

Measuring the Adequacy of Maps for Field Use

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Introduction

The study is aimed to work out a method for **estimating the adequacy of a map for field use**. Studies show that a person's **map reading skills can be measured with tests** (Wakabayashi 2013, Wakabayashi and Matsui 2013). According to the results, using small scale maps requires geographic knowledge, while the use of large scale maps is affected by spatial abilities. Even the comprehension of different map objects varies in difficulty for map readers: for example understanding symbols is a simpler task than comprehending contour lines and hypsography. **Cultural differences can also affect the orienting and map reading skills** (Ito and Sano 2011). While test subjects from North America could orient better using verbal directions, Japanese participants were more effective with maps. By studying the **perceptive and cognitive-skills required for orienting and spatial thinking** (Guzmán et al. 2008) it is found, that memory has an important role in orienting and recognition of relief forms. **The adequacy of map symbols can also be measured** (Pődör, 2002). Geometric symbols and pictograms can be recognised easier, than identical shapes with different colours. A previous study by Albert (2014) that **measures the amount of information that map readers receive while reading an archive map** defines seven map categories (directions; linear features; hypsography; names; measure units; coverage; points) to classify the data used by the subjects during map reading tests.

Methods

In the present research, **the use of two different types of maps** (a geological and a tourist map) **was tested** with 44 voluntary participants. The participants filled out a **questionnaire**, then took part in an **interview**. The purpose of the questionnaire was to **measure the map reading ability** of the subjects, this way distinguishing them into three categories: **beginner, intermediate, expert**. The analysis focused on the competences of the subjects, in connection with reading different map categories. The score of each task was weighted depending on the number of good answers given (the question's difficulty and the weighting was proportionate). The participants' map using habit was also tested to find out, if it is related

to the map reading skills. These questions focused on the map types the subjects used, and the frequency they used them.

During the interview, the participants had to **study and explain a route with their own words**. The route was the same on both types of maps and the scale of the maps was also the same (1:25 000), this way **the topographic information** used on the two maps **could be compared**. The verbal descriptions were digitized as texts, and the expressions, describing the different map categories were extracted from the texts with a semi-automated data-mining application.

After analysing the extracted data, the **difference between the adequacy of the two types of maps was expressed** for the three map user categories (Table 1.). Additionally it was also shown, which map category was used most frequently by the different map users. The relative adequacy of the compared maps was measured based on the assumption, that **a map is more adequate for field use, if a map reader used more expression while reading it**. This comparison can be expressed by percentages (100% means total similarity, a smaller number means less expression on the geologic map, while a larger number means more).

Results

According to the results, those participants, who often use **topographic maps** reached the **highest score** in the questionnaire (76% on average) meaning they are the most familiar with maps, while those who use **city maps** the most, reached the **lowest score** (64% on average). The participants, who read **tourist maps** often, used the **most expressions** (50 words on average) during the interview, while those who read **thematic maps** the most **used the least** (22 words on average).

The results also show that the **topographic content of the geological map was difficult to read** for all participants, while the same category on the tourist map was easy to read for them. The participants **used more expressions** on average **while reading the tourist map** (77 words), than reading the geological map (24 words). The **expert map readers used the most expressions**, an average of 51 words, while the beginners only used 19 words (the total average was 41 words). By measuring the **relative adequacy of the map categories** (Table 1.), it can be seen that the **linear features** (6-16%), the **hypsography** (75-200%) and the **coverage** (18-50%) **differed the most** amongst the map readers. The **smallest difference** can be found in **the directions** (60-69%) and **names** (63-83%). Although most map categories could be used better on the tourist map, **expressions of hypsography occurred more often on the geological map**. This suggests that by the lack of linear map objects, the participants tried to use the morphography for orientation. The overall results show that the **field-use adequacy of the geological map relative**

to the tourist map was 31-34%, meaning that the test subjects could understand **less topographic information** on the geological map by **67%**.

By using this method, other maps' adequacy can be measured numerically, and with the results, the maps can be changed to fit the map readers' demand.

	Dir.	Linear features	Hyps.	Names	Units	Coverage	Points	Relative adequacy
Expert	50%	13%	200%	50%	67%	13%	0%	31%
Intermediate	57%	12%	75%	83%	0%	25%	0%	33%
Beginner	60%	6%	200%	67%	100%	50%	0%	34%

1. Table The geological map's adequacy relative to the tourist map (100% means total similarity).

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