A Comparison of Geovisualizations and Data Tables for Transparency Enablement in the Open Government Data Landscape

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ABSTRACT

Recent years have witnessed progress of public institutions in making their datasets available online, free of charge, for re-use. There have been however limited studies which assess the actual effectiveness of different communication media in making key facts visible to citizens. This article analysed and systematically compared two representations which are relevant in the context of open government data: geovisualizations and data tables. An empirical user study (N=16) revealed that both types of representations have their strengths: geovisualizations make spatial knowledge and the attractiveness of open government data more visible, while data tables are more adequate for the communication of numerical data. The ideas presented are relevant to open data publishers interested in strategies to effectively put the hidden knowledge in current open government datasets into the hands of citizens.

KEYWORDS

Geovisualization, Open Government Data, Smart Cities, Tabular Data, Transparency

1. INTRODUCTION

The topic of smart cities has attracted growing interest from research, industry and local governments. Many definitions exist, reflecting the plurality of perspectives in the context. Within this article, a smart city is defined after Yin et al. (2015) as "a systematic integration of technological infrastructures that relies on advanced data processing, with the goals of making city governance more efficient, citizens happier, businesses more prosperous and the environment more sustainable". Citizen participation (i.e. getting citizens to timely voice their opinions and wishes) is a key aspect of making city governance more efficient and citizens happier. Indeed, as Milakovich (2010) noted, "Citizen participation provides a source of special insight, information, knowledge, and experience, which contributes to the soundness of government solutions to public problems". Improved citizen participation, in turn, requires greater transparency as citizens must know (or be made known) what is happening in their city and how they can best contribute to it, in order to effectively participate. As indicated by

previous work (e.g. Janssen, Charalabidis and Zuiderwijk, 2012; Ubaldi, 2013; Hossain, Dwivedi and Rana, 2016), open government data is a key enabler of transparency. There are several dimensions of transparency discussed in (Johannessen and Berntzen, 2018), but in this work the focus is on what Johannessen and Berntzen (2018) called 'benchmarking transparency', i.e. the availability of open data (e.g. results from user surveys, demographic information), which citizens and interested parties can use to get a better idea of what is happening within government entities.

Despite a greater availability of open datasets, there is "still a long way to go to put the power of data in the hands of citizens" (The World Wide Web Foundation, 2015). Visualising - or geovisualizing - open data seems the next logical step to put open data in the hands of citizens. Brunetti, Auer and García (2012) and Brunetti et al. (2013) formalised the whole process of getting from a raw dataset to a visualisation as a framework called the Linked Data Visualisation Model (LDVM). LODVisualization (Brunetti, Auer and García, 2012) and LinkedPipes Visualisation (Klímek, Helmich and Nečaský, 2016) are two examples of tools which support LDVM. The current work differs from these two in mainly two ways: (1) a deliberate focus on geographic data preparation, visualisation and interaction (while the two works aforementioned take a more generic approach towards visualisation of open data on the web); and (2) an account for the transformation from non-RDF data sources to RDF (which the two other tools did not intend to address). The main contributions of this article are twofold:

- An empirical investigation of the merits of table-based and geovisualization-based representations for information search in the context of open government data (OGD). Given that geovisualization creation on top of open government data necessitates human effort, empirical investigations of this sort are needed to increase our understanding of when making that extra investment is sensible, and when not;
- An articulation, based on existing theoretical work and data collected from participants, of the distinguishing characteristics of interactive maps and interactive data tables. The value of this characterization lies in a greater understanding of the strengths and limitations of both types of representations when used as communication media.

Background is presented in Section 2, before the introduction of some illustrative geovisualizations developed to increase transparency in the context of OGD (Section 3). Section 4 presents a controlled experiment done with 16 participants to assess the impact of both types of representations on transparency enablement. Section 5 discusses the implications of the results obtained as well as the overall limitations of the work, and Section 6 concludes the article.

2. BACKGROUND AND RELATED WORK

Kamaruddin and Md Noor (2017) identified four components of citizen-centricity which are used as a starting point in this paper: openness, transparency, responsiveness and participation. In line with (Michener and Bersch, 2013), transparency is viewed here as having two dimensions: visibility and inferability. The visibility dimension refers to the extent to which information is complete and easily located; the inferability dimension points to the degree to which information can be used to draw accurate conclusions. Conceptually, a map can be viewed as a geometric structure (Peuquet, 1988), a graphical image (Peuquet, 1988) or a set of statements made by an author at a point in time (Degbelo, 2017). Taking the viewpoint of maps as statements as a starting point, web maps are helpful to enable greater transparency in that they can make value more visible and inferable. Value of what? Of activities, processes and products pertaining to the public sphere. Why value? Because getting and keeping citizens interested in the participating in public decisions relies upon an appropriate communication of the value of their participation. Value, as used here, is in line with Benington (2009)'s definition of 'public value', and encompasses "ecological, political, social, and cultural

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