VISUALIZATION OF SCIENTIFIC RESEARCH RESULTS

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ABSTRACT

In recent years, a comparably fresh research field — information visualization has become commonly available for the researchers of all specialties. Information or knowledge maps play a role of interface for the analysis and intensive study of scientific community and knowledge domains development. The popularity of visualization techniques and interdisciplinary framework has resulted in many problems that have not been solved since the field had emerged. The article introduces the instrumental problems and challenges in this field.

Exposing the functions information visualization allows to understand the difficulties and barriers within the whole visualizing process. A particular example of insight into the Polish science map is considered in the context of a new knowledge.

Keywords: information visualization, visualization problems, science maps, Infovis.

INTRODUCTION

What is typical of the present times is that visualization has been adapted not only in statistical research but also in many fields not necessarily related to science. The visual language has become essential means of communication in the advertisement and any media applications. Its potential was first noted by Edward Tufte, whose book (1990) is being included in the basic tutorials of data visualization. Modern science is based on open access to the knowledge resources which are extremely fast growing now. These dynamics replicates the common trend of big data phenomena as well as technologies development and accessibility to

the wide audience. To subjugate information overload in science, the use of various data visualization techniques and methods is applied.

Visualization application based on scholars related data has particularly expanded in the recent two decades (Chen, 2001; Börner 2010). It is a proof of developing various tools and methods needed to represent the scientific knowledge (Osinska, 2016). On the other hand, such features as intensive social communication, open software standard and online resources like open scientific data and platforms foster the dissemination of information (Infovis) visualization in science. As Katy Börner calls her book — album illustrated by sophisticated maps of knowledge "Everyone can map" (Börner, 2015). She included there some exquisite examples

that were designed thanks to the working groups which are mainly represented interdisciplinary. Openness (big choice of open source tools or online services, open data), availability (user friendly software, Web data), as well as socialization (tools and experience sharing, user communities, published galleries) describe visualization nowadays.

MULTIFUNCTIONALITY

The visual language is omnipresent today in almost all domains of life and visualization is to be considered as one of the communication means, also in scientific fields. There is a tendency to use courageously Infovis instead of text, as its equivalent. For example, posters, illustrated abstracts, infographics — the instances of elements well adopted in scientific communication, evoked discussions between the specialists regardless of their specialization. We can see the communicative and social roles mutually interlace on the ground of information

visualization. Sometimes visual information distorts real facts, whether or not in line with the authors' intension. Manipulation examples can be often met in media. uthors' intension. Manipulation examples can be often met in media.

VISUALISATION PROCESS

Visualisation process consists of several phases which is illustrated on Figure 1. The first step is to collect the research data and it does not constitute a major effort.

Next, data need to be cleaned, processed and prepared for the visual representation (steps 2 and 3). Data science competences are required from the researchers at that phase. Input dataset is represented by vector of attributes, which are difficult to visualize in 2D or 3D configurations. There are two ways to resolve this problem: to reduce dimensions of data or extend output exploration space. In the first approach, different algorithms originated from statistics, machine learning, graphs drawing or artificial neural networks algorithms (ANN) have been applied (Chen, 2004; Börner,

2010). The second method, connected with topological transformations, is used in early Infovis stage (2000 – 2008) by adopting such techniques as "fish eye" view, zooming glass, that is particularly often met in the semantic browsers (Osinska, 2010). The final phase of the mapping process focuses on improving the usability of visual layout through matching glyphs and colours, constructing legend and adding data manipulation functions like sorting, filtering, zooming and another facility.

SUMMARY

In recent years, it can be observed that Infovis technologies have become commonly available and therefore popular among all major scientists. Dissemination of visualization techniques and interdisciplinary framework causes many problems that in majority have not been solved since the field have been emerged. The author discusses the problems and challenges of Infovis starting from exposing the usability context of visualization. If we list all possible functions visualization included, then it is possible to focus on difficulties and barriers and classify them. The main problems scientists face today can be grouped into scientific theoretical, scientific experimental (topological), technical, cognitive and aesthetical. Before visualization process begins we have to collect and process research data, that is the crucial task in initial stage.

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