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HOW TO DESIGN USERS' FRIENDLY MULTILINGUAL MAPS? CYRILLIC AND LATIN LABELS

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ABSTRACT

Labels are a basic map component especially with the increase use of multilingual maps. This paper is an attempt to provide empirical evidence of users' preference regarding label design readability. Two fundamental typographies were implemented in online tests. The first test included maps with Latin labels which were presented to Dutch speakers. Whereas, the second test included maps with Cyrillic labels which were presented to Bulgarian speakers. Both tests had identical maps apart from the labels. For each test, a trail of screen maps was presented to users in twos (or threes); where users expressed their preference of labels' design by choosing one of the two presented maps. Labels' design included variations regarding labels' size, shape, orientation, and texture, which were associated with both areal and point data. Results were statistically analysed and comparisons were made. The comparison between the applications of design's parameters on labels attributes the frames in which cartographic designers can use when labelling Latin and Cyrillic maps, for both monolingual and multilingual maps. Differences and similarities of users' preference were located between both typography (Latin and Cyrillic). To produce user friendly screen maps, these results shows that both designs can use identical parameters and indicated the need to elaborate on testing users' preference of labels' design parameters, considering different typography such as Chinese, Indian, and Arabic.

INTRODUCTION:

Worldwide, maps are the language of geography, since all the geographical phenomena and features can be represented by maps (typographic, thematic, cadastral…etc.). Nevertheless, the language, which the map is depicted with, is crucial for the map users to accomplish map readability and perception. To get the map message through, maps' typography

shall be understandable for map users. Users find reading maps so difficult when they had to use maps with languages that they don't frequently read, or even languages that are different from their mother tongue (Deeb and De Maeyer, 2010). Although map symbology is universal and their design is unified over most map types, map designers shall take into account typographic design rules to provide the highest level of legibility. Bertin defined seven visual variable 1970; size, shape, value, colour, orientation, texture, and X,Y position (placement), which were the basic principles of cartographic design and they were employed in many of the cartographic work. The earliest studies of typographic legibility on maps were presented by Bratz (1970a, 1970b). Since then, few studies tackled the usability of typographic designs on maps to provide better legibility. Like Phillips' (1981) who studied the label design in view point of letters' shape and case style, using eye tracking technique. Deeb et *al*. (2011, 2013b) studied users' preference of typographic design taking into account different users' categories and different map types and colours. In addition to that, they studied the efficiency of the typographic design using Bertin's visual variables as a basic of label design (2013a), where they differentiated between two categories of users considering their expertise and gender. All the mentioned studies considered Latin as a language of the map. Nevertheless, it shall not be neglected that many maps are designed with different lettering systems. Some lettering systems are symbolic like Chinese, Japanese, Korean; other systems are composed of letters of different characteristic. For example; some systems are written from write to left (Arabic and Hebrew) and many others are written from left to right. However, this paper tackles two of the most used lettering systems. Latin and Cyrillic lettering systems use within maps are studied preference wise. Therefore, two parallel experiments were presented to map users to test their preference towards the typographic design as it will be explained in the next section.

2. STUDY DESIGN

2.1. Apparatus

Two parallel controlled experiments were on line conducted. The first experiment was conducted in The Department of Geography laboratory, Ghent University, Ghent, Belgium. The second experiment was conducted in The Department of Photogrammetry and Cartography labratory, University of Architecture, Civil Engineering and Geodesy, Sofia, Bulgaria. The stimuli were displayed on 14-inch screens (1680×1050 pixels; refresh rate: 60 Hz). The first experiment is called The Latin test, where maps' typography were depicted in Latin letter and the interviewee were Dutch speakers, whose mother tongue is Dutch. The second experiment is called the Cyrillic test, where maps' typography was depicted in Cyrillic and the interviewee were Bulgarian speakers, who speak Bulgarian as a mother tongue.

2.2. Participants

Two groups of users participated in the study. First group followed the Latin test. This group consisted of 50 homogeneous Dutch speakers; 25 experts who were in daily contact with maps and they had obtained a Master degree of geographical sciences, and 25 novices who had just started their cartographic education and thus they had no previous cartographic training. The second group followed the Cyrillic test. It is consisted of 50 Bulgarian speakers. Similarly to the Latin test group, the group consist of 25 experts and 25 novices.

2.3. Maps and typographic design

Bertin's visual variables were used as parameters to change the typographic design. Both Latin and Cyrillic typography used the same variables parallelly. Four of Bertins' variables were applied in this study, which are size, shape, orientation, and texture. Four consecutive sizes (8, 10, 12, and 14) were applied on labels. In addition to that, bold sizes were added to these sizes (8 bold, 10 bold, 12 bold, and 14 bold). Typographic shape is linked directly to font types which are infinitive, nevertheless, both Latin and Cyrillic can be classified as serif and sans serif. The orientation of labels was studied in two level; firstly, the orientation of the letters within the world (Italic versus normal). Secondly, the orientation of the whole world in relation to the labeled feature shape. The hierarchy of labels is represented by Labels' texture. Table 1 shows examples of how the visual varaibles were implemented in the design. Both areal and point data were depicted in the test maps. When the two basic map designs were presented to users, labels' placements were preserved and both the typography and the letter system (Latin versus Cyrillic) has changed along the maps. Labels' names were designed carfully providing two conditions; firstly, the length of the names, which is controlled by the number of the used letters, were preserved similarly, and secondly, all the nemes were fictive to prevent any influence of users' previous knowledg on the collected results.

Table 1: Bertin's variables on text

Variable		Latin	Cyrillic
Size	Normal	Cartography Cartography Cartography	Картография Картография Картография
	Bold	**Cartography** **Cartography** **Cartography**	**Картография** **Картография** **Картография**
Shape		Cartography Cartography	Картография Картография
Orientation *Within the world*		Cartography *Cartography*	Картография *Картография*
Orientation *Of the world*		**Cartography** **Cartography**	**Картография** **Картография**
Texture		Cartography Cartography Cartography	Картография Картография Картография

2.4. Stimuli, task and procedure

Using Lime-survey, screen maps were presented to users. Two identical stimuli design were conducted, each of which had a sole difference of the typographic system design. The first stimuli introduced maps with Latin lettering design, and the second one introduced maps with Cyrillic lettering design. Two or three maps were presented to the participant simultaneously for each view during the test trail. Interviewees had to choose one of the presented maps as their preferred map and thus their preferred typographic design. Once the interviewee chose his/her preferred map, the record will be registered in the database. The sum of records for each variable is a weight which will represent the strength of this variable in the analysis. A pre-test questioner was presented to all participants before they started the test. The questionnaire investigate participants' characteristic such as age, gender, level of expertise, language background, the frequency of using maps, and education.

2.5. Data and recordings

Two datasets resulted from both stimuli. One data set is related to the Latin test and the other is related to the Cyrillic test. All records were online collected and automatically stored in a data base. The records were classified into groups coherently with their represented visual variable. From each data set the parallel records were compared and statistically analyzed.

3. RESULTS AND DISCUSSION

3.1 Size

Arial font was applied on both Latin and Cyrillic lettering system. Maps were presented at the scale of 1/100000. Table 2 shows users' preference of normal typographic sizes. The comparison shows that size 14 is the least preferred size in comparison with sizes 8, 10, and 12. The result is valid for both Latin and Cyrillic. Both lettering system showed

similar trend when sizes were pair wais compared. In addition to that, this comparison showed no significant difference between users' preference (*P=0.000*).

Table 2: typographic size comparison for both Latin and Cyrillic (vertical versus horizontal).

Latin	8	10	12	14
8		23	31	35
10	27		39	46
12	19	11		44
14	15	4	6	

Cyrillic	8	10	12	14
8		27	34	42
10	23		40	47
12	16	10		45
14	8	3	5	

Bold sizes were compared pair wise with normal sizes. Figure 1 illustrates the trend that users' showed over the four point sizes (8, 10, 12, and 14). ANOVA test showed no significant difference between Latin and Cyrillic trend (*F= 0.004, P= 0.954*). For bold design, on the one hand, size 8 is the most preferred and size 14 is the least preferred. A small fluctuation in the Cyrillic trend appeared between size 10 and size 12. On the other hand, the vice versa trend occurred for normal design.

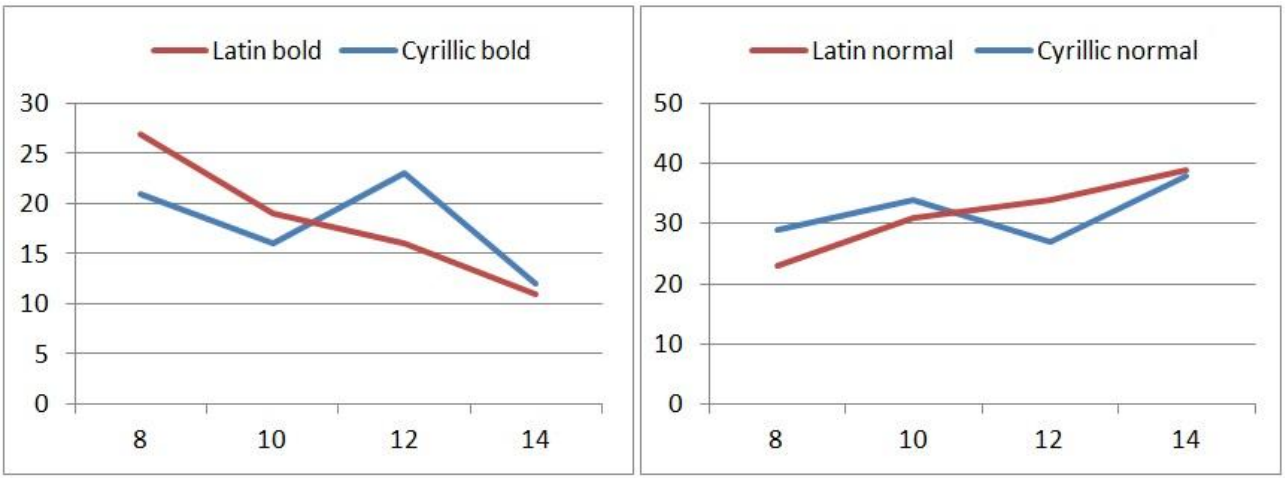

Figure 1: both bold and normal size comparison for Latin and Cyrillic designs.

Considering users' preference of the typographic design of both Latin and Cyrillic, users' responses referred to the similarity between the two lettering system size wise. This can be linked to the similarity of the letters' design themselves in both systems and the way they form words, unlike other lettering system like Chinese, Indian, and Arabic.

3.2 Shape

Since letter system shapes' are linked directly to letter fonts. The list of letters' shapes is infinitive and it falls into different categories; historical, automated, artistic, …etc. Additionally, for both Latin and Cyrillic shapes can be classified as serif and sans serif. In this paper Arial font was chosen as representative for sans serif font (Figure 2) and Times New Roman as a representative for serif font. The Latin test's results show a diversion from the Cyrillic test results in shape comparison, but it worth mentioning that this diversion in the average trend is not significantly different (*F= 0.810, P= 0.463*). See Figure 3. The results show more coherent influence of serif design over both Latin and Cyrillic.

It is not obvious what kind of influence could shape carry on both lettering system preference wise, therefore, further experiment shall be conducted to cover all shape categories in view point of each lettering system characteristics.

Figure 2: the application of Arial shape on both Latin and Cyrillic lettering system.

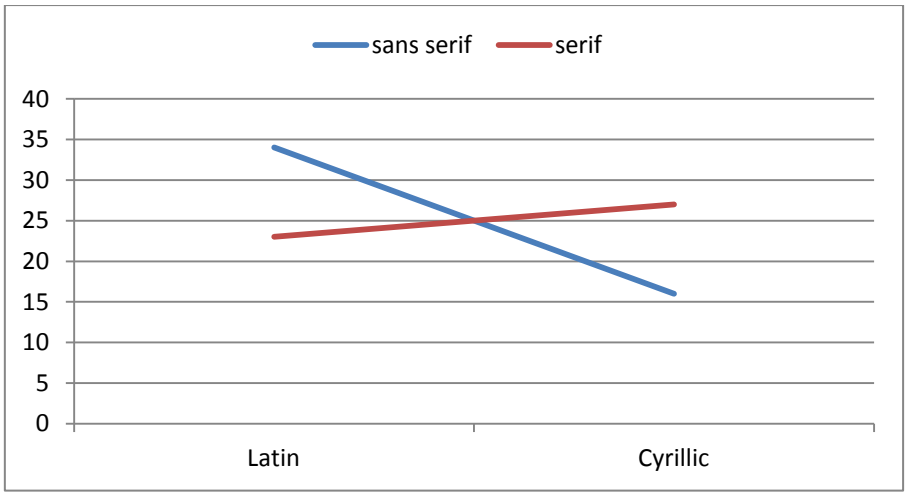

Figure 3: sans serif and serif comparison for Latin and Cyrillic designs.

3.3 Orientation

The orientation of labels was studied in two phases. The first phase tackled the orientation of the letters within the world (italic versus normal). And the second phase tackled the overall orientation of label in relation to the depicted feature. Figure 5 shows examples of the overall label orientation.

When italic labels were compared with straight labels, four sizes were engaged in this comparison (size 8, size 10, size12, and size 14). Straight label designs were preferred over italic label design along the four tested sizes. The comparison between the lettering systems showed no significant difference between Latin and Cyrillic (*F= 4.528, P= 0.077*).

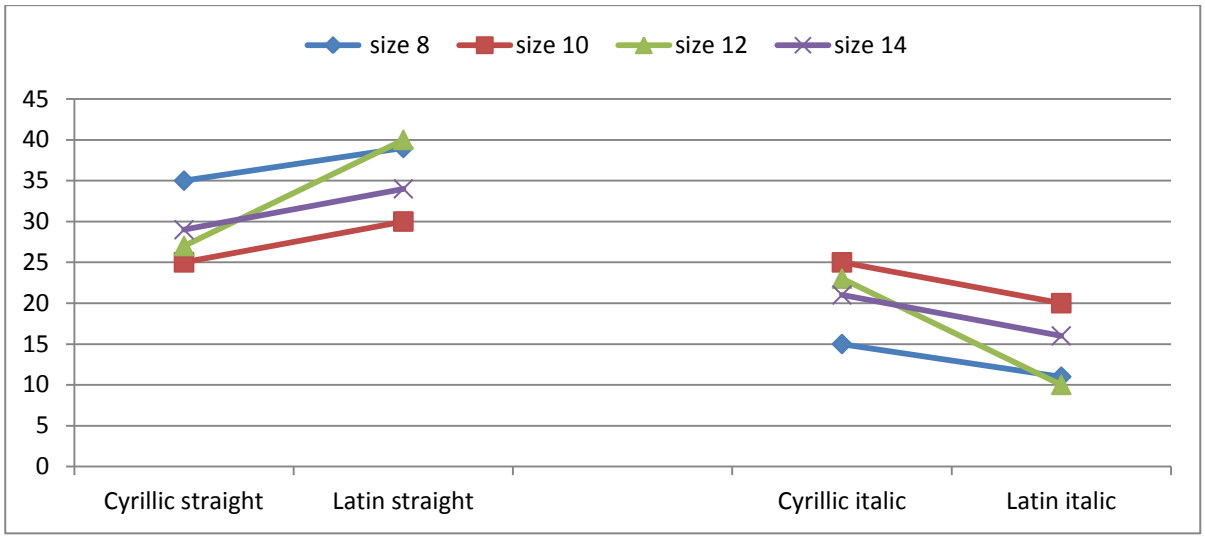

Figure 4: the application of the italic label orientation on both Latin and Cyrillic lettering system.

Three basic orientation of the overall orientation were studied; horizontal label orientation when all labels were placed in horizontal manner, tilted orientation when labels were placed in regard to the depicted feature shape, and finally mixed orientation which combines the two previously mentioned orientation. See Figure 5. The orientation of labels showed no significant difference between Latin and Cyrillic (*F= 0.005, P= 0.945*). Similar trend of users' preference for both lettering system, occurred and illustrated in Figure 6.

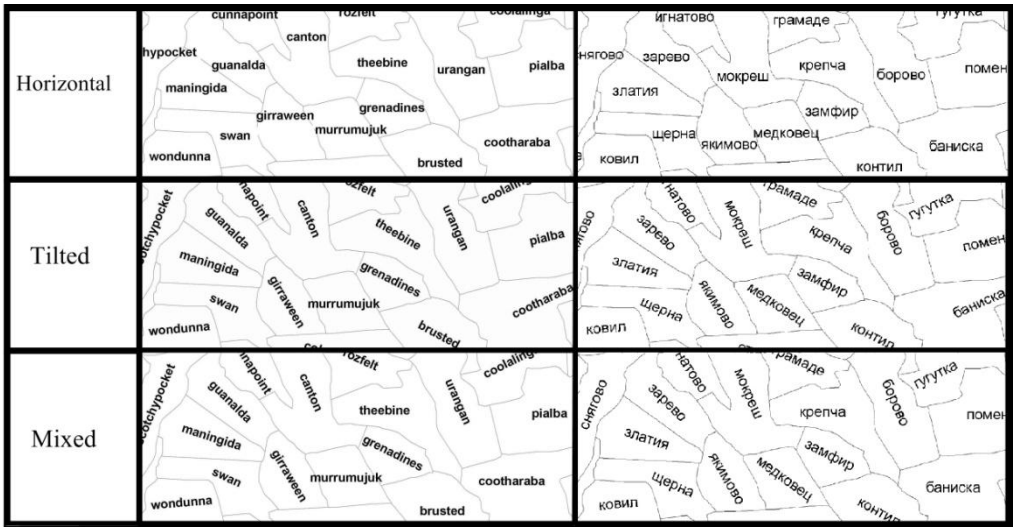

Figure 5: the application of the overall label orientation on both Latin and Cyrillic lettering system.

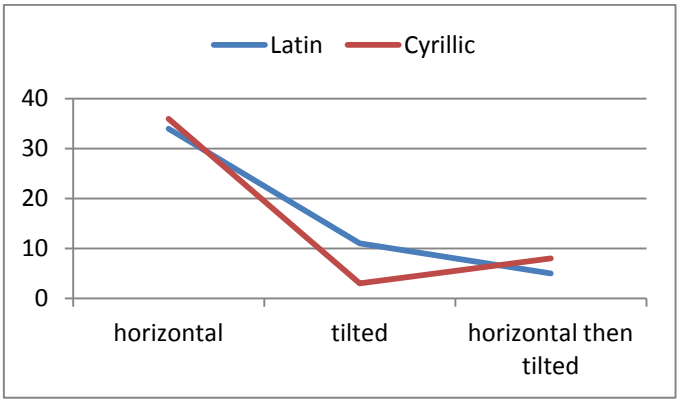

Figure 6: Users' preference of Label orientation for both Latin and Cyrillic lettering system.

3.4 Texture

Textur was formed by the combination of two variable at least. Hirarical texture involves different typographical sizes. This paper compares two shapes (serif versus sans serif within hierarical textur) and waight size (bold versus normal within hiererical texture). The first tested textural design was formed by the combination of three hierarical sizes (size 12, size 10, size 8) and two shapes (Arial versus Times New Roman). The second tested texture design was formed by the combination of three hierarical sizes (size 12, size 10, size 8) and the size waight (normal versus bold).

The first textural comparision (illustrated in Figure 7) describes users preference when sans serif font (Arial) and serif font (Times New Roman) were presented in Hirarical way. This comparision was made in two phase; first normal sizes were compared, then bold size was added to the comparision. Simmilar trend appeared in the comparision between Arial and Times New Roman. Texture with sans serif font is more prefered than texture with serif font for both Latin and Cyrillic and in both normal and bold design.

The second textural comparision (illustrated in Figure 8) describes users preference when normal size and bold size were presented in Hirarical way. This comparision was also made in two phase; first normal sizes were compared with bold sizes for Arial font, then normal sizes were compared with bold sizes for Times New Roman font. On the one hand, Texture of Cyrillic showed similar trend for both sans serif and serif font as users prefered texture of normal sizes over texture with bold sizes. On the other hand, Texture of Latin did not show similar trend; users preference of normal and bold size were almost the same with sans serif. But with serif font users preference of hieghrarical textur was higher for bold size.

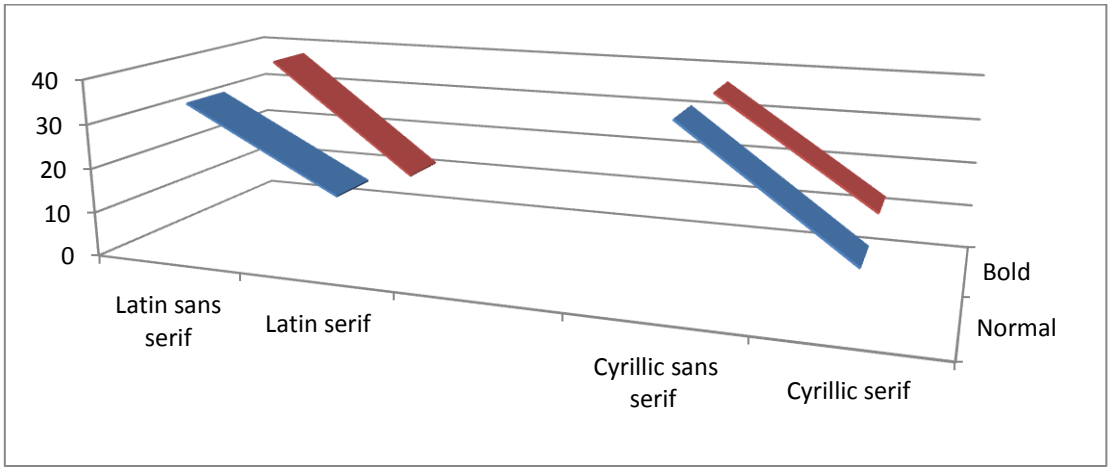

Figure 7: Users' preference of Labels' texture (sans serif versus serif) for both Latin and Cyrillic.

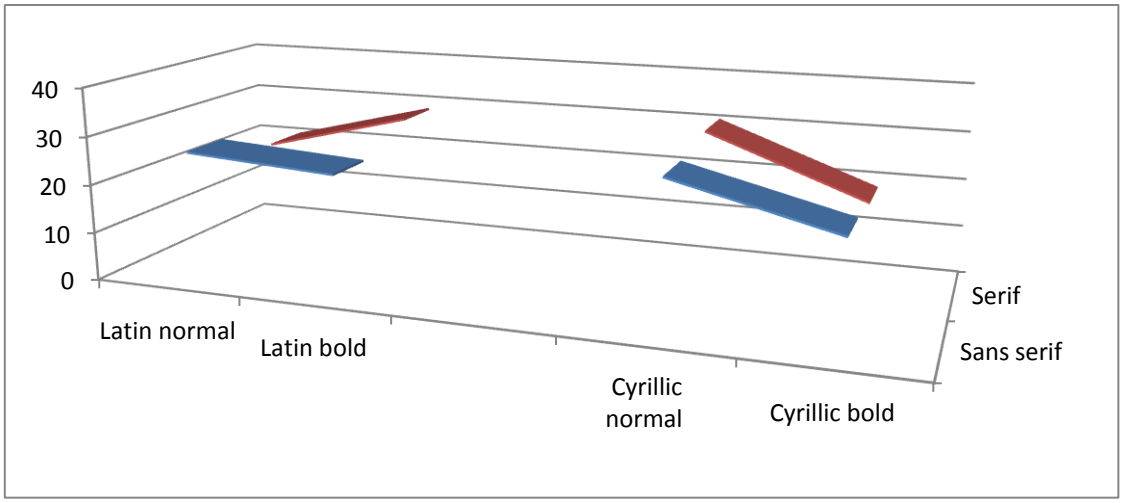

Figure 8: Users' preference of Labels' texture (normal versus bold) for both Latin and Cyrillic.

4. CONCLUSION AND FUTURE WORK

Users' preference of the visual variables' application on both Latin and Cyrillic typography showed similar trend of most variables. In addition to that, no significant difference was found between Latin and Cyrillic design. Therefore, for either monolingual or multilingual map design, which combines Latin and Cyrillic label, visual variables can be applied similarly and parallely for both lettering systems. Regarding size, shape, orientation and texture of labels, users' preference of label design is similar for both Latin and Cyrillic labels. Thus, Designing Latin and/or Cyrillic maps implies adjusting label design to the same level of visual variables parameters. Notwithstanding that this study is a comparison between the results of two parallel tests. An additional test shall be conducted to test whether the same rules can be applied onto multilingual maps.

REFERENCE

Bertin, J., 1970. *Semiology of Graphics: Diagram, Networks, Maps*, Translated by William J. Berg, California: Esri press.

Bratz, B.S., 1970a. An Analysis of the Typographic Legibility Literature, Assessment of Its Applicability to Cartography, *The Cartographic Journal*, 7(1), 6-17.

Bratz, B.S., 1970b. Experimental Use of The Search Task in The Analysis of Type Legibility in Cartography, *The Cartographic Journal*, 7(2), 103-113.

Deeb, R., Ooms, K., Vanopbroeke, V., De Maeyer, P., 2013a. Evaluating the Efficiency of Typographic Design: Gender and Expertise Variation, *The Cartographic Journal*, (in press).

Deeb, R., Ooms, K., Van etvelde, V., De Maeyer, P., 2013b. Toward a deeper understanding of cartographic text visualisation: assessment of user preferences and colour influence. The Cartographic Journal, (in press).

Deeb, R., Ooms, K. De Maeyer, P., 2012.Typography in the Eyes of Bertin, Gender and Expertise Variation, *The Cartographic Journal*, 49(2),176-185.

Deeb, R.and De Maeyer, P., 2010. An Interprative Phenomenological Analysis of The Noise Occuring in Reading Maps.The workshope on IPA methodology, doctoral school, Ghent university.

Phillips, R.J., 1981. 'Search for Target in a Random Arrangement of Names: an Eye Fixation Analysis', Canadian Journal of Psychology, 35(4), pp. 330-346.

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