

Cultural Aspects of Cartographic Creation: Use of Mental Maps in Cross-cultural Research

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Abstract. Although the interdisciplinary study of the cultural aspects of cartographic creation has in the recent past been dealt with in an indirect manner, for example by J.B. Harley and D. Woodward in the project "History of Cartography", the question has not as yet been adequately taken up on a complex level. The author of the present study attempts a more complex approach in his treatment of the problem. This paper includes a theoretical introduction devoted to map contents, map style and map language, which together represent the greatest potential cultural differences embodied by a map, considered here in its role as a depiction of reality and a visual manifestation of culture. A portion of the study focusing on method assesses the procedures employed in the formation of cognitive and mental maps by users and map creators. These maps may be used to discover cultural specifics of cartographic creation. The final portion of the study presents the findings of a field study of the mental maps of school children from Czechia, Western Europe and the village of Yawan (Papua-New Guinea).

Keywords: cross-culture research, mental maps, map stylistics, cultural specificities of artifacts

1. Introduction

Recent trends in cartography include an increasing, somewhat fascinated, reliance upon geoinformatics and geoinformation systems in the hope that they may one day solve all potential problems presented by the task of spatially depicting the world around us. On the other hand, there is ever more evidence that such solutions neglect the human and social aspects of cartographic creation. But it is the study of these very aspects that enables creators of maps to understand just what a user expects from a map, in what form a map is most useful to him or her, etc.

It is the aim of the theoretical portion of this paper to examine the use of “mental maps” in a cross-cultural research in order to demonstrate the enormous potential offered by a more user-centered or “humanitarian” approach to cartography. It shall also point out the rather close connection between cultural specifics in map creation and map style. The practical portion of the paper presents the findings of a field study of the mental maps of school children from Czechia, Western Europe, including France and Switzerland, and the village of Yawan in Papua-New Guinea. The paper also offers an interesting comparison of the map language and map contents of these maps.

The interdisciplinary study of the cultural aspects of cartographic creation has in the recent past been dealt with indirectly, for example in the project “History of Cartography” by J.B. Harley and D. Woodward (1992). Nevertheless, it remains for the question to be adequately taken up on a complex level. Meanwhile, consideration of users’ cultural specifics will assist future cartographers in creating maps that are truly useful and of high quality, and not merely according to conventional criteria.

2. Cultural specifics of cartographic works

This study uses two analogies as a theoretical basis for the study of the cultural specifics of maps: *the map as an image of reality* and *an analogy between map language and ordinary language*. The first offers as a tool the theory of the image (Aumont 2005), which is closely connected to visual anthropology and is concerned with the visual manifestations of culture. The second analogy provides space for observations and methodology taken from linguistic anthropology.

These two analogies are to a certain extent related to two aspects of maps’ cultural specificities, namely *map content* and *map language*. Of course it is also important to distinguish a map’s individualized characteristics, based directly on a particular map’s creator, from culturally determined characteristics. As Pravda (2003) notes, it can be quite easy to confuse the one for the other, regarding the manifestations of an individual cartographic style as elements of a culturally defined cartographic style. This problem may be avoided by addressing a significant sample of participants from all of the cultures in question and by the subsequent synthesis of these results.

2.1. Cultural differences in map contents

The first basic circumstance bearing on the analysis of a map’s cultural specificities is the fact that a map’s contents constitute information about the surrounding universe. If we regard culture as a cognitive system accord-

ing to Keesing's classification (1974), in which different cultures employ varying cognitive styles and have particular experiences and knowledge sets, then the universe will be interpreted differently by different cultures. As a consequence, two members of differing cultures regarding the same "reality" will (quite apart from the way a camera will interpret it) interpret that reality and depict it on a map in two different ways.

There will also be differences in the selection of objects and other phenomena due to differing priorities, such that members of a given culture may simply not perceive a given object or phenomenon. The result is a map depicting only that which a given subject regards as important. There are also differing strategies and means of generalizing reality. Among other things, this means that contents of maps designed by members of various cultures will differ, even as they depict the very same terrain. This is demonstrated by the results of Trent's study of the perception of space by children in the Canadian city of Whitehorse: "The maps demonstrate that certain landmarks were recorded by members of the Indian group, others by members of the non-Indian group of participants. Some recorded landmarks were common to both groups." (Trent 1971: 90)

2.2. Cultural differences in map language

A second analytical level of cultural differences in maps is that of map language. To a certain extent, map language is related to a map's means of expression, that is, to those means by which people communicate visually, as demonstrated by Bertin (1983). If we accept the analogy between map language and conventional language, then we may consider map language to be a specific tool of communication. Eco (2004) classifies map language, together with algebra and chemistry, among formalized languages.

As in other sub-disciplines of cultural anthropology, the dialogue between relativity and universality is a leavening agent of linguistic anthropology, which is also useful to the study of map language. According to the Sapir-Whorf hypothesis, a concept important to linguistic anthropology as an argument for linguistic relativity, cognition and interpretations of reality are closely related to the language conventions of a given culture, social group, etc. (Sapir 1912, Whorf 1940).

The question arises to what extent the grammar of a map language used by individual cultural groups is universal. The foremost proponent of the idea of universal grammar, i.e. of language's innate character, has been the American linguist Chomsky (Pokorný 2010). When examining contemporary maps, it is clear that map language is now more universal than it was in the past. Why is this so? A primary assumption of the notion of universalizing of map language is that it is similar to the contact that occurs among

ordinary languages. Just as with ordinary languages, change in a map language may occur in two basic forms: divergence and convergence. Whereas divergence is the result of differing development and consequential isolation, convergence occurs when languages become more similar to each other. Such changes also occur under the influence of prestige and cultural, political and economic dominance (ibid.). "Most languages suffer a 'slow death' that accompanies the transition to a more dominant language." (ibid. 151)

The case of map language reveals the influence of western cartographic production on native customs in practically every corner of a globalized world. As Monmonier observes (1996), one may still experience *cartographic culture shock* even within the context of differing map styles in the Western world. He demonstrates this by showing stylistic disparities among topographical maps from the U.S.A. and Switzerland.

2.3. Differing perception of reality and space, differing map styles

The greatest potential cause of differences in map contents and language is differing perception of reality and space. Various cultures have different ways of perceiving things such as distance and proportion, as well as colors, right angles, perspective, light and shadow; they read images in varying directions, etc. (Bohnemeyer & Brown 2007, Levinson & Wilkins 2006). This accounts in part for differing navigational-spatial systems, such as the geocentric system on Santa Isabel in Oceania. Perception and interpretation of space may be influenced by environment, experience and the society in which an individual finds him or herself.

A range of *cartographic conventions* are based on the perception of the space around us mediated by representations and photographs, as well as from traditional perception of colors and colored symbols. How else can we explain, for example, the use of blue to represent water when water is, in fact, clear? The fact that primitive societies did not experience developmental stages similar to the European Renaissance, which brought a new understanding of perspective among other things, might have an effect on perception of space, use of color and other means of expression in maps and, consequently, may lead to the rise of *differing cultural map styles*.

3. Use of mental maps in an intercultural map study

The question arises which methods to use when investigating the cultural specifics of maps and map styles. Cultural anthropology employs a range of methods, including long-term field research, a method in use since the 19th

century (Soukup 2009). Cultural-anthropological research generally combines quantitative and qualitative methods, with qualitative methods predominating. There are a range of methods for gathering data in the field, above all observation, interview and document collection. Collection of data is followed by its analysis and interpretation. The comparative method is most commonly used in cultural anthropology, opening possibilities for cross-cultural research.

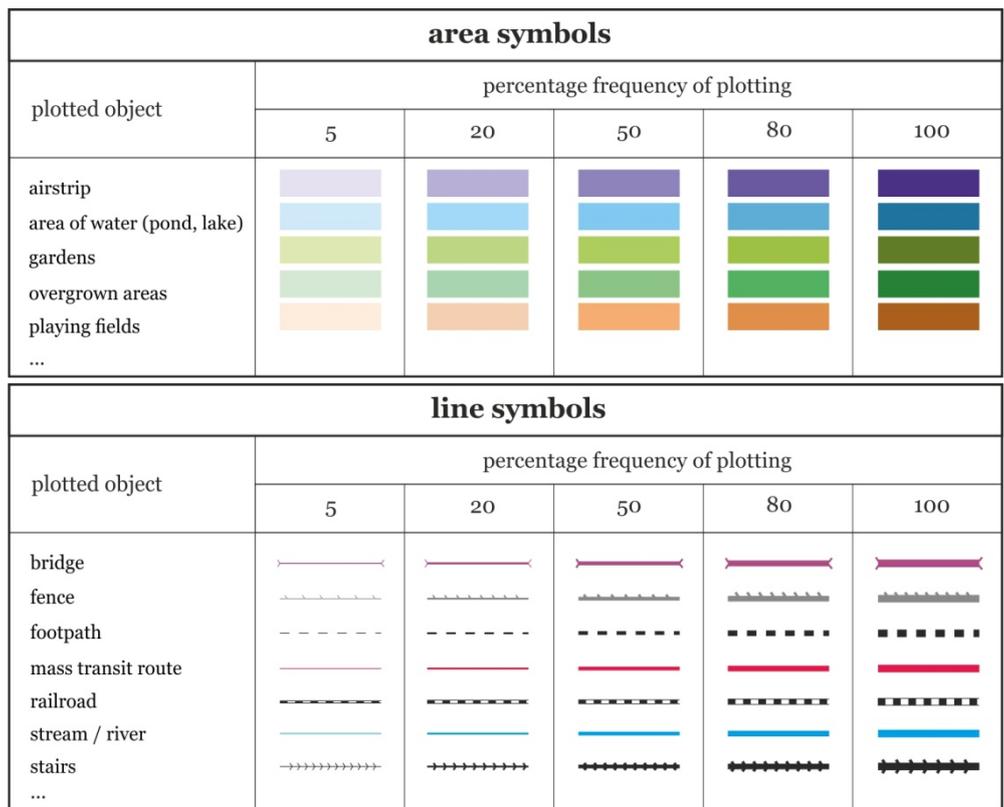
A desire to eliminate problems associated with verbal methods, namely interviews, led some researchers to employ *cognitive or mental maps created by respondents*. Such methods may be a highly useful tool for analysis of culturally specific maps. Tolman (1948) was the first to use the term “cognitive map” when describing orientation behavior in laboratory animals. A cognitive map is created in a process of “cognitive mapping” defined as “psychological processes enabling an individual to obtain, store and finally use information related to places and their characteristics.” (Downs & Stea 1973) The cognitive map concept often appears in concert with the “mental map” concept, the meaning of which has been defined by a number of experts (e.g. Lynch 1960 or Gould & White 1986) and may be understood as the materialization of ideas about space transferred to paper or another recording medium (Nižnanský 1994). It is important to note that some disciplines understand these concepts somewhat differently.

It was Nižnanský (1994) whose research determined how, on one hand, mental maps influence conventional maps and, on the other, how knowledge of conventional maps influences the formation of mental maps. An analogy between mental and conventional maps may be seen in their similar geometry and similar map key. Additional research (Trent 1971, Saarinen 1987, etc.) enables us to assert that mental maps represent suitable material for the analysis of cultural specificities of maps and of cultural map styles. This is especially true when dealing with cultures that possess no conventional maps and for which it is thus impossible to conduct traditional documentary analysis.

3.1. Analysis of the contents of mental maps

Most useful for the cultural analysis of maps is analysis of mental maps' contents – i.e. analyzing the frequency of individual objects and phenomena occurring on the map. For this purpose one may use a method for evaluating mental maps that has been tested, for example, on maps created by orienteering runners in the context of another study by the author of this paper (Kynčlová et al. 2009).

Mental maps obtained from participants in a study are aggregated on the basis of certain groupings (e.g. according to individual cultural groups). The result is a small set of “aggregated mental maps.” While these are after all merely a simplified representation of the mental map contents of the larger group, the smaller set of maps allows for more lucid comparison. Information about the frequency of particular content elements is preserved and expressed cartographically (*Figure 1*).



point symbols, map lettering					
plotted object	percentage frequency of plotting				
	5	20	50	80	100
"my home"					
church					
flowers					
school					
waterfall					
...					
names of map element	<i>Example</i>	<i>Example</i>	<i>Example</i>	<i>Example</i>	<i>Example</i>

Figure 1. Example of a part of map key from aggregated maps formed from the mental maps of study participants.

3.2. Analysis of map language of mental maps

In addition to contents, it is appropriate to conduct an analysis of the map language of mental maps based on an analysis of the concrete means of expression employed. For this purpose it is possible to use a method for evaluating the relation between mental maps and conventional maps used by Nižnanský (1994) based upon the statistical frequency of the means of expression (map symbols) employed and which classifies map symbols as "dominant and subordinate" (*Figure 2*). Objects and other phenomena depicted, as well as the varying forms for expressing meaning, may be entered in a table or on a map similar to the aggregated mental map above. Results should be prepared from data for each individual cultural group, and these results should in the end be compared.

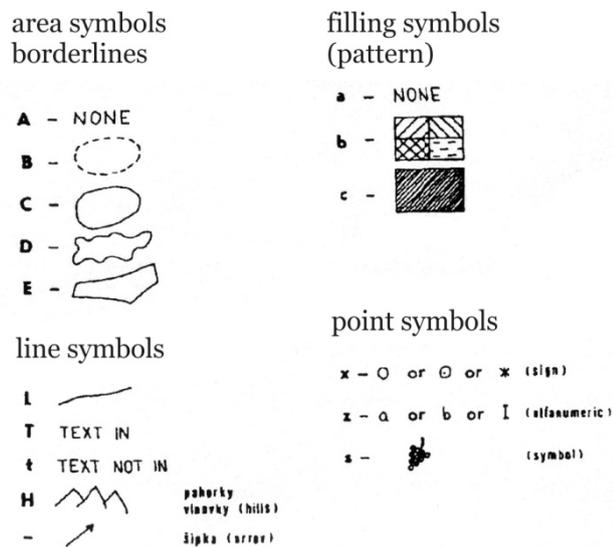


Figure 2. Means of expression for representing an area's mountains and wine regions (Nižnanský 1994).

4. Field study of cultural specificities in mental maps

4.1. Proposed course of research

During the initial phase of the study, it is necessary to conduct a search for a suitable pool of participants. In order to obtain comparable samples, each cultural group should be similar in size (e.g. 30–40 participants in each) and members' ages, and each should include both male and female members. A suitable target might be groups containing children between the ages of 10 and 15 years old. Children of this age are considered suitable with respect to the negligible influence of conventional cartographic products on them, but also because of their presumed experience with drawing and other graphic expression. An expanded variant might include more groups with members representing more age categories.

The key element of the study is of course the *nature of the tasks* themselves, which should be based on the demands of the research. The following tasks were assigned to participants and constituted the basis for all information obtained:

1. draw a path from your home to a familiar or a favorite place (e.g. to school, to work, to a restaurant, to a cliff on the beach) and mark important spots along the path (*path*),

2. using a map, describe the location, where you live, that you like or know intimately – the home and its surroundings – (*description of a place*),
3. using a map, mark out the territory or indicate the boundaries of your home (*territoriality*).

The performed tasks are then assessed, either in the presence or in the absence of the participants. An advantage of the first variant is increased understanding of individual maps; a disadvantage is the greater demand on time.

4.2. Course of research itself and results

Mental maps were obtained from members of several cultural groups within the framework of this study during 2009–2012. A total of 194 mental maps were obtained from a total of 110 individual participants. In the course of two anthropological excursions (2009 and 2011) in Yawan, Papua-New Guinea, the anthropologist M. Soukup obtained 13 and 12 mental maps respectively from Yawan school children. On the occasion of an international scout camp held in Czechia in summer, 2011, the author of this paper obtained a total of 55 mental maps from 12–17-year-old boys primarily of French citizenship. In spring, 2012, the author of this paper then obtained 114 additional mental maps from 12–14-year-old schoolchildren from two groups of a secondary school in Prague. Two basic mental map designs were involved: a map of European culture and a map depicting the Papuan language group Yup from the village Yawan and its surroundings.

When analyzing these mental maps, one notices immediately that the maps' languages – that is, the conventional “tongues” employed to communicate verbally – correspond to the cultural groupings of participants. That is, the majority of Francophone map creators describe objects in French, the Czech children use Czech and the Papuan children use the language spoken in their school, English.

Further comparison of the obtained samples reveals that the Papuan participants devoted much more attention to *compositional elements of the maps*. This may be due to the fact that they were given more time to draw their maps. None of these maps, of course, contain a scale or an indication of cardinal north. By contrast, the scale plays a much larger role for the European groups and is, in fact, the most frequently occurring compositional element. In many cases, the measure of the scale is judged poorly. The Papuan participants, given more time for their task, created maps whose composition is more carefully considered, sleeker and with content that forms a more condensed whole.

As this study also demonstrated, *map contents* are influenced by both the environment in which a creator lives and the situation in which the creator finds him or herself at the time of creation (e.g. the Francophone group, miles from home). A sizable role is also played by the precise assignment of a task, which should be as universal as possible. Results from the Czech group show that participants drew a path from home to school, whereas the Francophone participants were given a broader choice of possibilities. In this regard, unfortunately, it is impossible to conduct a comparison with the Papuan group. Each group drew into its map those content elements that serve as dominants or landmarks, as well as elements serving as trails or roads and enabling people to move through space, and even junctions / nodes. The Czech group shows a special tendency to enclose objects, drawing the borders of properties, of apartment blocks, etc., and to divide space into segments. The functional division of map contents also corresponds to the locality in which a participant lives, as well as to the task assigned. A statistical summation of map contents is provided by *Table 1*, which presents elements as they appeared in the analyzed maps, including the rough percentage frequency of their occurrence.

Groups participating in research	Czech	French	Papua 1	Papua 2
Depicted elements having the character of landmarks				
buildings / groups of buildings	80 %	100 %	100 %	100 %
museum, hotel or other important buildings	20 %	20 %	0 %	50 %
dwelling	80 %	100 %	100 %	100 %
"my home"	80 %	80 %	20 %	0 %
cemetery	0 %	20 %	20 %	5 %
trees	20 %	20 %	50 %	80 %
flowers	0 %	5 %	50 %	50 %
church tower	5 %	0 %	0 %	0 %
toilets	0 %	0 %	5 %	50 %
shine board	0 %	0 %	0 %	20 %
stones	0 %	0 %	5 %	5 %
waterfall	0 %	0 %	50 %	20 %
names of properties, streets, etc.	20 %	0 %	0 %	0 %
Depicted elements having the character of a nodes				
buildings				
school	80 %	20 %	5 %	20 %
church	20 %	20 %	80 %	80 %
railway station	5 %	5 %	0 %	0 %
intersection / crossing / traffic light	50 %	50 %	0 %	0 %
mass transit stop (with lettering)	50 %	20 %	0 %	0 %
reservoir /water container	0 %	0 %	5 %	5 %
Depicted elements having the character of a paths				
footpaths, streets, roads	80 %	100 %	100 %	100 %
mass transit route (with label)	80 %	0 %	0 %	0 %
railroad or other tracks	20 %	0 %	0 %	0 %
bridge	20 %	0 %	0 %	0 %
Depicted elements having the character of a borderline or edges				
fence	0 %	20 %	20 %	50 %
stairs	20 %	0 %	0 %	0 %
railroad / footpath / tracks	5 %	5 %	0 %	0 %
stream / river	20 %	5 %	20 %	50 %
Depicted elements having a districts				
gardens	0 %	20 %	20 %	80 %
hills	0 %	0 %	5 %	50 %
groups of buildings	20 %	5 %	0 %	0 %
municipal square / parking lot	20 %	20 %	0 %	0 %
edge of village / town	20 %	0 %	5 %	0 %
area of water (pond, lake)	0 %	5 %	5 %	20 %
airstrip	0 %	0 %	20 %	0 %
overgrown areas × areas with no vegetation	5 %	50 %	50 %	50 %
enclosure for fowl / pigs	0 %	0 %	5 %	5 %
playing fields	0 %	5 %	5 %	50 %

Table 1. Content of assessed mental maps with elements classified according to Lynch's theory (1960).

A basic comparison of *map language* allows us to conclude that the influence of Western cartographic conventions on the participants from Papua-New Guinea leads them to produce maps with only negligible differences from those produced by the Europeans. The Papuan maps are more colorful. Most of them are drawn with one shade of pencil and then colored in. This tends to be an effect when a map comes into being in stages. Iconic

representation of figurative elements and pictorial maps were produced more frequently in the Papuan group (Figure 3), yet it also revealed attempts to geometrize and schematize map symbols. In this group there were no examples of general schematization of space. The Czech group was unambiguously dominant in this regard (Figure 4).

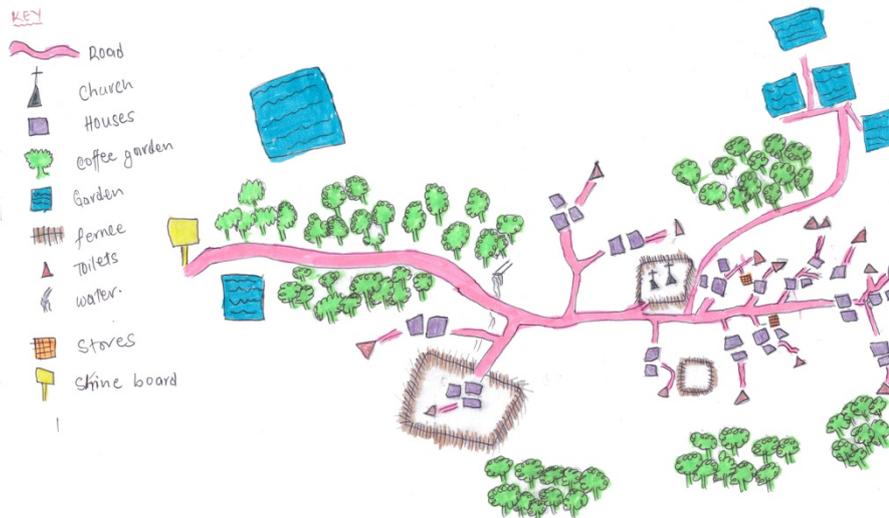


Figure 3. Sample mental map from Papuan group

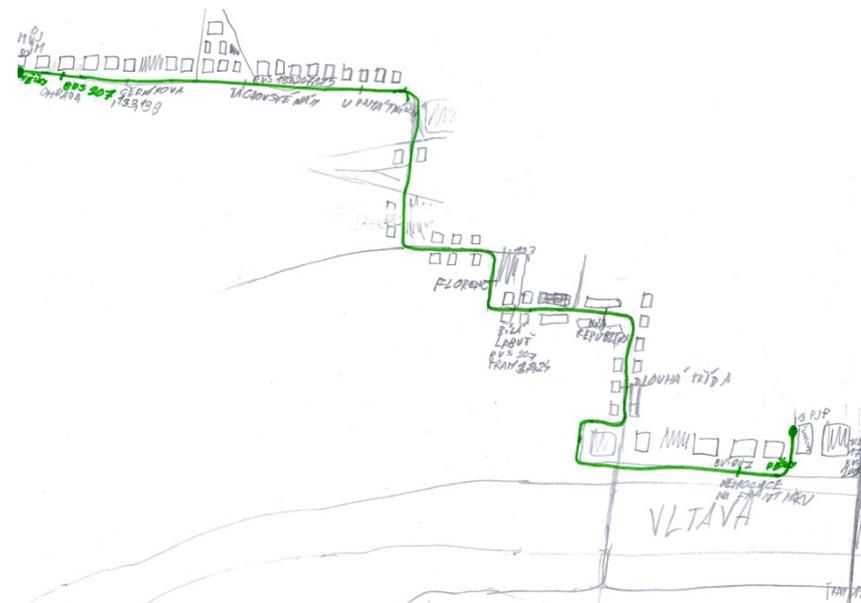


Figure 4. Sample mental map from Czech group

4.3. Evaluation of study

The goal of the research described above was to test the proposed methodology in a pilot study. The validity of the field study as it was conducted is somewhat limited, since the results do not meet all of the conditions of a comparative study and the proposed methodology was not fully observed. Nevertheless, the results provide valuable information, both in the event of further research along these lines and for the study of the cultural specificity of the maps themselves.

Fundamental problems in the field study are most evident in the fact that the mental maps are not created by the participants under comparable conditions: the assignment of tasks was conducted a bit differently for every group, which is reflected in the varying map contents; the Francophone participants were not in an optimal psychological state (away from home for a long period of time, fatigue); the maps were created under varying methodological circumstances, particularly in the case of the Papuan group; the Francophone group contained no girls; the ages among the groups did not fully correspond to one another; and, given the overall heterogeneity of the sample obtained, it must be considered to be a relatively small one.

5. Conclusion

In today's globalized world, it is increasingly evident that it is not enough for cartography to merely follow modern technological trends, but rather it must respect the specific needs of the users for whom maps are made. Only thus can it be guaranteed that the information conveyed to users may be correctly interpreted and successfully utilized. This is also the only way to increase maps' potential utility and make cartographic creation more effective. Interdisciplinary approaches employing knowledge from the humanities may be usefully exploited to this end.

This paper offers a cultural-anthropological perspective on cartographic creation, a much broader problem than it might seem at first glance. A crucial role in the analysis of cultural specificity of maps is played by, above all, map contents and map language manifesting itself through diverse means of expression. The visual nature of cartographic creation enables us to classify maps among the phenomena of visual culture, while the analogy between map language and conventional language allows us to make use of findings in linguistic anthropology. Both of these aspects of cultural variation are influenced by environment, experience and other attributes of an individual and his or her respective culture. Map content and map language then create space for the inception of a culturally specific map style.

The completion of the pilot study of schoolchildren from Western Europe, Czechia and Papua-New Guinea demonstrates the suitability of methodology employing the cognitive or mental maps of users. It is evident from the study that the success of such research depends upon a sufficiently large sample of users willing to participate in such a study. We must also acknowledge that, in spite of all efforts to the contrary, these questions will be studied from the perspective of European culture. For this reason it is necessary, as with any anthropological research, to try to detach ourselves from our roots. And these are truly great challenges.

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