

TACTUAL MAPPING

J. M. Gill*

Graphic representations are an established mode of communication for the sighted, but the visually handicapped have tended to rely on other forms of representation such as verbal or written descriptions. Such descriptions have obvious limitations for conveying information about complex spatial relationships.

The earliest reported method of producing embossed material was in 1517 by Francesco Lucas who engraved alphanumerics in wooden blocks. The first single-copy tactual maps were probably made by Weissenbourg in the early 18th century by sewing beads and threads on linen. In 1785 Valentin Haüy successfully embossed raised images in paper, but it was not until the last decade that maps have become widely available to the blind population. Leonard (1967) demonstrated that tactual maps could be a useful aid to mobility but no estimate has yet been made of the number of potential users.

The main problems in designing a tactual mobility map are:

1. Identification of useful landmarks.
2. Coding the information in an embossed notation.
3. Manufacture.
4. Training the user in reading and interpretation of the map.

*Department of Engineering, University of Warwick, Coventry, England.

USEFUL LANDMARKS

The identification of useful landmarks is not a trivial task since they may be dependent on the type of mobility aid used. For instance, guide dogs are trained to avoid obstacles such as pillar boxes. A landmark should have a known and exact location so that auditory and olfactory cues can sometimes be used. A further factor is that useful landmarks for the partially sighted differ considerably from those used by the blind, but research has not yet been done on this problem.

Franks and Nolan (1970 and 1971) have studied the problems of measuring geographical concept attainment which will determine when a child is ready to begin using maps. Berlá and Nolan (1972) stressed that a child's immediate environment can be used for teaching the concepts of spatial relationships, distance and scale.

TACTUAL SYMBOLS

Another problem is the lack of information about the parameters determining legibility of tactual symbols. Most research effort has been devoted to identifying sets of discriminable symbols in isolation and not in the context of a map. Other areas requiring research are:

1. Association of meanings with the tactual symbols.
2. Stimulus redundancy.

3. Information content of symbols.
4. Information density.
5. Physical size of the map.
6. Scale--topographical or topological.
7. Optimum elevation of symbols.
8. Use of reference points and grid systems.
9. Use of keys.

MANUFACTURE

Maps can either be made centrally by a professional transcriber, or locally by teachers or sighted volunteers. The advantages of a central facility are that a higher capital expenditure can be justified in order to achieve high quality copies with a relatively low unit cost, and the operator is trained in the translation from a visual map to a meaningful tactual one. At present the majority of maps are made locally by teachers, mobility instructors or sighted volunteers, and financial considerations tend to dominate their choice of production method.

An important, but often neglected, aspect is the drawing of maps by blind people. Variation in the elevation of symbols has been found to be a useful coding dimension. There is still no satisfactory method for blind people to draw multi-height maps which causes problems in the compatibility of symbols produced by different methods.

READING AND INTERPRETATION

There have been few systematic studies on the reading and interpretation of tactual maps. A notable exception has been the research by Berlá on tactual scanning strategies but these studies have been confined to pseudomaps.

It is often assumed, probably erroneously, that all potential map users can read braille. Although Gray and Todd (1968) found that 60 percent of the registered blind population in Britain could not read braille, it is not known how many are able or would wish to use tactual maps.

The area which has suffered the most neglect has been the design of maps for the partially sighted. Gray and Todd found that 70 percent of the visually-handicapped population had some useful vision. Although visual markings have been printed on tactual maps, little research has been done on the design of maps with both visual and tactual symbols.

Berlá and Nolan (1972) suggested that an ultimate practical goal would be to define those situations and content areas where maps convey either more information than a verbal description or at least convey it more efficiently.

DESIGN

Tactual maps have three categories of symbols: *point symbols* to show specific locations or landmarks, *line symbols* to designate boundaries or lines and *areal* or *texture symbols* for areas. The results of experiments on the discriminability of tactual symbols are summarized in Table 1.

Four major factors influencing discrimination are: size, elevation, form or configuration, orientation.

Size

Tactual symbols have to be constructed much larger than visual ones because of the relative inadequacy of touch as compared with vision. The difficulty in trying to define a minimum size is that difference in size may be one of the major factors contributing to legibility among point symbols.

Elevation

Variation in height has been used to differentiate between point, areal and line symbols in the context of a map (Wiedel and Groves, 1969), but James and Gill (1973) found that blind children had little difficulty in associating meanings with multi-height symbols representing steps.

Form or Configuration

Jansson (1972) suggested that the following kinds of point symbols are often confused:

TABLE 1

Results of Experiments on the Discriminability of Tactual Symbols

Author	Material	No. of Subjects	Linear			Areal			Point			Comments
			No. of sym- bols tested	No. discrim- inable	Length mm.	No. of sym- bols tested	No. discrim- inable	Size mm. (square)	No. of sym- bols tested	No. discrim- inable	Max. dimen- sion mm.	
Morris & Nolan (1961)	Virkotype	96	12	5	51							
Culbert & Stellwagen (1963)	Virkotype		40	(11)	50							not full pair- comparison
Morris & Nolan (1963)	plastic	60	7	2	6							
Nolan & Morris (1963)	Virkotype	96	18	3	102				18	1	6.4	
	plastic	96	13	9	102							
Schiff (1967)	plastic	92	13	7	51							
	plastic	12	24	4	19							
	plastic	12	24	8	25				26	17	14.3	upper case letters
Wiedel & Groves (1969)	plastic	24	17	4	3	1		15	3			method not reported
Nolan & Morris (1971)	plastic	60	13	7	102	11	8	51				
	plastic	58							12	8	5.1	
	plastic	58							12	5	5.1	
James & Gill (1973)	paper	60	21	7	102				19	11	14.0	
	plastic	62	17	10	100	8	5	50				
Gill & James (1973)	plastic	194							30	13	5.0	

