

Winston Churchill Memorial Trust Fellowship Report:  
Braille use in India and its application to Britain

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# 1 Dedication

Dedicated to the late, endlessly inventive N. Krishnaswamy, whom I had hoped to meet again during this trip.

## 2 Abbreviations and glossary

- *Braille*. The tactile alphabet for blind people, first developed by Charles Barbier and Louis Braille. Functionally very similar to print, except read through raised dots. It is the only widely used tactile reading medium around the world, with alternative mediums being supplanted by it by the early twentieth century.
- *Braille cells*. A Braille cell represents a character, which can be a letter, number, punctuation mark, musical note or various other symbols. There are up to six dots in a cell, arranged in two columns of up to three dots, each spaced around a tenth of an inch apart and raised around a twentieth of an inch.
- *Paper Braille*. Thick paper, around 120gsm, embossed with raised dots and bound into volumes. Read just like print, the major difference being that Braille paper takes up twenty times the volume of the equivalent text in print.
- *Slate and stylus*. The original and simplest way of rendering Braille onto paper, invented by Louis Braille. The slate, also called a *hand frame*, holds the paper in place so the stylus can be used to emboss letters one dot at a time by hand.
- *Braille*. A Braille typewriter. The terms are some times interchangeable, but often *Braille* will specifically refer to the *Perkins Braille*, which a classic writing device far more common than any other Braille writing device, except in those countries that still prefer the slate and stylus.
- *Braille printing house* and *Braille embosser*. Historically Braille printing houses used zinc plates with Braille embossed into them using large Brailles, run through presses similar to those used by print to produce paper Braille volumes. Embossers meanwhile are newer, electronic, and related to dot matrix printers. Most printing presses now use the latter rather than presses, but continue to perform the same function.
- *Refreshable Braille*. A digital emulation of paper Braille, where a fixed number of cells are modified (refreshed) to represent the text from a computer output. Typical devices include *Braille notetakers* (portable stand-alone devices including input for writing) and *Braille displays* (the equivalent of a computer monitor for sighted people). Typically these have electronically activated pins representing the dots in cells, which are individually actuated, and cost thousands of pounds.
- *Braille* and *transcription*. A Braille is someone who writes Braille professionally; often sighted and working with or for a Braille printing house. The act of converting from print to Braille is known as transcription rather than translation as Braille is a *code* not a *language*. The term Braille is now sometimes used to mean anyone who writes in Braille, including by my own community, the *Braille Foundation*.

## 3 About the author

In the day job I am Managing Director of Bristol Braille Technology, a not-for-profit company. We've spent the last six years developing Canute, the world's first multiline Braille e-reader, or the 'Braille Kindle'. It has 360 cells and yet costs less than conventional single line Braille displays.

I am also a member of the Braillists Foundation, which is a community group — primarily in the UK, but with a significant number of Irish, Spanish, Indian and American members too — whose aim it is to investigate and assist new technologies and projects that could promote Braille use.

## 4 Introduction

This report discusses the future of Braille. Or rather, it discusses a little bit about Braille in the present, but in India. And will hopefully persuade readers that what happens over the next few years in India will ultimately define Braille use across much of the rest of the world, especially in the English speaking world.

With half the world's blind people likely to call India their home within our lifetime, I asked the question, "What can we in Britain learn from the Indian experience with Braille?"

### 4.1 Relation to the trip journal

This report is based off a four week trip around Southern India which was completed by late September 2017. The trip has been documented in a fourteen part journal, which forms the basis of this report. Readers can refer to the journal for further background to any observations in this report.

Whereas this report concentrates on findings that apply to the British Braille reading community, anyone with a broader interest in Braille use in India, regardless of the implications for domestic promotion of Braille in Britain, would be recommended to read the journal.

### 4.2 Caveat lector

I was only in India for a month; a very hectic month, but still, just a month.

I tried to visit as many relevant organisations as possible in that time, but to an extent that made my understanding shallower.

I have been speaking with — and debating the merits of new technologies with — various Indian inventors for a decade, but those of us who develop new refreshable Braille technology are an eccentric and self-selecting group, and hardly representative.

And, lest we forget, India is huge. I only visited a few cities, mostly in the South. Most notably I was not able to travel to Delhi and did not speak to representatives from the biggest government bodies or charities. My interests were more local.

This report is, therefore, not an authoritative account of the situation in India. It is instead a call for further co-operation between Indian and British organisations with an interest in Braille, and some suggestions as to what form that co-operation could take.

## 5 Background

The background to this report is a long term decline in Braille use in Britain and around much of the world. My work with Bristol Braille Technology and the Braillists Foundation is focused on reversing that decline, especially through the provision of equipment and the promotion of Braille use to individuals.

As both organisations are relatively young (founded in 2011 and 2014, respectively) we have much to learn. For Bristol Braille this was a simple question of whether our products would be suitable for distribution in India. For the Braillists this was a much broader question about how they should focus their activities.

And so in 2017 I travelled to Southern India, sponsored by the Winston Churchill Memorial Trust. The WCMT support people from the UK to go to other nations and observe best practice in their particular field, with the intent of bring back useful knowledge to their home country.

### 5.1 The importance and decline of Braille

It is well established fact that that to many people, Braille is the means to literacy, education and employment. Employment correlates more or less directly with Braille reading amongst blind people in most countries where it was been studied. And yet, all across the world there is a real or perceived decline in Braille's use and in its promotion.

New technologies such as text to speech have played their part in this, as has the move to inclusive education. But it has long been my belief that the severe cost and stagnation in development of Braille equipment has been a primary cause of this, shall we say *ennui*, towards the medium.

### 5.2 The means for writing Braille has failed to evolve

There are Braille slates and styli: They are cheap, portable, simple, and still widely used in America, in India and elsewhere. But in much of the rest of the world, such as Britain, they have effectively fallen into disuse. Slates have their many fans — I'm one of them, and always carry a portable slate with me — but regardless, the slow writing speed and reverse writing style is too high a hurdle for many.

There are Perkins Braillers, or Braille typewriters: Excellent devices, as they were in the 1950s; dependable, high quality, fast to write on. But also; a 12lb cast iron typewriter that hasn't changed since 1951, which costs more than month's rent.

And there are embossers: Very expensive, very noisy customised dot matrix printers which automate the process of Brailleing.

That's one device for £10, the slate, the equivalent of a 50p pen, but is falling out of favour and is six times slower than writing on a keyboard.

Another for £700, the typewriter, which is impractical in many cases, if only for its weight.

And a final one, for upwards of £2,000, which is the equivalent of a £40 printer.

### 5.3 Reading Braille has also failed to evolve

Paper Braille takes up an entire bookshelf where the print copy would have been a single, pocket-able volume. Digital Braille, meanwhile, costs as much or more than a Braille embosser and gives you a single line at a time, or less than one-hundredth of the characters a small laptop monitor.

### 5.4 And so, to India

India has the largest population of blind people in the world.

It is a developing nation, without the relative resources to support its blind population with the kind of generous schemes found in many Western nations.

It has a well established education system; for sighted and for blind people; for adults and for children.

It has a large skilled workforce, and huge number of technology companies, charities and other organisations with the capacity to develop solutions to difficult problems.

In India, therefore, the difficulties of supporting Braille use are writ larger than in Britain. Correspondingly, the possible solutions seemed to me to be writ larger too.



Figure 1: A panorama from a roof top in Bangalore



## 6 Aims

- 1) Discover how Braille is used amongst the largest blind population in the world, and its significance compared with other mediums. For example, understand how Braille is taught and distributed to children and adults, urban and rural, rich and poor. What does this tell us about the future of Braille use in Britain?
- 2) To gather information about the promotion of Braille use that can inform the Braille Foundation's activities in Britain. What methods for spreading and maintaining Braille use would transfer across?
- 3) Discover and understand the most exciting developments in Braille technology from India. Why were so many interesting inventions coming out of India? Were they making an impact, or was Braille still in decline? And how, if at all, could they be applied by companies, charities and schools in Britain?
- 4) My own company, Bristol Braille Technology, has the goal of helping reverse the decline in Braille use around the world. Therefore I wanted to find out if our machine, Canute, be useful to people in India. (Thus also benefiting the British Braille reading community, as BBT is a not-for-profit which reinvests surplus into that community.)

### 6.1 Approach taken to achieve the aims

To get the broadest understanding of Indian Braille use, and maximise my chance of meeting the aims (see above), in the limited time available, I elected to take a whistle-stop tour of the following;

- Schools Braille was being taught to see the methods used.
- Societies and individuals who pushed for greater Braille support from outside the state system.
- Printing houses, get a sense for the demand for Braille books.
- Paul D'Souza, and other inventors, who have spent years working on affordable refreshable Braille, usually without the kind of resources extended to the more high profile projects in America, Korea and Europe.

Approximately the same range of questions would be asked in each case, of which here are a representative sample;

- How widely is Braille used in your field?
- How is that use changing?
- Which Braille equipment do you use or see used?

- To what extent, if any, is this equipment lacking?
- How do you promote Braille use, and is that successful?
- Could your equipment or methodology be applied in Britain?

## 7 Findings

### 7.1 There is a disparity between mainstream and special schooling

According to the Worth Trust 70–75% of blind children are in Government run schools. My interest is in how educational standards and Braille literacy vary between the mainstream and the specialist.

#### 7.1.1 Mitra Jyothi

Mitra Jyothi is a charity set up in the 90s to help blind people get employment, education and life skills. They are not a school, though do run classes. I spoke with Uma Krishnamurthy, the founder Madhu Singhal, and a few of their colleagues.

- They are adamant in their belief that blind children should be sent to specialist schools, at least at primary level, before they enter mainstream (or inclusive, as the term is here) schooling.
- In their experience blind children in India who have come through the former have confidence and education far in excess of their peers who have only come through the latter.
- Related to this specialist schooling, they equate Braille use amongst those students very closely with their superior reading and writing skills.
- Inclusive schools in India do not have an equivalent of teachers of the visually impaired (QTVIs in the UK) who come into those schools to provide specialist support for the blind child. This likely exacerbates the effect of the above, or perhaps even causes it.
- There are a number of blind schools in Bangalore; enough, they said, for them to decided to concentrate not on schooling directly, but on supporting in other ways, especially with a view to getting people employment.

#### 7.1.2 The Louis Braille Home explains schemes to help students in inclusive schools

Mrs Navaneetham Dorairaj co-founded the Louis Braille Home in Vellore to support blind students starting college, especially those coming into Vellore from the country (more on this in the next sections).



Figure 2: Mrs Mavaneetham and the author, with the Canute

As a result she is well aware of the different educations her students have had up until they reach her.

The Indian Govt has introduced something called SSA (Services Shiksha Aloh) to support disabled students in mainstream schools.

Blind students were already provided with 1,000 Rupees per month from the Govt (I did not establish is this is the same across all disabilities). However the student must to go to office to pick the cheque.

This creates a challenge around travelling to sign on, which makes parents of blind children reluctant to send them to special schools, which tend to be much farther away than the nearest inclusive school.

So the Govt created the SSA scheme, above, to support children who therefore go to inclusive schools, i.e. in the same district they picked up the cheques.

### **7.1.3 However specialist education is still widely preferred by many Braille specialists**

The key point to take away for me was that issues around travel (see ‘Travel between the cities and the country’) are another factor driving students away from specialist education.

Nonetheless, Mrs Navaneetham says that special schools still provide the superior education for blind students. This is because in the latter all the staff are trained, which cannot be assumed, even with the SSA scheme.

Her views were shared by everyone I spoke to. No doubt there are many proponents of inclusive education for blind students in India. Amongst the self-selected group I spoke to (who are notably more concerned with Braille literacy than others might be), however, it was felt that this long term trend away from specialist education was harming Braille use and blind students’ literacy.

### **7.1.4 The Christian Foundation for the Blind — India**

The CFBI are primarily a printing press (see more of that under ‘the Braille Printing Press still forms the bedrock’), but also do a lot of Braille promotion in schools.

They have found whilst visiting schools that now even amongst special schools Braille is only really taught in the lower years. This tallies with what I’ve been told elsewhere so does seem to be a general pattern.

## **7.2 Travel between the cities and the country**

### **7.2.1 Mitra Jyothi**

Mitra Jyothi try to focus on rural blind people, even though they are in Bangalore. This is because of the comparative poverty of the former, but also the need to be in a city so people

from many different states can reasonably travel to them (their coverage is across a wide range of Southern states). As such the centre includes dorms for both men and women.

### **7.2.2 The Louis Braille Home in Vellore**

The Louis Braille Home was set up to offer a home for poor rural blind students who wished to attend university in Vellore. Conditions are not necessarily easy for blind students coming to study in Indian cities, so the idea was to reduce the barriers to learning.

However when I met Mrs Navaneetham they had no longer had the boarding house and had changed to supporting students as they stayed in the usual dorms and rented accommodation. This is a temporary affair I understand.

Regardless, they focus their energies on providing equipment and materials to blind students.

### **7.2.3 Cultural attitudes also affect travel**

Kanthari is a small college for people from all over the world to come, stay, and learn how to run effective socially beneficial projects back in their home country. It runs intensive courses for seven months. Kanthari was founded by Sabriye Tenberken and Paul Kronenberg, who are perhaps more famous for Braille Without Borders, Tibet, and have been involved in various ideas for refreshable Braille designs over the year. More on that under ‘A low cost Braille typewriter’ and ‘A new generation of Braille displays is coming out of the woodwork’.

I mention this background by way of an introduction to the organisation, which is all about encouraging people to become artists and entrepreneurs to help their own communities. In several conversations I was told that it has proven a problem for Kanthari to attract either blind adult students or visiting blind children from India. The four hour journey from Kochi to Trivandrum was considered too dangerous, for example.

In contrast they have blind students from outside of India regularly. One girl came on from Peru, via Mumbai, to Trivandrum and then on the bus to Kanthari, having not left her country before. Independence for blind children is, as you might have gathered from the previous entry, an important recurring theme for Kanthari, and one which the staff their struggle to fully support amongst the Indian cohort.

## **7.3 Support for Braille use ends when college starts**

According to Mrs Navaneetham under 18 years of age Braille is widely used by the students she supports. But once over 18 this falls off and is replaced with iPad use. So, by her estimation, schools might still use Braille, but colleges tend not to. To a certain extent this reminds one of the situation in a country like Ireland, where support for Braille drops off after secondary education.

A college student might take notes on a slate and stylus, but they won’t be given any materials in Braille. They can get *general books* from NAB in Bombay or NIVH in Delhi, or from Christian missions, or from the RNIB, but not course specific textbooks.



Figure 3: Kanthari students and teachers dancing

None of the above provide under-graduate level books, post-grad level or PHD level.

### **7.3.1 How the Louis Braille Home supports college students**

So Mrs Navaneetham manually embosses all the students she supports copies of relevant sections from the books into Braille manually, using a Perkins Braille (!)

Presumably to avoid chronic wrist cramp she will only do critical sections and texts, such as what is necessary for a competition.

Currently she is supporting 15 students, mostly come from remote villages. Of people she previously supported 50-odd are in Govt posts, and another 50 are working in schools. Mainstream schools that is, rather than specialist schools. This, she asserts, is testament to the improving power of Braille.

## **7.4 The Braille slate remains the irreplaceable default**

### **7.4.1 Mitra Jyothi**

There were no electronic Braille displays within the Mitra Jyothi building. This as unsurprising. Their price was mentioned by Uma as an obvious barrier.

There was one Perkins, on Madhu's desk, and, so far as I could tell, no other types of Braille. This is a significant deviation from the UK, where they are commonplace, and quite surprising to me given that Perkins Braille are all made in Vellore, a half day's train ride away. Its good to have assumption about Braille typewriters disproven.

Full page slates are the usual writing tool for their students. Nothing unusual about these, except that they are significantly cheaper than in the UK (about the same price as they are in the States though). To many in Britain it would be surprising to see so many slates in active use.

### **7.4.2 Snehaddeep Trust**

The Snehaddeep Trust is set up for similar reasons to Mitra Jyothi; teaching blind people the skills they need to get on in life. Although entirely separate organisation, they have a very similar set up, and also concentrate on slate use as the primary means for writing Braille. This despite having a number of generous sponsors who purchase equipment like embossers for them, and no doubt would buy in Perkins Braille if requested.

In other words, slates are not being fallen back in absence of something better. They are considered the best method for writing Braille, at least in the classroom.



Figure 4: Students from the Snehadweep Trust entertaining sponsors from British American Tobacco



### **7.4.3 The St Louis School for the Blind and Deaf**

At this school there were 150 blind students. Teaching Braille was done on 27 line slates. There was a great deal of interest in refreshable Braille, but none evident, and no sign of Braille use.

### **7.4.4 The Worth Trust**

Having established the continued importance of the slate and stylus, I visited a factory in Vellore which manufactured them. Worth are a large company which specialise in employment for disabled people of all stripes.

They have a vocational training dept., a plastics works (i.e. injection moulding and blow moulding), and most famously the Perkins Braille assembly line.

I had been told by the various organisations I'd visited that Worth had manufactured their slates. During a tour of the facilities it was explained that they did, indeed, provide a large amount of the slates for the country.

The cost of these is very low indeed in India. Under 100 Rupees for a full size slate. Alas once exported the price goes up more than tenfold.

They also continue to manufacture NK's Universal Braille Kit (small plastic learning devices for teaching children the basics of Braille). I did not see these used in conjunction with slates in the wild, so cannot make any conjectures about their usefulness.

## **7.5 A low cost Braille typewriter concept has wide appeal**

### **7.5.1 Perkins Braille are made in India**

The Perkins was designed and for many decades made in the famous Perkins School for the Blind, Watertown, just outside Boston, USA. In 1996 assembly was moved to the Worth Trust. Since then every Perkins in the world has been assembled in Katpadi, Vellore.

The entire workforce in the Perkins Classic assembly line has disabilities, including blindness. The Braille components are sent to Worth, then the full Braille are sent back to Watertown, from whence they're exported across the world. (Certain components are made in America still and shipped over.) A worker will add a certain element to the Braille, check it, pass it on to the next, who will also check the previous person's work before adding their element. They can produce something like 50 a day, though I have no doubt could produce more if it was needed.

The price of a Perkins here in India is 37,000 INR, which is £410 at the time of writing. Price in America is around \$600. Price in UK is around £650. I didn't ask if Indian Braille are still sent back to Perkins before being re-imported to India (unlikely, you'd hope); but in any case Perkins are obviously able to sell at a lower rate in India.

It will come as no surprise to anyone who've used the various Perkins models that the Classic is by far the most popular. They no longer produce the plastic Next Generation, but Smart Brailleurs, based off the Next Gen, plus an electric screen, are being made elsewhere in Worth building.

The Smart Braille costs 1.3 Lakh INR (~£1,700) in India. No idea how this compares, as I thought they cost less than that.

### **7.5.2 ... But not widely used**

No-where I went was there widespread use of the Perkins Braille. This relates directly to the sections on slate use, above, and price, below.

### **7.5.3 Other typewriter designs have existing, and been dropped**

Many places I spoke to were interested in supplementing their slates with a more affordable version of the Braille. However none have every seemed practical, and the high quality of the Perkins Braille sets the bar high. For an upper limit of realistic price, we can probably equally apply Paul D'Souza's estimate of 15,000 Rupees for Braille displays to typewriters.

Kanthari have been sitting on a design for a low cost Braille, i.e. a portable Braille typewriter for under \$100. Paul came up with the design years back. Originally they asked a well know Indian Braille manufacturing firm to build it, but pressures I can't fully go into (from outside the country) saw to it that it was dropped.

Times have changed now and the organisation that caused the Braille to be dropped has changed leadership (several times in fact). Paul is once more interested in seeing it developed further. I have a copy of the schematics but have yet to study them for viability. Whether by Paul's design, or some other, the Braille have a long running interest in designing a more affordable Braille than the Perkins.

Besides the Braille itself, it is worth noting it as a documented case of an interesting and potentially very beneficial Braille project being scuppered by hidden pressures from elsewhere in the industry. Something to be noted by anyone in the field, especially where they become reliant for some component on a company also used by another apparently friendly Braille organisation.

## **7.6 As everywhere else, the Braille Printing Press still forms the bedrock**

### **7.6.1 Mitra Jyothi**

Mitra Jyothi have a Braille printing press. In fact they have two. These are the dot matrix embosser variety rather than actual presses (the latter are rare; I have only ever seen them at the Clovernook Centre in Ohio, and later in the trip, see below).

Their capacity is 2,000 lines per minute. For comparison a conventional embosser does around 80 lines per minute. These go out to over two hundred readers, and, though I didn't ask, you can assume the same rate of sharing as with CDs, thus I would guess their Braille books reach around 1,000.

## **7.6.2 The Braille Press of Tirusalem**

References to the Braille presses at the Christian Foundation for the Blind—India can be found on the frontispieces of many textbooks and library books in the states I'd been visiting. Although the full description of the presses is not strictly informative to Braille production in Britain, I nonetheless reproduce it below because it may be of interest to anyone who works in the field who is more used to the now more common embosser-based printing houses.

### **7.6.2.1 Embossing zinc**

The starting point is a Marlberg embosser; essentially a keyboard input stamping into zinc sheet. Its is a full table, about 4'x4'. One lady was typing at the keyboard, which used an interesting four-key chorded input. Think of a Perkins keyboard, but only embossing one half of the cell at a time, with another button to advance half a cell. This moved the bed on which the 10"x12" zinc was held left to right, forwards and back, underneath what looked like a very sturdy iron bridge that extended over the full range of the bed's movement. In the middle of this was an upright three dot embosser which embosses dots down into the zinc, i.e. righting upside down like a conventional slate. This is driven by a lever that runs down the back of the machine. The whole think makes a terrific noise.

The sheets are then taken out and checked. Any errors are flattened (for stray dots) or embossed (for missing dots) manually using a hammer and punch.

### **7.6.2.2 Embossing paper**

The zinc plates go to an original Heidelberg press. You can see an example of the press on the APH website. Its about 5' left to right, 6' deep and 4' high. The paper starts at the front left of the machine where it is picked up by an oscillating tray. The tray presses the paper against the plate which is held vertical in the centre of the machine, and from there is whisked across by an arm to a complete pile on the front right.

### **7.6.2.3 Cutting, binding &c.**

The paper is bought in large reels and manually cut down to correct Braille paper size. Once embossed it is fed into an automatic binding machine for large volumes.

The off-cuts are used by the CFBI to emboss small hand-held Braille calendars, about 3"x6".



Figure 5: Stamping a page of Braille in zinc sheet

## **7.7 The market for Braille technology is severely limited by the price...**

### **7.7.1 School use**

The Canute was considered something Mitra Jyothi students would love to have available to them. At an assumed price of 50,000 Rupees, it would too expensive for the great majority of individuals (unsurprising, as is pitched at being just about affordable by the average UK Braille reader), but could suit schools and so on, where there are multiple users.

### **7.7.2 Braille requires benefactor sponsorship**

According to Paul D'Souza, backed up by several other sources, until the price of the units drops to a fraction of even that of the Orbit/Canute/Touché, the best model for getting refreshable Braille devices distributed in India is a benefactor/institution relationship.

When another Paul, Mr Muddha, Founder of the Snehadeep Trust, met me, it turned into a perfect example of just this. There were two or three groups of corporate sponsors also stopping by at short-to-no notice, like I had, to donate some computer equipment and get a tour. Despite this we were collectively treated to a series of songs and speeches from the students.

Paul explained the only way to make any progress in these fields is through a combination of corporate sponsorship and Govt. approval, which Modular Infotech's advice below goes into more detail on.

### **7.7.3 Modular Infotech advises on exporting to India**

MI estimate, given their experience of selling the Mitra, that a Canute selling for 50,000 Rupees (around £600–700) would sell somewhere in the region of a dz units a year into India.

Greater sales could be made with a concerted marketing effort, but at that price it is outside of not only individuals, but even many Govt schemes to provide equipment for individuals, and the generosity of various corporate sponsors.

Which is not to say those sponsors couldn't be found for a series one 50kINR Canute, but that it would be far easier to get corporate sponsorship and onto the books of various Govt schemes if the price were somehow to drop by around two fifths: 30kINR.

Therefore we discussed likely ways of distributing new Braille technology into India, whether Canute or other;

- Short term: Import devices to India for high prices, finding small but influential users in universities &c.

- Medium term: Move production to India (for the Indian market models at least), thus allowing prices to drop significantly due to absence of tariffs and lower labour costs, establishing significant presence.
- Long term: Reconsider design to produce a custom device especially for the Indian market, with the focus on coming close to 10kINR, thus allowing widespread distribution, even to individuals.

#### 7.7.4 Schemes for purchasing material in India

Some information from the Worth Trust, specifically relating to how people are able to afford their equipment.

There is Govt funding to distribute equipment to blind people free of cost through two orgs; National Institute for Visually Handicapped and the Artificial Limb Centre

They can give 12,500 (~£160) INR free of cost, without many questions asked, for equipment. Otherwise if cost of equipment is higher, *the manufacturer* has to apply to be allowed onto the list.

This is called the ADIP scheme. It compares well to the American ‘Quota’, but perhaps less precisely to any British system (my knowledge here is lamentably lacking).

#### 7.7.5 Under-graduates would not be able to afford 50,000 Rupees

Having demonstrated the Canute to Mrs Navaneetham her conclusion was that it would be useful for Post Graduate and PHD students, but at 50k INR would be too dear for UG students.

### 7.8 Refreshable Braille has been adapted for Indian requirements

#### 7.8.1 Language support

As an example of the complexity of supporting Braille readers in such a multi-lingual country, Mitra Jyothi will do most of their titles in Kannada, the most spoken language of the state, which their readers may struggle to find from national organisations. But they also need to cater for any other Indian languages and for English.

Another example came from the Karna Vidya Foundation. The Foundation provides training for visually impaired and blind people to find employment, working with both children and adults.

During my visit Mr Kumaresan, an outreach and training consultant for Bookshare India, provided some Tamil books on a USB stick to load into the Canute I was travelling with. These came directly from the Bookshare website. Unfortunately the rendering was littered with errors. The pattern of errors meant it had to be in the BRF file and therefore a problem with the Liblouis table used by Bookshare.



Figure 6: Demonstrating Tamil Braille on Canute at the Karna Vidya Foundation

This will not come as a surprise to anyone used to the difficulties of supporting the myriad of Braille codes; but it is especially acute for anyone who needs to build in transcription to their devices and sell them in a country like India where it is necessary to support more languages than a small team could reasonably proof-read.

### **7.8.2 Modular Infotech**

I had been talking by email with Raghunandan Joshi, one of Modular Infotech's founders, for many years, but this was our first face to face meeting, where we were joined by Shekhar Jadhav and their fellow directors. He and I had always been enthusiastic about finding a way of combining our work; Modular specialise in Indian language support in Braille and screen reader technology.

They have also developed solutions to transcribe and emboss Braille paper Braille called Shree-Lipi Braille, which generates Braille in any of the 12 Indian languages, plus English, several varieties of Arabic and a few more.

### **7.8.3 Mitra 16 and Mitra 32**

MI make and sell two Braille displays; the Mitra 16 and the Mitra 32. Both single line (I'll leave you to guess the number of cells) and using Metek piezo-electric cells from Germany.

The form is a metal box about 1" by 10" by 10". The Braille cells are along to top half of the machine.

It is mains only through a DIN plug on the front. They told me they thought they would have to make a battery version, but it turns out people are happy with mains. This challenges an assumption I had about selling Braille devices in India, which was that internal batteries would be vital given the frequency of power cuts. And, frankly, it contradicts my own experiences of the last two weeks, when power cuts have sometimes been as frequent as six in a day/night.

The only controls are a horizontal row of ten small buttons above the cells, which one uses to programme in book numbers (books are numbered and are selected by their number) and page numbers. They also have specific modal functions for different menus, I gather. Then there are two more of the same type of buttons, one on either side of the line, for panning. These buttons have great tactile feel with at least 3mm of travel.

The design of the user interface software is —very broadly— similar to that taken by the Canute UI team; i.e. a focus on loading in pre-prepared material and cycling between those files as a stand-alone reading device. The interesting distinction is that they chose to navigate the book selection by catalogue number rather than flat file list, as on the Canute.

The Mitra 32 sells for something like £1,800, which is competitive, but, given its use of metek cells, not remarkably affordable, especially for India.

It should be pointed out that MI do not seem to be making a great deal of profit off these, but rather are doing it to further their aims of supporting Braille and regional Indian languages.



The Mitras are designed to be used in a ‘Braille Library’ set up. By this I don’t mean any old Braille library, but a specific concept by MI which they call a Braille Library; that is, five or so Mitras in a room, with a central computer with a scanner and MI OCR and transcription software. The PC produces the content, which is then loaded into each of the Mitras in turn. They have set up five of these libraries so far. I’ve not seen a MI Braille Library in action.

#### **7.8.4 The flow of print to Braille is different**

A long time correspondent of mine, Professor Solomon, met me to assess the Canute and discuss refreshable Braille requirements in India. He was keen on scanning and OCR being built into the Canute, especially given the absence of online BRF libraries.

This would be no mean feat but cannot be dismissed out of hand. One of the central planks of the Canute’s design, focusing on existing BRFs, has little value in India, where there is no ready supply of digital Braille files.

Before distributing Braille devices into India the organisation will have to think about the whole print-to-digital-Braille flow of information into the device, without assuming that anything will be pre-existing.

Modular Infotech (see above) do this by recommending they displays are used by institutions who hook them up in a ‘Braille library’ to a computer that does conversion through their own software.

Others talk about hooking it up to their phones (although it should be said that even more decay that as increasing the costs).

OCR is one solution. No easy solution, but there is no point distributing digital Braille equipment unless have an end-to-end solution for reading materials.

### **7.9 A new generation of Braille displays is coming out of the woodwork**

#### **7.9.1 Specific requirements for Indian Braille readers**

When we discussing new refreshable Braille in India, Mitra Jyothi insisted on the importance of the devices being stand-alone, so they don’t require a PC. This makes sense, but we did not discuss whether reliance on a mobile phone would be acceptable.

So far as I could tell there is little benefit in 40 cells in the Indian market. There doesn’t seem to be back-catalogues of BRF files, which is the only reason for it. So for the ‘longer term’ discussed above, the fictional device could be 20, 24 or 28 cells.

Only thing to counter that is that some Indian regional languages have much longer words than contracted English Braille; sometimes in the region of 20 cells.

Nonetheless this has been taken on by the following Indian projects; all of which are single line, twenty cells and stand alone.

### 7.9.2 Touché

For the last few years Paul D'Souza from Bangalore has been working on the Touché, an exciting new single line, 20 cell display. It is in many senses a potential competitor to the Orbit Reader 20 as has the capacity to be approximately the same weight, size and price.



Figure 7: Paul D'Souza, holding Canute, with the author, holding Touché and Paul's multiline prototype

I was very impressed with the feel of the Braille, which is solid, like sign-age Braille (it seems most of the new generation of refreshable Braille technologies are going for hard rather than compressible Braille). And the refresh rate was instantaneous. It is currently 8-dot, largely to prove that it can do 8-dot, but can be reduced to 6-dot, which would reduce the height and price.

After 8 years of being a lone inventor, development is now happening with another partner organisation in India and they have just received the backing of the Indian government.

The device is well advanced and I look forward to seeing a pre-production prototype soon. In fact, Paul was interested in my offer of having the Touché tested in the UK by the Braille Foundation. With any luck, we may get the non-Indian exclusive on this very interesting machine.

### 7.9.3 BrailleMe

Another in Mumbai called Braille Me is reporting progress, but I did not get to visit them, and no-one I spoke to had tried one or had any knowledge of it to report.

However I should note that since completing the journal the BrailleMe has been released, I've tried a few of them in various conferences, and can report that they represent an exciting opportunity for affordable single line Braille.

#### **7.9.4 Worth Trust**

One reason of travelling to see the Worth Trust was their historic association with alternative refreshable Braille technology. The Worth Trust worked on the late N Krishnaswamy's Natesan Display in 2010–11, on behalf of Vidya Vrikshah. This would later inspire BBT's Canute project, amongst others. The Natesan Display was first publicly demonstrated in Leipsig in 2011, at the Braille21 conference.

It seems like the Natesan Display project was wound up entirely a few years after that, at least at Worth Trust. I was unable to make contact with any one at Vidya Vrikshah, who may have moved the project to another company. It seems likely that the Natesan Display did not survive NK; except, of course, in the various projects it inspired.

#### **7.9.5 Other Indian Braille display projects**

There is a project in IIT Delhi (a university) which is using shape memory alloys, according to Paul. Neither of us can say if they are going to be able to complete the design, but they had reported progress over several years and development is ongoing. There is also interesting work being done by Project Mudra, especially on their teaching device, Annie.

## **8 Conclusions**

### **8.1 Braille is not sufficiently supported in inclusive education**

There was wide agreement that the support given to blind students to learn Braille in primary and secondary education was significantly lower in inclusive education, despite a concerted effort to prefer this mode of education of special schools in recent times. In higher education, which cannot reasonably be anything but inclusive, there is even less support.

### **8.2 Ease of travel affects Braille use**

Travel is a larger consideration for many blind Indians than it is for those from other (usually smaller) countries. Even the best facilities struggle to make an impact, especially amongst the rural blind, until particular measures and protection are taken to correct for it.



Figure 8: Canute being tried in a classroom



Figure 9: A beach scene from nearby the Kanthari campus

### **8.3 Corporate sponsorship is a vital route to equipping Braille facilities**

In India it is partnerships between corporate social responsibility and blind specialist schools which drives Braille use. There is also an important myriad of charities, of which I only Touchéd upon during the trip.

### **8.4 Expect Indian Braille displays to shake up the market**

The inventions around Braille that come from India are competitive with the American and Korean inventions that are assumed to be about to take over the market. Therefore I would expect Indian refreshable Braille to make a greater impact on the Western world than visa versa, and would not be surprised by a general shift towards Braille devices being manufactured in India by default in the coming decade.

### **8.5 There are no technologies that will replace the slate any time soon**

Braille in India continues to focus on the slate and stylus, not typewriters or digital (despite most typewriters being built there, and some of the best digital technology recently emerging from there). This focus on the slate and stylus could be supplemented by affordable Brailers, but I saw no evidence of an enthusiasm for moving away from them entirely. In this regard Indian Braille habits stands more with the American, against the general trend in Europe and elsewhere.

### **8.6 There's a long way to go before Braille displays are widely owned**

Paul D'Souza noted that 15,000 Rupees is about the limit any Indian individual is likely to pay for such a device. That's £165 at time of writing. There are, to date, no plausible projects I'm aware of that cost under double that price. Therefore while we can expect a proliferation of Indian based refreshable Braille projects over the next two years, we are still some way off mass personal ownership of Braille displays in India.

### **8.7 Braille use is perceived to be in serious decline**

The most striking finding to report? A great deal of pessimism, offset, perhaps, by the same measure of inventiveness.

Those I spoke to in India who were working with Braille found it increasingly difficult to persuade others of the medium's importance. They worried about its survival in the face

of official ambivalence, declining use of special schools and the ease of switching to text-to-speech software.

The people at Mitra Jyothi, the CFBI, the Snehadeep Trust and others have seen the deterioration of Braille use in India, to varying degrees. Therefore it seems plain that Braille use is either decline in India, as elsewhere, or is commonly thought to be by Braille advocates. It has become deeply unfashionable in many places and it is becoming more and more difficult to make the case for it.

## **9 Implications and recommendations for Braille in Britain**

### **9.1 Affordable manual Braille writing requires promotion**

The promotion of Braille as a whole we need to consider re-adopting the slate and stylus, or replacing it with something of comparable ease, cost and portability. Practically speaking this requires two immediate actions;

Firstly, making slates (and any other existing cheap manual Braille writing devices) both widely available for British Braille readers (whereas at present they are conspicuously absent or absurdly expensive), and openly promoted through consumer shows and podcasts.

To these ends I will be recommending my company, Bristol Braille Technology, assist, financially and otherwise, in the setting up of an independent shop for Braille devices ignored by existing British distributors, to be run by a member of the Braillists Foundation. This shop to investigate imports from India to fill this gap, and to make its goods available to the public at Sight Village events.

### **9.2 Slates will not be enough; a new Brailleur is required**

The price of Perkins Braillers is only one reason for the Indian organisations visited sticking to slates. The price — around £700 — applies less in Britain, but is far from insignificant and is undoubtedly a barrier to the manual writing of Braille. The other reasons were the impracticality of storing and maintaining so many cast iron 12lb typewriters that each require regular oiling and servicing. This applies just as surely in Britain.

Therefore I will recommend Bristol Braille Technology consider it a priority to consider designs for a new Brailleur at the soonest possibility. Practically speaking this is likely to be after release of the Canute 360 at the end of 2018.

I will also recommend that the Braillists Foundation makes an open call for Brailleur designs, and maintains an open platform to host, judge and, where they are promising, support the development of any designs received.

## 9.3 We must run trials of Indian refreshable Braille technology

I shall be recommending a series of trials of Indian technologies in Britain, run by the Brailleists Foundation. The initial aim of this is to make available the generally cheaper devices to the British Braille reading community, with all the obvious advantages that brings.

Further to that, we should hope that, by proactively supporting Indian inventors break out of their home market, our feedback and requirements can carry weight in the early stages of development, thus perhaps helping to tailor the devices to British requirements, something made easier by the shared language.

If we do not, and instead chose to wait for it to pass through, say, Germany first, then that lack of involvement would result in an inability to affect the feature sets received by British Braille readers. This passivity is something the Brailleists Foundation was specifically set up to change, and this is an opportunity to shape the future generation of Braille equipment that should not be passed up on.

To extend the specific example, imagining trials of the Touché happen in Germany rather than Britain:

We could expect the focus to be on making the feature-set fit the expensive requirements of the health insurance provision and ignore online library integration.

Firstly, the insurance model is predominant in German Braille provision, but irrelevant to Britain, whose readers cannot therefore sustain the same device prices.

Secondly, Germany has no notable digital German Braille libraries, whereas English Braille does have, and we would miss, for one, the opportunity to build in early support for the imminent online RNIB Braille library.

There are three technologies I will be recommending we begin with. All three trials will be considered and planned (if approved) over the Summer, as the Brailleists Foundation formalises.

### 9.3.1 The Touché

This is the only technology I've seen that may be capable of being more affordable than an Orbit Reader 20. I'm personally excited by the potential, but even if it cannot go that far it still provides healthy competition.

### 9.3.2 Project Mitra's digital slate input

*Annie* as a whole is an interesting device, and based off previous experience (such as with the Taptilo) the Brailleists Foundation is likely to find interest amongst the educators amongst its membership in trialling this learning tool.

However of specific interest, especially as it plays into the other recommendation of increasing slate use, is the digital slate input, whereby a user presses through holes in the device's panel, depressing buttons under a single celled slate, to write into a text file.

It appears obvious once seen, but so far as I know is unique. There are numerous ways this could be implemented across different devices, as many as possible which we should embrace and explore.

### **9.3.3 The Mitra 16 and the Mitra 32**

Simply put, a cut down piezoelectric Braille e-reader will increase choice and competition at a time when one manufacturer has just gone out of business and others are being merged into bigger conglomerates.

## **9.4 But there is still space for British inventions to make an impact in India**

While the above inventions are exciting, none of them suggest any solutions for multi-line Braille, meanwhile the only credible technology in this area remains the Canute, made by BBT in Bristol and Glamorgan.

I shall be recommending that BBT consider the following strategy;

- i) initially concentrating on small number of sponsored units (dozens) in the first year;
- ii) Followed by a reduced-cost Canute derivative in 1–2 years time that could sell in the hundreds;
- iii) Meanwhile developing custom equipment for the Indian market after the initial Canute release, designed to be manufactured with Indian partners, for devices that provide multi-line refreshable Braille for the individual reader to purchase for under £170, within four years.

## **9.5 Pairing corporate sponsorship with education could be trialled by BBT**

The most successful model I saw in India was this partnership, where new Braille equipment in education was often dependent on corporate sponsorship. In Britain this could be considered unnecessary; except that both BBT and the Braille Foundation are attempting to introduce *new* equipment into education, which may be more of a struggle to get through the existing Governmental and charitable channels.

Therefore Bristol Braille should adopt the model of pairing blind special schools and students with local corporate benefactors, specifically to aid the adoption of the Canute in education.



## 9.6 Long term consequences, or the importance of paying attention

Many of the finding above cannot be directly applied to the use of Braille in Britain, as they are specific to the Indian situation. However even in these cases it is increasingly important for us to take greater note of developments in India, positive or negative, as we already do with developments in North America, Europe and Korea.

India may have historically been on the periphery of developments in Braille use. But with its rising population, prosperity and the recent proliferation native inventions one has to suppose that at some point the modes of Braille use in India will begin to impact widely upon the rest of us.

## 10 Presenting and acting on the recommendations

- a) I have presented the findings of the journal (prior to writing this report) to the Braillists Foundation in London, shortly after London Sight Village in November 2017.
- b) The relevant findings have also been reported to my own company via our internal reporting system.
  - 1) We tried linking corporate sponsors to special schools and individuals in the UK. This gave proper focus and direction to our pattern of demos and publicity for the first time. Even when sponsorship is not the primary purpose it is a good way to measure work. However it must be said that for all the direction it has given us, it *has not* resulted in much actual sponsorship. We have therefore suspended the experiment at least until the Canute is ready for distribution.
  - 2) Our distribution strategy in India has ‘matured’ (in the sense that we did not really have a strategy before, certainly not an informed strategy). We now plan a phased introduction of Canute into India as per my recommendations. Most importantly it has allowed us to realise not only the means to distribute into India, but the limitations of doing so, and thusly how we cannot plan our business around substantial sales there in the short to medium term.
- c) I have had a paper entitled ‘Education in India: A window into Braille’s future’ accepted by the 33rd CSUN Assistive Technology Conference. It was presented in San Diego in March. The paper will soon be distributed in the UK.
- d) The Braillists Foundation will meet over the Summer to discuss possible slate & stylus promotion and how to promote viable Perkins alternatives.
- e) A friend, Dave Williams, has agreed to work with BBT to set up a shop selling Braille slates, abacus’ and tape-writers.
- f) Arrangements for UK trials between Braillists Foundation and the top three or four refreshable Braille inventors from India are planned over the next year.

# 11 Appendices

## 11.1 Source texts

There are two texts that provide further information on the trip;

- *Around India With a Canute*, the trip journal. This is available on the Braillists Forum as a blow-by-blow account, with some commentary from members of the community in Britain. It is also available as a collected and (slightly) corrected single volume on Bristol Braille Technology's website.
- *Braille and Education in India: A Window into Braille's Future*, published in the University of California Northridge Accessible Technology Conference Journal, 2018. The abstract and slides are available on Bristol Braille Braille Technology's website.

## 11.2 Acknowledgements

My thanks goes to all those who I met on the trip, many of whom went far out of their way to not only arrange my meeting with them, but with others about whom I hadn't even yet heard of. So a special thanks for everyone for being so patient with a wondering Englishman (Paul and Sabriye were so patient as to put me up for a week, for which I will always be grateful).

All the following organisations are worth looking up for further background for and understanding of the findings in this trip;

- Mitra Jyoti
- Touché
- Modular Infotech
- The Snehaddeep Trust
- The Worth Trust
- The Louis Braille Home
- The Vellore Blind School
- Naam Manidhass Katchi
- The Karna Vidya Foundation
- The St Louis Blind School
- The Christian Foundation for the Blind — India
- Braille Without Borders
- Kanthari

To follow the *outcomes* of this report, I can only suggest looking into and perhaps joining the (sparingly infrequent) email newsletters of the following;

- The Braillists Foundation

- Bristol Braille Technology CIC

Also thanks to the California State University Northridge Accessible Technology Conference for providing me with the public platform to share some of these findings.

And finally, thank you to everyone at the Winston Churchill Memorial Trust for making the trip happen; most particularly to Tristan Lawrence, who had the unenviable task of trying to tease a half decent report out of me.



Figure 10: The idyllic, leafy surroundings of the Kanthari campus