Track 7: Theorizing urban change: complexity and ethics (ID 863)

COMMUNICATION THROUGH VISUALIZATION: THE PURPOSE, ROLE AND STYLE OF VISUALIZATIONS IN URBAN PLANNING

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Abstract: Visualization is used to convey information to communicate a message and in its all different forms they help us to understand our cities and make it available for analysis. They increase our capacity of comprehension by making useful conceptual shortcuts in our understanding to have a glimpse of "what's happening" in our cities. The article analyses the use of visualization in planning discipline, how it was used and perceived throughout the planning tradition. The objective is to analyse the role of visualizations, how they are used to establish dialog, at what stage it is useful and effective to introduce them into the dialog. It further investigates the style of visualizations by analysing the basic design principles and as well as visual perception and cognition fundamentals to clarify what effects the efficacy of the visualization in traditional and digital visualization.

Keywords: visualization, planning, digital visualization

Planning with Images

We all experience cities differently. When we think of Paris, New York, Istanbul, Tokyo, distinctive images or narratives comes to mind. One of the most natural characteristics of the cities is being very diverse. They are capable of accommodating so many possibilities of both creative and destructive forces all together. This diverse nature makes our understanding of a city or a region almost impossible, a utopia. We need to make useful conceptual shortcuts in our thinking in order to have a glimpse on "what is really happening" in the city.

Cities must be understood as processes of constant change. While accommodating multi-layered character and increasing diversity makes it an ever more complex subject of active transformation in material terms. Finding meaning in complexity which is in constant change is not yet an easy task. However, planning needs to engage in cooperative action to maintain the power to act in a context of uncertainty and complex challenges.

Throughout the planning history, planning discipline has looked at visual representations in various different ways, sometimes paying no particular attention at all (Jarvis 1994; Neuman 1996, 2000; Faludi 1996; Dühr 2007) Since the notion of "planning through debate" (Healey, 1992) they are accepted as powerful communication tools. They help us to shape our attention, hence shaping the dialog (Forester 1988; Kunzmann 1996; Healey 1997, 2006; Forester 1999).

Collaborative planning made planning communicative and negotiable. While governments still hold the decision-making power, it requires cross disciplinary collaboration to support the process of meaning-making.

Discourse can produce meaning and challenge previously unquestioned knowledge. Therefore, any medium that supports the discourse must be interpreted as powerful tools to steer urban development.

There is no doubt that visualization in planning are powerful instruments, because often it conveys more clearly than a text would do. However, this may also result in manipulating the truth by focusing on certain parts while inevitably neglecting others. According to some theorists (Pickels 1992; Harvey 1996; Neuman 1996; Shields, 1996), this considered as treacherous, because the process of meaning-making via visuals are results of partial perspectives, reflecting one of several possibilities.

To investigate the role of the visualization in planning theories, rational planning theory would be an appropriate starting point. According to rational model in planning theory, planning is rather a technical process and there is a clear distinction between the planner, who has the objective expert statues and the politician who sets values and defines overall strategy (Dühr, 2007). The model also assumed that the planner has the sufficient autonomy and the authority to develop and design plans with rational decision-making skills and in the end, he holds the power to implement these as well.

This planning theory is mainly criticized that it is essentially focused on science and technology and being ignorant to societal values and norms, most importantly politics. Many theorists (Lindblom, 1959; Mandelbaum et al. 1996; Simon, 2013) have tried to point out the obvious delusions of the rational planning model, and some tried to enhance its capabilities by introducing modifications to make it more fitting for the real-life conditions.

However, this general belief on objectivity has changed when we realized that the planning is highly political and therefore open to manipulations (Forester, 1999). Recognizing planning as political has had important implications for the perception of the role of visualization in planning process. If planning viewed as a fundamentally political activity, ‘values’ become essentially important.

Over recent decades, planning theories strongly influenced by contemporary social and political theories, particularly Habermas’s theory of communicative action (1984). According to Habermas, the “truth” cannot be produced through science. Rather, science is an instrument which can be easily manipulated by the power relations in society. The science or the scientifically informed expert may produce the truth, however it might fail by being ignorant to societal values and norms. Therefore, the superiority of the expert knowledge become no longer valid, the local knowledge is recognized as important as the expert knowledge. Habermas’s theoretical approach has been highly influential in shaping contemporary planning theory which supports planning through debate. Healey (1997) describes it as collaborative planning which is basically about reaching consensus through dialog. And till consensus is reached all communication is the exercise of power.

The collaborative planning model accepts the limits to power and the ‘subjective’ selective process of decision-making of policies. It acknowledges that any planning institution has values, opinions, views on certain issues and therefore leads to particular planning objectives.

We created images and used them to convey meaning thousands of years before the first languages were recorded. The reason why we are focusing on visuals is obvious. Drawn images are used to support verbal statements of policy, enriches the discussions and the result is debated informed decision. While planning theorists are still sceptical of its deceits and difficulties, one does not have to wonder about the role of visuals in the creation of modern era city plans and the development of the planning profession.

After having a deeper look in the use of visuals and its role in urban planning, it became clear that not only the reason why we are using them (or why we are not using them), but how we are using them needed an investigation.

The role of visual representation was not only limited due to previously mentioned obstacles but also the perception according to different countries, cultures and planning traditions. Many countries look at urban representations in different ways, and that different view had a significant influence on the debates that took place. When in some countries a map is a plan, a blueprint of how things should be, in other countries they are more indicative, and abstract in nature.

Otto Neurath, a member of Vienna circle, already in the 1930s had realized the importance of the use of visualization (Neurath *et al*., 2013). Although during his time, the dominant view on visualization was more on the traditional side, he already knew that the co-operation between different disciplines is essential to achieve the best for public good. An essential task for him was to inform the Viennese about their city. The aim was to "represent social facts pictorially" and to bring "dead statistics" to life by making them visually attractive and memorable.

In urban planning, images can be considered as expert's viewpoint, a subjective one, which is one of several possibilities. As a consequence, visualization can support the transfer of the key themes of urban planning, which can be understood not only by the experts in planning, but also by the audience of non-experts. As a matter of fact, this is one of the main objectives of the contemporary planning theories, name it as collaborative planning, communicative planning or participatory planning. The local knowledge and the collaboration of the very audience itself, the ones who are directly affected by the actions taken by the planners, has become essential.

Furthermore, in order to be able to bring the lay people into the dialogue, the planning needs to be more attractive and appealing to the audience. Therefore, representing urban data visually to an ever-wider audience of experts and non-experts, in an attractive way becomes very important. On the other hand, how can we make planning interesting to a wider audience without using visuals (Zech, 2013)?

Communication through Visualization

The very notion of representing the city or rural areas has led to questions which requires interdisciplinary cooperation. Especially the ones on "how" we are creating those visuals. Due to the fact that urban planning has transformed into an open and cross-disciplinary process, dialog has become a vital part of the decision-making process, therefore the use of visualization as well. Through the process of decision-making in which a solution is negotiated amongst various interest groups, creation of the visuals becomes an important task, which is potentially challenged by power relations and ethical dilemmas. However, they may be used to manipulate or lead the discussion in a particular desired direction, but they may also give voice to disadvantaged parts of society.

A good visualization is the one that communicates effectively and efficiently. In other words, it should do, what it supposed to do and in most cases with minimum amount of resources. As Kosslyn (2006) puts it, a good visualization forces the reader to see the information the designer wanted to convey. It can be solely used to analyse certain group of information or to communicate a certain message with the help of the relevant dataset. Making a visual display attractive and visually appealing is the task of the creator mostly, whose talent and visual sense give a certain visual appeal.

Visual displays of information can be considered as cognitive artefacts (Bertin, 1983; Card et al., 1999; Tversky, 2001; Ware, 2012; Meirelles, 2013; Norman, 2014), in that they can strengthen our mental abilities to facilitate understanding and meaning-making. Ware (2012) argues that effective design should support quick and accurate processing of visual queries; thus, better understanding of the basic principles can lead to better design. However, in the information visualization literature there has been some concerns (Arnheim, 1969; Kosslyn, 1994, 2006; MacEachren, 2004; Ware, 2012) on how do we create them so that they can communicate effectively.

The efficacy of the visualization is pretty much dependent on two factors: (1) internal factors which are affected by the creation process of the visualization; and the (2) external factors which are relevant to the audience and their environment on how they receive this information. Effective design should facilitate both factors; thus, better understanding of the basic principles can lead to better design and effective delivery of the message that it carries. In regards to external factors, there is not much we can do other than trying to boost the cognitive capabilities of the human mind to facilitate effective communication.

The creation phase is mainly considering the basic design principles, which are focusing on different attributes ranging from contrast, colour, shape, size, figure-ground to recognizing patterns in two-dimensional space and three-dimensional patterns. The organization of seeing objects, so called Gestalt principles, are one of the main attributes that we have to keep in mind while designing. Gestalt principles refer to theories of visual perception that investigate how people tend to organize visuals, for instance according to their proximity, similarity, closure and symmetry. The Gestalt principles are effective not only in drawing attention and enhancing perceptual reading but also in facilitating problem solving and thinking processes.

When a visual is constructed, the relevant information is encoded (creation phase), basically through position, shape, size, colour, etc. When a person looks at a graph, the information is visually decoded (perception phase) by the person's visual system. A visualization is only successful if the decoding is effective. No matter how the informed decisions are made cleverly and how technologically impressive the encoding was, it would eventually fail if the decoding process fails (Cleveland, 1984). Therefore, understanding the constraints and capabilities of visual perception and cognition is essential for the creation of the effective visualizations. From information visualization to cartography to statistics, skills and the know-how on design principles are closely related with the visual perception and cognition principles.

Kahneman (2011) suggest that it is entirely legitimate to enlist cognitive basics (or outline cognitive biases) to work in our favour, and based on the studies of truth illusions this provides specific suggestions that may help us achieve this goal. The general principle is that anything you can do to reduce cognitive strain will help for our advantage.

“Know your audience” is an important step for the efficacy of the visualization. To communicate effectively, the intended audience need to be familiar with the content, background knowledge and the concept as much as possible. If the visualization is done with the presence of heavy jargon and technical or scientific terms, then the chances are quite high that the lay people who are non-experts in the area are going to lose interest or have difficulties to understand the image with minimal effort.

How decisions are made, what should and should not be visualized is solely dependent on subjective however informed decisions made by the creators and their experience on how the message is intended to be received in general. Clearly, we cannot eliminate the fact that the subjectivity of the creator due to his/her skills and ability to visualize or the cultural surrounding that he/she has experienced, this will inherent in any human artefact. Nonetheless, this does not give us the license to ignore the practical consequences of our decisions in designing that artefact. The realization that any profession contains similar limitations of skills and cultural baggage, does not reduce the significance of works such as Lynch's (1960) work on the image of the city.

Digital Visualization

Before the personal computer became as a commonly used tool, we were faced with a labour-intensive process to present data graphically, involving the use of a T-square, draftsmen’s triangles, and a collection of special pencils and pens (Few, 2009). The process itself took a lot of time and effort, and the graphical communication skills of the people who are responsible for this work usually took longer to develop.

Today, we can create visualizations much easier and faster. Thanks to the ubiquity of programs to create visualizations easily and the availability of massive, dynamic data sets which are easily accessible (Dunne *et al*., 2016). Data visualization, born from the marriage of classical charts and powerful computer graphics, is a way to discover meaning out of all these available data sets. But given that our modern chart forms such as the pie, line, and bar chart, which were originally invented to show dozens of data points only, today they need to adapt to showing thousands of those data points. Probably, William Playfair did not have this in mind when he first created the line chart in 1785.

The design guidelines for web-based contemporary visualizations are different. They can be in nature dynamic and interactive. Interactive visualizations can pack in much more information by separating the amount of information in different segments and making them available to the user which can be accessible on demand. This kind of segmentation helps to avoid frustration and allows the user to interactively get engaged in case he needs more details into certain specifics. Meirelles (2005) explains that in a dynamic environment, as in the web, the attributes such as shape, position, color, etc. are no longer enough, now they have properties in spatial and temporal dimensions that cannot be isolated anymore.

Over the years we have developed an intuition about what makes data visualization interfaces work well, there are valuable resources which provides resourceful guidelines (Kirk, 2012; Meirelles, 2013; Cleveland, 1984, 1993; Few, 2009, 2013; Ware, 2012) although we don't have a strict formula for a successful interface, we know that some basic principles do help.

The computer graphics revolution, which began in the 1960's and has intensified during the past years, stimulated the invention of graphical methods types of visualizations and types of quantitative information to be digitally visualized. It has grown so fast; the number of visualization techniques and styles makes it hard to follow and only time will show if they can stand longer or if new methods are going to replace them.

It is crucial that the web-visualization give users immediate and informative feedback at every step along the way. This means that the web-interface must not be too complex or confusing as to discourage users, nor so simplistic as to make them bored.

Open Data and its Impact on Visualization

Apart from the creation factors which are essential in affecting our cognitive capabilities and enabling us to perceive the desired message, there is the data factor. We are producing an enormous diversity of data, from governments to city councils to institutions they all try to make meaning out of this data. From real time GPS data to national development statistics, digital data visualization enables us to use hundreds and thousands of points instantly and to let readers "see through" points which has potentially meaningful outcomes.

The growing volume of open data makes cities more inclusive, enabling its citizen and different organizations to actively take part in it. Open data initiatives and institutions are actively encouraging their 'smart' citizens to use the data and make meaning out of it. This led us to think on more fundamental issues on how information is collected, structured, represented and communicated.

It is important to point that the open data, in and of itself, is not the same thing as open information. An open information policy would imply the further duty to provide data in citizen-accessible and citizen-intelligible form, and to provide for public access to the information used by experts, decision-makers, and service providers acting on urban systems. Despite the great accomplishment that the open data initiatives, in general, achieved, using this data with the help of visualizations tools that are available and turning it into public information works is quite labour intensive. However, this doesn't reduce its significance and achievements.

The planning discipline have been slow to adapt to the new advancements of data visualization. Connecting the available data sets is greatly valuable, but it is only part of the solution. For planning and design purposes, "hard" data is much more useful when properly fragmented and correlated with qualitative information and associated with geo-spatial attributes.

Creation of Urban Change in Time (UCIT)

UCIT (http://www.ucit.or.at) is created as an open source web-application consisting of open source solutions. The application brings together and shows the extent of development in Vienna from 1600s till today. It allows navigation through historical maps of Vienna from different times and different scales. Additionally, it lets you to explore the existing built fabric, by grouping the age of the buildings according to their built year and/or built period.

The making of UCIT showed that even though the willingness to have such visualization exist, the availability of the public information infrastructure was the main obstacle for the realization. The goal of integrating qualitative with quantitative dimensions of urban data to communicate a growth story, was already ambitious (although nothing new). In the beginning it seemed quite easy, to create such an application, the data should somehow exist. Find the data, use a fitting open source visualization technique and there you have it. However, the most cumbersome and exhausting part was to "find" the appropriate data (if even exists) and then "clean" it and structure it properly so that in can be used with the selected open source solutions that are available for use.

The central objective to the empirical research was whether it is possible to create such a visualization and by doing that to interact public and media attention by solely displaying the urban information interesting and easily available for public access. I believe UCIT has achieved a satisfactory response from public and the media (60k unique visitors, 8 publications), by creating a 'simple' web-application which led people talk, make critical analysis about the transformation and the age of the urban fabric of Vienna. The debate was not only focusing on what application has provided itself, but also the availability of the open data was one of the focal points of the critical discussion. Despite the fact that most of the data was provided as open source, some were still needed to be funded.

Conclusions

This article investigated the different aspects of visualization, first with an emphasis on its use and role in planning discipline, how it is used and the great potential that it contains in bringing the stakeholders into dialog. Secondly, the design aspects of visualization to clarify and enhance how we organize and encode information visually to establish an effective communication. It is my hope that this article (and eventually the thesis that it originates from) will help broaden the dialogue on creating visualizations both on static or dynamic terms, which can help foster skills in designing for information communication. This study is created with the planning discipline, its students and scholars in mind however the scope was not only limited to them.

The study of the visualization showed that having the attributes that are listed below results in successful communication:

- Communication-centred: Created with both experts and non-expert stakeholders in mind. Here it is important to break down the conventional distinction between user-friendliness (pretty) and expert-friendliness (functional).

- Collaboration-minded: Designed to support stakeholders interacting on the analysis or the investigation before, during or after the visualization.

- Know your audience: To communicate effectively, the intended audience need to be familiar with the content, background knowledge and the concept as much as possible.

- Convey a 'clear' message: Having a clear message or slogan in general is important for establishing effective communication. Provide a clear overview of the model, as well as the possibility to drill down into details, if necessary.

- Design basics in-mind: Better understanding of the basic design principles can lead to better design, eventually better communication.

- Perception and cognition basics in-mind: Enlisting perceptional or cognitional basics to work in our favour will help. The general principle is that anything you can do to reduce cognitive strain is helpful.

- Adaptability in-time: Available data will change over time and the new visualization techniques may replace existing ones; the adaptability is the key here.

We need to re-examine the city and its attributes within, keep it open to further critical analysis. Especially with the new possibilities that the web allows us, effective visualizations have the potential to lead to interesting discoveries and collaborative creations.

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