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Visualization and interactivity in data journalism projects

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Abstract:

Data journalism, as a new form of journalism, is gaining ever greater ground on newsrooms. Datasets and visualization applications have contributed to its bloom. Data and visualizations have a dominant role in the journalistic article, and their introduction affects the narration of the story, too. It is, also, considered by news organizations as a tool which provides information to users in meaningful ways and a part of the transition from being rather passive news-and-information sites to more news-and-information platforms.

On data journalism projects we take into account the existence or absence of interactivity related to the visualizations and the amount of text that is included. The taxonomies of data journalism that have been proposed, take into account various parameters such as the content of the articles, the type of visualizations and the type of interactivity.

In our research, we focus on a previously proposed taxonomy and we investigate how it applies to some of the most popular news organizations that develop online, data-driven, interactive news articles. By collecting data journalism articles, we try to check how visualization affects the story and the type of journalism interactivity. In particular, we examine the websites of *The Guardian* and *The New York Times*, which have been characterized as the “elite” of newsrooms, the *British Broadcasting Corporation (BBC)* and the *Cable News Network (CNN)*, two of the most popular networks, and the *Associated Press (AP)* and *Reuters*, two of the largest news agencies.

Keywords: Data Journalism, Taxonomy, Visualization, Interactivity

1. INTRODUCTION

New tools, services and applications offered by Web 2.0 and Web 3.0 form a constantly changing landscape in many professional disciplines. In this evolving landscape, media are not impassive. Instead, they try to adapt to the existing conditions. New technologies, new forms and new content characterize media on the Internet, which become a common place of work, education, relaxation, culture and politics.

Today, the ubiquitous presence of new media has led us to consider them as data (Lievrouw & Livingstone, 2006). Thus, the journalistic profession is changing. Journalists and news media organizations are required to adapt to new conditions in order to become competitive and respond to the needs of the market. News websites, online radio and web TV are the main areas of action. What is generally observed is that the arrival of digital technologies has made journalistic work both easier, as it has increased the detection of economic and political organizations, and more difficult, as it has overwhelmed journalists with more information than that which can be handled by their investigative toolbox (Venturini et al., 2017).

As a result of these changes, a new type of journalism emerges. It is called data journalism and it is related to data-driven journalism. Data journalism should be approached not as a technology that needs to be adopted or as a given existing practice, but rather as something that “materially and incoherently exists in a fundamentally relational space, across organizations, outside the news organizations, and even possibly across the national framework” as De Maeyer et al. (2015) noticed. This condition helps readers to understand easier the importance of articles or allows them to track data related to them. Data journalism combines spreadsheets, graphics, data analysis and the biggest stories (Rogers, 2008; Veglis, Bratsas, 2017a). This means that journalists, graphic designers and programmers have to collaborate (Uskali & Kuutti, 2015). However, it is important to clarify that data journalism is a kind of journalism that follows the same fundamentals as all the others. Data journalism aims to tell a good story, but the main difference is that the story is based on information coming from data and not from the traditional sources (Kalatzi, Veglis &

Bratsas, 2018). So, data journalism brings together data processing specialists and academics and this way of writing is characterized by complex work and collaboration methods (Charbonneaux & Gkouskou-Giannakou, 2015).

News organizations view data journalism as a tool to fulfil their core task: to provide relevant information to readers in meaningful ways. They perceive it as part of a transition from rather passive news-and-information websites to more interactive news-and-information platforms. On these platforms, readers can not only consume journalism but also interact with data depictions and raw data sets (Sirkkunen, 2011). According to scholars, these interactions can be characterized in different ways. For example, Bucy (2004) distinguishes two kinds of interaction: user-to-system interaction and interpersonal interaction (user-to-user). Jensen (1998) reports four kinds of interaction: transmissional, consultational, conversational, and registrational.

For science, as well as for journalism, it is inevitable to collect, manage and process this amount of information. Reading, interpreting and understanding text documents by using automated procedures are central points (Rysch, 2013). Current conditions change the way in which a journalistic story is narrated, as traditional journalistic methods are mixed with data analysis, programming and visualization techniques (Appelgren & Nyrgen, 2014). Thus, working groups consist of a combination of skills in journalism, web development, data analysis, visualization and statistics. Data visualization is now both a career in itself and a ubiquitous feature of digital arts and aesthetics of "post-digital". It is also a privileged vehicle for the imitation impetus to bring back recent aesthetic practices (Cubbit, 2015).

This paper addresses these issues and it is organized as follows: a definition of data journalism, a brief description of how visualization affects the narration and the type of journalism interactivity that may exist in data journalism projects. It focuses on a previously proposed taxonomy of data journalism projects and investigates how it applies to some of the most popular news organizations that develop online, data-driven, interactive news articles. In particular, the survey examines the websites of *The*

Guardian and *The New York Times*, which have been characterized as the “elite” of newsrooms, the *British Broadcasting Corporation (BBC)* and the *Cable News Network (CNN)*, two of the most popular networks, and the *Associated Press (AP)* and *Reuters*, two of the largest news agencies.

1. Literature review

Definition of Data Journalism

The first example of data journalism project was published in the *Guardian* in 1821, concerning the number of students who attended school and the cost per school in Manchester (Gray, Chambers & Bounegru, 2012). Data journalism as a term was firstly referred by Rogers Simon in a post to the *Guardian Insider Blog* (Knight, 2015). There have been many data journalism projects from then. The introduction of Information and Communications Technology (ICT) and the availability of large digital data sets, known as “big data”, have turned data journalism in the current form. “Big data refers to data sets that are too large for standard computer memory and software to process”, according to Lewis & Westlund (2015). Bradshaw (2012) notes that “data can be the source of data journalism or it can be the tool with which the story is told –or it can be both”.

Veglis and Bratsas (2017a) proposed a definition in order to better address the importance of visualization and interactivity, which are significant factors in data journalism. They defined data journalism as the process of extracting useful information from data, writing articles based on the information and embedding visualizations (interacting in some cases) in the articles that help readers understand the significant of the story or allow them to pinpoint data that relates to them.

Visualization in Data Journalism Projects

In a data journalism project traditional journalistic working methods are mixed with data analysis, programming and visualization techniques (Nygren, Appelgren & Huttenrauch, 2012), a project often combines graphic design, computer-assisted and investigative reporting. This means that the presentations can include interactive maps, visualizations, timelines and graphics (Royal, 2012). Some visualization systems have also begun to incorporate storytelling into their design (Segel & Heer, 2010).

Visualization is one of the main stages in data journalism workflow.

Veglis and Bratsas (2017a) have proposed a six-stage procedure related to how a data journalistic project is produced: Data compilation, data cleaning, data understanding, data validation, data visualization and article writing. During these stages, data journalists have to discover high-quality data, which means that they may have to find content in the *invisible Web*, clean “dirty” data, which means that they have to correct or clean a data set that is in an appropriate, non-proprietary format, use the appropriate tools of interrogation, which will allow data sets to be correlated, queried, manipulated and transformed, and integrate data, in order to get together from different sources (Halevy & McGregor, 2012).

Data journalism, also, promotes open journalism and open data, as Simon Rogers says. Tim Berners-Lee developed a five-star scheme¹ for open data which has been adapted by journalists, too, in order to produce articles in the Web 3.0 era. The first star means that data are accessible on the web with an open license, but locked-up in a document. The second star means that data are available as structured data. The third one means that data are in non-proprietary formats. The fourth star means that data have a Uniform Resource Identifier and can be shared on the Web. The fifth star means that users can link their data to other to provide context.

Journalism has now become familiar with data and databases as a subject of news and journalistic evidence. Also, in data journalism projects, the nature of data is changing. Big data and related approaches present new perspectives for understanding the epistemology of converting the raw information into journalistic truth. With regard to news distribution, big data is associated with emerging presentations of digital journalism, such as infographics, interactive data depictions and adaptable probability models, among others (Lewis & Westlund, 2015). Rogers (2014) defines open data as free information available to anyone in a machine-readable format that permits analysts to work with it. Data depictions and analysis are often part of the story, embedded in the plot rather than the cornerstone of the story. There are two basic ways to start a story of data journalism: A data set provides more information about a story theme that has already been discovered by the editorial room. A set of data functions as a starting point for the whole story (Sirkkunen, 2011).

Visualizations can be divided into static and interactive. In the static visualization, there is only one view of data and in many occasions, multiple cases are needed in order to fully understand the available information. Also, the number of dimensions of data is limited. Static visualization is ideal when alternate views are neither needed nor desired and are special suited for static medium (for example print). In the case of the Web, its capabilities can be exploited only with the utilization of interactive data visualization (Veglis, 2009).

Dynamic, interactive visualizations can empower people to explore data on their own. The basic guideline for interactive visualizations has been set by Ben Shneiderman (1996) who proposed a “Visual Information-Seeking Mantra” (overview first, zoom and filter, then details-on-demand) and it is the basic guide for every interactive visualization today. The above functions allow data to be accessible from every user, from the one who is just browsing or exploring the dataset to the one who approaches the visualization with a specific question in mind. So, it will be able to facilitate different audiences. An interactive visualization should initially offer an overview of data, but it must also include tools for discovering details. Interactive visualization may also include animated transitions and well-crafted interfaces in order to engage the audience with the subject it covers (Murray, 2013).

Users interact with the visualization by introducing a number of input types. With the help of these input actions, users can control both the information represented on the graph or the way that the information is presented. In the second case, the visualization is usually part of a feedback loop. In most cases the representation of the information is changed rather than the information itself (Ware, 2012; 2008).

Interactivity in Data Journalism Projects

In modern data journalism projects information is presented online with an interactive component which allows user customization and the use of databases which turn into graphics with dynamic information (Royal & Blasingame, 2015). So, data journalism allows the transition from being news-and-information site toward a more interactive news-and-information platform (Sirkkunen, 2011).

Many definitions of interactivity were introduced (Spyridou & Veglis, 2008), but the definition that best suits the case of interactive visualizations in media projects is: “a measure of a medium’s potential ability to let the user exert an amount of influence on the content and/or form of the mediated communication” (Jensen, 1998).

According to Bucy (2004) there are two types of interactivity: (i) content (or user-to-system) interactivity (involves the control that news consumers exercise over the selection and presentation of editorial content), and (ii) interpersonal (or user-to-user) interactivity (involves person-to-person conversations mediated by a network). Jensen (1998) categorizes interactivity into four types:

Transmissional interactivity: It is a measure of a media’s potential ability to let the user choose from a continuous stream of information in a one-way communication. It can apply to the majority of the visualizations.

Consultational interactivity: In this case there is a measure of a media’s potential ability to let the user choose from an existing selection of pre-generated information in a two-way media communication. It can cover all the visualization projects that offer many views of the same data.

Conversational interactivity: It is a measure of a media’s potential ability to let the user produce and input his/her own information in a two-way communication, which is stored or displayed in real time.

Registrational interactivity: In this case there is a measure of a media’s potential ability to register information from and thereby also adapt and/or respond to a given user’s needs and actions. It can be applied to the interactive visualizations that allow the input of user data that can produce an altered visualization in real time.

2. Theoretical framework

Taxonomy in data journalism projects

Data journalism projects have been categorized by researchers taking into account different parameters. Kang and Rosenbaum have proposed a taxonomy in which visualizations are an important characteristic (Gray et al., 2012; Kang, 2015). Simon Rogers (2014) treats the data journalism project as a total and he focuses on the type of data, the method of gathering data and the intended audience. The taxonomy proposed by Veglis and

Bratsas (2017b), which is the one used in our survey, has a hierarchical structure. At first, there is a distinction between projects related to their content: (i) projects that include only numbers, (ii) projects that include tables and (iii) projects that include some kind of visualization. In relation to the visualizations, projects can be divided into these in which the visualization is part of the story (and supplements or adds value to the narrative) and these in which the visualizations are structured as a story (the visualizations are the main part of the story and the actual text of the project is quite limited and attempts to explain and clarify parts of the visualization).

Both previously mentioned categories can include static or interactive visualizations. Projects with static visualizations can be published in both static (for example print) and also interactive mediums (for example the WWW).

Finally, projects with interactive visualizations can be further categorized depending on the type of interactivity they utilize: They can be: (i) transmissional, that includes projects that utilize simple interactive visualizations that allow the user to view the visualization and provide him with some additional explanation of various elements of the visualization in the form of pop up information, (ii) consultational, that includes projects that offer multiple views of the same data, as well as projects that include interactive visualization that allow the user to zoom in certain areas (maps, timelines, etc), and (iii) conversational that includes projects that visualization that accept input data from the user which can alter the visualization. It is worth noting that consultational and conversational interactive visualization projects allow the user to have a more active role in a data journalism project.

Also, we have to take into consideration the annotation layer, which is a feature that highlights interesting issues in the data which can be explored by the reader. This layer supplements the visualization that usually consists of a visual representation of the data and a navigation layer which can be used by readers in order to explore the data (Bradshaw et al., 2015). It is important to mention that it can be employed both in static and interactive visualizations. Each visualization included in a project usually incorporates

a proper headline, a short introduction that explains the context of the data for the graphic. This introduction to the graphic can help the reader understand the data more easily.

3. Methodology

The methodology of this study is based on content analysis. Specifically, the paper focuses on data journalism projects published by six news organizations that develop online, data-driven, interactive news articles. In particular, our survey examines data journalism projects that have been published on the websites of *The Guardian* (<https://www.theguardian.com/us>) and *The New York Times* (<https://www.nytimes.com/>), the *BBC* (<https://www.bbc.com/news>) and the *CNN* (<https://edition.cnn.com/>), and the *Associated Press* (<https://www.ap.org/en-us/>) and *Reuters* (<https://www.reuters.com/>). In our survey, we collected 63 data journalism articles as they were published in the websites referred above, from January till March (the first ten days of March) 2019. In particular, we examined six (6) articles of *The Guardian*, six (6) of *The New York Times*, sixteen (16) of the *BBC*, nine (9) of the *CNN*, fourteen (14) of the *Associated Press* and twelve (12) of the *Reuters*. At this point, we have to clarify that our interest is not about the number of the data journalism articles published by these news organizations during the period of the survey. Our interest is focused on how the taxonomy proposed by Veglis and Bratsas (2017b), which has been described earlier, can classify the projects.

According to the taxonomy, first of all we examined the content of the data journalism projects. We noticed if there were numbers, visualizations of tables. Secondly, we examine if the visualizations are part of the article, so they are supplementary or they are the article, so they are the basic part of it. The next step was to examine if the visualizations are static or interactive. Finally, we examined which of the three types of interactivity (transmissional, consultational, conversational) exists in the data journalism projects with interactive visualizations.

4. Data analysis

First of all, every article includes some type of visualization. Some of them include maps or pictures and others include charts or other diagrams. It is worth mentioning that some articles feature more than one visualization, while in others visualizations are given as external links. The themes of the articles are related to politics, economy, society, health, science/environment, and weather. The most popular categories are politics and economy as we meet them more frequently in relation to other categories and in most of the news media sites. (Figure 1 and 2).

Figure 1: Themes of the articles

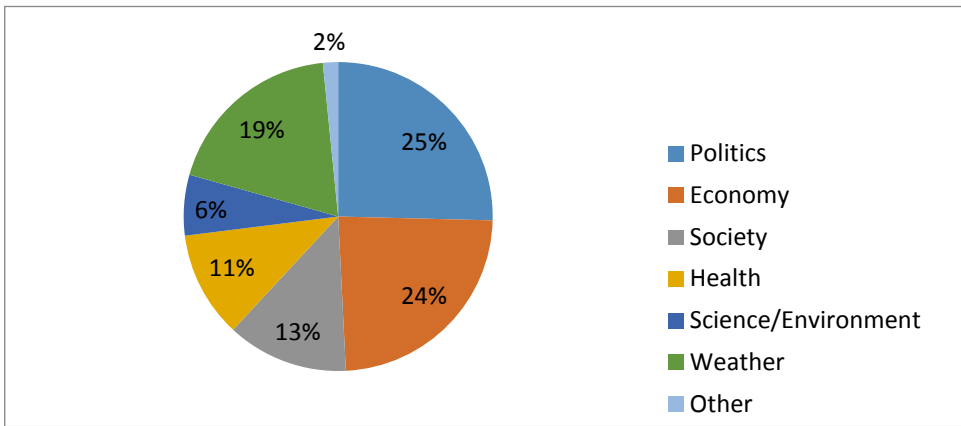
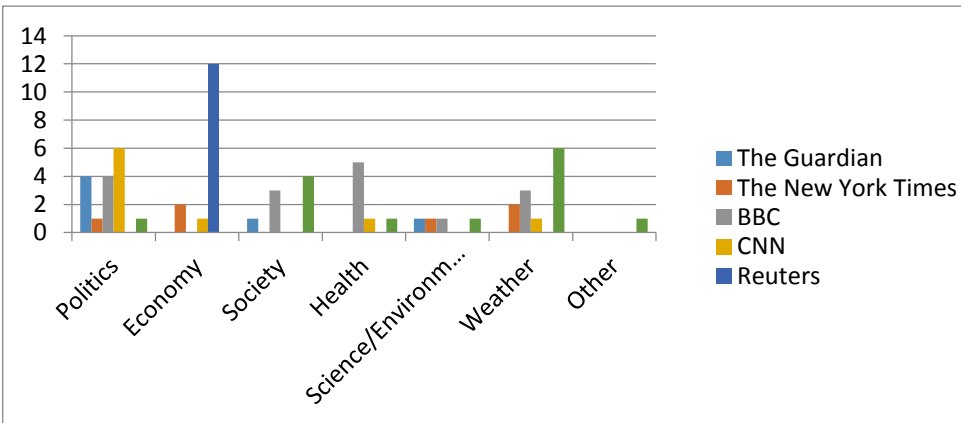


Figure 2: Themes and news organizations



In all the articles, visualizations are part of the story, which means that there is text and the visualizations are sometimes supplementary, supporting the text given, or explanatory, explaining the text with figures. In general,

the presence of these visualizations adds value to the narrative, without making them the basic part of the project.

87% of the visualizations are static, which means that the user cannot interact with them. They just depict the figures without giving any other options to the user. From the 63 articles, just eight (8) of them include interactive visualizations, which are maps and diagrams. In particular, five (5) of them are diagrams and three (3) of them are maps.

In relation to the type of interactivity, in most of the data journalism projects (62%) it is transmissional (Figure 3), as they allow users to view the visualization and provide them with additional information. In one of them the type of interactivity is consultational, as it is a map with a sliding bar, which allows the user to zoom in certain areas and obtain specific information (Figure 4). In two of them the type of interactivity is conversational, as there are maps that allow the user to input data that can alter the visualization in order to have access to particular information (Figure 5).

Figure 3: Article with transmissional interactivity

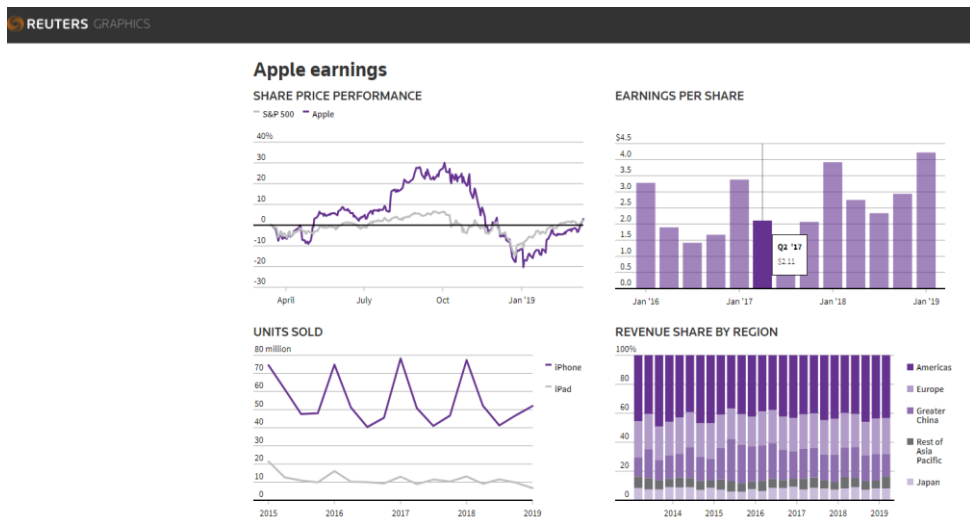


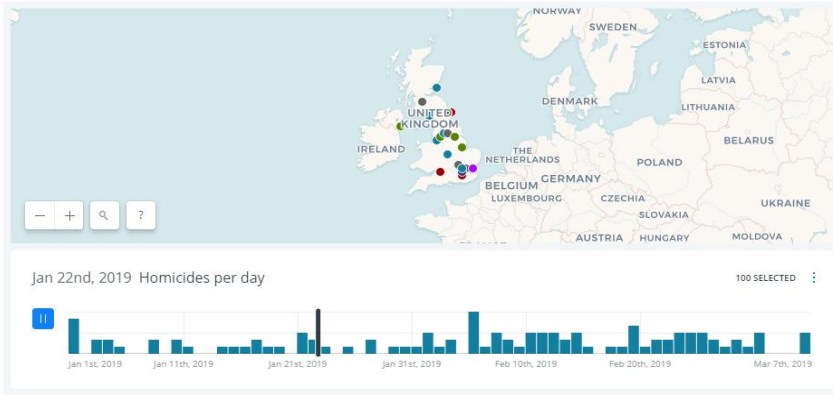
Figure 4: Article with consulational interactivity

Source: BBC research



Twenty-two victims were killed in London, nine in Greater Manchester and eight in the West Midlands.

The first 100 homicides of 2019
Tap or click for more details

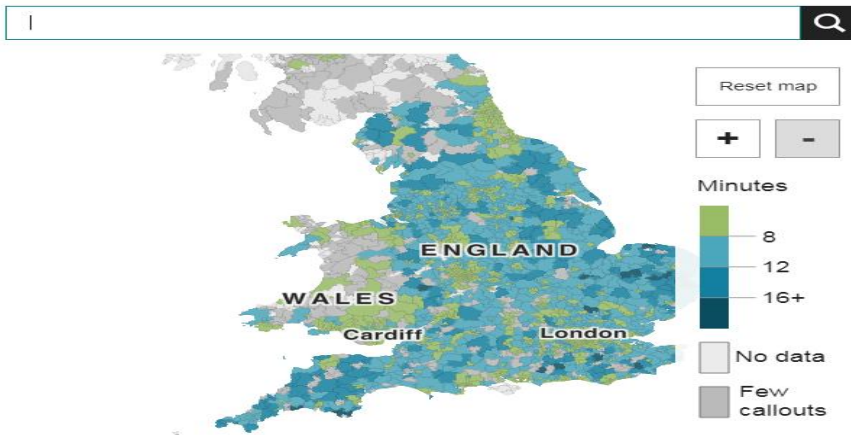


● Stabbed ● Assaulted ● Shot ● Fire ● Strangled ● Not known

BBC Research. Map built with Carto

Check urgent ambulance response times in your area

Enter a postcode or click on the map to explore



Source: Ambulance trusts. Data is shown for postcode districts with more than nine highest category callouts in January-October 2018. Districts with 10-49 callouts are labelled "low numbers". Northern Ireland does not use comparable categorisation.

The results of the survey indicate that all the data journalism projects that have been examined include a type of visualization, which is part of the story. The visualizations, in most cases, are static, so there is no

interactivity with the user. In the cases of interactive visualizations, the type of interactivity in most of the projects is transmissional.

6. Conclusion

The emergence of data journalism has formed new conditions for writing and distributing the news. Professionals adopt new methods and the public new practices about how to read information. More and more news organizations utilize it in order to tell a story. It is believed that data journalism is one of the pillars of modern journalism. In the big data era, this kind of journalism can play a significant role in utilizing the available data sets (Kalatzi, Bratsas & Veglis, 2018). In data journalism projects we notice a new way in which the information is spread. In this new landscape, visualizations have a central role to the narrative, whether they are static or interactive. In the case of interactivity of data journalism articles, the possibilities offered to the user are much more, and they give new features to the narrative. Interactive information graphics are “visual representation of information or knowledge” that combine verbal and visual elements “in such a way that they create a new hybrid form” (Weber & Rall, 2012).

This paper discusses the issue of visualizations and interactivity in data journalism projects. It uses a hierarchical taxonomy in order to classify data journalism articles published in *The Guardian*, *The New York Times*, the *BBC*, the *CNN*, the *Associated Press* and *Reuters*. As it is proved, the proposed taxonomy can be used in all the types of data journalism projects. Of course, this work could be extended in relation to both the duration of the survey period and the number of the sites of the news organizations that have been examined.

In the future, the effectiveness of the proposed model could be extended by including other types of visualizations, such as infographics, which are data-rich visualizations of a story that communicate complex data in an engaging manner (Harrison, Reinecke & Chang, 2015). They give information to the user in a quick and clear way (Siricharoen & Siricharoen, 2015) without having to read a lot, and their main goal is to be shared. In this way, the taxonomy could focus on a particular kind of visualizations, and this would help to test the effectiveness of infographics in the transmission and distribution of news.

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¹ <http://opendatahandbook.org/glossary/en/terms/five-stars-of-open-data/>