# Research Note

## Wall versus Path Tactile Maps for Route Planning in Buildings

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Because of the reduced spatial resolution of the sense of touch, far less information can be displayed on a tactile map than on a visual map. Thus, it is especially important to display tactile information usefully and efficiently. The issue addressed here is the relative usefulness of "wall"- and "path"-style maps for route planning on a floor in a building (see Figure 1). The wall map shows physical barriers, including walls. The path map portrays line routes of travel to floor locations, but no information about the sizes of spaces, such as the widths of hallways and interiors of rooms.

### METHOD

#### *Materials and apparatus*

The wall and path maps (see Figure 1) both depict the sixth floor of The Lighthouse Inc. headquarters in Manhattan during a recent renovation. The (acrylic) tactile maps, 63 x 28 cm (about 29 in. x 11 in.) with a scale of approximately 1:70, were positioned on a tilted stand. An audiocassette player was used to play the map-reading instructions.

#### *Participants*

The four male and two female participants were totally blind or had only light perception (for further details about the participants' characteristics and other aspects of the methodology, see Holmes & Arditi, 1997). The participants had never been to the mapped area or regularly visited the new Lighthouse building. All read braille numbers. Their experience with tactile maps ranged widely, as is the case in the general population of blind persons, from no exposure to maps to limited exposure to outdoor mobility maps to extensive expertise with maps.

#### *Procedure*

Each participant was tested on each map design in two separate sessions. Three participants used the wall map first, and three used the path map. The following five phases were included in the sessions for both the wall and path maps.

*Map reading instructions.* The participants listened to instructions introducing hands-on map concepts, which lasted six minutes (see Holmes & Arditi, 1997).

*Route planning.* In each map session, six route-planning tasks, such as "find Room 42," randomly chosen, were used. The participants first had to locate each goal on the map and then plan a route of how to walk to that goal from the "you are here" location. The time taken to locate the goal and the time spent planning the route were recorded.

*Route description.* After each route-planning task, the participants were immediately asked to describe the planned route aloud in the words they would use to direct another blind person.

*Map knowledge.* The participants then described from memory how to walk between four pairs of goals they had located in the previous phase. The task was

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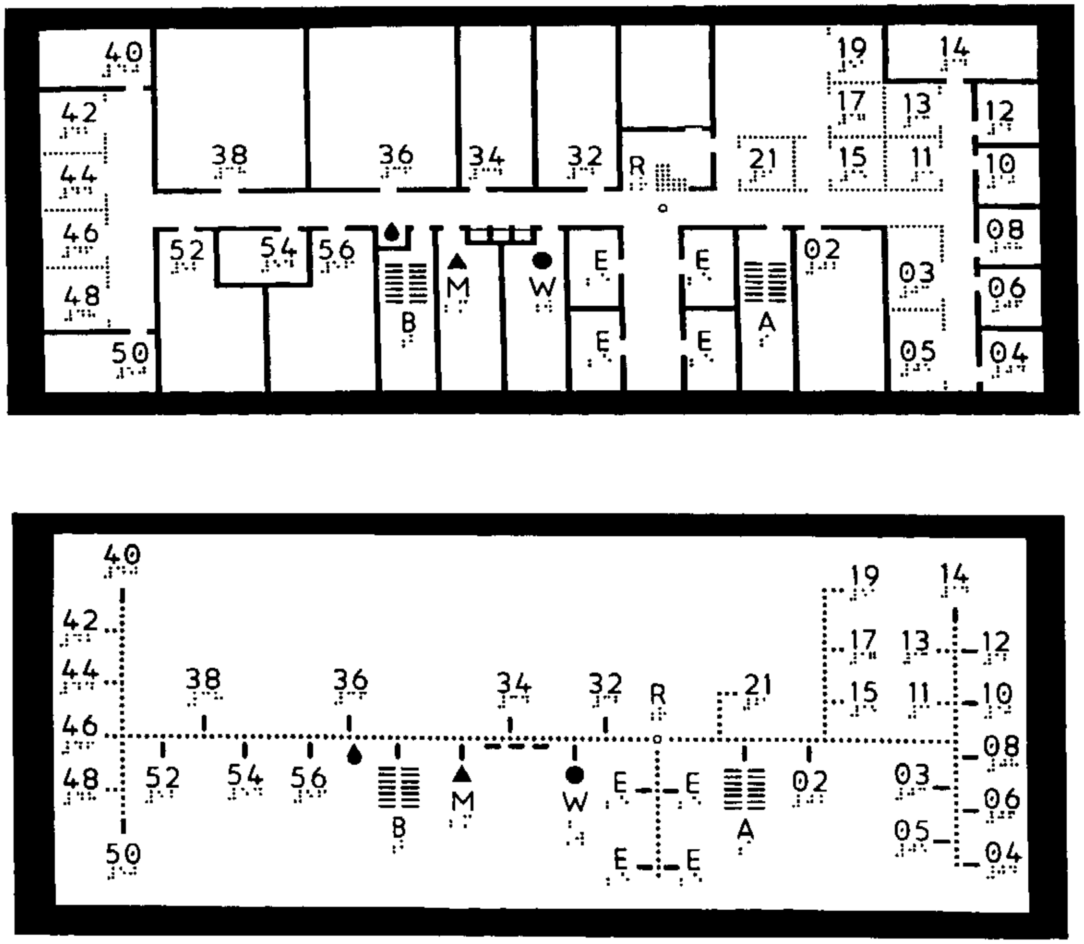


*Figure 1.* The wall map (top) and the path map (bottom). The "you are here symbol" is indicated by an open circle; on the actual maps, it consists of a prominent steel ball.

intended to assess the overall spatial knowledge that the participants had built up.

*Rating-scale questions.* In the last phase of each map session, the participants' subjective responses to five questions were assessed using 7-point rating scales.

## Results

### *Location of goal and route-planning speed*

There was no significant difference in the mean location time per goal between the maps: 52 seconds ($SD$ = 51 seconds) versus 68 seconds ($SD$ = 71 seconds) for the wall and path maps, respectively. However, significantly more time was spent planning the route to one goal using the wall map, mean = 135 seconds ($SD$ = 186 seconds), than the path map, mean = 78 seconds ($SD$ = 77 seconds), Wilcoxon test; $z = 2.61$, $p < .05$.

There were no systematic order effects. The mean overall times spent locating goals using the wall map in Sessions 1 and 2 were 59 and 59 seconds, respectively; for the path map, the times were 45 and 78 seconds, respectively. For route planning, the corresponding means, in the same order, were 88, 114, 182, and 41 seconds.

### *Accuracy of route descriptions*

The route descriptions were scored by comparing them against the maps as "accurate" (containing only correct navigational information needed to reach the goal), "incomplete" (containing accurate information, but lacking some information required to reach the goal), and "incorrect" (containing information that consisted of incorrect navigational decisions to complete the route). The participants described more routes accurately with the wall map than with the path map (56% versus 33%). This difference was not strictly significant with a sign test; however, it would be if it was hypothesized a priori that the wall map was more accurate ($x = 0$, $n = 5$, $p < .03$, one tailed).

There was no significant difference in the routes described incompletely, even with a one-tailed test). That is, 14% of the routes described with the wall map and 40% of those described with the path map were incorrect. This difference is significant ($x = 0$, $n = 6$, $p < .05$). Five of the six participants had more correct descriptions with the wall map than they did with the path map, whereas the sixth performed equally on both. Finally, there was no improvement in the mean accuracy of the route descriptions over the 12 route-planning tasks.

### *Map knowledge*

Descriptions of the map-knowledge task were scored in the same way as for the route-descriptions task. It was found that 38% of the wall map descriptions and 13% of the path map descriptions were described accurately. Although 38% of the wall map descriptions and 50% of the path map descriptions were incorrect, this difference was not statistically significant.

### *Subjective responses*

*Rating-scale questions.* A rating of 1 indicated "extremely negative" and a rating of 7 indicated "extremely positive" for the appropriate dimension. The participants' mean rated level of difficulty in learning to use the maps was 4.00 for both maps. The path map was rated more difficult than the wall map both for planning a route (3.3 versus 4.3) and building up a meaningful cognitive map of the route (2.8 versus 3.7). The wall map was rated as a more acceptable method of obtaining information for wayfinding in a building (4.5 versus 3.5). Both maps received high ratings for the likelihood that the participants would use them if they were available in a building visited for the first time (5.7 versus 5.2). A $t$-test for related samples revealed that the ratings for the wall map were significantly more positive than the ratings for the path map, $t(29) = 2.41$, $p < .025$.

*Preferences for the maps.* Four participants preferred the wall map, citing better imagery; for example, the indentation for a door seemed more logical as a symbol than the pointer bar used on the path map. Two participants preferred the path map's simplicity, reasoning that they did not need to know the shape of a room unless they were working in the building and that it was easier to locate things by following dotted lines.

## Discussion

The findings indicate that tactile maps accompanied by audiotaped instructions may be used independently by people who are blind for planning routes in unfamiliar buildings. The differences between the maps suggest that information about walls may be more useful than information about paths for route planning. This conclusion is corroborated by the participants' ratings and comments.

### *Generalizability*

However, these results may have limited generalizability. First, the sample was totally blind and hence is not representative of the wider population of people who are blind, who, for example, may use residual vision, as well as touch, in exploring maps. Second, many maps of buildings may be more complex than the maps used in this study. For example, for a university campus, strip maps of paths between buildings may be more useful than a plan of the whole area (Golledge, 1991), and for subway systems, "topological" maps may be the most useful (Luxton, Banai, & Kuperman, 1994). The limits of complexity and scale in map designs need to be explored further.

### *Previous reccomendations*

These results are interesting because they contradict implicit and explicit recommendations made previously by other experts. Edman (1992, p. 307), for example, encouraged the use of "topological" map designs that show "the route of the blind traveler, with all the extraneous details excluded." Preiser's (1983) second generation of tactile maps for building interiors are also path style. In addition, as Bentzen (1983) noted, paths represented as single lines are easier to follow tactilely than are wide double lines, such as those between walls on a wall map.

One unique component of the map system described here is the audiotaped instruction, which may have been critical for the success of the three participants who had never used any type of tactile mobility map. Training systems to explain the graphic conventions of a particular style of map can allow users to read maps independently and facilitate access to interiors of buildings. They can be implemented simply, as was done at The Lighthouse, with an audiotape player at the map location.

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