

Simple Maps – A Concept of Plain Cartography within a Mobile Context for Elderly Users

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Summary: Ageing reflects the way in which people read maps. Maps should be designed to take deficiencies such as presbyopia into account for better map accessibility. Map design should also consider other vision-related weaknesses, such as colour vision deficiency. We present a plain cartography concept for creating simple maps that the elderly can also read. The concept is realized on a Web server and iteratively developed for use on mobile devices.

KEYWORDS: Plain cartography, mobile cartography, presbyopia, colour vision deficiency

1. Introduction

The population is ageing and a growing number of elderly people have some kind of restriction on their ability to read maps, notably mobile maps on small displays. However, neither current research studies nor map specifications provide specific cartographic rules for how to create usable maps that the elderly can read while still being aesthetically pleasing.

An example of a disability that affects the elderly pertains to changes in their vision, such as presbyopia. Presbyopia occurs as a result of a hardening of the crystalline lens. However, presbyopia can be corrected by using reading glasses, but when untreated, presbyopia makes reading traditional outdoor maps difficult. Another type of disability, one that not only affects elderly map readers, is colour vision deficiency. Requirements for suitable colour schemes and palettes have been studied in different contexts, such as digital displays (Meyer and Greenberg, 1988), digital maps (Olson and Brewer, 1997) and car navigation (Pugliesi and Decanini, 2011). These colour schemes only contain colours that can be distinguished; that is to say, the colours are outside confusion lines. One option is to replace colours with patterns.

From the linguistic perspective, the problem of creating legible contents has been addressed through plain language (e.g. Cutts, 2004). The target audience of such a plain-language solution is not only users with decreased cognitive abilities; the theoretical framework can also be used to address the concerns of other user groups, such as the elderly. In a broader context, the principles of plain language could improve the efficiency of communication with the general public when the circumstances for communication are non-optimal, for example in a mobile context. The concept of plain language defines rules for how to create or convert the vocabulary, structure and content of a language into a more understandable and readable form. In addition, guides for plain language include design principles for efficient communication. In this paper we introduce the concept of *simple maps*, which represents an example maps that have been made by adopting the rules of *plain language for plain cartography*.

2. Realization of plain cartography

The simple maps concept arose as part of a requirement to simplify the maps that had been designed for the general public and for outdoor leisure activities in the MenoMaps project (Oksanen et al., 2011). The maps did not take the vision-related disabilities of users into account (Figure 1), and the elderly found them to be too complex and overloaded with information. During the HaptiMap project,

map accessibility became a central aim and, therefore, the map design needed to be recreated.

One possibility to take the elderly into account is to design entirely separate maps for them, which is nowadays feasible on digital platforms. For example, presbyopia can be taken into account in map design by increasing the contrast between objects, and by emphasizing the important features more than traditional cartography does. Also, the typography of map labels, such as their typeface design and print size, has to be adjusted for the users and for the desired reading range (Legge and Bigelow, 2011). Our aim was to make the maps usable not only for the elderly users that visit national parks, but also, to a certain extent, for other user groups. Hence, we addressed vision-related problems in a mobile context by first deriving the principles of plain cartography and then utilizing them to develop a simple map (Figure 2).



Figure 1. Original outdoor map created for the general public.

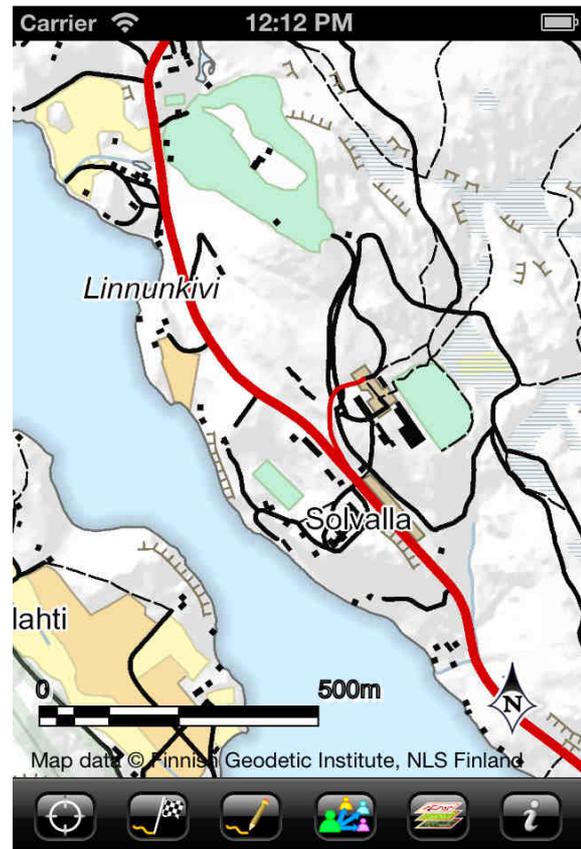


Figure 2. A simple map created for the elderly.

The aim in creating principles for plain cartography was to strike a balance between visual clarity, information density and the necessity of including particular map elements from the perspective of the accessibility of the terrain. By using this approach, only indispensable information from the earlier maps (Figure 1) was preserved; redundant information was removed and the symbology for the features was simplified and clarified. Thus, the selection of the map elements, the degree of generalization and the classification and symbology of the features reflect the principles of plain cartography.

We first ranked the map elements according to their importance within the context of outdoor activities. We gave the highest ranking to a road and path network and to lakes and rivers, cliffs, swamps and other land use features, as well as to buildings. Examples of map elements with the lowest ranking included power lines, forest-type symbols and polygons representing bedrock outcrops, all of which were left out from the simple map. In between the highest and lowest rankings we ranked the surface forms. For the simple map, we left out the contour lines and placed relief

shading behind all of the other map elements to decrease the information density of the map. Secondly, we combined road classes, showed fewer details of buildings and removed redundant and unnecessary labels. Thirdly, we simplified the symbology, for example by leaving out the outlines of road symbols. In addition, we replaced the colour of swamps with a line pattern to increase their visual differentiation. The primary colour of the text elements was still black, but we added a white halo to increase the contrast between the text and the background. We chose to colour the labels for bodies of water with dark gray to distinguish them from other places, and we used italics for labels denoting nature-related features. Finally, we validated that all of the colours were easier for those with poor vision to read by using an application (Vischeck, 2011) that simulates the colour appearance of dichromats (Figures 3 and 4).

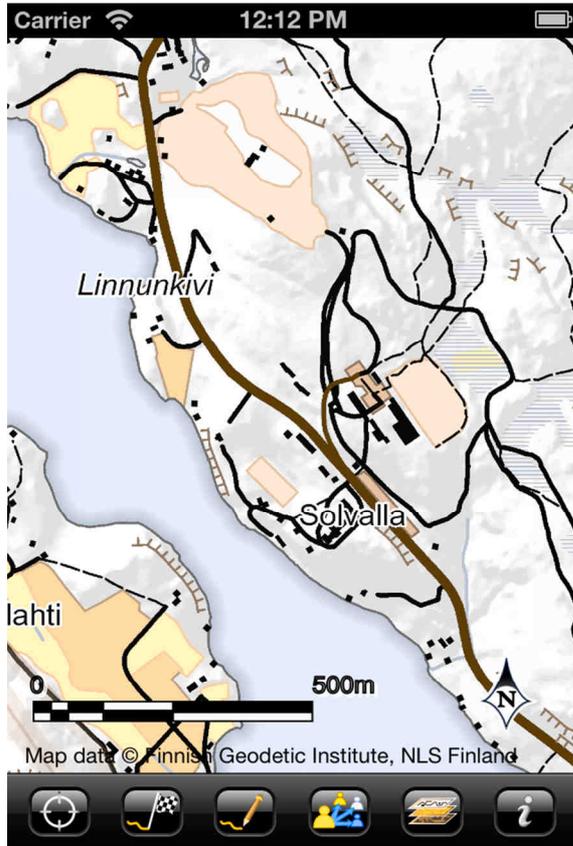


Figure 3. Simulation of the colour appearance of a simple map as seen by protanopes.

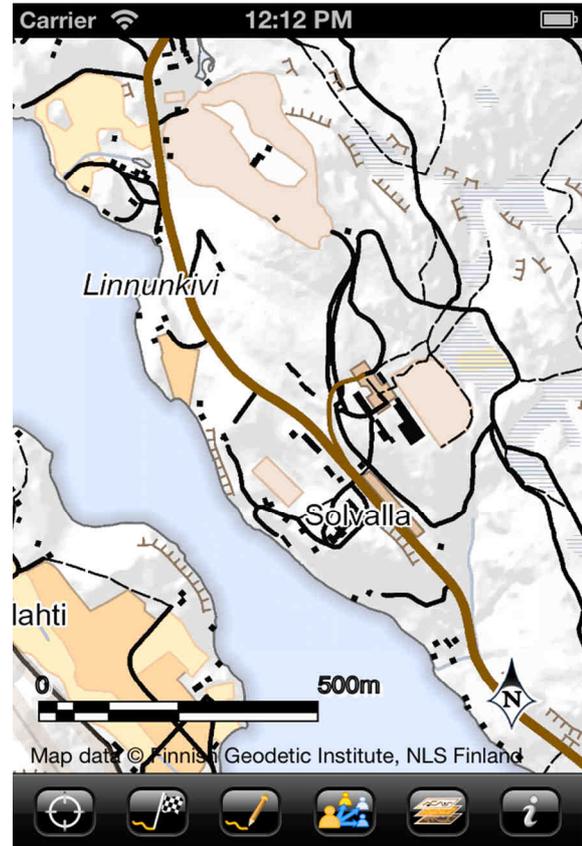


Figure 4. Simulation of the colour appearance of a simple map as seen by Deuteranopes.

We implemented the simple maps for six different design scales (Figure 5). The maps were rasterized and tiled to be suitable for small, high-resolution displays. This required two different sets of tiles. One set was created for displays with a resolution of approximately 150 points-per-inch and another targeting the displays with a resolution of approximately 300 points-per-inch. To reduce data download sizes, we chose PNG8 as the default data format; this also affected the colour palettes. Next, the tiles were made available through a Web Map Service interface. Finally, the maps were iteratively reviewed on an in-house built mobile application.

3. Conclusions and future work

In this paper we have presented the concept of plain cartography, which we consider a viable alternative to general cartography. The simplification and selection required for plain cartography creates maps that should be easier to understand by non-cartographers and especially by the elderly. The mobile context introduces another set of challenges, such as the limited view size and restricted

network connection. An example of the effects of the latter has to do with the maximum size of the colour palettes.

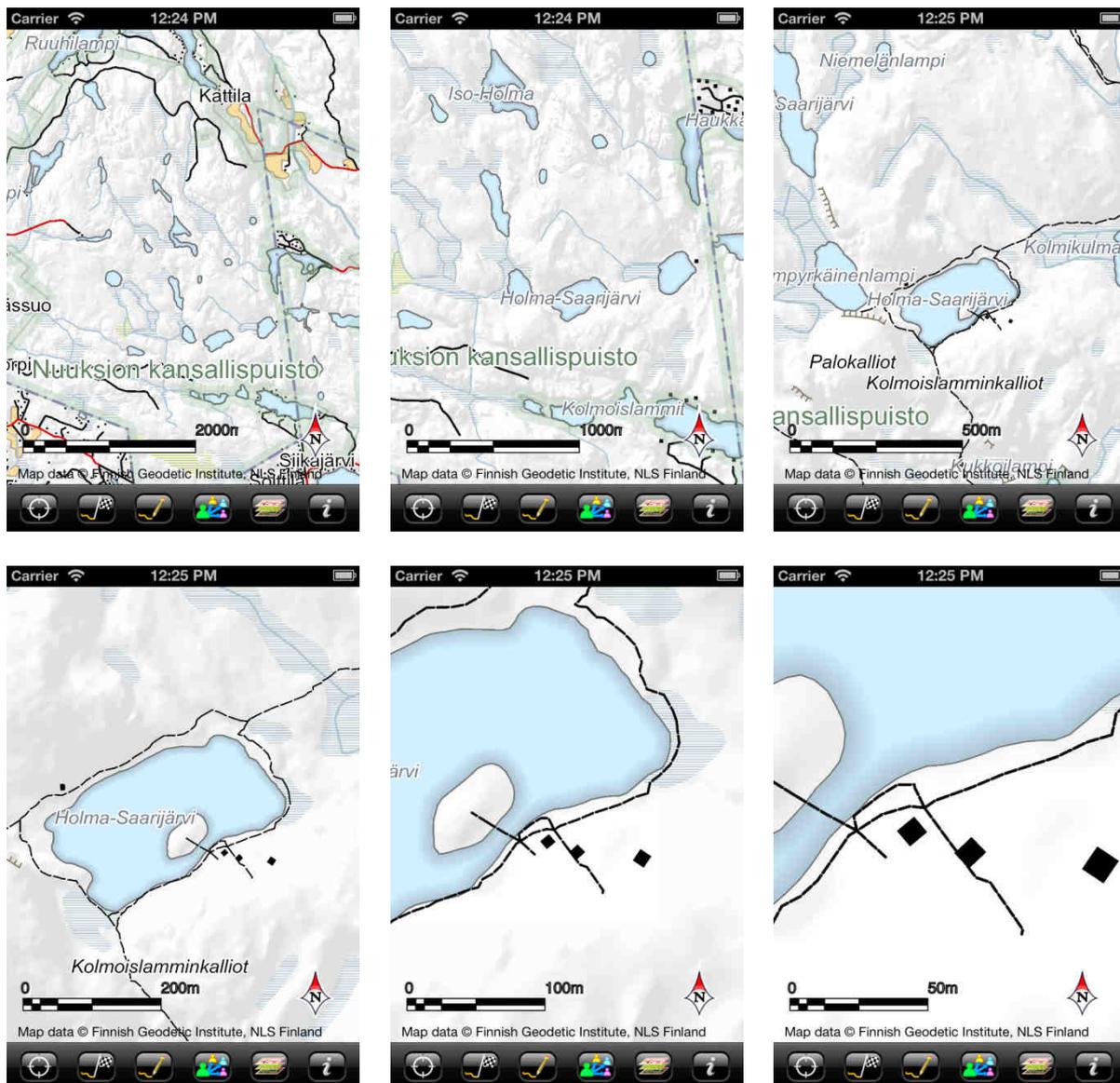


Figure 5. The simple maps on six scale levels, as seen on an in-house built client.

The presented study will continue with an expert evaluation. The results of the evaluation will be used as input for our next iteration, in which elderly users in real outdoor conditions validate the maps. In addition, we have not yet tested combining the simple maps as background maps with selectable themes especially important for the elderly, like the accessibility or steepness of paths. An important part of this research will involve finding a symbology and set of good colour schemes that could be used in these overlay layers.

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6. Biography

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