A Five-Year Practice of the Tactile Map Creation Service

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1. Introduction

To increase the use of tactile maps by visually impaired people, we have developed a tactile map automated creation system "*tmacs*" by utilizing ICT [1]. This Web application system enables visually impaired persons to make tactile maps by himself or herself. Because the system automatically provides tactually readable symbols for the maps [2]-[4], anyone can create easy-to-touch tactile maps.

As *tmacs* is a Web application, it is usable by anyone from any place. Nevertheless, few people personally own a Braille embosser or capsule paper heater for creating tactile maps. Thus, in June 2012, we began a service for creating and delivering tactile maps based on requests from visually impaired persons and their helpers. This is the first tactile map creation service in Japan. In the five years since then, we have created more than 120 tactile maps.

In this paper, we first categorize tactile map requests from visually impaired persons and clarify what kinds of maps are often desired. Next, on the basis of users' comments on the maps, we discuss requirements for making easy-to-read tactile maps.

2. Service Request Categorization

2.1 Number of Maps Created

From June 12, 2010, to June 11, 2015, we received 84 requests and made 120 tactile maps. Because there were applicants who requested multiple maps on an application, the number of tactile maps was greater than the number of applications. Furthermore, because from the map creator's discretion the same area is created as both a detailed map and wide-area map, in actuality there were more than 120 maps created.

2.2 Applicants

Of the 84 requests for map creation, 55 (65.5%) were made by the visually impaired person himself or herself, and 22 requests (26.2%) were made by helpers (teachers at schools for the blind or personnel at facilities for the visually impaired). The remaining seven requests were made on our own at events for visually impaired people (Sight World, Jump to Science Summer Camp, and Annual Conference of the Japanese Association of Rehabilitation for the Visually Impaired).

2.3 Categorization by Area and Purpose

Ninety of the 120 maps (75.0%) created were tactile maps of outdoor areas. Forty-eight of these outdoor maps (53.3%) were mobility maps. They included routes from one's home to the nearest train station, from a station to a destination (company, welfare facility, library, sports center, etc.). Some applicants expressed their desire to be able to walk to school or work by oneself by using the mobility map.

Forty-two of outdoor maps (46.7%) were town maps showing the surroundings of one's home or nearest train station or the whole town in which one lives. Reasons written in the applications included not knowing one's vicinity because of a recent move into the area and wishing to know one's town because of the inability to get a complete mental picture of it.

Not anticipated before the start of this service were requests for tactile floor plans of a building or property. Twenty-eight of this type of maps were made, about one-fourth of the total number of maps. Of this number, 23 maps were floor plans of a facility's layout, such as that of train stations, shops within a station building, shopping malls, and welfare facilities.

3. Map Creation Procedure

3.1 Map Image Creation

Tactile map images created to date can be divided into four types: (1) images of tactile maps created by *tmacs* and used as is, (2) images of tactile maps created by *tmacs* and greatly modified (joining multiple images or rotating), (3) maps created by tracing other maps, and (4) maps created by drawing from scratch. By percentage, type (1) makes up the majority of the tactile maps with 59.6%. Therefore we can say that *tmacs* is useful for the dissemination of tactile maps. Type (2) makes up 1.8%, type (3) makes up 24.6%, and type (4) makes up 14.0%.

(1) For a map of an outdoor area up to approximately 900 m horizontal × 400 m vertical, the tactile map image created by *tmacs* can be used almost as-is. For these maps, modification is limited to adding or deleting a small number of roads and symbols.

(2) If the desired range of the map area is broad, exceeding a roughly 900 m × 400 m area, the map is created by joining multiple map images created with *tmacs*. Because such a map may be difficult to understand due to too many roads, narrow roads are deleted.

The top of the map indicates the north in general. However, it is often easy to understand a space if major landmarks such as railroads and wide roads are aligned along the map's horizontal or vertical axis. Thus, the map can be rotated to allow such alignments.

(3), (4) If the range of the map area is further expanded, instead of deleting narrow

roads from the image created by *tmacs*, the map is created in a shorter time by tracing necessary roads from other map images.

If a district or provincial map is requested, because *tmacs* cannot output administrative boundaries, boundary lines are traced from some map image.

Similarly, *tmacs* cannot be used to create a tactile guide map of a building or property. Thus, tracing of the original visual map is done. For the original map, an architecture floor plan or building guide map is used.

To edit images of all four types of tactile maps, popular illustration or CAD software, such as CorelDraw (Corel), InkScape, and Canvas (Nihon Poladigital), is used.

3.2 Adding Tactile Symbols

The map scale and north sign is automatically added by *tmacs*. However, for the maps of type (2) to (4), the scale and direction is changed or not included initially. Thus, we add them manually using illustration software.

The surroundings of the map may have tick marks and coordinates added. By adding these features, the location of a shop or facility can be explained with a phrase like “A-1.”

3.3 Adding Braille

The names of the landmarks such as shops, facilities, roads, and railroads are input in this map image in Braille. However, Braille text takes some space. Thus, its names must be abbreviated and placed by hand. Pairs of an abbreviation and its original name are shown in the legend. The legend is included in the guide text (described below).

Since 2011, notations in ink are also included near Braille notations. This is for the sake of a sighted person who looks at tactile map and provides explanations. Because the ink is printed in a color besides black (blue or gray), it does not become raised even when heated, and does not hinder reading by touch.

3.4 Guide Text

To understand the tactile map, text explanation is essential (verbal explanation is preferable though). The content of our guide text includes the orientation of the map, north direction, names, locations, and direction of railroads and major roads, and legend. This guide text is sent to the applicant by email when sending the tactile map by post.

Figure 1 shows an example of tactile map whose image was created with *tmacs.* Tick marks and coordinates were added around the map image and Braille and notations in ink in the map.

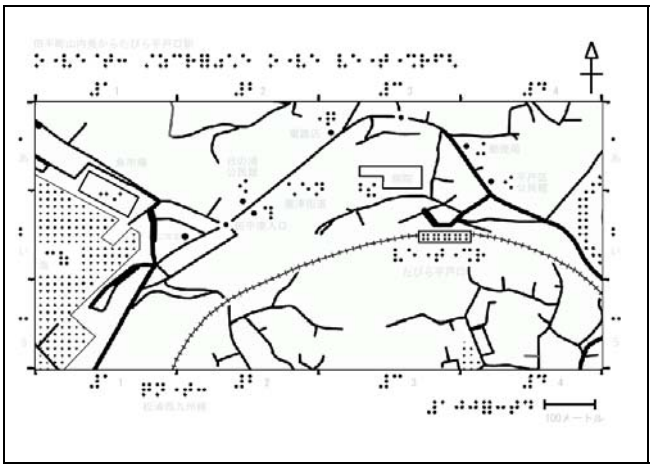

Figure 1 Example of tactile map.

4. Effectiveness of Tactile Maps

By examining received comments on tactile maps, we can explore the effectiveness of the maps and get specific suggestions on improvement.

In the five-year period since the start of this service, we have received comments from 20 persons. Sixteen of the comments were positive and seven were negative (Some applicants wrote both positive and negative comments.).

Positive comments expressed that the map helped them understand the locational relationship, namely the distance and direction, of points of interests. This understanding enabled the applicants to walk alone. For a user with low vision, the map with high contrast was easier to look at.

In contrast, negative comments stated that the map was too complicated to understand, Braille abbreviations without legend did not tell what building it was, and the entrances and exits of buildings were not drawn.

5. Future Work

On the basis of five years of map creation practice using *tmacs*, necessary improvements of it are as follows.

(1) Automated creation of wide-area maps: To respond to the requests for wide-area town maps, a function to create tactile map images that show only major roads for a map whose area exceeds 1 km on one side is needed.

(2) Direct manipulation of a map: To obtain a map that is as exact as wanted, online map applications allow the user to easily change the location and scale by the mouse. The same function is necessary for *tmacs* for sighted creators' convenience.

(3) Rotation of a map: As stated above, alignment of railways or major roads either horizontally or vertically immensely helps the user's understanding of the map. To do so,

rotation function is necessary.

(4) Auto tracing: To respond to the requests for indoor/outdoor guide maps in a shorter time, auto tracing function from some visual maps is necessary.

References

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