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Horizontal overview of the state of the art of digital visualization

The wealth of visual diversity and its application to the public sphere

-EXPANDED VERSION-



Alfonso de la Fuente Ruiz

<http://alfonsoycia.blogspot.com>

http://medialab-prado.es/article/convocatoria_de_proyectos_visualizar_09_datos_publicos_datos_en_publico

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This paper submitted as part of the call for “VISUALIZAR’09: Public Data, Data in Public (*Datos Públicos, Datos en Público*)” held at MEDIALAB-PRADO (Madrid, 12-27 November 2009).

The first part reproduces the original proposal. The second part consists of a text expanding on the concepts presented during the presentation and is available through the following link:

http://medialab-prado.es/article/recorrido_horizontal_por_el_estado_del_arte_de_la_visualizacion_digital

::Contents

This horizontal overview aims to offer a bird's eye view of the state of the art of visualization applied to public data sets.

Public administrations at the national, regional and municipal level, in addition to scientific organizations, for some time now have been making the visualization of their cartographic, demographic and statistical data sets more practical, useful and accessible.

With the massive use of information science and the advent of the Internet, organizations of people have seen the amount of data they record and should exploit growing continually, at times to an unmanageable degree. To make the most of this information, and add it in the form of exploitable knowledge, visualization systems must be used that are appropriate for the contents and the final audience of users.

This overview aims to touch on a variety of techniques already being used intensively, to contribute a context to the discussion. This series includes but is not limited to the following:

- Methodologies for developing multimedia software and contents
- Scientific visualization and the *demoscene*
- The metaphor of the 3D desktop (Beryl, virtualization, tactile)
- GIS on electric networks and data for utilities (traffic lights, street lights, cartography)
- Statistical data mining (OLAP-ROLAP-MOLAP and *down-drilling*)
- 3D Web and virtual reality on browsers (VRML-Cortona/X3D)
- Visualization of de ontologies on the Semantic Web
- Multi-objective video streaming (Megavideo, YouTube, Vimeo, Blip.tv)
- Revelation of hidden geometries and fractal patterns (Fractalius, GNU Xaos)
- Visualization of music and acoustic signals (AVS, pure:data)
- Free tools for 3D modelling and animation (Blender)
- Brief review of *crowdsourcing* and free licences for digital contents.

::Format

The presentation requires a computer with a graphics-accelerator card, Windows or Linux operating system and an Internet connection. The computer will be connected to a projector or a large screen. The Internet connection must be fast enough for real-time video streaming that is smooth, at average resolution or preferably HD. Additional plug-ins may need to be installed to the browser (Flash Player, Shockwave, Real Player, VRML-Cortona/X3D or something similar).

The presentation can last for 30, 60 or 90 minutes, with a brief question and answer period at the end. This format can be shortened or lengthened depending on event organizers' guidelines and the circumstances.

Most of the presentation will consist of real time audiovisual screenings, with brief comments before and after each one, which can be expanded as needed to explain certain details in greater depth. It can be synthesized in a slide format if time is limited.

As an alternative, it can be continued with an expanded investigation of the areas the audience is most interested in, through a series of participatory discussion sessions. To close, conclusions of the series will be presented in a format similar to that of the introduction.

::Links

For further information, the following links are provided to the author's articles and work, available on the Internet, as well as a selection of videos on the subject including one made by the author.

- <http://alfonsoycia.blogspot.com/2006/11/la-metfora-del-escriptorio.html>
- <http://alfonsoycia.blogspot.com/2007/06/virtualizar-sistemas-operativos.html>
- <http://alfonsoycia.blogspot.com/2008/07/linux-demoscene.html>
- <http://alfonsoycia.blogspot.com/2006/10/madridmticas.html>
- <http://alfonsoycia.blogspot.com/2009/05/oda-al-zeta-equis-spectrum-zx-spectrum.html>
- <http://alfonsoycia.blogspot.com/2008/11/redes-de-contactos-en-facebook-con.html>
- <http://alfonsoycia.blogspot.com/2008/08/estadsticas-inteligibles.html>
- <http://alfonsoycia.blogspot.com/2009/02/mas-television-ip.html>
- <http://alfonsoycia.blogspot.com/2008/08/explorando-el-caos-galera-fractal-con.html>

- http://www.youtube.com/view_play_list?p=AEBE1723E2A38854
- http://www.youtube.com/view_play_list?p=5AC661649F4FEF51
- http://www.youtube.com/view_play_list?p=4112796734A66C2B

- <http://alfonsoycia.blogspot.com/2007/08/metodologa-de-desarrollo-de.html>
- <http://alfonsoycia.blogspot.com/2008/05/proyecto-fin-de-mster-en-pdf.html>

- <http://www.youtube.com/watch?v=2e63Ols0A4s>

::Main text

The text of the presentation follows. It offers a reflection on the state of the art and technology of visualization applied to what is public.

Visualization is a discipline that has been used by humans since time began. Primates, birds and other animals use visualization techniques with marks and sticks to send their peers warnings and messages. The first known evidence of visual elements made by humans that have survived to our days are called "cave paintings". The Altamira Caves are an example. They have paintings of bison, common at the time, which could be hunted and eaten, as well as scenes from everyday life showing social relationships of a sexual nature or portraying power structures. Aboriginal paintings are another clear example of these techniques, made by applying pigments to the body according to a set of norms which are educational as well as aesthetic and functional.

Thus, the representation of a dead man next to a drawing of a snake could serve as a warning to other members of the community. Or a group of people hunting bison with spears could serve as a record of past feats, as well as teaching hunting techniques. In pre-historic societies and some cultures today that have changed since then (such as the Masai tribes in the south of Kenya and the north of Tanzania), all the plants and animals in a territory are considered resources for the community living there, for religious reasons. That is why they are often portrayed in paintings, bas-relief, sculptures and a variety of other types of crafts, which often include mystical signs.

Continuing along the timeline of history, the greatest example is that of the ancient Egyptians, who raised their hieroglyphs to the category of art, in their ubiquitous heterogeneity. They had a variety of uses for organizing public resource management, mainly within the moneyed classes at the pharaoh's court, as well as for planning their mammoth infrastructures. Ancient Eastern cultures did the same, and the pre-historic era ended and history began with the birth of writing, which permitted knowledge transmission across the generations, to supplement the oral tradition.

The Muslim world had certain restrictions in this respect, as drawing living creatures or reproductions of them in temple reliefs was prohibited. For this reason, almost all mosques have only fairly intricate geometrical designs, with interlocking leaf and flower designs at most. This severely limited the transmission capability of visual representations of matters of public interest, although it facilitated the growth of mathematics and geometry. These prohibitions did not exist in the Greco-Roman empire or during the Early and High Middle Ages, when murals, statues and mosaics were often used to show scenes of everyday life, like reaping grain or making wine.

In modern times, in Central Europe, several scientific trends clearly used visualization as a powerful tool with practical applications in managing the commons, such as the famous example of mathematician Leonhard Euler, whose solutions to problems like “the Bridges of Königsberg” served as catalysts for graph theory. There have been a large number of scientific and technological advances in the modern era related to visualization as a useful tool. One of its major applications is cartography of the land and the sky at various scales, which fostered the great expansion of empires that have competed fiercely with each other for the past five hundred years.

In the contemporary era, visualization is essential to public management, driven especially by the advent of computer science in the United States of America, where increasingly advanced visual interfaces have been developed, as exemplified by research work at the Xerox laboratory in Palo Alto that led to GUI (Graphic User Interface). These interfaces could not have been designed without prior technological discoveries such as vacuum valves, transistors, liquid crystal displays, and green phosphorous screens, which were often mass-produced at off-site locations in Southeast Asia. From that point on, exponential growth occurred through various software products until we reached the standards of excellence we enjoy today: millions of colours, various dimensions, very high resolution, and applications using sensory features like hearing and touch. There are also sophisticated statistical and mathematical tools for data treatment and visualization.

This brief historical overview aims to provide a look at how we have reached the present, so we can reflect on our place and time and make plausible predictions for the future. Our subject can be subdivided into geographic scales or uses, and given their numerous diversity, we have chosen the former, focusing on the basic unit of human societies: the city.

Managing cities involves various interrelated areas including infrastructures and public services of several kinds. From outside electric installations supplying energy to traffic lights and street lights to sewer water management, from preserving and maintaining parks and garden to public transport management, the variety of visualization applications is huge. However, there is one tool that stands out among many others due to its usefulness, and that is GIS (Geographic Information System). Initially used land register management and road infrastructure planning, today GIS is one of the most useful tools in the daily lives of citizens and municipal managers. This is due to its integration of visualization and mapping routines that enable drawings on computers of heterogeneous information superimposed on a detailed map. Few Internet users worldwide have not heard of Google Maps or the 3D version, Google Earth. In early 2010, the city of Madrid was honoured as the best city in the world in terms of having the biggest and most detailed presence of 3D models of its buildings. It is clear that this trend will not end here, and the next logical step is its integration into metaverses and augmented reality, as certain technological initiatives have already shown. Increased resolution will also help to advance this integration that include information on canalization, sewers, electricity supply systems, and countless other maps that can be geo-tagged to be treated by a semantic programme. Thanks to this type of technology, in the future, it will be possible to manage public transport with only remote human supervision, and we will have small robotic units to make repairs along our cities’ narrow underground tunnels for the good of all.

Visualization applied to the public sphere goes far beyond systems, encompassing a vast multitude of interconnected areas, such as data analysis and mining, and the promotion of campaigns. Here is where it is linked to traditional art disciplines in multimedia formats that include video, animation, comics, painting and printing, to name a few. The mistaken prejudice exists in society that if something is pretty, it is not serious and cannot be of much use. Nothing is further from the truth, for aesthetics is a useful extension of manufacturing that expresses the quintessence of perfection,

achieved through methodical artisanal work. Art is a form of communication with great bandwidth and quality, able to transmit not only raw data but also complex concepts and sensations that are indescribable through other media. It should not be scorned when considering an investment in public management tools with excellent economic and social returns. Information science tools that add artistic and functional design criteria to the interaction between humans and machines are much easier to use, more quickly learned, and better understood. As a result, their use is optimized much more than when graphic interfaces are harsh and rudimentary. That is why the man who for many years was the richest in the world based his business on programming user-accessible graphic interfaces. Today the source code for many of these tools, and other new ones, has already been made publicly available and can be copied, remixed and improved for private and public benefit. Among these programmes are tools that enable countless tasks from editing video sequences to the simulation of physical processes in several dimensions. The excuse that these sub-routines are private is no longer an excuse, for they are filtering into the public sphere and help is needed now in improving the management of what is public.

In closing, let's reflect briefly on the teleology of visualization applied to the public sphere, of its purposes, and of why such a thing should be done. Humans' wellbeing, in an increasingly more densely populated world, finds its limits where one's neighbour's freedom begins. That is why we should learn to live in society and improve our relationships through optimizing management of shared public space. Unless we see, we cannot come up with ideas; without ideas, we cannot explore or investigate, nor innovate without a great risk. Innovation requires management of the risk of doing something new that is better, not worse than what already exists. And the way to mitigate the risk of error is a painstaking investigation task. If we open our eyes, we will have a much clearer view of the right path to take, having sufficient perspective and the certainty that we are headed to a better place.