RESEARCH INVESTIGATIONS RELATED TO USER CENTERED DESIGN FOR GEOINFORMATION PRODUCTS

Claudia Robbi Sluter*, João Vitor Meza Bravo*, Melissa M. Yamada*

Federal University of Paraná
Postgraduate Program on Geodetic Science
Department of Geomatics
Curitiba BRAZIL 81531-990
robbisluter@gmail.com, jvmbravo@gmail.com, miel.my@gmail.com

Extended Abstract

This paper aims to present the results of our projects that the main goal is to develop investigations from research problems that are defined based on the relationship between geoinformation solutions and knowledge in Cartography and GIScience. Those projects are being developed over the last 10 years, and here we describe six of them: two at doctoral level and four at master level. For those doctoral dissertations, we relate the research problems to human perception and cognition. Their results discussion aimed to provide improvements in cartographic design solutions. Santil (2008) proposed the following research problem: "when the point and line symbols are designed from visual variables that stimulate the perceptual property called selectivity, what is the visual perception result?" He has applied a set of experiments to verify if the Gestalt laws (Köhler, 1947; Sternberg & Sternberg, 2012) - proximity, similarity, and *Prägnanz* – might help us to understand how we see those groups of symbols. From his experiments, we may conclude that proximity is a key element in seeing groups of symbols, but similarity is the factor that imposes the unity of symbols. Andrade (2014) investigated how visual perception of pictorial symbols can stimulate the acquisition of spatial knowledge by users of tourist maps. In this investigation, the results were discussed in accordance with the Gestalt laws — figure-ground, *Prägnanz*, proximity & similarity, and visual unification— to figure out how much the Gestalt laws influence the map reading process (Köhler, 1947; Sternberg & Sternberg, 2012).

One of the master investigations (Bravo, 2015) was developed from a research problem related to spatial cognition issues and VGI (Goodchild, 2007). The research problem is how the mental processes of knowledge

organization affect the reliability of VGI semantic content. Bravo (2015) has found that the reasoning of individuals depends on their cognitive skills of knowledge organization. The results pointed out that the participants understand geoinformation on a VGI system in accordance with the basic level categories (Rosch, 1973). The results also showed us that the participants organize their geographic knowledge through partonomy and taxonomy relations (Tversky & Hemenway, 1984; Bravo, Santil & Sluter, 2011). At the end, we concluded that mental processes of knowledge organization influence the judgement on VGI reliability.

For Ramos (2015) master thesis, the research problem is defined as how to improve the automation of geoinformation processes based on urban planners requirements for a geoinformation system. The hypothesis lies on two primary conditions that are the users' requirements must be elicited in accordance with the techniques and methods of the requirements engineering (Kotonya and Sommerville, 1998; Sluter et al., 2014); and the geodata queries and processing must be accomplished by an expert system that replaces some of the user spatial analyses tasks.

Finally, there are two works at master level (Prado, 2007; Yamada, 2015) with the research problems related to visual perception and cognition and, the results are verified in accordance with map use context. Prado (2007) defined his research problem as how 2D and 3D geovisualization can stimulate the spatial knowledge acquisition of soil scientists when they have to understand the landscape properties in order to define the soil samples locations. The hypothesis was that the 3D cartographic representations are more effective because they release our mind from creating mental images of the relief from 2D representation by contour lines. Consequently, the soil scientists need less cognitive effort to understand the landscape from cartographic representations, and they can focus their attentive cognition in the relationship between the landscape variables and the landscape patterns that influences the soil formations.

The last of these works was developed by Yamada (2015), and her research problem is proposed as "how are the mental schemata of urban planners when they define and represent urban public spaces?" The solution of this problem is obtained through discussing the results of identifying the components of propositional schemata (Rumelhart e Norman, 1985) of urban planners; identifying how their image schemata is used when they delineate public spaces; and understanding the relations between urban planners propositional and image schemata (Lakoff, 1987).

One of our premises for every research project we develop is that the success of a geoinformation product is dependent on the abilities of the cartographer, or geoinformation expert, to take into account the needs of the users in each product design decision. The systematic structure of

cartographic product design and production makes clear to us, cartographers, some lack of scientific and technological knowledge. A systematic understanding of human abilities, design decisions and map use context can be built from a point of view that is that the design of a geoinformation product can be developed in accordance with the UCD approach.

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