CAN EVERYBODY WORK WITH MAPS ON THE INTERNET?

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Abstrakt. Internet používá zhruba 14% obyvatelstva světa, přičemž toto číslo neustále narůstá. Vyhledávací nástroj Google nalezne po zadání klíčového slova „map“ více než 1 390 000 000 odkazů a okolo 44 900 000 obrázků. Narůstá také množství prostorových dat vizualizovaných kartografickými metodami. Otázkou ovšem zůstává, zda může každý uživatel internetu pracovat se všemi internetovými mapami.

Pro všechny digitální aplikace, včetně digitálních map, je důležitá optimalizace pro většinu uživatelů. Žádný uživatel by neměl být jakýmkoli způsobem diskriminován, což se netýká pouze osob se zdravotními handicapy (např. s poruchami zraku). Z pohledu informačních technologií je velice důležitá technologická bezbariérovost. Tím je myšlena možnost plného využívání digitální aplikace bez ohledu na úroveň hardware a software (včetně operačních systémů). Třetí typ přístupnosti map v prostředí internetu spočívá v dodržování kartografických pravidel a standardů.

Příspěvek "Can Everybody Work with Maps on the Internet?" popisuje typy přístupnosti a příklad testování přístupnosti. Hlavním přínosem příspěvku by mělo být zdůraznění pojmu přístupnost v digitální kartografii a vytvoření návrhu evaluace přístupnosti kartografických produktů.

Klíčová slova: Přístupnost, digitální kartografie, internetové mapy, standardy, návrh evaluace.

Abstract. The Internet is used by 14% population worldwide and this number is raising at present. The search engine Google discovers about 1 390 000 000 links and about 44 900 000 images after typing keyword "map". The number of spatial data visualized by cartographic methods increases. But there is the question – "Can everybody work with all maps on the Internet?"

For all digital applications (including digital maps) it is important to be optimized for a majority of users. Any user should be discriminated or limited in no way. It does not concern just to chalenged people (e.g. people with visual disorder). In the term of information technologies there the "technological barrierless" is very important. It means the possibility of the full usage of digital application no matter what the level of hardware or software (including operation systems) is. The third type of accessibility of a map on the Internet is the adherence to cartographic rules and standards.

The paper "Can Everybody Work with Maps on the Internet?" describes particular types of accessibility and a case of an evaluation of accessibility. The main goal of this paper is an emphasis on the accessibility problem in digital cartography

and creating of a design for the evaluation of accessibility of cartographic products.

Keywords: Accessibility, digital cartography, internet maps, standards, evaluation proposal.

1 Introduction

The question in the title of this paper ("Can Everybody Work with Maps on the Internet?") should give rise to a query, if the ever-increasing number of visualization on the Internet through cartographic instruments corresponds to

- a higher number of quality map applications,
- a higher number of gratified users and customers,

a better level of cartographic consciousness in the society.
Do not we face contradictory effects? Cannot a publishing of higher number of defect maps lead to

- depreciation of possibilities of cartography ("Cartographers do not know how to make better maps"),
- discourage of users ("Maps are very complicated, slow etc.")?

The paragraph above is related to accessibility problems. The word "accessibility" is in use in the world of information technologies (IT). Under Wikipedia, the free encyclopedia, accessibility is a general term used to describe the degree to which a system is usable by as many people as possible (http://en.wikipedia.org/wiki/Accessibility). David Špinar (an expert in accessibility) defines the accessibility as the status when nobody has trouble using the application.
On the Internet there are many different sources relevant to accessibility, for example:

- Web Accessibility Initiative (http://www.w3.org/WAI/)
- Section 508 (http://www.section508.gov/)
- Bartiméus Accessibility Foundation (http://www.accessibility.nl/)
- Research About Accessibility (http://www.microsoft.com/enable/research/default.aspx)
- The Ohio State University Web Accessibility Center (http://www.wac.ohio-state.edu/resources/tools.html)
- IBM Human Ability and Accessibility Center (http://www-03.ibm.com/able/)
- Adobe Accessibility Resource Center (http://www.adobe.com/accessibility/)
- isolani – Dynamic and Accessible web applications (http://www.isolani.co.uk/)
- Barrierefreies Webdesign: Einfach für Alle - eine Initiative der Aktion Mensch (http://www.einfach-fuer-alle.de/), just in German
- Přístupnost: Web a weblog věnovaný přístupnosti webových stránek (http://pristupnost.nawebu.cz/), just in Czech
- Blind Friendly Web - přístupnost webových stránek pro zrakově postižené (http://www.blindfriendly.cz/), just in Czech

The accessibility is not just a term promoted by an inner cabinet of IT experts. Accessibility requirements originate from the field of the legislation, too. The amendment of act 365/2000 (Czech law about information systems of the public administration) implements the duty to conform web pages of institution of the public administration to handicapped users. This law is important for map applications provided by the public administration. On the web pages

SAP Design Guild [Mei2005] there are some examples of Accessibility Legislation in about 23 countries [And2007].
In cartography the accessibility is not ranked among high-frequency used terms (there are some exceptions, e.g. the paper A More Accessible Map [Duf2006] describing the clues on how to create an accessible interactive web map). But cartographers are aware of the importance of the focus on the customer (it need not be only a commercial subject). It could show in increased earnings and prestige. That is why the Research Agenda of International Cartographic Association [Vir2007] deals with the question of accessibility. The accessibility is related to following keywords:

- Metadata and SDIs,
- Usability of Maps and GI,
- Map Production,
- Cartographic Theory,
- Education,
- Society. [Vir2007]

From the viewpoint of cartography we can define the accessibility of cartographic web applications as an effort distribution of cartographic product to a maximum number of users regardless of other conditions. What are the reasons of the inaccessibility of current cartographic applications?

- Poor cooperation of persons interested in creation and an usage of an application (e.g. data provider, data analyst, cartographer, end user, investor, marketing expert, designer etc.).
- Poor adherence to rules, standards and specifications, eventually implementing of new proprietary standards or new proprietary rules to existing standards.

2 Inaccessibility of cartographic web applications

The accessibility or inaccessibility of cartographic web applications could be divided into three fundamental categories (all categories are interconnected, e.g. technological problems do not make an application of user's needs possible) [Čer2007]:

1. Technological inaccessibility. Incompatibility of technological instruments on the user and author side, which makes easy working of the application impossible. The technological inaccessibility is caused by
   - a deprecation of quality and type of hardware and software on the user side (e.g. old networks, small size of screen etc.),
   - usage of close licenses, which makes user's modification of the application impossible,
   - a compact structure of the application makes simple integration into own systems impossible,
   - a request of usage and installation of particular (often commercial) software modules,
   - poor quality transformation of analog map to a digital form.
2. Cartographic inaccessibility (a cartographic incorrectness of the map or some errors in the content of the map) consists in a nonadherence to fundamental cartographic principles (known for more than 2 000 years). This type of inaccessibility makes for a not very precise or misrepresenting interpretation of source data. Cartographic inaccessibility could be caused by

- the map language unajusted to possibilities of modern technologies (e.g. missing definition of new cartographic variables [Zho2007] or rules for the creation of a digital map legend [Wan2007]),
- a wrongly selected cartographic interpretation method (fundamental misunderstanding of data),
- low level of the map composition,
- absence of fundamental composition elements of the map,
- misuse of colors,
- a wrong choice of a cartographic scale,
- level of generalization, etc. (more information about cartographic accessibility, see any cartographic publications, e.g. [Rob1995], [Pra2007], [Kaň1999] etc.).

3. Inaccessibility due to end-user specifics, which makes smooth decoding of information provided through cartographic application impossible. Some examples of end-user specifics:
   - Handicaps (e.g. hearing impairments, visual impairment, restriction in movements, disorders of concentration, combine disorders and other handicaps),
   - culture differences (different uderstanding of some part of cartographic language or visualized reality),
   - language differences (in the case of a map there are some problems in the notation of dublets, usage of multilanguage encodings, translation of the map and user interface),
   - end-user skills (different levels of the usage of maps and information technologies).

3 Analyse of accessibility of cartographic web applications

In terms of evaluation of the accessibility of cartographic web applications there four applications were tested provided by municipal offices of former district towns in the Czech republic. The tests concerned the first offered web page of the application exclusive of any changes. Control based of objective criteria was exercised through software tools (e.g. validation of markup languages, 48% of executed tests) and on the basics of subjective methods (52% of executed tests). The following aspects of accessibility were studied:

1. Common accessibility rules,
2. Technological accessibility,
3. Cartographic accessibility,
4. User's specifics – readability,
5. Other tested items.

1. Common accessibility rules
   1. Section 508
   2. WAI (Web Accessibility Initiative)
   3. WCAG 2.0 L2 (Web Content Accessibility Guidelines)
   4. WCAG, Priority 1
   5. WCAG, Priority 2
   6. WCAG, Priority 3

The principles of the web accessibility WCAG (Web Content Accessibility Guidelines) are created by the group WAI (Web Access Initiative) under the W3C organization (World Wide

Web Consortium). These principles are classified in fourteen rules divided into so-called checkpoints. WCAG recognizes three priorities:

- Priority 1. A Web content developer must satisfy this checkpoint. Otherwise, one or more groups will find it impossible to access information in the document. Satisfying this checkpoint is a basic requirement for some groups to be able to use Web documents.
- Priority 2. A Web content developer should satisfy this checkpoint. Otherwise, one or more groups will find it difficult to access information in the document. Satisfying this checkpoint will remove significant barriers to accessing Web documents.
- Priority 3. A Web content developer may address this checkpoint. Otherwise, one or more groups will find it somewhat difficult to access information in the document. Satisfying this checkpoint will improve access to Web documents. [Špi2003], [Chi1999]

2. Technological accessibility
    1. HTML or XHTML code validation
    2. Cascading stylesheets (CSS) validation
    3. Speed report
    4. Broken links and anchors
    5. Metadata records
3. Cartographic accessibility
    1. Base composition items of maps – title, scales, legend and printer's mark
4. User's specifics – readability
    1. Black and white (grayscale) picture
    2. 800 x 600 screen size
    3. Colour blindness (Deuteranopia)
5. Other tested items
    1. Used languages – declared and functional
    2. Help list
    3. Operating by keyboard

Table 1. Common accessibility rules.

Accessibility	A	B	C	D	Tool
Section 508 (Passed rules in %)	67%	50%	33%	50%	HiSoftware® Cynthia Says™ - Web Content Accessibility Report
WAI (Passed rules in %)	82%	70%	64%	55%	HiSoftware® Cynthia Says™ - Web Content Accessibility Report
WCAG 2.0 L2 (Known/Likely/Potential Problems)	0/9/67	5/0/42	10/0/5	56/1/323	ATRC Web Accessibility Checker
W3C WCAG Priority 1 (Error count)	100%	23%	11%	6%	WebXACT
W3C WCAG Priority 2 (Error count)	40%	33%	50%	5%	WebXACT
W3C WCAG Priority 3 (Error count)	11%	60%	100%	7%	WebXACT

Table 2. Technological accessibility.

Technology	A	B	C	D	Tool
(X)HTML code validation (Error count)	19	0	41	107	W3C Markup Validation Service
CSS validation (Error count)	0	2	CSS don't exist	Validation don't finish	W3C CSS Validation Service
Speed report (Dow nload time for 14.4K Connection Rate in seconds)	171,04	45,48	171,78	248,09	WebSiteOptimization.com
Broken Links and Anchors	0	0	0	1	WebXACT
Metadata Records	1	1	1	4	WebXACT

Table 3. Cartographic accessibility.

Tested Cartographic Items	A	B	C	D
Title	Yes	Yes	Yes	Yes
Legend of map	Defective	Defective	Defective	No
Graphical scale	Yes	Yes	Hardly readable	No
Natural scale	Static	No	No	No
Printer's mark	Yes	Yes	No	No

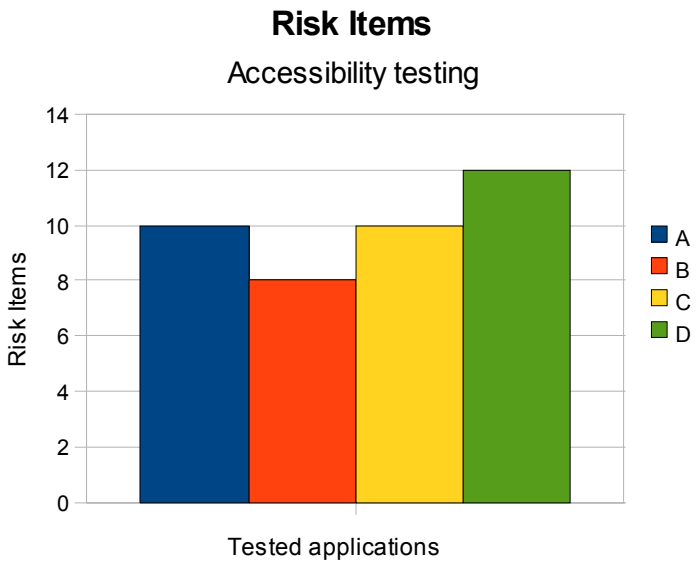
Table 4. User's specifics – readability.

Readability	A	B	C	D
black and w hite colours	Yes	Yes	Yes	Yes
800 x 600 screen size	Horizontal Scroll bar	Horizontal Scroll bar	Yes	Yes
Colour blindness (Deuteranopia)	Without expressive problems	Without expressive problems	Poor colour discrimination of public transport lines	Poor colour discrimination of building type

Table 5. Other tested items.

Other Tested Items	A	B	C	D
Declared number of languages	4	3	1	3
Functional number of languages	2	1	1	1
Help list	No	Czech	Czech	No
Operating by keyboard	Yes	Yes	Problematic sw itching of layers	Yes

In the previous tables risk items are emphasized with orange colour (significant departures from the standards). 23 aspects of accessibility were tested. The items of negative influence over accessibility of cartographic web application occupy values between 35% and 52%.



Pict. 1. Graph of risk items in accessibility tests.

The results of the test show underwork of providers of applications and insufficiently performed selection procedure on the side of municipal offices. Because accessibility requirements were not included in selection criteria for providers of web applications.

4 Conclusion

There are many reasons why cartographers should pay attention to accessibility. The web pages of Adobe company present a summary of important benefits of accessibility [Ado2007]:

1. Accessibility is the right thing to do.
2. Accessibility is the law for many institutions.
3. Accessibility offers benefits for all users.
4. Accessibility uses innovative technology.
5. Accessibility creates market opportunity.

Accessibility does not focus only on rigid adherence to the right of some minorities, because the impact of accessibility is more larger. Inaccessibility of applications could participate in

- financial profit of creators of applications (Inaccessible applications address about 70% customers, but the expenses on accessible and inaccessible application are the same [Špi2004].),
- prestige of creators of applications (Inaccessible application is a sign of underwork of its creators, because they have not necessary knowledge or they huddled through the job.),
- law-abidingness (Providers of inaccessible applications could be affected by laws in force.).

An accessible application is not important just in the view of users and experts. Some aspects of accessibility (e.g. metadata records) guarantee better cooperation of application and search

engines and robots (according to [Špi2003] the search engines are the most disabled users of the web).
The improvement of the accessibility of cartographic web applications could be characterized by the following three steps:

1. Creation of an independent and easy modifiable application regardless of technological accessories.
2. Adherence to cartographic rules.
3. Possibility of a change of different types of structure of an application (language changes, colour scheme changes, font size changes etc.) depending on user's requirements and needs.

With respect to accessibility it is very important to keep and support all standards and rules on the side of creators and users of cartographic web applications. Standards associated with creation and usage of web maps should be the important integral element keeping comfortable usage, sharing, modification, updating and providing information about map application. Observance of standards is a condition of mutual support and independence of these standards. In the view of standardization and normalization there are serious problems in the field of information technologies. These problems are based on duplicities and unexplained priorities. The enforcement of standards over the producers and users of information technologies is very complicated, too.

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