

## A PILOT STUDY ON THE DISCRIMINABILITY OF TACTILE AREAL AND LINE SYMBOLS FOR THE BLIND

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*Abstract:* Eight tactile areal and 17 linear symbols for use on maps and graphics for the blind were produced on Brailon and tested for discriminability in separate sets by the method of paired comparisons. Subjects' response times were recorded as latencies. The results indicated that only 5 of the areal symbols but 10 of the linear symbols met the stringent criteria for discriminability suggested by Nolan and Morris (1971). Errors in discrimination are discussed with reference to the parameters which contribute to the discriminability of the symbols used in the study, and latencies are discussed in relation to "response set."

### INTRODUCTION

It has been shown that there is a need for tactile maps and diagrams for blind schoolchildren. Leonard and Newman (1967 and 1970) demonstrated that at least half of the subjects in a study were able to complete an unfamiliar route with the aid of a tactile map to provide the relevant information.

Tactile maps and diagrams are composed of three categories of symbols: line symbols to designate boundaries or lines, areal or texture

symbols for areas, and point symbols to show specific locations or landmarks. This study is concerned only with areal and line symbols.

Several studies have attempted to define sets of discriminable tactile areal and line symbols for the blind. Heath (1958) conducted a pioneer study by examining the discriminability of 40 tactile areal symbols using the method of constant stimulus differences to compare symbols randomly grouped in sets of 10. He also found that areal symbols remained legible at a size of 50 x 50 mm. Culbert and Stellwagen (1963) also examined the discriminability of textural surfaces and found 11 out of 40 different patterns discriminable enough from all the others to be useful in the preparation of material such as maps for the blind. Nolan and Morris (1971) conducted several studies which represent the most extensive source of information. Their findings show that the number of tactile areal or line symbols which are discriminable in a set may not exceed 8 or ten. They relate this perceptual limit to the parameters which distinguish tactile symbols. A flexible production system is therefore an essential requirement in varying these parameters as much as possible in an attempt to increase the number of legible tactile symbols within a set.

### PRODUCTION METHOD

The study conducted by Heath (1958) used the Virkotype or Gestetner printing method. Wet ink print was

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dusted with a fine resinous powder which adhered to the wet ink and appeared as a raised plastic symbol when heated. The disadvantages of this method were stated by Nolan and Morris (1971): the degree of relief is poor (0.11 mm.), control of quality is poor, and the medium deteriorates in humid conditions.

The production method used in the Nolan and Morris studies involved reproducing the symbols to be studied by photoengraving in zinc. The master was then pressed into soft plaster which was then allowed to harden. The moulds were then used as masters to produce vacuum-formed copies in plastic 0.20 mm. thick. Embossed symbols were produced at a relief varying from 0.46 mm. to 0.62 mm.

In this country a variety of production methods have been investigated by Pickles (1970). Briefly, this type of approach involves building up a master map or diagram on transparent cellulose. Various thicknesses of string and wire are used for line symbols; sandpapers, linoleum, and fabrics are used for textures. The master can then be used to produce copies in Brailon on a Thermoform machine.

The production methods briefly described are generally time-consuming and therefore expensive if the cost of labor is taken into account. Recent developments at the University of Warwick are based on computer-aided design principles. The relief and type of line or texture is input to a computer from a keyboard. Symbol parameters can be varied accurately to include various heights of solid, dotted, dashed, and dot-dashed lines. Symbol specifications are stored by the computer. Once the symbols have been specified the master is engraved in a sheet of Tufnol by a computer-controlled machine tool. A positive copy of the engraved master is made using silicone rubber. Copies are produced in 0.18 mm. Brailon on a Thermoform machine.

This study is an initial attempt to define some of the parameters governing the discriminability of areal and line symbols produced by a computer-controlled method.

## METHOD

### Subjects

Sixty-two blind schoolboys were used as subjects. The age range was from 11 years 3 months to 19 years 1 month. This sample represented all braille readers who were available and in full-time education at Worcester College for the Blind. I.Q. scores, chronological ages, and braille reading speeds were obtained from the school. They assessed braille-reading speed in the following way:

1. Boys read braille out loud to the whole class for 3 minutes.
2. A score was taken for the number of braille-lines completed.
3. The number of lines completed was then multiplied by  $3/4$  to give an average speed in pages of braille per hour.

### Apparatus and Selection of Symbols

Figures 1 and 2 show the apparatus. A wooden board with a frame was used to hold the stimulus cards. Some previous studies have used a blindfold to exclude residual vision of some blind subjects but this may introduce psychological stress.



Figure 1. Experimental Apparatus.

