Using Information Visualization in the Media

Obstacles and Challenges

Gerard Smit, Laura Buijs, & Yael de Haan

University of Applied Sciences Utrecht

ABSTRACT

Depicting news graphically is considered an apt way to deal with two challenges of modern journalism: to disclose big data, and present the news attractively, visually, and fast to grasp. Newsrooms try their hand at it and are figuring out how to organize production of information visualizations effectively. This study delves into reported obstacles and challenges for the production of news visualizations and suggests that enhancing the quality of information visualization in news media, asks for a clear view on what information visualization means for the production of news, rather than only stimulating journalist to acquire new skills.

Keywords: Information visualization, data visualization, infographics, collaboration, multiskilled-journalists, case study

INTRODUCTION

News stories are increasingly accompanied by infographics and visualizations, and these are becoming more sophisticated than ever before (Giardina & Medina, 2013; Utt & Pasternak, 2000). Even though information visualization has a long history in other disciplines (Chen, 2004), within the journalism sector there is little agreement on the best way to integrate visualizations into the news production process (Weber & Rall, 2012).

Because of its potential for telling stories with data, the need for visualizations within journalism practices is growing (Giardina & Medina, 2013; Utt & Pasternak, 2000). Gershon and Page (2001) state that "storytelling allows visualization to reveal information as effectively and intuitively as if the viewer were watching a movie" (p. 31). Many media companies feel a sense of urgency to 'do something' with visualizations. Therefore newsrooms are experimenting with different kinds of information visualizations and best ways to produce them effectively.

As is known from attempts to make traditional and digital news desks work together, convergence is an arduous process that does not always produce the desired outcome of efficiently cooperating multi-skilled journalists (Tameling & Broersma, 2013; Quin, 2005). Journalists have a hard time developing new skills and don't feel attuned to the work ethos of the different departments (De Haan, Landman, Boyles, *in press*).

The emergence of information visualization in the media asks for a reallocation of skills and tasks in the media organization. A lot of questions remain to be answered. What can visualizations actually do for journalism? What skills are needed to produce adequate visualizations? How should these skills be allocated in the newsroom? How could text oriented journalist be stimulated to cooperate with information designers? And what do these processes and changes mean for competencies and skills of future journalists? Should

journalism students be skilled in writing, designing, and programming or is collaboration the key?

This study explores the research that has done on the requirements for the production of effective information visualizations and attempts to extract guidelines from the actual production of information visualization in the media industry.

The research question is:

How should the production process of information visualizations be organized in order to produce visualizations that are up to the standards of both journalist and designers?

To answer this question we will review the relevant literature on this topic, and focus on three sub questions:

1. *What skills are needed to produce adequate information visualization?*
2. *How should the different specialists involved in the production process collaborate?*
3. *What kind of organization structure is needed in order to produce adequate visualizations?*

By answering these questions this paper sheds light on the multifaceted challenge of optimizing the use of information visualization in journalism.

LITERATURE REVIEW

Information visualization goes by different names like 'data visualization' and 'infographics'. As our focus is the production process of information visualizations, we opt for the more general term 'information visualization', which refers to all mental models for data (Spence, 2007). More specifically we refer to infographics as visualizations that are manually generated around specific data, and to data visualization as visualizations that are

algorithmically generated and can be easily regenerated with different data (Iliinksy & Steele, 2011).

Influencing factors for production processes

To answer our research question, we looked at empirical studies on design processes, and workflow of information visualization. In addition, we studied the views of well know information visualization makers. We found that the main challenges in the production process of information visualizations can be grouped into an *individual*, *group*, and *organizational level*.

Skills (individual level)

Several studies state that visualizing data demands a range of skills, such as writing, editing, designing and programming (Giardina & Medina, 2013; Segel & Heer, 2010). According to Weber and Rall (2012) data journalists should have the skills to dig deep into data, to analyze and filter it, to create a story around it and visualize the story. Andy Kirk (freelance data visualization design consultant, and editor of the visualization blog visualisingdata.com) listed eight different required capabilities in his book *Data visualization: a successful design process.* Kirk proposed the capabilities as the "eight hats of data visualization design": (1) the initiator, (2) the data scientist, (3) the journalist, (4) the computer scientist, (5) the designer, (6) the cognitive scientist, (7) the communicator, and (8) the project manager (Kirk, 2012). According to Kirk: "Taking an analytical look at the range of required capabilities reveals a role and need for many types of people, which can of course be fulfilled by a number of people or just one" (p. 48).

News infographics not only require special skills, but are time-intensive as well (Hamblin, 2012). In newsrooms designers and programmers are mostly the ones responsible

for the visualization of data (Weber & Rall, 2012). Knowledge of data interpretation, however, often lacks. This may lead to misinterpretation and poor visualizations (Nijhuis & Boersema, 1999).

A survey (N = 200) conducted by the *European Journalism Centre* reveals that many journalists want to learn how to integrate data into their stories (Bradshaw, 2011). Most (70%) believed data journalism is very important, however, even more respondents felt they lacked adequate knowledge. The majority of the journalists were interested in acquiring knowledge in analyzing data, visualization, and verifying, cleaning, and finding data (Bradshaw, 2011).

This indicates that journalist are willing to learn about other disciplines. During the first roundtable on data-driven journalism in Amsterdam on 24 August 2010 (organized by the *European Journalism Centre* in collaboration with the *University of Amsterdam*), Stefan Fichtel, chief infographics designer at *Kircher-Burkhardt* (Berlin), stated that data-journalism could profit greatly from the knowledge of graphic designers (EJC, 2010). A process is needed where the data is first fully understood and then visualized. Whether this should best be done by a multi-skilled journalist, or by an interdisciplinary working team remains an open question.

Mindset (group level)

Several studies show that optimal collaboration between different experts, such as journalists, designers, and programmers, is crucial for design success (Beak, Liebowitz, & Lewis, 2000; Weber & Rall, 2012). Gerson Mora, an infographic-maker who published his work in several Brazilian publications, underlines the need for collaboration as well, and states that an information visualization within journalism practices should be the result of collaborative and multidisciplinary work (Mora, 2012). However, collaboration is not always successful.

Designers mostly think in terms of images (i.e., visual thinking), while journalists are trained in written text. This may lead to communication problems. Therefore several researchers believe the key to success is that journalists and designers speak the same 'language' (i.e., understand each other's professional language) (Kleinsman, Valkenburg, & Buijs, 2007; Weber & Rall, 2012). According to Lowrey (2002a) designers who speak the language of journalism' (i.e., understand journalistic concepts, know the news etc.) are most influential.

Maybe a change of attitude is required. According to Weber and Rall (2012) each expert should be considered a journalist, because of the shared journalistic product that's in creation. Programmers and designers of *The New York Times* for instance, already consider themselves journalists, in contrast to the designers of German and Swiss media companies who are more often considered as support (Weber & Rall, 2012).

According to Lowrey (2002b) collaboration must be performed in a way that individual expertise is stimulated, respected, and integrated. Like Steve Duenes, Graphics Director of *The New York Times* states: "You couldn't fill our department with technical illustrators alone and do the things we do" (Duenes, 2008). The Graphic Department of *The New York Times* has different staff members with a variety of expertise, such as writing, statistics, graphic design etc.

Nijhuis and Boersema (1999) argue that every team member must understand each other's discipline, in order to collaborate successfully. During the *Dutch Infographic Congress 2013* (March 1, in Zeist), Alberto Cairo, Professor Information Graphics and Visualization at the School of Communication (University of Miami), stressed the importance of knowing the basic knowledge and skills of each other's discipline as well. He said: "It's the responsibility of designers to deal with data. Therefore it's important for designers to learn the basics of statistics, not to become the best data analyst ever" (unpublished presentation).

Management (organizational level)

Besides the influence of knowledge, skills, and collaboration, the organizational system plays

an important role in the production process as well. Research shows five crucial factors:

working standards, organizational structure, physical distance, size of the organization, and

management support.

In newsrooms it's mostly important to be the first one in the field with the offered

news, with the scoop. However, data visualization requires time. It depends of the journalistic

standards of the organization, whether clarity, accuracy has priority (Weber & Rall, 2012).

Next to standards, organizational structures influence the production as well.

According to the Dutch freelance infographic-maker Remy Jon Ming, information

visualization is a process, that can be compared with a journalistic process (Vermanen, 2013).

In this process designers must be involved at the very beginning in order to guard basic

design principles, he states. According to Kirk (2012) the design process is "rarely a neat,

linear process and indeed some of the stages may occasionally switch in sequence and require

iteration. It is natural that new factors can emerge at any stage and influence alternative

solutions, so it is important to be open-minded and flexible" (p. 20).

Gerson Mora (Brazilian infographic-maker) state that a balanced team is needed were

each individual is equal in terms of decision making (Mora, 2012). However, Utt and

Pasternak (2000) questioned graphics or design editors from 125 different American

newspapers, and state that only "at 15 percent of the newspapers the decision to use an

informational graphic is made jointly" (p. 59). Mostly "the decision to use an infographic is

primarily the responsibility of a person working on the news desk at 59 percent of the

newspapers" (p. 59).

It's also important that different departments, such as news departments and graphic

departments are physically in the same space (Hamblin, 2012). Knowledge exchange and

collaboration is in this way stimulated. If we look at the convergence literature, physical

integrations were also important for the cross-pollination between print and online

departments at news organizations (Tameling & Broersma, 2012). However, cross-pollination

becomes more difficult if employees feel unsupported by their management (Hamblin, 2012)

     Sizes of news organizations are important for production processes as well. Most large

newsrooms contain information-visualization departments. Smaller ones mostly don't have

the resources to require a high level of specialization (Hamblin, 2012). In the smaller

newsrooms it is not uncommon that journalists produce their own information visualizations.

     Finally, the possession of the required software is crucial as well (Hamblin, 2012).

The theoretical framework above is best visualized in a figure, see Figure 1.
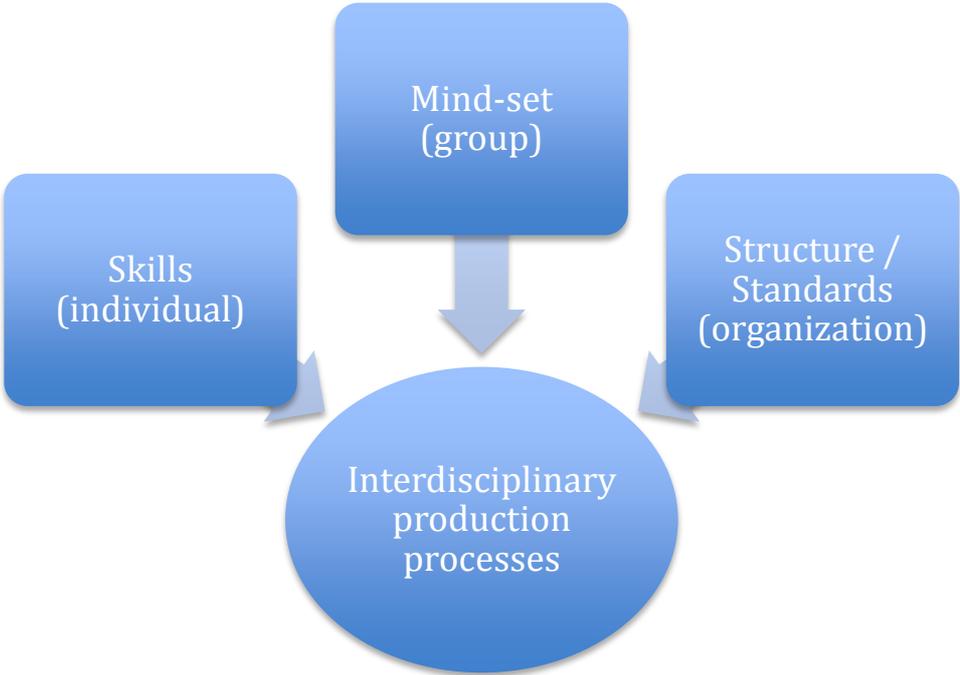

Figure 1. Factors Influencing Interdisciplinary Processes

RESEARCH METHODOLOGY

The research question we want to answer demands a qualitative approach as it takes a look at real-context factors that influence the collaboration between different disciplines for the production of information visualizations.

We took a two-step approach. Firstly, we wanted to get a broad understanding of how information visualization designers in the Netherlands see their role in the newsroom and with which kind of challenges they are coping with. Four interviews were held with information visualization designers, who are known for their unique work and unique position within their organization.

Following these interviews, we wanted to take a more in-depth look within organizations in order to understand the dynamics of the different disciplines involved in the making of information visualizations. Therefore, we chose a case study design (Gerring, 2007; Yin, 1989). In order to understand *how* different disciplines collaborate with each other, we selected an organization in which information visualization is central or becoming more dominant in the core business process. Within this selection we chose an organization of another disciplines (non-profit sector) in order to understand possible organizational, contextual and structural differences. This case was a foster childcare organization that asked a Dutch information visualization company to visualize their activities. The period of information gathering was from January till May 2013.

Within the case study approach we used three different methods: document analysis, observations and interviews. Firstly, written documents such as briefings, procedures, manuals were analyzed to understand the context of the organization and the project. Following, the researchers attended numerous meetings throughout the production process, such as meetings with the client, meetings between account managers and designers, and evaluation meetings with the client. Also we were allowed to look into several email

conversations in order to understand the entire process including the decisions-making phases and possible obstacles within this process. After these observation moments, there was also plenty of time for informal talks with the designers. Finally, one-to-one interviews were held with all the people involved in the production process leading to an information visualization including clients, account managers and information designers.

The documents, observation notes and interview transcripts were analyzed with the use of the qualitative software program MAXQDA, using a grounded-theory approach (Bryman, 2001; Glasser & Strauss, 1967). This means that codes and concepts were attributed to the data in order to detect patterns in order to build forth on a framework of theory.

The validity and reliability of this research was guaranteed through several procedures. Firstly, the observations and interviews were done in pairs in order to reflect on one's analysis. Moreover, through peer review the researchers assessed each other's coding and analysis of the data. Secondly, triangulation, or the use of different methods, helped to corroborate the evidence (Creswell & Miller, 2000). Lastly, after each case we verified the results with the interviewees as a form of member validation (Silverman, 2001).

RESULTS

Our literature review identified several challenges and obstacles in the production process on an individual, group, and organizational level. Our qualitative results will be grouped according to these different levels as well for reasons of comparison.

At an individual level

We found several challenges influencing the production process on an individual level depending on the background of the information designers.

All the information designers we talked to who work in newsrooms, expressed the need to acquire more skills or were in the process of learning some. Depending on their

background they wanted to become more apt to find an analyze data, program software, visualize data or to tell engaging stories. But in all cases the choice for skills to acquire depended on what they felt was needed for the organization they work for. Besides acquiring new skills it was felt important to have room for experimenting with visualizations to find out what works best.

Several respondents admitted to feel inconvenienced by a lack of knowledge about the effects of what they are making. "If I only knew how consumers are reading my data visualizations," said one of them, "I would feel more at ease. We normally only refer to our colleagues as to how they experience the design. Wouldn't it be nice to build a device that would inform us about the way people are navigating a visualization?" How do customers 'read' a graphic? What do they remember of its content? What works best for whom? These are often open questions.

Lacking the knowledge of what works best, most designers don't spend much time thinking about the specific function of an infographic. "I design in order to make complicated matters comprehensible for myself," said one of them. "If I can understand it, I suppose the public will". Designers sometimes felt uncomfortable with what they considered journalistic issues as to how explicit they could be in visualizing relationships between data. Some said they want to develop journalistic skills and learn to think as a journalist in order to know what data to look for, and how to organize them.

In most cases of our fieldwork the designers got their data from journalists. Only if an information designer decided to make a visualization on his own initiative, he looked for the data himself.

A small group of young designers working in the forefront of data journalism developed visualizations based on big data sets they had explored for themselves. During our

research, two of them set up a press agency for data journalism (Local Focus) where data journalists find, analyze and visualize data for local media.

At a group level

The daily routine of information visualization in newsrooms is far from the ideal of collaborating colleagues who speak the same language and know what the other is doing. In fact journalists, designers, and their clients are operating on different playing fields. An often-uttered complaint of designers is that laymen are mainly focused on form rather than content. Clients of information designers are asking for a nice looking visualization. Or they come up with an image of their competitors and ask for something that looks more or less the same. For most clients, information visualization is a complete new business. They are not prepared to talk about the message they want to get across, or the specific content they want to be visualized. It could be argued there exists a 'knowledge gap' between organization and client, which may lead to communication problems.

Within the newsroom where production time is limited, this results in visualizations that are mere embellishments of a text, or simple bar graphs illustrating the news. For professional designer studios this means they spent a lot of time to come to terms with their clients as to what actually should be the content of the visualization, what data should be used and how these should be labeled.

In the newsroom journalists with little knowledge of information design just ask a designer to make sure it looks nice. And even if they are a bit more learned about visualizations, and ask for example for a 'clickable map', they seldom discuss the interplay of content and form.

But there are also signs of blossoming collective mindsets. One of the designers of our sample added a feature to a map that should inform the reader about the nature of the

relationship of Arabic countries with the United States. The designer asked a journalist-expert on Arabic countries what to make of it. The journalist came up with a long and balanced story. "That is useless", the designer said. "It has to be either a, b or c." Although that seemed a ruthless simplification at first, they finally agreed on a form that was both informative and easy to grasp.

Not all journalistic departments are that flexible. As a junior designer in our sample said: "I have the most trouble with the science department of the newspaper. They are accustomed to graphics from scientific reports and are reluctant to use more fancy graphs, fearing it undermines the credibility of their story." The economic department, according to this designer, is often more willing to experiment, as they are used to liven up serious data.

A prior willingness to cooperate seems important for the working process as well. A designer from a Dutch agency specialized in visualizations and visual thinking indicated that she wanted to be more involved in the whole production process. She felt like it's just not in the minds of her colleagues to ask her for advice at an earlier stage, while she thought insights from an design expert can be crucial for certain decisions made early in the process. Designers express the need to collaborate on an equal basis and loathe a mere supportive role. They rather be seen and consulted as creative experts.

At an organizational level

One of the main obstacles for producing fancy visualization is the short time span in which the news has to be produced. Information designers are often the last in line to be asked for an up-to-data contribution. Designers not only want to be involved earlier in the news process to have their say as to how news stories could be told differently by visualizations, they also opt for a different way of thinking about what the news should look like in a time where the speed

of information is not the sole purview of the professional. Well-wrought visualizations could add to a more service oriented and reflective approach of journalism they say.

While some editors share this vision, they still struggle with the question as to how visualizations could play a more prominent role within news stories. It seems a waste of time and money to use time-consuming data visualizations for just one news item. As one designer said: "I don't feel like working for days on a visualization that disappears within half an hour in the black hole of the Internet." Even online news publications like the Dutch news website *Nu.nl*, still have to decide how to integrate data visualizations into the daily news production.

Certain fixed working structures for information visualization can be an obstacle for smooth collaboration at an organizational level as well. Some organizations work with strict linear structures. Visualizations are seen as mere icing on the cake. For instance, for the Dutch agency specialized in visualizations and visual thinking the designer is only brought in after the communication message is all thought out. This leaves the designer to the role of the mere executor.

Next to hierarchical differences, a tight planning can lead to difficulties as well. Linear working structures benefit from someone that monitors the time path. This person needs to inform all people working on an information visualization about this time path, and certain deadlines. However, because sometimes design support is only needed at the end of the process, designers are not that well informed about deadlines or just informed too late. When their support is needed at an earlier stage, they might be better informed or better capable to monitor their own time path. Some designers indicated that a less tight planning allows them to be more creative and less executive as well.

CONCLUSION AND DISCUSSION

If this paper proves anything, it is that there is not a 'one-size-fits-all' solution for using information visualizations in the media. Which is not to say there are no favorable patterns to follow.

According to the literature on design processes and workflow of information visualization there are three crucial aspects in analyzing the production process of information visualization: skills, mindset and management. As for the skills, it is argued that a combination of skills like data mining, programming, writing and designing is a necessary condition for high quality visualizations (Giardina & Medina, 2013; Kirk, 2012; Segel & Heer, 2010; Weber & Rall, 2012). Whether these skills are allocated to one individual or spread in a group is not decided. From our observations and interviews we learned that the front runners in the use of information visualization often work with multi-skilled professionals. The biggest pitfall is that someone is competent with many skills, but not outstanding in one, and therefore becomes a "Jack of all trades but master of none". As soon as the production of information visualizations becomes routinized, the need is felt for a more diverse team of professionals. A specialist who is capable of gathering and analyzing data, a programmer, is mostly the first expert organizations look for to accompany the journalist.

Our research also shows that visualization professionals feel a lack of knowledge about the effects of what they are doing. A common answer to the question why they had chosen for certain visualization solutions was: "I just wanted to make it clear for myself". The need is felt to get acquainted with the history of visualization, as well with the results of effect studies in order to add quality to what they are doing.

As for the choice of software, there seems to be no other advise than to look for anything that fits the demands of the news organization, especially the platforms that are used for publication.

Several studies and infographic-makers suggest that cooperation between journalist and visualization experts is key to success in the field (Lowrey, 2002b; Mora, 2012; Weber & Rall, 2012). But cooperation asks for a "common language' (Kleinsman, Valkenburg, & Buijs, 2007; Lowrey, 2002a; Weber & Rall, 2012). And that is where the problems start, as journalists are often text oriented, while designers are thinking visually. In our study we found that wherever there was a tendency with journalists to think visually, cooperation with designers and data journalist happened to be more successful. Some of the most valued visualizations emerged spontaneously when journalist sat together with designers and talked freely about trends and relationships they saw in their field of expertise, but never were able to substantiate. This often encouraged the designer to delve into relevant data and look for relationships. Especially in the field of sports journalism this led to some stunning visualizations. In order to formalize this kind of productive cooperation, non-visual-journalists might be encouraged to regularly brainstorm with information designers about their field of expertise. Other journalism departments felt reluctant to use unfamiliar design forms. They were afraid the public would not understand them or would not take the information seriously.

But 'speaking the same language' is only one prerequisite for collaboration according to the designers we interviewed. The other is that all participants involved in the production of news operate on a level of equality. That is to say designers have to be involved early in the process of news-making to see what possibilities there are to tell news stories with data and visualizations.

In order to find out how the organizational structure plays part in the successful integration of information visualization in the news, it is suggested to look at the following factors: working standards, organizational structure, physical distance, size of the organization, and management support.

As for the working standards, we found that focusing on being the first to publish the news is not a favorable condition for producing quality visualizations. Instead information visualizations are more in line with exploratory and explanatory news items.

Quality visualizations ask for more iterative organization structures, where visualizers and journalist are allowed to work on a trial and error bases.

Designers at newspapers sometimes feel they are isolated from the rest of the journalists working at a newspaper. This might thwart cooperation. But we also found examples of good cooperation of a Dutch data journalist with London based animators. It seems physical distance in itself is not the problem, only if it becomes the cause for a psychological distance.

The size of news organizations is important for production processes as well. Most large newsrooms contain information-visualization departments. Smaller ones mostly don't have the resources to require a high level of specialization (Hamblin, 2012). In the smaller newsrooms it is not uncommon that journalists produce their own information visualizations.

Our findings suggest that media organizations should first focus on the desired function of information visualizations, before they start thinking about the kind of skills that are needed to produce adequate news visualizations. A clear view on what visualization can do for the comprehension of news, might not only lead to new forms of cooperation between the news and the design department, but also to a rethinking of the function of journalism itself. The demand for information visualizations forces news organizations to be more outspoken about the kind of stories they want to tell.

With the emergence of open data sets, visualizations are an important tool to explain complex information. Only a few fortunate people have the ability to be a good data analyst, storywriter and infographic maker at the same time. For schools of journalism it is the

challenge to teach students the ins and outs of each competence without demanding an overall full-skilled design-journalist. This asks for an educational program that is not only skill-oriented, but also focuses on the functional aspects of information visualization and the organizational requirements for producing effective information visualizations.

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