THE YEARS IN RUSSIA

In spite of difficulties at home, Haüy's influence was to spread. The tzar of Russia, Alexander I, had received reports of Haüy's teaching, so he was invited to St. Petersburg to advise on the setting up of an institution for young blind people (Henri, 1966, p.20). He set out on the long journey in 1806, with his family and Fournier, one of his best pupils. On the way he was received at the Berlin Academy of Sciences (ibid., p.22) where he demonstrated his methods to the king of Prussia, and as a result a school for the blind was inaugurated. The future king Louis XVIII of France received him at Mittau, near Riga, and he too was impressed by Fournier's capabilities (ibid., p.22). By contrast, in spite of the royal invitation, Haüy found no preparations to welcome him at St. Petersburg, and after a year without pupils, his request to start work was greeted with a smile and the words, "We have no blind people in Russia!" (ibid., p.22). Eventually, he was provided with a building and some pupils and one very inefficient teacher. Haüy remained 11 years before he returned home a sadly disillusioned man.

18. HAUY'S LAST YEARS

Haüy had seen his great project founder and his stay in Russia had been beset with difficulties. Meanwhile, Louis XVIII who had met Haüy at Riga had been instrumental in the reopening of the school in Paris in 1814 under the new title l'Institut Royale des Jeunes Aveugles. The new director, Guillié , refused to let Haüy visit the school, perhaps because Haüy had left under a cloud, or perhaps Guillié wished to claim any success of his scholars. In his book (1819) he made no mention of Haüy in the main part of the text. Haüy died in March 1822.

19. CONCLUSION

Posterity has recognised Haüy's great pioneering work though he has been overshadowed by the name of Louis Braille who provided the lasting benefit of a punctiform code that is now used world wide. Haüy was the first in the western world to attempt to find a practical solution to the fact that the blind need to be recognised in their own right as people who should be regarded as citizens, able to make their own contribution to the general good. He opened the first school for the blind and was instrumental in the spread of institutions in Europe, and the reopening of the Paris school was largely the result of his fortuitous meeting with the future king Louis XVIII. He was also the first to provide a means of embossed reading and showed how books could be printed for use by his pupils. Others coming after a pioneer can benefit from previous mistakes. Haüy, in his desire for his pupils to be as much like the sighted as possible, chose an unsuitable embossed type, not fully understanding the perceptual problems of the Roman alphabet. He thought that reading merely involved using the same shapes but embossed and enlarged. New knowledge brings new methods.

CHAPTER 2

LOUIS BRAILLE (1809-1852)

1. COUPVRAY

2. L'INSTITUTION ROYALES DES JEUNES AVEUGLES

3. CHARLES BARBIER

4. BARBIER AND BRAILLE CODES COMPARED

5. 1928 PROCEDE

6. WRITING

7. 1829-1837

8. 1937 PROCEDE

9. NOUVEAU PROCEDE

10. THE PLANCHE A PISTONS, LATER KNOWN AS THE RAPHIGRAPHE

11. EPILOGUE

    Printing

    The Diffusion of the Braille Code

12. CONCLUSION

1. COUPVRAY

Louis Braille was born in 1809 at Coupvray, a small village lying approximately 40 kilometres (25 miles) east of Paris. His father was a master craftsman, the village saddler and harness maker, and both he and his wife could read and write. There were four children, Louis being the youngest by nearly 13 years. He was involved in an accident when he was only three years old. It is possible that the account given by Hypolyte Coltat (1853, p.14), Braille's pupil and later close friend, may be the most accurate available: "One day, when he was three years old, the child was sitting beside his father and wanted to work too and copy the movements he saw his father making. In one little hand he caught up a piece (strip) of leather and in the other the knife and started to work. Weakness frequently encounters difficulties and this is what happened. The sharp tool slipped sideways and struck the poor little workman in the eye."

Louis became blind in one eye and by the time he was five, he was totally blind. He attended the village school where he showed such ability that arrangements were made for him to attend l'Institut des Jeunes Aveugles in Paris from 15th February, 1819, when he was 10 years old (Pignier, 1859, pp.8-9).

2. L'INSTITUTION ROYALE DES JEUNES AVEUGLES

The building was different from the one Haüy left in 1802. The present buildings were cramped and unsuitable in design; the report of the consultant physician, dated 8th March, 1821, stated that "The house is situated in a low-lying district which is airless, evil-smelling and conducive to the spread of disease" (Henri, 1952, p.15). On the 1st March, 1832, the "Moniteur" gave an account of part of the session of the Chamber of Deputies in which the commission on the state of the school was being discussed "The house occupied by l'Institution Royale des

Jeunes Aveugles is very unhealthy. Mortality among the pupils is extremely high ..." (ibid., p.17). Delays in providing better accommodation continued, until Lamartine, poet, historian and statesman, made an impromptu speech at the bar of the house in 1832 (ibid., pp.17-18) which finally persuaded the authorities to provide a specially planned new accommodation. The new buildings were opened in 1843. Health at the school has been mentioned because it is without doubt that these living conditions were directly responsible for the tuberculosis from which Braille suffered for many years and which led to his early death when he was 43.

Pignier, the third director of the school, described (1859, pp.9-10) Braille's more than average ability and added, "His compositions, whether literary or scientific, contained only the exact notions; he was noted for the precision of his thought and the clarity and correctness of his style. One was aware of imagination; but it was always subject to his judgement". He won prizes for a wide variety of subjects. [An arithmetic prize bearing the signature of Pignier may be seen at the Braille Museum in Coupvray.] He was made foreman of the workshop where slippers were made when he was not quite 15 and was officially appointed tutor four years later (Henri, 1952, 29-30).

3. CHARLES BARBIER

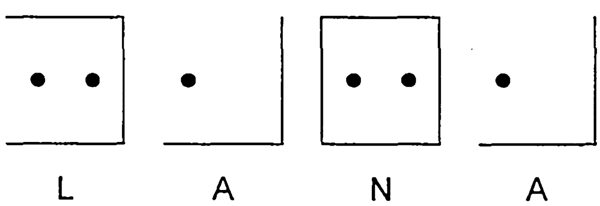
In 1823 when Braille was 14, a retired army officer, named Charles Barbier, visited the school to demonstrate a new method of embossed reading (Henri, 1947, pp.9-10). He believed that illiteracy was caused by difficulties inherent in the use of the alphabet and so he determined to simplify and thus speed up the process. Amongst other experiments he wanted to find a means of sending short messages secretly and quickly on the field of battle without a torch or lantern betraying positions to the enemy (ibid., p.6).

He was interested in codes and secret writing, so it is likely that he knew of a book published in 1803 by Coste d'Arnobat (Henri, 1952, p.40). It included a description of a code invented by Father Lana in 1617, which seems to be the first known means of punctiform writing. The system was never put into practice, but is of interest because knowledge of it may have stimulated Barbier's work.

Lana used a system of dots on a 3 x 3 grid, each dot or dots representing a letter of the alphabet:

A O	G P	B T V
F L	M N	E S P
C J	H R	D I Z

K, Q, U, W, X, and Y do not appear but both the French and English editions of Henri (1952, trans. 1987) show P appearing twice, probably due to a printing error. No explanation seems available to explain what criteria determined the position of the letters and if frequency was involved. To represent a letter it was necessary to draw the relevant part of the grid and include one, two, or three dots according to what was the first, second, or third letter of the group of letters written within it. "Lana" would therefore be represented by:



In 1809 (Henri, 1952, p.37) Barbier produced a pamphlet which included a description "d'écriture coupée pour suppliéer la plume ou le crayon et exécuter plusiers copies à lá fois sans tracer de charactères" (cut-out writing for which a penknife is used as a substitute for pen or pencil, so that several examples can be produced at once without copying). Though the intention was to duplicate copies, and at this stage Barbier was not considering work for the blind, it shows a step in the development of tangible writing. Short commands on the field of battle would require no punctuation. Barbier, therefore, worked out a punctiform system intending it for use in the army, but instead the Académie des Sciences recommended the system for use by the blind. In 1823 de Lacépède and Ampère, representatives of the Académie, carried out an experimental test which demonstrated the potential of the Barbier code for use by the blind (ibid., p.44).

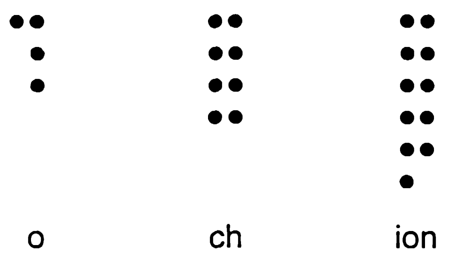
There were two stages to Barbier's system. His key to the code consisted of a grid made up of 36 rectangles, each containing one of the phonetic sounds into which he divided the French language. The rows of rectangles were numbered 1-6 down on the left and the columns of rectangles were numbered 1-6 across the top.

KEY TO BARBIER CODE

	1	2	3	4	5	6
1	a	i	o	u	é	è
2	an	in	on	un	eu	ou
3	b	d	g	j	v	z
4	p	t	q	ch	f	s
5	l	m	n	r	gn	ll
6	oi	oin	ian	ien	ion	ieu

Thus, each sound could be referred to by two numbers, first the row in which it appeared, followed by the number of the column. o would therefore be represented by 1-3, ch by 4-4, ion by 6-5, etc.

The sounds could also be represented by dots arranged on a matrix of 6 x 2. The first row of vertical dots would show the line position and the second the column position. For example:



This system requiring two stages, first of remembering the meanings and positions on the grid and then the necessity of using so many dots for the symbols must have slowed up the processes of reading and writing, but it was welcomed because tangibility is of prime importance. The earliest writing board consisted of a narrow strip of wood with six horizontal grooves on which was fixed a metal clip to hold the paper in place and regulate the width of the line of writing.

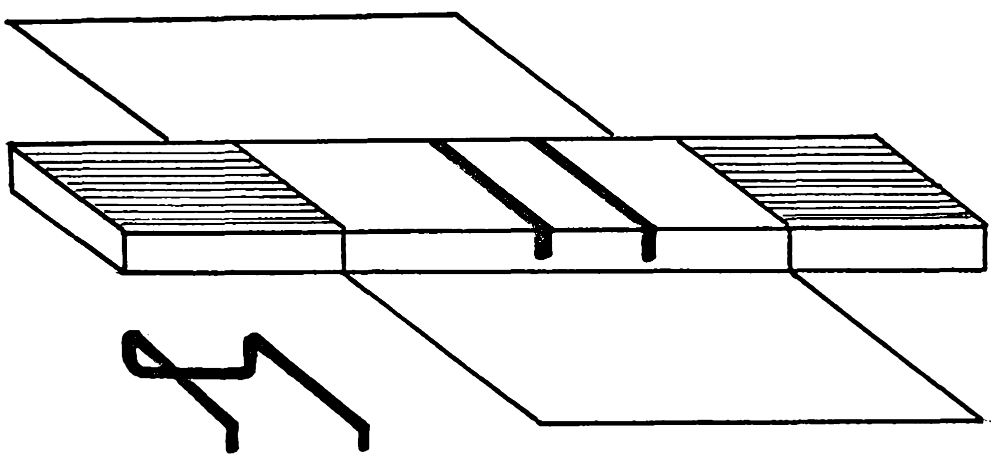


Diagram of Barbier writing board.

Later a simple guide was provided which was easier to use and gave more accurate results. The hinged guide had a grooved lower surface and the upper surface had slits, tall enough and wide enough for the possible 6 x 2 impressions in each. A pointed style was provided for making the dots. A larger frame was also available, again hinged so that it would open like a book for the paper to be inserted and which was capable of taking eight lines of code [Musée Historique, Musée Valentin Haüy and Coupvray museum].

The more intelligent pupils, who may also have had a more developed sense of touch, must have been delighted by the results. Not only could they read the embossed patterns more easily than those in the Guillié books, but for the first time there was a possible means of writing. This simple equipment was provided for those who wanted to practise and permission was also given for the frames to be taken home for use during the holidays.

With further practice some of the pupils became more critical, and Braille, who was particularly interested, asked if he could meet M. Barbier in order to make "some suggestions". According to Pignier (1859, p.14), Braille "pointed out to M. Barbier several improvements in this kind of writing and also solved some of the difficulties to which M. Barbier had for a long time been seeking solutions".

It is not clear when this conversation took place, but Barbier tended to be irascible and did not appreciate the criticism of his code. The report of l'Académie des Sciences 1823 stated "Ordinary writing is the art of speaking to the eyes, that discovered by M. Barbier is the art of speaking to the fingers" (Henri, 1952, p.44), so with such a testimony, together with his own assurance, it is no wonder that he did not appreciate young Braille's "suggestions". Even so, in the "Avertissement" which appears at the beginning of the first edition of Braille's code (1829, p.1) he wrote "If we have shown the advantages of our procédé over those of this inventor, we should like to say in his honour that it is his procédé that first gave us the idea of our own".

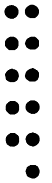
In 1827 "Recueil d'anecdotes, extrait de la monde en action" was printed in Barbier code and Henri (1947, pt.3, pp.10-11) demonstrated some of the problems that Braille had recognised before this publication. The essentials of Braille's code were ready by 1825 when he was 16 but not published until 1829.

4. BARBIER AND BRAILLE CODES COMPARED

In the "Recueil d'anecdotes", [Musée Valentin Haüy] "anecdote" appears as "anegdote" and "Monsieur" as "Mossieu". In the pronunciation of the French language the sounds of a silent letter at the end of one word is carried over to the beginning of the next if it begins with a vowel. Therefore, as Barbier's method was phonetic, "fait-en" became "fai-ten" and "en action" became "en naction". Punctuation was omitted and no spaces were left between words. For short messages for the soldiers Barbier had thought these details unnecessary. The fact that he had not included them by the time his night-writing (later to be known as sonography) was introduced to the blind pupils demonstrates, either that he had not found a means of showing punctuation, or had not realised its value for clarifying meaning. He was a code maker and not an educationalist. Construction of words and the use of punctuation are necessary for an understanding of the language and its lucid, flexible and imaginative use, and it is also essential for translation of foreign languages. This was to be of great importance in the future when the braille code would be adapted for use in many other tongues.

The second main difference lies in the size of the configurations. Braille halved the possible number of vertical dots in a cell resulting in a matrix of 3 x 2. The signs were thus immediately under the reading finger, no up and down movements were necessary and therefore reading could take place at a faster rate. Barbier's 6 x 2 matrix gives the possibility of 4,096 (2^{12}) combinations which is grossly in excess of need, and in fact he only used 36. Braille realised that 3 x 2 (2^6) gives 64 possible combinations, including a blank cell which was used for spaces between words. This was quite sufficient for the first simple versions of his code.

Barbier's dot positions depend on the position of the sounds in his key grid whereas Braille's use of full spelling made this extra stage unnecessary. All the dots in Barbier's code are used until the line or column position is reached, that is, the cell always includes dots starting from the top of the cell but of varying length downwards. Some of the cells must inevitably seem very similar. For example, it would be difficult to realise tactually the difference between:



and

ll f

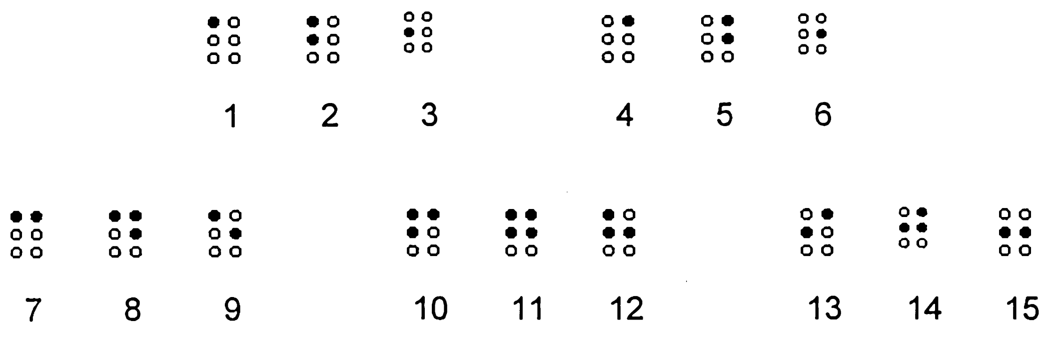
Later research (Nolan and Kederis, 1969, 38, Table 1) has shown that the dots in the lowest part of the cell are the more difficult to detect, yet in Barbier's code the emphasis must be on the lowest ones for recognition to take place. Braille, as an intelligent blind person, would have been more aware of the confusions that often arise in touch reading and he tried to avoid them where possible. Barbier, being sighted, may not have been so aware of such problems.

5. 1829 PROCEDE

By 1829 Braille was ready to have his work published, so he dictated the prose to Pignier, with the interesting result that the text is embossed in Guillié script and Braille wrote the examples in embossed point (Pignier, 1859, p.16) [Musée Valentin Haüy]. The title, "System for writing words, music and plainchant for the use of the blind and arranged for them by M. Braille" gives a clear indication of its contents. Braille had cogitated for a long while and made many trials including a transcription of portions of "La Grammaire des Grammaires" in 1827 to test his system (Pignier, 1860, p.82) [musée Valentin Haüy]. All the testing was carried out with the co-operation of pupils at the school so he had no experience of the use of his code by adults, except perhaps by some of the blind tutors, or the effect of old age in the mastery of his code.

People have often wondered how the first 10 letters of the alphabet were planned. At first they seem arbitrary yet they are particularly important because most of the rest of the code is based on these shapes. Gaudet, a master at the school, was a protagonist of the use of the code at a time when the authorities still frowned upon its use. He used the occasion of the inauguration of the new school buildings in 1843 to give a speech entitled, "Account of the system of writing raised dots for use by the blind" (Roblin, 1952, trans. 1955, p.55). As Gaudet knew Braille personally, his version is probably correct (Henri, 1952, pp.51-53).

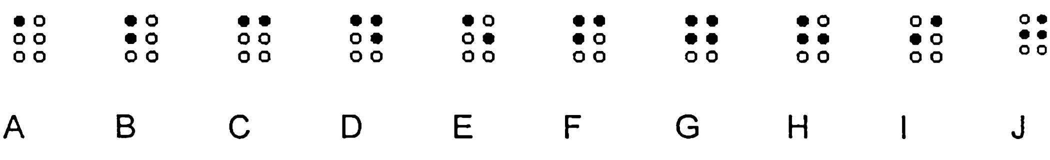
For this explanation only, the signs are numbered 1-15. For the first 10 letters of the alphabet he took all the 15 signs possible in which variations in position of the top four dots occur and arranged them in a logical order.



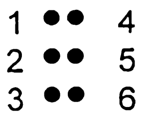
The first six signs are made up of the possible patterns using the left side of the cell, and then the corresponding ones on the right; he then combined the signs in the following order:

1 and 4, 1 and 5, 1 and 6, giving signs 7, 8, and 9.
2 and 4, 2 and 5, 2 and 6, giving signs 10, 11, and 12.
3 and 4, 3 and 5, 3 and 6, giving signs 13, 14, and 15.

Being blind and therefore knowing at first hand what was best for tactile reading, Braille eliminated all the single dots except the first one because location was a difficulty factor (numbers 3, 4, and 6). He also eliminated 5 because it could be confused with 2 and 15 was eliminated because of confusion with 7. The remaining signs became the first 10 letters of the alphabet.

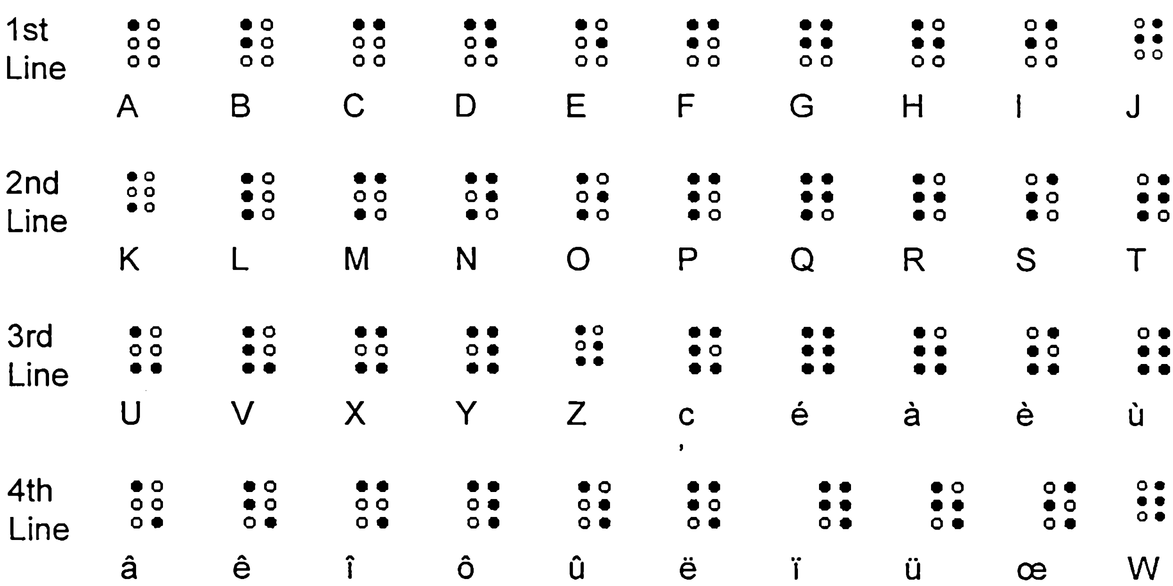


Braille did not number the dots within the cell but instead described their position in words; his second procédé of 1837 made a greater use of diagrams. Levitte (1880), basing his account on the work of a colleague named Ballu, used the following method:



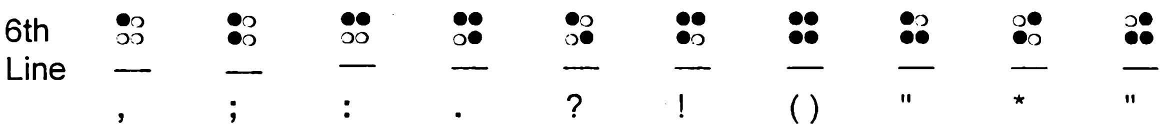
The numbering was altered in later years and then changed back to the earlier version; to save confusion this earlier method will be used throughout this work.

Much of the remainder of Braille's code was built up in further lines of 10 characters each having some addition to the base signs. For example, line two has dot 3 added to each sign, line three has dots 3 and 6 added and line four has dot 6 added.

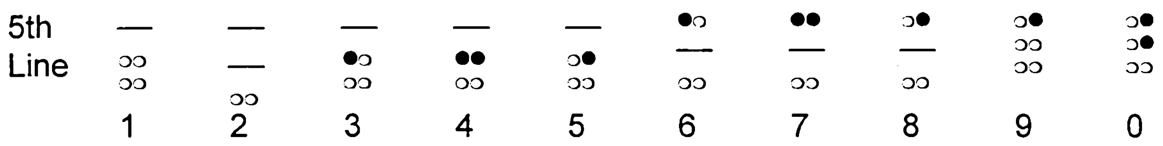


W appears at the end of the fourth line after the French modified letters instead of after V as would be expected, and there is an interesting reason for this described by Guilbeau (1907, p.47). At first, Braille was thinking in terms of classroom use such as for taking notes. One of the English pupils suggested that the W should be included because of its use in foreign languages, his own included, and that it would be needed for translation purposes. As it was not part of the French alphabet at the time it must have seemed logical to Braille to include it at the end of the accented letters.

Leaving the fifth line aside for the moment, it will be seen that line 6, for punctuation, uses all the signs of line 1 with the addition of dashes in the lowest parts of the cells.



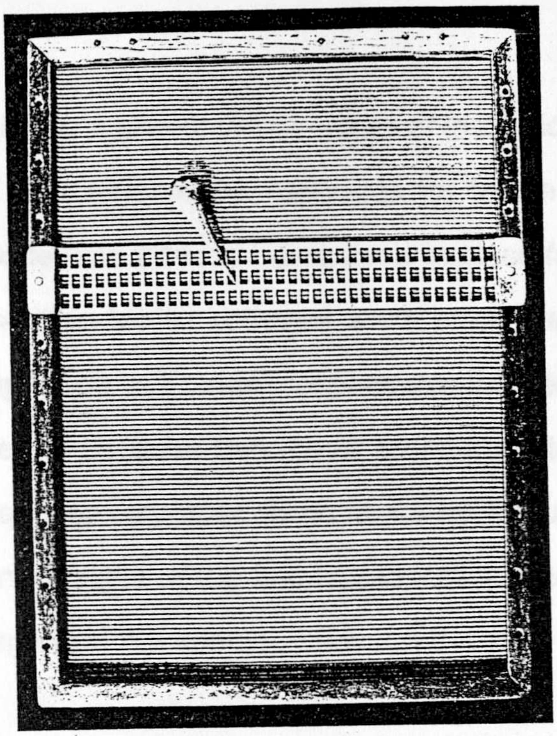
Line 5 used for numbers shows no resemblance to line 1, but here too it is possible to see the logical way in which Braille chose the configurations.



It was possible to write the dash used in signs for punctuation and numbers because the board had horizontal grooves, but Braille indicated in his "Procédé (1829, p.12) that the dash had been found difficult to make with a style, so another method would be found for writing numbers. He continued to experiment for he was a perfectionist. The remaining lines of the code were used for mathematics and music and there are a few signs with no meaning attached. He also included "a stenographic system in which 20 signs sufficient for writing all the words in the French language" ("Avertissement", p.1).

6. WRITING

For writing, the apparatus was not unlike the hand frames still used by a few people today but with some important differences.



Braille's own writing frame showing grooves all down the page.

Guide du Musée Association Valentin Haüy, Fig. 12.

The board was hinged at the top to a frame that held the paper, and down the upper surfaces of the sides of the frame there were a series of depressions. For each line of writing the board held three parallel grooves. The guide, made of a single piece of metal with two or three rows of cells, could be moved down the page as required by fitting the knobs on the under side into the depressions on the frame. The central part of the guide had to be lower than the edge so that it was in contact with the paper. A style was provided for making the dots, and each shape had to be made in reverse and the words written from right to left along the line so that they would appear in the correct reading order when the page was turned over.

7. 1829-1837

The authorities, and later some of the directors of institutions for the blind abroad, did not understand how suitable the code was for tactile reading and writing. In France the braille code was already being used in class for writing exercises and in 1832 two hand written braille volumes were printed entitled "Géographie de l'Asie" and "Géographie de la France" respectively [Musée Valentin Haüy]. They are of particular interest because they show an interim stage in the development of the code. Dashes were replaced in numbers by the use of the numeral sign. It was placed in front of signs of the first line to indicate numbers 1-9 and 0. The letters were very large and the spacing between the dots within cells was at least 3 mm.

In 1834 Fornier made the first attempt to adapt the writing frame so that writing could occur on both sides of the paper. By leaving the height of one cell between each line of writing on the first side of the page it was possible to write between the lines on the second side.

Music is not included in the brief of this work, but it is interesting for musicians to know that it was also in 1834 that Braille decided to use the first four lines of the code to denote pitch and sound values. Contrary, therefore, to many people's belief, the literary code was developed first and the signs of the literary code were the inspiration for the music code. Braille, himself, was a fine musician. Thirty-six pages dealing with the music code were added to the 1829 procédé in 1834 and l'Institut des Jeunes Aveugles owns Braille's own copy.

By the next year Braille was to suffer times of great tiredness and he had a violent haemorrhage, the first sign that he had tuberculosis of the lungs. In 1843 the school moved to new spacious buildings which are still in use today, but it was too late for Braille for the damage had been exacerbated by conditions in the old damp and cramped buildings.

Pignier (1859) paid tribute to Braille as a distinguished teacher. His work was supplemented with short treatises on the subjects he taught. One of these books entitled, "Petit memento d'Arithmétique à l'usage des commer, cants, contenant les nombres entiers et les fractions, décimales, suivi de cent problèmes" (musée Historique) is described by his friend, Coltat (1853, p.16) as "un chef-d'oeuvre de clarté et de concision". Maybe these short books were produced because there were so few text books available, but it is also possible that they were produced to save too much use of his voice during frequently occurring bouts of tiredness, or to help his pupils during his absences that were sometimes necessary for recuperation. Collat (1853, p.16) quoted Braille's view that: “Since our methods of writing and printing take up a lot of space on paper, we must compress the thought into the fewest possible words.”

8. 1837 PROCEDE

The first edition of the procédé had gone out of print, so Braille prefaced the second edition (p.2) by writing, "We are taking advantage of this fact to add some useful observations and ingenious applications which we owe to the kindness of several distinguished colleagues".

Line five for numbers had the dash eradicated and instead the signs of line one became numbers when prefaced by the numeral sign ⠼ written close up before each sign.

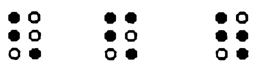
This sign was first used in the "Géographies" of 1832. Fractions were also prefaced by the numeral sign followed immediately by the numerator in the upper position and the denominator placed next in the lower position. Examples given by Braille were:

2/3 7/10

This method is still followed in many countries today.

In the promised new version the signs in the sixth line for punctuation showed the cells of the first line in the lower position of the cells.

In consideration of the slow rate of reading and writing and of the space the code required, the 1837 procédé provided second meanings for the signs of the fourth line, for example:



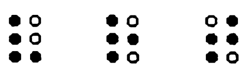
ê ë ü

in ou ch

Simple rules for the formation of shortform words are also included (ibid., p.21). Among Braille's examples are:

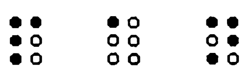
the omission of vowels immediately following a consonant;

verity vrt



if two vowels follow a consonant the first is omitted;

piano pan



Being a musician this would be a most useful shortform easily recognised in context, though there are two other meanings of "pan" in an unabbreviated form in the French language.

initial vowels must not be omitted;

utilité utlt

By now Braille was thinking of the dissemination of his code abroad, so he included parts of the Lord's Prayer in Latin, French, Italian, Spanish, German, and English and copies of the procédé were "sent to all the institutions for the blind then in existence, Philadelphia, Glasgow, Edinburgh, Brussels, Madrid, Budapest, Copenhagen, etc." (Pignier, 1860, p.107). The work also includes a description of the writing apparatus which is similar to that used in 1829. Braille added the practical comment that boards were now made of metal because wood did not last.

In 1837 the first printed book in braille was produced. It was in three volumes and entitled "Précis sur d'histoire de France" [Musee Valentin Hauy]. The first huge volume of format 22 x 28 sq. cms. weighs 1,750 grammes even though it has only 152 pages. The pages were stuck back to back as had been done for the Haüy volumes. Each page contains 25 lines with an approximate average of 34 letters to the line and the spacing between dots, instead of being 3 mms. was reduced to 2.4 mms. "... for reasons of economy only one design of type was cast embossed with all six dots of the cell. It was the pupils and tutors who, with a chisel, chipped off all the superfluous dots" in order to produce the separate letters required for printing the book (Henri, 1952, p.75). It was a remarkable instance of patience that inspired the pioneers in support of Braille's work. A wider appreciation came in 1854 when the Emperor of Brazil ordered a

Portuguese primer and paid for a new and complete set of type for the purpose. [A copy is exhibited at the Coupvray museum.]

Even though the authorities did not officially approve of the use of the braille code, Pignier permitted its use in the school because it improved the rate of reading and writing. In 1840 the deputy director, Dufau, became director and Pignier had to accept early and unwelcome retirement. Unfortunately, at first Dufau did not wish the code to be used and the pupils had to work with Dufau's improved version of Roman alphabet letters. Gaudet, his second master, persuaded him of the merits of the braille code, and when the new school building was inaugurated (1843), Gaudet took this public opportunity to give "un substantial exposé" (ibid., p.76) in praise of Braille's code. Though it was then used in the school, and in fact had never ceased to be used privately by the pupils, it was not until 1854, two years after Braille's death, that his code at long last became officially recognised for use in France.

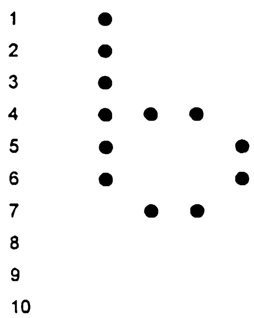
9. NOUVEAU PROCEDE

Braille regarded the 1837 Procédé as the definitive version of his literary code. It is not often realised that having devised a means for the blind to read and to communicate with each other, he then sought a method by which blind people could write in such a way that there could be recognition by vision as well as touch. He had learned to read by the Guillié version of Haüy's embossed linear script when he had first come to the institution, so would already have been familiar with the alphabet code used by those with sight. He now proposed to make approximations of the alphabetic shapes in dots, a simple task for someone with sight, but probably requiring many trials and much patience by a blind man. A writing frame on which equidistant dots could be made was now necessary.

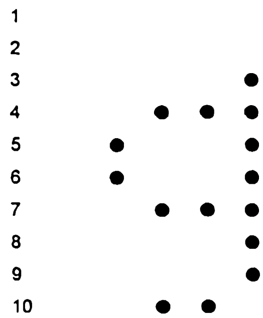
In 1839 Braille published his "Nouveau Procédé pour représenter par des points la forme même des lettres, les cartes de géographie, les figures de géométrie, les caractères de musique, etc., a l'usage des aveugles". Always precise, Braille's titles are apt to be long, even though the inkprint edition contains only nine pages of explanation and four pages of numerical tables for forming the letters.

The method is simple and probably did not take as long to learn as it may seem at first, but writing must have been tedious because of the necessary strings of numbers to be remembered in making each letter. Lower case letters required a height of four dots for the main part of the sign and three dots were allowed above or below for the extended parts of the letters. A height of seven upper dots were used for the capital letters. Numbers and punctuation were carried out on the same principle. The board required 10 horizontal grooves per line of writing and the guide was a fine grille making equidistant dots possible. One space was left between words.

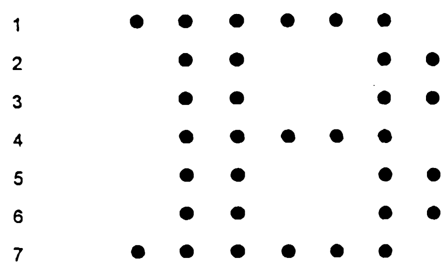
The plan of how the letters should be made has been compared with charts for tapestry designs; this is a visual opinion. Braille arranged for large scale models of dotted letters to be made so that his colleagues could become familiar with the punctiform shapes, but for writing by blind people he produced numbered rows of figures which were much easier for tactile use. The following examples show first, two lower case letters and then an example of a capital letter. (The signs have been enlarged.)



1 2 3 4 5 6 / 4 7 / 4 7 / 5 6



5 6 / 4 7 10 / 4 7 10 / 3 4 5 6 7 8 9



1 7 / 1 2 3 4 5 6 7 / 1 2 3 4 5 6 7 / 1 4 7 / 1 4 7 / 1 2 3 4 5 6 7 / 2 3 5 6

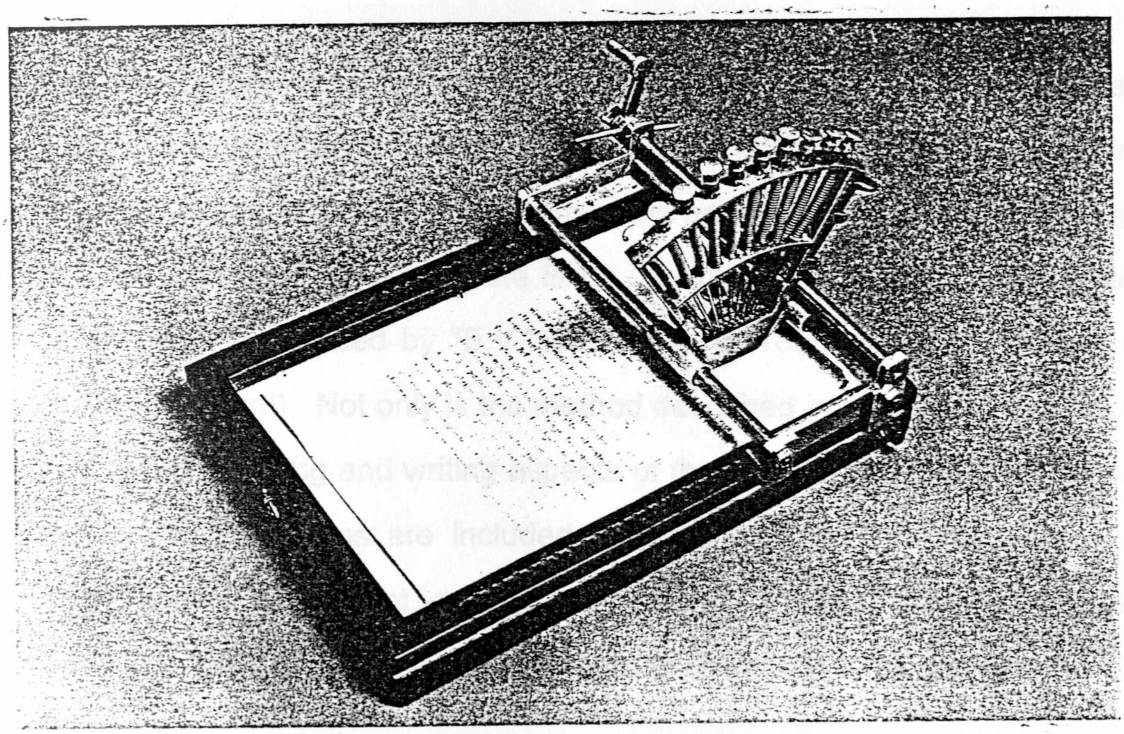
The patterns were written from right to left so that they were correct for reading when the page was turned over. It seems unnecessarily complicated for serifs to be included, but as a blind man, Braille may not have realised the relative unimportance of these excrescences. They had been included in the Haüy and Guillié type.

The system had its faults, not least because it was slow and complicated for some to carry out, but it is commendable that Braille wanted to make the attempt to communicate with the sighted world. He must have been only too aware that the braille code required only two dots for the letter 'b' whereas this new method required 12, and some of the letters were even more complicated. He had considered a system requiring seven dots high instead of 10 but rejected the idea because this writing was "smaller but less regular" (Henri, 1952, p.101). The method has been shown in some detail because it led to an invention by

Braille's friend, Foucault, who had been at the Paris school and was then living at the Quinze Vingts.

10. THE PLANCHE A PISTONS, LATER KNOWN AS THE RAPHIGRAPHE

Foucault was extremely able in inventing machinery for special purposes and he and Braille co-operated in producing apparatus that speeded up the new way of writing. The apparatus consisted of a board and frame to hold the paper, and mounted above on a movable carriage were 10 pistons, five for each hand. When the hands were held pointing towards each other with a finger or thumb on each key, up to 10 dots could be punched at a time before the carriage was moved to the left to make the next part of the letter. A handle at the side was worked to move the carriage down to the next line.



Raphigraphe

Guide du Musée, Association Valentin Haüy, Fig. 14.

The Institut Royal des Sourds-Muets et des Aveugles at Bruges has preserved the letter written by Braille on 21st May, 1842, to the abbé Carton, the school's founder, to demonstrate the use of the Foucault machine. "The address, written by the same means, was so clear that the packet, posted in Paris on 22nd May, was received by the abbé Carton in Bruges the following day" (Henri, 1952, p.100, footnote). Some of Braille's letters to his family are also extant [Coupvray]. This method enabled quicker, more accurate writing to be carried out but the machine was expensive so many people continued to use the hand frame.

The raphigraphe was in use for approximately 50 years until it was replaced by machines for typing dot patterns which were first invented in Germany and in America. These may be regarded as the forerunners of the print typewriter. They had six keys only for punching the dots as well as a space bar.

Attempts were made from time to time to modify Braille's plan using nine, seven, five, four, and even three dots in height to represent the letters but with varying success. An example using a 4 x 4 matrix has been found recently on a library shelf at the Edinburgh School for the Blind. It consists of a small hand-written booklet in French produced by "E.V." in Dunkirk in 1898 and is referred to as "Traitpoint" (linepoint). Not only is the method described in detail and illustrations supplied in both reading and writing aspects of the signs, including numbers and punctuation, but diagrams are included showing the order in which the dots should be made in an attempt to improve rate of writing. As in Braille's "Nouveau Procédé" the dots are numbered and given in linear form for making the configurations.

By 1840 Braille's health had deteriorated so much that he was forced to give up class teaching. He was given permission to continue living at the school but he also needed frequent times of recuperation at his home in the country. By 1847 he resumed work but by 1850 he was only giving occasional music lessons. He died on 6th January, 1852.

11. EPILOGUE

Braille had considered the 1837 procédé to be the definitive version of his work, but others found by experience the need to build on to it.

PRINTING

This was also improved. Instead of pages pressed from moveable type, in 1849 Laas d'Aguen invented embossed stereotyping on one side of metal sheets from which multi-copies could be made. "Imitation de Jesus Christ" by Thomas à Kempis [musée Valentin Haüy] was one of the first books to be printed in this way. The pages include two small punctiform illustrations, which must be the first examples of such use. Ballu and Levitte, circa 1867, introduced two-sided stereotyping. By 1888 Ballu was printing by the interpoint method, that is printing each column of the signs of the second side of the paper between those of the first side (Henri, 1952, 91-92). By this means 100% of space could be saved and as stereotyping required thinner paper the size of the books was much reduced.

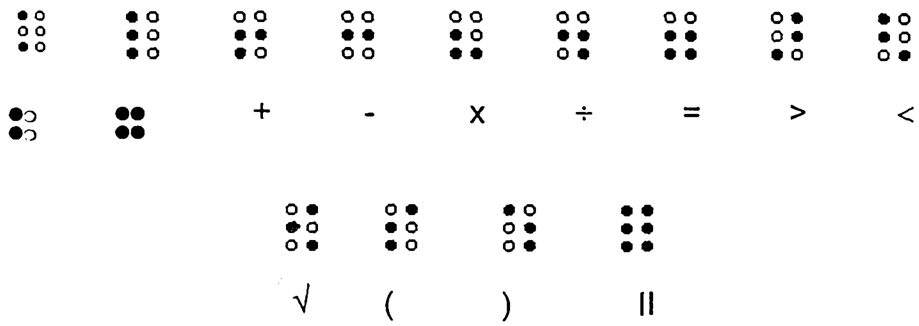
THE DIFFUSION OF THE BRAILLE CODE

By the inclusion of the Lord's Prayer in six languages in his procédé of 1837 (pp.8-18) and sending it to "all the institutions in existence" (Pignier, 1860, p.107), Braille must have hoped that many other blind people abroad would benefit from use of his code. In the main acceptance was slow. It was officially adopted in French-speaking Switzerland in 1858 (Henri, 1852, p.77), but other countries were slow to accept the new method, especially as it would need adaptation if contractions and shortform words were to be used. Both Edinburgh and Glasgow institutions received copies but Britain did not accept the braille code until 1870. Klein of the Vienna institute and Knie of Breslau rejected the code for several years on the grounds that it made a barrier between blind and sighted. Gaudet, who had done much to encourage its use in the Paris school, edited a journal entitled "L'Instituteur des Aveugles" 1855-1865 (ibid., p.76) in which he occasionally included articles on the code and it is thought that it was Gaudet who finally persuaded Knie to introduce the code in Breslau. Confusion arose elsewhere because St. Marie of Leipzig introduced a code in which the signs containing the fewest dots were used for letters which occurred most frequently. This arrangement saved space and improved writing time, but made translation to other languages impossible for letter frequencies would be different.

In an attempt to solve these problems an international congress was held in Paris in 1878, one of whose mandates was "to study the various methods of printing and writing with a view to the uniformity of the systems" (proceedings of the Congress for the Improvement of the Lot of the Blind and the Deaf Mutes, p.187). Discussion was heated, but finally a large majority "voted in favour of the general adoption of the unmodified braille system" (ibid., p.183). This was a momentous decision which avoided years of indecision.

As a result of the congress, Levitte, who was head of the teaching staff at the Paris school, issued a pamphlet entitled "Anaglyptographie et Raphigraphie de Braille" (1880). The contents were based on Braille's work as the title suggests but also includes the additions made by Ballu, who had been a pupil and then friend of Braille. (The ugly nomenclature of the title was invented by Levitte.) The pamphlet appears in three parts, anaglyptographie (uncontracted braille), sténographie (contracted braille), and lastly, raphigraphie, which was a replication of the details included in Braille's "Nouveau Procédé.

Besides numbering the dots within the cell for ready reference, the capital letter signs (dots 4-6 in front of a letter) was introduced. In 1932, the sign was changed to dot 6 preceding a letter. There is also more detailed information concerning the use of mathematics signs in the literary code (ibid., p.6), viz:



No information was given concerning rules for their use. In the "sténographie" section 38 partwords were included, seven whole words, a few suffices and 44 shortforms. Unlike the shortform words used in English braille today, there seems to have been little attempt to help the memory by retaining most of the consonants. This seems contrary to Braille's principles. In 1882 de la Sizeranne (1857-1924), a teacher at l'Institut, revised the French braille code to make it more orthographically correct, a further revision took place in 1924 and there have been later revisions (Henri, 1952, p.92).

12. CONCLUSION

Haüy, Barbier and Braille all made their contributions towards literacy being possible for blind people. Haüy was the first to believe education was possible, he opened the first school for them, discovered a viable means of tactile print and set up a printing department for producing embossed material. Barbier used a system invented for sighted soldiers which happened to have merit for use by the blind. He, like Haüy, was sighted and did not fully understand the tactile problems involved, but his great contribution was the use of points rather than the closely packed lines and curves of the Roman alphabet, and he also arranged the points in two parallel lines. Relying on touch for cognition Braille halved the size of Barbier's cell so that it was the right size to be under the pad of the reading finger, and he used alphabetically correct spelling instead of phonetic sounds. We can agree with Pignier (1859, p.14) that "Thus to modify is not to perfect but to invent".

The blind inmates of the school, such as Coltat, Ballu, and de la Sizeranne, not only realised the great benefit of the braille code, but wrote about it. Such was its success that sighted directors of the school also watched its success, "It was Pignier, Dufau, Gaudet, who in their writings proclaimed the merits of the new alphabet, not out of vanity and for the honour of the Institution, but because as Directors or Head Teachers of a school for the blind, they had personal experience of the enormous service which Braille had rendered to his fellows" (Henri, 1952, p.64).

CHAPTER 3

EARLY BRITISH CODES

1. INSTITUTIONS AND ASYLUMS FOR THE BLIND AND THE FIRST TACTILE MODES OF COMMUNICATION IN BRITAIN

2. A COMPETITION

3. ROMAN ALPHABET CODES

   Gall Type

   Alston Type

   Littledale Type

   Roman Upper and Lower Case Type

4. ARBITRARY CODES

   Hughes Type

   Lucas Type

   Frere Type

5. MIXED ROMAN AND ARBITRARY TYPE

   Moon Type

6. WRITING

1. INSTITUTIONS AND ASYLUMS FOR THE BLIND AND THE FIRST TACTILE MODES OF COMMUNICATION IN BRITAIN

Literacy for the blind developed more slowly in Britain than in France. Ritchie (1930, p.36) wrote, "If here and there the blind were kindly treated, it was because of the magnanimity of the philanthropic, not because they had any right to it ... the dawning consciousness of social justice as a right rather than a condescension was not fully understood". The first institutions were founded for the inmates to learn a manual trade "so that they might, if possible, maintain themselves by their own industry" (Carton, 1838, p.23). Liverpool, the first institution, was opened in 1791; 43 years later, "the intellectual instruction of the pupils has not been deemed of importance; they only learn a trade" (ibid., p.119).

Edinburgh Asylum was founded in 1793. Only training in manual crafts was given at first and later on oral instruction in spelling, grammar, arithmetic, geography and "a good general view of the solar system". One wonders why emphasis was given to a subject so far outside the experience of the pupils.

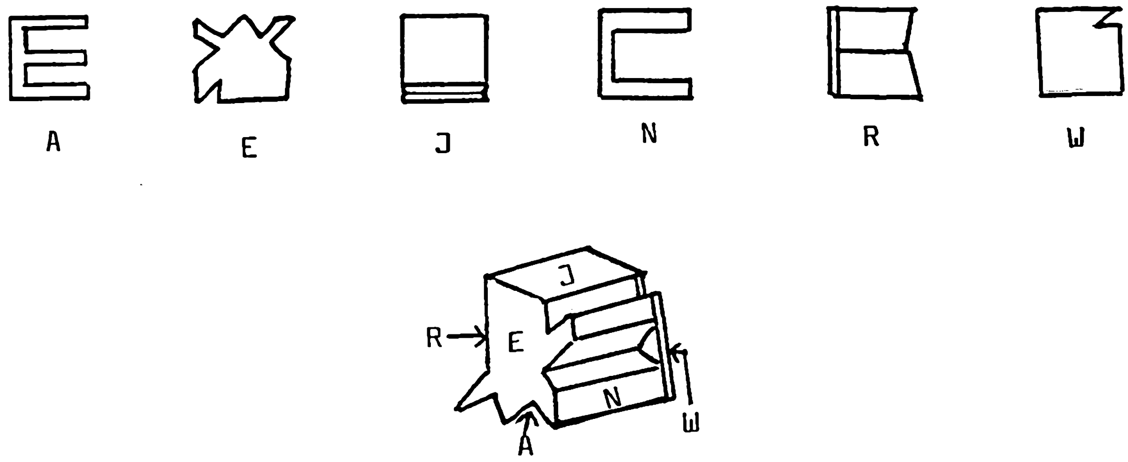
The first tactile aid to communication so far known in Britain came to light when it was on view prior to an auction in the spring of 1995. The following paragraph includes information given to the writer during a private viewing.

Letters patent for Mr. Casson's Panogram were taken out in 1813. John Casson (grandfather to Lewis Casson, the actor), is described as a professor of music at Liverpool, and as the copy of the specifications at the Patent Office shows that the patentee "made his mark", presumably Mr. Casson was blind. Unfortunately, the directions for use are missing, but a paper found inside the apparatus in 1856 describes it as "a method of teaching the Blind by means of Tangible Characters to write or read languages, Arithmetic, Music, etc." (sic).

Mr. Casson's Panogram - Open Position

(Reproduction of photograph.)

The Panogram consists of a mahogany box (approximately 8½ x 5½ x 2 inches) containing 300 identical small cubes arranged in rows, half in the base and half in the lid of the box which can open out flat. Each cube has nicks or grooves cut away making a different asymmetrical design on each side. As each of the six surfaces can be turned to four different positions 24 letters can be represented and similarly some of the positions could represent numbers. The cubes nest into square depressions but they protrude above the edges.



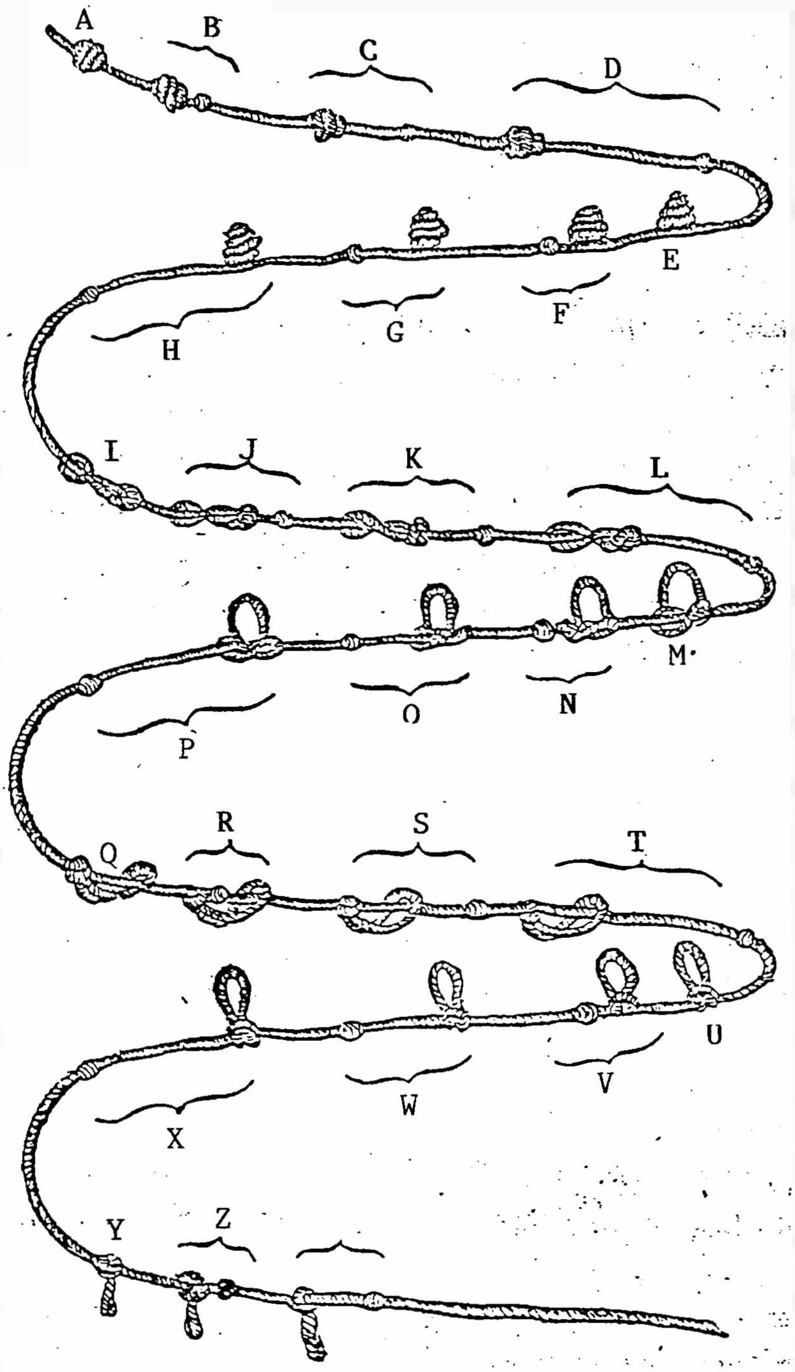
Mr. Casson's Panogram - Diagram showing six surfaces of the cubes with corresponding letters and one enlarged 3D cube to aid explanation.

There are three small holes on the left and right of each depression for the positioning of small pegs. The letters I and U are formed by placing a peg to the left of J and V respectively.

Mr. Casson's Panogram - Diagram of letters I and U with pegs in position.

It is suggested by the writer that, by the positioning of pegs, note values and key signatures could also be indicated. Rows of peg holes occur along the sides of the box, possibly for storage and to mark the place during use. The writer found it impressive to realise the amount of planning needed at the drawing board stage to encompass so many aspects of information. As far as is known only one Panogram exists. It would have been interesting to find out how easy it would be for blind people to use such apparatus. However, the experiment was not possible because the writer was outbid by an unknown buyer.

Two members of staff at the Edinburgh Asylum for the Blind invented a method of reading the Bible by means of knotted string (Baker, 1859, pp.13-17; Ritchie, 1930, p.26). The knotted alphabet consisted of seven large knots, all different, along a string representing A, E, I, M, Q, U, and Y respectively. The remaining letters were each made from a large knot plus a small single knot at a specific distance from the large knot according to its position in the alphabet.



Knotted String Alphabet (Ritchie, 1930, p.26).

The long and tedious work of string "writing" was used for the production of the gospel of St. Mark and a few other short works. For reading to be carried out the string was unwound from a roller and the fingers "read" the knots as they passed over the user's lap. It was ingenious but it must have been very slow in use, so perhaps its merit lay more in checking the memory than for a first time reading. A method of reading from the printed word was needed.

It is noticeable that whereas only 8 institutions were opened in Great Britain between 1791 and 1826, 26 were opened between 1827 and 1882 (Farrell, 1956, p.32). Two main reasons may be recognised, the growth of humanitarianism, and an interest in code making. "Humanitarian activity was the characteristic form in which their religious piety expressed itself" (Trevelyan, 1942, p.495) hence the provision of more institutions. A competition was organised in 1832 whose aim was to find the best code for the use of the blind, and the evangelicals were encouraging the reading of the Bible. Most of the publications in embossed codes were therefore religious works, chiefly parts of the Bible and "reading was taught that the Bible might be studied and that the blind by this means might be led from theological darkness into light" (Ritchie, 1930, p.21).

2. A COMPETITION

A text book on reading (1820) written by Guillié and printed in his code, property of Glasgow Asylum for the Blind [now on loan to the National Library of Scotland], reached Britain and, according to a hand written note on the cover, it eventually came into the possession of Alexander Hay, who was a blind man. Evidently Mr. Hay did not like the large Roman letters for he invented a new embossed code of arbitrary letters and sent it to the Society for the Encouragement of the Arts in Edinburgh for their approval. Stimulated by this effort, the Society published a report in 1832 and in the following year a gold medal to the value of £20 was offered with the following aims (Taylor, 1838, p.93): "To investigate what form and size of letters or characters, and what number of these should be adopted, with a view to constructing a general alphabet for the blind in Great Britain and Ireland; and secondly, the best and cheapest method of printing such letters or characters in relief, so as to render them most easily and accurately distinguishable by the touch".

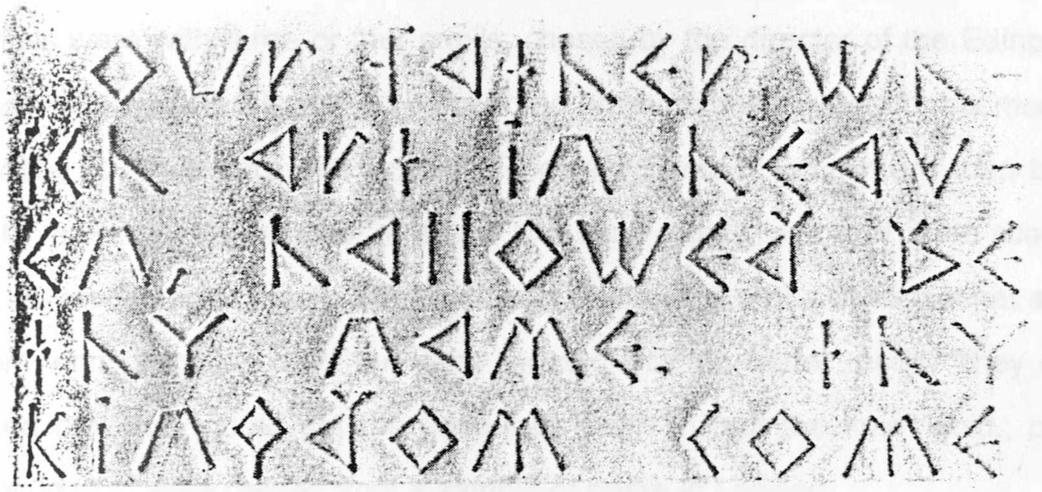
There were 20 entries, 3 modifications of ordinary Roman characters, 12 using arbitrary characters and 5 other entries were sent in for interest, but not to be included in the contest.

The difference of opinion concerning the use of Roman and arbitrary codes was to continue for many years and to be the main cause for delay in the production of a single code. Some of the authors of arbitrary codes for the competition illustrated in Carton, 1838 (opp., p.83) seemed carried away by the enjoyment of making a series of patterns with little idea of the perceptual and cognitive problems involved. The arbiter was the Reverend William Taylor of the York School, who being sighted, it is not surprising that he chose the entry of Dr Fry of Bristol, who had used the simplest form possible of capital letters using no serifs. A reader with sight always finds it difficult to assess the qualities of a code intended to be read by touch, and even a blind person needs practice before an unbiassed opinion should be given. Comments on all codes therefore need to be made with caution. The organisers of the competition had hoped that one best type would result from their project. In fact, it had the opposite effect for the number of codes multiplied. They little realised that unity within Britain would not be achieved until nearly 40 years later.

3. ROMAN ALPHABET CODES

Gall Type

James Gall, a printer in Edinburgh, was working on a code for tactile reading before the Society of Arts competition had even been considered. In the Report of the Royal Commission on the Useful Arts (1852, p.414) Gall was commended for his zeal and patience in his attempts to produce the perfect code. "It is to Mr. Gall, perhaps, more than any other man, that the interest in education of the blind was awakened throughout Great Britain and America". In 1837 (p.10) Gall described how, "perceiving that angles were more readily felt than rounds, and that the outside of the letter was more easily felt than the inside, he modified the alphabet into its most simple form, throwing the characteristics of each letter to the outside, and using angles instead of curves".



Gall Type (Ritchie, 1930, p.44)

The alphabet consisted of 26 configurations chosen from those he considered best for touch reading from all the upper and lower case letters. These were then modified in shape to make touch reading easier, yet at the same time keeping them still recognisable as Roman type. A, B, D, P, and Q became more triangular in shape, O was a diamond and G a smaller diamond standing on a stalk. The remainder of the letters were less changed from their original shape.

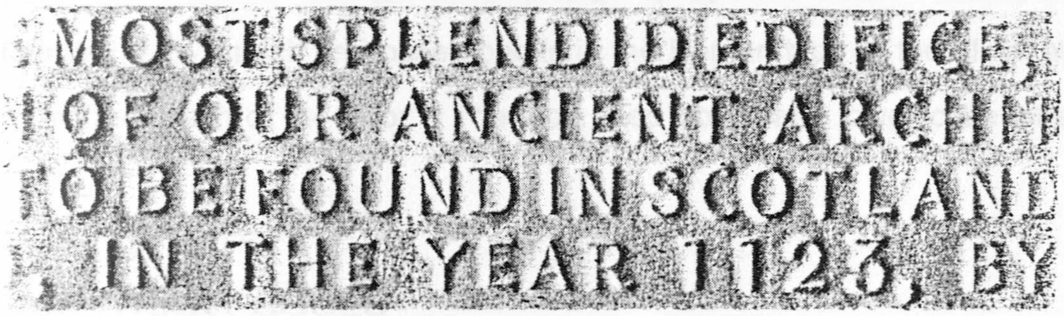
Some introductory books were produced and then Gall published the gospel of St. John. He entered the competition, but did not win the medal. In 1837 (p.10) he wrote, "After a long-continued, laborious and expensive series of experiments by means of blind persons, he has produced the perfect alphabet, which may now be considered the most simple, the most tangible, and therefore the most perfect alphabet which can be constructed for the blind". It is noticeable that he did not present his code as the best so far, but was quite categoric about it being perfect - the word is repeated twice.

It is worth giving some considerations to who those "blind people" were, and what success they really seemed to gain, for we are reminded of the exaggerated claims of Haüy for his embossed script some 50 years earlier. The first trials were with three or four pupils, chosen by the director of the Edinburgh Asylum, who received training by Gall three or four times a week for six months. According to Anderson (1837, p.54), "The result was nothing more than being able to make out letter by letter and a few short words, some of them scarcely that." A second trial (ibid., p.55) was made by six boys and a blind teacher at the asylum who practised daily for many months with no better result, "they even averred that they could get the gospel by heart in half the time" (ibid., p.55). Similar results were gained from a sample of pupils in London.

Later, Gall tried out "fretted type", that is the same shapes but made with embossed dots (Gall, 1837, p.56). He found that the "rough and sharp" configurations enabled the finger to be more distinctly indented while a much slighter pressure was required to produce the effect that was needed. He also found fretted embossing more durable, the shapes were less likely to "fall in the middle", the books were cheaper to produce and the pages could be printed on both sides. His earlier code was tried out at the Glasgow Asylum but it was soon superseded by Alston Type.

ALSTON TYPE

John Alston of Glasgow Asylum used a modification of the prize-winning version sent in by Fry of Bristol. Charles Baker, superintendent of the school for the deaf and dumb at Doncaster, wrote a series of small booklets for his pupils, and thinking that they could also be suitable for blind pupils he sent them to Alston to be embossed (Anderson, 1837, p.64). One of them, "First Lessons on Religion, and a Series of Lessons on Prayer" is in the writer's possession and has an inscription on the flyleaf by Alston. The capital letters are so unvarying in proportion that it must have been difficult to distinguish the differences for a beginner and possibly also for the more experienced reader. The booklet measures 23½ cm. in width by only 13½ cm. in height, and the letters are about ½ cm. high, leaving very little space between the 15 lines for return sweeps to the next line. There was a larger fount provided for the elderly.



Alston Type (Baker, 1837, p.1)

Alston was a capable organiser and soon after the results of the competition were announced he established a committee for collecting funds for printing, and his types and printing press were ready soon after (Scottish Guardian, 1837, 7th April). Public demonstrations of reading took place in 1838 and 1841 and already by 1840 he had printed "all the scriptures" and had sent consignments of his books to the Philadelphia institution in the United States where similar embossed capitals were being used.

In 1842 (p.4) Alston wrote, "Fry's letters were too broad to be easily deciphered by touch. Having therefore made numerous improvements on the size and sharpness of the type, and to obviate the sameness of some of the letters by adding the hair strokes as will be seen in the A, R, and N, etc. I brought out several elementary books". One wonders how successful the hair strokes were.

LITTLEDALE TYPE

Another modification of Roman type was tried out by Dawson Littledale who produced his code in 1838 (Armitage, 1886, p.2). Like Haüy, he used capitals as well as lower case letters which caused the reader more signs to learn and remember.

ROMAN UPPER AND LOWER CASE TYPE

Blair in a paper read in 1868 (printed 1876, p.11) reported that "a society has been founded ... to furnish embossed books in the Roman type to the blind, at a price within the reach of the poor". The type used upper and lower case letters (Blair, 1877).

4. ARBITRARY CODES

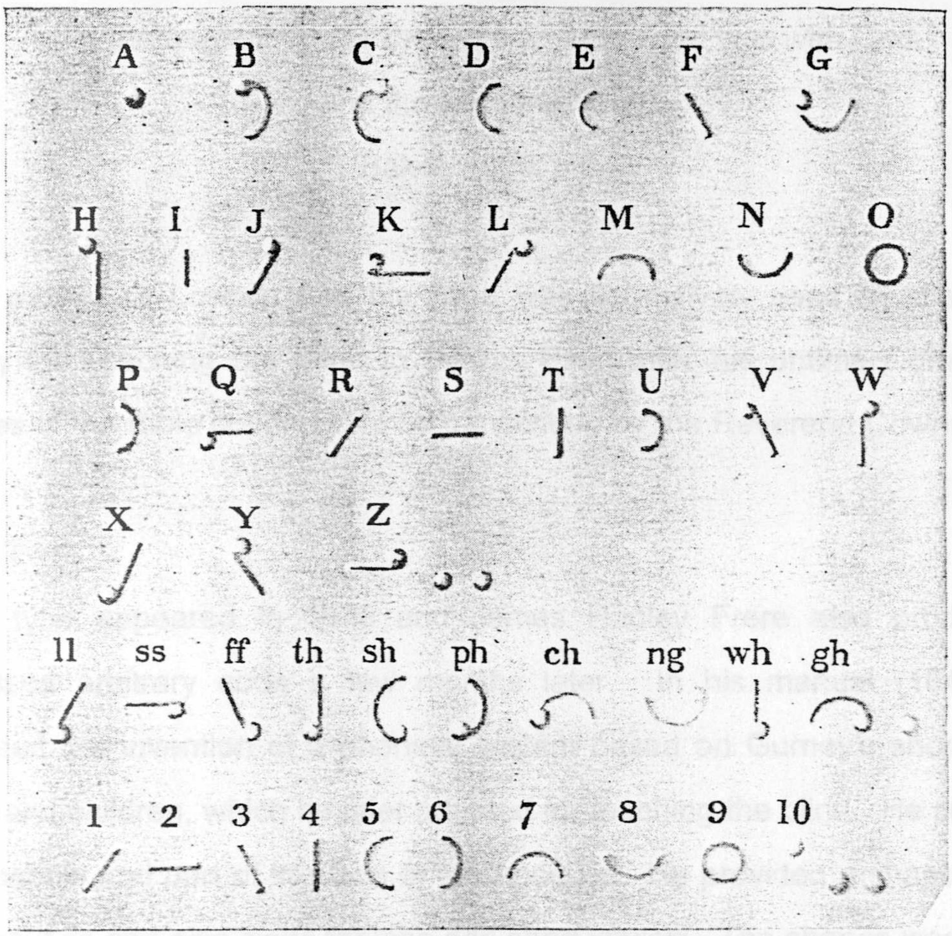
HUGHES TYPE

G.A. Hughes, a blind man and governor of the Manchester School, described (1843, p.31) his "new puncticula stenographic system of embossing by which the blind of all nations will be able to emboss for themselves on paper without type and to attain a perfect knowledge in reading, arithmetic, etc., with unprecedented facility". His manual is still available in libraries in Britain and in America. Perkins School for the Blind, near Boston, Massachusetts, has examples of his code, but there seem to be no available examples of his work in this country. Only three basic shapes were used, a dot, a dash, and a rosette or cluster of seven dots respectively used in various positions and combinations. Armitage (1886, p.31) wrote, "It produced very good printing, could be worked tolerably fast, and was easy to learn. It was, however, expensive". Harris (1981, p.10) thought, "His system was apparently used for no more than one or two books". If this was so it is possible that the punctiform code was too radical for British taste at that time.

LUCAS TYPE

Thomas Lucas, a teacher of shorthand, produced a similar system for use by the blind (ibid., p.10), and he also opened a small school for them. The abbé Carton, director of the Deaf, Dumb and Blind School at Bruges, visited the school and subsequently recorded in his report (1838, p.37) "the class is not large, and the success is ordinary. One of the pupils, after a year's practice, could only with difficulty read one line which I gave him in St. John's gospel, published by Mr. Lucas and only succeeded after making frequent mistakes". It seems hardly fair to blame the method because of a poor performance by just one pupil, for the method was difficult for more than one reason.

The signs consisted of a straight line, a curve, a circle and either a straight or a curved line with a circular blob to the side at one end.



Lucas Type (Ritchie, 1930, p.51).

The signs seem simple in outline but confusion is likely to have resulted because similar signs are used in so many positions. For example, the stright line with the blob had 16 different positions according to the angle of the line and on which side of the line the blob occurred, and eight positions for the curved example.

The stenographic nature of the method was difficult for the learners, for vowels were often omitted and some wordsigns could have as many as three meanings. The first sentence in St. John's gospel starts:

in t bgini ws t wrd a t w ws w g, a t w ws g

(In the beginning was the word and the word was with God,

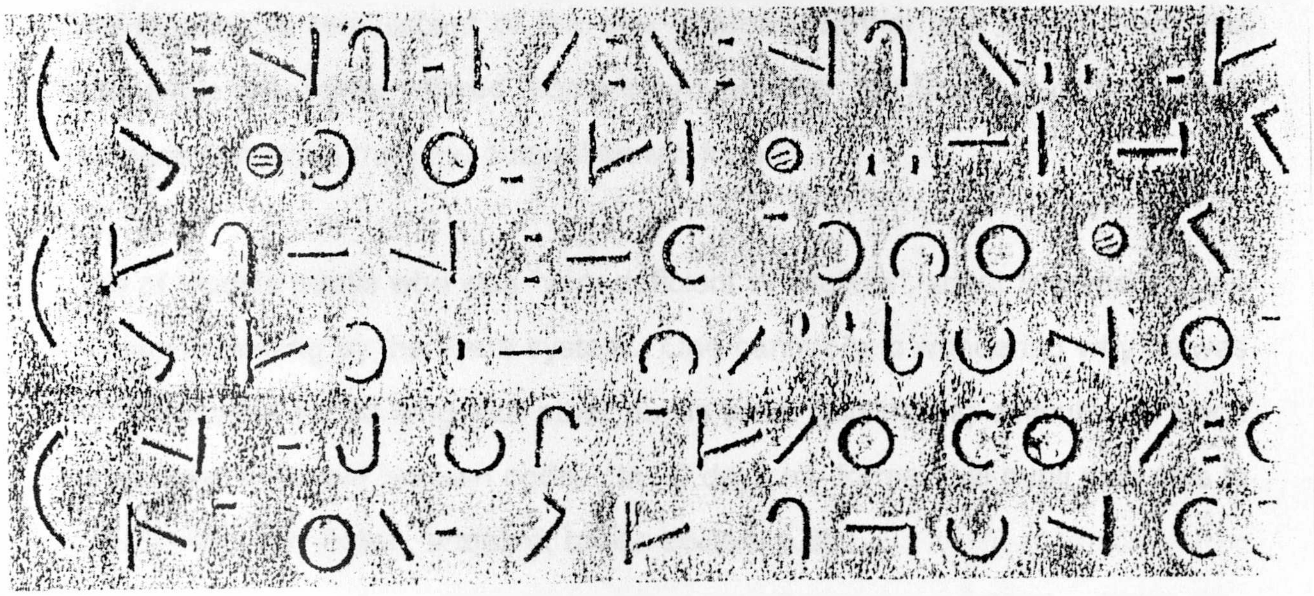
and the word was God).

(Baker, 1859, p.54.)

Lucas moved to London and his code was extensively used by the London Society for Teaching the Blind to Read. Even after his untimely death many volumes of the Bible continued to be transcribed by the Reverend Cowring.

FRERE TYPE

Lucas type appeared in 1838 and James Hadley Frere also produced an embossed arbitrary code a few months later. In his manual (1840) Frere described the invention of a phonetic system based on Gurney's shorthand for adults and children, which he later adapted for teaching the blind. He printed the four gospels and part of the Acts of the Apostles. He provided a shape for each of 26 sounds and also signs for long and short vowels. The shapes were straight and hooked lines, curves and circles, and the system was written in boustrophedon, that is, reading from left to right as in visual reading, then a curved line led the finger to the next line to be read from right to left. This was considered easier than retracing back by the finger before reading could continue from the left. On the return line each letter was reversed. The boustrophedon method not only saved time but less space was required between lines and thus was a cheaper method of production.



Frere Type (Ritchie, 1930, p.53).

5. MIXED ROMAN AND ARBITRARY TYPE

MOON TYPE

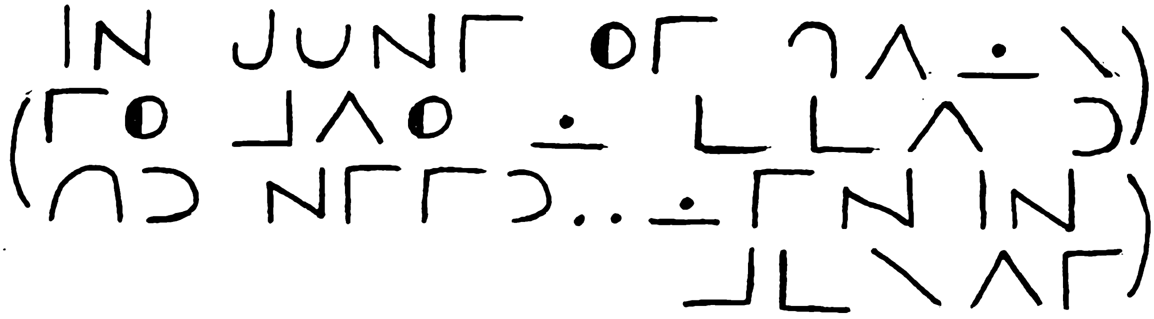
By the age of 21 William Moon had become totally blind. He had wanted to be a church minister but because of loss of sight he learned the Frere code, bought some embossed books and set up a small school. He was far from satisfied with the code and was very outspoken when he met the author (Rutherford, 1898, p.36): "I think it was in 1841 that I first met with Mr. Frere, and told him of the difficulties connected with his system of reading. He was very indignant and thought, being an older man than myself that he must know best. I told him that if he did not make the alterations I suggested or something like them, someone would, at a future date, either do so, or would invent another method which would supersede it, little thinking that I should be the very individual that would do it four years later."

The meeting is reminiscent of the one between Barbier and Braille when the latter while only young offered "some improvements", but Braille must have been far more restrained than the outspoken Mr. Moon.

One of Moon's pupils who was "very deficient in intellect", spent five years trying to master reading by the Frere system. One cannot help wondering why he was left to struggle for so long, but other pupils were also having difficulty so Moon determined to invent his own code. "In 10 days my former dull pupil was able to read sentences" (Moon, undated, braille edition, p.8).

At first scrutiny there are obvious similarities between Frere and Moon codes for some of the signs are the same but have different meanings. Moon also used the boustrophedon method. On the return line, while still keeping the signs in word order, Moon kept their shapes the usual way round, whereas Frere had reversed each sign as though reading through a mirror. There were other differences. Frere's system, being phonetic, used a single sign to represent a sound, no matter how many letters were involved, whereas Moon used a full orthography. Moon's code was therefore more suitable for children to learn to read and to spell, and for adults who had already learned by sighted methods.

Moon used alphabetical shapes, modified where necessary to make them more suitable for touch reading, and where this was not possible he introduced a few arbitrary shapes. As a result, he had an alphabet of 8 unaltered Roman letters, 11 Roman letters with parts left out, 2 more that are barely recognisable for their original meaning, and five new forms. It is sometimes difficult to recognise the origin of some of the modified letters but Moon must have considered this aspect mattered less than that they should be easily recognised by touch.



Moon Type (Ritchie, 1930, p.58)

His code met with increasing success, and it soon became evident that his future life was destined to be devoted to the provision of embossed religious literature.

So far Moon had been using movable type which involved resetting each time a page with different content was to be printed. This method was very slow and stereographic plates were too costly for the complete Bible to be embossed. He therefore experimented late at night for some while (Rutherford, 1898, p.30), occasionally burning his fingers, and eventually he was able to make suitable plates for a quarter of the cost of those used by Frere. Each plate was made of tinned iron which was washed over with a solution of chloride of zinc. His letters were made of copper wire, cut and twisted into shape and when these were laid on the plate and heated and then cooled, they were firmly soldered on. In this way he could prepare plates which could be used repeatedly. By the end of 1851 he had completed the whole of the New Testament, the Psalms and part of the book of Isaiah (Moon, undated, braille edition, p.16).

About 1853 Moon met Sir Charles Lowther (Rutherford, 1895, p.63), a blind man who was encouraged to collect and read embossed literature after his mother had brought back type and books from France embossed in Guillie type (ibid. p.24). With the help of a servant he embossed St. Mark's Gospel and several of the Epistles for his personal use. He was probably the first blind person in Britain to read embossed material for this was before the work of Gall and Alston. He became interested in Moon's code and his philanthropic enterprise is shown by the fact that within a five year period he donated 9,909 volumes in the Moon code for use in Britain and America (ibid., p.63). Moon was fortunate to have knowledge of his code spread in this way.

Moon had had to give up the idea of being a minister in his early years, but now his deep religious beliefs and his evangelism, together with the enhancement of reading for the blind were to lead him to another great work. With a friend, named Miss Graham, homes for the blind were visited with a three-fold purpose (Rutherford, 1898, pp.62-63) to teach, to lend books of the Bible and to read the scriptures to those unable to read. This was the origin of the Home Visiting Society, and his son carried out similar work in Philadelphia. Moon's evangelism led to a wide dissemination of his code.

6. WRITING

Blind people have always found difficulty in writing alphabet symbols and there was the added problem in many systems that the writer was not able to read his script. In Britain, the first attempt was made by George Gibson of Birmingham who sent his apparatus and an explanation to the Society of Arts in May 1827, and for his work he received the Gold Vulcan Medal (Gibson, 1827, p.91). He used prick writing (ibid., pp.90-96) in a manner which was probably similar to the method used by Mlle. Maria von Paradis nearly a hundred years earlier. He used cubes of wood with a raised sighted letter on one end for identification and the same letter reversed but made of projecting pins at the other. "If, therefore, a piece of paper be laid on a cushion, or surface of felt, and the type be pressed down, the points will enter the paper, and form on the under surface of it a raised or embossed representation". A shallow box lined with padding was provided which Gibson called a "typograph". It had slots on two opposite sides into which a metal bar was placed to hold the paper and a movable ruler was provided to keep the cubes in place during the writing process. The type was stored in a drawer under the tray.

Referring to the cost of paper in his day, Gibson suggested that "waste writing paper, such as has been written over with pen and ink, will answer the purpose of the blind quite as well as any other" (ibid., p.92). He wrote letters by this method and also kept his own accounts. Both Gall and Alston advocated prick writing but their respective apparatus was less sophisticated.

Gall also used a "typhlograph", which was a guide to help with handwriting (1837, pp.15-19, pp.48-51). It had a board for holding the paper, a slide-rest for enabling the writer to keep a straight line and a guide to help with forming the letters. By holding a pencil against the edges of a hole in the guide, upward or downward curves could be made, and the hole also had markings at intervals to indicate where straight lines could be started and ended. To make the next letter the pencil was held firmly at the right hand edge of the hole and then the guide was moved along so that the opposite side of the hole then met the pencil ready for the next letter to be inscribed. It is possible that Hughes' method was the most successful of those attempted before 1870 for it was regarded as providing good printing and according to Armitage (1886, p.31) the system could be used "tolerably fast".

7. COMPARISONS

The next few pages will endeavour to tease out some of the problems involved in the use of the Roman alphabet, and also arbitrary codes in order to bring some understanding and explanation of why most failed and only two are still in use today. The braille code was becoming recognised in France but did not begin to come into use in Britain until 1870. The main aspects to be addressed are the size and shape of the characters, their presentation in terms of clarity of line and use of space, the use of stenographic, phonetic and letter by letter systems, and finally some comments on the chaos caused by the diversity of codes.

Size and Shape of Configurations

At first it was thought that recognition of embossed signs would be easier if the configuration was larger than those used in inkprint. The range for visual reading can be enormous from letters on an air balloon in the sky to small print on a bottle of pills. By comparison the range for tactile reading has to be very small indeed. Only one letter at a time can be sensed, and if it is larger than the size of the finger pad then up and down and rotary movements will occur in attempts to collect the required information. These extra movements interrupt the light, even progression along a line of signs which is the best method leading to comprehension of words and sentences. In other words, if the sign is too large, the reading process is slower, and at the opposite end of the scale, if the signs are too compressed and produced too close together, the image seems blurred as in type that is too small for visual reading. Size and spacing of characters are critical factors for successful tactile reading.

Line Type

The early code makers who used an embossed Roman alphabet were, a priori, bound to find difficulties. Visually the alphabet signs seem simple, but tactually they are hard to decipher because many of the signs are complicated to the touch. To take a few examples: a capital A has a simple outline but the internal crossbar is difficult to sense; M and W are even more difficult because of the number of down strokes; and a lower e has a difficult curve to sense and the gap at the right may not be recognised so that the letter may be misread as an o.

Densely packed configurations are extremely difficult for perception and cognition to take place. Haüy, Guillié and Dufau in France, and Alston and Gall in Britain, experimented with different sizes of character but comparatively few pupils met with success. The problem was further compounded by the fact that large bulky books were very time consuming and costly to produce, so it was tempting to make the characters smaller than suited the majority of users.

Gall had showed some understanding of the problem when he wrote of "throwing the characteristics of each letter to the outside" (1837, p.10), but if he had taken that idea too far the letters would have been unrecognisable to those with vision. The sighted code makers of the time had not enough understanding of the processes involved to be able to accept the idea of an arbitrary code. They considered that their codes should be recognisable to sighted and blind alike. On the other hand, Moon, who had once had vision before he became blind at the age of 21, understood the problem and was prepared to go further. Keeping some of the easiest alphabet shapes helped readers who had once read by a sighted method and by altering others to very simple shapes he achieved more success.

Punctiform Type

The success of embossed dots over line type had been discovered in France, but in Britain at this time the nearest approach to braille were the codes of Littledale and Hughes. Gall was reaching out towards this method when he discontinued using his angular shaped alphabet letters and used simpler shapes with a fretted surface. If Hughes' code had been better known in his day the standard of reading might have improved.

PRESENTATION

The discomfiture of reading cramped letters on a badly presented page is well known, and it must be even more frustrating if similar faults occur in tactile reading. Embossed characters not only need to be of suitable size and clear in outline, but pleasant to feel as well. More variations are possible than may at first seem likely, and these include an easily recognised line or dot that is pleasant to the touch and of suitable height and with good spacing variables. The early code makers tended to pay too little attention to spaces between lines for fingers to make return sweeps between two lines of characters to the beginning of the next line. This may be because of lack of imagination on the part of sighted code makers, and was certainly also because of cost. The spacing between lines was not so critical where the boustrophedon method of printing was used.

Taylor, who judged the competition organised by the Society of Arts, was an advocate of the use of Roman type. He wrote (1838, p.102) the greatest sum of advantages "may not be the one which occupies the least space, for the bulk of books is of much less importance that the ease with which the contents can be perused". When Gall started using fretted letters he found that less pressure was necessary in production of material, so for the first time he was able to use thinner paper and introduce printing on both sides by the use of interlining. That is, the line on the reverse side occurs between the lines of the first side. This was a distinct advantage because it made a saving in cost and the idea was used again soon after the braille code was introduced into this country. Moon paid attention to dot height as well; for more advanced readers he arranged for the lines to be "flatter as well as nearer" (report of the Royal Commission on the Useful Arts, 1852, p.421).

Taylor (1838, p.90) summed up the quality of line type required as follows: "The paper used in printing in relief should be very good and strong, not liable to tear, tolerably thick and well-sized. If it be too thick the letter will not be sharp nor well-defined; neither should the elevation be too much elevated, or it will increase the bulk of the book and be more liable to injury. About $^{1}/_{40}$ or $^{1}/_{35}$ of an inch is generally found sufficiently high for small type impressions. Alphabets in first books for beginners should be a little higher."

STENOGRAPHIC, PHONETIC, AND FULL ORTHOGRAPHIC SYSTEMS

When reading accounts of the first 50 years of code production in Britain it is easy to be left with the impression of six codes being in contention for most of the time. However, the report of the Royal Commission (1852, p.420) stated that "the present state of printing in Roman character in Great Britain is ... that every press has been stopped, while books in arbitrary characters seem to be increasing in gaining favour". Littledale and Hughes type were only in production for a short while, so the relative merits of Lucas, Frere and Moon types remained.

Lucas' stenographic method left out so many letters in the words and there were as many as three different meanings for many of the signs, with the result that it was considered by some to be difficult to learn and to understand, yet others found it easy to use. How then can this apparent discrepancy be understood? Maybe the difference of opinion can be explained by a reason which has more to do with the attitude of the time rather than emphasis on the difficulties of the code. Because Bible reading was so much encouraged, and especially for the blind, it is possible that though Lucas type might seem difficult for a first reading, the very familiarity of the Bible words and Bible stories would supply the clue to the sign meanings. That is, the text served as a reminder rather than a provider of first hand knowledge.

The boustrophedon system of printing used by Frere and Moon for their codes is of mixed value. Undoubtedly it saved time because no unproductive return sweeps are necessary, but this advantage may have been outweighed for learners by the problems of perception when meeting words in a different form in the return line.

8. CONCLUSION

Each time a new code was invented the originator must have considered it to be the best and therefore not likely to be superseded, but unfortunately with every new system more difficulties became apparent for the very people for whom help was intended. Learners tended to know only one code, which was the method taught by the nearest institution, and so they were likely to be debarred from being able to understand other codes. Books were few because of expense and often duplicated in more than one code. This was particularly true of the Bible and other religious works. Thus there was an extreme shortage of reading material with few subjects covered, and there was consequent wastage of money and a great deal of unnecessary frustration for readers.

Eventually, it became abundantly clear that a resolution to the crisis must be found. Meetings were arranged, usually attended by only the sighted superintendents of institution, and they tended to favour the system with which they were most familiar. They also made the mistake of thinking that the matter could be solved quickly in perhaps one or two meetings. Baker (1859, p.66) wrote: "A conference should be held, partly composed of intelligent blind men to ascertain whether it is possible to unite all parties in the prosecution of one system of printing, or whether all should persevere in a course which divides the friends of the blind and injures their cause."

One blind man, Thomas Rhodes Armitage, was to show the imagination and determination to resolve this crisis in Britain. His work will be described and evaluated in the next chapter.

CHAPTER 4

UNIFORMITY: FIRST ATTEMPTS

1. INTRODUCTION
2. THE BRITISH AND FOREIGN BLIND ASSOCIATION
3. THE EXECUTIVE COUNCIL
4. DECISIONS
5. SOURCES SHOWING THE EARLY STAGES OF THE DEVELOPMENT OF THE LITERARY BRAILLE CODE IN BRITAIN
6. ADAPTATION OF THE BRAILLE CODE
7. APPARATUS USED FOR HAND WRITING AND PRINTING
8. THE FIRST INSTITUTIONS FOR THE BLIND IN AMERICA
9. WHICH TYPE FOR THE NEW WORLD?
10. HOWE TYPE
11. FURTHER TYPE INVESTIGATIONS
12. NEW YORK POINT TYPE

13. COMPARISON OF ENGLISH BRAILLE AND NEW YORK POINT SYSTEMS

Space Saving

Legibility

Rapidity of Writing

Facility of Correction

Facility of Learning

Universality

14. CONCLUSION

1. INTRODUCTION

Thomas Rhodes Armitage (1824-1890) gave up a flourishing practice as a physician at the age of 36 because of increasing blindness, and worked for the rest of his life to improve the lot of the blind. He spent the next two years with the Indigent Blind Visiting Society, one of the nine charities mentioned by Johnson (1860), who were working on behalf of approximately 5,000 blind persons in and around London, "all more or less struggling against their dire affliction" (ibid., p.3). As a result of this experience he became convinced that occasional provision for immediate needs and scripture reading in their own homes was not sufficient for the more able. Many could benefit from training for work and the consequent self-respect that comes from playing an active part in the community. Education was needed, and the first step was to consider all known codes in order to select the best in terms of legibility and cost.

2. THE BRITISH AND FOREIGN BLIND ASSOCIATION

In 1868 Armitage inaugurated an association, first known as the British and Foreign Blind Association for Improving Embossed Literature for the Blind, but by March 1869 (BFBA, executive council minutes) the title was changed to include promotion of their employment. Such were the small beginnings of the present Royal National Institute for the Blind which is renouned world-wide for its help in education, employment, leisure pursuits and care of the blind of all ages.

3. THE EXECUTIVE COUNCIL

It was thought that users would be the best able to make code decisions, so it was decided (ibid., October, 1868) that a member of the general council should be one "who is blind or suffers from such a defect of blindness as shall prevent his reading by sight". In addition, members of the executive council shall "have practical knowledge of at least three systems of raised characters" and "have no pecuniary interest in any system".

The first work was to consider the embossed codes already in existence, and to help gain as much knowledge as possible both here and abroad, the council employed several tactics. Corresponding members were enrolled who were expected to keep in close touch with all methods of reading and writing and the apparatus involved. Twenty-two "intelligent blind" were tested on the systems they could read and their views and reasons for their opinions were noted down. This "represented a sort of public opinion among those of the blind who had paid attention to the subject" (Armitage, 1886, p.39). Meanwhile council members were "constantly perfecting themselves in, and practising every system which either had obtained wide currency or appeared to possess special merit" ("First report of the British and Foreign Blind Association for promoting the education and employment of the blind for 1871", p.2). Clearly a high standard of efficiency was expected. In addition, five criteria were laid down for selecting a system of embossed characters:

1. the characters should be as clear to the touch as possible;
2. the size should be as small as is compatible with perfect and instantaneous recognition;
3. correct spelling shall not be interfered with;
4. if any means exist for shortening the process of reading they shall be adopted;

5. if possible, the written shall also be the printed character (Armitage, 1870, p.195).

These criteria have stood the test of time except for No. 4. There needs to be a fine balance between providing sufficient contractions to help overcome the slowness of the medium, yet not have so many that the learning load becomes too great for the majority of readers and the meanings become obscure. For example, the council did not imagine the hundreds of shortforms that were to be included in some European versions of the braille code such as those of France and Portugal.

4. DECISIONS

The first report of the council (BFBA, 1871, p.3) gives the results of the deliberations:

1. the Roman letter in all its forms was condemned by the almost unanimous consent of the educated blind in the civilized world;
2. the line systems of Lucas, Frere, and Moon were regarded as useful but imperfect;
3. "the only system which in the opinion of the Council meets the requirements of those who use it, as perfectly as their case admits of, is the dotted system of M. Braille".

As there was hardly any braille material in Britain, the Lucas, Frere, and Moon systems would continue to be used for a while, at least until braille production could be properly established.

5. SOURCES SHOWING THE EARLY STAGES OF THE DEVELOPMENT OF THE LITERARY BRAILLE CODE IN BRITAIN

The hand-written minute book showing the council's deliberations is still in existence. It gives interesting facts about the work carried out but hardly any details about decisions taken regarding the code. For example, in July 1870, an entry states that, "a number of stereographic contractions of braille were agreed provisionally", but there is no mention of what they were, nor does a later entry give the decision made concerning them. In addition to the minute book there are the early reports of the council and Dr Armitage's books published in 1871 and 1886 respectively.

In 1871 the council published a "Key to the braille and music notation" (Thomas, 1957, p.71). Unfortunately, it has not been possible to trace this booklet, but there is an undated primer (BFBA) in which the heading on the first page is "Key to reading and writing", which might possibly be the literary section of the same work. Inside the cover there are hints for the learner, who is encouraged to buy "The Table of Contractions" (price 2d.), but it is not surprising that such a small leaflet could be easily lost and none seems to have survived. A pamphlet entitled "Instructions for writing the braille system" by Plumtre was published by the BFBA for use by transcribers. The 4th edition, revised and corrected in June, 1895, is still extant, and as it was "approved by the late T.R. Armitage, Es., M.D.", the first edition must have appeared some time before his death in 1890. The British and Foreign Bible Society (BFBS - not to be confused with BFBA) existed to provide religious reading material, and in 1879 the organisation started to make embossed versions of their books. To help in getting this venture started the BFBA lent some of their plates. Inside the front cover of the "Amos to Malachi" volume of the Bible, published by the BFBS in 1880, there is a list of transcription rules; and in 1895 the BFBA published a "Dictionary of braille contractions with notes".

It had been hoped that if a sufficient number of braille books published before 1880 could be discovered, an analysis of the braille content would reveal further information about the development of the code. However, such examples are extremely rare and so this has not been possible. Few books would have been published during the early months of the council's deliberations; publication was deliberately stopped for several months while the merits of a new code from America were being considered (BFBA, second report, 1875); and the sixth report, 1879, states that the sale of books was down because of capital investment in "best apparatus" for printing which was being installed.

6. ADAPTATION OF THE BRAILLE CODE

The undated primer seems the closest we can get to the earliest version of the adaptation of the French code for use in Britain. The council members considered that as many of the signs as possible should have the same meaning, so that translation could be simpler and books could be shared between nations. They adopted the same alphabet letters and numbers but the punctuation was different from Braille's 1837 version. Instead of the use of dashes together with dots, the signs of the first line were used but made in the lower position of the cell.

Since braille is a bulky medium the council decided in favour of the inclusion of contractions and a list of criteria (Armitage, 1886, p.10) was drawn up for their selection:

1. not to omit letters except in some words of very common occurrence, and where this omission cannot lead to incorrect spelling;
2. to abbreviate by allowing characters to stand for groups of letters;
3. not to let the same sign have two meanings;
4. to assist the memory by allowing the groups of letters to occur in alphabetical order;
5. not to use contractions except in words or groups of letters which occur very frequently;
6. to allow the initials of common words to represent them.

No. 4 refers to position on the braille chart.

Ideally, the most frequently occurring strings of letters should be the ones represented by contractions and it is likely that some sort of frequency count was carried out. We have no details, but information is given (BFBA, 1874, pp.13-15) of the materials used when a comparison was made between the space saving value of the braille and New York codes, and it might have been labour saving then to use material already treated. In 1895 the BFBA published a "Dictionary of Braille Contractions".

[The Appendix shows the contractions and rules rearranged into "families" so that they may be easily compared with later versions, and thus an historical account has been built up. The method of numbering of the dots within a cell has been updated to save confusion.]

7. APPARATUS USED FOR HAND WRITING AND PRINTING

The council were very particular that handframes and guides should be of good quality and easy to use (BFBA, Executive Council minutes, October, 1870, and May, 1873) and in January, 1872, the council minutes show that Armitage demonstrated a new method of printing on both sides of the paper using "new shifting writing frames". He persuaded some educated ladies in London to undertake transcription of simple books for children. It is of passing interest that the mother of Beatrix Potter used to help in this way. "Years and years ago ... my mother transcribed many volumes for a blind Association in London" (Lane, 1978, p.57). She was to see one of her own "Peter Rabbit" books published in braille, but it is perhaps not surprising that one who could write and illustrate her own books, who had a learned paper on "The germination of the spores of agaricinae" (fungi) presented to the prestigious Linnaean Society, and who was to become a founder member of the National Trust, should have refused her mother's invitation to help because she would have found transcription unimaginative and not a little tedious.

Stereotyped plates similar to those used for Moon type were used, but instead of fusing strips of wire to the surface, it was necessary to raise points on the brass plate from the back with the help of a punch and hammer. At first the depressions on the underside of the dots were filled with cement so that the dots would not become pressed down and a sheet of paper glued to the back. A cheaper method was then found of preparing the plates for printing on both sides of the paper. A sheet of brass was folded on itself and the lines on the reverse side punched between the lines of the first side. Paper was interleaved between the two halves of the plate before being placed in the press. In November, 1870, the first works to be printed in braille in this country were produced, namely some advent hymns and Cowper's poem, "John Gilpin".

One of the resolutions passed at the meeting of the American Association of Instructors of the Blind, held in 1871, was to the effect "that the New York horizontal point alphabet, as arranged by Mr. Wait, should be taught in all institutions for the blind". Once more, the council felt that this must be investigated even though they had thought that the braille code was to be their preference. The special apparatus necessary was ordered, and when it was available members set about learning and practising its use so that a fair choice could be made. At this point the description of events in Britain will be broken off in order to outline the growth of literacy in America. The chapter will then conclude with a comparison of the two codes and the choice made by the council.

8. THE FIRST INSTITUTIONS FOR THE BLIND IN AMERICA

In 1832, during the time when Louis Braille was perfecting the second edition of his code, and the Society of Arts was about to set up a competition in an attempt to find the best embossed code in Britain, three institutions for the blind opened in America. They were situated at Boston, New York, and Philadelphia.

Julius Reinhold Friedlander had attended the university of Leipzig and then taught blind pupils, but he longed for the freedom of the New World. He visited institutions in Europe before travelling to Philadelphia, where eventually he became director of the new institution ("The centenary Celebrations of the Pennsylvania Institution for the Instruction of the Blind, 1933").

Dr Russ had witnessed the desperate conditions resulting from the Greek war of independence, and was distressed by the many cases of blindness in New

York where there was an epidemic of eye disease. He rented rooms for his first six pupils in the country house of a leading merchant (van Cleeve, 1933, p.3) and this venture was the beginning of the New York institution for the blind.

Dr Howe of Boston had also been to Greece, and, like Byron, had fought in the cause of freedom against the Turks (Farrell, 1932, pp.8-9). On his return to Boston, his philanthropic attitude and determination were admired, and within weeks he was off to Europe on a tour of the institutions for the blind, before taking up his new work as director of the new institution. The "Address of the Trustees of the New England Institution for the Education for the Blind" (1833), includes descriptions of impressions gained during this tour. Although Howe had no training as a teacher, he quickly developed positive opinions. For example, "As children destined to a trade should not devote too much of their time to intellectual pursuits, so on the other hand, those educated for a higher occupation should not be left unacquainted with some manual occupations; they cannot have their mental powers always on the stretch" (ibid., p.14).

He regarded the institution at Edinburgh (ibid., p.10) as "on the whole, the best I saw in Europe ... it is not as showy as that in Paris ... nor has it printed books for their use, still, they receive a most excellent education and learn some most useful trades". Even so, he regarded reading from the gospel according to St. John using knotted string wound on a revolving spindle as, "the clumsiest and most uncouth system ever devised", and to those who considered reading unnecessary for the blind he wrote, "there is infinitely more pleasure and advantage to be derived from feeling out the letters themselves. They can stop and go back or read over a passage a dozen times, reflect upon it as long as they choose and refer to it in any occasion" (ibid., p.9). These words are echoed today whenever braille reading is encouraged. According to Sibley (1892, proceedings of the American Association of Instructors of the Blind, p.68), Howe "was especially impressed with the work of Mr. Gall".

9. WHICH TYPE FOR THE NEW WORLD?

The directors of the three institutions wished to avoid the problems caused by the multiplicity of embossed codes used in Europe. "There is reason for believing that there was an understanding to the effect that Dr Howe and Mr. Friedlander should inquire into the subject and that each having decided upon the style of tangible letter which he deemed most suitable, should submit it, with his reasons, to the other for criticism" (Wait, 1890, pp.5-6). If there was disagreement the head of the New York school was to have the casting vote. This plan seemed so simple, but matters went wrong from the start.

Howe devised his code in 1832-4, and as he was "an ignoramus in mechanical matters and was obliged to depend on others for the execution of the work" (letter, 29th April, 1854), the new press was designed and set up by a very able foreman and printing started immediately. He sent an embossed copy of the Acts of the Apostles to Friedlander who had thought only samples of codes were required on which to base discussion. His own type consisted of capital letters similar to the work of Alston so the two directors went their separate ways, and it seems that Dr Russ, in New York, was never consulted. Already, by 1835, the Howe Press had published a "catalogue" mentioning several books in Howe type, some of which had been sent to Europe. The New Testament was published in Howe type in 1836 by the American Bible Society and the Old Testament appeared in 1843. "By introducing a new alphabet and various improvements in printing he ascertained that books might be printed at a quarter of the cost of those of Europe" (5th report, 1837, in Lane, 1811, p.22) and two years later (ibid., p.56) he published extracts from authors and "passages of elevating and cheerful nature".

10. HOWE TYPE

In the report of the Royal Commission on the Useful Arts (1852, Class XVII, p.416), Howe's type was commended above all others. The jury commented that, "His aim was to compress the letter into a comparatively compact and cheap form. This he accomplished by cutting off all the flourishes and points about the letters, and reducing them to the minimum size and elevation which could be distinguished by the generality of the blind ... A few of the circular letters were modified into angular shapes, yet preserving the original form sufficiently to be easily read by all." There is a remarkable resemblance to Gall's early characters, but Howe never used the triangular or fretted versions. Leigh Richmond's "Dairyman's Daughter" (1836), in the care of the University of Birmingham, shows that the lower case E is embossed in the shape of the Greek epsilon ε so that as the reading finger meets the letter from the left it is not confused with the front curve of the letter C. None of the letters extend below the line, thus saving considerable space between lines.

It is difficult for a sighted person to appreciate fully the legibility of embossed print except by experiment concerning accuracy and comprehension. In earlier days, rate of reading does not seem to have been regarded as important. The Boston line type, even with its simpler shapes, seems rather small; that is, legibility was possibly sacrificed for the sake of cost. However, while at Boston in 1993, the writer asked to be introduced to a lady aged 82 who was reputed to be an excellent braillist. Surprisingly, she told the writer that she had been taught to read by the Howe method. Its use at Boston, therefore, had continued in spite of three other systems being regarded successively as official codes (proceedings: AAIB, 1871 and 1892, and American Association of Workers for the Blind (AWB), 1913) before braille came in to general use in America in 1921. To questions about legibility she replied, "Oh, we preferred the letters; we didn't like it when we were made to read those dots!". Her friends had been of the same opinion. How, therefore, was this to be reconciled up with previous views on legibility? Methods learned first are often preferred and perhaps there was an element of disinclination to learn a new code instead of continuing to use one that not only was familiar, but seemed satisfactory? However, it does seem that some readers have such good co-ordination of touch and cognition that they have little difficulty in reading more than one code. For such, the problem might be an occasional difficulty in remembering which shapes belong to which code, particularly in punctiform examples, and even so, readers may have their preferences for particular codes (Helen Keller, public hearing, March, 1909, p.40).

When the writer was visiting Perkins School for the Blind, near Boston, Massachusetts, she saw an example of Howe type which has an interesting history. During his stay in America in 1842, Charles Dickens visited the school, and was much impressed by the training given to the deaf and blind Laura Bridgman. She learned to read Howe type and could produce very neat handwriting with no kind of apparatus to keep the lines straight. Dickens gave an account of his observations in "American Notes" (1842). Years later Howe wrote to Dickens (18th February,1868) asking for permission to print one of his books for, "they want something to gladden their hearts" as a change from religious works and the text books used in school. The writer was shown the letter in which Dickens not only agreed for "The Old Curiosity Shop" to be treated in this way, but sent $1,700, enough for 250 books to be "distributed as a gift to the asylums for the blind". [A copy of The Old Curiosity Shop" in three three volumes in Howe type is on show at the school.] This event is also recorded in Johnson, 1977 (p.539).

Earlier in 1853, the first convention of the American Instructors of the Blind was held, primarily in order to make application to Congress for a permanent printing fund for the use of the blind. The resolutions ("The Blind", vol.1, p.5) included a recommendation "that the Boston letter, so called, in which the great bulk of books for the blind have been printed, be preferred as the standard type for all future books published for the blind", and that "a committee of three (including Dr Howe) be appointed". As far as is known, no committee was appointed and no other meeting took place until 1871.

11. FURTHER TYPE INVESTIGATIONS

It has not been possible to gain access to the early reports of the directors of the New York institution, but Kerney (1952), in commemoration of the centenary of the death of Louis Braille, wrote a concise but detailed paper entitled, "First tidings of literary braille in North America". It covers two schools in Canada, and New York, Pennsylvania and Missouri institution in the USA, with only passing references to Boston because of Howe's rigid adherence to his line type.

In 1835 (ibid., p.113) the treasurer of the New York institution received a report from a former professor of the school for the deaf and dumb in New York, who was visiting the Paris school. He recommended a literary code, mentioning Barbier and referring to Braille as "one of the blind tutors". The advice seems to have been ignored. John Adams, one of the managers of the New York institution, visited the Paris school several times during 1853-4 (ibid. p.113) and his report appeared on pp.35-44 of the nineteenth annual report of the managers of the New York Institution for the Blind, published in 1858 (ibid., pp.113 and 116). He brought back specimens of the braille alphabet and a frame with a guide and style, and specially mentioned the "system of raised points (sic) invented by M. Braille". The twentieth annual report, published in 1856 (ibid., pp.113 and 117) reported on pages 11-30 the use of braille at the Institution in 1855 though, it was a "modification" of the original "brought into use by an inmate".

An "imperfect" sample of the modified code was described by Russ, a director of the Institute in his third "Number" published in 1862 (ibid., pp.113-114, 118). The signs were a curious mixture including a contraction for ING and "only two letters, A and L, can be called identical with those of Louis Braille's original system on the limited basis afforded by Russ" (ibid., p.114). At the ninth meeting of the AAIB in 1886 a teacher, named Babcock, described how a frame had been found but no-one knew how to use it. A blind teacher had recognised that 63 characters were possible and decided for himself which ones should represent alphabet letters. This was the form of braille used by some of the pupils when Wait became director in 1863.

Wait (1890, p.10) found that many of the pupils could not read and immediately determined to remedy the situation. He admitted (1890, p.10) that he "assumed that the pupils could learn to read the books in line letter with uniform facility, according to their grade". He arranged for the entire school to be put into graded classes. New alphabet cards and reading books in the Boston line type were procured. The classes all read at the same time, five times a week, and extra time was given to the slower pupils. From week to week the grades were rearranged so that no pupil should be out of grade and this practice continued for two years. The care and labour are commendable; unfortunately, Wait had started with a faulty hypothesis, namely, that all children, whatever their ability, could eventually reach the same standard given the necessary time and good teaching with suitable materials. At the end of two years (Wait, 1890, p.10) the results must have been disappointing:

- could read with facility 20%
- could read moderately well 48%
- non readers 32%

Wait then collected statistics from six of the largest schools where pupils had had no special training. The percentages on the three classes of attainment varied somewhat, which could be expected, but the range of children who could not read was between 14% and 58% (ibid., p.10). It is not indicated whether the children were specifically tested or whether the figures represented the subjective estimates of the teachers.

Wait had set 100 words per minute for oral reading as a target for average readers, using a range from easy to difficult compositions, but found that only five children reached this limit. Because of the variety of methods of reading used in the institutions, it is obvious that the requirements of modern research methodology could not be applied; for example, the books were "generally" in Boston type, so not even the basic materials were the same for each pupil. Books were still few in number; those used for testing were well worn and it is probable that some testees knew the contents by heart. Testing by measuring the number of words read per minute was an unfamiliar method, though it is not clear if any of the schools used this instruction from Wait. Two of his conclusions (ibid., p.11) are of particular interest for future researchers:

1. The group of non-readers included some of the brightest pupils.
2. The capacity for touch reading was no test of mental ability.

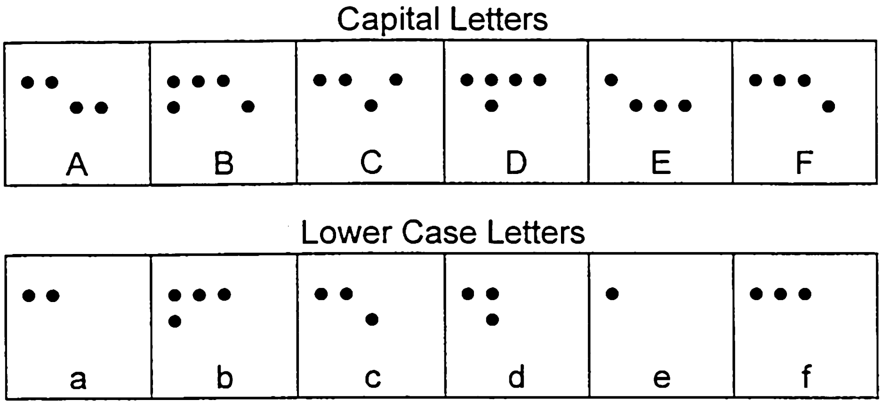
As a result of these findings, he concluded that the Roman letter could no longer be regarded as the most effective for educational use.

The St. Louis school at Missouri had closed for six months sometime between 1860-1861 so "a mystery surrounds the actual year when braille became a tool of instruction". Kerney (1952) suggests 1859, 1860, or 1861 as possible dates. There Wait found that 65% could read with facility and 35% moderately well. This result seems questionable for in any general representative sample there are likely to be some pupils who will never manage to read the code. Meanwhile, Wait had received a translation of Braille's "Procédé" of 1837 and considered that although the code could be written it was wasteful of space. Even so, his 31st annual report noted, "the braille system is an excellent one, and inasmuch as there are already too many systems of print in use, which difficulty would be magnified by the introduction of another, ... I would especially urge upon all persons or institutions ... the importance of printing books in the points system of the braille code" (Wait, 1890, pp.13-14).

No response came from Philadelphia or Boston. In 1868 Wait published a paper indicating "some of the principles to be followed in the construction of a more legible and cheaper system" (Wait, 1890, p.14). Later, in a paper read before the World's Congress of Educators of the Blind, Chicago, 1893 (p.6), he claimed that "the thirty-two per cent, of the pupils in the New York school who had failed to read the line letters in common with the others, learned the New York system in eleven lessons of one hour each". He was so anxious for a single code that he was even prepared to sacrifice his new improved one if the other institutions would accept braille. When this proposal, too, was not accepted, he felt free to publish his New York literary code in his report of 1869. This was the code that Armitage and his council felt must be studied and practised before their own final choice could be made.

12. NEW YORK POINT TYPE

Farrell (1956, p.111) wrote "There is still some controversy as to whether this system was actually developed by Mr. Wait, for there is considerable evidence that Dr Russ, the first principal of the New York Institute, had devised it, but certainly Mr. Wait promoted it with all his energy". Armitage (1886, p.13) had correspondence with Russ which helps to clarify the matter. Russ had at first considered a phonetic shorthand similar to that of Frere, but eventually his characters were "applied by him to ordinary writing, and the main question was whether his or the original Braillé (sic) system possessed on the whole the greatest advantages". Though braille and New York point codes are punctiform, comparisons immediately reveal that they differ fundamentally in construction. Whereas braille is based on a matrix of 3 x 2 points, the signs of New York point are never more than two points high. The width is variable, taking from 1 to 4 points. It is therefore clear that the two codes are in no way interchangeable, and guides for writing must be based on different design.



New York Point type.

For braille each letter occupies a separate cell, and each space equals one cell plus the width of the bars of the guide on each side that separate it from adjoining cells. As the New York system has a variable base a continuous line of points must be possible. The New York guide, therefore, has openings in which a possible four points may be made, that is 2 x 2. The bar between each opening is the same width as the distance between the possible horizontal points within the cell. A single horizontal space is left between words, i.e. the same as half the width of the cell, or the bar between the last and first positions of adjacent cells. Two or three points width are left between words.

Another difference between the codes lies in the characters designated for each letter. Being only two points high more lines could be accommodated on a page, thus saving space in one dimension. It was important that this should not be negated by the width of the letters. Wait, therefore, used a new principle for allotting signs to letters by giving signs with the fewest points to the letters of the highest frequency. To make this choice he counted their occurrence in a varied selection of printed material, resulting in the following order:

- 1 point E T
- 2 points A I N O S
- 3 points C D F L M P R U V W Y
- 4 points B G J K Q
- 5 points H X Z

At first glance G and H seem surprisingly far down the list. This is explained by the fact that there were 10 contractions at that time. G would occur many times in ING and H would be well represented in CH, SH, TH, THAT, and THE. Subjectively, it would seem that B and V could have exchanged position.

13. COMPARISON OF ENGLISH BRAILLE AND NEW YORK POINT SYSTEMS

When the BFBA executive council had acquired sufficient knowledge and practice in using the new code, Armitage carried out an examination of Wait's conclusions and, finding errors, made his own calculations. These, together with the council's opinions on legibility, rapidity of writing, facility of correction, facility of learning, and universality, were published in 1874 under the title, "The Braille and New York systems compared" (Executive Council of the BFBA, July, 1874).

SPACE SAVING

It might have been expected by a council of blind persons that legibility would have been considered first. However, space saving was regarded of importance because book production was very expensive. Wait's estimate of space saving as against braille seemed too high because of incorrect methodology. "It appeared to the Council (ibid., p.3) that the best way of testing the correctness of Mr. Wait's calculation would be to write out the same matter on the same scale in the two systems and measure the space occupied"; they included only the 10 corresponding contractions which appeared in the New York code, even though the British code had several more.

Selections from Gibbon, Macaulay, Judges and Acts of the Apostles from the Bible, and Mills' "Subjection of Women" were used (ibid., pp.13-15); from studying these five extracts he found that they gave space saving in favour of New York point of 20.6%, 18.8%, 22.0%, 22.5%, and 20.5% respectively, averaging 20.48%. This was 12.52% less than claimed by Wait, but enough for a close study of the other factors involved to be necessary.

LEGIBILITY

The council agreed (ibid., p.6) that a character only two points high "comes more fully under the finger, and therefore is pleasanter to read than a deep character like the Braille", but New York point was criticised for leaving too small a space between the letters. A space of one point was not considered sufficient, and two points gave better legibility but more loss of space. Armitage noticed that the New York cell had been slightly increased vertically, causing the lines of type to be closer at the expense of easy reading. He believed that this had been done to clarify the difference between the points in the upper and lower positions, but this change led to a greater distance between points that were diagonal to each other. It was, therefore, not always easy to determine "whether they form part of one letter or of two different letters" (ibid., p.7). These observations by Armitage demonstrate how much reading is affected by the different positions of the points, the spaces between them, and also line space. Though not commented on in this instance, the size and shape of dots are also important. These aspects were not addressed in detail until some 80 years later (see Chapter 8).

Rapidity of Writing

Not unexpectedly, Armitage found that the new signs, being only two points in depth and the fewest points being assigned to the most frequently occurring letters, led to a slight advantage in writing of New York point over braille.

Facility of Correction

Correction is a very practical aspect not covered by other early code makers. Because each letter has its own cell in braille it is an easy matter to add or delete dots, even though in practice the rubbing out of a dot is always noticeable by a touch reader. As new York letters vary in length, some corrections might affect the rest of the line.

Facility of Learning

Armitage claimed that braille had the advantage because the remainder of the signs are derived from the original 10 characters. This advantage is of limited value because a capable braillist soon learns to recognise shapes without reference to other characters, and in fact many do not learn in this way. Reference to characters already learned may give confidence to adult readers who have already learned to read by the inkprint method. All New York characters have to be learned separately.

Universality

Several countries on mainland Europe were already using braille, so the same letters and numbers could be used, but because of their construction, New York point letters were not compatible with braille. The council expressed their regret that Mr. Wait, "while retaining the 10 letters used in braille to denote numerals, has so changed their significance that if both systems are ultimately adopted the greatest confusion must arise in the interchange of books where numbers are used, as in numbering of pages, numbers placed on maps, &." (ibid.,p.11). It is difficult to understand the reasoning behind Wait's choice for his signs, for numbers 7, 8, and 9 have fewer dots yet it would seem that they occur less frequently than 1 and 3-6. 1 is one of the most frequently occurring numbers yet has been allotted the most dots.

Music is not within the scope of this project, but it seems important to mention that the braille music code was being used in Europe and was beginning to be used in some American institutions even where they still used a line type for reading and writing, another advantage in favour of the choice of braille for general use. Wait devised his own music code (1890, p.18) but it was clumsy and was never much favoured.

14. CONCLUSION

The BFBA executive council had examined several line systems in terms of shape of the configurations and ease of reading, and had also taken the trouble to test other users and ask for their opinions. In March, 1870, the minutes show that the merits of New York point and braille were being compared and the special frames necessary were ordered ready for further trials. In April, correspondence was received from the St. Louis school in Missouri concerning their use of braille, so already the council knew that the braille code had reached America. However, there the W was placed after V instead of at the end of Braille's fourth line involving a change in the shapes of W, X, Y, and Z. During all this time and for many months more there was ongoing discussion about which new contractions should be included in the developing English literary code.

The contents of the New York point code together with the opinions of Armitage and the BFBA council have been included in some detail in this chapter for two main reasons. First because they demonstrate the great care with which the council's work was carried out. Secondly, in 1871 the New York point system was accepted by the AAIB for use in schools. Its use in America for some forty years, together with other codes, was to result in much discord and delay so some acquaintance with its design was necessary before the events in the next chapter are described.

The BFBA council remained firm in their decision to keep to the exclusive use of the braille literary code. It seems ironic that Russ, Friedlander, and Howe had intended right from the inauguration of their institutions that America should not suffer from a diversity of codes as had happened in Britain. In spite of their praiseworthy intentions, by 1871 there were already a lingering use of line types, braille somewhat similar to the French version, and New York point and, before long, yet another code. A clash of personalities as much as the diversity of the types was to be the cause of dissension.

CHAPTER 5

DISSENSIONS

1. ROMAN TYPE AGAIN

2. OPPORTUNITIES FOR EDUCATION

3. THE ARMITAGE DIARIES

4. GROWING DISSATISFACTION WITH THE BRAILLE CODE

5. "REVISED BRAILLE" 1905

6. CODES IN USE IN AMERICA FROM 1871

7. MODIFIED, LATER KNOWN AS AMERICAN, BRAILLE

   Labour of Writing

   Calculation of Space Saved

   The New Code

8. PRINTING

9. MORE COMPARISONS

10. AMERICAN ASSOCIATION OF WORKERS FOR THE BLIND

11. COMMISSION ON TYPE FOR THE BLIND

1. ROMAN TYPE AGAIN

Worcester College for the Blind Sons of Gentlemen was founded in 1866 and about the same time a society was formed to provide embossed books in the Roman type (Armitage, 1886, p.212). Armitage regarded this as a retrograde step so would have disapproved of the decision of the London School Board (1876) to use Roman type in their schools for the blind. Haüy's contention that the blind should be treated in all ways as much like the sighted as possible still lingered on, and few fully realised that Roman letters present difficulties for tactile recognition.

Two years later Blair, the first headmaster of the College, read a paper before the National Association for the Promotion of Social Science entitled "Education of the Blind" (published 1876) in which he described all known 'living' examples of embossed codes. He praised the braille code but his own preference was for upper and lower case Roman letters, perhaps not realising that, depending on the script used, approximately half the lower case letters are different shapes from the capitals. For tactile reading this increase in the number of symbols to be recognised is an extra burden. He considered (1877) that it was simple for the blind to read if the letters were printed large enough, and then described which parts of the letters were easiest to identify, in particular, those which extended above and below the line. In fact, it is the internal parts of letters which cause most confusion. For example, in capital letters the cross bar in A and H, the complicated designs of B, E, K, and R, and the number of upright (or sloping lines ascending to type used) of M, N, V, and W are all difficult to detect.

Blair considered that speed was not important because "Blind men have generally very few books to read and more time at their disposal" (1876, pp.9-10). He could not forecast the vast amount of reading required by future pupils who took up professions such as law and the church.

2. OPPORTUNITIES FOR EDUCATION

The Elementary Education Act of 1870, while not superseding the work of the voluntary school, authorised local authorities to create board schools, and education became mandatory. Blind children were not specifically mentioned, many not receiving education under the clause which exempted children from attending school if there was "some reasonable cause", (Hurt, 1988, p.103).

Armitage realised that there was a category of young people who had potential and for whom suitable educational opportunities were not provided. Education and work prospects are intertwined given the right training, and the braille code provided the means of learning. The school at Paris was at this time providing musical training leading to work as piano tuners and organists. Armitage described how this came about in the 1883, June/July number of the first volume of "Progress", the first magazine specially provided for braille readers which was edited and largely written by himself (see also Armitage, 1886, pp.64-66;

Illingworth, 1910, pp.51-52). The training resulted in many of the students becoming self-supporting and Armitage wished to introduce similar prospects for blind students in Britain.

In 1870, by a fortunate coincidence (Hurst, 1890, p.4), Francis Campbell, director of music at Perkins School for the Blind, called on Armitage and they soon discovered their similar ambitions. Together they were prime movers in the establishment of the Royal Normal College and Academy of Music for the Blind in 1872, with Campbell as principal. The venture was successful and the college was "soon turning out well-qualified musicians and teachers and still larger numbers of piano tuners with the majority of them able to support themselves" (Langdon, 1972, p.2). Armitage's aims of education made possible by the means of the braille code, in this case including the braille music code, and followed by employment, were coming true.

3. THE ARMITAGE DIARIES

Armitage wrote several diaries during the 1870s and 1880s. He wrote about his social life, contents of sermons, descriptions of scenery, how interesting pieces of machinery worked, etc., but wherever he went in Britain he seems to have made a special effort to visit institutions for the blind, smaller organisations and even blind individuals. A typical entry was, "No reading to speak of but they promised to introduce braille and higher music to the more intelligent" (Armitage (1870), Diary Entry, Glasnevin, 1878, braille p.56). He also made several

European tours more specifically to enquire into methods of education and conditions of work when education was completed. He wrote because he was interested, but the diaries also demonstrate his campaign for a more active and rewarding life for blind people, and, as shown above, he used these opportunities to advertise the need for the use of the braille code.

Later, when Armitage and Campbell were among those chosen to give evidence before the Royal Commission on the Blind, the Deaf and the Dumb, etc. (Report 1889), his entries become more specific. Unfortunately, some of the diaries are missing, but judging from the large amount of detail included concerning the deaf in mainland Europe, it may be inferred that similar minutiae were collected concerning blind people. In 1884 he made an extended tour of institutions in eastern America. He described the buildings and the conditions of work and never failed to enquire into the educational methods, encouraging the use of braille wherever possible. (A shortened account of conditions in American institutions occurs in Armitage, 1886, pp.183-211). Armitage died in 1890. Francis Campbell received a knighthood for his services to the blind, and had Armitage lived longer it is more than likely that he too would have received this accolade in recognition of his long and enterprising work on behalf of blind people.

4. GROWING DISSATISFACTION WITH THE BRAILLE CODE

"Hora Jucunda", a monthly magazine published at the Edinburgh Asylum, first appeared in 1893 with Illingworth, the headmaster, as editor. It was one of five such braille productions appearing at the time and there were two magazines in Moon type (Illingworth, 1910, p.56). It seemed that there was a growing dissatisfaction amongst some braille readers concerning the code so Illingworth asked for correspondence on the matter. A letter by A.C. which appeared in the first number included the following: "The thanks of the blind are due to the British and Foreign Blind Association for introducing the Braille type into this country; but in the matter of contractions that body has not always acted with that clearness and precision which one could have wished. The arbitrary rules which they drew up have often been violated by them in the printing of their books. Now this leads to confusion."

Several more extracts from letters were quoted (ibid., pp.57-61) culminating with another from A.C.: "What we want is uniformity in printing; if we could get the London people to adhere to their own rules, and co-operate with us in working out some minor improvements, we will have achieved a great deal."

The BFBA cannot be blamed for all the confusion, for unauthorised changes and mistakes were sometimes introduced in "Santa Lucia" (ibid., p.75) and other journals for the blind. Most differences involved the use of contractions across syllables and unwise omission of letters in words, for example "I distinctly remember reading in the Bible about the man that 'fred' the Lord" (ibid., p.60) giving connotation of 'Frederick' instead of 'feared'.

As an outcome of the correspondence and because of the non-cooperation of the BFBA, "Our English Braille Union" was formed with branches throughout the country (ibid., p.62-63). Part of their remit was to discuss the present braille code, which was to be printed in successive numbers of "Hora Jucunda", with a view to possible improvements. Eventually, BFBA produced a system of "Recommendations", but in spite of the great amount of work that had been engendered, the contents were considered to be unsuitable. This dismay was voiced by Illingworth when he read a paper entitled "Uniform Braille System" at a Conference on Matters relating to the Blind held in London in 1902.

The "Recommendations" were couched in legal language, and the extract included in Illingworth's paper (ibid., p.79) certainly proves this point. Furthermore, there were "no less than 820 words or thereby (sic), in the majority of which not the smallest guide is given to the correct spelling of the original word". He also objected to many of the contractions included "because by their omission of vowels, etc., and neglect of the rules of syllabication, they cannot convey to the reader the sense of delight" which literature should bring. He made further more detailed objections and then made a plea for the inclusion of the capital letter.

The conference recommended the setting up of a committee to make a further study of the braille code. The first meeting of the (British) Uniform Braille Committee took place on 6th January, 1902 (minutes, UBC), and the aim was defined at the next meeting (7th February, 1902) viz. "to consider the point systems now in use for the blind, with a view to recommending a uniform system of sufficient simplicity to be generally acceptable".

The committee first considered whether it would be advisable to adopt American braille, which differed from British braille in that the letters which appeared most frequently were allotted the signs with the least number of dots in the cell. [A more detailed description of this system will be given later in this chapter.] As this version of the code was not universal in America, and blind users in Britain might not be ready to accept such a change, it was decided that work should be confined to the betterment of the present British version. The BFBA were asked to co-operate and this joint British Braille Committee eventually produced their report at the first Triennial Conference for the Blind held in Edinburgh in 1905.

5. "REVISED BRAILLE" 1905

The long awaited report of the British Braille Committee, which was presented at the first Triennial International Conference on the Blind in 1905, showed that the contractions omitted from "old braille" were minimal: SELF and FAITHFUL were left out and DECLARED and RECEIVED were replaced by DECLARING (dclg) and RECEIVING (rcvg). Six meanings which had previously been represented by simple upper wordsigns were given different configurations. These simple wordsigns could then represent new words of greater frequency.

The total number of new signs added in 1905 were more than double those appearing in the "Dictionary of Braille Contractions" (BFBA, 1895), most of the additions being composite wordsigns and shortforms. The following table gives this information in a compact form (see Appendix).

Table 1. Table to show the number of signs contained in the British literacy braille code in 1895 and 1905 respectively.

	1895	1905
Simple upper wordsigns	27	34
Upper groupsigns	12	13
Lower contractions	14	19
Composite wordsigns	9	36
Composite groupsigns	11	14
Shortforms	24	73
Totals	97	189

The 1895 dictionary also included 20 words from which the EA sign should be omitted. This rule became obsolete when a contraction for EA was included.

Details of these changes may be seen in Appendix 1. Some of these contractions do not occur frequently enough to seem worth their inclusion; this aspect will be discussed more fully in the next chapter.

6. CODES IN USE IN AMERICA FROM 1971

In contrast with the comparatively settled state of braille reached in Britain by 1905, America had a long and sometimes bitter struggle ahead, often referred to as "the battle of the dots". It lasted from 1871 when Wait introduced the New York point system as an alternative to Howe, later known as Boston, line type, until 1932 when Grade 2 was finally accepted. Comparative unity then became possible among English speaking peoples of the world (Irwin, 1955, p.3).

The Missouri institution was the first to accept the original braille system some time between 1859 and 1861 (Kerney, 1952, p.115). The position of the letter W had been changed so that it appeared between V and X on the seven line table which Braille had used to demonstrate his system; this involved a symbol change for W, X, Y, and Z. The contractions listed in Smith (1878, p.43) are fewer than those used in Britain at that time (BFBA, "Key to Braille reading and writing", undated). When the New York point system was introduced in 1871 the Missouri Institution followed the fashion for a short while, but this code was found to be unsatisfactory so the newly purchased writing apparatus was "sold to the ragman" (Kerney, 1952, p.116) and braille was used there once again.

The several code changes over the years were not adopted immediately by the institutions, for old stock of materials had to be used until new type material could be produced in sufficient numbers. Braille music was found to be superior to Wait's music code (Smith, 1878, p.51) so this resulted in the anomaly of some institutions using braille for music and New York point in the classroom (Sibley, 1892, p.75). At the Illinois institution where New York point was the official type, students began to use braille for their own use, but the slates were confiscated when this fact became known to the superintendent (ibid., pp.74-75).

7. MODIFIED, LATER KNOWN AS AMERICAN, BRAILLE

Howe's son-in-law, Michael Anagnos, succeeded him in 1876. Recognising the need for a punctiform code to replace the use of Boston line type, he encouraged Joel W. Smith, a blind piano tuner at the school, to seek an improvement on the present systems. Accordingly, Smith undertook "a careful examination to ascertain how exactly and completely the conflicting reports which have been published set forth the value of their respective systems" (Smith, 1878, p.40). This was in preparation for the convention of the AAIB to be held in Columbus, Ohio, in 1878.

LABOUR OF WRITING

From a representative selection of authors he counted a total of 50,038 letters together with the punctuation involved. In both codes the frequency of occurrence for each letter of the alphabet and punctuation sign were multiplied by the number of dots occurring in each symbol The resulting totals showed gains in the labour of writing the New York point over braille of 16½% for uncontracted and 1½% for contracted codes (ibid., Tables 1 and 2, pp.42-43).

The individual punctuation figures seem high for New York point. When extracted they give a gain of 41.3% over braille punctuation, a result which is not surprising. Wait had not included punctuation in his first draft. He could not use the braille symbols because, having a code of only two dots high the symbols were already used. Smith allowed five points width for each punctuation mark in his calculations of space used by New York point (ibid., p.45, Table 3).

CALCULATION OF SPACE SAVED

Armitage (BFBA, 1874, p.2) had used only the same ten contractions that occurred in the New York point code when making his comparison of space, whereas Smith considered that "each system should be compared as they are ordinarily published or written" (ibid., p.47). No details seem available of the complete list of contractions used at that time, and Smith confessed (ibid., p.48) that he had omitted some which he thought of least value. Had they been included it is likely that they would have had a minimal effect on the results. By using the numbers of dots already counted and by representing spaces between letters and words and also between lines, Smith was able to compare the area covered by each code. The results showed gains for New York point for uncontracted and contracted versions of 18¼% and 4% respectively (ibid., pp.45-

46). These results are very different from the claims made by Wait of 50% and "about 75%" in 1868 and 1871 respectively (ibid., p.40).

Having proved the superiority of New York point in both the labour of writing and the saving of space, Smith then considered the following factors:

1. music is a universal language and Braille's music code was used exclusively in Europe and also in some institutions in America, where it was regarded as an improvement on Wait's version;
2. it would therefore be an advantage for the literary code also to be in braille;
3. from the encouraging results of Wait's use of the smallest number of dots for the words of greatest frequency, the braille code could be modified accordingly.

THE NEW CODE

When re-arranging the letters and contractions according to this principle he was able to keep twelve of the letters in their original shapes, thus making it easier for learners to transfer from the old to the new version. No change was made to braille punctuation or numbers. Smith then compared his results between the three systems.

The following table was compiled from information contained in Smith's (1878) paper (1878) entitled "Comparison of the braille and New York systems of point writing, and proposed modifications of the braille system".

Table 2. Table to show percentage gains, in the labour of writing New York point over "old braille", modified braille over "old braille", and modified braille over New York point.

	Uncontracted	Contracted
New York point and "old braille"	16.5%	1.5%
Modified braille and "old braille"	25.6%	23.2%
Modified braille and New York point	10.9%	22.0%

Encouraged by these findings Smith presented his case for the adoption of modified braille at the AAIB conference held in 1878. He was given short shrift by Wait and his followers. Most institutions were already using the New York point code and the grant from the government for publishing embossed material was used exclusively by the American Printing House for this purpose. Other codes had to be paid for so Wait's code already had an unfair advantage.

Undeterred, Smith presented another paper a month later at the Congress for the Improvement of the Lot of the Blind and the Deaf Mutes in Paris. From samples of French and German literature he had used a similar method to compare the frequencies in the French and German languages. He claimed that there was enough similarity in letter frequencies for a universal modified code to be possible. This seems unduly optimistic so it is not surprising that the vote went in favour of a general adoption of unmodified braille. New York point continued for the time being to be the code used most extensively in America.

In 1890 Edward J. Allen became director of the institute for the blind in Philadelphia. He had taught at the Royal Normal College in London and then at the Boston school, so he had a working knowledge of both English braille and modified braille. At the AAIB convention held at Brantford in 1892, he was a prime mover in the appointment of a subcommittee set up to consider yet again the choice of the best code. This time the choice was the modified code, later known as American braille, even though no books were then available outside the Boston school.

8. PRINTING

A development of great importance was to substantiate this preference for the modified code. At the same conference (1892) Frank H. Hall demonstrated his braille typewriter. It had six keys, each able to make one dot of the 3 x 2 matrix which could be combined to make the symbols. It was claimed that a competent operator would be able to write "two or three scores of words per minute" whereas a writer using a handframe "could seldom achieve more than twenty words per minute" (Irwin, 1955, p.8). The "stereotypemaker" followed the same design but was powerful enough to emboss sheets of brass for printing.

Wait speedily produced his own versions of the two machines but he encountered problems. New York point symbols for letters and contractions varied from 1 to 4 points in width and between 2 and 4 points for punctuation, whereas braille symbols were always 2 points wide. Wait planned the new apparatus so that "the small letters can be made into capitals by means of styles which form larger points than those of small letters" (Bledsoe, 1972). This would save space because no capital sign would be required but according to J. Lorimer, who was a braille user, such type might be tactually confusing (pers. comm.). As far as is known this difference in size of dots within a text has never been tested. "The competition between backers of the two systems stimulated the development of improved appliances which might otherwise have been long delayed" (Irwin, 1955, p.10), and the success of Hall's innovations must have encouraged the use of some form of braille.

9. MORE COMPARISONS

A committee of the New York Board of Education called a meeting in 1909 to discuss which type should be used in their public schools, but the rivalry and exaggeration of the various claimants was so fraught that a second meeting had to be arranged (ibid., 1909, March and May). There is also a lively account of the proceedings by Irwin (1955, pp.10-16) who was present together with Charles Campbell, son of the director of the Royal Normal College for the Blind, and first editor of the American quarterly "Outlook for the Blind". Helen Keller, who was deaf and blind and who rarely intervened in such controversies, sent a letter to the secretary of the New York Board of Education giving detailed reasons with examples to show her preference for American braille (report of the second hearing held before of the Board of Education of the City of New York, 18th May, 1909, pp.85-86). The decision went in favour of American (modified) braille.

In the following year it was agreed that "forty per cent of the federal appropriation went for American braille books until revised braille completely supplanted both of the contending systems" (ibid., pp.20-21).

10. AMERICAN ASSOCIATION OF WORKERS FOR THE BLIND

While members of the AAIB, many of whom were sighted directors of institutions, were wrangling over which code should be best, the Association of Workers for the Blind (AAWB) decided upon a more practical approach. Many of these workers had little or no sight so would have been more aware of perceptual factors, and their aims included the encouragement of reading and training of blind people for work. In addition it was decided "that a committee be appointed to investigate the various forms of tactile print and to labor for the adoption of some one universal system" (Nolan, E.J., 1907, pp.17-18). A uniform type committee was set up and throughout 1907-1913 testing was carried out concerning legibility of the characters in New York point, the current British braille, and American braille respectively. These investigations involved dot density and position of dots within the cell, equivocal and unequivocal wordsigns and part-wordsigns, capitalisation and also the use of hands and fingers.

At the 1911 convention it was realised that with insufficient funds available no conclusive decisions could be made concerning the relative merits of the three codes. A successful appeal was made and two ladies, one blind and one sighted, travelled many miles conducting tests in thirty-six states (Irwin, 1955, p.32). Twelve hundred American readers were tested eventually, showing that neither New York point nor American braille was superior. To help resolve the matter, "several scores of pupils" were tested (ibid., p.33) at the Halifax school where British braille was taught, and by comparison with other codes was found to give the best results. This result was unexpected and would no doubt have caused consternation amongst the various claimants for the best code.

In an attempt to resolve the situation a new code to be called "Standard Dot" was invented, which synthesised what were claimed to be the best elements of the three previous codes, as follows:

French braille: alphabet letters;

American braille: contractions formed on the principle of the most frequently occurring letter groups having symbols with fewest dots;

New York point: moveable base.

This new code seems to have been compiled without any field testing and may have been a panic measure because of probable pressure to make a quick settlement. This seems an unfortunate decision when compared with the previous pioneer years of detailed research. By trying to combine the best features of three codes little consideration seems to have been taken of resulting defects.

Representatives visited Britain to gain further knowledge concerning British braille and were present at the international conference concerning the blind which was held at Edinburgh in 1914. Standard Dot was then presented to the combined meeting of the AAIB and AAWB at a convention held in 1915. The AAWB accepted the new code but the AAIB only did so on condition that the British authorities would do likewise (ibid., p.37). At the same convention the Uniform Type Committee of the AAWB was discharged, to be replaced by a joint Commission on Type for the Blind.

11. COMMISSION ON TYPE FOR THE BLIND

The last minuted meeting of the British Braille Committee was held on 25th March, 1905, and the British Uniform Type Committee was not convened until 19th May, 1916. Meanwhile, to those interested in uniformity, it was important to take quick action to reject the American suggestion of the use of Standard Dot. Mr. Stone, headmaster of the Edinburgh school, wrote to Mr. Latimer, secretary of the American Commission, expressing this view (17th December, 1915) and an open letter to the same effect appeared in "The Teacher" (January, 1916).

The Commission must have realised that there was little chance of Standard Dot receiving universal approval, so even before its rejection by the British, they abandoned the long search for the chimera of a near perfect code and decided to look for a politico-economic solution instead. They hoped to dissuade advocates from their chosen preferences and to unite in considering a version of the braille code which was already in use in parts of Europe. Such a decision would incur a loss of plates, machinery and books for a code which might seem inferior in some respects. It was much to ask in the name of uniformity and credit should be given for this radical decision.

By July, 1915, "Changes in 'Revised Braille for Reading and Writing'" had been drafted, and on 30th March, 1916, in reply to a request from Mr. Stainsby, Secretary General of the RNIB and Registrar of the College of Teachers of the Blind, several copies were sent to Britain for consideration. The British Uniform Type Committee was speedily convened as a result.

It is an interesting paper because the contents show how much code knowledge had been acquired as a result of the previous years of research, and as each point is made it is immediately followed by an explanation of the ground on which it is made. The emphasis seems to have been on ease of reading.

The first suggestion was that British braille should become "as completely capitalised as in literature for the seeing". This difference between American and British braille has continued up to the present day with only the Americans consistently showing capitalization. Other suggestions included the suppression of the poetry sign, the suppression of lower contractions in the interests of legibility, sequencing to be discontinued, and 17 wordsigns left out on the ground that they placed a burden on memory.

It became obvious that the rules of British braille were regarded as settled so once more the reply from Britain was negative (Irwin, 1955, 43-44). The Americans therefore felt free to make their own decisions. They wanted a code which could be understood by those who read both Grade 1 and Grade 2 so the choice was Grade 1½ (Commission on Uniform Type, 1918). Grade 1 was to be almost identical with the British version except that it was to include capitalisation. For Grade 1½ the number of contractions was limited, though the 44 shortforms included were identical with British characters. Contractions occupying more than one cell were not permitted.

At last the New World had a code which could be understood by other English-speaking peoples, and immediately a large scale publication of books in the new code took place. By 1923 a permanent commission on uniform type was recognised by both the AAIB and the AAWB (Latimer, 1930, 468-472).

CHAPTER 6

A CLEARER UNDERSTANDING

1. BRITAIN - A PERIOD OF CONSOLIDATION

2. AMERICAN - THE USE OF GRADE 1½

3. 1929 - 1932

4. A SURVEY OF THE FREQUENCY AND SPACE-SAVING OF THE CONTRACTIONS OF GRADE 2

5. THE 1956 BRAILLE WORKING PARTY

6. "A STUDY OF BRAILLE CONTRACTIONS", 1982
   - (A) Literature Survey (Pt.2, 115pp.)
   - (B) Questionnaire (Pt.2, Vol.2, pp.1-4)
   - (C) Surveys of Space-saving and Frequency of Contractions (Pt.1, Vol.2, pp.5-80)
   - (D) Experiments with Modified Grade 2 Braille Codes to Determine their Effect on Reading Speed (Pt.1, Vol.4, p.39; Material Used, Pt.1, Vol.3, pp.1-58)

(E) "The Limitations of Braille as a Medium for Communication and the Possibility of Improving Reading Standards" (Lorimer, J., 1978) (Pt.1, Vol.4A, pp.1-21)

(F) Analysis of Symbols, Meanings and Rules of Standard English Braille (Pt.1, Vol.4B, pp.1-16)

(G) Analysis of Errors (Pt.1, Vol.1, pp.31-34)

(H) Outlines of a Short Course to Improve Braille Reading Efficiency (Pt.1, Vol.4C, pp.1-47)

7. THE WASHINGTON INTERNATIONAL CONFERENCE ON ENGLISH BRAILLE GRADE 2 (1982)

8. POST WASHINGTON

Capital Letters

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The BAUK Questionnaire

9. THE LONDON INTERNATIONAL CONFERENCE ON ENGLISH BRAILLE GRADE 2 (1988)

10. OBSERVATIONS ON CODE DESIGN AND CHANGES IN ENGLISH BRAILLE FROM C1870 TO 1960

Circa 1870

1895

1905 Revised Braille

1932

1960

1. BRITAIN - A PERIOD OF CONSOLIDATION

After revised braille had been accepted at the international conference held in Edinburgh in 1905, a time of consolidation followed. The National Lending Library for the Blind, which supplied books in both braille and moon codes, had been in existence since 1862. The standard of transcription was high for "volume by volume the books come in, are corrected at the library, shellaced and bound to wait on a cellar shelf until completed. A report on each volume is sent to the writer, so that any mistakes are not repeated" (*Outlook for the Blind*, 1909, 2, p.173). "Shellac" refers to a type of varnish applied to the pages which made them stronger and the dots less likely to be depressed. The first braille copies were made by sighted transcribers then blind people made replicas either voluntarily or as a means of paid employment. To maintain a high standard of teaching, the College of Teachers of the Blind was inaugurated in 1907. Its examinations were recognised by the Board of Education and these included a test of a knowledge of braille.

The settled state of the code was demonstrated by the fact that no meetings of the British Braille Executive Committee were entered in its minute book after 1905 until May 1916, though records of sub-committee meetings to tidy up the 1905 decisions still exist.

In 1916 the National Institute for the Blind convened a meeting of representatives of educational societies, publishing houses, the home-teaching society and libraries, "to appoint a thoroughly representative committee (which shall in effect be a national committee) to deal with the whole subject of Uniform Type". It became known as the National Uniform Type Committee and the first work to be considered was the changes contained in "Revised Braille for reading and writing, 1915" at the request of the American Commission on Uniform Type (see the previous chapter). Besides the ensuing meetings and correspondence made necessary while the Americans were determining their code, a meeting was held in Britain in 1922 (Irwin, 1922, p.64) to the motion "that the present system known as Official Grade II does not adequately meet the requirements of the blind student, and that the present time is opportune for a more scientific adaptation of the Braille System". In fact, the committee considered the timing most inopportune, for many Americans already thought Grade 2 was far too complicated and therefore differences between the two grades should not be increased. It was decided that if so required, a scientific work could be prefaced with suitable symbols and their meanings. No further code problems arose until Irwin put some American suggestions to a meeting of the British Uniform Type Committee in November, 1929.

2. AMERICAN - THE USE OF GRADE 1½

Once the Commission on Uniform Type in the United States had accepted Grade 1½ (1918) no time was lost in the production of text books for schools. It was hoped that Grades 1½ and 2 were sufficiently alike for exchanges of adult books to take place across the Atlantic. In fact, it gradually became apparent from opinions given by library users, that whereas British people rarely read Grade 1½, approximately 20% of Americans read Grade 2 and the trend seemed to be increasing (Irwin and Wilcox, 1929, p.1). The Commission on Uniform Type for the Blind (1917, p.14) had been instructed to "continue its labors with the British National Uniform Type Committee with the view of reaching a complete agreement regarding the whole question of uniform type". Having produced a number of text books for children the Americans were about to provide classics and more fiction for adult readers (Irwin, 1929, typescript, p.6), so it seemed the moment for the research department of the American Foundation for the Blind to undertake a more detailed study of the differences between the two codes.

On first inspection the main differences seemed clear cut. Grade 1½ used 44 of the 189 contractions included in Grade 2; two-space contractions, double letter signs and shortforms were not included; and the American version used capital letter signs wherever capital letters occur in inkprint.

The American lexicographer, Noah Webster, devoted much of his life, particularly between 1789 and 1828 "to the zealous championing of the cause of American language, its spelling, its grammar and its punctuation" (McCrum, et.al., 1987, pp.240-241). Webster's maxim was, "A good articulation consists in giving every letter in a syllable its due proportion of sound, according to the most approved custom of pronouncing it, and in making such a distribution between syllables of which words are composed that the ear shall without difficulty acknowledge their number", and school children were often made to chant columns of his spelling lists (ibid., pp.241-242). It does not seem too far-fetched to suggest that his writings had an effect on American preference for syllabication in braille usage over a century later. Syllable divisions are not always easy to determine so a dictionary is a useful tool for the transcriber.

By contrast, in Britain contraction rules permitted the shortening of words so long as the clarity of meaning was not impaired. This sequencing often resulted in contractions crossing syllable boundaries and sometimes a choice of contractions had to be made involving the need for yet more rules of usage.

No exhaustive analysis of space-saving values had been carried out in the 1920s when Grade 1½ was being used in America. In the interests of uniformity, Irwin and Wilcox (1929) made a study of 91,564 words taken from four volumes, specifically to determine the space-saving effects of the use of Grade 2 over Grade 1½. They were particularly interested to know what the effect would be if

Americans accepted the 44 contractions and shortforms not included in Grade 1½.

The 91,564 words were treated as if written in a continuous line to obviate the effect of varying lengths of lines in the publications consulted. When written in Grade 1½ they took up 427,776 cells and the Grade 2 version used 376,866 cells, that is, 11.9% less space than Grade 1½. This saving was caused not only by the differences between the space saving of the contractions, but because Grade 1½ had to omit some of the contractions because of the syllabication rule (Loomis, 1936, pp.4-5). For example, the following contractions were not permitted:

AR	in	library, military,
ER	in	serious, exterior,
AND	in	candle, abandon.

Because of these imposed restrictions in the use of Grade 1½ the code was less flexible and the uncontracted letter strings were likely to have had a deleterious effect on the rate of reading.

Irwin and Wilcox included tables showing in descending order the space saving value of each contraction and also its frequency of occurrence. Both these measures are necessary for determining the relative value of contractions for inclusion in the code. The extent to which they facilitate or hinder reading is more difficult to determine and more accurate results can only be provided by research. The results showed that the code was even less economic than forecast, for it was found that though TO saved 7% of all the space saved by Grade 2 over Grade 1½, fifty contractions at the lower end of the table taken together did not save as much space as some individual contractions at the top of the table, and seven contractions or shortforms did not appear in the literature selected. The study was sent to members of the (British) Uniform Type Committee with the hope that by a judicious addition of contractions to Grade 1½ and some deletions from Grade 2, a better measure of uniformity might ensue.

3. 1929 - 1932

Irwin set out some general proposals for bringing the two grades closer together before the meeting of the British authorities held in July, 1929 (British NUTC minutes). Though not all members were enthusiastic, they agreed to set up a sub-committee to meet with the Americans. The American Printing Press were so concerned by Irwin's activities that the director sent a cable to England, the gist of which was "We are not sure what you are doing in your effort to bring about braille uniformity, but whatever it is, please desist" (Irwin, 1955, p.50). It did not reach him until his meeting with the British was concluded!

The AAIB and AAWB were asked to bring the study before their members to enable them to discuss what further steps should be taken. Publishers of braille magazines in America had helped readers to understand possible changes by gradually introducing Grade 2 signs in their publications before a conference was held in London in July, 1932, between representatives of the braille authorities of Britain and America (Irwin, 1932, p.138). By contrast with past disagreements, the atmosphere was cordial and it would seem that a great deal of this co-operation was due to the careful preparation carried out by Robert Irwin, himself a blind man.

The main decisions (British UTC Minutes, 1932) included the following:

1. The dot numbers within the cell were changed from:

1 ○○ 2 3 ○○ 4 5 ○○ 6	to	1 ○○ 4 2 ○○ 5 3 ○○ 6

(This reversion to the French method was probably taken so as to be compatible with braille in mainland Europe. It is suggested by the writer that the interim method may have been used so as to be the same as dot numbering for music.)

2. The British signs for capital letters and italics were reversed, the new positions being:

Capital Letter	Italics
○ ○ ○ ○ ○ ●	○ ● ○ ○ ○ ●

(This decision helped recognition of two-spaced compound contractions. America continued to use capital letters wherever they occur in print, whereas in Britain the capital was not generally used.)

3. Britain agreed to drop the use of nine biblical words except in religious literature, and five new shortforms were added (see Appendix 1).

4. The Americans agreed to adopt all the contractions and shortforms not already included in Grade 1½.

The Americans had come a long way in accepting so many of the Grade 2 rulings in the interests of uniformity, but they still differed over some of the British practices with regard to sequencing within words. Rule 34 was inserted in

"Standard English Braille, Grades 1 and 2" (1932, National Institute for the Blind, p.18) as a compromise: "The contractions forming parts of words should not be used when they are likely to lead to obscurity in recognition of pronunciation, and therefore they should not overlap well-defined syllable divisions. Word signs should be used sparingly in the middle of words unless they form distinct syllables. Special care should be taken to avoid words of relatively infrequent occurrence."

Lists of words showing preferred methods of contracting were appended, which is evidence of the problems involved in trying to use a code of comparatively few signs to represent the large vocabulary making up a language. Despite these difficulties, after a century of endeavour, the English-speaking peoples on both sides of the Atlantic were united in having a code similar enough for an increase in the exchange of books, and any further code alterations could be decided together in a spirit of harmony. Canada, Australia, and New Zealand would benefit as well as the peoples for whom English is a second language. The conference was a significant occasion in the history of the development of the braille code.

4. A SURVEY OF THE FREQUENCY AND SPACE-SAVING OF THE CONTRACTIONS OF GRADE 2

Although a close degree of uniformity had been reached in 1932, a sub-committee of the (British) UTC undertook to look to the future to determine whether yet more improvements could be made. A more detailed research was needed (British NUTC minutes, 28th January, 1950), so the first task undertaken was a wide ranging survey of the frequency and space saving values of all existing Grade 2 contractions to see how far it is an effective system. This was carried out by Lochhead and Lorimer, J. (1954).

To fulfil its purpose a survey not only has to be carried out with accuracy, but must cover as wide a range as possible in proportionate amounts within the confines of the subject studied. With these criteria in mind, the larger the number of words studied, the more accurate the study should prove to be.

The study was to cover general reading so learned and scientific works were not included. Twelve subject areas were covered ranging from nineteenth century fiction to modern day periodicals. No calculators or computers were available at that time so the processing of half a million words was carried out by volunteer helpers who were all experienced braillists. From this information the relative space saving of each contraction, and also the usefulness of "families" of contractions which have similar rules for usage, could be determined. The results again showed that Grade 2 is a far from efficient system. Nine contractions had been deleted and 5 new ones added in 1932 bringing the total to 185. Of these, the first 14 contractions do almost as much work as the remaining 171 and the last 45 contractions between them only save 500 spaces. The survey was a model of careful planning and efficient execution. A copy of the report was sent to the Joint Uniform Braille Committee in America (British NUTC minutes, 25th March, 1955).

5. THE 1956 BRAILLE WORKING PARTY

With the publication of a detailed rule book by the British UTC (1953), and the Lochhead and Lorimer survey showing strengths and weaknesses of the code, the NUTC felt in a strong position to make suggestions for possible improvements. It was considered that "space saving was important, but that readability and ease of learning were more important" (British UTC minutes, 25th March, 1955). A sub-committee produced 10 recommendations (ibid., 3rd June, 1955), which were sent to the Americans, who in turn sent some of their own which were less far-reaching. They also suggested a joint working party for all the proposals to be discussed, so representatives from both countries met in London in 1956.

The joint decisions (ibid., 30th November, 1956) were considered by representative bodies in Britain and North America. Many of the suggestions were accepted in Britain, but in America, not only were the deletions suggested in 1956 approved, but further deletions had been approved since, thus breaking the "gentlemen's agreement" between the two countries. It had been a democratic decision by the American public. The main changes concerned the use of lower signs when used in sequence, the addition of four shortforms (bringing the total to 189), and the dropping of the use of a hyphen in three compound words. America had agreed to most of the contents of Grade 2 in 1932. The position was now reversed with Britain agreeing to American preference.

6. "A STUDY OF BRAILLE CONTRACTIONS", 1982

During the 50s and 60s some research studies on the braille code were carried out by members of the research committee of the College of Teachers of the Blind. Meanwhile, a substantial amount of speculative and empirical braille research was accelerating in America into the perception of braille and methods of making the code easier to learn and to read. The time had come for the CTB research committee to be disbanded and instead, the full-time Research Centre for the Education of the Visually Handicapped was set up at Birmingham University in 1970. Warwick University also had a research centre.

Douce and Tobin (1976) considered that the time was ripe for a multi-variate approach "to generate the kind of information that would make it possible to formulate decisions about code modifications that would, in turn, make the learning of braille, and subsequent improvement in reading efficiency, easier". A joint three year project was therefore undertaken by Warwick and Birmingham universities (Lorimer, J., et al., 1982, vol.1, p.2) with two main aims: (1) to explore the possibility of producing an alternative Grade 2 code that would be shorter and simpler to learn, but could be read as fast as the existing Grade 2 code and would require no more space, and (2) to investigate ways of improving teaching methods and materials. Descriptions of some of the main studies follow.

(A) LITERATURE SURVEY (PT.2, 115PP.)

An annotated bibliography was compiled by the writer during the first year of the study for the benefit of the research team. It included works on the development of the braille code, research and education, but because of the time factor, parameters had to be set; approximately 300 entries were included, most of them published between 1945 and 1980. An author index was included and also a subject index compiled from the descriptors which had been included with each entry.

(B) QUESTIONNAIRE (PT.2, VOL.2, PP.1-4)

The questionnaire survey was undertaken to help in identifying specific aspects of the braille contraction system which merited detailed study. Three hundred and one responses were received from blind, partially sighted, and sighted subjects whose age range was 20-93 years, all of whom lived in the United Kingdom. Information was received on such aspects as preferred grade of braille, opinions on space saving, specific problems in recognition of certain contractions, and opinions on punctuation and unit signs, and format. In conclusion (p.4) "the general view seems to be that there is no desire for any change unless it can be very clearly demonstrated that there are some very significant advantages to be gained by modifying the system".

(c) SURVEYS OF SPACE-SAVING AND FREQUENCY OF CONTRACTIONS (PT.1, VOL.2, PP.5-80)

The Gill corpus of 2,255,326 words was compiled at Warwick University using a selection of material already stored in the data bank. This consisted of short runs which had been put into braille at the request of individuals, and also an almost equal number of words entered from novels, short stories and non-fiction. Also included were the contents of the Kucera and Francis count (1967), often referred to as the Brown Corpus. Numbers of pairs, three-letter and four-letter strings of letters were tabulated indicating whether they occurred at the beginning, medial and final positions in words, and a table in descending order of space-saving was also included. Thus, by inspection, it was possible to determine which groups of letters would be the most economical to include in a projected improvement to Grade 2 braille.

The Lochhead and Lorimer study (1954) containing approximately 540,000 words, and the Kederis, Siems and Haynes (1965) count containing 291,000 words from children's literature, were already in existence, but it was felt that none of the four corpora was entirely satisfactory because of differences in the selection and proportion of the materials treated, the differences in the number of words analysed and also the variations in language and braille usage between Britain and America. To obtain a more accurate result each contraction was reduced to occurrences per million words in each of the four counts and then the mean frequency was computed and tabulated in descending order. A similar treatment was given to demonstrate the space-saving values. A further table showed the space saving contribution made by 'families' of contractions each containing contractions which have similar rules. This knowledge is useful because keeping a whole family or deleting the whole or part of it may have a considerable effect on the use of space and the number of necessary rules.

(D) EXPERIMENTS WITH MODIFIED GRADE 2 BRAILLE CODES TO DETERMINE THEIR EFFECT ON READING SPEED (PT.1, VOL.4, P.39; MATERIAL USED, PT.1, VOL.3, PP.1-58)

In general, reductions in the contents of a code will decrease the number of necessary rules and make the learning task easier, whereas extensions will increase the learning load. However, before changes are made it is necessary to estimate the probable effect of these changes in terms of space-saving, ease of learning and on rate of reading. Findings of frequency and space-saving surveys had given information that might lead to improvements, but so far no measurements had been made of the effect of possible modifications based on this information in terms of words read per minute.

During the first year of the study while other investigations were proceeding, 10 code modifications were tried out under controlled conditions in order to determine their effect on rate of reading. It was realised that because of lack of experience with the experimental codes, subjects tended to read them more slowly than the Grade 2 version with which they were familiar, and therefore differences in the scores obtained should be regarded as maximal. However, they provided a useful indication of the effect of certain modifications on reading rate.

The criteria for the experiments included the fiats that space-saving and reading rate should be at least equal to those for Grade 2. The results of the experiments showed that about 70 of the useful contractions could be deleted, but to fulfil the terms of the criteria, about 10 new space-saving contractions of greater value could be added. Statistical data supplied by other investigations in the study supplied further predictions (Vol.2, Ch.5, p.79).

(E) "The Limitations of Braille as a Medium for Communication and the Possibility of Improving Reading Standards" (Lorimer, J., 1978) (Pt.1, Vol4A, pp.1-21)

This paper, written during the early stages of the project, was read at a meeting organised by the British Psychological Society. Comparisons are made between accuracy, comprehension, and reading rates of blind and sighted children (Ashcroft, 1960; Williams, 1971; Lorimer, 1977). Information is also included concerning intelligence and braille reading, the limitations of touch perception, and the application of rapid reading techniques for inkprint to braille reading in an attempt to improve braille reading standards.

(F) Analysis of Symbols, Meanings and Rules of Standard English Braille (Pt.1, Vol.4B, pp.1-16)

It has long been realised that one of the main difficulties in reading braille has been the number and complexity of the rules. Fewer contractions with attendant rules might make the code easier for some people at the learning stage, particularly adults who can already read inkprint yet have to learn a new set of symbols and need training in their perception. Computer programmers would also welcome a simpler code. An analysis was carried out to determine:

1. the number of symbols, meanings, and governing rules;
2. the number of rules which need not be known by beginners;
3. how far rules for a revised code could be reduced without lowering the efficiency of braille.

(G) ANALYSIS OF ERRORS (PT.1, VOL.1, PP.31-34)

The Lorimer Braille Recognition Test (1962) was administered to 91 subjects in the United Kingdom, of whom 64 were under the age of 20 and 27 aged 20 and over. The test included 178 of the 189 contractions of Grade 2. No errors were recorded on 23 contractions and of the 23 contractions most associated with error, 311 mistakes were recorded by subjects under the age of 20 and 111 errors by those who were 20 years and above. This test had been standardised on a sample of 332 children but there is no standardised braille reading test yet available in Britain for use with adults. These facts, though gained on a relatively small sample, can be taken as an indication of some of the reading difficulties of Grade 2 braille.

(H) OUTLINES OF A SHORT COURSE TO IMPROVE BRAILLE READING EFFICIENCY (PT.1, VOL.4C, PP.1-47).

Based partly on rapid reading techniques involved for sighted readers (Fry, 1963; de Leeuw, M. and E., 1965) and research on rates of braille reading (McBride, 1974; Crandall and Wallace, 1974), Lorimer, J. planned a course intended to improve the rates of reading of pupils in the lower grades of senior schools. The materials used are included in the report and also a table for converting reading time to reading rate so that replication of the experiment is possible.

The Birmingham/Warwick study was the most extensive investigation of braille ever attempted and was bound to accelerate further studies of the code. The report was sent to the Department of Health and Social Security, and members of the Braille Authority of North America (BANA). The writer was present at the Toronto conference held in 1981 in preparation for the Conference of English Braille, Grade 2, held a year later. The chairman praised the work of the university investigators and remarked (pers. comm.) that the enquiry was at least five years ahead of any other enquiry at that time.

7. THE WASHINGTON INTERNATIONAL CONFERENCE ON ENGLISH BRAILLE GRADE 2 (1982)

The basic assumption of the universities' study was that there should be one official code in general use. Members of BAUK recognised the advantage of reducing the number of contractions to be learned without sacrificing space and it was hoped that such changes would induce more adults to want to learn the code. However, a few members of the Braille Authority of the United Kingdom (BAUK, formerly British UTC) wanted an advanced grade as well, with many more contractions for the use of fluent, extensive braille users even though such people would be in the minority (Milligan, 1982, p.93).

In 1978, the Braille Authority of North America (BANA) submitted the following recommendation for consideration by BAUK (proceedings of the Washington conference, 1982): "The Braille Authority of North America wishes to join with the National Uniform Type Committee of the United Kingdom to explore the possibility of devising a common Literary Braille Code for the English language. The exploration should encompass both readability and computer implementation."

At the Washington Conference (1982) delegates recognised that computer use of braille would make some code changes inevitable, but such changes should be regarded as "temporary, experimental guidelines, rather than amendments to the braille code" (Resolution 6, p.248).

Amongst the research suggestions (Resolution 7, p.248) were: the development and field-testing of a contracted literary code based on the experience of users and teachers as well as on theoretical consideration and research findings; the achievement of uniformity in the form, placement, and spacing of unit abbreviations for coinage, weights, and measures; and attempts to persuade properly qualified persons to provide information about the structure and functions of the touch sense (with reference to braille reading). These suggestions seem wide ranging and it was encouraging to the writer, who was present, to note the attempted welding together of expert theoretical knowledge with user experience.

Possibly the most important resolution passed was the setting up of an international co-ordinating committee whose members were to be one representative from each of the participating nations. Their mandate included the preparation of proposals for the establishment of an international authority on English literary braille. This was a commendable step, for so far the only authorities making decisions had been those of Britain and America. The activities of the proposed international authority will be further considered in Chapter 9.

Another conference was planned to take place in London when definite proposals for changes to the code would be considered and braille users were to be fully consulted before any such changes were implemented. The exception was the immediate acceptance by Britain of the American practice of using the AR contraction in preference to EA in the letter group "ear".

8. POST WASHINGTON

Capital Letters

A joint investigation was carried out between the USA, Canada, and Britain to determine what effect the capital letter sign had on the comprehension and rate of reading. The results were insignificant and at present each country is following its own preference regarding the use of capital letters. Americans still prefer to use them where they occur in print and the British use them very rarely. An ongoing enquiry under the auspices of BAUK is at present (1996) being carried out concerning "Capitalization in British Braille" (see Chapter 9).

CODE REVISIONS

A large proportion of inter-conference time was spent in Britain on evolving a variety of new versions of the literary braille code system. These may be consulted in "Essays in Code Design" (RNIB, 1986) where (p.5) the report is regarded as "the culmination of the research" carried out by Birmingham and Warwick universities. They include:

- a simple contracted code intended for those who are unable or have not the time or inclination to master the intricacies of Grade 2;
- two codes intended for the average reader;
- and a very much simplified code which is the springboard to another which is greatly expanded for the advanced reader.

These codes, together with the experimental ones tried out in the universities' study, demonstrate very clearly that there can be no one universal code suitable for all braille readers. Varying abilities, interests, and circumstances need to be considered, preferably the codes should have the same meanings for the symbols that are common, and it would be impractical in terms of expense to have books in too many code versions. The trials were useful exercises in demonstrating the difficulties for code design is a very complex exercise.

THE BAUK QUESTIONNAIRE (1986)

A questionnaire on braille code reform was circulated by BAUK in 1986 to which there were in all 1627 replies, 1217 of whom were touch readers. Braille is an emotive subject for blind people. It is something they regard as their own and conservative feelings about change were expected, especially among the older members of the population. On the whole, advanced readers and young readers were the more ready for reform. About two-thirds of the braille using respondants wished the contents of Grade 2 to remain substantially unaltered but with some further contractions added (Lorimer, 1988).

9. THE LONDON INTERNATIONAL CONFERENCE ON ENGLISH BRAILLE GRADE 2 (1988)

The BAUK questionnaire (1986) had revealed that the majority of braille users who sent in replies did not want any major changes to the literary braille code. The Washington braille conference (1982) had recommended the setting up of an international council on English braille which would be ratified at the London Braille Conference of 1988. These two decisions led to a conference decision that any further improvements to the code should be delayed until the International Council on English Braille was set up. Arrangements for the latter were to begin immediately following the conference. However, a few changes were agreed involving the use of quotation marks, fractions, and unit abbreviations.

10. OBSERVATIONS ON CODE DESIGN AND CHANGES IN ENGLISH BRAILLE FROM C1870 TO 1960

Because touch reading is such a slow medium, the choice of contractions to reduce the amount fingers must travel is of great importance. In theory, the more contractions that are included, the greater the rate of reading, but there are other qualifying aspects. Too many different symbols increase the learning load and number of rules, and of even greater importance is an understanding of the problems presented by embossed material. These perceptual difficulties are complex and will be considered at greater length in Chapter 8. More easily measured is the amount of space-saving contributed by each contraction leading to an increased rate of reading.

Because "the Grade 2 code is not as efficient a communication medium as it might be" (Lorimer, J., Tobin, Douce, and Gill, 1982, p.121) it is obvious that some contractions save more space than others. For example, "immediate" IMM saves 6 spaces whereas "your" YR saves 2, so it might be thought that "immediate" would be of better value in space-saving, but it is also necessary to know how often the contraction is likely to occur. Even after calculating the mean values of four counts in order to gain greater accuracy of values of space-saving, Lorimer, J. added ("Study of Braille Contractions", Vol.2, p.49) that these "must be regarded as approximations, for there can be no absolute frequency or space-saving value for any contractions". Using Table 17 (ibid., Vol.2, p.58) it may be seen that in a million words "immediate" saved only 865 spaces whereas "your" saved 3,134, the reverse of what might have been previously expected before frequency was considered.

This aspect of space-saving was not always recognised in the past so Table 3 (below) was compiled by the writer to provide the information in a compact form. It is realised that vocabularies change slightly over the years but even so the values shown in the table give some indication of the success of the added contractions. A few of the contractions were given different symbols in ensuing revisions so, by adjustment, the contractions here show space-saving at the time when they were first included in the code.

Nine religious contractions and five others were included in the British Literacy braille code at various times between c1870 and 1932. These were not included after 1932 so there are no space saving values included for them in the 1956 and 1978 counts, and therefore do not appear in the table. The table should therefore be regarded as indicating main trends in the year before 1932.

Table 3

Table to show the number of new contractions introduced into the British literary braille code between c1870 and 1960, which saved at least one space over Grade 1 per million words.
(The space saving shown here does not include alphabetic, punctuation, composition or mathematical signs.)

Total Number of Spaces Saved by Each Contraction	Number of Contractions Introduced				
	c1870	1895	1905	1932	1960
Over 50 Thousand	4	-	-	-	-
40,000 - 49,999	3	-	-	-	-
30,000 - 39,999	4	-	-	-	-
20,000 - 29,999	3	-	2	2	-
10,000 - 19,999	17	-	3	3	-
9,000 - 9,999	2	-	1	-	-
8,000 - 8,999	1	1	1	-	-
7,000 - 7,999	1	-	2	-	-
6,000 - 6,999	2	1	4	-	-
5,000 - 5,999	3	1	6	-	-
4,000 - 4,999	5	1	5	-	-
3,000 - 3,999	1	2	9	-	1
2,000 - 2,999	7	4	11	-	2
1,000 - 1,999	7	4	22	-	-
900 - 999	-	-	7	-	1
800 - 899	-	1	-	-	-
700 - 799	-	-	1	-	-
600 - 699	1	-	6	-	-
500 - 599	-	-	1	-	-
400 - 499	-	-	1	-	-
300 - 399	1	2	5	-	-
200 - 299	-	-	1	-	-
100 - 199	-	-	3	-	-
Under 100	-	2	8	-	-
Total Number of New Signs	62	19	99	5	4

CIRCA 1870

At once it becomes apparent that the choice of contractions included in the first version of the English braille code was excellent, for at least half of them saved over 10,000 spaces each per million words and very few must have saved less than a thousand spaces. However, it has to be remembered that there was a certain freedom of individual choice concerning the use of shortforms so these cannot be included. It is known that Armitage (1874) analysed passages from four works to calculate space saving, so it is surmised that he may have already used these values when the code was being adapted from the French version.

1895

The additions had been decided in committee over the intervening years since 1870 (BFBA minutes) so do not represent a full-scale revision of the code. 1870 had had first choice for the most space-saving contractions so a concentration on middle-range contractions was to be expected. The worst feature was the inclusion of more contractions in the lowest space-saving range, which suggests that the choice was made without reference to frequency.

1905 REVISED BRAILLE

After revision in 1905 the new code became just over double the size. This was partly caused by the addition of specific shortforms instead of the writer being left with the choice. The decision made for less guessing by the reader and presumably speedier reading. The transference of some meanings from simple to compound symbols to make room for new words is to be commended. Altogether 13 simple upper wordsigns were added. IT saves 10,515 spaces per million words, 9 words were added in the middle range, and 3 each saving less than a thousand spaces. KNOWLEDGE occurs very infrequently and GO and US are so short that they were not worth being included, but other short words earn their place because of their frequency value. Most simple wordsigns were planned to be represented by their first letter to help lessen the learning load. It is not always easy to find a suitable replacement if this mnemonic help is to be retained. On the other hand braille is limited by the number of signs available. 1895 had included such words as RECEIVE, DECLARE, REJOICE, and the 1905 version continued the trend, sometimes seeming to prefer a collection of similar words instead of finding ones of more value. However, the committee members did not have the use of the extensive frequency lists that are available today. 1905 presented a great opportunity and some good decisions were made but insufficient knowledge and some subjective choices led to inclusion of some uneconomic contractions which remain in the code today.

1932 "STANDARD ENGLISH BRAILLE"

The Americans were hoping that in accepting Grade 2 there would be a reduction of some of the contractions (Irwin, 1931, p.33). Only 9 religious words were eliminated.

1960

Only four new contractions were introduced (British UTC, 1960).

The BAUK questionnaire had indicated that a majority of braille readers preferred no further changes to contractions in words for the time being. Vocabularies, codes and technical advance never stay still so the last chapter will include more information about the possible future of the English literary braille code.

PART 2

AN ANALYSIS AND EVALUATION OF RESEARCHES CARRIED OUT IN ENDEAVOURS TO MAKE THE BRAILLE CODE EASIER TO READ AND TO WRITE

CHAPTER 7

PSYCHOLOGICAL PROPERTIES OF TOUCH PERCEPTION

1. INTRODUCTION

2. PASSIVE TOUCH, STUDIES OF SEPARATE TOUCH SENSATIONS

3. ORGANISATION OF THE HAPTIC SYSTEM

   The Skeletel System

   The Neural System

4. DIFFERENCES BETWEEN PASSIVE AND ACTIVE TOUCH

5. THE THEORIES OF J.J. GIBSON

   Perceptual Meaning

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7. PERIPHERAL MECHANISMS

Structure of the Glabrous Skin of the Human Hand

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Hemisphere Asymmetry

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Memory

11. THE INTERLOCKING STRUCTURE OF VARIABLES

1. INTRODUCTION

This short introduction to the psychophysiology of touch perception as it relates to using the braille code is included because an understanding of the functions involved in braille reading is incomplete without it. For many years educational psychologists and teachers investigated reading habits of blind children, and the studies of Ashcroft (1960) and Nolan and Kederis (1969), for example, showed the effects of different reading situations such as dot numerosity and the use of contractions in different parts of the words. Investigations, since approximately 1970, have highlighted a greater understanding of the peripheral and central mechanisms of neural input, which can be applied to the complex procedures involved in braille reading. However, as so often happens, this new knowledge leads to the realisation that so much more is still waiting to be discovered about tactual reading. Many investigations are being made, but direct application to braille reading still needs considerable expansion.

To many the code has proved difficult to learn and to use for several reasons. Amongst these are problems of perception, and the many rules made necessary because only 63 configurations are possible using Braille's 3x2 matrix. The same sign may have to represent up to 8 different meanings according to position within the matrix, within the word and when used for punctuation. As a result of such difficulties it is a very slow medium to use, for the average number of words read per minute is approximately only a third of those read in a visual medium. The past 50 years has seen a succession of attempts to alleviate this situation by means of observation, experiment, and training in endeavours to improve the accuracy, comprehension and rate of braille reading performance. The more important of these efforts will be discussed.

To be of most help these studies need to be read in the light of an understanding of touch perception as it applies to the reading of braille. Much has been written about the psychophysiology of visual and auditory systems, occasionally using the touch modality for contrast, but little has been understood about the latter until the writings of Katz in 1925. His work was not translated into English in its entirety so was comparatively little known. It was therefore all the more impressive when the works of J.J. Gibson (1962; 1966, published in Britain, 1968) became known in America and Britain. In a personal comment on Katz' monograph "Der Aufbau der Tastwelt", Gibson said "I owe more to it than I have recognised recently" (Krueger, 1982), but such a comment does not detract from J.J. Gibson's work for all research should be carried out with due recognition of what has already been discovered. Since then there have been several studies on different, specialised aspects of touch perception. Much work still needs to be carried out in these areas, but meanwhile the present knowledge needs to be linked up with what is known concerning the braille code and reading in braille.

2. PASSIVE TOUCH, STUDIES OF SEPARATE TOUCH SENSATIONS

"For a long time, two assumptions have been made about the senses, first that they are the only sources of knowledge about the world, and second that they are the channels for special qualities of experience" (Gibson, 1968, p.47), yet as late as 1973 Taylor, Lederman, and Gibson noted that "It is remarkable how little is known about perception by touch after more than a century of experimental psychology" (Krueger, 1982, p.4). Reasons that have contributed to this lack of knowledge include:

1. there is no single sensory centre for the touch modality as there is for vision, hearing, taste, and smell;
2. psychologists have carried out many experiments concerning vision and hearing sometimes using touch perception as a contrast, and this has tended to lead to an underestimation of the possibilities of the touch perception when other modalities, particularly vision, are missing;

For a century from approximately 1830, tactual perception was studied as cutaneous sensitivity. Parts of the skin were probed in efforts to determine reactions such as awareness of pain or cold, and it therefore seemed reasonable to suggest that each sensation corresponded to a nerve ending which, when excited, would convey the information to the brain. An attempt to list the mosaic of sensations proved impossible because parameters of the sensations were difficult to define. For example, "It was argued that temperature was a different quality from touch, and that pain also was different" (Gibson, 1968, p.98), that warmth must be separated from cold and that pressure differed from prickly pain. Early in this century it was thought that touch could be divided into 5 senses of pressure, warmth, cold, pain, and kinesthesis, which is an awareness of movement (ibid., p.98). All these enquiries were confined to the study of passive touch rather than active touch.

Revesz (1950) wrote "the sighted organize space mainly in terms of external spatial co-ordinates. The congenitally totally blind rely instead on haptic (touch and movement) space" (Millar, 1994, p.19). This seems highly probable and will be discussed later in the chapter.

3. ORGANISATION OF THE HAPTIC SYSTEM

THE SKELETAL SYSTEM

Katz suggested that the hand should be regarded as the organ of touch (Krueger, 1982, p.17) because of its versatility. Its movements make possible the perception of tactual qualities, the manipulation of objects, and it is constantly in use in a variety of ways. More specifically, Gibson wrote (1962, p.479) "When the hand is feeling an object the movement or angle of each joint from the first phalanx of each finger up to the shoulder and backbone makes its contribution". That is, the skeleton is an organized system simultaneously and successively linked via joints and tendons to the central nervous system. It is "not a collection of sensations, but structured perception" (Gibson, 1968, p.118). In 1968 (p.110) Gibson included an illustration showing the innervation of the muscle of the upper arm resulting in the movement of the arm at the elbow. It would seem reasonable to infer that a similar mechanism must be responsible for the flex and stretch of the muscles in the fingers when reading braille.

THE NEURAL SYSTEM

The neural system is also arranged hierarchically comprising the peripheral nerves connected with the spinal column and thence to the brain. Cranial nerves are involved with vision, hearing, tasting, and smelling, all within the region of the head, but the touch mechanism is more complex and wide-spread. The receptive units, being affected by mechanical energy, are termed mechanoreceptors. They occur all over the body (ibid., p.108), in and below the skin, in joints and connecting ligaments between bones, in the muscles and tendons and also wrapped around blood vessels. The afferent (ingoing) nerves lead to nerve centres and some continue as far as the brain, and efferent (outgoing) nerves from the brain or nerve centres connect with muscles and joints responsible for movement (ibid., p.5). All of these parts are mobile. For example, the skin is deformed as it passes over a surface, the joints rotate in their sockets and muscles are contractile (ibid., p.118). Gibson (1988, p.5) regarded the system as a series of active neural loops which are "ways of seeking and extracting information about the environment from the flowing array of ambient energy" that seem to function at different levels. From Gibson's list (ibid., p.37) the following are extracted as being most involved in touch perception:

(a) lower proprioceptive systems responsible for posture and equilibrium linked with gravity;

(b) higher proprioceptive systems which are muscular and in which the receptors are probably excited by tension and probably register effort but not movement;

(c) articular, in which the receptors are in the joints and possibly the tendons;

(d) cutaneous in which the receptors are in the skin and perhaps also in most body tissue.

It is remarkable how the articular and nervous systems co-ordinate so perfectly that we are generally unaware of their activities.

4. DIFFERENCES BETWEEN PASSIVE AND ACTIVE TOUCH

Katz, a German psychologist, wrote "Der Aufbau der Tastwelt" (The World of Touch) in 1925, but only parts of it were translated into English. Meanwhile, J.J. Gibson, who agreed with many of Katz' theories, published his own radical ideas about perception in 1962 and 1966 respectively. (The latter was published in Britain 2 year later and references here are to this edition.) Both psychologists emphasised movement being necessary for active touch to take place. In touching, concentration can be of two kinds:

1. passive touch - the impression made on the skin which involves the excitation of nerve endings, known as receptors, resulting in a sensation;
2. active touch - which involves movement necessary for seeking for information by nerve endings which Gibson termed mechanoreceptors. The stimulus energy produced originates not with the object perceived, braille text for example, but with the pressure of the reader's finger pad on the braille symbol followed by movement to acquire yet more information. Katz wrote "the full richness of the palpable world is opened up to the touch only through movement" (Krueger, 1982, p.52) and Gibson later wrote "learning can be a process of detection and differentiation" (1968, p.52), that is, the stimulation is obtained, not imposed.

5. THE THEORIES OF J.J. GIBSON

Perceptual Meaning

Gibson believed that the information that is detected via neural loops has intrinsic qualities which never vary; for example, a hard surface may always be recognised as such and a ball is always a spherical shape. He realised that there was insufficient evidence to be certain about how these invariances from the external world could get into the nervous system and that much more research was needed. He stated that the sources of stimulation are in the environment, but the actual stimuli are "patterns and transformations of energy at the receptors" (1968, p.28). He compared active awareness to tentacles or feelers and that "the function of the brain when looped into its perceptual organs is not to decode signals, nor to interpret messages, nor to accept images. Instead, the entire neural loop, including the brain, is involved in seeking and extracting information" (ibid., p.5). He went even further from orthodox thinking by suggesting that "perception requires neither memory of past events nor inference from sense impressions". We are left wondering how learning takes place, how it is remembered and how the information is retrieved.

Information Pickup

The input from the external world is limitless so there must be some mechanism of selection. Gibson suggested that instead the perceptive system uses attention to explore and select, seeking for clarity, and ignores unwanted or unprocessed information. Perception also involves learning by association (Gibson, p.273). This ability to select and refine improves with use and with growth. Information that is adjacent can be detected within the span of attention, but a problem arises when information is successive beyond this span and therefore involves time. It would seem that the one involves only perceiving and the other both perceiving and remembering. The latter is often referred to as "short-term memory", but according to Gibson "learning does not depend on memory at all, at least not on the re-arousal of traces or remembering of the past". Instead, he thought (ibid., p.262) that "the development of this attunement, or education of attention, depends on past experience but not on the storage of past experiences". In other words, instead of dependence on memory, recurring attention will result in recognition, not only in the detection of finer details, and the span of attention will also be increased (ibid., p.270).

VERBAL MEANING

So far the references above have been to perceptual meaning where a stimulus extracts invariant information from the environment leading via resonance in neural loops to a percept of the environment. For learning to be possible there must also be indirect responses to sources produced by thought, and by responses to other people, either in speech or in the written word. This is second hand information about the world. Man has invented symbolic speech which has to be learned before communication can take place. Two stages are necessary, a knowledge of the coded signal and also what it represents. For verbal meaning the item referred to, by social convention, is given a symbol or word and by association this leads to thought.

EVALUATION OF J.J. GIBSON'S CONTRIBUTION

Gibson's theories seem to suggest that experiences are built on as they occur, so that by repetition they become clearer. He believed that exterioception and proprioception work in conjunction in the same neural loops and referred (ibid., p.284) to "calibration" of the ranges of inputs from different perceptual organs, and that this might be learning of a higher order. The higher order invariants go direct to the brain.

Together with Katz, the main contribution made by Gibson to an understanding of touch perception was his belief that touch can be active as well as passive. For approximately a century before his work became known touch perception was thought of in terms of sensations produced by cutaneous stimulation, and this led to the supposition that there were separate nerve endings in the skin running direct to the brain. His work opened the way for psychologists to progress to the discovery of new facts about touch perception. Some investigations were concerned with the peripheral mechanisms of touch perception such as pressure, vibration and shear force leading to further information on discrimination of roughness (Lederman, 1982), while others specialized in aspects of the central mechanism of the nervous system, such as asymmetry (Hermelin and O'Connor, 1971), memory, convergence, and cross modal function (Millar, 1994). Both parts of the neural system are interdependent, and a greater knowledge of their functions should lead to a better understanding of the processes that underlie behaviour in braille reading. Where appropriate, some of the major braille studies will be included. Many of the latter have been carried out during the past 3 decades and give little or no indication of the underlying psychology of touch perception.

6. SOME EARLY INVESTIGATIONS INTO BRAILLE READING BEHAVIOUR

It is an interesting facet of the use of braille that there is a large body of experimental work, known to educational psychologists, some of which was carried out before the work of Katz and Gibson became more generally known (Burklen, 1922, translated into English in 1932; Holland and Eatman, 1933;

Holland, 1934; Fertsch, 1946, 1947; Kusajima, 1961). These investigations mainly involved various aspects of braille reading behaviour, basically with the hope that such knowledge would help reading achievement. There was a substantial increase in the number of investigations during the 60's and 70's in America when grants were more readily available, and because the reading of braille is a multimodal activity, this continues to be an area where there is scope for further investigation. There must be some reason or reasons why the braille code has needed several reconsiderations whereas such is not the case for alphabet forms used in visual reading. In general, it is true to say that most of the investigations connected with braille reading until the 70's are geared towards the improvement of reading rate, which is measured in terms of words read per minute (w.p.m.). Part 1 has shown the constant need for revisions of the code to be made in endeavours to make the code easier to read and to use. Certain changes have been necessary from time to time for several reasons, viz. attempts to choose or alter the contracted versions of certain groups of letters in endeavours to help recognition, simplification of the many necessary rules, and an overview from time to time to keep braille usage compatible between countries using the same language.

Burklen, a German psychologist, contemporary with Katz, published a study on touch reading by blind people (1922), but it was not translated into English until 1932. His observations comprised the first detailed research on braille reading behaviour since the less scientific, but nevertheless worthy attempts to study embossed reading, carried out under the auspices of the American Association of Workers for the Blind from 1907 through 1913. Burklen's studies covered such aspects as the characteristics of symbols, pressure, the use of left and right hands and speed of reading. His work was not replicated because the braille reading was tested under rather artificial conditions. For example, he used nail heads for braille dots, and later ones made of tin to save continual replacement of embossed paper because of the dots becoming pressed by constant use. In addition, each student wore a "tastschreiber" on the reading finger which may have caused some discomfiture. The device was bent round the reading finger and extended beyond the embossed material to smoked paper on which finger movements were recorded. Even so, Burklen's work provided the fillip which encouraged further experimental studies on braille usage.

Holland and Eatman (1933) compared the silent reading habits of good and poor readers in school grades 3 through 11. These basic general observations were needed before more detailed examinations of reading habits could be carried out, hopefully leading to some means of improving performance, particularly in the field of rate of reading. Moving pictures were obtained by mounting a camera above the subject's hands to photograph the fingers as they moved along the line of braille, and by means of a projecting device the records were later superimposed upon the material read. Some of the time-consuming complexities of braille reading are indicated by the following list of information obtained: the total number of exposures per line, the average number of braille cells read by the left and right hand independently, the time taken by the subjects at the beginning and end of each line, the number of regressive movements made when facing difficulties of interpretation, and the time taken in making "return sweeps" to find the beginning of the next line. More detailed reference will be made to hand use in the section on asymmetry later in this chapter.

Holland (1934) next investigated the relation of pressure to the rate of reading by good and poor readers using a device for measuring pressure, a timing mechanism and a kymograph which recorded results on smoked paper. The apparatus was not intrusive to the reading situation. The results showed (ibid., p.17) that fast readers tended to use less pressure than slow readers, the amount of pressure varies within a given line, and poor readers showed a tendency to increase the amount of pressure as they read from the beginning to the end of a given paragraph. The cause of these variations by slow readers was regarded as being largely due to difficulties in interpretation of meaning. Holland regarded the study as "an hypothesis rather than an absolute truth" (ibid., p.17) because of the small size of student participation.

Similar general observations of braille reading to those of Burklen were carried out by Kusajima in Japan in 1961. He recorded observations on the movements of the reading finger, and the function of the accompanying finger of the other hand. As in Burklen's experiments, the students wore a tactual recorder on the reading finger. In addition, he compared the differences between visual and touch reading. He replicated his experiments with further detail in 1974.

It is noticeable that because so little was understood about touch perception before 1960, all these early braille experiments observed reading behaviour and the knowledge was important, but there was little psychological explanation given on why such behaviour occurred. In many instances the link still has to be made.

7. PERIPHERAL MECHANISMS

Structure of the Glabrous Skin of the Human Hand

During the 70's investigations were carried out to determine in detail what contribution is made by the neural units in human fingers. In this area the finger-pad is thicker than other cutaneous surfaces of the body (Quilliam, 1978, p.5). Quilliam also gave the following information (ibid., p.12). The skin consists of several cellular layers, and the surface has ridges, well-known because their impressions are the finger prints used for legal purposes. Sweat glands occur along the upper surfaces of the ridges in greater profusion than anywhere else on the body surface, and because the ridges are arranged parallel to each other, the "channelling effect" distributes the sweat evenly over the fingers. Elsewhere on the body shearing force when applied to the skin results in wrinkling, but in the fingers (and toes) the outer and inner layers of the skin are attached, and it is possible that the sweat glands between the layers also help to bind the surfaces together. Fat cells also contribute to make the firm, cushioned surface typical of the finger-pads. These factors combined with the presence of an accumulation of sensory units concerned with temperature, pain, and touch perception, demonstrate the high quality of fingers as sensing mechanisms. The implications for braille reading are obvious.

Practically speaking, sensory units concerned with temperature also play a part in this activity. From comments made by blind children and blind colleagues, it is known that braille dots cannot be successfully sensed when fingers are cold, and likewise, braille reading becomes difficult when fingers become hot and sweaty. A cold surface also impedes reading for it "feels smoother than neutral or warm ones (Lederman, 1982, p.141).

Knibestöl and Vallbo (1970) were the first to demonstrate that there are 4 main types of mechanoreceptors in the glabrous skin of the human hand (Vallbo and Johansson, 1978, p.32). So far the function of these four types of nerve endings is not fully understood, though there have been several tentative suggestions (Vallbo and Johansson, 1978, p.33, p.36; Lederman, 1982, 143-145).

RECEPTIVE FIELDS

Receptors respond to mechanical energy, on/off units firing bursts of impulses at the beginning and end of excitation. Two types of measurements can be made. Mechanoreceptors can be rapid or slow responding and also vary according to the size of their receptive field. Rapidly adapting units with small receptive fields are appropriate for braille reading, and indeed, the finger pads have been shown to be rich in these particular units (Vallbo and Johansson, 1978, p.44). The second type of measurement registers their sequence of responses resulting from sustained indentation. These investigators commented (p.48) that "particularly striking is the very high density of these two unit types at the finger tips, indicating that this is a skin area with outstanding qualities for tactile spatial analysis". It would seem that together with the versatile movements of the hand as a whole, movements in this part of the body are well adapted to tactile activity.

8. PSYCHOLOGICAL STUDIES OF PERIPHERAL MECHANISMS

Roughness Discimination

Because braille consists of raised patterns of dots it is possible to think of the reading finger moving along a line of characters in a continuum of changing textures. Lederman (1982, p.131) wrote, "the perception of texture may be thought of as a microcosm of the entire spectrum of perceptual activities", and (ibid., p.135) "texture perception by touch still remains relatively unexplored to-day".

Roughness is an aspect of texture discrimination and this fact was used by Nolan and Morris (1965) in the realm of braille reading. They published a test which was intended to show the development of the ability of young blind children "to utilize the tactual receptors and hands in a co-ordinated fashion", this being critical for the reading process. The test included comparisons between sandpaper of different grades of grit. No relation was found between ability to discriminate degrees of roughness and chronological age, but was positively associated with level of grade assignment. An important finding was that growth in this ability appeared to level off after Grade 3. The test was used in schools in America to predict likely ability in the use of braille for reading and writing, and was one of the tests used by Nolan and Kederis (1969, p.88) when selecting subjects for testing "the influence of number of dots and position of dots on recognition thresholds for braille words". Sandpaper shows an unregulated mass of texture compared with the more regular positions of dots and spaces which make up braille configurations.

PRESSURE, VIBRATION, AND SHEAR

It has already been shown that pressure applied to a surface results in a passive impression, but that movement in active touch is dynamic and includes vibration. Katz was more interested in surface structure rather than its shape (Krueger, 1982, p.41) and during investigations of movement considered that "the vibration sense represents temporal holism. The hand as a unitary organ ... represents spatial holism (ibid., 16-17). That is, both time and space are involved. Put another way, 3 aspects may be recognised, the 2 surfaces involved, finger force, and speed of movement.

Vibrations are set up in the skin when movement takes place. As the finger traverses a line of braille, the skin is squashed upwards towards the deep-seated part of the finger-pad and sideways as a result of lateral movement. Quilliám (1978, p.12) suggested that when this occurs a secondary type of vibration may also be present caused by movement across the ridges and spaces on the cutaneous surface, thus producing multiple exposure to the stimulus (ibid., p.12, 1978, p.12). However, the clarity of perception is blurred to a certain extent by the "oiling" by the sweat glands whose function affects the shearing action between the finger and surface being explored. Katz (Lederman, 1982, p.133) showed that by smearing the sensing finger(s) with collodion perception was improved, and Lederman (ibid., p.138) obtained a similar result when thin paper was placed between the finger and the rough surface. Both methods would neutralise the effect of the layer of sweat. The degree of callus on elderly or work roughened fingers would have the same effect.

Shear force, speed of movement, already studied by Holland (1934), and the effect of temperature may also be involved. Lederman included these aspects when she made a series of systematic studies on roughness discrimination using "aluminium plates with linear gratings of rectangular cross section cut into the surface" (Lederman, 1982, p.136). Concerning the surface of the plates, results showed that the ratio of groove to ridge width does not affect perceived roughness and neither does the fundamental spatial frequency of the stimulus grating. Finger force proved to be the second most influential factor, perceived roughness increasing with increases in force applied perpendicular to the surface; and for hand speed, perceived roughness decreased slightly with increasing speed, but this was negligible relative to groove width and finger force effects. Lederman (ibid., 136-137) argued that if the effect of hand speed was negligible the actual movements of the skin are unimportant and therefore temporal pulse frequency to ratio of skin displacement plays no role.

Lederman herself questioned whether such results could be used in comparison when other types of surface are involved (ibid., p.142). This aspect must surely be taken into account before comparison can be made with the sensing of a braille surface, for a metal surface with slits and ridges will give a very different "feel" from the use of plastic or paper surface covered with domed dots. For example, in the one the finger will slightly penetrate the slits, whereas in the other it will tend to slightly fold over the protuberances.

It has been said here that roughness is a part of the structure of texture. For braille, texture has added meaning, and therefore this aspect will be addressed in the section on central mechanisms.

9. CENTRAL MECHANISMS

PARTS OF THE BRAIN INVOLVED IN TOUCH PERCEPTION

When the neural inputs from peripheral regions involving touch reach the brain they join the cerebellum which lies under, and towards the back of the brain. Overlying the cerebellum and anterior to it is the mid-brain and overlying that is the cerebral cortex. The latter, consisting of much convoluted soft tissue, and therefore giving a much enlarged total surface, is divided into 2 hemispheres connected by fibres which are together known as the corpus callosum. From the cerebellum the information is linked with a network of intercommunications between different, specialized regions of the brain.

Each of the hemispheres consists of the occipital lobe at the back, the parietal lobe further forward with the temporal lobe beneath, and anterior to these is the frontal lobe. When the neural impulses reach the corpus callosum most of them diverge to opposite sides of the brain, so that information from the left side of the body is controlled by the right hemisphere and the left hemisphere deals with information from the right side of the body. There is considerable specialization in different parts of the brain. Sherrick and Craig (1982, 60-63) showed that the touch sensitivity in monkeys is located in the parietal lobes of both hemispheres, and Millar has stated that in humans touch information is represented in the anterior part of the parietal cortex with spatial coding represented in the posterior part of the parietel lobe (ibid., p.53).

10. PSYCHOPHYSICAL STUDIES OF CENTRAL MECHANISMS

HEMISPHERE ASYMMETRY

Some of the information concerning the relative functioning of the 2 hemispheres has been gained from observations of malfunctioning due to illness, operations, gunshot wounds and the like. For example, it was found that when the left hemisphere was damaged, speech was sometimes affected, although "some aspects of language are also represented in the right hemisphere". In a similar way it has been found that the right hemisphere is involved in space recognition, yet not exclusively so. Concerning activity in the hemispheres, Millar (1994, p.58) wrote, "The systems do not simply duplicate each other; they are sufficiently specialized to provide additional functions, as well as forming a basis for fail-safe multiple representation".

Before 1971, investigations concerning the best hand or hands for reading braille had proved inconclusive (American Association of Workers for the Blind, 1913, both hands; Burklen, 1932, left hand; Fertsch, 1947,I right hand). Teachers were, therefore, inclined to leave preference to the readers. Hermelin and O'Connor (1971) were the first to apply a psychological explanation for these different findings. They quoted Kimura (1971) who had shown that numbers of dots shown visually were identified better by the left than the right visual field, that is, by the right hemisphere. Conversely, letters were identified better by the right visual field, that is by the left hemisphere (Hermelin and O'Connor, 1971A). As braille reading involves both dots and representations for letters, that is, space as well as language, Hermelin and O'Connor questioned which hemisphere and therefore, which hand, was best for reading punctiform characters (ibid., 1971A).

Fourteen children, aged between 8 and 10 years read separately with the index and centre fingers on the left and right hands respectively. The centre finger reading had been included to obviate the practice factor. Results showed that left-handed reading (right hemisphere - space) was significantly faster than right-handed reading (left hemisphere - language). This fact suggested that "the brain treats input such as braille reading material, as spatially arranged items, to be more efficiently analysed by the right hemisphere before or while verbal coding of the material occurs in the left". A similar experiment was carried out with adults (ibid., 1971B). No difference in speed was found between the use of each hand but fewer mistakes were found in reading with the left middle finger. It was therefore assumed by teachers that pupils who read with the left hand had more advantage than those who used right handed reading. Further experimental work concerning right, left, or both handed reading of braille is explored in Chapter 8.

CONVERGENCE

So far only a general account has been given of the parts of the brain involved in touch perception. Input from the peripheral regions is co-ordinated in the cerebellum and sent on to specific regions, mostly in the cerebral cortex, where it is encoded, and responses when required are sent to the motor output neural systems. The paradigm of separate specialised inputs being the sole means of coding inputs must be rejected as being too simple an explanation. For example, it has been seen how information concerning space and word recognition combine to help determine hand use when reading braille. Major specialised regions of the brain have been recognised (e.g. Longman, 1982, p.656, diagram) and these are linked up by a complicated network of neural pathways; indeed Millar (1994, p.54) has hypothesised that as knowledge of the cross-modal functioning of the brain becomes better known, it is likely that a finer more interrelating network of pathways will be discovered, and that the information centres will be recognised to be sub-divided into smaller, more specialised units.

It could be thought that for those lacking the sense of sight all the enrichment that comes via the visual pathways is lost. This impression may be enhanced by the fact that many psychologists have used comparisons of those without vision as controls, in order to find out more about visual conditions, thus strengthening the negative side of the deprivation. Millar (1994, p.84) suggests that, being without the information coming via the visual pathways not only causes greater dependence upon the remaining senses, as would be expected, but that extra neural links may, in consequence, be formed between the specialised areas.

Information will usually be selected from several inputs. For example, when moving across a letter U some of the inputs which combine for recognition of this braille configuration, may include the number and position of the dots, the outline shape of the letter and the likelihood of it being U because the previous letter was Q. Sometimes the information from more than one specific area will result in redundancy, making the impression stronger, and "one condition in which correlated information from another source facilitates recognition, is when perception from one of the sources is difficult, or clarity is reduced" (ibid. p.43). Millar (1994, p.15) suggests that this cross-modal functioning can lead to a partial overlap of information, that is, "the sense modalities are sources of specialised, but complementary and convergent information" (ibid., p.15). Since this partial overlapping information comes from differently specialised inputs, theoretically this partial redundancy should lead not only to more accurate input, but even to "improved tactual recognition of otherwise difficult patterns (ibid., p.44).

Warren's opinion (1982, p.123), though writing in general terms, may well apply to braille reading: "... there is much research to be done on the encoding and retention of haptically gained information as with most developmental research, careful attention will have to be paid to the comparability of experimental tasks across age groups. Converging operations, in which the same issue is approached from several experimental paradigms, will be necessary before firm conclusions can be reached".

MEMORY

Contrary to early beliefs, there is no one centre of the brain labelled "memory". J.J. Gibson (1968, p.264) wrote "... a kind of memory in a new sense of the term is definitely required if we are to explain not apprehension over time, but repeated apprehension over time. For the fact is that an observer learns with experience to isolate more subtle invariants during transformation and to establish more exactly the permanent features of an array". Memory is part of the whole process of input from peripheral regions, and encoding (that is organising the information so that it is available for synthesising with other input), makes retrieval possible when required.

Problems arise when attempts are made to discover more about haptic memory, together with speech, and, at a higher level of thought. Warren asked the questions, how is the information encoded, and what is stored, suggesting four possible approaches (Warren, 1982, 118-122):

1. asking for haptic reports;
2. instructions given in an attempt to influence coding of haptically gained information;
3. experimental interference with coding during retention period;
4. comparison of performance by groups that are assumed, a priori, to differ in ability to perform a certain kind of coding.

Warren (ibid., p.122) considered the third option was promising, but had not yet been sufficiently tested to give a good indication of its potential. Even so, Millar (1974) assumed that this programme might give results for blind children's reading. First (1974) she tested subjects aged approximately 10 years using four duplicated sets of three-dimensional nonsense shapes; the interval activity involved unfilled delay, verbal distractor, movement distractor and movement rehearsal respectively. The last condition used finger tracing of the shapes from memory. Both blind and sighted children were included in the samples. It was argued from the results that "tactile short-term memory involves both decay of tactile impressions with time, and interference by additional activities with a longer-term process" (ibid., p.263). Further tests were carried out in 1985 involving braille letters, which are described in the next chapter. Both experimental interference and instructions given in an attempt to influence coding were involved.

11. THE INTERLOCKING STRUCTURE OF VARIABLES

So far the mechanisms of perception in both the peripheral and central regions have been described, but what makes the mechanisms work? A car cannot drive itself; intelligence and ability are required by the driver of a car; but these qualities are still not enough. A driver has to learn how to use the mechanism before competence can be established, and so it is with learning how to recognise braille characters and use them in words and sentences. For children, there is the added complication concerning the rate of development at different stages during the learning process. These aspects all interact and need to be understood for the most successful teaching and learning situations.

The use of standardized tests is one way to monitor progress. The Williams Intelligence Test for children with defective vision (1956) has been proved to have a satisfactory overall test/retest correlation over a two-year period (Tobin, 1994, p.40). Gomulicki (1961) investigated the basic learning capacities of blind children, and his tests included observations of manipulative ability and tactile discrimination. In each case (p.22 and p.24 respectively) intelligence played a significant role. In his concluding remarks concerning all the investigations he stated (ibid., p.52) "... the net correlation between intelligence and performance is nevertheless significant at a higher level for the blind than for the sighted". Nolan and Kederis (1969, p.44) considered that "mental ability is a limiting factor" and suggested (ibid., p.48) that "for students whose IQ is below 85 braille is an extremely inefficient medium of communication and that the necessity of mastering it may constitute an additional handicap". Tobin (1971, p.52), when considering some teaching and psychological variables, wrote "the correlational part of the study was aimed at uncovering something of the interlocking structure of organismic and personality variables associated with success in learning braille" and as an integral part of this interlocking, has stated (personal comment) that the correlation between intelligence and braille is higher than the correlation between intelligence and print reading.

Aspects of braille reading can be confidently assessed using standardized tests such as those devised or adapted by Tooze (1962), Lorimer, J. (1962), and Lorimer, J. (1977). These tests are all referred to in more detail in the next chapter. They are all used individually and scores gained may be compared with the norms provided for each age group. Such tests give general markers of progress achieved and some also have diagnostic value. However, for unstandardized but more detailed information on specific aspects, such as hand use and strategies used in character recognition, it is necessary to become familiar with investigations which have been carried out by educational psychologists over the years. A selection of the more important of these is presented and reviewed in Chapter 8.

The American Association of Workers for the Blind made the first studies of how braille reading is carried out (1907-1913), and from then until the present day most investigators have been aware of the necessity for comparing the achievements of different age groups and differing abilities and linking this information with stages of development. It would seem to the writer that more information is needed to show in detail the effects of learning without the major sense of sight; how the individual copes with this deficit; and, more specifically in relation to the use of braille, the effect of age of onset has on individual progress. "It should be obvious, then, that there are some important unanswered questions in the development of haptic perception. The questions are both theoretical and practical. Vigorous focal research is needed to answer them" (Warren, 1982, p.126).

CHAPTER 8

TOUCH PERCEPTION WITH REFERENCE TO SPECIFIC PROBLEMS PRESENTED BY READING IN THE MEDIUM OF BRAILLE

1. COMPARISON OF VISUAL AND TACTUAL METHODS OF READING

2. QUALITY PROVISION

   Quality of Materials

   Size and Shape of Dots

   Spacing Variables

   Layout

3. TECHNIQUES OF READING

   Use of Hands and Fingers

   Types of Hand Movement

   Characteristics of Movement by the Fingers

   Can the Use of Hands and Fingers be Taught?

4. PERCEPTUAL FACTORS

   Analysis of Errors Within Words

   The Word Method of Learning to Read

   Recognition of Single-cell Braille Characters

   Effect of the Number of Dots in a Cell

   Position of Dots Within a Cell

   The Effect of the Use of Contractions

   The Effect of Word-length, Familiarity, and Orthography on Recognition

   Thresholds for Braille Words

Unit of Recognition

5. DEVELOPMENTAL FACTORS AND THEIR EFFECT ON BRAILLE READING

General Development and its Effect on Braille Reading

Short-term Memory

Strategy Choices by Young Braille Readers

Strategy Choices by Fluent Braillists

6. STRATEGIES FOR IMPROVEMENT OF THE RATE OF READING

Changing the Code

Diagnostic Tests

Training in Rapid Reading

7. SUGGESTIONS FOR FUTURE RESEARCH

8. CONCLUSION

1. COMPARISON OF VISUAL AND TACTUAL METHODS OF READING

When comparing visual with tactual methods of reading Gibson (1962, 488-489) wrote, "Succession enters into the operation of both senses. The eyes normally fixate in succession just as the fingers explore in succession. Both senses are active". This statement needs qualifying because the manner of succession in the two methods is different. It is commonly thought that visual reading takes place during a smooth, even focus of the eyes along the lines of print, and that touch reading is a similar process except that information is gathered via the nerve endings in the finger pads instead of using the eyes. A better understanding of the mechanisms involved is necessary before the advantages and disadvantages of reading in the medium of braille can be recognised.

According to Fry (1963) and Watts and Buzan (1973), movement of the eyes during visual reading takes place in a series of 'jerks', that is, short movements from left to right interspersed with short pauses, and the amount taken in at a fixation is more variable than the fixation time depending on the ability of the reader. Therefore, the more that can be taken in at a fixation, the fewer will be the number of fixations necessary and the quicker the reading rate. Foulke (1982, 168-169) referred to "the relatively large field of view of the visual system, which makes possible the observation at one time, of a relatively large number of symbols" because of "the high compatibility between display and the perceptual system".

The tactile system is not as well adjusted for reading as the visual sense in that the field of 'vision' is much reduced because reading is a character by character succession without the fixations of visual reading. In addition, the braille reader cannot glimpse ahead. For example, "In his cap___" could become "In his capable hands" but could alternatively become "In his capacity as ...". Visual readers may be aware of misprints, though often these are not picked up because content meaning is dominant. In braille reading a missed dot can be crucial to the meeting. For example, in a watery setting "The rush..." (first letter ⠗) may anticipate ideas such as tumbling waters, whereas if the lower dot is omitted (⠓) it becomes "The hush" anticipating possibilities of a silent pool or the evening calm. It could also be most disconcerting to read "He is dead" instead of "He is deaf", caused by the sign for F being reversed in error. These and other perceptual problems to be discussed later in this chapter contribute to some serious limitations for touch readers.

Comparisons of rates of reading between samples are only reliable when variables such as age, intelligence and the effect of rate on accuracy and comprehension are taken into account. However, average silent visual reading rates for adults are quoted by the de Leeuws (1965, p.28) as 200-250 w.p.m. and by Foulke (1982, p.172) as 250-300 w.p.m. Williams (1971, p.116) concluded from a nation-wide survey of braille reading pupils aged 10 to 16 years that "with narrative requiring to be read and not just skimmed, a braille reading rate of 100 words per minute can be considered average, and extending this on either side, a rate of 80-120 words per minute can be considered as fairly normal".

2. QUALITY PROVISION

Whatever the skill, playing the violin or building a brick wall for example, two aspects need to be considered before successful results can be expected. These are the quality of materials used and the techniques needed for execution. The same is true for braille reading.

QUALITY OF MATERIALS

A badly produced text on poor paper, with unhelpful spacing and poor quality of printing, both in depth of inking and size of symbols, can all cause difficulties and irritation in visual reading. Publishing embossed print has its own problems. One abortive effort was the use of solid dot braille. The intention was to use a stronger yet lighter weight paper with durable dots applied to the surface. It was unpopular with adult readers because the hard surface of the dots was tiring to read (personal comment by braille users) and the dots could be accidentally removed; indeed, in the classroom the paper sometimes became torn and "fingers" enjoyed picking off the dots in idle moments, with disastrous results for the braille content. Two weights of paper are currently provided by the RNIB for personal use, the lightweight one being more typically used for short term work and the heavyweight one for material of more lasting use. "White rag" paper is used for production of "The Braille Radio Times" whose useful life can be little more than a week at most. Brailon consists of plastic sheets used for the production of multiple copies from a braille master copy embossed on manilla paper. It has lasting qualities, but is easily creased and hands tend to become sweaty in use. In spite of a large amount of research on many aspects of the use of braille, nothing had been published on the detailed characteristics of these materials until 1986, yet to have the most suitable of materials is crucial to the braille reader and writer.

In 1986 Cooper, Davies, Lawson-Williams, and Tobin compared these three types of paper together with three synthetic ones for physical characteristics such as weight, thickness, bulk, porosity, smoothness, strain, and "burst". Porosity is important for unless the air can pass through the paper the surface can feel sweaty in a warm atmosphere or occasionally if the reading is carried out in stressful circumstances. According to the 16 subjects who took part in the investigation, there was no overall preference for all the circumstances tested, but in descending order heavyweight manilla, lightweight manilla, and white rag were preferred to the synthetic materials. Brailon was considered to have the smoothest surface.

Though the study was not conclusive, the investigators felt that it would merit further work with a larger sample, longer reading passages, and some more accurate means of assessing the "feel" of braille. The experimenters pointed out (ibid., p.327) that this more detailed knowledge is important "especially if new electronics and other devices are to be offered to blind people with braille as one of the major forms of output".

Size and Shape of Dots

In 1890 (p.11) Fowler wrote "It is the experience of many that the sharp conical dots, though very distinct at first, soon irritate and confuse the touch; the dots should therefore be made dome-shaped, so as to present a smooth surface to the finger". The symbols of old braille books printed about the turn of the century by the British and Foreign Blind Association are sometimes colloquially referred to as "knitting needle braille" and have received very favourable comments by those blind people who have been able to see copies (personal comments). The master plates were punched on copper sheets and the results probably approached the quality advocated by Fowler. [The writer owns plates used for the libretto of one of the arias in Handel's "Messiah".] Later machine printing shows dots that seem less wide in diameter though still adequate. With the coming of computerised braille which can be easily and speedily replaced there has been a tendency to produce braille that is sometimes of inferior quality and less durable. It is important that dot shape shall be of maximum comfort to the reader.

It has also been found that some beginners and also some whose touch is less perceptive prefer to use the expanded cell, often referred to as "jumbo dot". The height of the dots remains the same but the diameter of the base of the dots is increased as well as the spacing between dots. It would seem that individual differences are important when deciding on the size of cell to be used. For example, a person with less acute touch might prefer the expanded cell at the beginning stage. Tobin (1982), in his self-instructional reading scheme for newly blinded adults, used the expanded cell type of braille for the first book, books 2 and 3 contain identical material so the learner can choose when to progress from jumbo braille to standard size braille, and book 4 is in standard size braille. Young children starting braille have smaller finger pads to cover the symbols, and using the larger cell might encourage "scrubbing" instead of a smooth left to right progression.

SPACING VARIABLES

No information exists to show how the three variables of spacing of dots within a cell, between cells along the line, and between lines, were determined by the BFBA when braille was first introduced into Britain. A study of braille readability was carried out by the American Commission on Uniform Type in 1920, but no experimentation on spacing variables was carried out until that done by Meyers, Ethington and Ashcroft (1958). Rate of reading in words per minute was the measure for testing 275 blind children on the three variables of dot spacing within cells, between letters and the space between lines. Three values for each variable were selected and material was read in all possible combinations. The middle values for each were found to be the most readable and corresponded closely to the values already being used. Comprehension was controlled. It was suggested that the experiment should be replicated but with a considerably longer period of reading time and with values not included in the current investigation.

Layout

The layout of braille material is similar to that of inkprint in that the material is read from left to right and set out in paragraphs. When books were expensive to produce, blank lines were never left but paragraphs were indented, each starting in the third space. Whereas it is an easy matter for the visual reader to move quickly to another part of the text, the blind reader can at least find the next paragraph by running the reading finger down the left side of the page to find the indentations. An indented paragraph preceded by an italics sign indicates a side heading. With the coming of computerized braille the leaving of lines where appropriate may become more prevalent.

An investigation was carried out by Hartley, Tobin, and Trueman in 1987 to determine whether headings were helpful and in what form. The findings were not conclusive. The writer suggests that the content of headings merits attention. Their purpose is to indicate the following subject matter, and therefore, depending on context, a single word can be meaningless and too long a heading wastes valuable reading time. Braille's own view seems pertinent here: "Since our methods of writing and printing take up a lot of space on paper, we must compress the thought into the fewest possible words" (Coltat, 1853, p.16).

3. TECHNIQUES OF READING

Use of Hands and Fingers

The most obvious external differences between braille readers are the ways in which their hands and fingers are used. These variations include which hands are used, how they are held, characteristics of movement involving type of progression from left to right, regressions, scrubbing movements when difficulties are encountered, and even erratic movements employed when knowledge of the code and/or reading efficiency are insufficient. It is not surprising therefore that studies of these aspects have received much attention (Holland and Eatman, 1933; Fertsch, 1946; Kusajima, 1961, 1974; Hermelin and O'Connor, 1971A, 1971B) in the continuing hope that analyses might lead to improved techniques and ultimately an increase in the rate of reading.

TYPES OF HAND MOVEMENT

Hand movement is a very individual matter depending on such factors as the effect of asymmetry in the brain (which determines which hand shall be dominant), the relative sensitivity of each finger, and possibly the training, if any, received at an early stage of learning. Some read with the left or right hand alone, with one hand merely marking the place, and some use both hands at the same time. It is usual for one or both the forefingers to be the reading finger(s). In 1982 (p.202) Foulke quoted his experiment of (1964) in which subjects read passages with each of the fingers alone on either hand while reading ability was measured against accuracy and time. The results showed rapidly diminishing ability in the progression from the forefinger to the little finger. All the fingers showed some sensory capacity. Contrary to expectation the dominant hand had no connection with whether the reader is left or right handed in everyday activities.

There is also variety when both hands are used at the same time. Beginners sometimes hold both forefingers side by side sometimes touching or having a short space between them. It has been hypothesized that for left handed readers the right hand may pick up some information that is confirmed by the following and dominant hand. For right handed readers the role of the left hand may be to check and reinforce what has been sensed. In both cases the less active hand can be used to mark the beginnings or ends of lines. The most efficient method seems to be the use of both hands but working independently.

The left starts reading, the right takes over somewhere along the line, and while it completes the line the left finds and then starts the beginning of the next line. Most readers have one hand slightly more dominant and this will determine how far along the line the right hand takes over. The most obvious advantage of this method is the time saved in the return sweep to find the next line and obviates the consequent interruption in the sense of what is being read. The loss of 6-7% (Fertsch, 1946) of reading time taken up by return sweeps is a serious matter and no doubt is one of the factors that leads to braille being a slower reading medium than print.

Characteristics of Movement by the Fingers

Moving picture records of fingers reading braille (Holland and Eatman, 1933; Fertsch, 1947) demonstrated characteristics of the less able readers which, though intended to help, may in themselves cause further problems. When the reader is not sure if a word or words have been interpreted correctly it is natural to regress for one or more words before continuing. It is usually found more convenient for this to be carried out by the left hand while the right hand keeps the place, but both hands being used together for the purpose can be regarded as more typical of performance by a poor reader. Sometimes regression becomes a habit, particularly by the more hesitant reader. If the letter or word presents difficulties the reader may resort to "scrubbing" the symbol or symbols. More pressure is used, some loss of direction may occur as the usual left to right progression is interrupted and often there is a break in concentration. There is also a tendency for beginners to lose the line. This is sometimes due to the fact that it is a more natural movement for hands to move in a curve equidistant from the body and learners therefore need to become used to working along straight lines. Good readers show an even, steady progression.

In 1978 hand movements of school children aged 10 to 12 were filmed for a demonstration by the writer to show different methods of hand use at a braille workshop for teachers of blind children. It was not conducted under experimental conditions, but was used as a talking point to show that there are considerable individual variations in techniques of reading, in addition to knowing which hand or hands are employed. It is the writer's belief that teachers are sometimes so involved in checking the accuracy of oral reading that they sometimes leave little opportunity to observe individual differences of technique.

From a total of approximately 24 children aged between 10 and 12, 7 were selected showing a variety of reading behaviour and some of their performances are briefly described here. It was noticeable how techniques were affected by the size of hand and more particularly the length of fingers.

Lee had very large hands which he found difficult to adapt to the reading of small symbols. The screen seemed filled with fingers and thumbs and the thumbs were sometimes used under the fingers as props to propel the hand along, resulting in rather jerky reading. He was not alone in using the thumbs in this way. At other times the left thumb was held higher than the other fingers. Sometimes readers hold the fingers not being used above the reading finger so that the whole hand is slightly tilted towards the thumb. It seems a tiring position but could be caused by the portion of the finger pad nearest the thumb being the most sensitive part. Lee's reading fingers kept in contact with each other even when moving to a new line.

By contrast, *Amanda* had short fingers with the pads held very flat on the page making the most of this surface of sensitivity.

Toni used only the right hand, yet according to her previous teacher she was helped during a whole year to use both hands on different lines very successfully. It is interesting that she had reverted to the use of one hand, probably because the habit was more fixed or she may have found using the addition of the left hand slowed her down. It darted across to help if there was a difficulty.

Jean Pierre's method was unique. He was a left handed reader and the hand was rotated 90° so that the reading finger, the second in this instance, pointed towards the right. Fingers 3 and 4 rested lightly on the page above the line being read and finger 1 was below the line. All the fingers travelled lightly towards the right hand which indicated the end of the line. The pupil had presumably found his own best method, and though unorthodox it seemed successful.

Jane showed two-handed reading, both hands reading to the mid part of the line, the right ending the line while the left moved to the next line. She did not read the first part alone with the left hand so had apparently developed the most economical method for a reader using both hands, the left one being less capable.

Enough has perhaps been included here to show that some movements are helpful and some provide difficulties which hinder not only speed of reading but are also liable to contribute towards inaccuracies.

CAN THE USE OF HANDS AND FINGERS BE TAUGHT?

It has been shown in Chapter 7 that in several experiments carried out concerning hand use, the results showed conflicting evidence over which hand would give the best results in reading braille. In 1984 Millar suggested that a pattern could be seen showing that there appears to be a tendency for beginners to rely on texture and show no hand advantage; while still attending to spatial coding and physical characters of the signs readers tend to use the left hand; and highly proficient readers who use verbal strategies prefer the right hands. Her experiments (1984, p.85) showed that "the notion of a generally 'best hand' for braille is untenable" and that (ibid., p.84) "two-handed reading is superior to reading by each hand alone". This information has been repeated here because it shows the dilemma for those attempting to teach hand use, bearing in mind Fertsch's findings (1946, p.131) that "reading habits become established about the time a pupil has reached the third grade and do not change noticeably with increase in reading experience". This finding puts the onus on teachers of young pupils and the process is more complex than would at first appear.

Hand-use training seems to be a neglected aspect which teachers often leave children to discover for themselves. It needs to be carried out with a proper understanding of what is involved or harm can be done. For example, when the writer selected another group of pupils again for filming of hand-use a few years later, it proved very difficult to select a suitable left-handed reader. This was so unusual that enquiries were made, leading to the knowledge that one conscientious teacher had been training the young children to use their right hands because right hands were used for most activities by children with vision.

Hands are usually held slightly arched and the forearms should bear their weight. Children will generally choose to use their most dominant finger for reading and a few may use the second finger held close to the forefinger. This presumably checks or adds more information but, depending on the relative length of the fingers, may cause a less relaxed way of reading. this is because the extra length of the second finger causes it to be more arched so that more of the tip rather than the pad is in contact with the paper. Each hand could be temporarily tried out on its own to see if two-handed reading might eventually be possible thus eliminating the time used for return sweeps. If the dominance of one hand is very marked the other should still not be neglected, for being able to read even one word at the beginning or end of a line would save valuable time. However, this method is not suitable for all readers. Some children start one way and never try any other method, so a little encouragement while the teacher and child are finding the best method should be very worth while. Allowance has to be made for the effect of hand dominance (see previous chapter) and also the possibility that the sensitivity of the forefingers may vary. There are many varieties of hand use and the individual's best must be sought, for, apart from comfort, it is imperative to find the way that will promote the best rate of reading. Late beginners, including adults should benefit from similar training.

4. PERCEPTUAL FACTORS

ANALYSIS OF ERRORS WITHIN WORDS

Any analysis of braille reading problems should include a knowledge of the mental and perceptual abilities of the reader and problems presented by the medium itself. Ashcroft (1960) considered that the physical mechanisms are extremely important in reading braille, for in part it is a tactual-kinaesthetic process, "However, the most important aspect of the problem would seem to be the accurate perception of ideas from the printed page. No matter how good the mechanics of reading, if errors plague the reader, the result can be neither efficient nor effective in obtaining ideas from his reading" (ibid., p.22).

Ashcroft provided 12 paragraphs of increasing difficulty, each forming a story to be read orally. Specific interest was centred on pupils in Grades 2, 4, and 6, but data were also obtained from pupils in Grades 3 and 5 so that trends could be monitored. 728 pupils took part in the experiment and each child read until 10 successive errors had been made Oral reading errors were examined in terms of orthographic features in the code with the following results shown in descending order of frequency of errors (ibid., p.53):

<u>Rank</u>	<u>Title</u>
1	Shortform words.
2	Multiple cell contractions.
3	Combinations of orthography.
4	Lower contractions.
5	Upper contractions.
6	Full spelling.
7	Simple upper wordsigns.

Some of the shortforms were unfamiliar because of infrequent occurrence, and because some had so many letters excluded that they became a burden on memory causing a slow-down rather than a means of increasing speed of reading. This is reminiscent of the similar problem included in the reading of Lucas type (see Chapter 3).

Multiple cell contractions seem to have caused problems in two ways. The extra dots sometimes caused perceptual problems, and mistakes were made because of the varieties of position of dots in the previous half cell making different meanings which had to be learned, e.g. ⠐⠺ work, ⠘⠺ word, ⠸⠺ world.

Lower contractions proved to be the most difficult of the single-cell contractions. They can be confused with the same signs occurring in the upper part of the cell but which have different meanings; the dots occur in the lower part of the cell and these, as will be discussed later, seem to be the ones most likely to not be sensed; and they represent a multiplicity of meanings according to position in a sentence. For example:

⠂	⠆	⠒	⠲	⠢	⠖	⠶	⠦	⠔	⠴
,	;	:	.		!	()	"		"
deci-mal point							?		
ea		con	dis	en				in	
	bb		dd		ff	gg			

The sign for COM and the apostrophe sign are made from the lowest dots in the cell. Ashcroft recommended that the double letter signs should no longer be included in the code. However, one aspect seems important to the writer. By their inclusion a word can become less cluttered with dots, and therefore may be more legible.

The upper contractions include whole and part-word signs. AND, FOR, OF, THE, and WITH are frequently occurring words but Ashcroft found that they caused more errors when used in words. Perhaps this is because they contribute to the clutter of dots in a word, or they are so frequent as words that they are not always recognised at once as partwords. Partwords, nevertheless, did not cause much difficulty.

The words in full spelling caused little difficulty and words represented by a single alphabet word were the easiest of all, though some were not recognised because they occur so infrequently, e.g. ⠅ for KNOWLEDGE. The fact that individual letters are recognised more easily emphasises the fact that though contractions can save a lot of time when familiar to the reader, it is the multiplicity of meanings which seems to cause problems.

In addition, Ashcroft categorized the error types and the following table (ibid., p.43) should be useful to teachers, particularly those engaged in remedial work.

Table 4. Table to Show Distribution of Eight Braille Error-type Groups. (Ashcroft (1960), p.43, Table 6).

Error Group	**Number of Errors**	**Percentage of Errors**
Missed Dots	1702	15.6
Ending Problems	1599	14.6
Reversals	1434	13.1
Added Dots	1392	12.7
Association	1358	12.4
Gross Substitutions	1335	12.2
Up and Down Alignment	1140	10.4
Left and Right Alignment	973	8.9
Totals	10,933	99.9

To get a clearer understanding of the problems involved these errors may be classified as follows:

Perception: missed dots, added dots, ending errors;

Orientation: reversals, vertical alignment, horizontal alignment;

Meaning: association errors, gross substitutions.

The results showed that space-saving devices contributed substantially to the difficulties encountered, also the failure to suspend judgement until the whole of the symbol had been sensed, and perceptual errors, particularly of missed dots. By using continuous prose in the form of short stories Ashcroft's subjects were likely to have been well-motivated, and the better readers would have been able to make use of context cues which is not possible when single letters or words form the test material. His analysis of errors provided a wealth of insights into problems encountered by young learners when reading braille. In addition, he suggested ways of improving the code, gave ideas to help teachers, and made suggestions for future research. These included (ibid., p.89) a consideration of the effectiveness of different approaches to teaching; evaluation of space-saving devices in terms of reading and comprehension; development of means of increasing the rate of reading by scientific evaluation of the code itself; and recommendation of the use of controlled testing of progress in reading.

THE WORD METHOD OF LEARNING TO READ

The word method of reading (a recognition of whole words rather than a synthesis of individual sign meanings to make a word) was the acceptable practice of teaching braille reading in America on the advice of Maxfield (1928). Nolan and Kederis (1969, preface) set out "to study factors in braille word recognition in order to delineate more clearly the cues that make braille reading by the whole word method possible" for blind pupils in a series of 9 related studies.

A tachistotactometer was used which was capable of exposing characters for controlled periods of time. The braille characters were punched on plasticized paper and they could be pushed up through a line of holes corresponding to 36 braille cells. The use of the tachistotactometer could be criticized in that it does not conform closely enough to the braille reading situation. Instead of the reading finger getting stimulation from the progress along the line of characters the machine raised the dots up to the fingers, so reduced finger movement occurred. This view is supported by Foulke (1982, p.184). The dot locator (the 6-dot cell) was included for testing single cell signs to help distinguish lower signs from the same shapes in the upper position of the cell, but for some readers the resulting conglomeration of dots may have been confusing until they became used to this method of presentation.

RECOGNITION OF SINGLE-CELL BRAILLE CHARACTERS

The investigation carried out by Ashcroft in 1960 had provided considerable information concerning the difficulties in recognition of individual characters within words. Nolan and Kederis (1969) also measured the time taken to recognise single cell signs. Only the total times were recorded which represented times for recognition of the character plus its naming. 36 subjects in Grades 4 through 12 took part. The exposure times were gradually increased by steps of .01 sec. until all the characters were recognised by all the participants. The results were tabulated in ascending order of mean recognition times (ibid., p.61) and the range was from .02 to .19 sec. Though taking longer time, the slow readers (study 8) showed a similar difficulty order. Foulke (1982, p.178) pointed out that it was not possible to adjust the tachistotactometer used by Nolan and Kederis to measure the threshold values for a few of the characters which required the shortest recognition times. The minimum time possible by the apparatus of .02 sec. was therefore given in these instances. The order of difficulty was found to be similar to that found by Ashcroft both for fast and slow readers.

THE EFFECT OF THE NUMBER OF DOTS IN A CELL

The recognition times for characters increased according to the number of dots in a cell. This is demonstrated in the following short table:

Table 5. Table to Show Recognition Times of Characters Grouped According to Number of Dots (Nolan and Kederis, 1969, p.62).

Number of Dots	**1**	**2**	**3**	**4**	**5**	**6**
Time (secs.)	.030	.033	.058	.091	.128	.190

Position of Dots Within a Cell

Excluding the 2 dot configurations, it was found that "characters having a greater space at the bottom and/or the right required 22% more time to be recognised", the lower signs requiring 55%, and dot 6 was missed more than those in other positions in the cell (ibid., p.63). No suggestions were made as to why this should be. Braille is read sequentially from left to right so the finger reaches the left hand dots first and information gained from the left side of the cell must be held over until the whole of the cell has been covered.

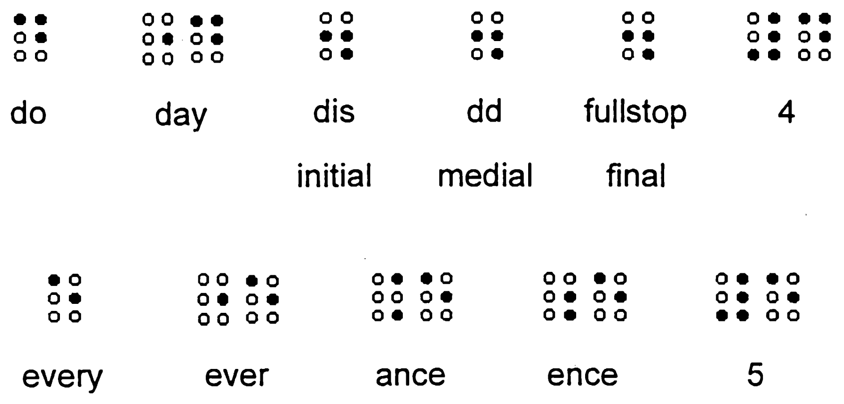
Another possibility is tentatively suggested by the writer: braille is set out in straight horizontal lines but it is natural for the hands to move in a curve equidistant from the body; the reading finger is shorter than the middle finger, and these factors result in the fingers being held in a slightly arched position at approximately 30° from the page. There must therefore be a tendency for the finger pad to be held sloping slightly downwards which may result in a more definite recognition of the upper position of the cells and the lower parts of the pads hardly touching the page or not making contact.

The signs seemed to be recognised as dot patterns and when dots were omitted the sign was confused with another one with some similarity. Table 8 (ibid., 65-66) is very revealing. For example, X ⠭ was confused with M ⠍, ING ⠬ with U ⠥, and Q ⠟ is shown to be confused with its parts ⠏ and ⠋.

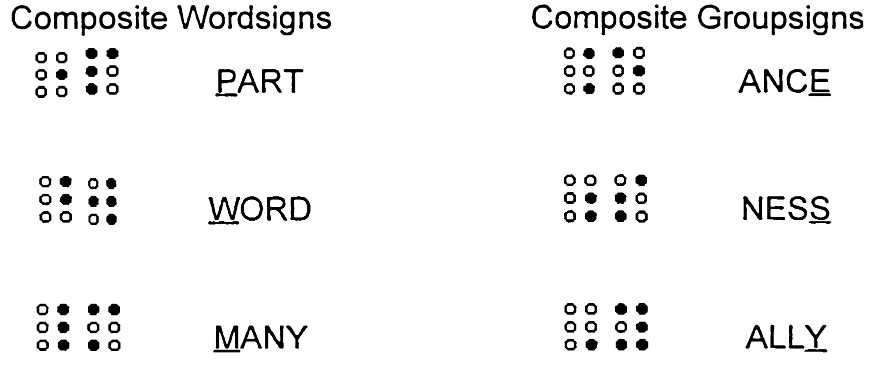
It is interesting to note that these tactual aspects were taken into account by Louis Braille approximately 170 years ago when he was first considering the make-up of his code. It has been shown (Chapter 2) that when he selected 10 characters from the 15 that were possible using the top four dots in the cell, he omitted ⠈, ⠘, and ⠐. In addition, when he added dots in the lower positions to make further symbols the only alphabet letter to be made with the addition of dot 6 was W ⠺. The remaining signs of the first line with dot 6 added were used for accents. These signs were used for one-space upper wordsigns incorporating dot 6 when the code was adapted for the English language in 1870.

The Effect of the Use of Contractions

Contractions were invented to save space and therefore reading time, and also the cost of production. If the learning load is not too great and if they are sufficiently known, their use is of great benefit, even though the wisest allocation of meanings was not always made (see Chapter 6). A main difficulty is the insufficiency of meanings that are possible using the 2 x 3 matrix. Solutions have been the use of the same sign in the initial, medial and final positions of a word, each with a different meaning; if a sign is 2 dots high it can be used in the upper or lower position; and a third device is the placing of a dot or dots in the half cell immediately preceding the sign. These strategies all present extra learning compared with visual reading where only 26 letters have to be remembered in their upper and lower case forms. Two examples will demonstrate the extra learning involved:



It will be noticed that the 33 composite wordsigns (beginning with dot 5, dots 4-5, or dots 4-5-6) include the first "sound" in the string of letters. However, the final signs, now known as composite group signs (beginning with dots 4-6, dots 5-6, or dot 6) use the last "letter" of the string. This divergence from the norm may cause confusion to some readers, perhaps because they may be anticipating the composite group signs to also begin with the first sound of the string: for example:



These examples are included to show the precise knowledge that needs to be acquired before contractions can provide the intended help. Contractions concentrate more information per character and thus in principle speed up reading.

In study 4 Nolan and Kederis (1969) studied the influence of contractions upon recognition thresholds for words. Lists of words were provided containing one or two contractions in familiar and unfamiliar words. Upper and lower contractions were included. Although lower contractions can cause problems, Nolan and Kederis found that "familiar words having lower contractions are recognised more easily than familiar words having dots in all the rows of the braille cells" (ibid., p.99). It is suggested that this is probably due to the fact that a more open space occurring between signs containing more dots makes for easier recognition. Unfamiliar words with lower contractions were found less easy to recognise.

The position of the contractions is also important, for Nolan and Kederis (ibid., p.99) found that in familiar words contractions in the medial position are the easiest to recognise and those at the ends of words the hardest. It is suggested that this may sometimes be due to Ashcroft's finding (1960, p.66) that meanings are sometimes guessed before the whole word has been sensed. In unfamiliar words the difficulty diminishes as the position of the contraction moves from the beginning to the end of the word. A likely explanation may be that the meaning is being synthesized as the word is being covered but no guessing occurs. It would seem that recognition of words with the help of contractions is more complex than many have recognised.

The Effect of Word Length, Familiarity, and Orthography on Recognition Thresholds for Braille Words

High school students from three residential schools who read braille with above average comprehension were selected by Nolan and Kederis (ibid., p.72) and then ranked for fast to slow performance. From these, 15 students were selected from each of the upper and lower thirds of the distribution. A multivariate design was necessary. Students read separate characters and also familiar and unfamiliar words of 3, 5, and 7 letters in length, the presentation times being systematically increased until each subject could recognise all the words. In addition, the cover time (time taken until at least one finger had encountered all the letters), and the synthetic time (the sums of recognition times for all the letters in the word) were recorded.

The following (ibid., p.25) were among the findings: the effects on word recognition times of increase in word length and decrease in familiarity augmented one another; the single and combined effects of the variables were proportionately greater for slow readers; and the order of legibility of braille characters was the same for the fast and slow readers. It was also found (ibid., p.81) that of the 36 words read by 30 students (total 1,080 words) 111 words or 10.27% were recognised before the reading fingers had covered all the letters in the word. Other cues must therefore play a part in recognition.

The experiment was replicated with elementary-aged pupils (Study 7) and with pupils with lower intelligence (Study 8), so comparisons could be made demonstrating the development of reading skills at this level. It was found (ibid., p.43) that "the development of reading skills is retarded and reading, even at the upper elementary level, may proceed in a fairly mechanical manner. Once this basic maturational process has been concluded, the child is free to make rapid growth". This overall picture was later to be refined in experiments carried out by Millar (1984; 1985; 1988) which will be referred to later in this chapter. It needs to be remembered that the Nolan and Kederis experiments described above were carried out with the use of the tachistotactometer which does not provide the natural reading situation so the results need to be interpreted with caution.

Unit of Recognition

The most striking result was the difference between the synthetic times and the times required for recognition of these words. To take one example (ibid., p.79, from Table 15): the mean recognition time for an uncontracted familiar five-letter word by a fast reader was .63 sec. and .42 sec. for synthetic recognition time. The corresponding times for slow readers were 1.11 sec. and .79 sec.

The last result had a profound effect on teaching method for it implied that "the process of word recognition appears to be a sequential one in which word recognition is the result of the accumulation of information over a temporal period (ibid., p.39) and that "whole word reading" is not characteristic of the braille readers studied and that the perceptual unit in word recognition is the braille cell" and this seemed to be the answer that Nolan and Kederis had set out to discover. It was to be remembered that all the experiments carried out by Nolan and Kederis (1969), except for Study 9 on the effect of character training, involved testing by means of the tachistotactometer involving oral reading under rigid timing conditions. It would seem that more natural conditions of reading might have given more flexible conditions for strategy choice.

Nolan and Kederis (ibid., 47-48) added the suggestion "that below a certain level of mental ability, braille ceases to be an effective medium for education" so that "for students whose IQ is below 85% it is an extremely inefficient medium of communication". In the opinion of the writer the suggested level of IQ 85 can be taken liberally, for there are a small proportion of readers who may have a comparatively low IQ, who show poor evidence of recall, as evaluated in answers to comprehension questions, and yet who seem to gain much satisfaction from reading. Their rates of reading may be faster than their intelligence would suggest. Such children will progress slowly in education, but their sense of achievement and enjoyment of reading is remarkable in the circumstances. Braille readers show many individual differences in coping with a complex medium.

5. DEVELOPMENTAL FACTORS AND THEIR EFFECT ON BRAILLE READING

General Development and its Effect on Braille Reading

Gomulicki (1961, p.51) found that "at the age of 5 the blind child was at a distinct disadvantage as compared with the sighted one, taking decidedly longer to produce results that were markedly inferior", but "by their mid-teens or thereabouts, the blind children became ... as good as the sighted children of the same age". He regarded this catching up from a slow start as being "at enormous cost of prolonged effort of the intellect" (ibid., p.52). Gomulicki was writing in more general terms than in the sphere of braille learning, but nevertheless, this background needs to be taken into account in any review of the blind child's reading development.

It is well known that many of the experiences that contribute to reading readiness for sighted children are necessary for the blind child too. However, because the surroundings are less accessible in the absence of sight, many have to be deliberately brought to the notice of the young blind child, and emphasis laid on the remaining senses in order to help concept development. As a result, reading by means of the braille code has a slow start too, intelligence being an important factor.

As a direct result of Gibson's enquiries (1962; 1968) and researches carried out in the '70s and '80s, the type of research into braille reading began to have a different slant. Instead of stressing reading behaviour, researchers were concentrating more on why and how. That is, how does mental development affect braille learning and use, what strategies are used for discrimination and recognition of symbols, and at what stage of development? Because these factors are all interrelated the problems posed by braille reading are seen to be more complex but need to be probed so that a greater understanding can ultimately help the braille reader.

SHORT-TERM MEMORY

As shown in Chapter 7, short-term memory is a major factor leading to the recognition of braille characters and words, but little experimental work has been carried out in this area. Recall may involve tactual memory or verbal memory, or both occurring concomitantly. Millar (1975, p.194) conducted an enquiry to test the effects of tactual and phonological features of braille consonants on tactual recall by blind children. Lists were compiled containing up to 6 braille letters (ibid., p.195), which were:

1. heterogeneous in feel and in name sound (K, L, M, S, H, Y);
2. phonologically similar, but dissimilar in feel (B, C, D, V, P, G);
3. tactually similar, but phonologically dissimilar (W, R, T, N, Q, Y).

   (There is a misprint in List 1 for H (⠓) is shown as F (⠋).)

The set size, that is number of items, for each child was determined by a test showing the number of serial items which produced a score of 60%-100% correct responses. The results showed that recall of braille letters by blind children is affected by both verbal and tactual features and that this interacts with the number of letters on which they were tested. Further experiments are needed to determine the proportion of these features affecting recall, but the findings, so far, indicate that verbal coding is associated with high levels of total recall (ibid., p.200).

Strategy Choices by Young Braille Readers

Ashcroft (1960) and Nolan and Kederis (1969) thought the perceptual unit of reading comprised outline shape of the characters, as helped by recognition of dot numerosity. For many years teachers have based their teaching methods on these findings.

Because braille characters are read sequentially the first half of the cell comes under the reading finger pad before the second half can be integrated with it, and during this process the relative positions of dots and spaces have to be registered before recognition can take place. This must be a slow process if not helped by other strategies. In 1984 (p.568), Millar posed the question of whether "shape can actually help with coding, or whether it relates to coding by sound and meaning at different levels of reading efficiency". As a result of observations on a retarded blind child's use of sound in memorising how to write braille characters, Millar suggested that phonological strategies may not only help retarded blind children, but may also be used in the early braille learning of normal children. She therefore carried out investigations (1984) to determine which of phonological, shape, dot numerosity and semantic strategies were used at different levels of reading ability, by retarded and normal children. Two hypotheses were tested (ibid., p.569):

1. that coding strategies change with reading rate level, and
2. that coding strategies differ between normal and retarded readers.

For hypothesis (1), subjects were divided into 3 groups according to reading rates, and for testing hypothesis (2), reading age relative to mental age norms were used (ibid., 569-570).

For the first experiment Millar selected four-letter words from which the subject had to choose the 'odd man out'. The words were carefully chosen so that the choice would reveal which strategy or strategies had been used. For example, for semantic versus phonological choice, the selected words were GIRL, CURL, and LADY, where CURL is odd semantically, and LADY is odd phonologically. In the second experiment the same strategies were tested, but the critical stimulus word was given as well as the coding instruction to be used. Pseudo-words were also included to assess whether the coding instructions could be maintained.

The results showed that for all types of readers shape was the most difficult of the strategies - a radical change from previous thinking. Dot numerosity could be used as additional help. In general the results showed a 'mixed model' of processing, that is more than one type was used. The retarded reader tended to ignore the harder strategies, such as determination by shape and to rely more on phonology. The differences in coding suggested an interaction with mental age differences. It would seem that some readers may need to be helped to adopt additional strategies, thus leading to greater enjoyment of reading with an improved rate of reading.

In 1985, Millar backed up these findings by mounting two experiments on matching braille characters in dot pattern and in outline shape respectively, followed by an analysis of subjects' drawings of braille outline shapes. It was found that even the fastest readers were better at dot patterns than outline shapes and that "subjects were less accurate and slower at matching outline shapes than dot patterns at all levels efficiency". In fact (ibid., 16-17), "facilitation from shape coding is more a matter of individual differences in coding strategies rather than either the cause or effect of faster reading as such". It will be remembered that Ashcroft included errors of orientation in his list of braille difficulties. Here (ibid., p.17), Millar suggested that some readers seem to depend less on confusing mirror image shapes than on confusing small differences in spatial positions of dots within a letter, and also on confusion about the main reference axis in reading. She considered these factors to be more important than practice in detecting global letter shapes (ibid., p.17). Millar's findings on strategy choices by young blind children (1984; 1985) as extended and developed by further research, should have a far reaching effect on their education.

STRATEGY CHOICES BY FLUENT BRAILLISTS

To understand more about the strategies used by faster, more fluent readers, three assumptions can be made (Millar, 1988, p.89):

1. in a "letter-by-letter" method a small change, such as a missed dot, is likely to be registered and so produce significant results;
2. if speed depends on use of context, contextual changes will be registered, but a small change in a letter in a word should not be registered in overall reading speed; and
3. if prose reading involves a number of component strategies, which may relate in a compensating manner, both mis-spelling and context changes will be registered.

Millar (1988) demonstrated these variables by measuring their effect on speed as shown by hand movements during oral reading. For this measure of performance a detailed and exactly timed mechanism was needed, much in advance of the more primitive apparatus used by Holland and Eatman (1933) and Fertsch (1946). Hand movements were video recorded from below a transparent reading surface, and synchronised with cumulative timing and voice output. Details of text showed up against the finger pads of the reading finger. Critical words, involving mis-spellings and context changes were included in the narrative, and problems caused by them were indicated in the oral reading and, more particularly, by a change in the tempo of reading.

Theories about the rate of braille reading include fast letter recognition, the fast coding of shapes, the use of context cues, and a knowledge of syntax. The hypotheses to be tested by Millar (1988, p.89) were:

1. braille reading is slowed down if the critical words are spelt incorrectly; or
2. physically degraded; or
3. if the prior context is inappropriate; and
4. reading is slowed significantly more by context change in conjunction with physically degraded words. (Words were degraded by using a braille eraser to depress the dots to a level that made discrimination difficult for experienced braillists, that is 60%-70% correct recognition.)

The subjects read braille prose passages aloud. Each of the 6 stories was presented in 6 versions according to the 6 test conditions. These were:

1. control story;
2. story with degraded critical words;
3. story with incorrectly spelt critical words;
4. story with context change;
5. story with incorrect critical words plus context change;
6. story with degraded critical words plus context change.

Each subject read 6 different stories bringing in 6 different test conditions, the stories being counterbalanced across the subjects. It was found that stimulus quality, coherence in the text, and mis-spellings affected overall prose reading speeds, but their full effect in reading words and full text on speed is not yet fully understood.

Using the same apparatus, Millar (1987) had shown that when two hands are used in prose reading, they do not process different parts of the prose simultaneously. The left hand, when moving to a new line, does not start reading until the right hand has completed reading the previous line. The evidence suggests (ibid., p.120) "that fluent reading depends to a considerable extent on fast intermittent alterations in function between two hands".

Millar's comments (1984, 74-75) in connection with hand use, and the development in braille reading shown in the above experiments, are summarised when she wrote "highly proficient reading depends mainly on verbal strategies and skill ...; less proficient reading demands attention to spatial coding of the physical characters ...; whilst early learning subjects rely on non-spatial 'texture' (e.g. dot density) features of braille characters ...". Clear cut stages are not apparent, for children develop at differing rates and, as has been seen (Millar, 1984), use a variety of strategic choices, but the main trend can be recognised.

6. STRATEGIES FOR IMPROVEMENT OF THE RATE OF READING

CHANGING THE CODE

Ever since 1870 attempts have been made to change the code so that it would become easier to read and to use. These attempts have been chronicled in Part 1 as far as the London conference of 1978. Current work on the code will be discussed in the next chapter.

DIAGNOSTIC TESTS

Few alterations have been made to the braille code since the British revision of 1905. Teachers have always known that the medium is less efficient and more difficult than visual reading, so great efforts have been made to improve methods of teaching as demonstrated in books, articles in journals and in presentations during conferences. By observation it was known that the development of blind children was slow compared with that of their sighted peers. Comparisons with the development of sighted children at any age are difficult and this must be particularly so when the complexities of braille reading are being considered. Standardized tests for sighted children have been converted in the absence of anything more appropriate, but braille reading especially needs to be assessed by tests standardized on samples of blind children.

The Tooze Braille Speed Test (1962). The test is intended to assess the child's attainment in "actually reading braille symbols" for children of primary school age. It consists of 120 three-letter words that contain no contractions. Reading is timed and the raw scores obtained in one minute can then be used with chronological age to transform the scores into reading ages and standard scores.

Lorimer Braille Recognition Test (1962). In 1962 (p.5), Lorimer, J., wrote that when reading tests of comprehension were attempted, "there was no way of knowing if or to what extent results were affected by difficulties with braille contractions". It was for this reason that he provided a standardized test based on a population of 332 children of primary school age, which was intended to measure "the braille factor". 174 unrelated but carefully chosen words were provided, each containing a contraction. For example, too much familiarity with a word would mask whether the contraction was recognised, so less familiar words were chosen. The test was terminated after 10 successive failures, and norms are given for each half year from 7.0 to 12.6 years. The test was diagnostic in that it determined the types of errors likely to be made when reading braille, and it could also provide guidance in the construction of teaching material and for remedial help.

Neale Analysis of Reading Ability, adapted for use with blind children (1977). Neither the Tooze test (1962) nor the Lorimer test (1962) was intended to test comprehension, and Lorimer, J., felt that "there was an urgent need for a test which not only provides reliable quantitative measures of accuracy, comprehension and rate in reading ... but also yields diagnostic information which reveals specific difficulties and indicates the type of remediation needed" (1977, 1-2). The blind population in Britain is comparatively small and therefore it would not have been possible to find sufficient numbers needed for trials and final versions of a new test. It was therefore necessary to use a well-tried test for sighted pupils and standardize it for braille-reading pupils. The Neale test for sighted pupils provided 3 parallel forms, which were of comparable standard to make retesting possible. Each form consisted of 6 graded reading passages with questions provided to test comprehension. Based on a sample of 299 blind children, the Lorimer adaptation has proved successful not only in testing accuracy, comprehension, and rate of reading, but also in having diagnostic value. Testing provision is made for recognition of the error types typified by Ashcroft (1960) as well as fundamental reading difficulties specific to the braille code. The test is currently being restandardized and will be referred to again in the last chapter.

TRAINING IN RAPID READING

Having determined that the braille character is the perceptual unit for braille reading, Nolan and Kederis (1969), investigated the effect of training on the rate of reading. They used 3 types of training, the rate and error scores in oral reading of individual characters and in words, and the rate and comprehension in silent reading. 12 students took part in each of Grades 3 through 6. Pre- and post-tests were administered and after training the results revealed that for the experimental group, an increase in time of 42% for individual characters and 15% for words, and for error scores a decrease of 83% for individual letters and 28% for words. The corresponding scores for the control group were an increase of 15% on time for individual letters, with a decrease of error scores of 19% but the scores for rate and error for words changed hardly at all. Unfortunately, the scores for comprehension were unreliable because some of the students were so highly motivated by monetary rewards that comprehension suffered. The results were encouraging but a replication would have been desirable because the sample was so small. Other training programmes to increase rate of reading included those by Flanigan and Joslin (1969) and Umsted (1972).

At the beginning of this chapter reference was made to the work of Fry (1963) and Watts and Buzan (1973) who attempted to teach sighted adults to read faster. Braille reading is considerably slower for most readers, not only because of perceptual problems and difficulties inherent in the code, but teaching has sometimes inadvertently encouraged this tendency. Stress had been laid on accurate oral reading and silent reading was perhaps not encouraged because of lack of reading material. Now that most blind children are integrated into the main stream, uncorrected silent reading is more common. Material well within the pupil's grasp will encourage a desire to hurry on when enjoying the story.

In America McBride (1974) organised several two-week workshops intended to help increase the reading rates of blind adults. Candidates were encouraged to experiment individually for "each person developed his reading skills in his own way, through suggestions from workshop directors and through comparing his own techniques with others in the class". Each subject provided his own material and comprehension was tested by other participants; meanwhile purposeful reading, active responses, elimination of sub-vocalising, continuous effort to read faster yet with flexibility of speed were all emphasised. A series of exercises were also employed involving rapid scanning of pages of braille using one or both hands and using one or more fingers. The result showed an increase in average reading rate from 138 w.p.m. at the beginning of the course to 710 w.p.m. at the conclusion. It was found that the subjects in the sample were highly motivated professionals. Though not conducted under rigid conditions the workshops stimulated others into action, and within the year (1975) two more studies were mounted.

Crandell and Wallace (1975) divided the participants into two groups, one having training in rapid reading and also code recognition, the other having training in rapid reading only. The results showed gains for the experimental group of approximately 39% and the control group showed only marginal improvement. The experimental group gained speeds of up to 225 w.p.m.

Olson, Harlow, and Williams (1975) divided their participants into three groups, two braille reading and one using large print. One group was taught by an ex-member of one of McBride's workshops and followed his informal methods. The other braille group was taught by more formal methods but also had informal sessions. Both informal post tests revealed substantial gains, but not in the realms of those achieved by McBride. They found (ibid., p.395) that "age had a negative effect on one's chances to increase his reading rate. It is obvious, then, that we should concentrate our training efforts on young children who have not yet established their reading habits". This fits in with the finding made by Fertsch (1946), p.131) that reading habits are established by the third grade, and Olson (1976) published an article entitled "Faster reading: preparation at the reading readiness level" (1976).

In 1977, Lorimer, J., published *Outlines of a short course to improve the braille reading efficiency of children in lower senior classes.* The study is unusual in that it was carried out under normal classroom conditions. Six classes in a residential school were divided into two groups of three. Half of them contained the 11 pupils regarded as the experimental group and half, the control group, were contained in the parallel three classes. The mean age and IQ of the experimental group was 12.10 years and 96.5 and the control group 13.2 years and 95.6 respectively. All the pupils in the 6 classes took part even if their efforts were not included in the results, and the pupils were unaware of experimental conditions, regarding the proceedings as extra reading training. Some showed little motivation at first, but there was noticeable enthusiasm as the training proceeded. Each class had 19 periods of 40 minutes training. The experimental group showed a gain of 84% in w.p.m. with only a slight drop in comprehension. There was a small gain for the control group. The training involved practice in techniques of hand use and speed reading with and without comprehension, Lorimer, J., stressed that the course was not regarded as comprehensive and that "more research-based information about the process and the limitations of reading by touch is needed before the design of a complete post-primary course in rapid reading can confidently be attempted" (ibid., p.10).

7. SUGGESTIONS FOR FUTURE RESEARCH

The selection of research findings concerned with reading in the medium of braille included in this chapter spans more than 60 years. In the earlier years much of the work was observational and equipment for measuring results was primitive compared with the more sophisticated devices of present day, but this groundwork formed the basis of much of present day enquiries. Since the late sixties more is being found out about the psychophysical properties of touch perception so a more holistic approach is now possible.

New research throws up further ideas of what needs to be investigated. For example, Millar's findings concerning the strategies used by young children when learning braille show that the processes concerned involve wider choices than had already been realised and were different for stages of development and for those of lesser intelligence. Further research in this area seems of prime importance for the more that is understood, the more will be the benefit to learners and teachers alike. Obviously, teachers need a fuller knowledge of the strategies being used and therefore where to strengthen the learning process.

Because tactile reading takes longer to learn than visual reading there is less time available to learn such skills as the use of context cues, syntax and dictionary skills. There is therefore an urgent need for blind children to be given extra help in this area for them to reach their full potential. More research is needed for a better understanding of when such help is appropriate for each child.

Lorimer, J.'s, research (1977) on improving the braille reading efficiency of children in the lower senior classes could be suitably adapted for use with fluent younger children, based on more research-based information about the stages of development in braille reading at that age.

More research is needed regarding verbal processing and finger and hand movements. This is also important because it has direct bearing on the early stages of reading when the learners are determining their best hand use before their reading habits become more set.

So far little has been said about adult reading because there has been little research carried out in this area. Children were easier to select where whole samples could be found in a special school, and, now that children are more integrated into normal schools in Britain, travelling for researchers is expensive and time consuming. Adult learning of braille is very different for two main reasons; adults are not learning 'to read' at the same time as they are learning braille, and they have the disadvantage of having to learn a new skill without the old word patterns intervening. The teenager who must learn quickly so as to get on with training or for a waiting job, the adult suddenly blinded who has to adjust to new working conditions, the retired professional who wants a purposeful new life, and the elderly blind person who may learn slowly but needs braille for simple organisation in the home, are but a few of the adults who need new literary skills. It is obvious that their needs are very different.

In conclusion it seems to the writer who has been both teacher and researcher, that there is not a sufficient link between the valuable findings of researchers and their application in the learning situation. It is necessary that findings are written up in research journals so that others may build on previous work. Understandably, teachers often do not always understand the statistics involved or even the special vocabulary that is necessary to convey exact meaning. No blame is attached anywhere, for it is the natural result of the working of separate disciplines, and all have problems of lack of time. Yet the matter needs to be addressed for the sake, ultimately of those for whom the research is carried out. The Braille Authorities of the United Kingdom and North America have also supported the desirability of having this knowledge made more available. The International Conference on English Braille, Grade 2, held in Washington, D.C., in 1982, passed resolution 7.5 (p.248) which stated, "Little appears to be known about the structure and functioning of the touch sense or about the psychophysical factors which affect tactile sensitivity in perceiving braille characters. Research on this topic is clearly beyond the competence of any braille authority to carry out. It is therefore proposed that efforts to be made to persuade properly qualified specialists to undertake this task.". No reference was made to this aspect in the following conference held in London in 1988.

8. CONCLUSION

The intention of this chapter has been to explore some of the factors in the braille code which cause it to be a comparatively slow medium of reading. Inevitably, therefore, the difficulties became highlighted in order that they might be mitigated to some extent. To end on a positive and kindly note, let Ashcroft (1960, p.52) end the chapter, "The low incidence of errors, about 5 errors per 100 words, is a positive and encouraging finding of the study. Braille is often described as a difficult, cumbersome, and illogical system ... . Nevertheless, this study, which concentrated upon errors, and held a widely inclusive definition of error, revealed relatively little difficulty in a large sample of children of wide range in age, grade, and ability.".

CHAPTER 9

BRAILLE TODAY AND TOMORROW

1. THE BRAILLE CODE: EVENTS SINCE THE LONDON CONFERENCE (1988)

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   Capitalization

2. SOME ONGOING RESEARCH PROJECTS

   Longitudinal Study of Blind and Partially Sighted Children in Special Schools in England and Wales

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1. THE BRAILLE CODE: EVENTS SINCE THE LONDON CONFERENCE (1988)

INTERNATIONAL COUNCIL ON ENGLISH BRAILLE

As agreed at the International Conference on English Braille, Grade 2, held in London in 1988, the International Council on English Braille was set up in the following year. The Executive Council is made up of one member from each English-speaking country represented at the London conference, and its brief is to monitor the use of braille so that unagreed anomalies do not creep in, to review any necessary changes to the code as they become necessary, and to be involved in changes that will be necessary in order to contain computer use of braille. The latter is urgent because there has been a tendency for printing houses to make their own rules in the absence of any central direction.

In 1992 the Braille Authority of North American (BANA) appointed a sub-committee charged with defining the basic methodology for extending the basic literary code (English braille) as the first step towards a Unified Braille Code (UBC). The word "Unified" may need an explanatory note to braille users in the UK. In America there are three braille codes concerned with mathematics and science and these are incompatible for use in the literary braille code. It was felt necessary to simplify these codes and bring them within one basic code. In Britain, although there are special usages for mathematics and science, much more information is contained within the literary code. Sub-committees were set up in America to deal with specific areas of code usage. Committee 2, concerned with the literary code, was extended to include mathematics, computer science and other technical fields (Report by the Objective 2 Committee, 1995). The work of the committees was originally confined to consideration by BANA, but it was soon realised that such work should have international co-operation in the interests of braille uniformity among English-speaking peoples. A brief introduction by Sullivan (December, 1995) was issued for "people who already read braille or transcribe English braille" showing, in some technical detail, what UBC may look like. The aim has always been to keep as much of the present literary code as intact as possible. Many discussions and decisions still have to be made.

BRITISH BRAILLE

"British Braille: A Restatement of Standard English Braille" was compiled by the Braille Authority of the United Kingdom and published in 1992.

CAPITALIZATION

There was no reference to the use of capital letters in Braille's two "Procédés" of 1829 and 1837 and when braille was introduced for use in Britain the BFBA must have considered their use superfluous. Space had to be saved to reduce cost of production and the clutter of dots avoided in the interests of legibility. Fewer official documents were in everyday use, particularly in braille, and the frequent use of acronyms is a modern trend. The first public plea for their use in Britain was probably that made by Illingworth in a speech delivered at the Conference on Matters Relating to the Blind in 1902 (Illingworth, 1910, p.83). The sign was introduced into the code after the 1905 conference and a Primer produced sometime after stated "capital letters, and consequently the Capital Sign, are not used in this Grade except in school books or when specially desired" (Douglas-Hamilton, undated, p.6). One cannot help wondering why school children must learn their use if they are not likely to meet them afterwards.

In America the first known book to use capital letters and full punctuation was printed in 1893 (report of the Board of Education, 1909, p.33). There have been repeated requests from America since for Britain to use capitalization, but even as late as 1986 when BAUK issued a questionnaire on many aspects of braille usage, British braille users showed that the majority considered their use to be superfluous. However, new inventions and closer co-operation as the world becomes smaller calls for changes.

In 1992 BAUK received several requests to consider bringing the capital sign into full use in the UK and it was likely that once more, a decision would have to be made by Britain as a member of the ICEB. BAUK makes the final decision regarding code changes in this country, but takes public opinion into account beforehand. Poole, chairman of BAUK, issued an article (1994, 8-12) giving arguments for and against the proposal. Among the arguments for the use of the capital were:

1. Canada, New Zealand, Australia, and South Africa were now using the capital sign;
2. recognition of capitals and their function have now become a part of the National Curriculum and their use is regarded as a criterion of literacy;
3. knowledge of capitalization is necessary for those pupils and students who are learning typing skills.

Poole added (p.9) "Learning the rules needs to be reinforced by constant confrontation with the capital letter in use, if people are to apply them correctly and spontaneously".

The main arguments against were:

1. both the Gill survey and the longer BAUK survey of 1986 showed that the braille-reading public did not want capitalization;
2. unlike print, the braille capital sign occupies extra spaces. Poole quoted 4.4% extra according to the Kederis count of 1965;
3. the extra characters can cause clutter of dots which sometimes results in perceptual problems in reading.

1,200 replies, including opinions from both visually impaired and sighted users of braille, were received in answer to a questionnaire prepared and issued by BAUK in 1995. They were recorded and analysed by the Research Centre for the Education of the Visually Handicapped (RCEVH), University of Birmingham, and a report on the findings was sent to BAUK in 1996. Questions on preference re: capitalization had previously been included in the BAUK survey of 1986 (see Chapter 6). The 1986 replies from sighted users of braille were recorded but not published because of a flaw in the figures; some respondents had given options, which they considered their pupils would prefer instead of giving their own opinions. It is therefore only possible to compare results for touch readers.

Some of the questions differed slightly but it is interesting to note the opinions in 1986 and 1996 regarding the two main options, (a) the capital letter sign should be used to show capital letters wherever they appear in print, and (b) there should be no change to the present practice. The results for (a) by touch readers were 1986 14.57% and 1996 55.42%, and the figures for (b) were 1986 26.20% and 1996 27.77%. It seems that those who think capitalization superfluous kept to their 1986 opinion, but the increase of 40.85% in the preference for capitalization by touch readers needs some explanation. The swing towards capitalization came partly from a rejection of its use only in educational text books, and from the use of capitals for proper names, but not to begin sentences. Also, 22.79% in 1986 voted for capitals to be used only "to clear up confusion in the text" - a rather nebulous option that was not included in 1996. The figures which include options from both touch and visual readers for 1996 were (a) 46.25% and (b) 29.58%. The over-riding reasons in favour of capitalization are probably due to more information being given to the general public before the questionnaire was issued (Poole, 1994, 8-12) and to awareness that computers have come to stay and the braille code would have to accommodate this new use of the code. BAUK's decision to include full capitalization in the British braille code was ratified in July, 1996, and this decision has now been made public (Poole, 1996, 12-13).

2. SOME ONGOING RESEARCH PROJECTS

LONGITUDINAL STUDY OF BLIND AND PARTIALLY SIGHTED CHILDREN IN SPECIAL SCHOOLS IN ENGLAND AND WALES

Being without the major sense of sight results in a child needing to develop strategies for learning using the remaining senses. To assess the problems and the achievements it is first necessary to know such factors as the type of visual defect and the age of onset.

In 1973, the RCEVH at Birmingham, under the direction of Dr M.J. Tobin, began "a longitudinal investigation into various aspects of cognitive development and school achievement in children registered as blind or partially sighted". This was the first such study. 120 subjects were included from eight schools for the blind and nine for partially sighted children. All the subjects became five during the school year 1973-1974 and they have been tested at regular intervals until the age of 18, the tests involving such factors as intelligence, manual dexterity, tactual perception and braille reading. These factors inter-relate as the child develops so that, when the onerous task of treating the statistics is completed, a much clearer picture should emerge of development stages in blind and partially sighted children as sub-groups but also, and importantly, of the development of individuals. The study should have provided valuable basic information for psychologists, teachers, social workers, and parents.

Testing for braille reading was carried out using the three standardized tests, viz: Tooze Braille Speed Test (1962), Lorimer Braille Recognition Test (1962), and the Neale Analysis of Reading Ability, adapted for use with blind children, (1972). These tests have been described in some detail in Chapter 8. There are parallel versions of the Neale test so it was possible to test the children for accuracy, comprehension and rate of reading at three regular intervals from when the child started reading until the age of approximately 11 years.

THE DEVELOPMENT OF A NEW TEST OF CHILDREN'S BRAILLE READING ABILITY

The narratives in the Lorimer adaptation into braille (1977) of the original Neale Analysis Test for sighted children (1958) gradually became out-of-date and it was necessary to standardize a new test on a current population of children of school age as "it would be impossible to obtain the two or three sufficiently large samples required for the trials and final standardization of an original test" (Lorimer, J., 1977, p.3). It was decided, eventually, that the Neale Analysis (1958) should be used again, but modifications were likely to be needed. Already the NFER Publishing Company had approved some slight changes in the narratives to bring them up-to-date, but it was felt necessary to test the parallel forms in more detail to assess the contraction difficulty at each stage. Lorimer's use of introductory sentences instead of pictures will also be assessed (Greaney, Arter, Hill, Mason, McCall, Stone, and Tobin, 1994).

Information gathering has now been completed and normative data for two parallel forms have been produced. Further analysis is currently being undertaken into the kinds and frequencies of braille errors. Eventually it is proposed that there shall be a teachers' handbook and when this is available workshops will be arranged to train teachers and psychologists how to administer and score the test and to interpret the findings (Director's Twenty-seventh Annual Report, RCEVH, 1996, p.12).

Braille Software Developed at the RCEVH

During the early 1980's the following braille software was developed at the RCEVH for the BBC computer, which was used in most schools at that time. The programmes have now been converted for use also in the IBM compatible machines. The following are a selection.

Talking Braille Cell. For the visually impaired who already have some knowledge of braille. It enables the user to practise their braille without needing the constant attention of the teacher. The visually impaired person can use the six keys on the keyboard which emulate a Perkins Brailler. It is a speech programme, so a speech synthesizer would be needed.

Talking Transcribe. For visually impaired adults who are learning braille. This programme is designed to test the user when transcribing from print to Grade 2 braille. Immediate feedback is given in speech so a speech synthesizer is required.

Braille to Test. For visually impaired people who need to have their braille put into print for sighted colleagues. The six keys on the keyboard emulate a Perkins Brailler.

With the use of the foregoing equipment, the visually impaired person can develop the very necessary independence which is missing to a degree by so many, as well as being of help at school, at the workplace, and, if required, in home circumstances.

3. OTHER EMBOSSED CODES

THE MOON CODE

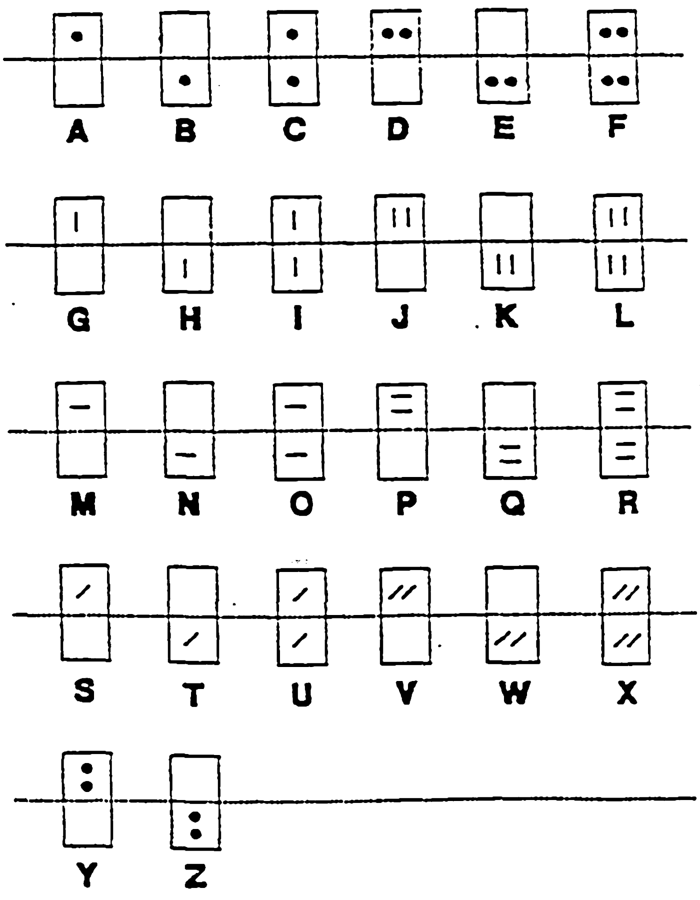
The code devised by Dr Moon in 1847 (see Chapter 3) became popular for adult use during his lifetime and after his death his daughter took over responsibility for production. Its popularity was due to the comparatively clear outline and distinctive shapes of the characters which those with poorer sensitivity of touch found easier to recognise than braille. However, in "Blind and partially sighted adults in Britain: The RNIB Survey, Volume 1" (Bruce, McKennell, Walker, 1992, 10-11), it was shown that "more than 9 in 10 visually impaired people had heard of braille while Moon was known by fewer than 1 in 10". It was suggested that among the elderly registrably blind people, "the penetration and quality of teaching must be increased and the supply of relevant magazines and books to learners and readers improved".

In 1992, a project named "Moon as a route to literacy" was launched by the RNIB with the aim of investigating "the potential of Moon as a tactile code for children with a visual impairment and additional difficulties". A series of books and tapes were made and Bozic, then on the staff of the RCEVH, produced a "SoundBook" demonstrating how a range of interesting sounds could be incorporated for use with the Moon Reading Scheme (Moon Report, Issue 1, January, 1993). During discussion at the Moon Conference held in December, 1992, anecdotal evidence was given suggesting that Moon might be a stepping stone to braille for some learners.

One of the chief problems in the use of Moon is the lack of an efficient writing machine. At the request of the RNIB, the RCEVH spent a year evaluating new prototypes. "Using his right index finger in a wire loop, the operator "draws" the Moon symbol on a small plate or plaque which contains grooves and other guide-marks to help him draw the curves and straight lines that constitute the letters of the Moon system". As the shape is drawn, a writing mechanism inscribes its replica, but smaller in size, onto paper under the plate. It was considered that with practice, writers could master reading and writing in Grade 2 Moon. The device was regarded as "the most promising mechanical advance in the 140-year history of the Moon system" (Tobin and Hill, 1984, p.176).

THE FISHBURNE ALPHABET (1979)

The 26 letters of the Fishburne alphabet are signs on rectangular backgrounds similar to dominoes. They are best explained in a diagram.



The Fishburne Alphabet (Newman and Hall, 1986, p.6)

The system does not appear to be well known, but is intended for use by those who would find braille difficult, both tactually and mentally. Its use was suggested as being an alternative to braille for labelling and possibly as a preliminary to learning braille. It was suggested that success with an easier tactile code might give the necessary confidence to encourage a start with learning braille.

4. TECHNOLOGY AND THE BRAILLE CODE

ASPIRATIONS OF THE 60'S AND 70'S

From when the braille code became established as the means to literacy for the visually handicapped, in both America and Great Britain, its importance was recognised by organisations and individuals. However, according to Clark (1979, p.5) the situation in America began to change. The cause was "benign neglect" for several reasons, including the advent of talking books and synthetic speech, and the increased cost of braille production. Clark added that "there are more persons with low vision who do not require braille, more elderly who do not seem to want it, and more adults who do not use it" (ibid., p.5).

INCREASE IN VARIETY AND PURPOSE OF NEW INVENTIONS

One solution was technical innovation. Talking books provide a real service, but they provide passive listening. Machines using synthetic speech also have their place, but, because of low redundancy compared with normal speech, listening brings fatigue after a period. In the 60's and 70's when more money was available for research and the problem of the decline in braille readership was first being realised, two paths were followed in an attempt to remediate the situation.

More and cheaper production was necessary with a closer co-operation between what was being produced and what was required. Indeed, it was a dream that braille books would become so easy to produce that supply and demand would no longer be a problem, and, for example, text books for students would no longer arrive after their need was over. At the same time technological advances meant that paperless braille would become a possibility. Instead of always using embossed manila paper, portable machines would eventually provide a variety of options giving input, output, and speech. One of the first was the VersaBraille computer which had a keyboard with six keys and a space bar similar in use to the Perkins brailler and the storage capacity was apprximately 400 pages held in an audio cassette. "The braille display consists of a metal plate with 120 holes spaced for 20 braille cells. Each hole has a metal pin which can be raised or lowered by mechanical action" and the display can then be read as in normal paper braille. Many electrical devices have been developed since. Both technical displays and embossed paper are useful for their own particular purposes, but it was not sufficiently understood at first that, for some, talking books, the use of tape, and reading machines which could convert print to speech might take over, or at least provide the excuse not to spend the time and effort to learn braille. When new inventions appear which are intended to improve the acquisition of literacy for the visually handicapped, they are often much publicised and greeted warmly by the general public. Unfortunately, few stop to realise that such inventions are often too expensive for individual use, often for several years, although they could eventually find a place in the job situation.

5. ATTITUDES TOWARDS THE USE OF BRAILLE

Reasons for Disinclination to Learn Braille

The coming of technology is not the sole cause for the lack of motivation by some visually impaired people to learn and use braille. It can be caused by a variety of factors, differing according to circumstances.

In Chapter 1, reference was made to attitudes towards visually impaired people. In spite of a change in attitude such people are still not always accepted, and by some are regarded in some way as being inferior. Fortunately this is not so common as in the past, but the individual blind person may also be lacking in confidence because a certain amount of dependence on sighted help is inevitable. Some do not wish to admit this, and the result may be a determination not to be labelled as blind. Learning braille may seem to underlie this attitude, similar to some blind individual's dislike of using a white stick.

Another problem is the lack of resources for learning braille and even a determination by some sighted people to deny such rights because of effort required by themselves. It is not always the fault of the reluctant teacher. In Britain a social service used to be visits by Home Teachers of the Bind who were trained in braille teaching. When social workers became generic there was little time or inclination to learn and teach braille, especially if there were more urgent demands on time. The RNIB has recently compiled a list of braille users willing to teach others. There was a ready response but now the Institution must arrange for the would-be teachers to be adequately trained. Now that children are mostly integrated into sighted schools, both here and in America, less resources and teaching time are available for braille reading, which succeeds best if tuition can be 'little and often'.

Unfortunately, braille is publicised as being difficult to learn, particularly by those unwilling to teach. It is more difficult than print reading, but many children take it in their stride as they progress through school, and many adults who have learned, wonder how they would have managed without. To end this work, it seems appropriate for some users of braille to give their own opinions. One extract is from a published journal and the other contributors have all given permission for their names to be included.

EXAMPLES OF BRAILLE IN USE TODAY

Mary Hallam, retired physiotherapist.

"I have used it since the age of six. I used braille extensively throughout my school days. Finally, I obtained sufficient qualifications in the usual public exams to gain a place in the RNIB School of Physiotherapy. Here again I used braille during my studies for reading and for keeping my own personal patients' case notes. This went on throughout my career of approximately 30 years. At home I keep a very good filing system in braille for business and domestic use, also a card index for addresses and phone numbers. All our physiotherapy machines and domestic appliances have embossed markings on them. All through the years I have collected recipes which I have put into braille if they were not already brailled, for which my family were very appreciative. This private use of braille has enabled me to feel very independent, and I have felt able to keep up with my friends and colleagues all my life."

Mary Thomas, retired shorthand typist.

"I learnt braille at school and then became a shorthand typist for 10 years until I had to retire on health grounds. At home I braille messages and use the braille telephone directory. I enjoy reading. I read magazines and read approximately five volumes of braille a month. I wouldn't be without braille."

Michael Hodgson, post-graduate student.

I began to learn braille at the age of 16 shortly after losing my eye-sight. Intellectually, the learning process was not so difficult; mastering the patterns of various contractions, etc., the practical element of relating what the mind understood - or imagined it understood - to the clumsy *sensibilities of finger-tip on page was quite another matter, and I found my slowness at learning how to read very frustrating. Fourteen years later I still seldom read anything of much length from beginning to end all at once. I am reluctant for instance to begin anything much in excess of 10 or perhaps 12 pages. Braille does, however, play an indispensable part in my life and as a student it would be impossible for me to work at all without it. Even if I were to be a more confident user of the medium, one undaunted by the prospect of reading innumerable volumes - which I am not - my chosen discipline, philosophy, is not well provided for in terms of braille publications and for this I rely more on recorded material. I use braille every day, however, to write my own notes for later transcription into print and without braille labels the recorded text necessary to my research - some 700 tapes at present - would be inaccessible. I cannot imagine anything could adequately replace it."*

Terry Bullingham, public relations officer for St. Dunstan's.

"I lost my sight suddenly and totally during the Falklands war of 1982 and I am pleased to say that braille played a significant part in my subsequent rehabilitation. I have often heard people say that they don't need braille nowadays with talking books and computers. Naturally, I use computer technology and taped material which I appreciate. Currently, I use braille in the following situations: my bedside novel is always in braille; the notes I use as a public speaker are in braille; a lot of my correspondence is in braille, particularly to visually impaired friends; my bank statements and telephone bills are in braille; my long-playing records, compact discs and discs as well on open reel tapes, are all labelled in braille as well as their respective catalogues; the front panel of the microwave oven has braille labels; additionally, I am a 'Meccano' enthusiast and braille is absolutely essential in labelling the various tins containing the components. Contrary

to the statement, therefore, braille is still very much an essential part of my life. There is nothing nicer than taking one's book from the bedside table, drawing it under the covers into the warmth, and reading without disturbing one's spouse."

David Blunkett, MP.

"With all its quirks and frustrations, braille is essential. Without it, it would be very difficult for me to do my job. I use it for making notes, for preparing speeches - where I use headline phrases and note form, rather than following a detailed text - and, of course, for being able to refer directly to quotations or other detailed text that needs to be accurately repeated.

I enjoy reading books very much, although I get less time than I would wish to be able to do this. To me, braille is the natural corollary of print and therefore an essential tool in everyday life, whether in work, recreation or normal family activity. For me, the availability of quotes, briefing notes or documents that must be held in durable form is crucial in doing my job, both as an MP and as a Front Bench representative of the Labour Party. The availability of braille transcription through computer software and using a braille embosser makes an enormous difference. Staff can produce braille without having to know braille, and documents on disc can be transcribed with the minimum of fuss. Configurating braille material still remains a problem, as does the type of braille that is available in software packages, but the tremendous advantages massively outweigh the difficulties."

Pedro Zurita, Secretary General of the World Blind Union. ("The World Blind", July 1994 - March 1995, No.12, p.6, English translation).

> *"...all this technical paraphernalia does not substitute braille, but rather, on the contrary, it complements and even multiples its usefulness."*
>
> *"He truly wishes that braille would cease to be an innocent victim, whose demise is announced every time a new discovery is made. He cannot help but think how much easier the work would be of the Mongolian mathematician he met who was told upon losing his sight, that it was not worth it to learn braille. And he would like to provide the suitable tools to those children he saw on more than one occasion in African schools copying their own books with writing frames. And he loudly proclaims that reading and writing braille is in no way inferior to any other means of accessing information, and therefore, children and adults with serious visual impairments who are unable to effectively use visual media, must not be deprived of the opportunity to learn to read with their fingertips on the basis of pedagogical prejudices. Braille is wondrous and absolutely innocent and, after all, what is important is not whether information and knowledge reach us through our fingers or through our eyes, but rather what we do with them with our hearts and minds."*

These extracts show something of the variety of needs which knowledge of the braille code can help to fulfil, for it may provide a necessary ingredient for success at work, it can bring organisation in the home, and provide pleasure in some leisure time pursuits. This is a far cry from the days of its invention when it was first used for taking notes in the classroom. As this thesis has attempted to reveal, braille has both a history and a future.

REFERENCES

ALSTON, J. (1842). *Statements on the education, employment, and internal arrangements adopted at the asylum for the blind, Glasgow.* Glasgow: Smith and Son. Reprint, London: Sampson Low, Marston & Co., 64pp.

AMERICAN ASSOCIATION OF INSTRUCTORS OF THE BLIND (1871). *Proceedings of the second convention of American instructors of the blind.* Indianapolis.

AMERICAN ASSOCIATION OF INSTRUCTORS OF THE BLIND (1892). *Proceedings of the 12th biennial convention.* Brantford.

AMERICAN ASSOCIATION OF INSTRUCTORS OF THE BLIND (1915). "Report of the Uniform Type Committee." In: *Proceedings of the 5th Biennial Convention.*

AMERICAN ASSOCIATION OF INSTRUCTORS OF THE BLIND and AMERICAN ASSOCIATION OF WORKERS FOR THE BLIND (1913). *Proceedings of the Convention.*

AMERICAN ASSOCIATION OF INSTRUCTORS OF THE BLIND and AMERICAN ASSOCIATION OF WORKERS FOR THE BLIND (1915). *Proceedings of the Convention.*

AMERICAN ASSOCIATION OF WORKERS FOR THE BLIND (1907). Report of the Uniform Type Committee." *Outlook for the Blind*, 1, 154-162.

AMERICAN ASSOCIATION OF WORKERS FOR THE BLIND (1909). "Report of the Uniform Type Committee." *Outlook for the Blind,* 4, 73-82.

AMERICAN ASSOCIATION OF WORKERS FOR THE BLIND (1911). "Report of the Uniform Type Committee." *Outlook for the Blind,* 5, 1-10.

AMERICAN ASSOCIATION OF WORKERS FOR THE BLIND (1913). "Report of the Uniform Type Committee." *Outlook for the Blind*, 7, 2-48.

AMERICAN COMMISSION ON UNIFORM TYPE FOR THE BLIND (1915). *Changes in 'Revised Braille for Reading and Writing'.* Grade 2 (including Grade 1), Seventh Edition, July, 1915, 1-4. Submitted for consideration by the British UTC, 30th March, 1916.

AMERICAN COMMISSION ON UNIFORM TYPE FOR THE BLIND (1918). *Data concerning revised braille grade one and a half.* The Commission, 4pp.

AMERICAN COMMISSION ON UNIFORM TYPE FOR THE BLIND (1918). Third Report." *Outlook for the Blind*, 12, 1918.

AMERICAN INSTRUCTORS OF THE BLIND (1853). "Proceedings of the Convention." Resolution published in: *The Blind*, 1, 5.

ANDERSON, T. (1837). *Observations on the employment, education, and habits of the blind.* With a comparative view of the benefits of the asylum and school systems. London: Simpkins, Marshall, and Co., 103pp.

ARMITAGE, T.R. (1870). "On the modes of reading in use by the blind and the means for arriving at uniformity." *J. of Soc. of Aits*, 28th January, 195-201.

ARMITAGE, T.R. (1870). Personal diaries kept in braille (some volumes are missing).

ARMITAGE, T.R. (1886). *The education and employment of the blind: what it has been, is, and ought to be.* London: Harrison and Sons, 216pp.

ASHCROFT, S.C. (1960). *Errors in oral reading of braille at elementary grade levels.*. Ph.D. Thesis, University of Illinois, 127pp.

BAKER, C. (1859). *The blind.* From: The English Cyclopaedia. London: Sampson Low, Marston and Co., 66pp.

BLAIR, R.H. (1876). "Education of the Blind." Paper read at the meeting of the National Association for the Promotion of Social Science, Birmingham. Bound with: The Blind School Board for London, Conference, 1876, 9pp.

BLAIR, R.H. (1877). "Hints for blind home students." Bound with: The Blind School Board for London, Conference, *The Venture*, 3, 89.

BLEDSOE, W. (1972). "Braille: a success story." In: *Evaluation of sensory aids for the visually handicapped.* Washington, DC: National Academy of Science, 3-33.

BRAILLE, L. (1829). *Procédé pour Éecrire les paroles, la musique et le plein chant.* Paris: Imprinerie de l'Institution des Jennes Aveugles (text - embossed Guillie, examples - embossed braille).

BRAILLE, L. (1837). *Procédé pour Éecrire les paroles, la musique et le plein chant.* Second edition, revue covug*ée et augmentée.* Paris: Imprinerie de l'Institution des Jennes Aveugles (text - embossed Guillie, examples - embossed braille).

BRAILLE, L. (1839). Nouveau p*rocédé pour representer par des points la forme méme des lettres, les cartes de géography, les figures de geometrie, les charactéres de musique, etc. A l'usage des aveugles.* Paris: se vend a l'Institution Royale.

BRAILLE AUTHORITY OF NORTH AMERICA, THE, and BRAILLE AUTHORITY OF THE UNITED KINGDOM, THE (1982). *Proceedings of the International Conference on English Braille, Grade* 2. Washington, DC.

BRAILLE AUTHORITY OF THE UNITED KINGDOM, (1986). *Braille code revision questionnaire.* Typescript, 9pp.

BRAILLE AUTHORITY OF THE UNITED KINGDOM (1995). *Capitalization in British Braille. A Questionnaire.* London: Royal National Institute for the Blind.

BRITISH BRAILLE COMMITTEE (1905). Minutes, 1902-1905.

BRITISH BRAILLE COMMITTEE (1905). "Report." In: *Proceedings of the International Conference on the Blind.* Edinburgh.

BRITISH AND FOREIGN BLIND ASSOCIATION (1868). *Minutes of the Executive Council to determine the best type for the blind.* MSS.

BRITISH AND FOREIGN BLIND ASSOCIATION (1871). *First report of the British and Foreign Blind Association for promoting the education and employment of the blind for 1871.* Mimeo.

BRITISH AND FOREIGN BLIND ASSOCIATION: THE EXECUTIVE COUNCIL OF (1874). *The Braille and New York systems compared.* London: BFBA, 15pp.

BRITISH AND FOREIGN BLIND ASSOCIATION (1875). *Second report of the British and Foreign Blind Association.* London. Bound in: BFBA Reports.

BRITISH AND FOREIGN BLIND ASSOCIATION (1879). *Sixth report of the British and Foreign Blind Association.* London. Bound in: BFBA Reports.

BRITISH AND FOREIGN BLIND ASSOCIATION (1895). *Dictionary of braille contractions with rules, also diagrams explanatory of arithmetic, algebra, and music.* London: BFBA.

BRITISH NATIONAL UNIFORM TYPE COMMITTEE (1916). *Minutes, 1916.*

BRITISH NATIONAL UNIFORM TYPE COMMITTEE (1953). *A statement of the layout, definitions, and rules of the standard English braille system.* Part 1, Basic Code, 1952. Part 2, Advanced Code, 1953. Braille Editions.

BRITISH NATIONAL UNIFORM TYPE COMMITTEE (1977). *A restatement of the layout, definitions, and rules of the standard English braille system.* Part 1, Basic Code, 1968, Part 2, Advanced Code, 1977. Braille edition.

BRUCE, I., McKENNELL, A., and WALKER, E. (1992). *Blind and partially sighted adults in Britain. The RNIB Survey, Volume 1.* Chapter 10, Braille. London: HMSO.

BURKLEN, E. (1932). *Touch reading of the blind* (Trans., Merry, F.K.). New York: American Foundation for the Blind.

CARTON, C. (1838) Reprint: Sampson, Low, Marston, & Co. (1895). *The establishments for the blind in England: a report to the Minister of the Interior and Foreign Affairs.* London: Law, Marston, and Co., 1895, 108pp.

CHAPMAN, E.K. (1978). *Visually handicapped children and young people.* London: Routledge and Kegan Paul, 162pp.

CLARK, L.L. (1979). "The future of braille." In: Gill, J.M., Clark, L.I. (Eds.), *Braille Research Newsletter No. 9.* Warwick University Research Unit for the Blind.

CLARKE, H.H. (1979). "Research perspectives on the braille code." In: Gill, J.M., Clark, L.L. (Eds.), *Braille Research Newsletter No. 7.* Warwick University Research Unit for the Blind.

van CLEEVE, E.M. (1933). "Centenary of the New York Institute for the Blind." ...*And there was light*, 2, 6, 1-5.

COBBAN, A. (1957). *A history of modern France.* Vol.1 1715-1799, 292pp. Harmondsworth, Middlesex: Penguin Books.

COLTAT, H. (1853). *Notice biographique sur L.Braille.* pp.13-26. Eulogy given by Coltat when a bust of Braille "was placed in the entrance hall of the

Institution and unveiled on 25th May, 1853". Translation from French edition, p.126.

COMMISSION ON UNIFORM TYPE FOR THE BLIND (1917). "Report of the Uniform Type Committee." *Outlook for the Blind,* 3, 3-14.

COMMISSION ON UNIFORM TYPE FOR THE BLIND (1918). *Data concerning revised braille, Grade 1½.* The Commission.

COOPER, A., DAVIES, B.T., LAWSON-WILLIAMS, N., and TOBIN, M.J. (1985). "An examination of natural and synthetic papers for embossing braille." *The New Beacon*, 69, 823, 325-327.

CRANDELL, J.M. and WALLACE, D.H. (1974). "Speed reading in braille: an empirical study." *New Outlook for the Blind*, 68, 1, 13-19.

DALPHIN, M. and DALPHIN, N. (undated). *Le musée Valentin Haüy: guide du muséee.* Paris: Association Valentin Haüy.

DAVIS, C.M. (1994). "Moon's mission." *The New Beacon*, 924, 24-25.

DEPARTMENT OF EDUCATION AND SCIENCE (1972). *The education of the visually handicapped (Vernon Report).* HMSO.

DICKENS, C. (1842). *American notes*. London: Hazell, Wetson, and Viney, 31-42.

DICKENS, C. (1868). *Letter to Dr S.G. Howe*. Perkins School for the Blind, Reference Library.

DIDEROT, D. (Ed.) (1751). *Enclyclopédie.*

DIDEROT, D. (1773). *An essay on blindness; in a letter to a person of distinction.* London: Sampson Low, Marston and Co., 74pp.

DOUCE, J.L. and TOBIN, M.J. (1976). "The braille code, extending the use of braille and the improvement of reading skills." *New Outlook for the Blind*, 70, 5, p.215.

DOUGLAS-HAMILTON, L. (Undated). *Braille Primer, Grade 2.* London: British and Foreign Blind Association.

FARRELL, G. (1932). "The centennial of Perkins Institution for the Blind." *...And there was light*, 2, 5.

FARRELL, G. (1956). *The story of blindness.* Cambridge: Harvard University Press, 270pp.

FERTSCH, P.F. (1946). "An analysis of braille reading." *Outlook for the Blind*, 40, 5, 128-131.

FERTSCH, P.F. (1947). "Hand dominance in reading braille." *American Journal of Psychology*, 60, 335-349.

FLANIGAN, P. and JOSLIN, E. (1969). "Patterns of response in the perception of braille configurations." *New Outlook for the Blind,* 63, 232-244.

FOULKE, E. (1982). "Reading braille." In: Schiff, W., Foulke, E. (Eds.), *Tactual perception: a source book.* Cambridge: Cambridge University Press, 168-208.

FOWLER, E.H. (1890). "Printing and writing for the blind." A paper read at the anual meeting of the Alumni Association of the Perkins Institution for the Blind. Boston: George H. Ellis.

FRENCH, R.S. (1932). *From Homer to Helen Keller: a social and educational study of the blind.* New York: American Foundation for the Blind, 298pp.

FRERE, J.H. (1840). *The art of teaching to read by elementary sounds in two parts. Part 1. For the blind.* London: Darton and Clark, 64pp.

FRY, E. (1963). *Teaching faster reading: a manual.* Cambridge: Cambridge University Press.

GALL, J. (1837). *An account of the recent discoveries which have been made for facilitating the education of the blind.* Edinburgh: James Gall. Reprint: 1894, London: Sampson Law, Marston & Co., 67pp.

GALLIOD, M. (1828). *Notice historique sur l'Établissement des Jeunes Aveugles.* (The book was published in 1829.)

GIBSON, G. (1827). "Types for the blind." In: *Transactions of the Society for the Encouragement of the Arts.* 90-96.

GIBSON, J.J. (1962). "Observations on active touch." *Psychological Review,* 69, 6, 477-491.

GIBSON, J.J. (1968). *The senses considered as perceptual systems.* London: Allen and Unwin.

GOMULICKI, B.R. (1961). *The development of perception and learning in blind children."* Cambridge: University of Cambridge Psychological Laboratory. Mimeo.

GREANEY, J., ARTER, C., HILL, E., MASON, H., McCALL, S., STONE, J., and TOBIN, M. (1994). "The development of a new test of children's braille reading development." Birmingham: School of Education, University of Birmingham.

GUILBEAU, E. (1907). *Histoire de l'Institut Nationale des Jeunes Aveugles.* Paris: Berlin Frères, 196pp.

GUILLIÉ, DR. (Translated 1819). *An essay on the instruction and amusements of the blind.* London: Sampson Low, Marston and Co., (Reprint 1894).

HARRIS, E.M. (1981). *In touch: printing and writing for the blind in the nineteenth century.* Smithsonian Institute Press.

HARTLEY, J., TOBIN, M.J., and TRUEMAN, M. (1987). "The effects of providing headings in braille text." *Journal of Visual Impairment and Blindness*, 81, 5, 213-214.

HAÜY, V. (1784). *Letter to the 'Journal'.* 20th September, 1784.

HAÜY, V. (1786). *Essai sur l'education des aveugles.* Paris: élèves lves de Haüy. (Haüy noire).

HAÜY, V. (1786). Trans. Blacklock (1793). *An essay on the education of the blind.* Reprint. London: Sampson Low, Marston and Co. (Also, Advertisement to the French Exhibition, 1786.)

HAÜY, V. (1786). Trans. Blacklock (1793). *An historical summary of the rise, progress and the actual state of the institution of the blind children.* Reprint. London: Sampson Low, Marston and Co. pp5.

HAÜY, V. (1800). *Première, deuxième et troisième notes du citoyen Haüy.* Paris: les aveugles travailleurs, 16pp.

HENRI, P. (1947). *Charles Barbier et la genese du système braille.* Paris: Le Valentin Haüy. 1. Jan-Mar. 2. Avril-Juin. 3. Oct-Dec.

HENRI, P. (1952). *La vie et l'œuvre de Louis Braille: inventeur de l;alphabet des aveugles (1809-1852*). Paris: Ire édition avec subvention du concours du Centre Nationale de la Recherche Scientifique et de l'Institution Nationale des Jennes Aveugles de Paris auxi Presses Universitaites de France, 128pp. (References in text are to this French edition.)

HENRI, P. (1952). English Trans. (1987). *The life and works of Louis Braille: the inventor of the alphabet of the blind 1809-1852).* Pretoria: South Africa National Council for the Blind, 93pp.

HENRI, P. (1966). *Valentin Haüy: premier insituteur des aveugles.* Paris: Association Valentin Haüy, 31pp.

HENRI, P. (1984). *La vie et l'œuvre de Valentin Haüy.* Paris: Presses Universitaires de France, 208pp.

HERMELIN, B. and O'CONNOR, N. (1971A). "Right and left handed reading of braille." *Nature*, 231, 470.

HERMELIN, B. and O'CONNOR, N. (1971B). "Functional asymmetry in the reading of braille." *Neuropsychologia*, 9, 431-435.

HOLLAND, B.F. (1934). "Speed and pressure factors in braille reading." *Teacher's Forum*, 7, 13-17.

HOLLAND, B.F. and EATMAN, P.F. (1933). "The silent reading habits of blind children. *Teacher's Forum*, 6, 1, 4-11, 19.

HOWE, S.G. (1854). *Letter to W. van Storden, Esq., 29th April, 1854.* Extracts taken from handwritten duplicate in one o the letter books at Perkins School for the Blind.

HOWE, S.G. (1868). *Letter to Charles Dickens* (copy). Perkins School for the Blind, Reference Library.

HUGHES, G. (1843). *The new punctiuncular stenographic system of embossing.* London: The Author, 28pp.

HURST, A. (1890). *The late Dr Armitage - his memorial and his proposed legislation for the blind.* Leeds Mercury, 16th December, 1890

HURT, J.S. (1988). *Outside the mainstream: a history of special education.* London: Batsford, 222pp.

ILLINGWORTH, W.H. (1902). *Uniform braille system.* In: Willingworth, W.H., p.79.

ILLINGWORTH, W.H. (1910). *History of the education of the blind.* London: Sampson Low, Marston and Co., 163pp.

INTERNATIONAL COUNCIL ON ENGLISH BRAILLE (Undated). *Unified braille code research project. Objective 2. Extension of the basic code.* Report by the Objective 2 Committee.

IRWIN, R.B. (1922). "Is further adaptation of braille necessary?" *Outlook for the Blind,* 16, 2, 64-65.

IRWIN, R.B. (1929). *Why not a greater uniformity in the braille systems?* Paper read before the British Uniform Type Committee and representatives of organisations for the blind. Mimeo.

IRWIN, R.B. (1931). "Report of the Type Committee." In: *Proceedings of the Convention of the AAWB.* New York City, 32-35.

IRWIN, R.B. (1932). "Uniform braille for the English-speaking world achieved." *Outlook for the Blind*, 26, 1, 137-138.

IRWIN, R.B. (1955). "The war of the dots." In: Irwin, R.B., *As I see it.* (Ch.1). New York: AFB, 3-56.

IRWIN, R.B. and WILCOX, R.E. (1929). *A comparative study of braille Grade One and a Half and braille Grade Two.* New York: AFB, 17pp.

JEAN, G. (1987). English Trans. Oates, J. (1992). *Writing: the story of alphabets and scripts,* illus. London: Thomas and Hudson, pp.207.

JOHNSON, E.C. (1860). *The blind of London.* Reprinted from "The Times" with additions. London: Mitchell, 62pp.

JOHNSON, E. (1977). *Charles Dickens: his tragedy and triumph.* London: Penguin Books, 601pp.

KEDERIS, C.J., SIEMS, J.R., and HAYNES, R.L. (1965). "A frequency count of the symbology of English braille, Grade 2, American usage." *Int. J. Educ. of the Blind*, 15, 2, 38-46.

KERNEY, E. (1952). "First tidings of literary braille in North America." *Int. J. Educ. of the Blind*, 2, 1, 112-118.

KRUEGER, L.E. (1982). "Tactual perception in historical perspective: David Katz's world of touch." In: Schiff, W., Foulke, E. (Eds.), *Tactual perception: a sourcebook.* Cambridge: Cambridge University Press, 1-54.

KUCERA, H. and FRANCIS, W.N. (1967). *Computational analysis of present-day American English.* Providence, Rhode Island: Brown University Press, 42pp.

KUSAJIMA, T. (1961). *Psychology of the blind.* Tokyo: Tokyo Central Kohhan.

KUSAJIMA, T. (1974). *Visual reading and braille reading: an experimental investigation of the physiology and psychology of visual and tactual reading.* New York: American Foundation for the Blind, Mimeo, 60pp.

LANE, M. (1978). *The magic years of Beatrix Potter.* London: Fontana/Collins, 216pp.

LANE, S.E. (1911). *History of the Howe Memorial Press and Library of Embossed Books.* Perkins School for the Bl9ind, Watertown, Mass. (Handwritten, bound).

LANGDON, J.N. (1972). *The Royal Normal Colege for the Blind: a short history.* 3pp.

LATIMER, H.R. (1930). "Embossed printing for the blind: work toward unity and prevention of duplication." In: *Proceedings of the Convention of the American Association of Instructors of the Blind,* 468-472.

LEDERMAN, S.J. (1982). "The perception of texture by touch." In: Schiff, W., Foulke, E. (Eds.), *Tactual perceptions: a sourcebook.* Cambridge: Cambridge University Press, 130-167.

de LEEUW, M. and de LEEUW, E. (1965). *Read better, read faster. A new approach to efficient reading.* Harmondsworth, Middlesex: Penguin, 249pp.

LEVITTE, (1880). *Anaglyptographie et raphigraphie de braille.* Paris: Institut Nationale des Jeunes Aveugles Imprimerie Nationale.

LEVY, W.H. (1872). *Blindness and the blind: or a treatise on the science of typhlology.* London: Chapman and Hall, 518pp.

LOCHHEAD, H.M. and LORIMER, J. (1954). *Report of the survey of the frequency of all the contractions of Standard English braille, Grade 2.* Edinburgh: Scottish Braille Press.

LONDON, SCHOOL BOARD FOR (1876). *Report of the conference on the instruction of blind children.* London: Spottiswood, 11pp.

LONGMAN (1982). *Longman new universal dictionary.* Harlow, Essex: Longman.

LORIMER, J. (1962). *The Lorimer braille recognition test.* Bristol: College of Teachers of the Blind (now available from VIEW).

LORIMER, J. (1977). *Neale analysis of reading ability: adapted for use with blind children. Manual of directions and norms.* Windsor: NFER, 43pp.

LORIMER, J. (1977). *Outlines of a short course to improve the braqille reading efficiency of children in the lower senior classes.* Birmingham: University of Birmingham, 47pp. Mimeo.

LORIMER, J. (1978). "The limitations of braille as a medium for communication and the possibility of improving reading standards." In: *Occasional Papers*, 2, 2, 60-67. Leicester: British Psychological Society.

LORIMER, J. (1982). "The space-saving efficiency of Grade 1 braille and the possibility of improving it." In: *Proceedings of the International Conference on English Braille, Grade 2.* 121-129.

LORIMER, J., TOBIN, M.J., DOUCE, J., and GILL, J. (1982). *A study of braille contractions.* London: Royal National Institute for the Blind.

LORIMER, P. (1983). *The braille code and reading in braille: an introductory sourcebook for teachers.* Birmingham: Research Centre for the Education of the Visually Handicapped, University of Birmingham (see Lorimer, J., Tobin, M.J., Douce, J., Gill, J. (1982), Part 4).

LUKOFF, I.F. and COHEN, O. (1972). *Attitudes toward blind persons.* New York: AFB, 74pp.

MAXFIELD, K.E. (1928). *The blind child and his reading.* New York: American Foundation for the Blind.

McBRIDE, V.G. (1974). "Explorations in rapid reading in braille." *New Outlook for the Blind*, 68, 1, 8-12.

McCRUM, R., CRAN, W., and MacNEIL, (1987). *The story of English.* London: Guild Publishing.

MEYERS, E., ETHINGTON, D., and ASHCROFT, S.C. (1958). "Readability of braille as a function of three spacing variables." *J. Applied Psychol.*, 42, 3, 163-165.

MILLAR, S. (1974). "Tactile short-term memory by blind and sighted children." *British Journal of Psychology*, 65, 2, 253-263.

MILLAR, S. (1975). "Effects of tactual and phonological similarity on the recall of braille letters by blind children." *British Journal of Psychology*, 66, 193-201.

MILLAR, S. (1984A). "Is there a best hand for braille/" *Cortex*, 13, 75-87.

MILLAR, S. (1984B). "Strategy choices by young braille readers." *Perception*, 12, 5, 567-579.

MILLAR, S. (1985). "The perception of complex patterns by touch." *Perception,* 14, 293-303.

MILLAR, S. (1987). "The perceptual 'window' in two-handed braille: do the left and right hands process text simultaneously?" *Cortex*, 23, 111-122.

MILLAR, S. (1988). "Prose reading by touch: the role of stimulus quality, orthography and context." *British Journal of Psychology*, 79, 87-103.

MILLAR, S. (1994). *Understanding and representing space: theory and evidence from studies with blind and sighted children.* Oxford: Clarendon Press.

MILLIGAN, M.D. (1982). "Should there be two grades of contracted English braille?" In: *Proceedings of the International Conference on English Braille, Grade 2*, 93-109.

MONBECK, M.E. (1973). *The meaning of blindness: attitudes towards blindness and blind people.* Bloomington: Indiana University Press, ix, 214pp.

MOON, W.M. (undated). *Dr William Moon: an autobiographical sketch.* London: RNIB, braille edition, 19pp.

NATIONAL INSTITUTE FOR THE BLIND (1932). *Standard English braille, Grades 1 and 2.* London: National Institute for the Blind.

NEALE, M.D. (1958). *The Neale analysis of reading ability.* London: MacMillan Education.

NEW ENGLAND INSTITUTION FOR THE EDUCATION OF THE BLIND, TRUSTEES OF THE (1833). *Address to the public.*

NEW YORK, THE BOARD OF EDUCATION OF THE CITY OF (1909). "Which tactiel print for New York City, New York print or braille" Report of public hearing held before a committee of the Board of Education of the City of New York, 24th March, 18th May *Outlook for the Blind*, 25-46, 64-88.

NEWMAN, S.E. and HALL, A.D. (1986). *Amount leamined from two alphabets used with the blind.* Paper presented at the annual meeting of the Eastern Psychological Association, New York, 17-20.

NOLAN, C.Y. and KEDERIS, C.J. (1969). *Perceptual factors in braille word recognition.* New York: AFB, Research Series No. 20, 178pp.

NOLAN, C.Y. and MORRIS, J.E. (1965). "Development and validation of the roughness discrimination test." *International Journal for the Education of the Blind*, 15, 1, 1-6.

NOLAN, E.J. (1907). "Historical sketch." In: *Proceedings of the 9th Convention of the AAWB. Outlook for the Blind*, 1, 1, 17-18.

OLSON, M.R. (1976). "Faster braille reading: preparation at the reading readiness level." *New Outlook for the Blind,* 70, 341-343.

OLSON, M.R., HARLOW, S.D., and WILLIAMS, J. (1975). "Rapid reading in braille and large print: an examination of McBride's procedures." *New Outlook for the Blind,* 69, 392-395.

OUTLOOK FOR THE BLIND (1909). "Three interesting libraries for the blind. *Outlook for the Blind*, 2, 4, 173-175.

PENNSYLVANIA INSTITUTION FOR THE INSTRUCTION OF THE BLIND (1933). "The centenary of the Institution for the Instruction of the Blind." *...And there was light*, 3, 9.

PIGNIER, DR. (1859). "Notice biographique sur Louis Braille." In: *Notice biographique sur trois professeurs, anciens étèves de l'Institution des Jeunes Aveugles de Paris*, 7-27.

PIGNIER, DR. (1860). *Essai historique sur l'Institution des Jeunes Aveugles.*

PLUMPTRE, K. (1895). *Instructions for writing in the braille system.* London: BFBA, 12pp.

POOLE, W. (1994). "Capitalization in British braille." *The New Beacon*, March, 8-12.

POOLE, W. (1996). "Braille capitalization - letter." *The New Beacon*, 948, 12-13.

PRITCHARD, D.G. (1963). *Education and the handicapped, 1760-1960.* London: Routledge and Kegan Paul, 250pp.

QUILLIAM, T.A. (1978). "The structure of finger print skin." In: Gordon, G. (Ed.), *Active touch: the mechanism of recognition of objects by touch.* Oxford: Pergamon Press, 1-18.

RITCHIE, J.M. (1930). *Concerning the blind. Being a historical sketch of organised effort on behalf of the blind in Great Britain.* Edinburgh: Oliver and Boyd, 244pp.

ROBLIN, J. (1952). English Trans. Mandaliah, R.G. (1955). *The reading fingers: life of Louis Braille, 1809-1852.* New York: AFB, 65pp.

ROYAL COMMISSION ON THE BLIND, THE DEAF, AND THE DUMB (1889). Report.

ROYAL COMMISSION ON THE USEFUL ARTS (1852). Report. Class XVII. Printing for the Blind, 413-422. Instruments for the use of the blind, 423.

ROYAL NATIONAL INSTITUTE FOR THE BLIND (1986). *Essays in code design.* 40pp.

RUTHERFORD, J. (1898). *William Moon, L.L.D., F.R.G.S., F.S.A., and his work for the blind.* London: Hodder and Stoughton, vii, 280pp.

SCOTTISH GUARDIAN (1837). *Printing for the blind.* 7th April.

SHERRICK, C.E. and GRAIG, J.C. (1982). "The psychophysics of touch." In: Schiff, W., Foulke, E. (Eds.), *Tactual perception: a sourcebook.* Cambridge: Cambridge University Press, 55-81.

SIBLEY, J.T. (1892). "Systems of embossed printing." In: *Proceedings of the 12th Biennial Convention of the AAIB.* Brantford, 21-36.

de la SIZERANNE, M. English Trans. Lewis (1893). *The blind as seen through blind eyes.* London: Putnams, 154pp.

SMITH, J.W. (1878). "Comparisons of the braille and New York systems of point writing, and proposed modifications of the braille system." In: *Proceedings of the 5th Biennial Convention of the AAIB.* Columbus, 39-69.

SMITH, J.W. (1879). Rapport Par M. J.W. Smith de Boston (Amerique). *Congrès universal pour l'amelioration du sort des aveugles et des sourds-muets,* tenu à Paris, due 23 au 30 Septembre, 1878. Appendix 5, 257-265.

STONE, W.M. (1915). "Letter to Mr. H.R. Latimer, Secretary of American Commission." In: Irwin, R.B. 1955, 38-39, also *The Teacher*, 1916, January.

SULLIVAN, J.E. (1995). "Unified braille code - a brief introduction for people who already read or transcribe English braille." Unpublished.

TAYLOR, W. (1838). "Various modes of printing for use of the blind." Extract from the report of the seventh meeting of the British Association for the Advancement of Science.

THOMAS, M.G. (1957). *The Royal National Institute for the Blind, 1868-1956.* Brighton, England.

TOBIN, M.J. (1971). *Programmed instruction and braille learning.* Study 4. Teaching methods and ergonomic variables in the learning of braille: an experimental and correlational study, 50-79.

TOBIN, M.J. (1972). *Beginning braille.* A Self-instructional reading scheme for newly blinded adults. Birmingham: Research Centre for the Education of the Visually Handicapped, University of Birmingham.

TOBIN, M.J. (1979). "A longitudinal study of blind and partially sighted children in special schools in England and Wales." *Insight*, 1, 1, 11-14.

TOBIN, M.J. (1994). *Assessing visually handicapped people: an introduction to test procedures.* London: David Fulton.

TOBIN, M.J. (1996). *Director's twenty-seventh annual report, RCEVH.* Birmingham: Research Centre for the Education of the Visually Handicapped, University of Birmingham.

TOBIN, M.J. and HILL, E.W. (1984). "A Moon writer." *The New Beacon,* 68, 173-176.

TOBIN, M.J., WHITTAKER, J.R., GREANEY, J., HILL, E.W. (1996). *The issue of braille capitalization in the UK: the BAUK survey.* A report for the Braille Authority of the United Kingdom, 1996.

TOOZE, F.H.G. (1962). *The Tooze braille speed test.* Bristol: College of Teachers of the Blind (now available from VIEW).

TREVELYAN, G.M. (1942). *English social history: a survey of six centuries, Chaucer to Queen Victoria.* (Chps. 15-16, Cobbett's England, 1793-1832.) London: Longmans, Green and Co.

UMSTED, R.G. (1972). "Improvement of braille reading through code recognition training.! *New Outlook for the Blind*, 66, 6, 169-177.

UNIVERSITY OF BIRMINGHAM (1993). 'Moon as a route to literacy' Project. Report, January 1993.

VALLBO, A.B. and JOHANSSON, R.S. (1978). "The tactile sensory innervation of the glabrous skin of the human hand." In: Gordon, G. (Ed.), *Active touch: the mechanism of recognition of objects by touch.* Oxford: Pergamon Press, 29-54.

WAIT, W.B. (1890). *A review of the origin and development of embossed literature and music for touch reading with special reference to the educational interests of the blind in the United States.* New York, 41pp.

WAIT, W.B. (1893). "The New York system of punctography." In: *Proceedings of the World Congress of Educators of the Blind.* Chicago. New York: The Bradshaw Press, 3-10.

WARREN, D.H. (1982). "The development of haptic perception." In: Schiff, W., Foulke, E. (Eds.), *Tactual perception: a sourcebook.* Cambridge: Cambridge University Press, 52-129.

WATTS, W.J. and BUZAN, A. (1973). *A project in advanced learning methods.* Braille transcription.

WILLIAMS, M. (1956). *Williams intelligence test for children with defective vision.* Windsor: NFER-Nelson.

WILLIAMS, M. (1971). "Braille reading." *Teacher of the Blind*, 59, 3, 103-116.

ZURITA, P. (1994-1995). "From zero to infinity." *The World Blind,* 12, 3-6.

APPENDIX 1

THE INTRODUCTION OF GRADE 2 CONTRACTIONS AND SHORTFORMS INTO THE BRITISH LITERARY BRAILLE CODE DURING THE YEARS CIRCA 1870 AND 1990

INTRODUCTION

The French braille code was adapted for use in Britain in 1870, but because of perceptual problems encountered when reading embossed material, changes to the contents of the code have been made from time to time in endeavours to make it easier to read and to write. These have been described in the text. This appendix condenses the information concerning contracted words and letter strings at six stages in time from 1870 until 1990. It is possible from information given here to recognise main trends and the more specific information regarding each contraction. A summary is given at the end.

Not only are the lists of historical interest, but the information contained, coupled with a knowledge of the frequency of occurrence of the signs (e.g. Lorimer, J., Tobin, Douce, and Gill, "A Study of Braille Contractions", Vol.2, Statistical Data, 1982) will help to provide a basis for implementing future changes to the literary braille code.

Only symbols officially recognised by the British and Foreign Blind Association, the Uniform Type Committee, the British Uniform Type Committee, and the Braille Authority of the United Kingdom respectively are included in this appendix. Contents of primers have not been specifically mentioned because the information included in them is derived from the official rule books.

SOURCES

Circa 1870 British and Foreign Blind Association

"Key to Braille Reading and Writing." This four-page pamphlet appears to be the first available source of information concerning the British braille code.

1895 British and Foreign Blind Association

"Dictionary of Braille Contractions with Rules." The dictionary was intended for the use of transcribers.

1905 British and Foreign Blind Association

"Revised Braille for Reading and Writing, Grade 2." This was published subsequent to the report given at the First Triennial Conference on the Blind, 1905. Only the fourth edition (May, 1912) was available with no reference to the date of the first edition, so entries have been placed under 1905.

1932 British National Uniform Type Committee together with the American Committee on Grade 2 (representing jointly the American Association of Instructors of the Blind, the American Association of Workers for the Blind, and the American Foundation for the Blind).

"Standard English Braille, Grades 1 and 2."

1960 British Uniform Type Committee

"Changes to Standard English Braille, 1st May, 1960." Several alterations to Grade 2 were considered at a working party held in 1956 between the braille authorities of Britain and America. Public opinion was sought before the changes were authorised.

1990 Braille Authority of the United Kingdom

"Changes to Grade 2 Braille, 1st May, 1990." Decisions made at the International Braille Conference held in 1988 were authorised in 1990.

Key

- • Absent from the code.
- ✓ Present in the code.
- T Transferred.

In 1905 six meanings which had previously been represented by simple upper wordsigns were given different configurations. These wordsigns could then represent new words of greater frequency.

SIMPLE UPPER WORDSIGNS

		c1870	1895	1905	1932	1960	1990
⠃	but	✓	✓	✓	✓	✓	✓
⠉	can	•	•	✓	✓	✓	✓
⠉	Christ	✓	✓	T			
⠙	do	•	•	✓	✓	✓	✓
⠑	every	✓	✓	✓	✓	✓	✓
⠋	from	✓	✓	✓	✓	✓	✓
⠛	go	•	•	✓	✓	✓	✓
⠛	God	✓	✓	T			
⠓	have	✓	✓	✓	✓	✓	✓
⠚	Jesus	✓	✓	T			
⠚	just	•	•	✓	✓	✓	✓
⠅	knowledge	•	•	✓	✓	✓	✓
⠇	lord	✓	✓	T			
⠇	like	•	•	✓	✓	✓	✓
⠍	more	•	•	✓	✓	✓	✓
⠝	not	✓	✓	✓	✓	✓	✓
⠏	people	✓	✓	✓	✓	✓	✓
⠟	quite	✓	✓	✓	✓	✓	✓
⠗	rather	•	•	✓	✓	✓	✓
⠗	right	✓	✓	T			
⠎	so	•	•	✓	✓	✓	✓
⠎	some	✓	✓	T			
⠞	that	✓	✓	✓	✓	✓	✓
⠥	unto	✓	✓	✓	•	•	•

SIMPLE UPPER WORDSIGNS (Continued)

		c1870	1895	1905	1932	1960	1990
⠥	us	•	•	✓	✓	✓	✓
⠧	very	✓	✓	✓	✓	✓	✓
⠺	will	✓	✓	✓	✓	✓	✓
⠭	it	•	•	✓	✓	✓	✓
⠽	you	✓	✓	✓	✓	✓	✓
⠵	as	•	•	✓	✓	✓	✓
⠯	and	✓	✓	✓	✓	✓	✓
⠿	for	✓	✓	✓	✓	✓	✓
⠷	of	✓	✓	✓	✓	✓	✓
⠮	the	✓	✓	✓	✓	✓	✓
⠾	with	✓	✓	✓	✓	✓	✓
⠡	child	✓	✓	✓	✓	✓	✓
⠩	shall	✓	✓	✓	✓	✓	✓
⠹	this	✓	✓	✓	✓	✓	✓
⠱	which	✓	✓	✓	✓	✓	✓
⠳	out	•	•	✓	✓	✓	✓
⠌	still	•	•	✓	✓	✓	✓

SIMPLE UPPER GROUPSIGNS

		c1870	1895	1905	1932	1960	1990
⠯	AND	✓	✓	✓	✓	✓	✓
⠿	FOR	✓	✓	✓	✓	✓	✓
⠷	OF	✓	✓	✓	✓	✓	✓
⠮	THE	✓	✓	✓	✓	✓	✓
⠾	WITH	✓	✓	✓	✓	✓	✓
⠡	CH	✓	✓	✓	✓	✓	✓
⠣	GH	✓	✓	✓	✓	✓	✓
⠩	SH	✓	✓	✓	✓	✓	✓
⠹	TH	✓	✓	✓	✓	✓	✓
⠱	WH	✓	✓	✓	✓	✓	✓
⠫	ED	✓	✓	✓	✓	✓	✓
⠻	ER	✓	✓	✓	✓	✓	✓
⠳	OU	✓	✓	✓	✓	✓	✓
⠪	OW	✓	✓	✓	✓	✓	✓
⠌	ST	✓	✓	✓	✓	✓	✓
⠜	AR	•	•	✓	✓	✓	✓
⠼	BLE	✓	✓	✓	✓	✓	✓
⠬	ING	✓	✓	✓	✓	✓	✓

LOWER CONTRACTIONS

WORDSIGNS

		c1870	1895	1905	1932	1960	1990
⠿ ⠆	be	•	•	✓	✓	✓	✓
⠿ ⠢	enough	•	•	✓	✓	✓	✓
⠿ ⠖	to	✓	✓	✓	✓	✓	✓
⠿ ⠶	were	•	•	✓	✓	✓	✓
⠿ ⠦	his	✓	✓	✓	✓	✓	✓
⠿ ⠔	in	✓	✓	✓	✓	✓	✓
⠿ ⠔⠖	into	•	•	✓	✓	✓	✓
⠿ ⠤	was	✓	✓	✓	✓	✓	✓
⠿ ⠴	by	•	•	✓	✓	✓	✓

INITIAL GROUPSIGNS

		c1870	1895	1905	1932	1960	1990
⠿ ⠆	BE	✓	✓	✓	✓	✓	✓
⠿ ⠒	CON	✓	✓	✓	✓	✓	✓
⠿ ⠲	DIS	✓	✓	✓	✓	✓	✓
⠿ ⠤	COM	•	•	✓	✓	✓	✓

LOWER CONTRACTIONS (Continued)

		c1870	1895	1905	1932	1960	1990
MEDIAL GROUPSIGNS							
⠿⠂	EA	•	•	✓	✓	✓	✓
⠿⠆	BB	•	•	✓	✓	✓	✓
⠿⠒	CC	•	•	✓	✓	✓	✓
⠿⠲	DD	•	•	✓	✓	✓	✓
⠿⠖	FF	•	•	✓	✓	✓	✓
⠿⠶	GG	•	•	✓	✓	✓	✓
INITIAL, MEDIAL AND TERMINAL GROUPSIGNS							
⠿⠢	EN	✓	✓	✓	✓	✓	✓
⠿⠔	IN	✓	✓	✓	✓	✓	✓

COMPOSITE WORDSIGNS

			c1870	1895	1905	1932	1960	1990
⠐	⠉	Christ			T ✓	•	•	•
⠐	⠙	day	•	•	✓	✓	✓	✓
⠐	⠑	ever	✓	✓	✓	✓	✓	✓
⠐	⠋	father	✓	✓	✓	✓	✓	✓
⠐	⠛	God			T ✓	•	•	•
⠐	⠓	here	•	•	✓	✓	✓	✓
⠐	⠚	Jesus			T ✓	•	•	•
⠐	⠅	know	•	•	✓	✓	✓	✓
⠐	⠇	lord			T ✓	✓	✓	✓
⠐	⠍	mother	✓	✓	✓	✓	✓	✓
⠐	⠝	name	•	•	✓	✓	✓	✓
⠐	⠕	one	•	•	✓	✓	✓	✓
⠐	⠏	part	•	•	✓	✓	✓	✓
⠐	⠟	question	•	•	•	•	✓	✓
⠐	⠗	right			T ✓	✓	✓	✓
⠐	⠎	some			T ✓	✓	✓	✓
⠐	⠞	time	•	•	✓	✓	✓	✓
⠐	⠥	under	✓	✓	✓	✓	✓	✓
⠐	⠺	work	•	•	✓	✓	✓	✓
⠐	⠽	young	•	•	✓	✓	✓	✓
⠐	⠮	there	•	•	✓	✓	✓	✓
⠐	⠡	character	•	•	✓	✓	✓	✓
⠐	⠹	through	•	•	✓	✓	✓	✓

COMPOSITE WORDSIGNS (Continued)

		c1870	1895	1905	1932	1960	1990
⠐⠱	where	•	•	✓	✓	✓	✓
⠐⠳	ought	•	•	✓	✓	✓	✓
⠘⠥	upon	✓	✓	✓	✓	✓	✓
⠘⠺	word	✓	✓	✓	✓	✓	✓
⠘⠮	these	•	•	✓	✓	✓	✓
⠘⠹	those	✓	✓	✓	✓	✓	✓
⠘⠱	whose	✓	✓	✓	✓	✓	✓
⠸⠉	cannot	•	•	✓	✓	✓	✓
⠸⠓	had	•	•	✓	✓	✓	✓
⠸⠍	many	•	•	✓	✓	✓	✓
⠸⠎	spirit	•	•	✓	✓	✓	✓
⠸⠥	unto	•	•	✓	•	•	•
⠸⠺	world	✓	✓	✓	✓	✓	✓
⠸⠮	their	•	•	✓	✓	✓	✓

COMPOSITE GROUPSIGNS

		c1870	1895	1905	1932	1960	1990
⠨⠙	OUND	•	•	✓	✓	✓	✓
⠨⠑	ANCE	✓	✓	✓	✓	✓	✓
⠨⠝	SION	✓	✓	✓	✓	✓	✓
⠨⠎	LESS	✓	✓	✓	✓	✓	✓
⠨⠞	OUNT	•	•	✓	✓	✓	✓
⠰⠑	ENCE	✓	✓	✓	✓	✓	✓
⠰⠋	SELF	✓	✓	•	•	•	•
⠰⠛	ONG	✓	✓	✓	✓	✓	✓
⠰⠇	FUL	✓	✓	✓	✓	✓	✓
⠰⠝	TION	✓	✓	✓	✓	✓	✓
⠰⠎	NESS	✓	✓	✓	✓	✓	✓
⠰⠞	MENT	✓	✓	✓	✓	✓	✓
⠰⠽	ITY	•	•	✓	✓	✓	✓
⠠⠝	ATION	✓	✓	✓	✓	✓	✓
⠠⠽	ALLY	•	•	✓	✓	✓	✓

SHORTFORMS (ABBREVIATED WORDS)

Contractions are indicated by capital letters.

		c1870	1895	1905	1932	1960	1990
ab	about	•	•	✓	✓	✓	✓
abv	above	•	•	✓	✓	✓	✓
ac	according	•	✓	✓	✓	✓	✓
acr	across	•	•	•	✓	✓	✓
af	after	•	•	✓	✓	✓	✓
afn	afternoon	•	•	•	•	✓	✓
afw	afterward	•	•	✓	✓	✓	✓
afws	afterwards	•	•	•	•	✓	•
ag	again	•	•	✓	✓	✓	✓
agST	against	•	✓	✓	✓	✓	✓
alm	almost	•	•	✓	✓	✓	✓
alr	already	•	•	✓	✓	✓	✓
al	also	•	✓	✓	✓	✓	✓
alTH	although	•	•	✓	✓	✓	✓
alt	altogether	•	•	✓	✓	✓	✓
alw	always	•	✓	✓	✓	✓	✓
BEc	because	•	✓	✓	✓	✓	✓
BEf	before	•	•	✓	✓	✓	✓
BEh	behind	•	•	✓	✓	✓	✓
BEl	below	•	•	✓	✓	✓	✓
BEn	beneath	•	•	✓	✓	✓	✓

SHORTFORMS (ABBREVIATED WORDS) (Continued)

		c1870	1895	1905	1932	1960	1990
BEs	beside	•	•	✓	✓	✓	✓
BEss	besides	•	•	•	•	✓	•
BEt	between	•	✓	✓	✓	✓	✓
BEy	beyond	•	•	✓	✓	✓	✓
bl	blind	•	•	✓	✓	✓	✓
brl	braille	•	•	✓	✓	✓	✓
CHn	children	•	✓	✓	✓	✓	✓
CONc	conceive	•	•	✓	✓	✓	✓
CONcv	conceiving	•	•	✓	✓	✓	✓
cd	could	•	✓	✓	✓	✓	✓
dcv	deceive	•	•	✓	✓	✓	✓
dcvg	deceiving	•	•	✓	✓	✓	✓
dcl	declare	•	✓	✓	✓	✓	✓
dcld	declared	•	✓	•	•	•	•
ei	either	•	•	✓	✓	✓	✓
fTH	faith	•	✓	✓	•	•	•
fTHful	faithful	•	✓	•	•	•	•
fST	first	•	•	•	•	✓	✓
fr	friend	•	•	•	•	✓	✓
gl	glory	•	•	✓	•	•	•
gd	good	•	✓	✓	✓	✓	✓
gr	grace	•	•	✓	•	•	•

SHORTFORMS (ABBREVIATED WORDS) (Continued)

		c1870	1895	1905	1932	1960	1990
grt	great	•	•	✓	✓	✓	✓
hERf	herself	•	•	✓	✓	✓	✓
hm	him	•	✓	✓	✓	✓	✓
hmf	himself	•	•	✓	✓	✓	✓
hl	holy	•	•	✓	•	•	•
imm	immediate	•	•	✓	✓	✓	✓
xs	its	•	•	✓	✓	✓	✓
xf	itself	•	•	✓	✓	✓	✓
lr	letter	•	•	•	✓	✓	✓
ll	little	•	✓	✓	✓	✓	✓
mCH	much	•	•	✓	✓	✓	✓
mST	must	•	•	✓	✓	✓	✓
myf	myself	•	•	✓	✓	✓	✓
nec	necessary	•	•	•	✓	✓	✓
nei	neither	•	•	✓	✓	✓	✓
o'c	o'clock	•	•	✓	✓	✓	✓
ONEf	oneself	•	•	✓	✓	✓	✓
OUrvs	ourselves	•	✓	✓	✓	✓	✓
pd	paid	•	•	✓	✓	✓	✓
pERcv	perceive	•	•	✓	✓	✓	✓
pERcvg	perceiving	•	•	✓	✓	✓	✓
pERh	perhaps	•	•	✓	✓	✓	✓
qk	quick	•	•	•	✓	✓	✓

SHORTFORMS (ABBREVIATED WORDS) (Continued)

		c1870	1895	1905	1932	1960	1990
rcv	receive	•	✓	✓	✓	✓	✓
rcvd	received	•	✓	•	•	•	•
rcvg	receiving	•	•	✓	✓	✓	✓
rjc	rejoice	•	✓	✓	✓	✓	✓
rjcd	rejoiced	•	✓	•	•	•	•
rjcg	rejoicing	•	•	✓	✓	✓	✓
sd	said	•	•	✓	✓	✓	✓
sTH	saith	•	•	✓	•	•	•
SHd	should	•	✓	✓	✓	✓	✓
sCH	such	•	•	✓	✓	✓	✓
THEmvs	themselves	•	✓	✓	✓	✓	✓
THyf	thyself	•	•	✓	✓	✓	✓
t-d	today	•	•	✓	✓	•	•
td	today	•	•	•	•	✓	✓
tgr	together	•	•	•	✓	✓	✓
t-m	tomorrow	•	•	✓	✓	•	•
tm	tomorrow	•	•	•	•	✓	✓
t-n	tonight	•	•	✓	✓	•	•
tn	tonight	•	•	•	•	✓	✓
wd	would	•	✓	✓	✓	✓	✓
yr	your	•	•	✓	✓	✓	✓
yrf	yourself	•	•	✓	✓	✓	✓
yrvs	yourselves	•	✓	✓	✓	✓	✓

SUMMARY

Total number of contractions contained in the British literary braille code, Grade 2, in c 1870, 1895, 1905, 1932, 1960, and 1990 respectively.

	c1870	1895	1905	1932	1960	1990
Simple Upper Wordsigns	27	27	34	34	34	34
Simple Upper Groupsigns	12	12	13	13	13	13
Lower Signs	14	14	19	19	19	19
Composite Wordsigns	9	9	36	32	33	33
Composite Groupsigns	11	11	14	14	14	14
Shortforms	0	24	73	73	78	76
Totals	73	97	189	185	191	189

Where a sign can represent both a word and a part-word, it is only counted once.

APPENDIX 2

EMBOSSED MATERIAL
(BEFORE 1870)

FRANCE

- Haüy Type
- Guillie Type
- Barbier Type
- Braille Type
- Decapointe

BRITAIN

- Gall Type
- Alston Type
- Lucas Type

AMERICA

- Boston Line Type

A selection of examples of embossed text of special interest inspected by the writer. The following initials indicate where the examples may be located.

B Birmingham University.

C Louis Braille's birthplace at Coupvray.

INJA l'Institut Nationale des Jeunes Aveugles, Paris.

L Lorimer.

MVH Musée Valentin Haüy, Association Valentin Haüy, Paris.

N National Library of Scotland.

P Perkins School for the Blind, Watertown, Mass.

R Royal National Institute for the Blind, London.

FRANCE

HAUY TYPE

1789 Haüy, Valentin. *Essai sur l'education des Jeunes* Aveugles, Paris: les élèves de Haüy.

This was the first book ever produced for the use of the blind. (INJA; MVH)

1787 *Catéchisme de Paris.*

Used by the pupils at l'Institution Nationale des Jeunes Aveugles. The book demonstrates Haüy's abortive effort to use contractions. (MVH)

Guillie Type

1817 *Notice historique sur l'Institution Royale des Jeunes* Aveugles.

Imprimée par les jeunes aveugles; et disposes pour eux.

This was the first book embossed in relief introduced into England. Lady Lowther brought it home in 1818 for the use of her blind son. After being repaired it was eventually returned to Paris in 1985. (MVH)

1820 Guillié, Dr. *Elément de lecture, ou exercices syllabiques a l'usage des jeunes aveugles et disposés pour eux.*

It is most likely that this volume was also brought to England by Lady Lowther. It came into the possession of Mr. Alexander Hay, the blind man whose code encouraged the Society of Arts to organise a competition to find the best embossed code for the blind. The book was given to the Society in 1838 and later became the property of the Edinburgh Asylum for the Blind. (NLS)

Barbier Type

1829 *Recueil d'anecdotes, extrait de la morale en action*

Imprimée par Galliod, ancien elévè de Haüy.

Galliod used a small press at the Quinze Vingts, the asylum for the blind, where he was then living. Barbier's type was intended for the use of short commands on the field of battle and not originally for continuous prose. Very little of his type exists. He was probably spurred on to having this work transcribed into his own code when he saw the production of "Grammaire de Grammaires" in braille type (see below) followed by the first official edition of Braille's code. (MVH)

BRAILLE TYPE

1827 *Grammaire de* Grammaires (excerpts).

These excerpts were embossed as a trial of Braille's new system before the first official version of his own code was published. He was 18 at the time. (MVH).

1829 *Procédé pour écrire les paroles, la musique et le plainchant au moyen de points a l'usage des aveugles et disposés pour eux, par Louis Braille, repetiteur à l'Institution Royale des Jeunes Aveugles.*

The instructions were written in embossed linear type by Dr Pignier, the director of the institution, on the instruction of Braille, and the latter supplied the braille examples. (INJA; MVH)

1832 *Géographie de l'Asie* and *Géographie de la France.*

Printed by M. Hayter, the pupil who persuaded Braille to include the letter W in his code. This letter was not in general use in the French language at the time.

Punctuation is used as in the 1829 "Procédé" using dashes in the lower positions of the cells. For the first time the numeral sign was used followed immediately by a sign from the first line of the chart of symbols, instead of the 1829 method of showing numerals. (MVH)

1837 *Procédé ...*

Second edition.

Braille regarded this edition as definitive.

1837 LC and FBP, *Précis sur l'Histoire de France divisée par siècles, accompagné de synchronismes relatifs à l'histoire générale placés à la fin de chaque règne.*

The first volume has large pages (22 x 28 cms) stuck back to back, and weighs 1,759 grms. To save cost type was cast with 6 dots on the printing surfaces. The students filed off the requisite number of dots to make a set of sufficient symbols.

The publication of the book had far reaching effects for Dr Pignier was pensioned off before his time on a charge of having corrupted the young by the teaching of history. Such an attitude is difficult to understand today and the charge probably only highlights one aspect of the disagreement. (MVH).

1938 Braille, *Petit mémento d'arithmétique*.

The first edition was printed in the 1829 code, and in 1840 was reprinted in the 1837 version.

In 1859 Pignier wrote that it was the product of "much hard work" and it is an example of one of the booklets Braille produced from time to time to help his pupils. (C)

1849 à Kempis, Thomas. *Imitation du Christ.*

This book was one of the first to be printed by the use of plates instead of a handframe. The size of cells and spacing are smaller, approximating to present day use. For the first time punctiform illustrations were attempted. These represented the bread and wine and the monstrance. They are small and detailed but it is doubtful if they were tactually meaningful. (MVH)

DECAPOINTE

In 1839 Braille invented a means for blind people to communicate with the sighted by embossing punctiform Roman alphabet letters. An adapted writing frame or a machine known as a raphigraph could be used. The latter was in use for approximately 50 years until replaced by the typewriter.

Letters written by Braille.

1847 to his mother. (C)

1848 to his mother. (C)

1848 to his mother. (C)

1851 to his nephew and niece. (C)

BRITAIN

GALL TYPE

1834 *The Gospel of St. John for the blind.*

Most of the code makers in the second quarter of the nineteenth century printed copies of the Bible or other religious works. (NLS)

1842 *The sinner's help.*

Religious Tract Society.

Gall type symbols were used but they were made in "fretted" or dotted form which Gall considered was easier to read and cheaper to produce. (NLS)

ALSTON TYPE

1837 Baker, Charles. *First lessons in religion and a series of lessons on prayer for the use of the blind.*

Charles Baker, headmaster of the Institution for the Deaf and Dumb at Doncaster, wrote a series of booklets on religious subjects for use at his institution. He thought they might be useful for blind people so sent them to the Glasgow Institution for the Blind for transcription. The letters are very square shaped and the lines almost touching. A copy in the writer's possession bears the inscription "To Chas. Baker Esq. with the kind regards of Mr. Alston". (L)

1838 *The authorised version of the Psalms of David in metre embossed for the use of the blind.*

The title page is unusual in that it has a decorated border. (NLS)

LUCAS TYPE

The Rev. Gowring transcribed many of the books of the Bible. Inside the second book of Samuel there is an introductory key to the Lucas system. (RNIB)

1857 *Book of Common Prayer* (two volumes, one incomplete).

One of the librarians at the National Library of Scotland asked if the writer could identify two small volumes in Lucas type. Lucas type omits many of the letters in words and symbols may have up to three meanings. However, from a photograph of one of the pages in the two volumes and with the help of the key in the second book of Samuel, it was discovered that the page contained a prayer of thanksgiving "for deliverance from the plague and other common sickness" which is included in the Book of

Common Prayer. Because of the non-use of a certain contraction the volumes could be dated as having been printed after 1850. (NLS)

AMERICA

BOSTON LINE TYPE

1836 Richmond, Leigh. *The dairyman's daughter.*
A tract. (B)

1868 Dickens, Charles. *The old curiosity shop.*
These three large volumes were a gift from the author in answer to a request from Dr Howe, director of Perkins School for the Blind, for "something to gladden their hearts". The pupils' reading matter consisted mainly of religious works or school text books. The generous gift extended to other institutions in the USA. (P)

LORIMER, P. (1996).

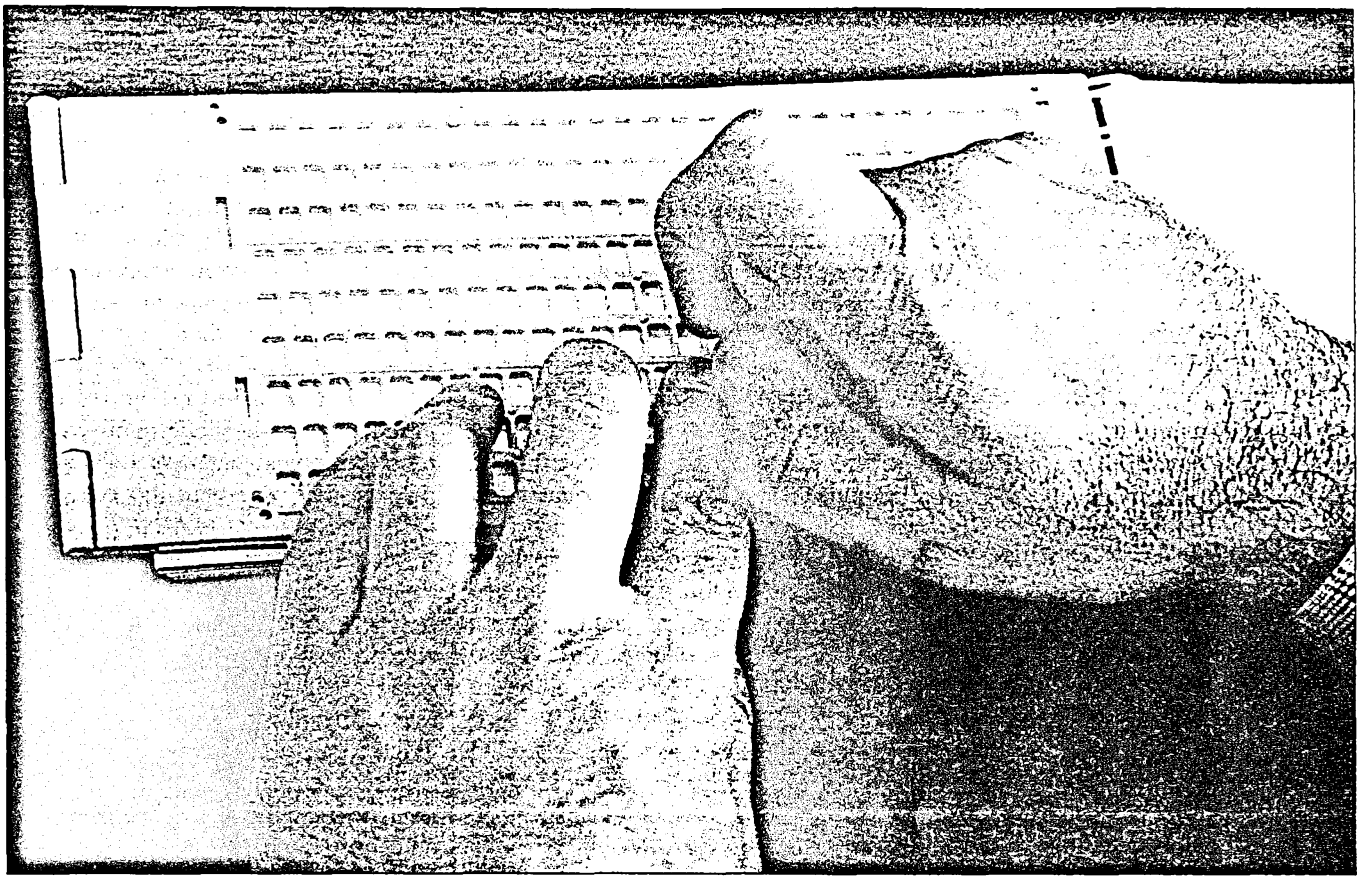
"Braille and research."

The World Blind,

July, 13, 22-24.

BRAILLE AND RESEARCH

For many years it was considered that the reading process is essentially the same for both sighted and blind learners, the only difference being the use of embossed instead of print symbols. But, according to the author, this belief needs to be considerably modified, for the use of tactual perception and the code problems involved make braille reading a slower and more inaccurate process. In spite of the use of different languages our difficulties are similar.



Braille's alphabet signs are often the same, numbers are common and we all share the 63 shapes which are possible from the 3 x 2 matrix no matter what meaning has been given to them. We all have the same perceptual problems posed by the position and density of dots in the cell, and the shapes which are likely to cause confusion. Techniques of reading are linked with the slow rate of reading whatever the language. How then can we help to solve such problems which have always been with us?

Clues to the problem

When observing an individual person's reading behaviour teachers often compare progress with others at the same stage trying to isolate certain aspects of success and of difficulty. This is the beginning of research. However, it is useful to read more about other studies which may reinforce opinion and often the detailed accounts show up new information. A large body of research has been carried out but the results are buried in journals, past and present, and so there tends to be a dichotomy between the work carried out in research laboratories and the efforts of teachers in the classroom. It is all too easy when hearing a pupil read to help with correction of errors yet not analyze their cause. Research will not provide all the answers, and sometime seems only to be proving the obvious, but findings can often give a deeper understanding. Examples quoted here are but a small selection.

Braille is verbal yet the dots are arranged spatially so it is interesting to know how the brain treats embossed material

Research and teaching method

Studies carried out in the past, if well planned and carried outunder stringent conditions of validity, still have relevance today, for the same problems in braille reading remain. Certain aspects are studied leaving the teacher to decide how such help can be incorporated in the classroom.

Ashcroft (1960) sought to provide useful information on reading braille through a critical analysis of the type, frequency and level of occurrences of errors that are found in children's reading. He hoped that the results might facilitate more accurate and rapid understanding of ideas from the embossed page, but he also incorporated suggestions for the teaching situation. It is for this reason that his work will be considered first together with some findings by Nolan and Kederis (1969).

Ashcroft tested 728 pupils from five grade levels on twelve short passages, which included all the contractions used in America at that time. In descending order of difficulty errors were found to be: short form words, contractions and word signs occupying two braille cells, combinations of contractions and word signs, lower contractions and word signs, single cell upper contractions representing letter groups or whole words, words in full spelling, and alphabet wordsigns. For further consideration the errors and implications for the teaching situation were categorised into problems relating to perception, orientation and meaning.

Perception

A missed or added dot to a symbol radically changes the meaning, and such mistakes rank amongst the most common of the errors. Nolan and Kederis found that these errors were responsible for 86% of the mistakes made in their experiments. They also found that dots are most likely to be left out in the lower parts of the cells. Errors made towards the ends of words indicate that there has been a premature closure of understanding with the endings missed, guessed at or even wrongly added. Blind children have less experience to draw on, so reading material should be well within their understanding. This aspect is not always sufficiently considered when blind children work with others who are sighted, or in using material not primarily intended for their use. Ashcroft thought that more meaningful reading should reduce the number of perceptual errors.

Orientation

Reversal errors. Because the braille code has only 63 possible symbols there are many examples of mirror images and errors of this kind are common though decreasing with experience. Poorer readers who have recourse to retracing and 'scrubbing' become confused in orientation, and so simpler reading materials and more practice should be available.

Vertical alignment errors. As might be expected these are most common where lower signs are concerned. It was suggested that correct body orientation to the reading material is important for accurate recognition of the level of the dots in the cell. This would also apply to horizontal alignment. More symbols include top level dots and so are easier to locate. Lower signs occurring alone are likely to need extra practice, for these have no adjoining letters to help with orientation.

Horizontal alignment. These occurred most frequently with multiple cell contractions, with symbols having dots only on the left side of the cell and dots occurring in diagonal positions. Noticing positions of adjacent letters helps together with an emphasis on reading with meaning.

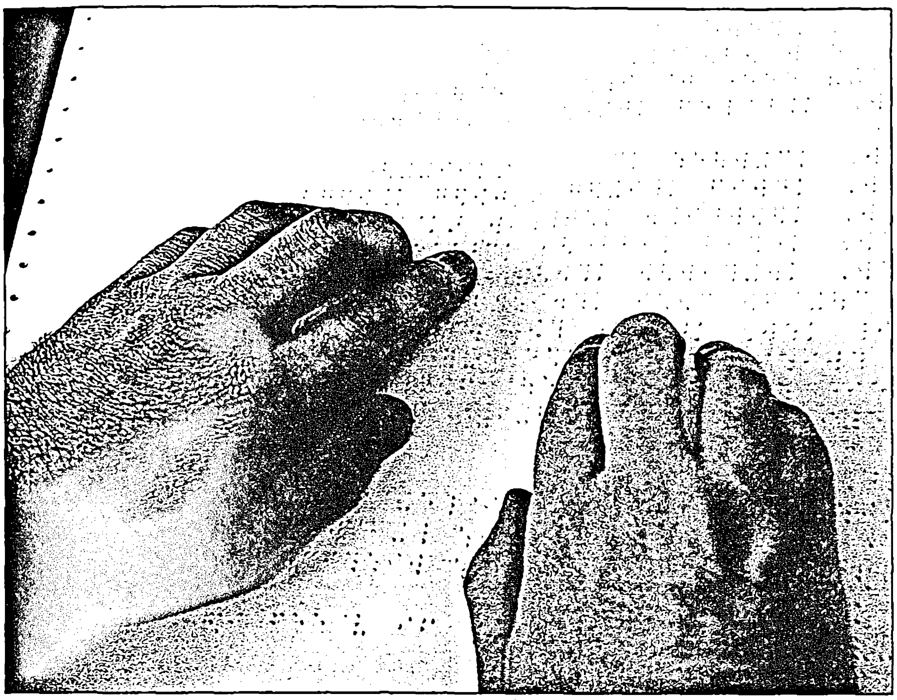

Pamela Lorimer, who is sighted, worked for many years with her husband John (totally blind) on research related to the Braille system mainly in conjunction with the University of Birmingham research unit on issues related to blindness. When her husband died some years ago, Pamela decided to go on alone with the investigations begun with her husband and strive to have their results published.

Meaning of individual symbols

As a child grows older and gains more experience these errors decrease. They are most common with alphabetical word signs which have had insufficient practice in association with their names, with abbreviated words which have insufficient clues left, and in multiple cell contractions. Care needs to be taken with the order in which they are introduced. When reading braille symbols which often have several meanings it is of particular importance for the reader to suspend judgment until all the facts are known. Therefore, the use of short words in the initial stages is indicated until memory and recognition are more trained.

Further research projects

Hand use. Teachers sometimes assume that a right handed person will read better with the right hand and vice versa, and have even persuaded a child to read accordingly without first establishing which method would be the more successful. There seems to be little relation between general handedness and which hand is used for braille reading. There are many individual ways of using hands so researchers have tried to determine which methods are likely to lead to more accurate and faster results. It has been established that the left hemisphere of right handed people decodes verbal items and the right hemisphere is more concerned with spatial items. Braille is verbal yet the dots are arranged spatially so it is interesting to know how the brain treats embossed material. Hermelin and O'Connor (1971), albeit with rather small samples of children and adults, considered it possible that "the brain treats input such as braille reading material as spatially arranged items, to be more effectively analyzed by the right hemisphere before or while verbal coding of the material occurs in the left". This could account for the fact that left handed readers may have a slight advantage over right hand readers, but early training also has an effect.



Braillists may vary in natural preference. Patterns of reading behaviour are established early (Fertsch, 1947) so it follows that young children should be watched to see if there is any preference. Two handed reading where the right hand finishes the line while the left finds the new one, has been found to be faster and more accurate but not all can manage to read by this method. A few single-handed readers can achieve remarkable speeds but two index fingers held side by side have been found to be the least successful method.

Rate. Though there are wide variations in performance it has been shown that braille reading is approximately two and a half times slower than visual reading. This is a serious problem and several experimenters have attempted to use courses to improve the speed of reading, either by the constant use of practice material, or by a series of different activities adapted from similar courses arranged for visual readers. In one such project carried out by John Lorimer (1977) tests were given before and after the training, to measure increase in speed of reading, followed up some months later by a retest to see if the improvement had been maintained. A control group received no specific training during the same period. The final tests showed an overall improvement in speed and comprehension. Ashcroft suggested that more awareness of the need to improve rate of reading should be maintained for several years after the braille code has been mastered.

Tests. Most teachers carry out some form of testing from time to time in order to measure individual progress. It is helpful if a standardized test can occasionally be used making a comparison possible with measurements gained from a much larger sample. In the braille world there is the difficulty of getting a large enough sample for testing so that it can be standardised. Criticisms have been made that a standardized test is of marginal use for the teacher, but these refer to tests that are not geared for diagnosis. A test already standardized for sighted children on accuracy, comprehension and rate was restandardized by John Lorimer in 1971. This has proved to be the most successful so far in Britain; the original print version has been brought up to date and its braille counterpart is being restandardized on a fresh sample of blind children. Unfortunately such a test would not have valid results in a different country because the background, experiences and vocabulary would not be the same. However, it is a useful example of how such a test could be put together.

Pam Lorimer ■

Suggestions

Research has shown the kind of mistakes which are common in braille reading, and with this more detailed knowledge teachers can be helped to know what remediation is necessary or even how to anticipate the problems by suitable training.

Attention should be focused on techniques of reading from the early stages leading to more accurate and faster reading.

The provision of interesting reading material well within the capacity of the reader should automatically improve the speed of reading. However, there is a need for the pupil as well as the teacher to be more aware of this aspect even after fluency has been gained.

The use of a test that has been standardized on the braille reading community and which is also diagnostic may be of great help to both teachers and learners.

Keep in touch by reading research articles that appear in journals from time to time.

Braille workshops give valuable help and teachers then can learn much from informal discussion.

When conferences are held, they might include a paper given by a researcher on a particular aspect of braille, followed by teachers giving classroom experiences on the same subject.

Technical aids such as reading machines and computers can be of great use in learning and in providing a wider range of knowledge but they are no complete substitute for the individual use of the braille code.