

The Understanding of Blind People in Recognizing Road Infrastructure On Tactile Map

F Mustofa¹⁾, S Eka Wati¹⁾, Turmudi¹⁾, Setiyani¹⁾, Setia AP²⁾, S Murdoko¹⁾,

¹⁾National Coordinating Agency for Surveys and Mapping, Indonesia

²⁾Specialized School in Yogyakarta, Indonesia

The need of any information including geospatial information is one of human rights that must be fulfilled by government and related parties. Commonly, spatial information presented on digital map or atlas, paper sheet, and book is proposed for normal people with normal vision. For blind people, a special tool is required. The tool is represented by tactile map which helps them to recognize the map, the symbol upon it, and the explanation depicted through Braille word.

Tactile map with road infrastructure's theme is an interesting focus for blind people since it will give an important knowledge on how to reach a certain area. They usually identify the environment by listening to some conversations or information given by the other people. They have not yet understood how to get into a particular area and its accessibility. Therefore, this research is intended to find the ability of blind people in recognizing road infrastructure in several big islands and among cities in Indonesia.

The result of the research shows that blind people are able to identify the symbols of road infrastructure. The further result is they are not only able to recognize, but also to understand spatial dimension among cities in Indonesia.

Key word: tactile map, land transportation, blind people

1. Introduction

The need of information including spatial information or geospatial is a human right. Geospatial information plays a role to enhance human knowledge in relation with region and its supporting infrastructures. The knowledge itself is important especially to strengthen orientation ability which influences mobility's level. The higher the human ability in recognizing the transportation facilities represents the higher their mobile ability. This mobile ability contributes human activity in fulfilling their need and resolving their problems.

Data and geospatial information are commonly available in the form of map both digital and paper sheet. Generally, those maps are intended to normal people with good sight. Cartographical contents depicted on the map can be clearly seen by them. In contrast, blind people need a certain tool to read and understand the information displayed on map.

Reading ability of blind people is determined by palm sensitivity in touching the Braille words. The result is then stimulated to the brain. The Braille words assist

them to obtain a lot of information. Unfortunately, they are not able to gather geospatial information from the common map. Therefore, a special media to disseminate geospatial information must be developed. Tactile map is the solution.

Tactile maps are a group of thematic maps which is developed by embossing the map and mixed with Braille words. A few years ago, the form of tactile map was quite simple and it only presented information of daily routine, as an example the way from home to office. The development of emboss technique is an advanced technology in developing tactile map. Through this technique, perception of blind people to understand space relatively increases. Since 1990, ICA (international Cartographic Association) committed to help blind people through tactile map. They dedicated TacNEWS as a special magazine for blind people.

Blind people in Indonesia need to know Indonesia and its characteristics as their environment. In case of curricula in special school, introduction of Indonesian's characteristics becomes an important part to improve their spatial knowledge. To address such situation, Indonesia government represented by BAKOSURTANAL held readable test of tactile map with theme of region in 2010 and road infrastructure in 2011. Readable test of road infrastructure is intended to identify mobile ability of blind people in recognizing the relationship among regions.

2. Objective and Goal

Objective:

- Introduce road infrastructure displayed on tactile map to blind people
- Examine the ability to read tactile map with theme of land transportation

Goal:

- Blind people consist of teacher and student at junior high school and senior high school in Bandung, Makassar, and Surakarta. The total is 90 people.
- Final goal is intended to the other special schools in another province in Indonesia.

3. Study Area

The study area used in readable testis Indonesia and its boundaries with neighbor countries. Besides, some of selected road infrastructures are also presented, i.e. highway, main road, secondary road, and rail way.



Figure. 1. Tactual Map of the Republic of Indonesia

4. Method

To support the readable test of tactile map with theme of road infrastructure, some required tools are needed, as follow:

- a. Readable test instrument, i.e. 30 questions related to road infrastructure.
- b. Tactile map with theme of land transportation. The dimension of the map is A3-paper size. The map covers several regions in Indonesia, i.e. Sumatra Island, Java Island, South Sumatra Island, West Java Island, Special Region of Jakarta, Central Java Province, Yogyakarta Special Province, and East Java Province.

The used method consists of several stages which are:

- a. Recognizing several variables used on tactile map.
The participants in readable test were asked to learn the map first. This activity was done to give brief description about variables and symbols used on the map. Therefore, they were able to answer the given questions. The variables and symbols on the map are displayed below:

Table 1. The Examples of Observed Objects on Tactile Map

No	Variable	Symbol	Example of Observed Object
1	Shape	Line	The symbol of rail way
2	Shape	Area	The shape of Sulawesi Island
3	Dimension	Line	The length of rail way between Jakarta-Semarang and Semarang-Surabaya
4	Dimension	Area	The width of Kalimantan Island and Java Island
5	Orientation	Point	The first and the last city of the rail way in Sumatra Island
6	Orientation	Area	Orientation and position of Malaysia as foreign country in Kalimantan Island
7	Texture	Area	Different texture between Malaysia and Indonesia at boundary zone in Kalimantan Island

Each participant tried to read the tactile map. On the left side, they identified the map whereas on the right side, they read the map explanation presented by using Braille words. All participants were expected to be able reading the symbols (point, line, area) and the explanation as well. After the practice time, they were allowed to discuss the unidentified things.

- b. Answering the questions
There were 30 questions that must be answered by all participants. The questions are closely related to the information depicted on tactile map.
- c. Evaluating the result
The answers were evaluated. The right answer must be equal or more than 60 percent. This score is a normal percentage in terms of study completion.

5. Result and Discussion

The introduction of variables and map symbols

Readable test of tactile map has been done in three specialized school (SLB), i.e. SLB Public A in Bandung, SLB-A YKAB in Surakarta City, and SLB-A YAPTI in Makassar. The participants consist of teachers and students with total of 90 people. All participants were very interested to be involved in the test. Most of them stated that they just knew the tactile map that contains information about Indonesia and its road and rail way network.

Representation of region and road network is presented upon tactile map by using the symbols of point, line, and area. As an example, a city is symbolized by point, railway by line, and island by area. The symbols were created by considering several things, i.e. easy to identify, efficient, different, consistent, and flexible. Various map symbols are grouped into some variables which are shape, dimension, orientation, and texture.

Symbol introduction held in the first day of the test gave a result that most participants did not fully understand the symbols. This situation was caused by less experience in reading the map. To cope with this condition, instructor helped them by explaining related material to the symbols.

After introducing the symbols, the test was continued by touching the symbols on the map. Participants made some simple spatial analyses. Those simple analyzes were intended to develop thought and perception about regions and connectivity among them. Participants touched all road network (high way, main, secondary, and rail way) and tried to find the correlation among them, particularly starting point and end of the road. The points themselves were associated with the first city in the beginning of the road, the last city in the end of the road, and several cities passed by such road.

Figure 2 shows rail way network in West Java Province. Generally, all participants are able to understand rail way network between Jakarta - Cirebon and Jakarta - Bandung - Tasikmalaya. This connectivity represents the relationship among places and spaces. Based on this relationship, blind people can choose their alternative way and transportation mode to get into the intended place. Furthermore, they can also predict the budget and time to reach such place. In this case, they must choose the closest way and the cheapest fare. Therefore, the role of geospatial information becomes the most important thing to inform the accessibility among places.

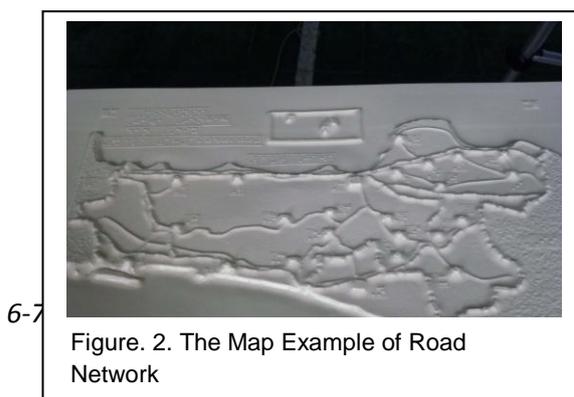




Figure. 4. The Participants



Figure. 5. The Participants Touch The Map of Road Network in Sumatra

Answering the questions

At least 30 questions were given to the participants in order to find out the ability to read and to understand the tactile map. The questions are generally grouped as shown in Table 1. Based on this method, the participants were expected to be able recognizing line shape, area shape, line dimension, area dimension, point orientation, area orientation, and area texture. Below are the examples of given questions:

Type of area orientation

Malaysia is located in.....

- A. Northern part of Sulawesi Island
- B. Northern part of Kalimantan Island
- C. Northeastern part of Timor Island
- D. Eastern part of Papua Island

Type of line shape

Rail way in Sumatra Island connectscity with.....city

- A. Bandar Lampung - Bengkulu
- B. Palembang - Padang
- C. Bandar Lampung - Padang
- D. Bandar Lampung - Palembang

Type of line dimension

By train, the distance between Jakarta and Semarang is.....the distance between Semarang and Surabaya

- A. Shorter than
- B. Longer than
- C. A quite shorter than
- D. Equal to

Approximately in 90 minutes, the participants could finish to answer the question. Explanation and practice done in the first day was quite effective to help them in answering multiple choices' question. The ability to understand the symbols and spatial intelligence's level plays a role in determining the capability to answer the given questions.



Figure. 6. The Participants Filled the Answer Sheet

Evaluation

Evaluation was conducted to analyze the answer of the participants. Commonly, the answer represents the comprehension of participants to decipher the tactile map with theme of land transportation. If participants could answer more than 60% of questions, it assumed that they were able to understand variables and symbols. However, less than 60% stands for the condition in which they could not well understand the variables and symbols.

For shape variable depicted with line symbol corresponds to the symbol of high way, main road, secondary road, and rail way. Those symbols could be well realized by the participants. The difference between main road and secondary road shown by different thickness could be also known by them. Therefore, those symbols are subsequently recommended to be standardized.

The combination of line symbol of rail way and another variable have not been well identified yet. As an example, the participants could not recognize the first city and the last city passed by rail way in Sumatra Island. It was only 57% of participants from Junior High School who could realize it. Besides, they could not distinguish the different distance of rail way between Jakarta – Yogyakarta via Semarang and via Bandung as well. The complete comparison and evaluation of the participant's answer is illustrated in Table 2.

Table 2. The Comparison and Evaluation of Participant's Answer

No	Observed Items Sample	Percentage of Participants Who Are Able To Understand / Have Correct Answers (%)		
		Teacher	Senior High School	Junior High School
1	The first city and the last city passed by rail way in Sumatra Island			57
2	Different distance of rail way between Jakarta – Yogyakarta via Semarang and via Bandung	37	30	
3	Different length of rail way between Semarang - Surabaya and between Yogyakarta - Surabaya		27	

4	Different length of rail way between Tegal - Semarang and between Purwokerto - Surakarta	47		50
5	Different distance of highway between Jakarta – Bandung and between Jakarta - Bogor			50
6	Cities passed by main road from Jakarta to Bandung			57
7	Different distance of main road from Bandung to Bogor and from Bandung to Ciamis	40	33	50
	Cities passed by northern main road from Surabaya to Banyuwangi	47	40	47
8	Different width area of Kalimantan Island Java Island	27	47	
9	Cities passed by main road from Banda Aceh to Palembang	67	67	67
10	Cities passed by west main road from Bandar Lampung to Jambi	60	60	60
11	Different distance of rail way between Palembang – Prabumulih and between Prabumulih – Lubuklinggau		63	67
12	Different length of rail way between Jakarta - Semarang and between Semarang - Surabaya	63	60	77
13	Cities passed by rail way from Palembang to Lubuklinggau	60	67	67
14	Cities passed by north path from Yogyakarta to Tegal	60	60	60
15	Cities in East Java connected by high way	83	60	60

Shape variable displayed into area symbol, particularly which is illustrated in the form of island and region was well understood by the participants. Nevertheless, they have not been yet identified the width area. Most of them had difficulties in identifying the width area. It was only 27% of teacher and 47% of senior high school student who could know the different width area of Kalimantan Island and Java Island (see Table 2 number 8).

For dimension variable with line symbol presented in thickness of main road and secondary road was easy to understand even the participant still had problems in relation with the length of high way (see Table 2 number 5 and 7). On the other hand, orientation variable with point symbol demonstrated as a direction from one city to another through rail way, high way, main road, or secondary road was quite difficult to figure out. However, for some questions, they could easily recognize it (see Table 2 number 9 to 15).

Orientation and texture variable with area symbol can be well apprehended by the participants. More than 60% of participants could answer two question related to direction and position of Malaysia in Kalimantan Island and also western boundary of South Sumatra Province.

Conclusions

1. Generally, the main symbol used on tactile map with theme of land transportation (rail way, high way, main road, and secondary road) can be identified by the participants. It can be shown from the percentage of correct answers.
2. Less comprehension in recognizing the symbols is influenced by less experience and knowledge to read the map.

3. Specification of main symbol on current tactile map (rail way, high way, main road, and secondary road) is proposed to be standardized and utilized as a guidance to develop tactual map with theme of land transportation.

References

- Bakosurtanal. 2011. Draft of Tactile Map Specification and General Rule to Develop Tactile Map. Annual Report.
- Bowerman, P. 2009. SA Braille Atlas. *Paper*
- Evan BS.2008. Tactile Learning and the ICT Curriculum. *Paper*
- Kardono, P. 2006. *Pengembangan Peta untuk Tuna Netra (Tactile Map) dan Perspektifnya di Indonesia. Paper.*
- Vozenilek, V. 2006. 3D Printing Technology in Tactile Maps Compiling. *Paper.*

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2	Title of the paper	The Understanding of Blind People in Recognizing Road Infrastructure On Tactile Map
3	Name of the Presenter	Fakhruddin Mustofa, S.Si, M.Si
4	Mailing Address	Bakosurtanal, Jl. Jakarta-Bogor Km 46 Cibinong, Bogor 16911
5	Email Address	uddin_mustofa@yahoo.com
6	Fax number	62 8764613
7	Author(s) Photograph	
8	Brief Biography	Place, date of birth: Klaten, 2 Juni 1978 Religion: Islam Educational History: - Senior High School of Jatinom, Klaten - Graduate: Faculty of Geography, Gadjah Mada University - Post-graduate: Environmental Study, Indonesia University Work: Center for Atlas and Spatial Planning National Coordinating Agency for Surveys and Mapping (BAKOSURTANAL) Jl. Raya Bogor Km. 46, Cibinong, Bogor, West Java