SELECTED CULTURAL DIFFERENCES AND THEIR POTENTIAL INFLUENCE ON MAP-BASED COMMUNICATION IN EARLY WARNING AND CRISIS MANAGEMENT

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Abstract
Growing internationalization in early warning and crisis management increasingly puts cross-cultural issues on the agenda. This holds especially true in the response phase where numerous time critical decisions have to be made and mistakes might have serious consequences. As maps play a crucial role in such situations, cultural impact on them and its implications are the focus of this paper. Considering two topics from cross-cultural research - assessment of context information and classification strategies - possible consequences for map design and interpretation are discussed. First selected results from cross-cultural studies are introduced for each topic, followed by several examples from German and Chinese city maps that document likely cultural influences. Finally, potential impacts on map-based communication in early warning and crisis management are addressed.

Keywords: China, cross-cultural cartography, cross-cultural research, early warning and crisis management, Germany, map design, map signs

INTRODUCTION

In times of increasing global integration, international cooperation is of growing importance. This holds true for efforts in the realm of early warning (EW) and crisis management (CM). In these efforts maps, as the most important means of spatial communication play a crucial role. This is especially true in the response phase ("Successful Response Starts with a map"; NRC, 2007), but also in all other phases of the emergency management cycle (recovery, prevention/mitigation, and preparedness).

A characteristic that makes the response phase so special is the often-necessary struggle to save as many lives as possible. In such situations, countless sensitive time critical decisions have to be made and the mistakes might have serious consequences. These distinctive stressing factors put a lot of pressure on the search and rescue (SAR) team members. Maps designed for use under such circumstances must be optimized in so as far as possible.

One essential precondition for such an optimization is comprehensive knowledge about the map users involved. Among the characteristics that are less well understood so far are cultural traits. In SAR operations often times people from several different cultural backgrounds (e.g. among the affected population as well as SAR team members from several cultural groups) have to communicate with each other by means of maps. Which problems could arise in such situations?

The following sections of this paper address two exemplary topics: assessment of context information and classification strategies. First, several studies from cross-cultural research are summarized. In a second step, these results are applied to explain certain differences between German and Chinese city maps. Finally in the last section, some possible consequences for map-based communication in SAR operations are discussed.
EXAMPLE ONE - ASSESSMENT OF CONTEXT INFORMATION

What we can learn from cross-cultural research

Context or contextualization is a topic of interest for many years in cross-cultural research. In 1976, the American anthropologist Edward T. Hall formulated the following definition: "A high-context (HC) communication or message is one in which most of the information is either in the physical context or internalized in the person, while very little is in the coded, explicit, transmitted part of the message. A low-context (LC) communication is just the opposite; i.e., the mass of the information is vested in the explicit code." (1989:91).

While Hall's view was grounded in his behavioral observations, several cross-cultural psychologists extended this definition of difference between HC and LC communication and applied it to perceptual domain. Ji, Peng, and Nisbett (2000 cited after Nisbett 2003:96), for example, conducted a Rod and Frame Test with participants from East Asia (mostly Chinese and Koreans) and from the US. In this test, initially invented by Witkin and his team 1954 (ibid.), participants judge the orientation of a rod within a rotatable frame. For participants from HC cultures this judgement is expected to be more influenced by the frame position. In LC cultures, the judgement is expected to be less field dependent. The results showed that the judgement was more influenced by the frame position among the Asian participants.

Especially interesting from a cartographical point of view is the Framed-line Test developed by Kitayama, Duffy, Kawamura, and Larsen (2003 cited after Norenzayan et al. 2007:579). The initial experimental design consists of a square with a vertical line inside. Participants draw either a line of the same length or a line of relatively the same length in another, differently sized, square. The experiment was conducted with Americans and Japanese. As expected, the members of a HC culture like Japan performed better in the relative task while the members from the LC American culture performed better in the absolute task.

Chua, Boland, and Nisbett (2005) tested European American and Chinese graduate students for differences in scene perception using eye-tracking equipment and photographs with clear-cut focal objects and backgrounds. The eye fixations of participants were recorded while looking at each picture for three seconds. The results mirrored membership of the participants to LC and HC cultures respectively. European Americans were less interested in the background (= context) information and looked earlier and longer at the focal objects than the Chinese participants, who likely were more inclined to assume that the background provides important context information. The authors of this study concluded: "The result is that we see different aspects of the world, in different ways." (Chua et al. 2005:12633).

Evidence from maps

As Hall pointed out, Germany and China are situated at the opposite ends of the LC-HC continuum (1989:91). Could this have any effect on maps produced in these countries? Based on evidence from cross-cultural psychology we have to assume yes. However, how exactly could this influence manifest itself in maps? In this section, some evidence from German and Chinese maps is interrogated to generate some potential answers to this question.

Angsüsser, in a study of point symbols (map icons) in city maps (2011) found distinct cultural differences in how theses signs are separated from their backgrounds. Altogether 540 map icons from 20 German and 476 map icons from 20 Chinese city maps were compared. The presence or absence of a background, a border line, or a shadow effect in these maps was evaluated (Fig. 1a). While nearly 57% of all German map icons used at least one of these features, only about 28% of the Chinese map icons were designed in such way. Additionally there was a difference between icons with partial backgrounds or partial border lines (Fig. 1a) in the two icon sets. Of the 57% German icons examined about 9% had only partially designed backgrounds or border lines. For the 28% Chinese icons examined, this ratio was about 21%. Thus, only about 23% of the Chinese map icons were completely enclosed by a background or borderline, or separated from the map background by a shadow effect. Figure 1b shows the two most extreme examples of all 1016 map icons investigated. The figure in the German sign is separated from the map background by a high contrast icon background, a border line, and a shadow effect, while the Chinese sign is hardly discernable because it nearly merges into the map background.
When comparing maps, it was also interesting to see that in China the background is sometimes used differently than in Germany. In the maps shown in Figure 2, for example, areas are highlighted by presenting them with higher information density, i.e. a more detailed and naturalistic background.

Another example is the Beijing Airport Express Train map as displayed inside trains above the doors (Fig. 3a). In this schematic route map, the background is used for another map depicting the whole subway network with the airport express train as a part of it (Fig. 3b). In this instance, two different scaled maps are shown at the same time. From a geometric point of view, the larger scaled map in the foreground is more abstract than the smaller scaled map in the background. These examples clearly show that in Chinese cartographic representations, the background is also a source of information in its own right, not just an accessory part with some supportive function for the foreground as typically seen in Western maps.
EXAMPLE TWO - CLASSIFICATION STRATEGIES

What we can learn from cross-cultural research

Not all cultures attach the same amount of importance to classification and grouping strategies. Chinese scholars, for example, traditionally regard it with suspicion. Nisbett cited (from Mote 1971) the ancient Taoist philosopher Chuang Tzu with the words: "[...] the problem of [...] how terms and attributes are to be delimited, leads one in precisely the wrong direction. Classifying or limiting knowledge fractures the greater knowledge." (2003:138).

In every society, classification strategies are necessary to some extent, for reasoning and communicating. However, as several cross-cultural studies have shown, there are distinctions in the kind of strategies used in different cultures. Nisbett and Norenzayan summarized them for East Asians and Americans in the following statement: "East Asians tend to group objects on the basis of similarities and relationships among the objects, whereas Americans tend to group on the basis of categories and rules." (2002:585).

The four studies selected for being introduced here dealt with matching habits concerning pictures, words, and objects. In a study by Chiu 1972 (cited after Nisbett 2003:140) American and Chinese children had to match single pictures (e.g., one of a cow) to one of two other images (e.g., one of a chicken and one of grass). The Western children were more likely to select a picture of an object which can be connected via a common category; they selected the chicken because cow and chicken are animals. The Chinese children on the other hand, preferred to match pictures of objects that were connected via a relationship between them; they matched the cow with the grass picture because cows eat grass.

Norenzayan, Smith, Kim, and Nisbett (2002:663ff) presented two sets of four drawings depicting flowers to European American, Asian American, and East Asian (Chinese and Korean) undergraduate students. The participants then decided into which of these two groups they would classify other, similar drawings, the so-called target objects. Most of the European Americans chose the group where it was possible to apply a single distinct rule for the classification (e.g., flowers with straight short stem). Whereas the East Asians, classified the target objects more often into other groupings based on more complex criteria. Here no simple rule existed, but by comparing several properties (e.g., petals, stems, and leaves of the flowers), the East Asian students tried to optimize family resemblance. The Asian Americans showed - as expected - intermediate results.

A third study, conducted by Ji, Nisbett, and Zhang (2002 cited after Nisbett 2003:140f), applied a similar procedure to test American and Chinese (from mainland and Taiwan) college students. Instead of pictures, three words (e.g., panda, monkey, banana) were shown to the study participants; they had to decide which two of them fit together best. Again, the strategy used most often by the Americans was to find a common category (e.g., panda and monkey are grouped together). The Chinese participants on the other hand showed the expected preference for a relationship-based matching of the words (e.g., monkey and banana).
Iwao and Gentner (1997 cited after Nisbett/Norenzayan 2002:583) investigated how Americans and Japanese (children and adults) group objects. First they presented, a pyramid made of cork and then two other objects, e.g., a pyramid made of white plastic and a piece of cork. Afterwards the participants had to decide which of the two shown objects are more similar to the one first displayed. Americans most often chose two equally shaped objects (e.g., cork pyramid and plastic pyramid), while Chinese preferred matching based on substance (e.g., cork pyramid and cork piece).

**Evidence from maps**

Based on these studies, it is quite easy to infer that Chinese, like East Asians generally, tend to classify based on inherent similarities and relationships. However, in none of these studies did German participants took part. Which classification and grouping strategies do they prefer? It can be assumed that Germans use similar strategies as Americans, i.e. they classify based on categories and rules. Arguments to justify this view are the language similarity and the intellectual history (e.g., founding of set theory by the German Georg Cantor 1874).

Therefore, in this section some examples from German and Chinese maps demonstrate the probable influence of the different classification and grouping strategies. In Figure 4, a map icon from a Chinese city map with the meaning "travel agency, point of interest" is reproduced. These two meanings are connected via a functional relationship, i.e., at a travel agency one can book a guided tour to points of interest. The sign depicts a female tour guide with a flag (tour guides typically use flags to signal their group where they are). Such a combination of meanings is very unlikely in German maps, because map producers there would prefer to separate such meanings.

![Figure 4: Map icon (resized) with the meaning "Travel agency, Point of interest" taken from a Chinese city map (see Appendix)](image)

This can clearly be seen in the second example. While in Chinese city maps the meanings "hotel" and "restaurant" are often depicted together, i.e., with only one sign expression (Fig. 5a), they are always represented separately in German city maps (Fig. 5b). This also reflects differences in the languages. In Chinese the characters "酒店" [jiǔdiàn] mean hotel as well as restaurant. Again, a functional relationship between hotel and restaurant can be assumed because the latter is often a part of the former. In the first example, however, it was possible to choose one sign expression (presenting a female tour guide) that is related to both sign meanings (travel agency, point of interest). For the meanings "hotel" and "restaurant" this is more difficult (under the given size restrictions for such map signs).

![Figure 5a: Map icons (resized) with the meaning "Hotel, Restaurant" taken from four Chinese city maps (see Appendix)](image)
The four map icons chosen for Figure 5a exemplify four different solutions to this problem. Two times the restaurant part (crossed fork and knife, wine glass) of the overall meaning is favoured and two times the hotel part (bed, letter "H"). In one of the German signs both meanings are depicted (crossed fork and knife above a bed) although the explanation in the legend only covers the meaning "hotel (choice)". The addendum "(choice)" together with the crossed fork and knife in the sign suggest that only hotels with a restaurant are included in that map. Still, the mapmakers preferred to explain only one meaning in the legend. Even in this situation, they shy away from subsuming two usually separated meanings in one sign expression.

![Figure 5b: Map icons (resized) with the meanings "Hotel" and "Restaurant" taken from two German city maps (see Appendix)](image)

The last example (Fig. 6a) is about a map icon with the meaning "fly-over crossing". From a Western perspective, its topology looks quite strange. It evokes an association of the biohazard sign (Fig. 6b). A possible explanation for its shape is a kind of graphical family resemblance of a complex real-world crossing. In fact, many geometrical relationship properties of such a crossing are there: converging and diverging lines, crossing lines, and circle-like structures. They tell us something about the inner structure or substance of a fly-over crossing, while the overall impression of the outer shape is not depicted.

![Figure 6a: Map icon (resized) with the meaning "Fly-over crossing" from a Chinese city map (see Appendix)](image)

HOW CULTURAL DIFFERENCES COULD INFLUENCE MAP-BASED COMMUNICATION IN EARLY WARNING AND CRISIS MANAGEMENT

The examples discussed in the evidence from maps sections underscore differences between maps produced in Germany and China. Likely explanations for them are cultural differences although other explanations are possible as well. Even if we assume they are culturally related, the potential impact does not seem to be substantial. Most of them may be no problem in everyday map-based communication, but under the special conditions in EW and CM, with its high time pressure and other stress factors, such minor differences could have serious consequences.

The different role context information may play in HC and LC cultures could lead, for example, to a loss of information in cross-cultural communication situations. From a Westerners view, certain information could be hidden in the context (e.g., in the background like in the Beijing Airport Express Train map; see Fig. 3a). People from the West usually expect to get all-important information in a straightforward way. In cartographical education they learn to organize the map content in hierarchical layers (e.g., Spiess 1996:66), dedicating the crucial information to the first layer in the foreground. Consequently message speed (Hall / Hall 1990:4ff) is higher in Germany than, for example, in China.
At first glance, a higher message speed seems to be an advantage for maps used in EW and CM. On the other hand, it increases the risk of overlooking important information. As there is less contextual information included, interesting relationships might get lost. From this point of view, the best solution is probably to produce and use different kinds of maps depending on the task: highly selective analytical maps for communicating the most crucial information as fast as possible and comprehensive complex maps including more background information (e.g., satellite imagery) to enable thorough analysis of relevant relationships.

Of course, it is not a new idea to produce different kinds of maps for different kinds of tasks. The point is that there are distinctions in the prevalent cognitive style of members of different cultures who are therefore better suited to handle certain kinds of maps. However, this does not ensure successful map-based cross-cultural communication in EW and CM. To achieve this goal it is necessary to standardize to a large extent the purpose, design, and usage of relevant maps. This must be done as part of international (cross-cultural) training courses.

It is not enough to standardize map symbols alone as differences in classification and grouping strategies create additional complexity. To know what a sign expression represents it is necessary to have comprehensive information about its meaning and its real world object, i.e., to study its semantics and sigmatics. Otherwise, there is even more room for misunderstanding although people are communicating with the same map signs and words (both are sign expressions; meanings only exist in our minds).

CONCLUSIONS

The examples and discussions in this paper point out potential influence of cultural differences on map-based communication in early warning and crisis management. If such influence becomes an actual problem highly depends on the circumstances in certain map use situations. However, it is impossible to define these circumstances precisely because of research deficits as well as the inherent general vagueness of cultural concepts. It is neither clear what exactly culture is, or how to find the spatial and temporal borders between groups with similar cultural traits. Additionally it is impossible to predict a single person's properties solely based on his/her cultural background. Even if we were able to define all cultural characteristics with sufficient precision, we would not know how individual characteristics influence cognition. Some people may be typical representatives of their culture, others are not.

The real benefit to gain from cross-cultural research is to raise awareness of differences between people from distinct world areas. Already described systems of thought (Nisbett et al. 2001), or cognitive styles (Witkin 1967; Sadler-Smith / Boland, J. E. / Nisbett, R. E. (2005): Cultural variation in eye movements during scene perception. In: Proceedings of the National Academy of Sciences of the United States of America (PNAS), Volume 102, Number 35, August 30, 2005: 12629-12633.


BIOGRAPHY

Stephan Angüsüß is a lecturer at the Department of Geographic Information Science and Cartography, School of Resource and Environmental Science, Wuhan University (China). After studying Geography/Cartography at the University of Vienna (Austria), he worked as Teaching Assistant at the Department of Cartography at the Technische Universität München (Germany). His research interests focus on theoretical cartography, map design, and cross-cultural issues in cartography. He is a member of the national cartographic societies of Austria and Germany.

APPENDIX

Figure sources (all map titles are translations from the original languages German and Chinese; if you need original titles, please contact the author)

Figure 1a (from left to right):
Official City Map Düsseldorf, 1:20000, Provincial Capital Düsseldorf's Survey and Land Registration Bureau, 2003
City Plan Nuremberg, approx. 1:17000, Fuchs Publishing House, ca. 2002
Official City Map Regensburg, 1:12500, City of Regensburg's Planning and Building Department, 12th Edition, 2005
Shanghai Tourist Guide and Map, approx. 1:31000, Shanghai People's Publishing House, Shanghai Surveying Institute, 2005
Guangzhou Traffic and Tourist Map, 1:32000, Guangdong Map Publishing House, 8th Impression, 2007
Figure 1b (from left to right):

Figure 2 (from left to right):

Figure 3a & 3b:
Resized and modified photographs of the Beijing Airport Express Train map; taken inside the train by Angsüsser, 2009-12-31

Figure 4:

Figure 5a (from left to right and top to bottom):
Shanghai Transport Map, approx. 1:53000, Zhonghua Cartographic Publishing House (Shanghai), Shanghai Surveying Institute, 1st Edition, 1st Impression, 2005

Figure 5b (left side and right side):

Figure 6a:
Shanghai Transport Map, approx. 1:53000, Zhonghua Cartographic Publishing House (Shanghai), Shanghai Surveying Institute, 1st Edition, 1st Impression, 2005

Figure 6b:
Biohazard sign: https://tse4.mm.bing.net/th?id=OIP.RqOt_sPJIKutzQR9urik7gHaKd&pid=Api (accessed on 2018-05-01; modified)