

Usability of Methods and Techniques of Use and User Research in Cartography and Geoinformation Science

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ABSTRACT

UPDATED—21 July 2015. This position paper poses the research challenge to learn to optimally apply, and investigate the usability of, the currently available great variety of methods and techniques of use and user research in the domains of cartography and geoinformation science. We need to know more about this usability, in order to be able to implement mixed methods and User-Centred Design approaches in the design of use, user and usability research projects.

Author Keywords

Research methods; usability; use and user research; User-Centred Design; mixed methods.

ACM Classification Keywords

Still to be completed.

INTRODUCTION

At last! After a long period of focussing on technological developments, in the past decade we have finally and clearly noticed a growing interest in the human beings who work with cartographic tools: not only the end-users of our cartographic products, but also, for instance, the contributors in cartographic crowdsourcing activities [3]. Because of this growing interest we also noticed an increasing application of User-Centred Design (UCD) approaches in our discipline [1] with more emphasis on the requirement analysis stages in these approaches. This was and is very much needed with the change of static cartographic tools into interactive, dynamic and personalized ones.

In relation with these recent developments, *usability of maps and GI* became one of the nine key themes in the ICA research agenda [5]. And, indeed, in the past decade, a great increase can be noticed as well in the number of use and user experiments that have been executed and reported upon in scientific publications. However, from these publications it became clear that the quality of the use and user research that is required in UCD approaches is still lagging behind. This is a consequence of the fact that, on the one hand, researchers are not yet fully aware of the potential of a variety of all kinds of new (at least to our discipline) user research methods and techniques (outside the traditional surveys and interviews) and, on the other hand, there is not enough knowledge yet about the peculiarities of implementing user research methods and

techniques that have already been used successfully in other disciplines, like human-computer interaction, psychology, etc. in cartography and geographic information science.

This position paper addresses the big research challenge to learn to optimally apply and investigate the usability of the currently available great variety of methods and techniques of use and user research in our cartographic discipline.

To this end, this paper first touches upon the growing awareness of the need for UCD and then discusses a tip of the iceberg of currently available methods and techniques of use and user research and their implementation. Thereafter, a plea is made for UCD of use, user and usability research projects in cartography and geoinformation science and the paper will be concluded by listing the resulting research challenges.

USER-CENTRED DESIGN (UCD)

In our discipline, there are more and more proofs of a systematic implementation of UCD approaches. In such an approach three main stages may be distinguished (see Figure 1): a *design solution* is produced after a systematic *requirement analysis* and followed by an iterative *evaluation*.

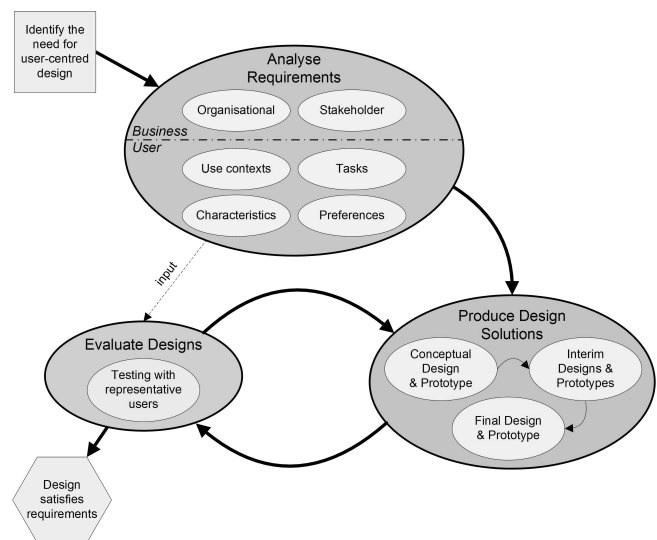


Figure 1. Three stages User-Centred Design [2]

In the past, user research mainly focussed on iterative usability evaluation, i.e. the evaluation of an already

existing (prototype of a) design solution, e.g. a map, interactive geovisualization environment or location based service. This focus on usability is also reflected in the 2009 ICA Research Agenda [5]. Fortunately, nowadays there is also much more attention for the requirement analysis stage, i.e. the stage in which there is no prototype yet. Among other things, in this stage the characteristics and the preferences of the potential users are established, as well as the spatio-temporal questions (the uses) to which they want to find answers. Many of the methods and techniques that are applied in usability evaluations can also be applied in use and user research in the requirement analysis stage.

RESEARCH METHODS AND TECHNIQUES

Not so long ago, and still, many researchers who want to do use and user investigations only thought about setting up surveys and/or interviews. Alternatively, heuristic evaluations were implemented with experts, who were not always representing the actual real users and are not as engaged as actual users are, who really want to find the answers to the spatio-temporal questions they have. When tests with actual users were planned, a general opinion also was that many subjects were required to get useful results (i.e. quantitative research).

However, gradually the cartographic scientific community is discovering the value of other use and user research techniques which are directed more to observing the users during their spatio-temporal problem solving activities and analyzing the products they generate (e.g. a planned route as an answer to a spatio-temporal question). In view of the number of test persons required, these techniques can also be of a more qualitative nature and still provide very valuable information in the requirement analysis stage of the UCD process and for an initial usability evaluation of a prototype design.

Many of these “new” (at least for many researchers in our community) user research methods and techniques are borrowed from other disciplines, like human-computer interaction, communication science, psychology, etc., where they have been in successful use for a much longer period of time already. Examples from the recent past are techniques like thinking aloud, fMRI, eye-tracking, emotional response measurement, video observation, etc. To a great extent, these “new” techniques came up as a consequence of the same technological developments that so much changed the cartographic discipline. Another important factor was that more resources became available for researchers to execute more advanced use, user and usability research [3]. However, although other disciplines may offer us new research techniques, we have already discovered that these other disciplines cannot always help us with the implementation of these techniques in cartography and geoinformation science. This is because our spatio-temporal domain is of a unique and great complexity in which users try to match their mental maps with geographic reality and the cartographic visualization

of that geographic reality. Therefore, we need to know more about the implementation of the new research techniques in our domain.

Although not many researchers are fully aware yet of the characteristics and potential values of the variety of the available methods and techniques, it quickly became clear already that different methods and techniques may lead to different information about the users, uses, effectiveness and efficiency of, and satisfaction with, cartographic tools and products as well as the cognitive aspects involved. Therefore, already it is recommended to implement so-called *mixed methods* approaches in use, user and usability research to get the best and most complete research outcomes.

UCD IN USE, USER AND USABILITY RESEARCH DESIGN

Such mixed method approaches clearly call for a User-Centred Design, or perhaps it is better to say USE-Centred Design, of the methodology applied in use, user and usability research. Such UCD should also go through the three stages illustrated in Figure 1, although an iterative usability evaluation will usually not be implemented within one and the same research project and be restricted to the discussion section of the research report. A lot of attention should be paid to the requirement analysis stage of the UCD of a research methodology, but in order to be able to translate the results into a suitable research design we clearly need to know more about the usability of all different techniques of use, user and usability research that are currently available.

CONCLUSION: RESEARCH CHALLENGES

Indeed, particularly for ICA Commissions it is a great research challenge to:

- investigate the peculiarities of the implementation of user research methods and techniques known from other scientific domains in cartography and geo-information science;
- find out about the usability of individual techniques that are currently available for doing use, user and usability research in cartography and geo-information science;
- identify gaps and weaknesses in the currently available collection of user research methods and techniques and improve existing, or develop new, methods and techniques;
- find ways to optimally combine individual research techniques in usable mixed methods research designs;
- optimize UCD approaches for the design of usable use, user and usability research projects.

Eventually, our research contribution should lead to more effective, efficient and satisfying geovisualization and map designs and for a better understanding of the users' cognition.

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