

# User-Driven Usability Assessment of Internet Maps

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**Abstract.** This paper describes problematic related with the use of standard usability tests establishing the relationship between user experience and his expectation to user interface (UI) and functionality. In the second part of the paper author presents the basics of a newly built user-driven usability assessment methodology. The essence of the application of this methodology can be defined as a recognition of the user and his needs by providing a possibility to build the maps of different types by himself and this way to specify his own needs.

**Keywords:** Graphical user interface, Maps Usability, Usability assessment, Users needs and preferences, Usability research

## 1. Introduction

Maps became an integral part of web technologies. Social nets and WEB GIS applications started using millions different users. Today web maps users are usually non-experts having different technological skills, knowledge, needs and expectations of map use experience (Skarlatidou 2006). Informational technologies usage trends form the user which does not evaluate the majority of web maps functions but their utility and usage convenience. With web maps usage becoming mass, the newly built web maps solutions have to be inevitably adjusted to user's needs. Successful identification and realization of these needs determine if the newly built map will become successfully used. Due to this reason, the usability researches become the underlying trend of modern cartography researches and the usability quality of the map becomes one of the basic criterion of its evaluation. This also reflects the structure of International Cartographers Association in which Commissions on Cognitive Visualization, Geovisualization, Maps and the Internet, Use and User Issues analyse the issues of web maps usability.

The workflow of web maps following the principles of User Centered Design (hereinafter - UCD) involves users and the analysis of their needs. UCD researches methods as usability tests (hereinafter - UT), heuristic evaluation, etc., provide a possibility to identify weak points of the newly built web map, e.g. unclear management of the map and the complexity of functions usage, complicated user interface, etc. These methods are widely applied in modern cartography when building and improving the maps. However, practical and concentrated application of usability researches for the improvement of concrete maps or functions formed the lack of knowledge about general needs of the user. This topic becomes actual when determining the connection between the user, his needs and expression of these needs in a Graphical user interface (hereinafter – GUI) and functionality. This would provide a possibility to determine general principles of web maps building but not to identify concrete shortages.

In this article the author presents the basics of a newly built user-driven usability assessment methodology. The essence of the application of this methodology can be defined as a recognition of the user and his needs by providing a possibility to build the maps of different types by himself and this way to specify his own needs. By this methodology it is aimed to identify general needs of the user for the GUI and functionality of different type web maps. The article analyses the generated hypothesis that this methodology would help to solve the topic of knowledge about general users' needs which reveals when analysing the practice of modern cartography usability researches.

## **2. Background and Objectives**

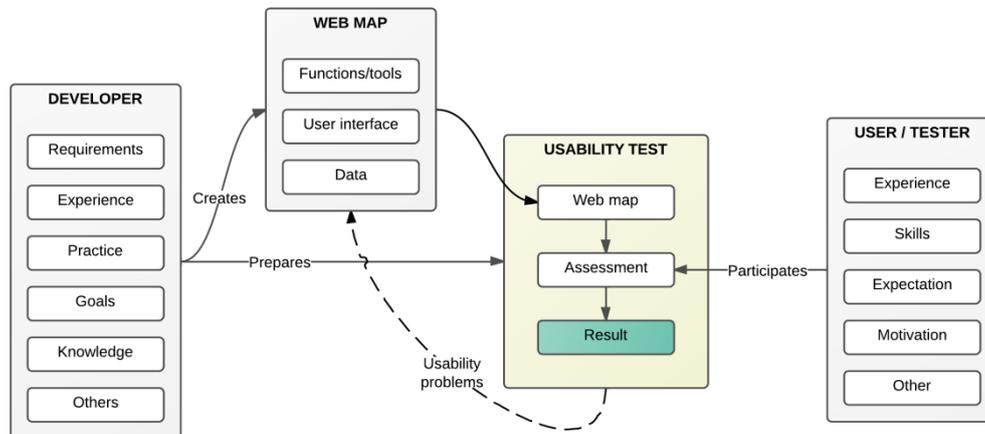
Usability is a wide conception which can be generalized as 'quality attribute that assesses how easy user interfaces are to use' (J. Nielsen 2012, January). Such outlined by J. Nielsen usability quality defining components as Learnability, Efficiency, Memorability, Errors and Satisfaction may be considered universal, however, the principles of their application in web maps differ from those which are applied to common web content (websites, blogs, news sites, etc.). Due to this reason, the need to know the specifics of the quality of web maps usability, to know users' needs, their expectations and abilities to use specialized geographical information management tools.

The usability topic in the process of web maps building is not a novelty. By following the UCD principles provided in ISO 9241-210:2010 standard and using different usability researches methods, the user is also involved in the process of building new web maps. In wide meaning UCD can be considered a product development philosophy involving a wide scope of means by

which the user in one or the other way can be involved in product development process (Abrás et al. 2004; Rubin 1994). In the main methods by using which it is aimed to determine the application of the developed product for users' needs can be considered the following: usability evaluations (surveys/questionnaires, expert reviews, heuristic evaluations) and usability tests (usability.gov). These methods are widely applied in modern cartography by analysing the issues of the quality of web maps usability. The usability researches practice based on the principles of UCD in cartography has a history of several decades. Considering the evaluated in these researches and analysed object, they can be divided into the following groups:

- Researches of concrete functions/tools in which the convenience and effectiveness of concrete functions of the map is evaluated. For example, Usability of zoomable maps with overview map (Hornbaek et al., 2002), Usability Evaluation of Web Map Zoom and Pan Functions (Manlai et al., 2007);
- Researches of concrete use cases in which a concrete maps usage case is analysed and the issues of maps usage process are identified. For example, Usability of Interactive Maps for geovisualisation (Andrienko et al., 2002);
- Researches of concrete maps usability in which the usability quality of the maps under development or already developed maps is evaluated. For example, Usability research of Lakeshore Nature Preserve Interactive Map (Roth & Harrover 2008);
- General maps usability researches in which the results of concrete maps usability researches are generalized and general problems of usability are identified. For example, Usability evaluation of different web mapping sites (Nivala et al. 2008).

However, the question can be made: why these researches do not provide enough information for the determination of general needs of web maps user, ones which in the theory of classical cartography are formed to the semantics of the maps? The answer to this question can be provided having analysed the process of usability researches performance most often applied in the practice of Internet maps researches (Fig. 1).



**Figure 1.** The standard process of usability researches.

In the above scheme of the predominating in cartography usability researches process it can be determined that the provided to the participant of the research testing surrounding suggests solutions generated by the map developer and the type of map usage process (especially when the prepared in advance testing cases are being used). The user is put into particular frames which are defined by the functionality of the tested map and GUI possibilities. Standard UT are applied for already built application, the functionality and GUI of which are prepared by a developer. The developer of map generates the usability experience on the basis of the set to him requirements, his own developing experience and knowledge and the goals due to which the map is generally developed. A particular developed map version is provided for testing following the prepared in advance testing cases and by analysing their implementation success rate. In such case the needs of the user reflect only in the context of the tested map. During the test it is not determined (at least directly) what were general user's expectations, what view of GUI would he like to see or what functions did he need. Namely this becomes a barrier to identify not the problems of a concrete map usage, but to understand which type of map is useful to the user.

Users have different experience of web maps usage which is not inherent but more or less developed by using different web maps, their functionality and GUI. User collects this knowledge and when opening a new web map he naturally tries to apply the gained knowledge. It is possible to determine how he manages to do this by applying standard UT, e.g.: observe and fix the actions performed by a user with a map and at the same time to ask opinion about the functioning of one or the other function. However, if you want to determine which GUI is optimal to the user, it is not enough only to

determine the problems between the tested map and the needs of the user. We have to manage to determine not what bad in a provided tested map sees the user but how he imagines it himself, i.e. what are common needs of the user for a particular type of maps. Due to this reason the author of the map suggests to form a new methodology of usability researches which would provide a possibility to know the needs of the users not for concrete web maps but in the level of different web maps (e.g., tourist, objects locations, WEB GIS).

Besides the identification topic of general needs, the concentration of usability researches to concrete web maps limits the possibilities to generate recommendations which could be applied in the initial map building stage, i.e. when designing the functionality of future map and user interface. It is difficult to make conclusions about general recommendations for web maps or different their types on the basis of concrete maps usability researches. Many web maps have an individual GUI to which the user has to get used and learn to use the functionality (Manlai et al., 2007). GUI and the solutions of functionality in a concrete map are made in order to reach a particular goal but not to analyse the user. Thus, having applied the results of concrete maps usability researches as a standard to create the other maps, we would transfer to a map development process only a part of user's requirements, i.e. only those requirements which were appointed in the case of concrete map usage. With the purpose to develop recommendations or standards which would involve general needs of the users, not the map appointed and adapted to this concrete usage case should be tested but interface which the user could adapt to his needs by himself.

Having analysed the usability researches practice and topic in cartography, having evaluated the needs of usability researches results, three main requirements for a newly developed usability researches methodology were formed:

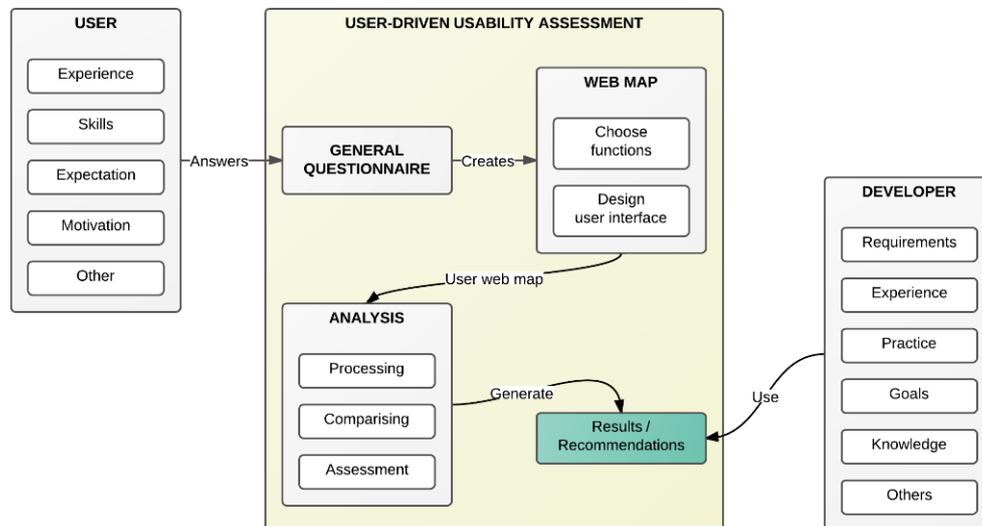
1. The methodology of researches should determine the general needs of the user for the GUI and functionality of different types web maps.
2. The methodology of researches should provide a possibility to the user to express his own requirements not through the implementation of the prepared in advance concrete map usage cases and remarks/suggestions provision (e.g. UT case) but through a map development process.
3. The methodology of researches should eliminate the subjectivity and possible side effect to the user which can occur through GUI or functionality solutions of the developed and tested in advance web map.

Following these requirements, UCD principals and by integrating different techniques of researches, a methodology of User-driven usability assessment and its theoretical background is being formed.

### **3. Approach and Methods**

The main aim stated for user-driven usability assessment researches methodology is to identify general needs of the users for the functionality and GUI of different type web maps. In the theory of modern cartography general needs of the users can be defined as the requirements for web map functions package and GUI elements (layout), colour scheme, etc. Considering the specifics of the developed usability researches methodology, a solution of research performance realization was defined, i.e. to make the user himself the developer of web map and to determine general requirements through the characteristics of the developed by the user suitable to his map. Such realization would provide a possibility to determine which functions the user needs in order to create a map of a particular purpose, where he wants to see these functions in GUI, what are the solutions of GUI elements (sizes of buttons, layout, colours, etc.) are the most acceptable to him. On a purpose to create such researches methodology based on the principle of participatory design (hereinafter - PD), a theoretical background, analysis mechanism and means for practical implementation of these researches are necessary.

The main UCD principal emphasizes the early focus on users and their tasks, however, in the initial maps developing process the developer immediately needs the knowledge about primary needs and expectations of the user because he has to define which functions in the map he has to create and how to paste-up the GUI. Besides, knowing the primary needs would make a possibility to avoid the development of excess functionality and would provide a possibility to specify in more detail the developed map. In the first part of the article presented process of standard UT researches performance reflects the involvement of the user to the development of the generated product. In case the user-driven usability assessment methodology is developed, the usability research is performed by the user himself through the specification of his own requirements in the map development process (Fig. 2). Due to this process, the developer of web maps could get basic recommendations about the implementation of users' needs not by performing a testing but by planning only the solution of a future map.



**Figure 2.** The process of user-driven usability assessment.

The essence of a user driven usability assessment methodology is to provide to the user a freedom to create the interface for a map of a chosen type. The user, following his own experience and knowledge of web maps usage, creates GUI in a specially developed testing web application. The analysis of information is performed inside the mechanism of the methodology itself, i.e. unnecessary intervention of a researcher to the calculation results. By using different analysis and evaluation techniques, the results and recommendations are generated. Social general questions are also involved in the users' research process in order the results could be grouped according different type of users (non-experts, novice, etc.). Then, considering the presented research implementation process, the following main principles of the developed researches methodology are formed:

- The user is given social general questions (e.g. how much time does he spend for using internet, education, etc.).
- The user is given a possibility to decide what functionality he will need to build a particular web map.
- The user is given a possibility to choose the desired GUI configuration. The user can locate the chosen necessary functions in GUI.
- The maps built by users are grouped according the results of general questions and they are compared with each other by determining general GUI and the features of functionality development.

What practical use would have such implementation of usability researches process for web maps developers? During the design stage, the developers of web maps could use the recommendations in which primary requirements of different users groups for particular type of maps would reflect. These requirements would be defined as generalized graphical user's interfaces and functionality features, i.e. where and what functions should be located in the layout of a web map. This would accelerate the primary web maps development stage and it would already involve users. It is also important to mention that user driven usability assessment research process application eliminates possible influence of the developer to the user and by evaluating the results of subjectivity usability research. The application of the other suggested methodology results related to theoretical usability research issues in cartography. The research results would provide a possibility to determine the following:

- How the user sees optimal user's interface for the implementation of different tasks.
- How the user applies his usability knowledge for map development and what is possible source of this knowledge.
- What is the connection between user's abilities and the complexity and perfection of the developed interface.
- If the users have a formed one GUI image.
- Possibilities of individual application of maps interface for particular users groups and concrete tasks.

In the primary development stage of the suggested methodology the aim to clear out if there is a need to develop a design based on the principle of participatory methodology was defined considering the usability researches practice in cartography as well as to define its development possibilities and requirements. This article deals with general theoretical and practical application principles of the developed usability researches methodology, however, in order to determine its effectiveness in cartographical researches, a real application of it in practice is necessary: technical realization and results evaluation.

#### **4. Conclusions and Future Works**

The usability researches practice in cartography is mostly based on the methods suggested by UCD paradigm, concentrated on the quality of a concrete developed product (web map) usability. In practical researches these

methods provide applied information about the shortages of the developed map and perfection possibilities, however, the application of these results in theoretical level does not provide any information about primary users expectations on which functionality the user needs. The described in the article methodology of user driven usability assessment would provide a possibility to form the development recommendations of web maps which would be based not in case of concrete products usage (e.g. in case of using not Google maps) but general experience of users. The implemented in the methodology principles of PD and user's needs identification through the specification of the developed by him map user interface and functionality, usability researches workflow transfers from a developer's to user's level.

In the project of user driven usability assessment methodology development, four main stages are defined: the reasoning of methodology development necessity, forming of theoretical and practical basement, development of research means and case study which would reason if the developed researches methodology is really effective. Such plan concept is chosen in order to provide the developed methodology with a strong practical and theoretical reasoning which could be reached through the approbation of the results of implemented plan elements in science environment. This article deals with the reasoning of research methodology development, i.e. the first stage of this methodology implementation. Considering the usability researches practice and topic in cartography as well as having evaluated the concept of the developed user driven usability assessment methodology it can be stated that the need of the development of this methodology and the necessity of its results in cartography is reasonable.

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