

Measuring the adequacy of maps for field use

Csaba SZIGETI¹ and Gáspár ALBERT¹

¹ Department of Cartography and Geoinformatics, Faculty of Informatics, Eötvös Loránd University, Budapest, Hungary

Introduction

The study's goal was to create a method for estimating the adequacy of maps for field use. For this, 44 voluntary participants filled a test to separate them into three categories according to their map reading skills, then took part in an interview that measured the adequacy of a geological and a tourist map.

Previous studies show that a person's map reading skill can be measured with tests (Wakabayashi 2013, Wakabayashi and Matsui 2013). This is affected by various factors including cultural differences (Ito and Sano 2011) and memory, which has an important role in orienting and recognition of relief forms (Guzmán et al. 2008). The adequacy of map symbols can be measured, and certain types are recognised easier (Pödör, 2002). The information used during map reading can be classified into seven map categories: directions; linear features; hypsography; names; measure units; coverage; points (Albert, 2014).

Methods

Measuring the map reading skills

The purpose of the test was to measure the map reading ability of the test 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 (Figure 1). 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 use, and the frequency they use them.

Measuring the maps' adequacy

During the interview, the participants received either the geological or the tourist map, and had to study and explain a route with their own words (Figure 2). The route and the scale (1:25 000) was the same on maps, this way the topographic information could be compared. The verbal descriptions were digitised as texts, and the expressions describing the different map categories were extracted with a semi-automated data-mining application.

By analysing the extracted data, the difference between the adequacy of the two types of maps was expressed for the three categories (Table 1), and the frequency of different map categories' usage was also shown (Figure 3). 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).

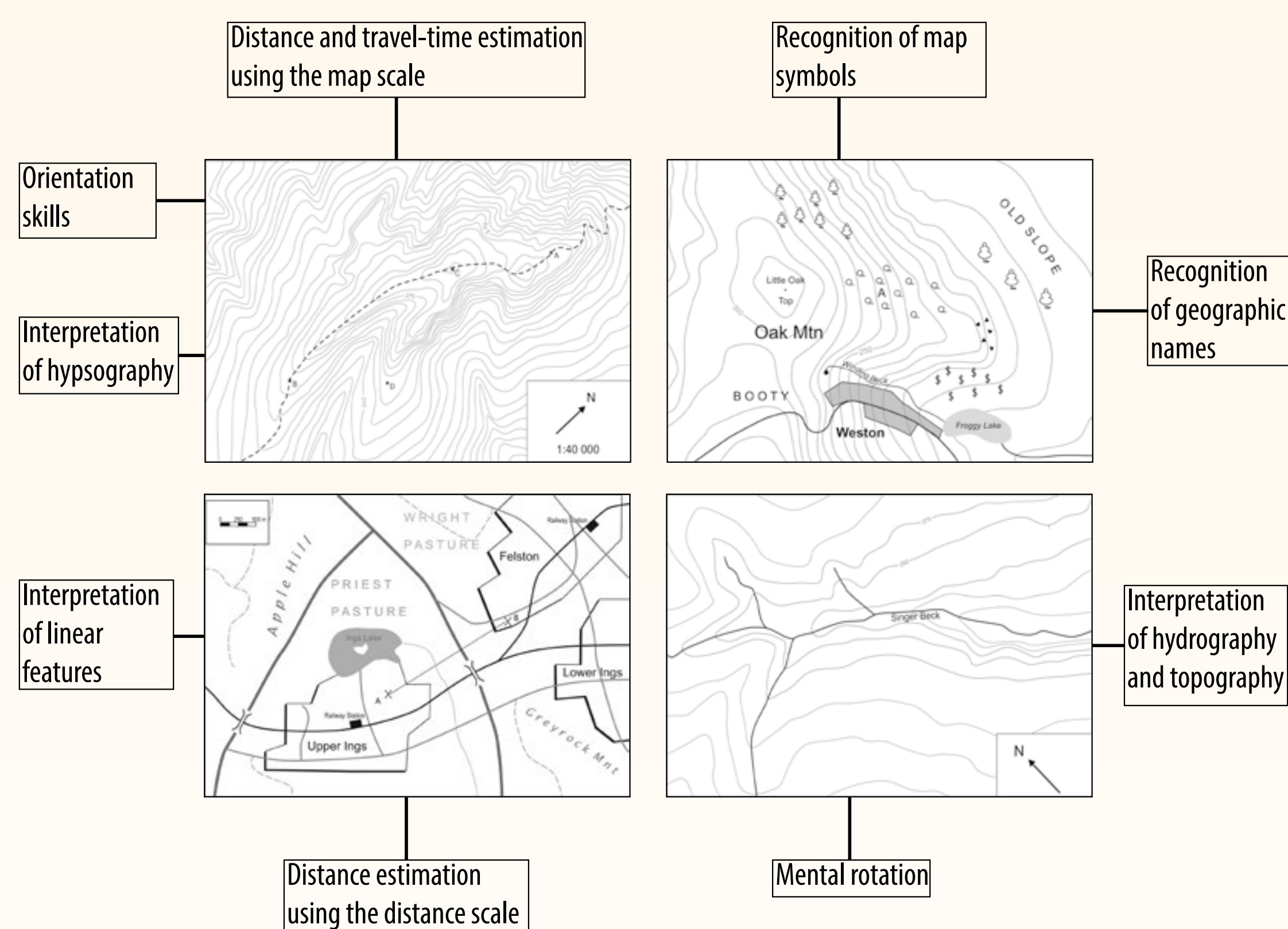


Figure 1 showing four maps that were designed to test specific map reading competences.

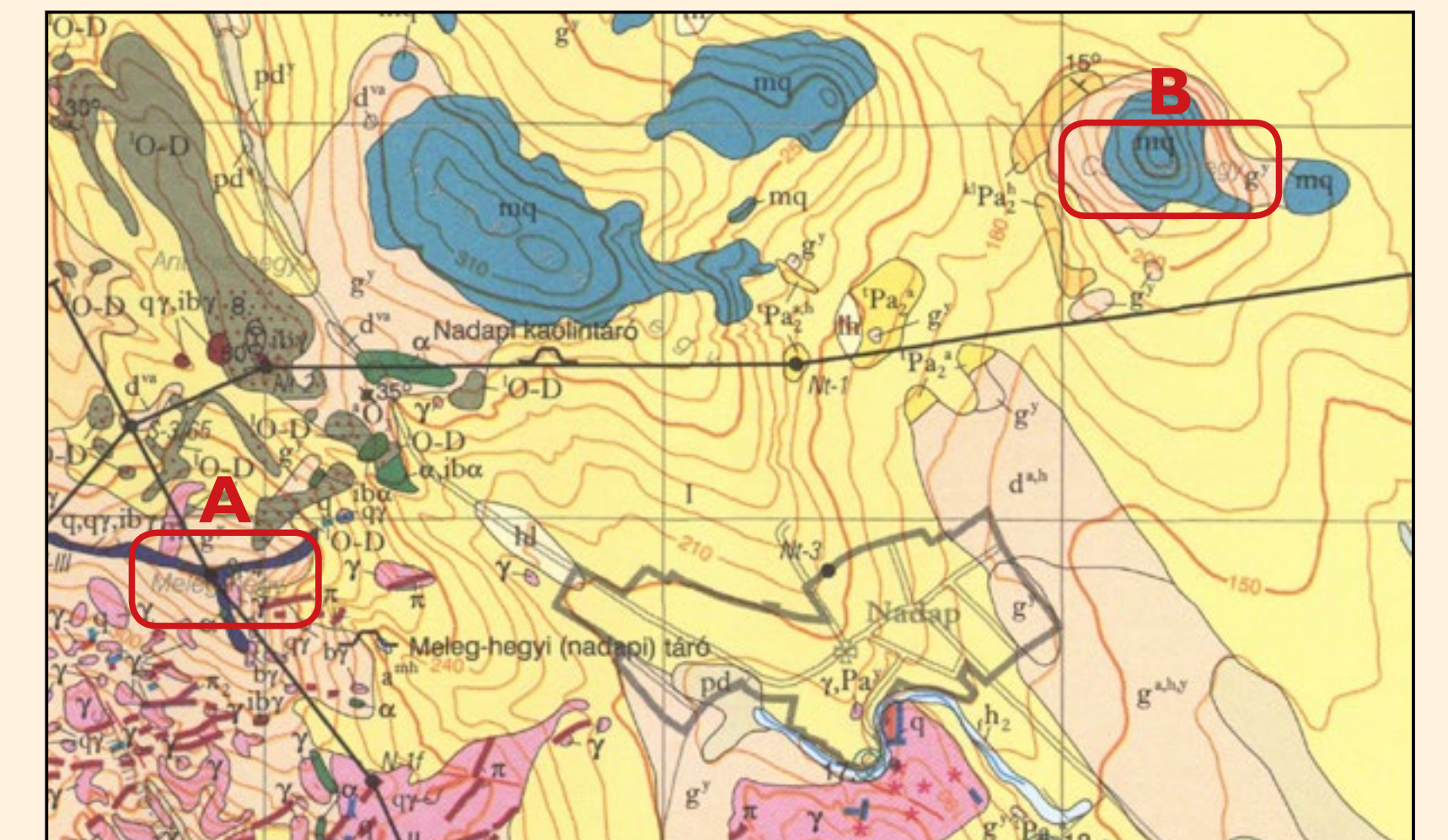
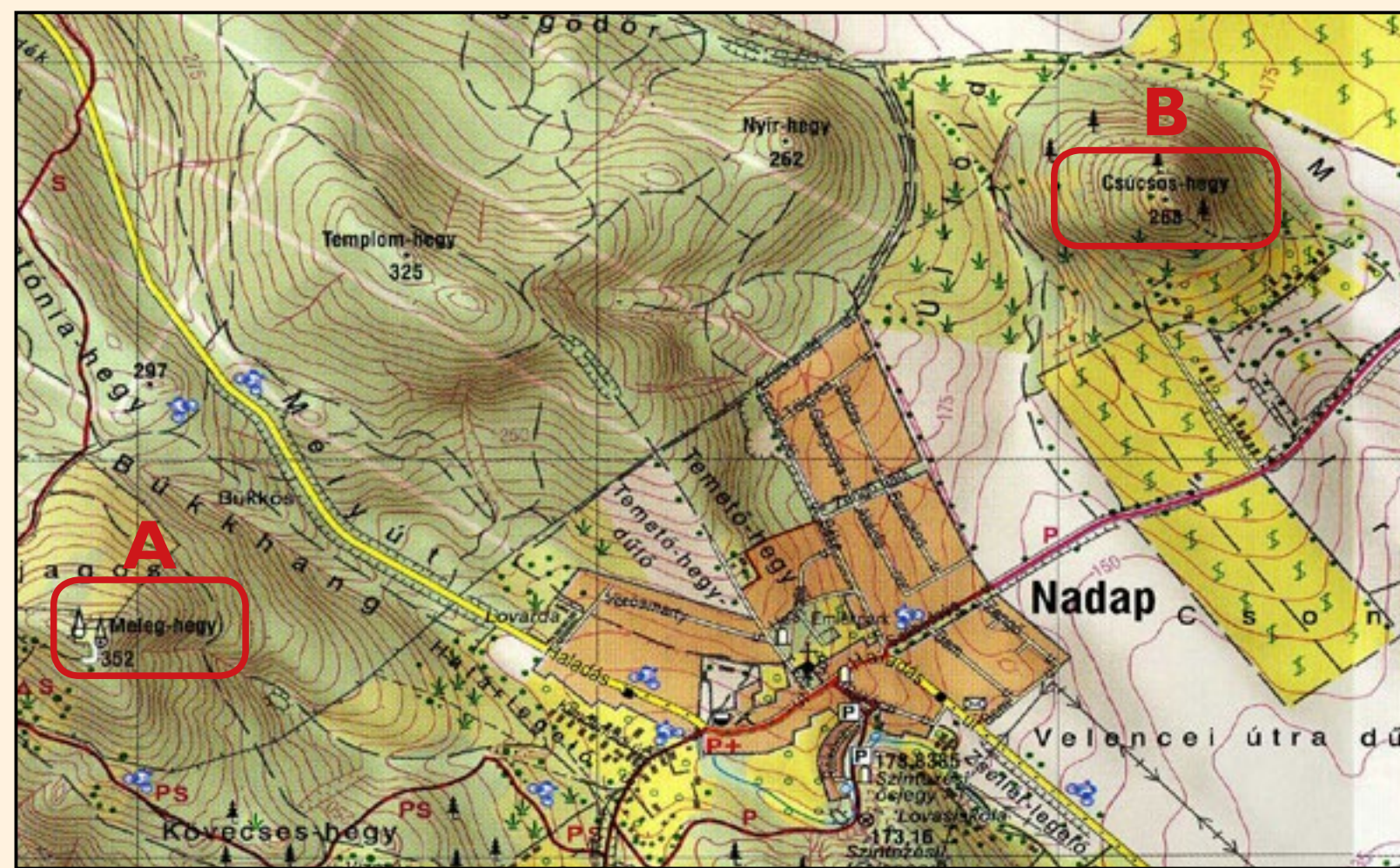


Figure 2 showing the tourist map (left) and the geological map (right) used during the interview. The participants had to describe a route from point A to point B on one of the maps.

Results and Conclusion

A total of 44 test subjects were involved in the research. Those participants, who often use topographic maps reached the highest score in the map reading test, meaning they have the best map reading abilities, while those who use city maps the most, reached the lowest score (Figure 4). The participants, who read tourist maps often, used the most expressions during the interview, meaning they can apply maps the most effectively for field use. Those who read thematic maps the most, used the least expressions (Figure 5).

The geological map's topographic content was more difficult to read for all participants, than the tourist map's. On the geological map, the participants mainly used expressions related to directions, and used the points', coverage's, measurement units' expressions the least. On the tourist map the most used expressions were linear features, and the points, measurement units, hypsography were used the least (Figure 3). The relative adequacy of the map categories were measured (Table 1). The adequacy of linear features (6-13%), 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%). Most of the map categories could be used better on

the tourist map, but 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 33% on average, 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.

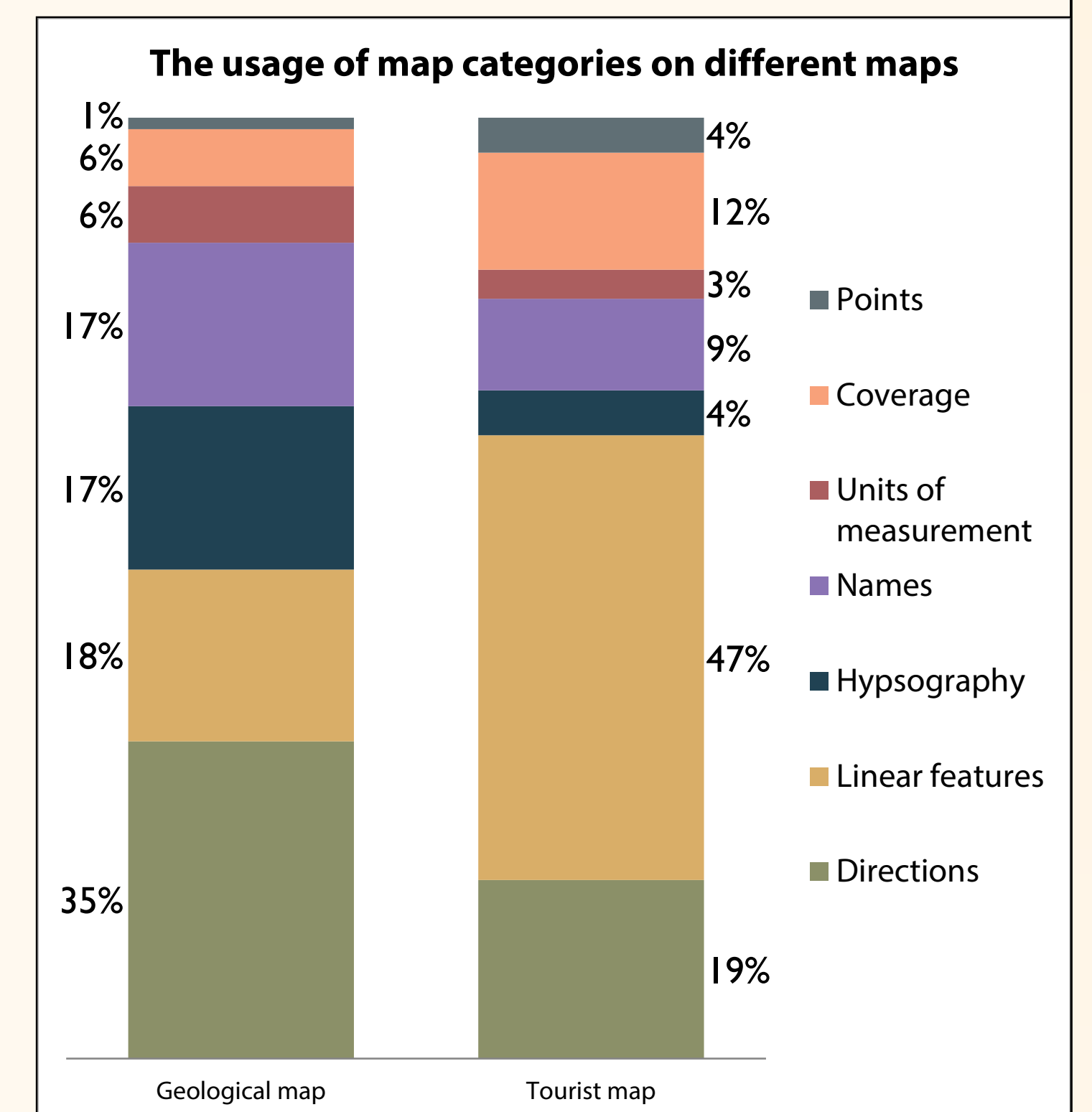


Figure 3 showing the usage of map categories on the geological and tourist map. The participants mainly used directions on the former and linear features on the latter one.

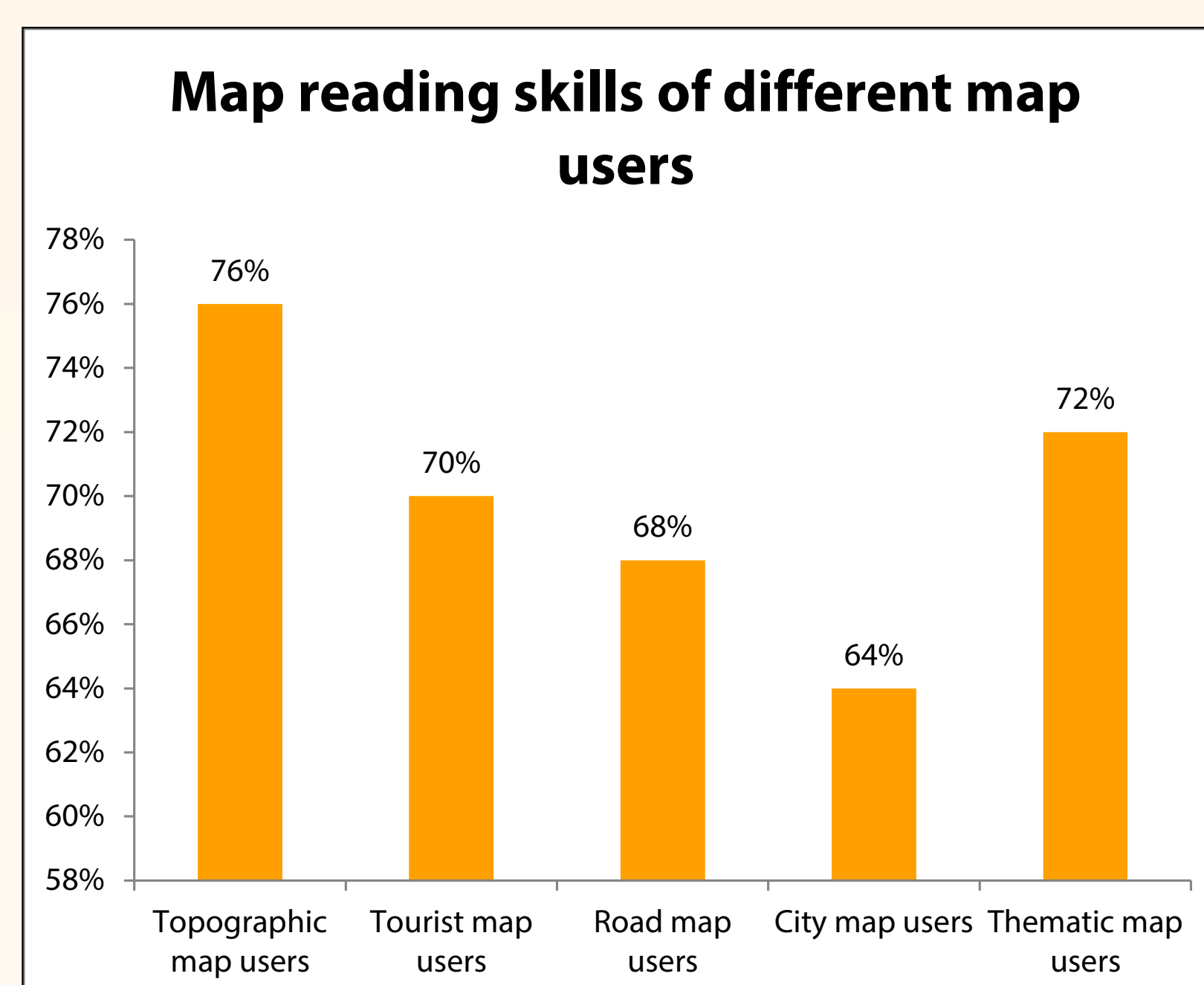


Figure 4 showing that those who read topographic maps have the best overall map reading abilities.

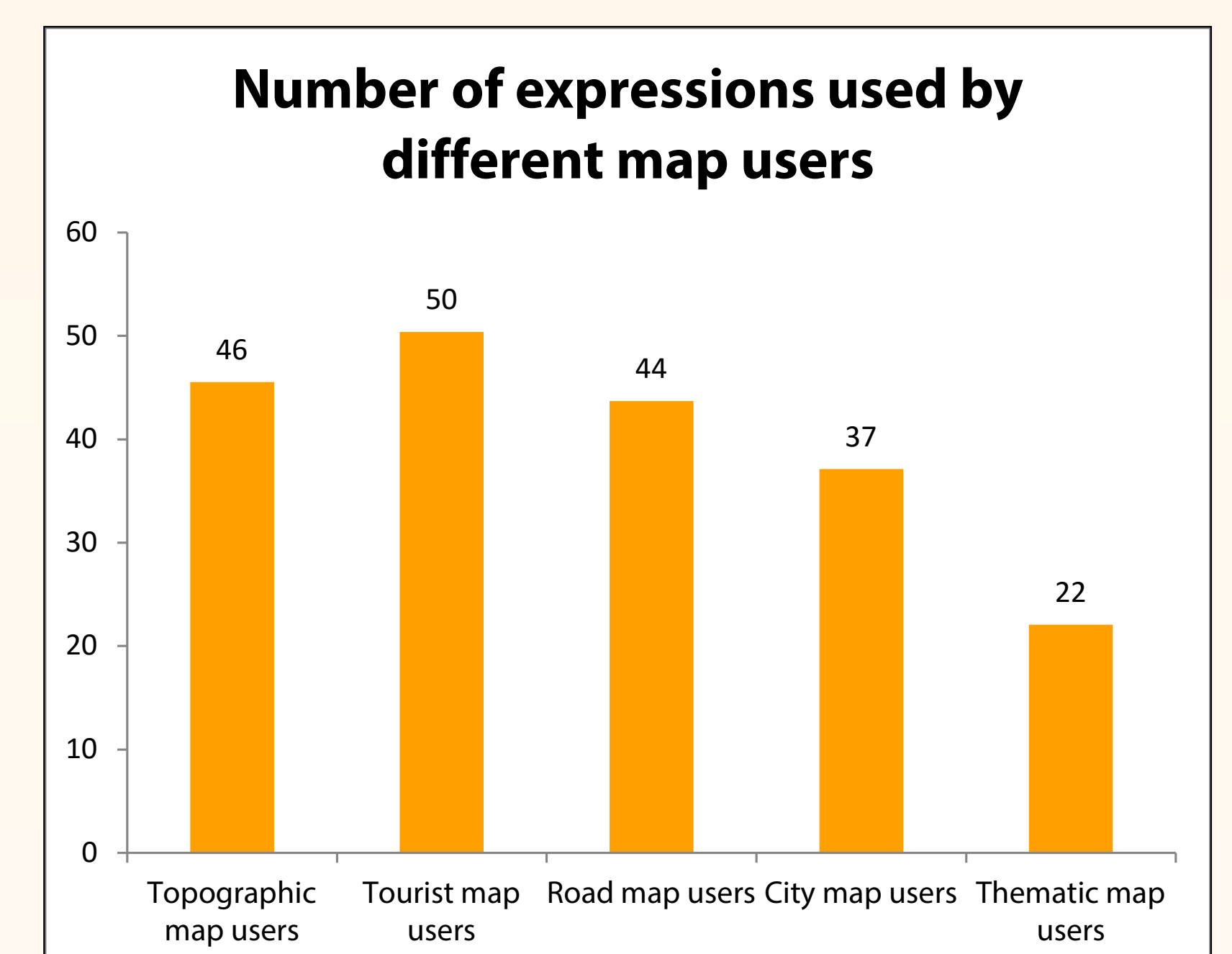


Figure 5 showing that those who read tourist maps can apply maps the most effectively for field use.

	Directions	Linear features	Hypsography	Names	Units of measurement	Coverage	Points	Overall
Beginner	60%	6%	200%	67%	100%	50%	0%	34%
Intermediate	57%	12%	75%	83%	0%	25%	0%	33%
Expert	50%	13%	200%	50%	67%	13%	0%	31%

Table 1 showing the geological map's relative adequacy to the tourist map. 100% means total similarity, smaller values mean lower while higher ones mean better adequacy.

References

Albert G. (2014) What Does an Archive Map Tell the Contemporary Map Readers?: Information Transmissivity Analysis on the Survey Maps of the Josephinische Landesaufnahme (1763–1787). 9th International Workshop on Digital Approaches to Cartographic Heritage. Budapest, Hungary, International Cartographic Association
 Guzmán J. F, Pablos A. M, Pablos C. (2008). Perceptive-cognitive skills and performance in orienteering. *Perceptual and Motor Skills* 107 (1): 159-164.
 Ito K, Sano Y. (2011). Cultural differences in the use of spatial information in wayfinding behaviour. Ruas A. (Ed.). 25th International Cartographic Conference, Paris, France, International Cartographic Association.

Pödör A. (2002). A halak tartózkodási helyének horgászterképeken történő optimális ábrázolásának vizsgálata (Examination of the optimal representation of the residence of fishes on maps). *Térképtudományi Tanulmányok (Studia Cartologica)* 12: 153-160
 Wakabayashi Y. (2013). Role of geographic knowledge and spatial abilities in map reading process: implications for geospatial thinking. *Geographical reports of Tokyo Metropolitan University* 48: 37-48.
 Wakabayashi Y, Matsui, Y (2013). Variation of geospatial thinking in answering geography questions based on topographic maps. Buchroithner M. F. (Ed.). 26th International Cartographic Conference, Dresden, International Cartographic Association.