

Embossed Information for the Blind

J.M. Gill

Warwick Research Unit for the Blind  
University of Warwick  
Coventry  
England

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## 1. Introduction

Although the braille system was developed over 150 years ago, it still has not been superceded as a reading and writing medium for the blind. The inexpensive tape recorder and the expensive devices for reading ordinary print are regarded as useful in addition to braille and not as replacements. For instance it would be very difficult to use audio tape for conveying graphical information such as the political map of Europe.

## 2. Orientation Maps

A blind person who has to find his way round a strange town is faced with two major problems: firstly, the problem of walking along pavements and crossing roads without getting seriously injured, and secondly the problem that the blind person has no knowledge of the layout, or names, of the streets. If a blind person has some form of mental picture of the street layout he can then add pieces of information to this basic picture. The problem becomes more serious with children who are born blind since they often have great difficulty in understanding the layout of roads and road junctions; for instance the author found that a considerable number of blind teenagers did not realise the purpose or shape of a roundabout. An embossed map can sometimes be useful in these situations.

In making an embossed map the first problem is to choose suitable landmarks for a blind pedestrian. This is not trivial since a guidedog is trained to avoid obstacles such as pillar boxes. Noises and even smells can sometimes be useful in determining one's position.

The information to be included on the map, has to be embossed in a way that is both clear and unambiguous. The sense of touch lacks the fine resolution of vision, so much less can be marked on an embossed map than on a visual

one. Contrary to popular belief, blind people do not have a better sense of touch than their sighted peers. The blind often have difficulty understanding many common visual symbols such as the compass rose.

Most blind people have never used an embossed map. Someone who was born blind has to be taught how a map can be a scaled and coded representation of the environment. It is also necessary to teach a blind child to scan a map in a systematic manner in order to build up some form of mental picture of the area. This is similar to the problem of a sighted person reading a large wall map but only being allowed to look at one square inch at a time.

To make a clear map by any manual method is very time-consuming and therefore expensive if one takes into account the cost of labour. With these methods it is very difficult to change the scale of the map or to up-date the information.

A computer-assisted system was developed to overcome these problems. A large scale map is marked up with the extra information which will be useful to a blind pedestrian. This information may include gradients, bus stops, names of shops and likely destinations.

The operator goes selectively round this map with a stylus which is connected to the computer (Figure 1). The map is simultaneously displayed on the screen of the visual display unit. The operator can now modify the map by inserting or deleting individual lines, moving end points of lines and changing the scale.

The ability to change the scale is important since a map is usually an aid to the organisation of information as well as a scaled-down form of representation. It is often desirable to enlarge an area around a road junction; the blind often measure distance by the time it takes to walk, so a moderate enlargement of a road junction does not create any serious difficulties in interpretation.

The operator can also make the lines have different elevations as well as different forms such as solid, dotted or dashed. Standard symbols, representing features such as zebra crossings or steps, can be added to the display. The operator can also type in text from the keyboard and the computer program will convert it to braille.

When the operator is satisfied with the display, the computer is instructed to punch the numerical data on paper tape. A map can be stored in numerical form on paper tape and then quickly modified at a later date.

The punched paper tape controls an engraving machine (Figure 2) which cuts a mirror-imaged copy of the map. Since the map is engraved into the material, a copy has to be made in epoxy resin. This epoxy copy is identical to the desired shape for the final copies so it is used as a mold in a vacuum-forming machine.

This system offers an inexpensive and faster alternative to the current time-consuming methods for making embossed maps for the blind. The system has now reached the stage where it can be used for routine map production.

The evaluation of these maps has been done by Warwick Research Unit for the Blind in cooperation with the Blind Mobility Research Unit. The initial task was to identify sets of embossed symbols which can be easily distinguished by touch. Eight areal, seventeen line and thirty point symbols were tested; these experiments involved two hundred and fifty-six subjects including blind school children as well as adults who read braille and adults who do not read braille.

The next experiment involved teaching blind school children the meanings of fourteen embossed symbols (Figures 3 and 4). This was done by presenting the child with each symbol in turn, with a tape recording giving the meaning ten seconds later. The child had to beat the tape recording in giving the correct meaning. This test

was repeated three weeks later to see how well the children had remembered the symbols and their meanings. The most surprising result was that the children found the symbols for steps going up and steps going down the easiest to remember even though these two symbols only varied in elevation.

After a further three weeks, the children were given an embossed map and asked to find the symbols on the map. In order to determine whether the errors were due to failure to remember the symbols or inability to find them on the map, half the subjects were given a list of symbols with their meanings in braille. There was no significant difference in the number of errors made by these two groups which indicates that tactual scanning is a major problem in learning to read an embossed map.

A further experiment studied the use of single and double line representation of roads. It was found that the subjects, blind adults, were significantly faster at reading the single line map. However it should be noted that the results might have been very different if the subjects had been congenitally blind children.

Maps of the insides of buildings, shopping centres and neighbourhoods have been tested less formally using adult blind subjects. These evaluations have proved useful in ensuring that the research is directed towards realistic situations.

### 3. Braille Transcription

Braille is based on a cell which has six dot positions (Figure 5) spaced 2.5 mm apart, with adjacent cells spaced 4 mm apart. The cell size together with the height of embossing (.5 mm) and thick paper necessary will explain why the bible takes up 72 braille volumes.

