

Collaborative Development of Symbols for Reference Maps

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Keywords: symbology, collaborative development, reference maps.

Abstract:

Geographic information is commonly disseminated and consumed through visual representations of features and their environmental context on maps. Using collaboration and interactive work to develop symbols for cartographic design (Robinson et al., 2012) is an innovative way to find symbols suitable for detecting, discriminating and recognising map features. Research in Cartography comprises several methods and theories to pursue map communication through understanding cognition (Montello, 2002). Such search comes from the realisation that users' perceptual and cognitive abilities are essential for understanding maps (Stigmar & Harrie, 2011). Thus, to develop semantically more suitable symbols for understanding a group of users, it is required to consider cultural characteristics, as they will assist in navigation tasks and increase the accessibility of maps (Korpi & Ahonen-Rainio, 2010). According to (Robinson et al., 2011), current methods for developing map symbols typically feature multiple phases, including collecting existing symbols, defining features to be symbolised, and evaluating the resulting symbol produced. In this research, we involve groups of users in activities to collect the visual understanding of concepts represented by point and area symbols in topographic maps. Based on the study of patterns common to the outcomes, with support from Gestalt laws and semiotic theory, it is possible to develop groups of symbols connected through shared meaning elements to be tested in subsequent phases. Thus, we sought to define symbols developed for Brazilian users, suitable for the multi-scale representation and focused on user experience. The first experiment was carried out with individuals with diverse professional backgrounds. It was carried out remotely in early 2020, during the social isolation period of the COVID-19 pandemic. This activity aimed to develop new pictorial symbols for commercial buildings, public buildings, cultural spaces, bandstands, and cinemas in 1:2000 maps. In a previous phase, the symbols proposed by the cartographers alone did not pass the intended recognition threshold. Therefore, the five concept's meanings were presented to the volunteers, and they had to draw a symbol of what this concept would represent according to their understanding. Nine volunteers participated, so each provided drawings for all proposed concepts. Then, we observed which elements were common in the draw's variations and drew a new pictorial symbol using the common elements. Table 1 shows an example of drawings made by the volunteers. Finally, the proposed symbols were tested in another study with 80 users and were mainly approved.



Concept Commercial Building: Commercial or service building is a building with commercial or service functions.	
Volunteer drawings	
Pictorial symbol developed from Volunteer drawings	

Table 1. Pictorial symbol developed from the drawings made by the volunteers, to represent the concept of a commercial building. In the image, we used colours to indicate the common elements identified in the users' drawings to create the final pictogram.

A new experiment was conducted in late 2021, also remotely. This task aimed to design a supplementary group of pictorial symbols, this time for a coastal region. Again, the volunteers were presented with semantic concepts to be represented in 1:2000 and smaller-scale maps. They designed the symbols according to their comprehension.

Twenty-one volunteers participated in this experiment, with each concept's corresponding set of visual interpretations. These new symbols will still undergo comprehension testing in the second half of 2022. In figure 1, we have the example of the user proposals for the Marina feature and the derived symbol options.



Figure 1. Examples of the volunteer's drawings for the concept “Marina” t (a) and symbols developed from them (b). In the image, we used colours to indicate the common elements identified in the users' drawings to create the final pictogram.

In addition to experiments with pictorial symbology, our group also applied the collaborative design in a study about colours. In this study, we seek to understand how users of topographic maps associate different Brazilian vegetation classes through colours. According to Grassi (2021), topographic map symbols must be consistent with the local landscape based on cartographic principles. Readers' preference for landscape can influence their preference for different map designs (Grassi, 2021; Raposo and Brewer, 2014; Dearden, 1984). In this task, from researching colour characteristics of each land use and occupation class in official maps, satellite images or from characteristics present in popular entertainment games, the participants should suggest one to three colours for each class through their perceptions. The volunteers should indicate these colours through the parameters of Munsell's system. They also coloured blank maps with the suggested colours. The goal was to understand users' perceptions regarding the semantics of colours for classes in several Brazilian biomes. It was possible to observe the range of values in the perception for classes with more complex definitions as mangrove, cultivation and cultivated vegetation. Classes with definitions more common to users had closer values. Thus, it is expected that the subsequent study, with a greater number of users, will allow a deeper cognitive understanding to define, in the colour system, a range of colour values that improves the user's perception, considering cultural differences and accessibility issues.

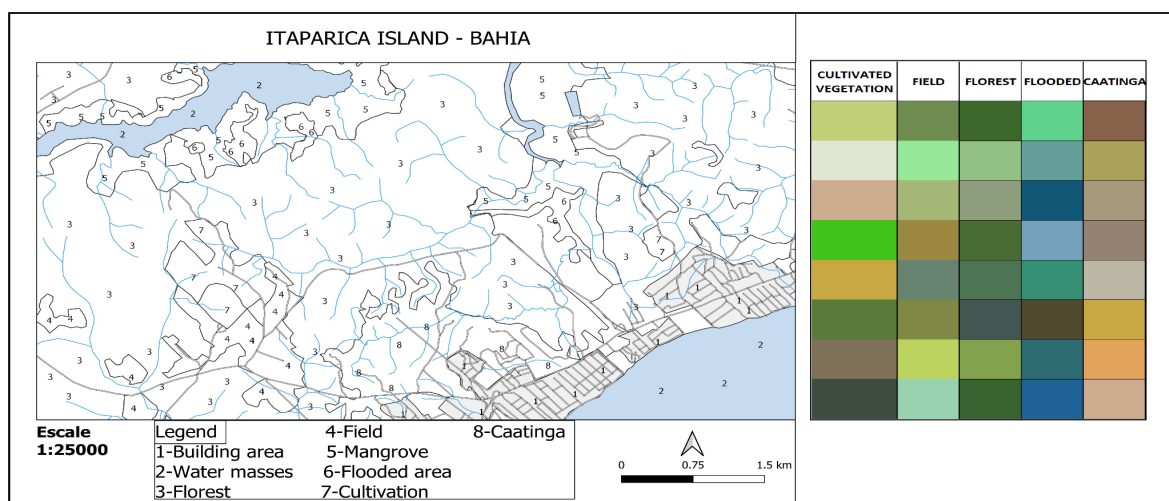


Figure 2. Example of a blank map with the classes and the resulting colour palette.

With the insertion of this step of collaborative creation of symbols in the procedures of tests of perception and cognition of maps, we realised that it is possible to involve the user from the beginning of the process, promoting a broader vision of the concepts and their representations than just the singular vision of the cartographer. Thus, we noticed a clear improvement in understanding symbols with larger groups in the tests already carried out. Another advantage is the possibility of carrying out these activities online with groups from different regions and backgrounds, thus expanding the universal character of the application of reference maps, especially in the case of large and diverse countries such as Brazil.

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