HOW EVALUATE CARTOGRAPHIC FUNCTIONALITY

IN GIS SOFTWARE

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Key words: evaluation, GIS software, testing, Goal-Question-Metric method

Introduction

GIS software widely support creation of quality cartographic output nowadays. But this functionality is different between types of GIS software or between new and older version of this same software. It is necessary evaluate functionality of GIS software before buying software and its exploration for map creation. Z. Dobesova (2007) compared two GIS software from the point of view of data organisation and cartographic functionality in their dissertation thesis. The programmes were ArcGIS 9.1, produced by ESRI, Inc. and AutoCAD Map 3D 2006, produced by Autodesk, Inc. Differences between cartographic functionality are under strong influence of data format.

Testing theory

R. Patton (2002) divided process of testing to three main steps: planning of tests, main testing and finally reports about testing results. Finally report is important for repeating and verifying of test. The selection of testing examples is realized according method: "*subdivision to the classes of equivalent task*". This method reduces infinite number of testing task to representative set of testing examples. The aim is to create optimal set of tests (not many, not few). This theory was applied also for testing of cartography functionality. The representative tasks are suggested by examples of thematic maps for regional information systems.

From the point of testing theory insufficiencies and errors are different (Patton, 2002). Insufficiencies of functionality are where some of visualisation tools missing. Cases, where software does not perform visualisation tasks according to documentation, are considered as errors. Record of errors and insufficiencies of software functionality is also part of test reports.

Tests of cartographic functionality

16 tests of thematic maps were designed for testing cartographic functionality in doctoral thesis. The tests were divided into four groups according to the geometry type of the main theme:

- point, line, area feature and label.

The visualisation for these geometry types is expressed by point, line and area symbols. There were created three or four thematic maps in every group to demonstrate parameters of symbol and various cartographic methods. The possibilities of visualisation of qualitative and quantitative phenomena were also investigated. The possibilities for labelling and texts in maps as well as supplemental compositional elements (arrow, legend, scale bar, diagram, table, photograph, text) were also tested. Each test of thematic map represents large set of equivalent thematic map. On Fig.1 is test for line feature – movement line. The thickness of line expresses the number of commuting people every day to Olomouc. There are also point features (towns) and area features (areas of tree districts express quality), features of topography base (rivers, roads, railways), labels and supplemental compositional elements (tables, scale bar).

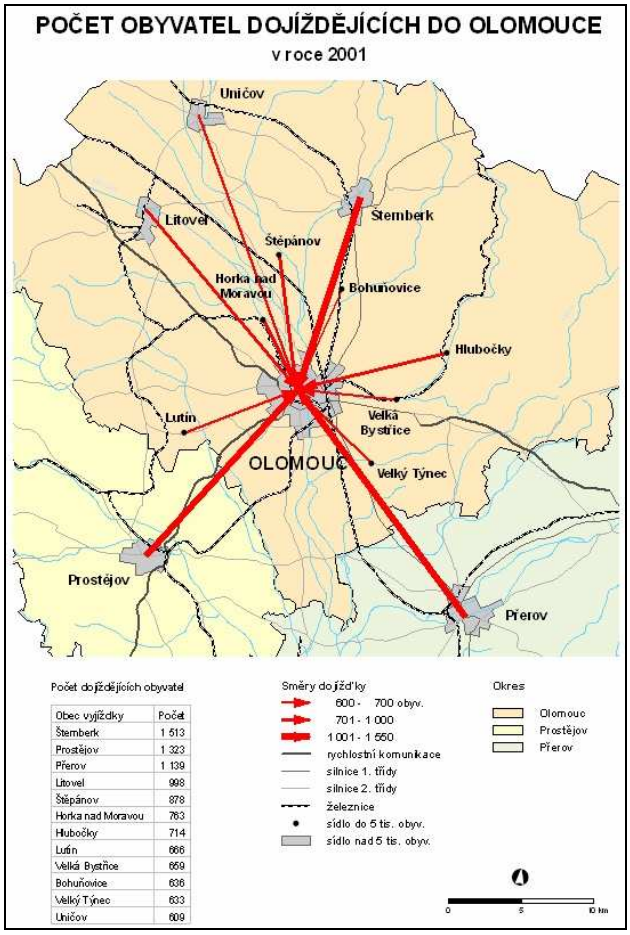

Fig. 1: Number of inhabitant commuting to Olomouc (according census) – line diagram

The advantage of creating complete map with all components, not only with one type of feature (for example line), is testing of interaction of separate part. Some troubles, problems or advantages appear in that complete testing.

Results of testing

The results of test were putted to the several tables. Functionalities of cartographic methods were recorded by Yes or No indicator. Some remarks (limitations) were recorded in these tables. The example of table for method of line symbol is on Tab. 1.

Thematic map – line symbol	**Autodesk Map 3D 2006**	**ArcGIS 9.1**
Line symbol	yes, but limited creation of own symbol	yes
Quality express by line symbol	yes	yes
Quantity express by line symbol	yes	yes
Compound line symbol	yes, not possible set offset from centre line	yes
Line with supplement point symbols	yes, but very limited	yes
Join of lines	no	yes
Set of type for line crossing	no	yes
Line simple chart	yes	yes
Line summary char	no	yes

Tab. 1: Evaluation table for line symbol (Dobešová, 2007)

The final evaluation were summarised to simply table in Tab 2. There are also mentioned insufficiencies and errors.

Aspect of cartographic visualisation	**Autodesk Map 3D 2006**	**ArcGIS 9.1**
Laboriousness of thematic map creation	high	middle
Number of insufficiencies in thematic map creation	middle	low
Number of errors	middle	low

Tab. 2: Summarised evaluation table (Dobešová, 2007)

This simply evaluation is suitable for comparison of two GIS software. This evaluation does not bring number range for comparing more GIS software.

Goal-Question-Metric method

Goal-Question-Metric method (GQM) is designed by Victor Basili at University of Maryland, College Park and in Software Engineering Laboratory in Goddard Space Flight Centre NASA. This is a system of questions and simple answers for evaluation of properties.

GQM defines a measurement model on three levels (Basili, 1994):

- **Conceptual level (goal)**

  A goal is defined for an object for a variety of reasons, with respect to various models of quality, from various points of view and relative to a particular environment.

- **Operational level (question)**

  A set of questions is used to define models of the object of study and then focuses on that object to characterize the assessment or achievement of a specific goal.

- **Quantitative level (metric)**

  A set of metrics, based on the models, is associated with every question in order to answer it in a measurable way.

GQM method was used for evaluating Open Source Software (OSS) for GIS and Remote sensing under project CASCADOSS. Project CASCADOSS is an Europien project for support spreading OSS in the area of natural monitoring (Orlitová, Vobora, 2008).

GQM method for cartographic evaluation will be work out by authors. There is two difficult steps. The first is creation of set of question for evaluating of cartographic functiomnality and the second is a set of metrics. It will be processed pilot stage for evaluation for two ar four GIS software so improved set of question, answers and metrics. The suggested testing methot will be universal for any GIS software in the end.

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Abstract

This article describes author's experiences with comparing of cartographic functionality ArcGIS 9 and AutoCAD Map software. The conception of creating thematic maps differs in these two software products.

16 tests of thematic maps were evaluated for testing cartographic functionality. The tests were divided into groups according to the geometry type of the main theme (point, line, area feature and label). The visualisation for these geometry types is expressed by point, line and area symbols. The possibilities of visualisation of qualitative and quantitative phenomena were investigated. The possibilities for labelling and texts in maps as well as supplemental compositional elements were also tested. Each test of thematic map represents large set of equivalent thematic map.

From the point of testing theory insufficiencies and errors are different. Insufficiencies of functionality are where some of visualisation tools missing. Cases, where software does not perform visualisation tasks according to documentation, are considered as errors.

The thematic map creation is more complicated in Autodesk Map than in ArcGIS. Autodesk Map also has more insufficiencies and some functions for cartographic design are missing. Frequency graph of data set for set limits in interval scale is missing in Autodesk Map. Transparency colour and chart maps are also missing. Labelling from the table related to the feature in cardinality N:M is missing in ArcGIS. The results of testing are stored in several tables.

It is possible to use elaborate tests for other GIS software than two mentioned and verify their visualization functionality. Goal-Question-Metric method will be work out as second method of comparison in the field of cartographic functionality.

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