

# VISUAL EPISTEMOLOGY FOR COMMUNICATION DESIGN EDUCATION

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## ABSTRACT:

Visualization is an ancient human device, yet in the last couple decades, has seen a marked increase of interest and influence in various disciplines. From Information Visualization to Data Journalism, from Visual Analytics to Digital Cartography, the recent forces that have been shaping this upturn in interest demonstrated how visualizations can be not only considered as communication medium but more importantly can work as tools to explore and comprehend phenomena.

This research discusses the future impact of these incipient forces have upon the contemporary discourse on the field of Visual Languages and the consequent significance and impact for Communication Design education. It presents a theoretical framework based on the difference between the use of visualization as a *medium for communication* and visualization as a *tool* for generating knowledge. It develops and discusses the potentials of a *Visual epistemology* for Communication Design education.

## 1. VISUALIZATION AS A MEDIUM AND AS A TOOL

Visualization is an ancient human device and constitutes one of the central medium for human communication and expression. Visual artifacts have always permeated societies across cultures. It is an innate part of our nature to use visual languages for rendering concepts and thoughts both as a *medium* for communicating with others and as a *tool* for reasoning and understanding.

At present, the leading purpose of visualization artifacts serves the human need of self-expression and social interaction. As Tolstoy (Tolstoy, 1899) describe in his article on art: "To evoke in oneself a feeling one has once experienced, and having evoked it in oneself, then, by means of movements, lines, colors, sounds, or forms expressed in words, so to transmit that feeling that others may experience the same feeling - this is the activity of art. (...) one of the indispensable means of communication, without which mankind could not exist". Visual languages possess an undeniable communicative power: they are able to condense complex knowledge, to facilitate comprehension and are highly engaging. In the last five years however, the capillary diffusion of the use of visual languages has provided new understanding of an additional function. Visualizations can be not only considered as communication devices but more importantly can work as tools to explore and investigate phenomena. A phenomenon, especially when complex, can be better analyzed, observed, and understood through the development of visual constructs (Scagnetti, Ricci, Baule, & Ciuccarelli, 2007).

The instrumental function of visualization has been prompting an upturn in interest from different domains. Many disciplines have started to recognize the efficacy of visualization as an aid for research and begun to require the development of visual tool tailored for their disciplinary domains. Visualization has a long history of being used as a tool for *sense making* in many disciplines. From astronomy and geography, to medicine and chemistry, graphic representations functioned as valuable devices for creating meaningful interpretations of reality. The animal-shaped representations of constellations is a very efficient method to create recognizable pattern in the night sky and identify the direction of the North Pole, for example; the diagrammatic representation of the Königsberg bridge problem was an essential part of its solution.

Visual representations have always played a fundamental role in scientific development, helping the understanding of complex phenomena and the generation of new ideas. Yet in the last couple of decades, this role has seen a marked increase of interest and influence in various disciplines. Information Visualization became recognized as a new promising discipline that can shape the scientific progress within the near future. Ben Fry's Genomic Cartography (B. Fry, 2002) and the consequent development of Processing was fuel by the biologists' need for tools that could help in interacting with the massive amount of data obtained from the sequencing of DNA. "Biology has rapidly become a data-rich science, where the amount of data collected can outpace the speed with which it can be analyzed and subsequently understood. Sequencing projects have made available billions of letters of genetic code, as analysis continues to add layers of annotation that describe known or predicted features along the linear sequence (...) But more importantly, a clear design process and set of tools for dynamic cartography of genomic data need to be developed to augment the abilities of the designer or computational biologist" (B. J. Fry, 2004)

The aesthetical satisfaction and the emotional engagement that visualization can generate in the viewers have been identified as part of the reason why scientific visualization are rarely doubted in the validity of the data and in the appropriateness of the representation (Kallick-Wakker, 1994). The persuasive power of visualizations has raised a question of scientific soundness for visual representations: are visualizations valid tools for discovering new knowledge or only media for convincing about an argument? The answer to this question

designates and underlines a double role. Visualizations always involve this double meaning: persuading, engaging and seducing on one side, and understanding, discovering and interpreting on the other.

Visualization is becoming a tool for research not only within the so called *hard science*, but it in many humanistic domains as well. Many research projects in the social sciences are relying more and more on visualization as a tool for understanding and analyzing cultural artifacts. Lev Manovich calls them *Visual analytics* (Manovich, 2008), Bruno Latour refers to *Mapping of controversies* (Latour, 2005), and the Stanford Humanities Center is researching on how to visualize the Electronic Enlightenment in a project called *Mapping the Republic of Letters* (Chang et al., 2009); these are only some of the ongoing research projects that are using the here presented approach.

The first conference on data driven journalism has been organized in Amsterdam in 2010 with the aim of "Developing the know-how to use the available data more effectively, to understand it, communicate and generate stories based on it, could be a huge opportunity to breathe new life into journalism. Reporters can find new roles as 'sense-makers' by digging deep into data, in turn making journalism more socially relevant" (European Journalism Centre, 2010). The main focus of this interest is not much on the data but on the data visualization as tool for sense making and knowledge gathering. This happens because visualizations are interfaces between knowledge and experience. They can be studied and used to generate new knowledge; they are communicative artifacts that do not merely describe a system but are able to reveal the weak links between elements and reveal the hidden dynamics that are happening within a system. Through visualization, you can extrapolate from what we know what will be possible (Scagnetti & Ricci, 2007). The effectiveness of visualizations lies, in fact, into their ability to act as a mediator with explicative functions among different and interrelated quantities, as a sort of graphic shortcut for representing complex phenomena, what Deleuze (Deleuze, 2006) describes as an abstract machine, *almost mute and blind, albeit it enables us to see and speak*.

## 2. THE METAPHOR OF THE CARTOGRAPHER

We designers are like the ancient cartographers; we produce representations of the world, as we know it; we explore our world and we represent it, and we use our representation to explore the world and to understand it (Farinelli, 2003). The action of representing the world around us is conducted through a design action, and those representations reflect the way we understand and interpret what we see. The process can be diagrammed as in Figure 1. The designer (D) observes a system (S) and produces a visual representation (V) with the objective of communicating a message to an audience (A).

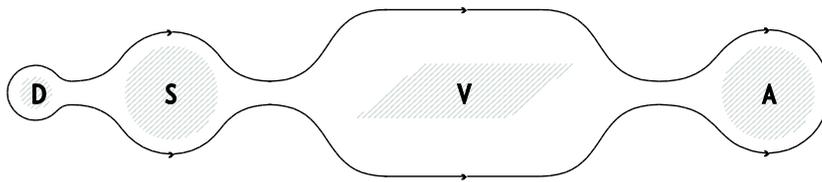


Figure 1: The process of using Visualization as a *medium for communication*.

The majority of our visual communications are based on this model. Advertising and packaging design, brand identity or graphic printed media i.e. are all final outcomes of a design process where the visualization functions as a medium for transferring or translating a message. The message would activate the audience to perform a specific behavior. Designing a communication artifact requires to acquire and master the use of a visual *vocabulary* made of graphical *elements* (lines, shapes, textures, volumes, colors...), of *relations* among those elements (arrangement, contrast, rhythm, sequence...) and *devices* to manage the relation between the element and the graphical environment (grain, scale, grid, frame, viewpoint...). A visual vocabulary, however, is not enough for designing effective communication: there is the need of a *visual rhetoric* to move an audience to action through an argument.

With visual rhetoric I refer here to the art of using a graphic language to distribute and choose elements in an effectual and persuasive visual discourse. Rhetoric is the study of the effective use of a language. Using visualization as a medium implies to build a visual rhetoric out of graphical elements that will convey a message to a selected audience. A visual rhetoric is a persuasive technology (Fogg, 2009; Redström, 2006; Winner, 1980) designed to drive the audience in performing a desired behavior. Desired behaviors can range from triggering consumers choices, to activating participation, from fostering awareness to constructing new symbolic meanings. As discussed above this use of communication design artifacts represents only one of the two functions that visualization performs. Nevertheless in Design Education is the most employed.

The representations of the world we build not only can trigger our behaviors but they also modify our perception of the world in itself. Following the metaphor of the cartographer, we understand and interpret the world through our representation of it. As cartographer used maps for orienting and navigating, our understanding of the world is shaped by our interaction with the representations we design. Geographical map for example have shaped the idea of the geographical space for long time, the world has been believed to be as its cartographic representation (Pickles, 2004). As Johanna Drucker (Drucker, 2006) pointed out "No visualization can be identical to what it represents. Diagrams are programmatic in several senses. It is a structure in which value or meaning is provided by the relationships into which entities are put, thus it operates as a figure that performs relations of value, rather than representing them. Diagrams encode instructions and historical assumptions about conditions of use and action within a culturally complex system of mediation".

In this framework, visualizations do not provide the observer with preexisting answers, but function as tools for fostering greater understanding of faced issues. Designing visualization as a tool for generating new knowledge (or problem solving, planning, orienting...) means to build a *visual epistemology* reflecting on the action of gathering new knowledge from the use and analysis of visual devices. In this process the designer (D) observes and designs a visual representation (V) to make sense of a system (S) in order to perform a specific task (T).

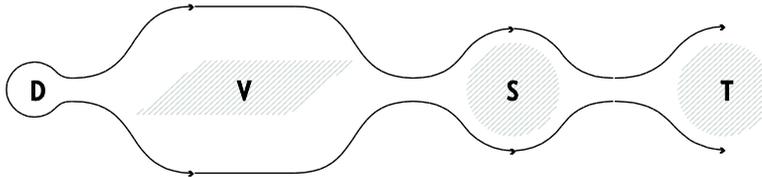


Figure 2: The process of using Visualization as a tool.

Maps for example are visualization used to orient oneself within an unknown space, scatter plot diagrams are devices used to understand the degree of correlation between two variables, instruction manual are visualizations designed to perform a specific process of actions etc. Designing visualizations that work as tools should take in account this final objective of the visualization. Furthermore, it requires a distinctive comprehension on how we generate and justify knowledge through the interrogation of visualizations, in other words a *visual epistemology*.

### 3. APPLICATION TO DESIGN EDUCATION

The second year of the Bachelor Degree at CommDe, International Communication Design Programme, at Chulalongkorn University has been structured on the base of this mode of thinking. Our hypothesis of Design Education is that the application of this notion of double function can foster the student's understanding of the role of design in contemporary society.

In the first semester of the year students approach visualization as medium in studio based classes where they develop design projects with the purpose of communicating a message. The course teaches them how to build a visual rhetoric that can efficiently communicate using graphic elements that will convey a message to the targeted audience. Lectures are designed to help them understanding the significance of *rhetoric* and provide them with the necessary knowledge about the elements of a visual language, their relations and their position in a graphical environment. Projects are designed to prove in practice the concepts explained during the lectures and allow a continuous interaction between teachers and students based on suggestion, critique and improvement. In the first semester we follows a more traditional and established Graphic Communication Design educational framework; the projects are focused on mastering the use of a visual language supported by the interaction between students and tutor to collaboratively evaluate the suitability of design choices to a specific brief with a communication objective.

In the second semester, we approach, discuss and question the role of visualization as a tool for acquiring new knowledge. As a first exploratory exercise students experiment with materials with the purpose of building a tridimensional wearable object that can distort their perception of the world around them. This first interpretation of the concept is broadened up by an ethnographic research aiming to build a collection of examples of visualizations designed to perform a specific task. The following five design briefs aim to understand how new knowledge can be gathered from our interaction with visual artifacts. Using visualization as a tool means to build a visual epistemology that can make the student reflect on their action of interpreting the world and how visualizations modify the way they experience it. Students learn through the practice of Communication Design projects in a studio-based class designed to facilitate them in developing awareness and sensibility about the difference between visual rhetoric and visual epistemology in order to apply this knowledge in the Design profession.

Furthermore, this approach works as an explanatory framework for understanding the practice of design, inspired by Lévi Strauss' concept of *bricoleur* (Lévi-Strauss, 1966). Design briefs merge visual design with design of tools; in other words students are asked to design their own tools for learning how to design. In order to master their ability in the use of typography for example, they are required to design a font catalog that they will use to facilitate their typographic choices in future projects. In the first semester - when they are learning the basic of visualization as a *medium for communication* - they design tools for their own practice as designers, whereas in the second semester - when they use visualizations as tools - they generate instruments for other users.

## 4. CONCLUSIONS

The curricular approach aims to raise the student's awareness of the incipient emerging forces that are shaping the communication design discourse and to foster their ability of taking an active part in these transformations. The notion of a double function of visualization is applied throughout the teaching and studio activities as an explanatory framework: Visualization is treated as an *old-tech equipment* that we can use to explore unknown domains, as Bruce Mau (Mau, 1998) suggests in his incomplete manifesto: "Explore the other edge. Great liberty exists when we avoid trying to run with the technological pack. We can't find the leading edge because it's trampled underfoot. Try using old-tech equipment made obsolete by an economic cycle but still rich with potential".

Since Schön's concept of 'graphical conversation with the design' (Schön, 1995), the importance of visual representations for design practice and reasoning has been widely discussed and demonstrated in many publications and papers (Dietrich, 1999; Lawson, 2006; Oxman & Planning, 1997, 1999; Park, Kim, & Cho, 2006). Visual thinking is considered the main strategy for designers reasoning (Park et al., 2006). But if the use of visualization as a tool to facilitate the performing of a design action has been used in design practice for long time, it is only in the last five years that many other disciplines have recognized the significance of visualization as potential tool for investigation. As a consequence, presently a lack of theory and research

about visualization as an instrument still exists. The need for research on visual epistemology, aiming to explore the use of visualization as a tool for acquiring new knowledge, has strongly emerged. "In the study of complex phenomena many problems can be answered only by direct simulation or collections of data far beyond the scale of human assimilation. These activities can often be expressed only in terms of imagery. Furthermore, in the inexact sciences that attempt to model highly contingent events, a form of 'pure' simulation is emerging that seeks only to reproduce the behaviour of phenomena without any pretence to a theoretical understanding. In these cases the generation of visualisation imagery could assume the status of a common epistemological currency—the creation of a visual knowledge" (Wright, 1990).

Traditionally the abilities of Communication Designers have been acknowledged more for aesthetical value than for capability to trigger unexpected findings. But in the last years, the increased interest in information visualization as a discipline able to deal with massive amount of data has started to develop a more diffuse appreciation about what visualization can offer to any research context. The aim of Communication Design education is now to provide the fertile environment for students to master and therefore offer their talent so that they can become factors of change and participate in the contemporary knowledge production.

## LIMITS AND FUTURE WORK:

Recognizing the importance of this new framework for Visual Communication is an important step for Design education. The role of Visual epistemology is now starting to be understood, but the lack of academic research dedicated to develop a deeper comprehension about the way we create new knowledge throughout the interaction with visual artifacts is very much present. Alongside the need to investigate the topic within design education and to support the Design practice of visualizations as tools, I believe there is an imperative need for analysis and inquiry not only over the human interaction with visual tools but also over the role that these tools have in shaping the understanding of contemporary issues.

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