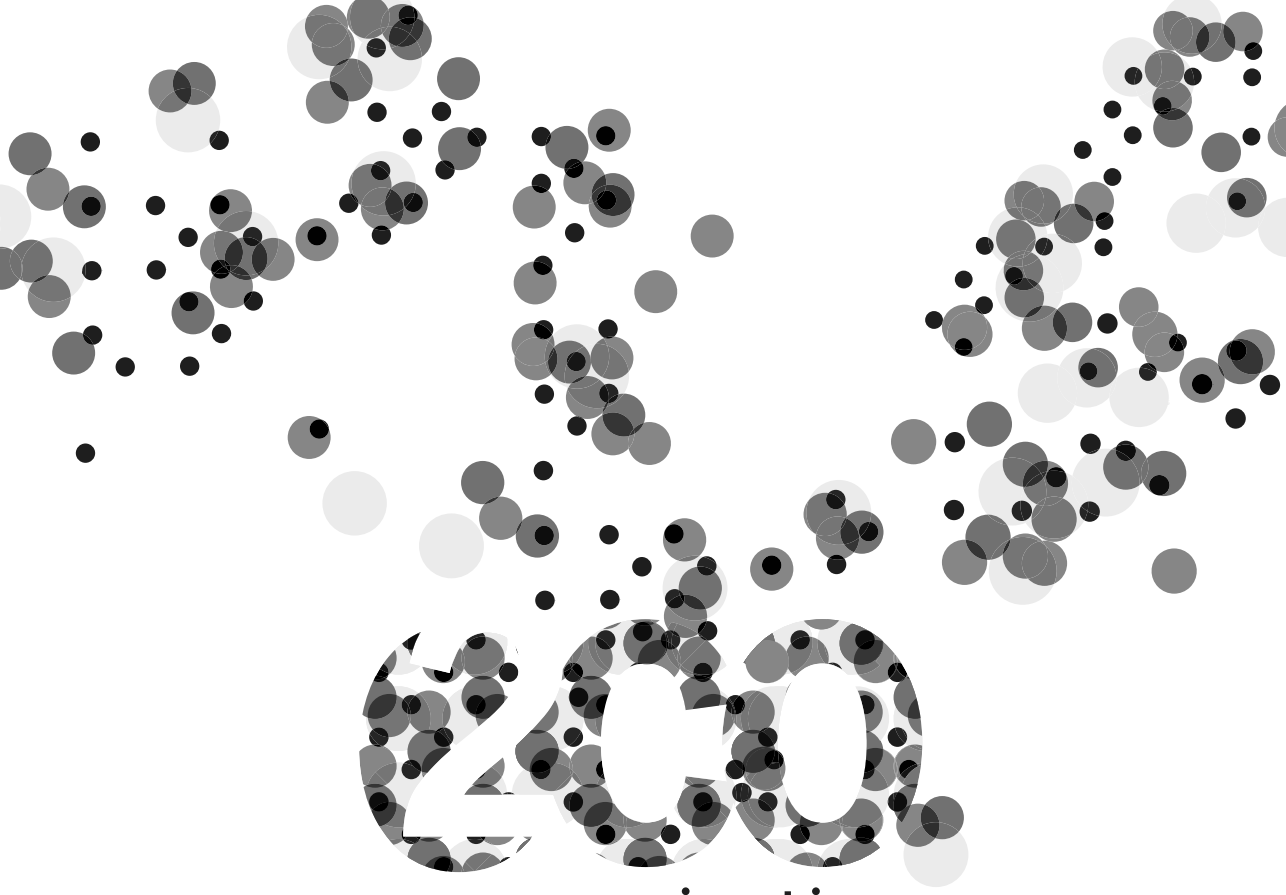

communicating complexity

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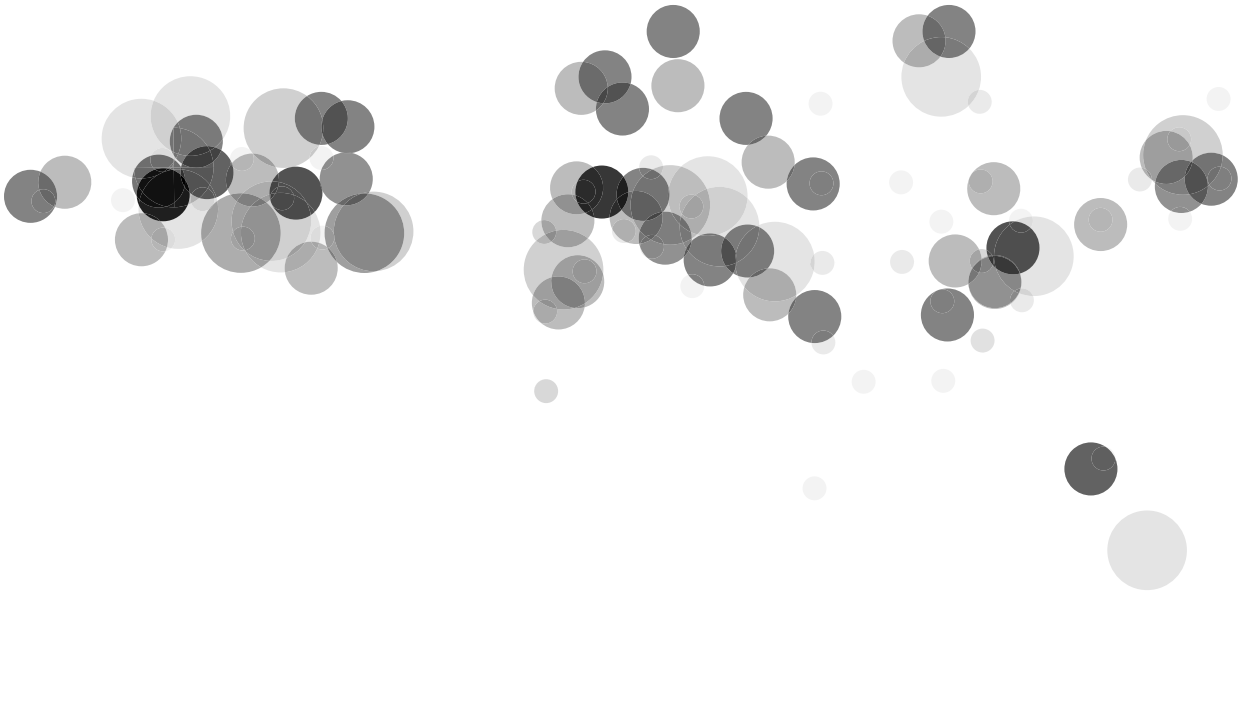

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.2 Interactive Data Visualization

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The convergence between factors such as a growing accessibility to new tools, channels, and approaches towards communication, and their encounter with the increasing levels of specialization and complexity characteristic of our society, unveils new and stimulating scenarios for the communication design community.

In such a constantly evolving general framework the dissemination of technical, scientific, social and environmental contents tends to shift from the more traditional and consolidated channels to new communication territories.

This new information ‘space’ is populated by networks of discrete units of information: concise communicative elements that combine graphics, typography, illustration, animation and narrative in new informative formats, giving shape to a sophisticated ecosystem, where a variety of hybrid informative units collaborate and complement each other.

This scenario, which takes full advantage of the emerging patterns of social networking, has not only rapidly transformed the way we inform, forcing well established actors in the traditional information arena to change their approach to communication. This new way to promote ideas, projects and values has opened to new players unexpected opportunities to make their voice heard.

Within this emerging communication landscape, new forms of ‘visual explanations’ of complexity respond to the growing demand for direct participation, and to the idea of networked communities based on the sharing of information. Being capable of balancing the transmission of complex contents, while engaging the public’s attention and curiosity, these new ways to inform and communicate have become the field of study and of professional activity of a vast international community of designers, scholars, professionals, that confront themselves with exciting interdisciplinary challenges.

COmmunicating COmplexity is the result of three years of collaboration between a consortium of European Universities, that in 2011 started working together in the InformAnimation project, and other fellow Universities active in visual design teaching and research. The 2CO international design conference aims at gathering professionals, scholars, educators and young designers involved in making complex information accessible through design, to share experiences, points of views and methodologies in three main areas of interest: informative-animation; interactive data visualization; info-graphics, becoming an international reference point in the exploration of languages, approaches and technologies for communicating complexity through new media.

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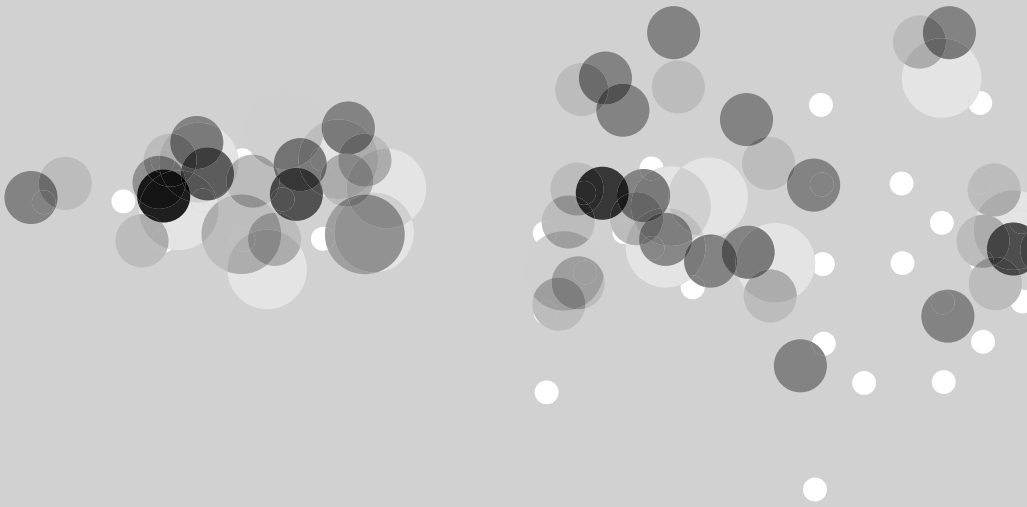
01. Full papers

1 : Info-Graphics



Conceptual Metaphors as Image Schemas in Information Visualizations

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Abstract. Language is a central feature of the communicative process that allows the transmission of abstract and complex ideas in the form of information. We have devised tools such as metaphors or analogies to help us explain something that is not well understood in terms of another that is well understood. Linguistic phenomena like conceptual metaphors have parallel levels of content, form, and context with information visualizations and have a prominent position in the field of information design. When visualizing information, designers employ a variety of metaphorical devices to make abstract or complex information graphically communicative. This paper explores the relationship between conceptual metaphors and information visualizations and how they are linked with cognitively embedded patterns that have their origins in our early sensory experiences. These patterns have been termed image schemas and use metaphorical thinking to create reasoning on phenomena like containment, force dynamics and movement. Through selected paradigms I attempt to shed light on how these schematic structures have come to evoke meaning in the way they do in information design and examine whether they function in a catachrestic base.

Keywords: conceptual metaphor / catachresis / information visualization / image schemas

1 Introduction

Simply defined, information is that which consists of facts, data or knowledge, it exists to resolves uncertainty. Outside the concept of communication, information could be considered arbitrary and one could argue that information exists as a concept because of its interlinked relation with the communicative process. Through this process, intangible information finds a form in order to be communicated and understood. In every attempt to communicate information, the concepts of the medium and the message, form and content takes precedence.

In the English language the word information derivers from the Latin verb infōrmō, which means to give form, or to shape an idea. [1] According to several dictionaries, the word information may refer to news, data, facts, intelligence or

knowledge. Ironically the words used to describe the word information to the general public can describe themselves different things. Information scientist John J. Costello Jr. thinks of data and information as different things "Data can be numerically expressed, that is quantified, quantifiable, tabular or objective… Data is highly repetitive. Information is not highly repetitive or quantified or qualifiable; it's characterized as narrative, subjective, qualitative, textual or descriptive. Data then, are numbers or unit fats, frequently repeated, whereas information is ideas." (Costello, 1965) Nevertheless information includes data and data includes further information, they are two interlinked concepts.

2 Conceptual metaphors and cognitive processes

As previously mentioned information is without substance if not involved in a communicative process. A communicative attempt can be considered successful once the receiver has understood the message of the sender. We can simply describe communication as the act of transferring information from a transmitter to a receiver with the end result of understanding. While this explanation may seem simple, when we begin to think of the ways we can use to communicate a subject, levels of complexity start illuminating. When we are not dealing with data like numbers and figures, the information that needs to be visually translated in most cases exists as a manifestation of language. Designers are called to give an understandable form to information that is given to them written and is orally explained. In Information visualization, form includes the visual language through images representing expressions of objects or concepts, and the language made visible through typography. Typography succeeds in covering numerical aspects of the information that needs to be communicated and elements such as titles or parts of that information that need to be highlighted. For the purposes of this paper we will focus on aspects of the visual language of information visualizations, leaving typography out, as it subjects to different sets of rules.

2.1 Figures of speech and figures of thought

Visual language has the potential of carrying the qualities properties of the spoken language such as phonology, prosody, syntax and the semantic structure of the words. Our visual language extends beyond grammar and phonology and includes attributes of the spoken language such as metaphors and other figures of speech. Metaphor is a type of analogy that is closely related to other rhetorical figures of speech that achieve their effects via association, comparison or resemblance including allegory, hyperbole, and simile. [2], [3]

By figure of speech we refer to the use of a word or a phrase; and in our case visual element or image, which transcends its literal interpretation. While this may seem a bit ambiguous when we are dealing with the facts, figures of speech

like metaphors have the power of adding to the levels of understanding of a piece of visual communication and seem to be having a long history of use in information visualizations.

Metaphor comes from the Greek word μεταφορά (metaphora), meaning, 'to transfer, or transport across'. As a rhetorical figure, metaphor means taking a word, or group of words, from one context and meaning, and placing them in another, so that a similarity appears between two elements once treated as different. It is now generally accepted that analogy and metaphor are key aspects of human cognition. [4], [5], [6]. Analogical processes play key roles in everyday communication, and underlie many, if not most, abstract reasoning processes. [3], [7], [8] Already accumulated knowledge on something can help us make sense out of something else, less understood. Metaphorical thought has enabled us to extend knowledge about things we understand to completely different domains of experience. In the same way graphical metaphors enable us to understand abstract concepts in terms of familiar and well-understood visual-spatial phenomena.

According to linguistics, metaphor is a figure of speech in which a word or phrase representing one kind of object or action is used in place of another to suggest a likeness or analogy between them (as in 'heart of gold'). A metaphor is an implied comparison in contrast to the clear comparison of the simile ('as cold as ice). [9] "In its broad sense, metaphor is not only a figure of speech but also a figure of thought. It is a mode of understanding and a means of perceiving and expressing something in a radically different way. In such a sense, figurative images are not simply decorative but serve to reveal aspects of experience in a new light." (Yu, 1996)

Metaphors seem to spark creativity by linking things that are originally unrelated. No matter how overused, metaphors are not clichés, but have come to form entirely new images that can be used without further references. The term catachresis describes a metaphor which has become literalized, and in spoken language is found in expressions like 'the leaves of the book', where 'leaves' is used as a substitute for the word "pages". The case of catachresis is a powerful indicator of the effect that metaphors have in the sphere of human communication and cognition. A catachresis differs from the typical comparison metaphor in that there is no semantic connection between the name and its referent.[10]

Catachresis is generally considered a vice as it describes "The use of a word in a context that differs from its proper application."[11]; however, Quintilian defends its use as a way by which one adapts existing terms to applications where a proper term does not exist. While Catachresis is usually interpreted as abusio, modern scholars extend the Quintilian argument and use the term in the meaning "to make full use of, thoroughly employ". Because, however, it has no semantic connection with its referent, the connection between them is not made by an act of cognitive comparison but by the intersubjective context of communication, the context of use. [12] In linguistics, catachresis is interlinked with the terms dead or conceptual metaphors.[13], [3] These metaphors have become so entrenched in thinking and language that go almost completely unnoticed in everyday use. For example, the phrase "grasp the idea" employs the conceptual meta-

phor IDEAS ARE OBJECTS (that can be grasped). [3] Similarly many of the graphical tropes employed in information visualization seem to have a similar nature. For example, in information graphics intangible concepts like time (from minutes to years) become something that can be seen and have a visible length. Conceptual metaphors like this are so established in our thought processes that their metaphorical nature passes unnoticed.

Following the logic above, graphical metaphors make statements on relations between a set of concepts in terms of some source relational structure that are expressed graphically. In these metaphors however the source domain is a type of spatial pattern that has clearly understood relational characteristics, but is semantically distant from the target phenomena that is portrayed. This is to say that the spatial pattern includes discrete, perceptually prominent components that bear some meaningful spatial or topological relationship to one another, but which are mapped to a non-spatial target domain.[14] Graphical metaphors seem to promote the understanding of abstract concepts in terms of well understood visual -spatial phenomena.

Graphical metaphors employing representations of physical objects have a long history of use. In art for instance, symbolic objects are arranged in meaningful spatial configurations that metaphorically (or allegorically) express relations among the concepts the objects. Information visualizations function in a similar way. Information designers catachrestically take for granted the fact that certain design elements and configurations have particular, abstract meanings. For example graphic metaphors used to represent quantitative information like bar charts or network diagrams have become in a sense visually literal.

2.2 Perceptual spaces and visual manifestations. A cognitive approach

Why is it that certain spatial patterns are able to associate with unrelated, abstract concepts with meaning? The answer seems to be that we are conditioned from birth to organize and reason about abstract concepts in spatial terms. According to emerging theories of embodied cognition, early sensory experiences with phenomena such as movement or force dynamics become abstracted and schematized [15]. These schemas function as “conceptual structures” for organizing and understanding more abstract and complex concepts. As we grow up they become cognitively embedded in our minds and become “invisible” in practical use. These structural patterns have been termed image schemas as they function on a largely visual-perceptual basis. [16] A big part of our conscious thought is largely based on the metaphorical use of image schemas. This seems to provide the basis for the function of information graphics, and has led to the development of the variability of information visualizations we see today.

Graphical representations of hierarchical conceptual structures for example commonly reflect a preferred vertical orientation and are in agreement with Lankoff’s Spatialization of Form hypothesis. Spatialization of Form hypothesis is a general theory of conceptual organization that explains the role that image schemas play in semantic understanding. [13] It describes the conceptual struc-

tures used for organizing abstract concepts having an image-schematic basis. Further, it associates particular key conceptual structures with specific image schemas. A hierarchical structure for example is understood in terms of PART-WHOLE and UP-DOWN schemas. Lakoff describes this organizing process as a metaphorical mapping of spatial structure into conceptual structure. In this way, concepts are given meaning according to the image schematic structures with which they are associated. Lankoff mentions a number of conceptual structures that are associated with specific image schemas. For the purposes of this paper we will focus on selected examples that will help us understand how these cognitive processes function.

Examining the simple case of bar charts we see that vertically oriented bar charts, like many other common statistical graphics, are interpreted in terms of the conceptual metaphor that MORE IS UP. [3] This seems to be a universal cross culture metaphor and is, echoed in the English language in statements like "turning down the heat" and "inflation is going up." Larger quantities seem to be ascending. Humans grow taller when they grow up. When Archimedes had his famous Eureka bath the water level went up in his bathtub. This kind of universal experiences seem to become part of our subconscious mind and structure concept formation in analogous situations.

Another example of a type of information graphic that graphical metaphors seem to have a catachrestic nature is the Venn diagram. Several previous authors have noted that Venn/Euler diagrams employ a visual conceptual metaphor based on the CONTAINMENT schema. [13], [17] The structural elements of this schema include an INTERIOR, a BOUNDARY, and an EXTERIOR. During our childhood, we learn the concepts of collection and containment from an early age while playing, putting objects into containers and taking them out again, putting containers into other containers, and so on. [18]. These experiences root in us as cognitive patterns that we naturally employ in abstract reasoning. Note that we can conceive of, and reason about, the abstract concept of containment independent of the existence of any contained objects. It is clear that Euler diagrams are intuitively understood due to their interpretation in terms of embodied spatial schema.

Research has also shown that vertical relations among the units shown in diagrams seem significant while horizontal relations appear as arbitrary. The "root" in most cases is positioned at the top. [17] It is speculated that the reason for that is our experience of the human form that serves as an image schematic source domain for this metaphor. The human form is embedded in the human experience, and presents a hierarchical branching structure with the top located on the head where attention is focused during human interaction. Vertically oriented tree diagrams and the human form seem to be anatomically and semantically associated.

It is generally accepted that the principal function of information graphics is to illustrate relations among ideas or concepts. Bertin argues strongly on it stating that "What is properly called information graphics depicts only the relationships established among components or elements".[19] Components and elements based on the general agreement that certain conceptual metaphors have a

specific meaning. Tversky, agreeing with Bertin says "…graphic elements are generally used to represent elements in the world, and graphic space is used to represent the relations between elements".[20] Based on the theories mentioned, one could argue that information graphics fully qualify as conceptual metaphors for the information they represent.

3 Conclusions

A metaphor is an attempt to make a poorly understood phenomenon more understandable by relating it to a more meaningful one. Similarly, information graphics present selected aspects of complex phenomena in ways that are comprehensible communicative. Metaphorical graphics function by presenting non-spatial concepts in spatial terms. Thus abstract concepts are related in systematic ways that stimulate natural modes of conceptual structuring. Based on the theories mentioned above, one could say that metaphorical graphics derive much of their meaning from their functional alignment with image schemas. These cognitively embedded patterns that deriver for our experiences can theoretically serve as the link between perception and cognition. [21] Through these patterns abstract reasoning processes are structured through metaphorical reasoning that is grounded throughout our cognitive and perceptual experiences. It is evidenced that in information visualizations, abstract concepts are related in systematic ways that stimulate natural modes of conceptual structuring. Building on previous theory, one can argue that they are so deeply embedded in the way we visualize information that they function on a catachrestic base.

When visualizing information, designers reflect their thought processes, mirroring the subconscious schematic spatial patterns that are the foundation of much of our cognitive processes. This has led to the invention and refinement of the particular types of graphic devices we use today. Historically, information designers have naturally evolved graphic tools that reflect and strengthen their cognitive processes. As a consequence, information graphics have come to mimic the subconscious schematic spatial patterns that form the basis of much of our thought and reasoning. Image schema theory, deriving from linguistic and cognitive studies, can functions as a basis for a "visualization grammar" that employs conceptual metaphors based on image schematic patterns. It seems that graphics that purposefully align data and information, graphically interpret certain image schematic patterns that are universal. These metaphorical schemas seem to function on a catachrestic base and when visually interpreted as information graphics are communicated and understood without further reference to why or how they have come to evoke meaning in the way they do.

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Carbonia Landscape Machine. A Complex Action on Modern and Contemporary Landscape

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Abstract. Carbonia was founded during the Fascist era to serve the large Serbariu coal mine. Due to its extraneous nature, divorced from the Sardinian context but still an important part of the island's recent economic and social history, Carbonia is neither a simple subject nor can it be simplified. After a long period of decline, a collaborative project between the University of Cagliari and the municipal administration sought to reconnect Carbonia's history to its present. The project lasted several years and is, in some ways, still under way. In 2011, this complex urban redevelopment project and the communication of the context's extraordinary territorial, historical, architectural, and anthropological resources won the Landscape Award of the Council of Europe.

1 Introduction

Mentioning Henry Miller , the word complexity was invented to indicate an order that cannot be understood. This quote opened the book of Ludovico Quaroni "The Tower of Babel" of 1967. The image / myth of the Tower of Babel is ambiguous, rich of suggestions and new interpretations : the chaos, the loss of common points of view, a reality in progress that can hardly be represented by a unitary figure. The design activity, intended as an anticipation of a clear and concrete solution, seems to be weakened today by the complexity of the processes that we are called to govern, and by the tools that appear outdated or however inappropriate.

We propose to contribute to this reflection with a concrete example of design practice that has faced these issues, taking into consideration the epistemological background within which it was going to take place. It is a project, developed over a period of about ten years, that has activated and coordinated various levels and combinations of the complex structure of a city and a territory, from the political / institutional one, to the technical / operational, considering also the economic and urban planning instruments, and the research, intended as background within which it was possible to build actions and measure the results. This project, called Carbonia Landscape Machine, metaphor of the machine as a

complex devise into a coherent structure, have created a new order in the complex palimpsest of the contemporary landscape, a possible answer to the incapacity to manage the processes of formation and transformation of the contemporary landscape .

Carbonia is not only a city, but a complex and difficult reality. An urban and architectural object detached from the historical context and landscape, a new, gigantic and unexpected industrial machine parachuted in an area with no apparent identity due to a monocratic and functionalistic decision. After more than sixty years, Carbonia decided to regain his past, judged embarrassing by its own inhabitants, reconquering the pride of a difficult story, because related to a series of unpleasant events that, however, represent a fundamental and inseparable part of its urban and human heritage. The great challenge of the city administration, accepted by the University of Cagliari, consists in the restoration of the historical and geographical synapses, if certifiable, and in the interpretation of all the others that the time and oblivion had deleted. And finally, the construction of a new grid of possibilities to share proposals and identities.

Fig. 1. Carbonia, in its original state, 1940

For this project Carbonia received the Council of Europe Landscape Award with the following motivation: «the Carbonia Landscape Machine is the winner of the 2nd session of the Landscape Award 2011 considering the exhaustive and multi-scale development of the project. This exemplary achievement which aims to regenerate a 20th century modernist, urban and mining landscape in a sustainable development perspective, fulfills all the criteria for the Landscape Award with ample force, proving that sustainable territorial development can be achieved by public participation on all levels and accompanied by extensive awareness raising. The use of its historical resources to create a new identity

was, at the outset, the requalification of this urban landscape. The work on the mine was accompanied by a revival of the whole city with the restoration of public squares, roads and monuments. This regeneration of the urban fabric of Carbonia has fused a new cultural identity in the town»[1].

The motivations that brought about this fine result underscore, above all, the value of the multi-level project, which was able to intervene in the various areas of the city (urban, architectural, social, etc.) and which strove to achieve sustainable territorial development through coordinated protection, management and planning actions, interventions and processes that favoured the re-qualification and relaunching of the identifiable traces of the history and culture of this area.

Carbonia has been recognised as a synthesis of a planned project that, without forgetting its historical industrial vocation, today seeks to regenerate itself using the most modern of models for sustainable territorial development, represented both by the recovery efforts and the conservation of the identity of the sites of the city and its urban texture, while at the same time striving to give a new meaning to the concept of landscape in this area.

Fig. 2. The city and the mine, 1938
Fig. 3. Houses in Via Satta, 1939

[1] Landscape award of the Council of Europe second session 2010-2011, final document written by the VI Council of Europe, Conference on the European Landscape Convention, Palais de l'Europe, Strasbourg, 3-4 May 2011.

2 The new complex town

Carbonia is a company town that was built between 1937 and 1938. Its organisation and management was conceived in such a way that every aspect of its existence would be controlled from above. It came about when Italy's most extensive coal reserves were discovered in south-western Sardinia, a discovery that soon transformed the area into an industrial zone with a complex regional plan based on the construction of various interconnecting urban areas with infrastructures that still today mark the landscape. Carbonia was the largest of the residential areas of the system and bears witness to the policies and projects applied to the construction of company towns in the early 1900s. It was, in fact, the first time that an urban centre of such dimensions had been constructed, especially as compared to other company towns, which had come about mainly as administrative and service centres for rural populations. This new city was an opportunity to experiment with the creation of a 'perfect city', a city whose functions were of the highest efficiency, whose population would be entirely controlled, in short, the ultimate expression of the ideals of the reigning Fascist regime[2].

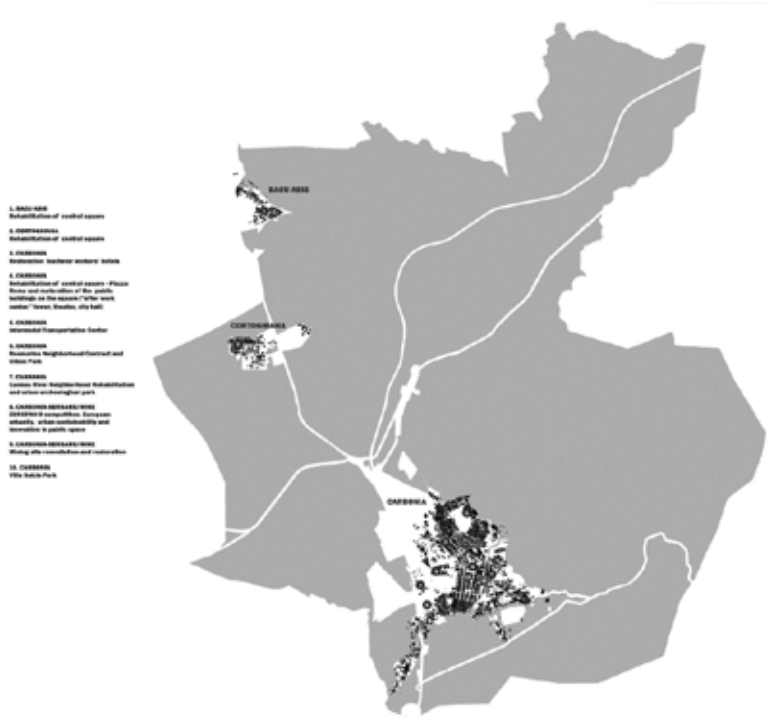

Fig. 4. The Carbonia district and protected landscape areas (A. Sanna, G. Peghin)

[2] More documentation regarding the company town can be found in G. Peghin, A. Sanna, *Carbonia città del Novecento*, Skira, Milan 2009.

Carbonia was hit by the industrial mining crisis in the second half of the twentieth century and, apart from undergoing an evident socio-economic change, began to suffer from a gradual decline in the management model of the company town as the controls governing the maintenance of real estate became progressively lax. The new economic and social reality soon weakened the city as its context changed and the original historical and cultural setting that had given life to it disappeared. And yet, the persistence of the urban structure, of the extensive network of buildings, the urban monuments, and the architectural and constructive fragments with their serial repetition remained the hallmark of the city and allowed Carbonia to be seen as a city of quality that could re-establish its threatened and weakened identity and mend its ties with its history in order to rediscover the value of the physical forms of its urban space and landscape.

These problems were the context dominating the recovery of the urban and territorial heritage, a complex and articulated action of a much wider programme of projects the city had designed as they set its urban regeneration strategy[3]. The new city Urban Plan, in particular, has determined that the requalification of the residential area's fabric and the modification project is central to bringing the residential units up to modern standards.

This situation led to an articulated, heterogeneous and diversified strategy, made up of analytical and project tools, as well as management processes, education and a small fishing village to became the region's main cultural awareness raising imperative, the catalogue of the rationalist architectural heritage of Carbonia and the typical catalogue of rationalist-based buildings, the Urban Quality Charter, the Recovery Manual for modern buildings, the Rules for Modifications, tools associated with the management actions taken by the Urban Quality Laboratory and the open-air museum known as Carbonia Itinerari di Architettura Moderna (CIAM: Modern Architecture Itineraries of Carbonia).

[3] For a detailed description of the Carbonia project, see G. Peghin, A. Sanna (eds), *Modern Urban Heritage. Experiences and Reflections for the Twentieth-Century City,* Allemandi Editore, Torino 2012 and G. Peghin, *Quartieri e città del Novecento. Da Pessac a Carbonia. La tutela del patrimonio urbano moderno*, Franco Angeli, Milan 2010.

Fig. 5-6. Piazza Roma, 1938-2013 (A. Sanna and partners)

Fig. 7-8. CIAM open air museum. Piazza Roma and Serbariu Mine (S. Asili, G. Peghin)

CIAM became the symbolic feature of the actions undertaken over the last decade to safeguard the city's heritage. It is an open-air itinerary/museum that connects the various buildings and highlights of the company town. Its objective is to tell the story of Carbonia's history through architecture and urban layout. It came about with the double aim to make the architecture and urban environment 'visible' and to bring the inhabitant closer to his city, showing him the interdependence of the historical, cultural and social components and their role in the new urban identity. Its focus is identity, the participation of the local com-

munity and the potential of the territory as a place where sustainable development is encouraged.

The mission of the museum is, in short, to create a cultural project that can promote the understanding and interpretation of the signs scattered throughout the urban fabric and to bridge the gap between the static nature of historical documents and the dynamism of the social practices that distinguish the city: objectives that can be effectively achieved if the cognitive experience of the historical values of the buildings are not separated from their context. In short, the mission of the museum is to promote a cultural project able to favour social renewal. It was designed on the basis of an itinerary that touches certain important city areas and marks their importance with explanatory structures designed to create new urban landmarks. The lower part of the metal structures have panels describing the history of the city with pictures, project designs and explanations, while the higher part of the structures have punctured metal panels showing the molecular structure of coal, a featured used repeatedly throughout the city.

Fig. 9. Entrance at Serbariu Mine (S. Asili, G. Peghin)

3 Communicating the stratified identity

These actions, which have faced the complexity of the physical structure of the city, have been integrated with an overall project in order to redefine the visual identity and its communication. A project which designed a systematic research of the symbolic elements of continuity from the past, able to interpret the future prospects.

Carbonia wanted a new future and wanted to forget its past in a hurry. In its soul, which was open to innovation because it was born without memory (or with the artificial memory of an empire), it wanted to reinvent itself as something else, utilising its roots as a container for new imaginations. It wanted colour where before everything had been only black, to erase the memory of black, because its significance as the colour of coal had been exhausted. Black made room for painful memories of the fascist ideology, become a symbol for the oppression of the workers and the dashing of their dreams.

Getting rid of black, however, would have meant using a selective, and therefore an anti-historical, memory. Second it would have involved wasting an extraordinary opportunity to establish an identity, already inherent in its name, of incredibly strong evocative and communicative power. The cohesion of the city's image would be steeped in black: it had to be clear that colourful makeup would lend a grotesque appearance to the image of a city scarred by conflict at work and for work: the hardest work of all, the work done by miners and their families. Black, then.

Fig. 10. Carbuncle typeface (S. Asili)

Fig. 11. The museum logo on a T-shirt (S. Asili)

First and foremost Carbonia is a city of narrative. When Calvino wrote Invisible Cities he may have forgotten it. Carbonia is the oxymoron city. It is the double city that contains its own negative. One lies at the surface, the other, literally a carbon copy, unfolds in the subsurface of the Serbariu mine. Two vertical cities.

We have reconstructed a typeface used in the large-scale titles in line with this verticality and this transition, and we have chosen to call it Carbuncle.

We have combined this typeface with a number of other existing font families still drawing on characters consistent with the site's historical image.

Black holes are the memory of dead stars. The lights of those miners teeming in the darkness are the stars of hell, an upside-down sky, a new system of time and space, which takes shape in the depths, designing new constellations.

The sense of time is distorted by the dark and by the shifts that follow one another around the clock. Such coordinates can be measured in terms of years-darkness.

The stars of hell mentioned above have inspired the branding, whose abstract nature is far removed from the rhetoric of the symbols that represent the work of miners, and consists of a set of seven lights in the dark (the same number of lamps as there are stars in the Plough) inside a black rectangle.

Moreover, transposed onto a stave, they have also become the museum's 'musical logo', so that even blind visitors, who, like the miners, live through an everlasting experience of darkness each day, can recognise their location through a sequence of sounds.

Providing a countermelody to the lyrical aspect of a superhuman, mythological dimension, we have the multitude: the algebraic sum of identities who be-

come 'labour units', that become histograms divested of suffering, in the Isotype codification figurines by Otto Neurath and Gerd Arntz.

Carbonia's history is hence one of contrasting stratifications that, though physical, are most of all human, symbolic and meaningful. The same stratified and vertical composition can thus be seen on the entrance banner and in the brief introductory leaflet, which are structured as though they were a huge core sample of the city's soul.

We have sought to maintain the feeling of the mine and its histories everywhere, in some cases using codes that are not immediately decipherable. Thus, on the headed paper, life rolling on is represented by remarks and by words written on the white page, whereas the branding and the directions, the visual identity of the mine, are below, always below. The feeling of the mine is expressed in the poster that looks towards the pit-head frame from the Lamp Room.

Fig. 12-13. Inside the Coal Museum, Lamp Room (G. Peghin)

It lies in the Babel of dialects compressed and regimented in daily work, stories of men and women from different places and times, interpreted by typographic relics reset by Maura Saddi. It lies in the palette of colours verging on

earthy tones: on oxides, on rusts, on danger signs, on the signals necessary for surviving in the subsurface.

The more specifically scientific and technical panels/walls - devoted to the structure and genesis of the material, extraction methods, the uses of coal and a comparison between the various technologies used in the various parts of the world and at various times - alternate with dramatic presentations of statistical data: the many crosses throughout the carboniferous basin of the Sulcis area, whose red heart is formed of the dead of Serbariu, are contrasted with a huge blown-up photograph of a silicotic lung.

Two long corridors present the history of the city/mine and the key stages of its architectural construction, enveloping a walkway in which the physical objects of memory are catalogued for visitors. Here too, as with the scientific walls, the photographic and textual information is accompanied by continuous film clips and animated sequences. Functional signage has also been designed using buildingyard materials.

The shower galleries have been refitted. Like two long embankments protecting the workplace, these signalled home time. One of them becomes a gallery of identity, in which the description of times and bodies tells of the lives of the workers and their families: the skills of their trade; their daily heroism and their particular heroism in standing up against tyranny and exploitation; their physical suffering; and the price paid by both men and women. Identity tags and cards are laid out opposite one another as a way of comparing personal and professional identities. Work tools are juxtaposed with diagrams of functional classifications, organisation charts and statistics. The amniotic environment of the sound gallery and projections enable visitors to concentrate their senses on the archive material, on the moving images, on the voices of the workers, on the noises of the mine. A flimsy curtain lines the way through the gallery, immersing it in a diffused light that represents the water vapour from the old showers.The other gallery, which runs parallel, speaks for itself. The showers have been left as bare as the bodies they once held, white surfaces of all possible imaginations, pages erased and rewritten every day by coal dust washed away. It thrives on absence.

Fig. 14. Inside the Anthropologic Gallery, Lamp Room (S. Asili, P. Atzeni, G. Peghin)

Carbonia Itinerari di Architettura Moderna (CIAM: Carbonia Itineraries of Modern Architecture) has come into being. It is a physical path that re-appropriates the places of the city, a laboratory of introspection regarding its own origins, a presence once again empowered by a 're-cognised' identity. The view from above has traced out the 'song roads', in which narration reaffirms memory. At the junctions stand totemic parallelepipeds, whose form dialogues with the pre-existing features of the rationalist city. The interwoven part representing the crystalline structure of coal is designed using the material of labour - steel. At the bottom, passers-by can read an architectural history, it, too, inextricably intertwined with the theme of labour.

Fig. 15. Crabo, the Museum mascot (S. Asili)

A museum of memories, albeit memories that for the most part are painful, cannot be closed in on itself and escape dialogue. Dialogue is necessary for the future of the museum: dialogue with new generations. This need has led to the creation of Crabò, the museum's mascot. Crabò too has an ambivalent nature. It is man/woman, it is a human being and a goat, it is an ancient legacy of sheep and goat farming and a modern expression of the civilisation of machines, it is a demon and a clown, smiling and chthonic, graphically modern but in line with the artisan and artistic products of the 1930s; from Antonio Rubino to Eugenio Tavolara, innovator and organiser of Sardinia's iconic heritage. The name Crabò also has two meanings: it is the contraction of craboni, which in Sardinian signifies both he-goat and coal. Having started life as the mine's mascot, it has become the symbol of Carbonia's carnival and, let us hope, of the city's new, rediscovered, dignified will to live.

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Icons of Complexity

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Abstract. In many areas of communication, it is easy to use a pictogram to express a concept. This is more difficult when communicating complexity, an area in which only concepts such as feedback, homeostasis, redundancy, can be efficiently and concisely expressed only verbally. This paper documents the early stage of an attempt to use individual pictograms to express some complex concepts - just as we use individual words to express those concepts.

Keywords: Icons / Complexity / Feedback / Homeostasis

1 Introduction

Is a picture really worth 1,000 words? This could possibly be true in many fields, but not when communicating complexity. Nowadays, concepts such as feedback, homeostasis, redundancy, can be efficiently and concisely expressed only verbally, since there is no iconic and simple graphic equivalent. Most of the times their representation reproduces an "exploded view" of the elements involved, even though such a slavish schematization is not always required.

This paper documents the early stage of an attempt to use individual pictograms to express some complex concepts - just as we use individual words to express those concepts.

2 From pictograms to writing

The Western cultural tradition sees the history of writing as a linear process that starts with orality, goes through the pictorial representation of objects, then on to the use of conventional characters that transcribe words and phrases, to finally get to alphabetic writing.

In Plato's *Phaedrus*, Socrates tells Phaedrus about the Egyptian god Theuth: «To him (to pharaoh Thamus) came Theuth to show his inventions and Thamus asked what use there was in each (...). When they came to the letters, “This invention, O king,” said Theuth, “will make the Egyptians wiser and will improve their memories; for it is an elixir of memory and wisdom that I have discovered.” » [1]

Even though Plato questions this thesis, tradition will adopt it fully, as can be seen in the following quotes, the first from the collection "Essays on Life, Art and Science" by English novelist Samuel Butler, the second by Edward Burnett Tylor, first professor of anthropology at the University of Oxford:

« The spoken symbol is formed by means of various organs in or about the mouth, appeals to the ear, not the eye, perishes instantly without material trace, and if it lives at all does so only in the minds of those who heard it. The range of its action is no wider than that within which a voice can be heard; and every time a fresh impression is wanted the type must be set up anew. The written symbol extends infinitely, as regards time and space, the range within which one mind can communicate with another; it gives the writer's mind a life limited by the duration of ink, paper, and readers, as against that of his flesh and blood body. » [2]

« The invention of writing was the great movement by which mankind rose from barbarism to civilization. How vast its effect was, may be best measured by looking at the low condition of tribes still living without it, dependent on memory for their traditions and rules of life, and unable to amass knowledge as we do by keeping records of events, and storing up new observations for the use of future generations. » [3]

When Butler and Tylor talk about writing, they refer to the concept currently used in the Western world: alphabetic writing, which is supposed to be the only one to guarantee civilization. One hundred years before Butler and Tylor, Jean-Jacques Rousseau in his *Essai sur l'origine de langues* already differentiated three types of writing: pictorial representations, conventional signs and alphabetic writing.

« These three ways of writing correspond fairly precisely to three different states of which one can consider men assembled into nations. The depiction of objects suits savage peoples; signs of word and propositions, barbarian peoples, and the alphabet, civilized peoples.[1] » [4]

This classification is not a thing of the past. Visionary and pioneer sociologist Marshall McLuhan deemed this classification still very relevant in 1962 in his famous book *The Gutenberg Galaxy*, which has been a point of reference in the study of mass media for decades:

« Only the phonetic alphabet makes a break between eye and ear, between semantic meaning and visual code; and thus only phonetic writing has the power to translate man from the tribal to the civilized sphere, to give him an eye for an ear. The Chinese culture is considerably more refined and perceptive than the Western world has ever been. But the Chinese are tribal, people of the ear. » [5]

[1] «Ces trois manières d'écrire répondent assez exactement aux trois divers états sous lesquels on peut considérer les hommes rassemblés en nations. La peinture des objets convient aux peuples sauvages ; les signes des mots et des propositions, aux peuples barbares, et l'alphabet, aux peuples policés.»

3 From writing to pictograms

Yet the pictographic language was not detached from the Western cultural context. In the second half of the 1920's Otto Neurath was already at work in Vienna within the intellectual context of logical empiricism. Economist and philosopher, he was head of the economic section of the Ministry of Defense and founder of the Museum of Society and Economy. The museum had the explicit mission to educate adults and within this mission Neurath developed the “Vienna method of pictorial statistics" which included the development of ISOTYPE (International System of TYpographic Picture Education), a corpus of sophisticated pictograms - designed by Neurath and drawn by designer Gerd Arntz - which over the years grew to contain about 4,000 symbols.

« Turning the statements of science into pictures in frequently a delicate business, and it is not the work of a man of science or of a designer[2] Special attention to this process has given birth to the ISOTYPE system. Its rules are the instruments for putting together the work of science and the work of design[2]. » [6]

Otto Neurath, Gerd Arntz and ISOTYPE were the forerunners not only of scientific and statistical dissemination and therefore of modern information design, but also of the whole communicative context that includes public service signage systems and the graphical user interfaces for computers. [7] The "transformation" method theorized by Otto Neurath underlies all the stylization involved in the design of modern icons. Is it possible to think that after many years of cultural dominance by alphabetic writing, the current period brings a return to the pictographic language of the beginnings of human history? Is it some kind of revenge?

This revenge is in fact evident. Just think of the huge amount of pictographic signs that are part of our daily experience. Although a classification of icons and pictograms conducted with a scientific method is not available yet (as far as the writer can tell), cataloguing in broad terms by using some significant sources available [8, 9, 10, 11] leads to the following approximate families:

- signs (broadly speaking);
- interface with devices (and interaction design);
- emotional communication (with the many variations of the emoticons of typographic origin);
- representation of objects for cataloguing (ecommerce etc.);
- representation for “seductive” purposes (pictograms of a brand).

However, it is clear that the greatest creative effort is concentrated on the creation of different styles of icons and pictograms, rather than on creating new ones. For example, the same corpus of one hundred icons representing the office environment recurs several times with different designs, while it is very difficult

[2] The words "designer" and "design" were not used in the current sense, but rather to simply mean "person who draws" and "drawing". Even more so in this text which is not written in English but in Basic English. [TN]

to put together a stylistically consistent set to represents the classification of single cell organisms or the various types of investment funds, just to give a few examples.

In short, the ample dissemination of pictographic language has affected almost all areas of visual communication, but it has had little or no impact on the fields that actually started the phenomenon, namely education and the dissemination of ideas and of scientific, economic, sociological concepts and so on. The pictographic language is sometimes used to complicate what is already simple but it is rarely used to simplify what is complex!

4 Pictographic language and complexity

Albert Einstein is reported to have said: « Everything should be as simple as it can be, but not simpler. » [12] For several authors, complexity is what stands on the border between order and chaos. The map of the states of a complex system by Stuart Kauffman [13] and the map of the states of a cellular automaton by Christopher Langton [14] efficiently outline this concept. In the domains of order and chaos there is nothing to explain on the left side and on the right side: nothing yet on the left, nothing anymore on the right.

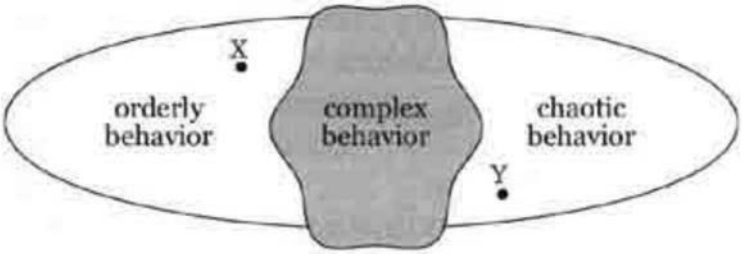


Fig. 1. Map of the states of a complex system according to the results of the study of Boolean networks (Kauffman).

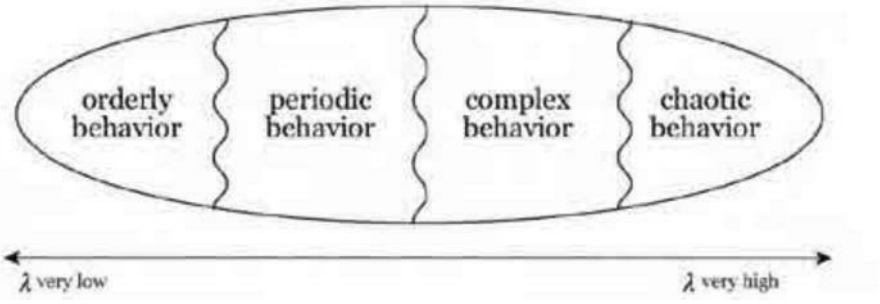


Fig. 2. Map of the states of a cellular automaton (Langton).

In the field of visual communication, these representations bring to mind “Chaos-Order”, the first chapter of one of Adrian Frutiger's most important books, “Symbols & Signs”:

« For Twentieth century humans it is difficult to imagine a void, a chaos, because they have learned that a kind of order appears to prevail in both the infinitely small and the infinitely large. The understanding that there is no element of chance around or in us, but that all things, both mind and matter, follow an ordered pattern, supports the argument that even the simplest blot or scribble cannot exist randomly and without meaning, but rather that it is the observer who does not clearly recognize the cause, the origin and the occasion of such a “design”. »[3] [15]

To better explain his thought, Frutiger uses pictograms to represent the concepts of chaos and order:

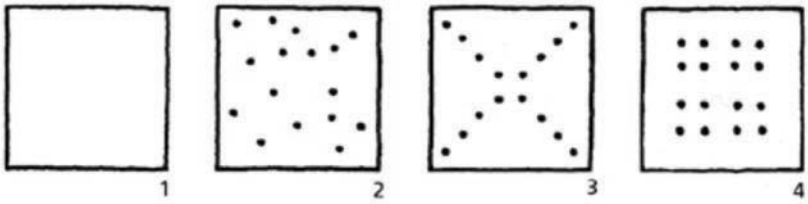


Fig. 3. Chaos-Order (Frutiger).

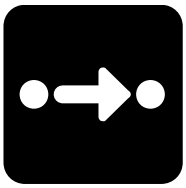
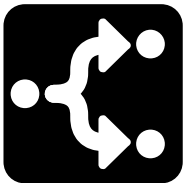
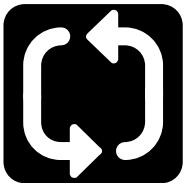
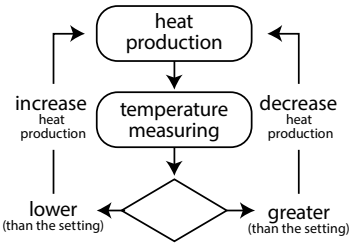
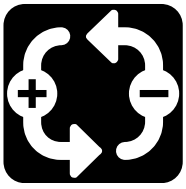
It is interesting to note that Frutiger's book does not deal with information design or the representation of complexity, but rather with the graphic history of signs. Frutiger deems it important to tell the story from the beginning, from the inherent human need to always assign a meaning to what one sees, therefore to create signs that can carry some meaning.

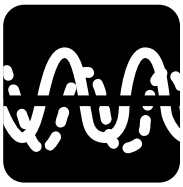
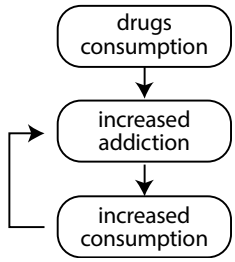
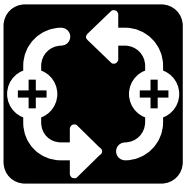
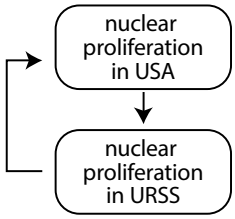
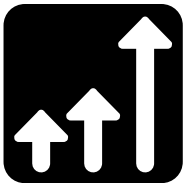
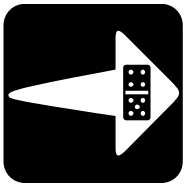
From this point of view, signs belong to the inherent human need to represent and communicate the meaning of things. Just as the concepts of complexity have advanced our understanding of reality by moving the border of what is understandable at the expense of the territory of chaos, the pictograms of information design, from Neurath's ISOTYPE to the present day, have moved the border towards a greater portrayal or "explicability" of reality.

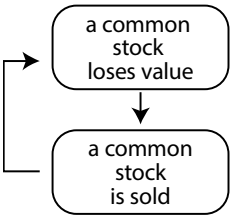
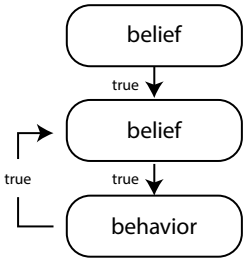
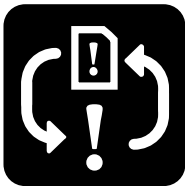
[3] «Für einen Menschen des 20. Jahrhunderts ist es schwierig, sich eine Leere, ein Chaos vorzustellen, denn er hat gelernt, daß im unendlich Kleinen wie auch im unendlich Großen eine Ordnung zu herrschen scheint. Die Tatsache des Begreifens, daß es um und in uns keine Zufälle gibt, sondern, daß die gesamte Materie (auch die geistige) einer geordneten Zusammensetzung folgt, unterstützt die Begründung, daß auch das naivste Gekleckste oder Gekritzel nicht unwesentlich, nicht rein zufällig sein kann, insofern der Betrachter die Ursachen, den Ursprung und die Veranlassung dieser »Aufzeichnung« nicht eindeutig erkennt.»

5 New icons to explain complexity

As anticipated at the end of Section 3, however, the "isotype-ization" (i.e. the design of pictograms that are useful for education purposes and for the dissemination of ideas and of scientific, economic, sociological concepts etc.), has come to a halt or it is slowly carrying on. Many pictograms are needed. In this section we offer some of them, specifically related to a few key words of complexity.

Linear interaction (sequential)	A component affects another component. Example: a star and a planet	$A \rightarrow B$	
Idem	A component affects another component, which affects a third component (and so on). Example: a star, a planet and a satellite.	$A \rightarrow B \rightarrow C$	
Linear interaction (Hub)	A component affects a second and a third component. Example: a transmitter and two receivers	$A \rightarrow B$ $\searrow$ C	
Feedback	A component affects another component. In turn, the second component affects the first.	A $\nwarrow\searrow$ B	
Negative feedback	A component affects /stimulates a second component, which inhibits/stops the first. The system levels off and finds a balance. Example: a heat control system		

Homeo-stasis	A component affects another component. In turn, the second component affects the first. The system levels off and finds a balance. Example: Lotka-Volterra predator–prey equations.	$\frac{dx}{dt} = x(\alpha - \beta y)$ $\frac{dy}{dt} = -y(\gamma - \delta x)$	
Positive Feedback	A component affects /stimulates another component. The second component further affects the first one. Example: the vicious circle of drug addiction.		
Escalation	A component affects /stimulates another component. The second component further affects the first one. The system grows really fast. Example: nuclear proliferation.		
Domino effect	A component affects another component, which affects a third component (and so on). The system grows really fast. Example: German reunification	**German reunification** – 19 August 1989: Hungary disabled physical border defenses – 18 October 1989: Erich Honecker resignation – 10 November 1989: Wall fall – 18 March 1990: East Germany election day – 1 July 1990: East Germany adopted West German currency – 3 October 1990: German reunification	

Snowball effect	A component affects another component, which affects a third component (and so on). The system grows really fast. Example: Stock Exchange		
Butterfly effect	Small perturbations can cause huge variations of a system. Example 1: meteorology. Example 2: Blaise Pascal and Cleopatra's Nose[4],		
Self-fulfilling prophecy	Prediction that causes itself to become true, due to positive feedback between belief and behavior. Example: the Oedipus myth (Karl Popper).		

[4] « Cleopatra's nose, had it been shorter, the whole face of the world would have been changed. » Blaise Pascal, *Pensées (180)*

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Without Emotion, Numbers don't mean much. Infographics as a Tool to interpret Reality

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Abstract. This paper will show how infographics can extract stories from information and how it is also possible to do it from an emotional point of view, using a qualitative analysis of the information and the type of visual representation chosen.
The main objective of this project is to unite a qualitative exploration of the information with a quantitative analysis. The graphic representation of the statistics provides us with a cognitive, but superficial, vision of the stories behind any large amount of information. Meanwhile, a direct interaction with individual stories provides us with a more visceral version of the nature of the emotions, actions, and decisions of people's daily lives. The paper intends to present a case study that proves these premises. We focused on the space-time context of Barcelona's Design-Communication scenario to recreate the different fields of action of the sector and detect how they have been affected in recent years. To locate these variables and their evolution, we follow a process of analysis of statistical data, contrasting with the information extracted from different interviews from designers of different profile and situation: residents, foreigners, students, unemployed or workers.

Keywords: Emotional infographics / Design and visual communication / interaction

1 Introduction

Today we can access a large amount of new information each second as it arrives from the other side of the world or from even farther away. Nevertheless, all of this gross information is useless by itself. The utilization of graphics facilitates the process of analysis and allows the final result to be shared with others so that they can understand it in a simple way. Due to, in this case, the fact that our perception is visual, we remember images easier than words and we recognize patterns more quickly in images than in phrases [1].

Now we are becoming keener as we play with the creation and linking of creative elements to make ourselves understood universally beyond the stigmatic barriers of language, culture, social status or gender. This is why the urgent need

for infographics has appeared, which combines these qualities in a perfect and creative harmony beyond the traditional use of the written word.

A basic diagram, a bar graph or a simple time line should be understood immediately, but when more elaborate graphs are used they may need to be accompanied by an explanation. A good computer graphic does not have to be self-explanatory, but it must be explainable [2]. It is uncommon for a graphic to solve a problem, transmit a clear message, communicate a strong meaning and inspire a deep understanding without using at least one legend. The idea is not to use the graphics to replace all words; the idea is to use a drawing to replace those words that are communicated, understood, and remembered more efficiently in a visual way. "The purpose of the visualization is comprehension, not the images [3]."

We communicate, understand and remember via infographics. To this list we can add another equally interesting action: creating emotion. Infographics can extract stories from information, stories that bring us closer to the reality that is behind a mass amount of information. Its properties go beyond functional, appealing and revealing; they show you facts that with the information alone unrepresented, cannot be seen [4].

Our purpose is not only to prove that information visualization can be used as an instrument to expand knowledge [5] but also that it allows a deeper understanding of an item by using qualitative information.

Therefore, the main objective of this project is to unite a qualitative exploration of the information with a quantitative analysis. The graphic representation of statistics provides us with a cognitive vision, although superficial, of the stories behind any large amount of information. Meanwhile, a direct interaction with individual stories provides us with a more visceral version of the nature of the emotions, actions, and decisions of people's daily lives. Visualization should reflect the "life" that the information represents. The numerical value of a data point is only part of the story, we must not forget the who, what, when, where, and why [6].

One goal that we propose is to improve the interpretation of infographics by representing, using graphics and illustrations, a quick and simple discourse. As the Social Science professor Hans Rosling [7] mentions, when showing data, it's not enough to only show the bare facts, you must prepare them to be understood, and if possible, to be enjoyed.

2 Implementation and development

The design solution combines the diagrammatic property of the graphic as well as other suggestive elements to create a visual narration. To do this, we use a methodological process that helps us collect and structure information, and we also keep in mind aspects of language and communication that are essential to transmit the most emotional side of the information.

Functions of visual language

We distinguish different functions of language and we use them for infographic design. We call the first function referential function. This objectively represents a reality by presenting the information. The second one, called poetic function, creates a series of sensations in the receiver. As is mentioned in the introduction, what is important is not so much what is said, but rather how it is said. The conative function tries to catch the attention of the receiver, trying to provoke a specific reaction. In graphic communication, this quality of infographics can be reflected in different ways such as typography, color, shape, or contrast [8].

This is why the definition, the approach, and the way the content of the message is presented and the environment in which it is presented depend on our objective in relation to the needs of the user.

Levels of iconicity

Along with using visual and formal language to make the information understood, the design of a graphic presents different iconic levels of representation that go from the worded description up to the actual physical object, passing through different types of diagrams, pictograms, illustrations, photographs and bi- or tridimensional models.

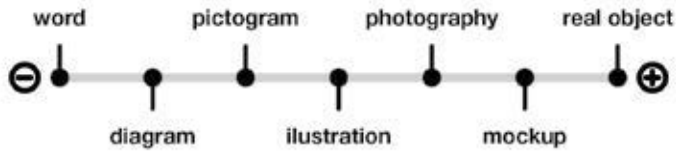

Fig. 1. Representation levels of iconicity.

The actual physical object used to give form to the information allows for a more memorable and powerful experience. This experience is augmented if the information is contextualized, that is, if the object is in the setting or environment relative to the topic.
An experience with the actual object, whether visual or palpable, allows a more tangible interaction for the audience. This provides us with a larger emotional impact.

Empathize with the user. Objective aspects and sunesthetic relations

The ability to inform and the emotional impact created are important when collected information is represented. We must keep in mind, therefore, that all elements are susceptible to being interpreted: a sound, a taste, a warm feeling or, in

this case, an image [9]. Perception only provides objective information, which proves practically identical in all people. But interpreting information received is different for each reader – the disparities in culture, education, beliefs, age, memory, intelligence, and even emotional state, cause influence.

Along with having this in mind, normally infographics must be simple, easy to assimilate and contain few elements to capture the attention quickly to the main points. On occasion, the objective public is willing to compromise time and energy to make sure the most detailed information is captured. In this moment, nothing explains better than seeing how a graphic is drawn step by step. This is something to be kept in mind to explain the process of this paper. Showing the graphics step by step as they are explained allows them to be shared openly, helps to better understand the process, motivates those interested to make observations, evokes interesting conversation, and supports decision-making [10].

Application

To develop everything discussed up to this moment, the paper intends to present a case study that proves these premises. We focused on the space-time context of Barcelona's Design-Communication scenario to analyze the different ways that students and professionals of the sector look for work. The city, heaped full of schools, studios and agencies, has been affected by the economic situation and the current labor state. A scenario in constant change to which new variables are added, affecting job searching. To locate these variables and their evolution, we follow a process of analysis of statistical data, contrasting with the information extracted from different interviews from resident, foreign, student, unemployed or working designers.

A study has been set out with the following objectives:

Classify: To determine and organize the different dimensions within the circle of designers in the city of Barcelona.

Discover: To obtain a first approach about how the sector is structured and how it is currently represented in the city.

Orientate: To pass over from general knowledge to specific realities that better explain each facet of this reality.

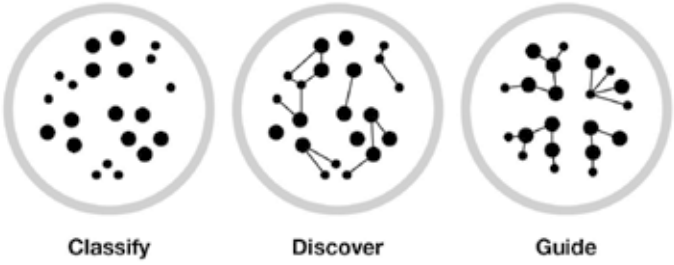

Fig. 2. Shows the tree phases in which is divided the process of study.

The process of the study is divided into three phases that also define the structure of the results of the infographics. The results from this first visual representation establish the bases for possible future lines of investigation.

Methodology

A methodology using quantitative and qualitative measures has been developed. This allows distinct approaches to be carried out in the reality of design in Barcelona. A transversal reading is done using three approaches, exposing them to dialogue and contrast.

Documental approach: Analysis of various studies of distinct territorial and sectorial reach. The objective is to systematize the data and knowledge already acquired thanks to different previous studies.

Quantitative approach: Survey to 500 designers that work or have worked in Barcelona, with the objective of knowing the ideas of these professionals from different points of view. After all, a profession is defined through its professionals.

Qualitative approach: Interviews to 10 professionals from diverse disciplines of design. In this way, people can learn about the distinct profiles and contrast the different discourses about the current situation of the profession.

Fig. 3. Shows the approaches that define the methodology.

This part of the study presents the nature of a sector with vague contours. The designer faces important debates in relation to his/her conceptual definition. There is no large consensus about what activities should and should not be considered part of the sector [11]. One characteristic of the designer is that he/she has, or should have, some presence in all industrial and service sectors. The designer's function is to participate not only in an economic context, but also in a political and social context, providing value to the real needs of the environment. This study takes on the richness of this open debate and sets out, not just to look for solutions, but to collect fundamental aspects that give us an estimated foresight of the future of these professionals and their role in society. Therefore, it is not so much about defining precise borders as it is presenting a reality with different levels of intensity.

3 Conclusions

On one hand the results of this first visual representation show that:

- Uniting quantitative and qualitative data adds value to the content of the infographics, achieves an approximation to the real discourse, making the reality more evident. Being to give form to the infographics using this type of data gives us the opportunity to tell a story and, consequently, the power of the message is reinforced.
- Equally or more important than the message that is transmitted, is how it is transmitted. If an effort is made to affect the public through the how, the public is able to focus their attention, interpret the events and draw their own conclusions about our society, the decisions we make, what we value, etc.
- There is proof that if factors such as the level of iconicity and the different functions of language are used appropriately, a better and more memorable impact is achieved in the audience.

On the other hand possible future lines of investigation regarding this case study are established:

- Put in motion an international comparative evaluation between the reality of the design world in Barcelona and the realities that exist in other cities of similar characteristics.
- Carry out approaches, from a designing point of view, to specific activity sectors. This way, the knowledge of the impact of design in other sectors in the Catalonian economy can be deepened.
- Analyze professions in design, studying what roles and services the designers can develop. The growing number of people dedicated to the design industry indicates the aptitude to better know the main characteristics of these specialties.

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A Defense of Artistic License in Illustrating Scientific Concepts for a Non-Specialist Audience

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Abstract. Before you can even begin to communicate a complex topic, you must first engage an audience. Whereas minimalist and abstract iconography may be the most efficient and elegant way to communicate complex findings within a research community (arguably a captive audience), I suggest that this design approach can actually be off-putting to a non-specialist audience. If an information graphic does not incorporate immediately-visible context, a familiar visual vocabulary, or a welcoming gesture for the non-specialist reader, it may simply confirm a preconception that the content itself is abstract and unrelatable — thereby shutting down the opportunity to convey that information to a new audience.

In this paper I present examples from *Scientific American Magazine* (a publication founded in 1845, dedicated to communicating groundbreaking events in science and technology to the general public), including some formal and unapologetically academic and abstract graphics from the archive, to more recent examples that aim to appeal to and engage an ever-broadening audience. I discuss the thought process behind the evolving philosophy towards information graphics produced for the magazine, as well as the tension between accurately representing the cutting edge research of our scientist-authors to readers fluent in the topic and readers that are looking to us as an accessible entry point to the topic.

I argue that although it's possible that superfluous texture, detail, and color may distract a bit of attention from communicating the core concept, the trade-off can be worth it. Beautifully detailed and somewhat fancifully figurative art can engage and inspire a reader. This is particularly true, for example, when trying make counterintuitive and complex concepts in cosmology and quantum physics accessible to a science savvy, but non-specialist audience.

Keywords: information graphics / science communication / complexity

* *The views expressed are those of the author and are not necessarily those of Scientific American*

1 Introduction

Not long ago, I directed an artist to develop a dimensional and detailed representation of a particle for publication in *Scientific American Magazine*. A particle that—by the author's own admission—may or may not exist. And if it does exist, we certainly know nothing of its form, texture, or color. Yet I asked the artist to imbue it with all of those qualities. How can I justify those instructions in light of the prevailing wisdom on perception as articulated by Alberto Cairo?

"…One illustration shows how [something] looks, while the others show how something works…The drawing styles are matched to their goals. If the goal is to explain machines, mechanisms, and processes, a very realistic style is not appropriate because, as Ramachandran [1]*, points out…, 'Your attention is distracted by the clutter of texture and other details.' Better to use a sketch-like display, so attention is focused on what really matters."* [2][1]

This premise isn't unique to Cairo and Ramachandran. As Edward Tufte famously put it, "Graphical excellence is that which gives to the viewer the greatest number of ideas in the shortest time with the least ink in the smallest space." [3] (Although, several pages later he does concede that decoration can help editorialize the topic, as long as it doesn't distort the information at-hand). Further, Connie Malamed writes,

"Working memory has a limited capacity and is easily overloaded. When viewing a high-fidelity graphic composed of superfluous elements, the additional information can overload working memory, acting as a barrier to comprehension. Distilling a graphic down to its essential visual elements minimizes the information processing required to understand it." [4]

Yet I had encouraged the artist to introduce extraneous and arguably fanciful visual details for an infographic that did not revolve around how the particle looks. How could I justify the disconnect between form and function?

I propose that infographics aiming to communicate complex or theoretical topics to a non-specialist, non-captive audience actually benefit from being rendered out in a more realistic style than normally advisable. Non-essential figurative details can act as a much-needed welcoming gesture, and capture the interest of the reader. Indeed, As Colin Ware writes,

"Recognizing an object can cause both physical and cognitive action patterns to be primed, facilitating future neural activation sequences. This means that seeing an

[1] In case this excerpt suggests otherwise—in *The Functional Art*, Cairo does not set forth blindly hard and fast rules for information graphics. He acknowledges that there's a natural tension between a variety of variables: The audience and goal of the information graphic will help inform the approach. And that making an information graphic beautiful is great, as long as it first and foremost presents the information in a clear manner.

object biases our brains towards particular thought and action patterns, making them more likely." [5]

See, for example, the two graphics presented in Fig. 1. Both illustrate the structure of matter. Which version captures your imagination?

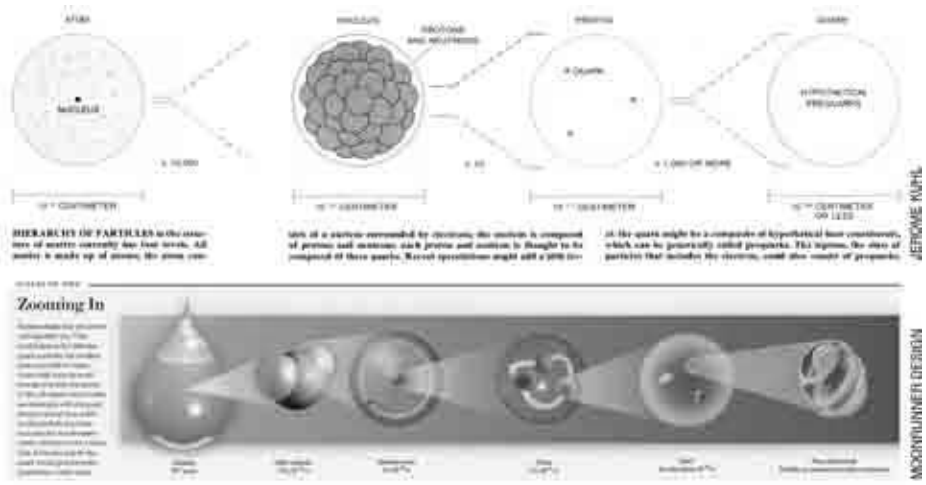

Fig. 1. Top: schematic representation of particle hierarchy (*Scientific American*, Apr 1983). Bottom: arguably a more engaging stylistic approach to the same topic (*Scientific American*, Nov 2012).

The trick lies in finding the right balance—figurative details should assist, but not distract from, overwhelm, or confuse the core concept being illustrated.

Scientific American presents a unique case study: over 167 years of science and technology infographics, against a backdrop of a subtly shifting mission and ever-broadening audience. Several examples from the magazine follow, showcasing some early graphics that exhibited great clarity of thought, but didn't push beyond the information to engage a broader audience. More recent examples show an attempt to maintain logical underpinnings when setting up the graphic, but also allow for playful and rich styling to capture the imagination and attention of the non-specialist reader.

2 Context: Infographics in *Scientific American*, 1845 – 2013

Scientific American is the oldest continuously published magazine in the United States. It was founded in 1845 by Rufus Porter as a weekly devoted primarily to inventions. In 1921, the scope of the magazine officially broadened; "It was no longer the inventor's paper, but a periodical of popular science." [6] (Fig. 2)

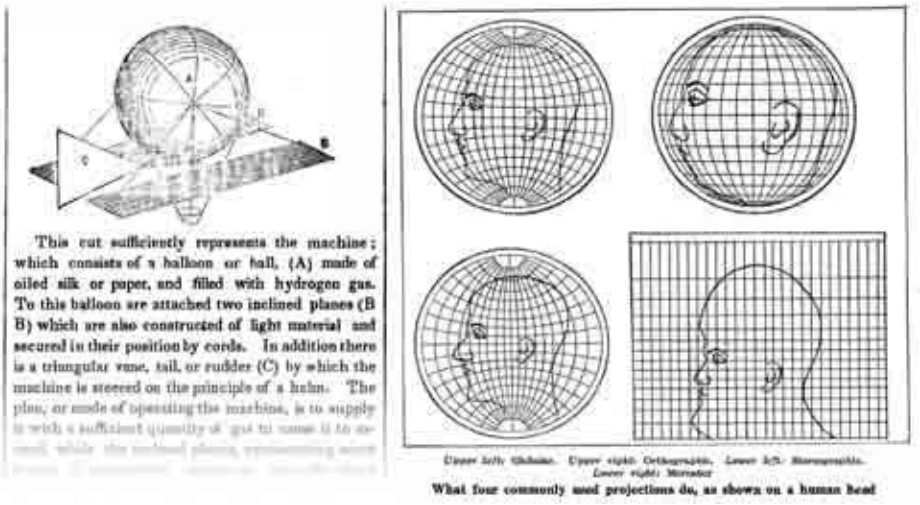

Fig. 2. Early graphics from *Scientific American*. Left: technical illustration in the first issue, Aug 28, 1845. Right: descriptive, clear & playful diagram from Dec, 1921 (artists unknown)

In 1948, the mission was fine-tuned further. The editors shifted focus to fill a gap between technical journals and popular magazines of science.

"More than a digest [of the technical press], it will organize and relate the basic documents on each subject...[The articles] will be written in plain English. Where words are inadequate, the new Scientific American *will make use of the full range of the graphic arts for their power to convey the nature of the tools, the matter and the method of science."* [7]

When surveying covers from 1948 through the mid-1990's, the consistency of style is notable. There's a visible evolution of aesthetics and content over the years, but still clearly referential to the 1948 benchmark. At times, the graphics skewed unapologeti-cally academic, a visual reminder that this periodical took its content seriously, and expected it's readership to delight in the—at times—esoteric and complex nature of the topics covered. (Fig. 3)

I think it's safe to say that the pace of aesthetic evolution quickened, however. Perhaps in part due to the rapidly growing offerings available to readers on the web in the late 1990's, and the sense that magazines also needed to offer readers multiple entry points, and smaller, more digestible and dynamic chunks of content. And perhaps in part due to the shift in illustration tools. As digital media began to over-shadow traditional media, a distinctly different visual style emerged, as well as a change in methodology. With traditional media, precise content details and inform-ation design needed to happen early in the production cycle. Last minute changes were time-consuming and complicated after a physical painting was received by parcel post. But with digital media, the process became more fluid. Elements of a graphic could jump into final rendering stages

before the narrative was completely thought through. Bold moves carried less risk, sometimes with great rewards, but sometimes resulting in less thoughtful information design.

An official and distinct shift in aesthetics (and notably, the infographics) occurred with a redesign in 2001. As the editor wrote,

"So why tamper with success? Why rethink the look and content of a magazine that is the best at what it does? Precisely because the magazine's mission hasn't changed but the readers' world has. The pace of discovery and innovation has quickened. Time for reading has become more precious. This magazine's methods and coverage therefore need to shift just so that it can continue to provide the same service." [8]

The graphics in the 2001 redesign issue are more notable for their visual richness than their informational richness. Complex stories are left to the text. Images seem to function first and foremost as entry points, rather than primary content vessels.

The graphics evolved after the redesign launch, and began to carry more and more information. But core idea of images as friendly entry points was reiterated in the 2007 redesign issue:

"The topflight content of SciAm is unchanged: our feature articles continue to be written by leading scientific authorities and journalists and illustrated by the finest artists. The layouts and figures, however, are more modern and approachable." [9]

In an effort to be approachable and engaging, the imagery remained bold and consciously dynamic. But it's also apparent that infographics were once again officially embraced as medium to communicate complex information. But, at times, exuberant styling still overshadowed the information.

Which brings us to the next redesign. In Oct 2010, the magazine was defined as,

"the world's premier magazine of scientific discovery and technological innovation for the general public…Its readers are not primarily scientists; to the extent that they have technical backgrounds, they read Scientific American *for information about areas outside their expertise. In every issue, leading scientists, inventors and engineers from diverse fields describe their ideas and achievements in clear and accessible prose; the work of select journalists rounds out the offerings. The graphics are rich in content and visual style."* [10]

Content, as it relates to graphics, was leveraged back to top billing. A subtle shift in semantics. But a shift that reflected the philosophy in developing infographics for the magazine. Conveying information would be the primary goal. But it would still be critical to engage and inspire non-specialist readers with an inviting, rich visual style.

The goal wasn't to simply return to the classically elegant but sometimes intimidating graphics that were the hallmark of *Scientific American* from the mid to late 1900's. It would be foolish to ignore the impetus behind the official aesthetic

changes made in 2001 and 2007. The goal was to honor the complexity and nuance of the subject matter, and to clarify the content without oversimplifying. But also without underestimating the power of a familiar visual vocabulary and rich renderings when it comes to reaching out to the uninitiated, or a non-captive audience. (Fig.4)

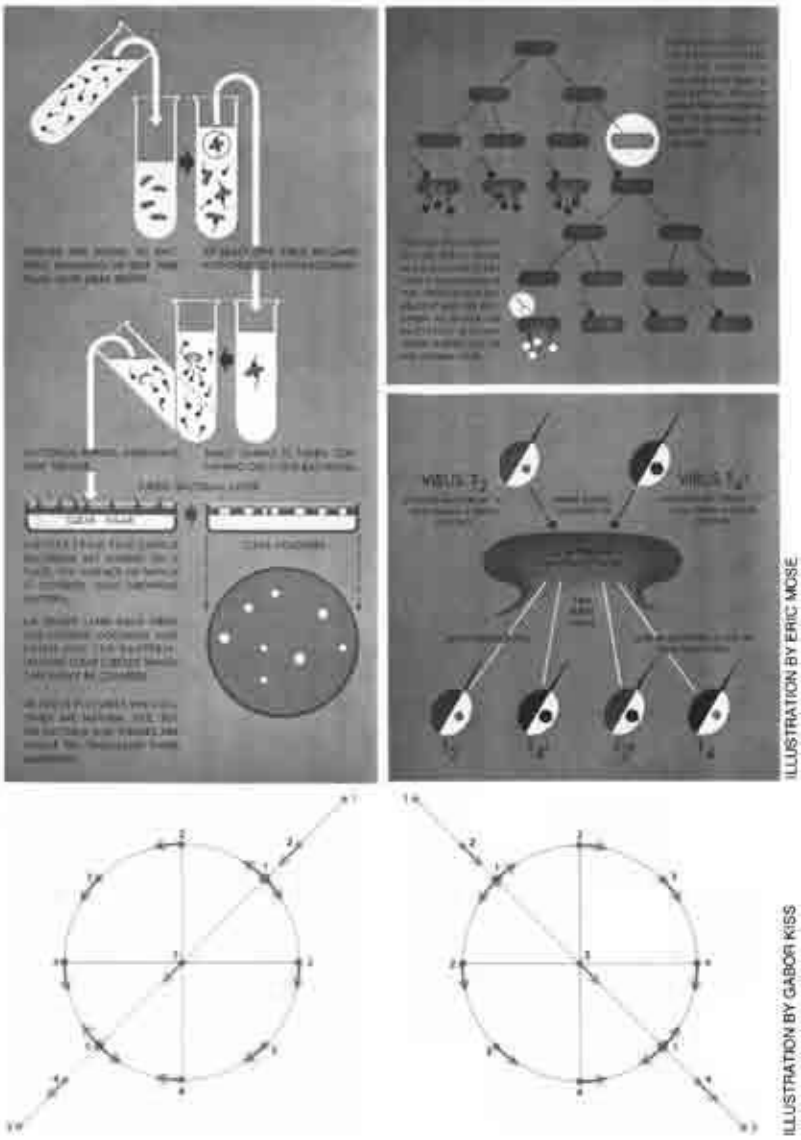

Fig. 3. Graphics from *Scientific American*. Top: authoritative & accessible, Nov 1948. Bottom: elegant but challenging, Dec 1988

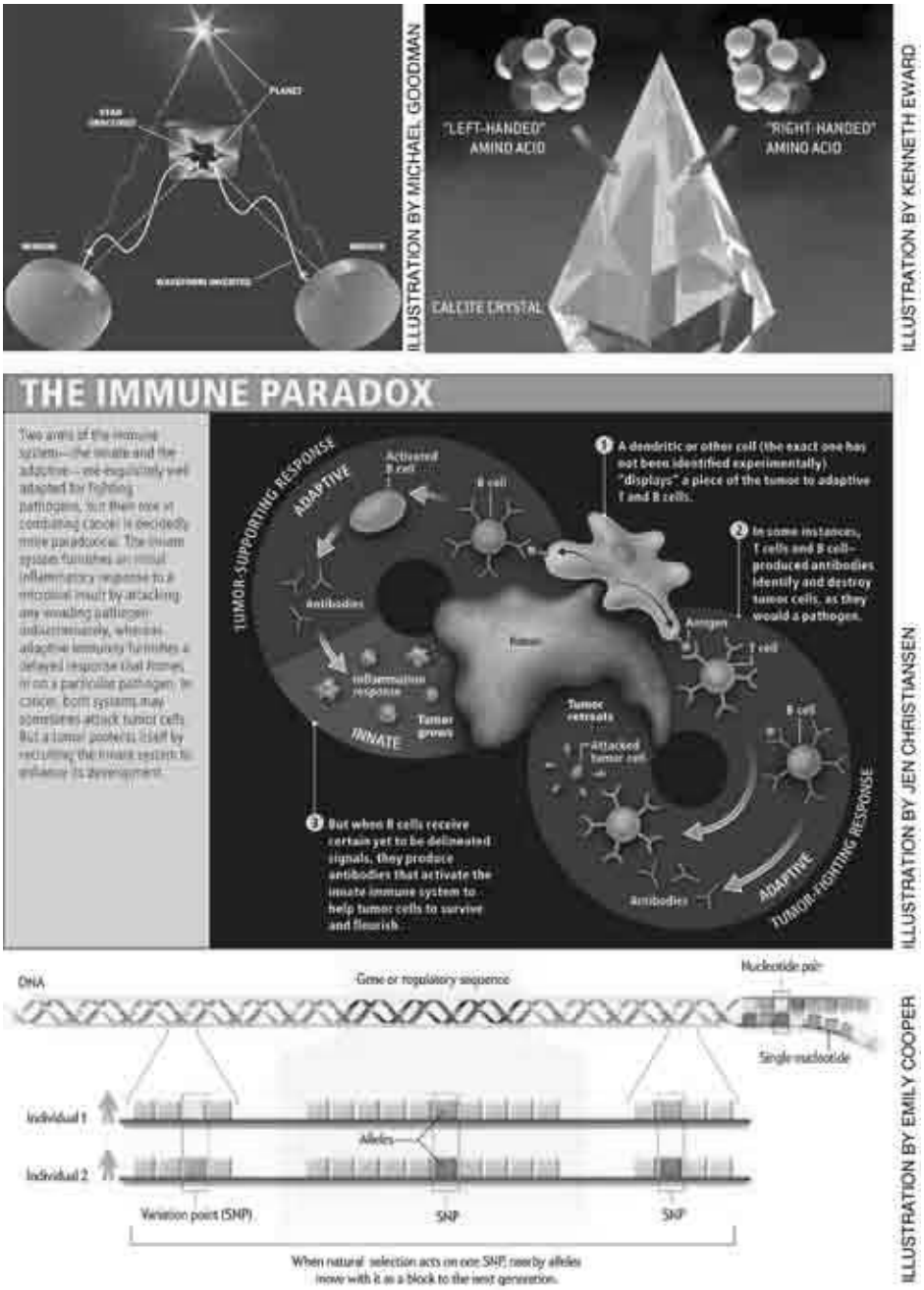

Fig. 4. Graphics from *Scientific American*. Top left: descriptive & clear, Apr 1996. Top right: visually rich but low on content, Apr 2001. Middle: lots of content but over-styled, Jul 2007. Bottom: authoritative & accessible, Oct 2010

3 Engagement Strategies

When developing graphics about complex or abstract topics for a non-specialist audience, I propose the following three strategies.

3.1 Immediately-visible context

See Fig. 5 for an elegant and minimalist diagram that clearly shows expansion of some sort. But without the caption, title, or full article text, the reader has no clue that this is an infographic about the universe (specifically, cosmic expansion).

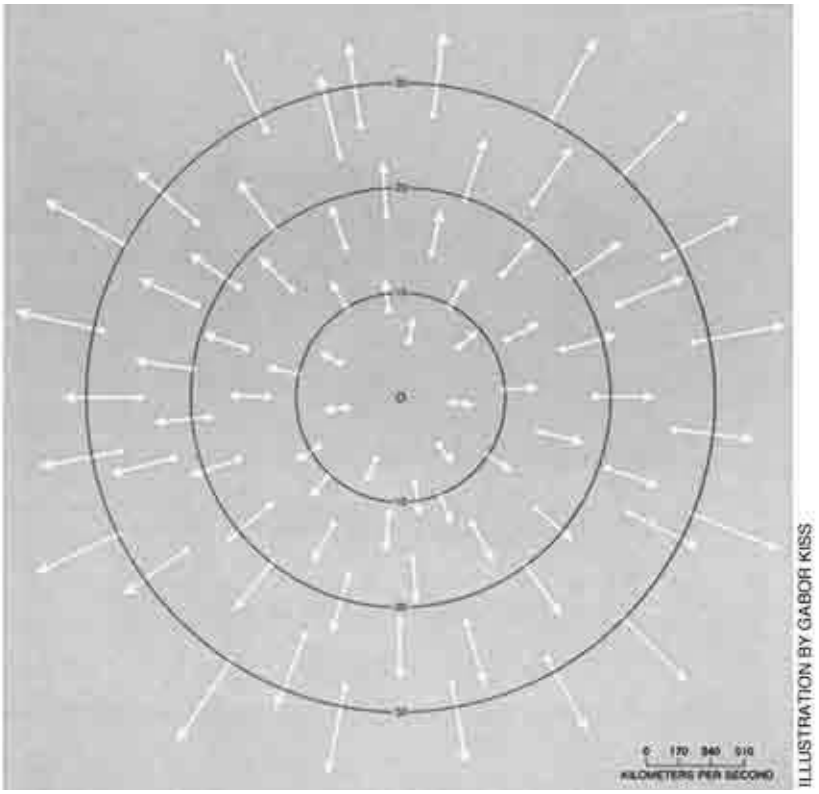

Fig. 5. Cosmic expansion, in which the observer seems to be at the center of the universe, with other galaxies zooming away (arrow length = velocity) *Scientific American*, Mar 1976

Fig. 6 addresses the same topic, but makes a bit of a trade-off. References to quantitative values are dropped, but *visible figurative context* is added. The casual reader now has a better sense of place—this is an article about the cosmos—and a clearer view of the implications of expansion over time.

To be sure, there's something intellectually and aesthetically appealing about the 1976 graphic as an icon for cosmic expansion. But the immediately-visible context in the 2006 graphic helps set the scene, providing a concrete set for a larger concept, as well as providing the casual reader with an engaging hook. A reader can picture themselves on a planet in one of those tiny galaxies in an expanding universe.

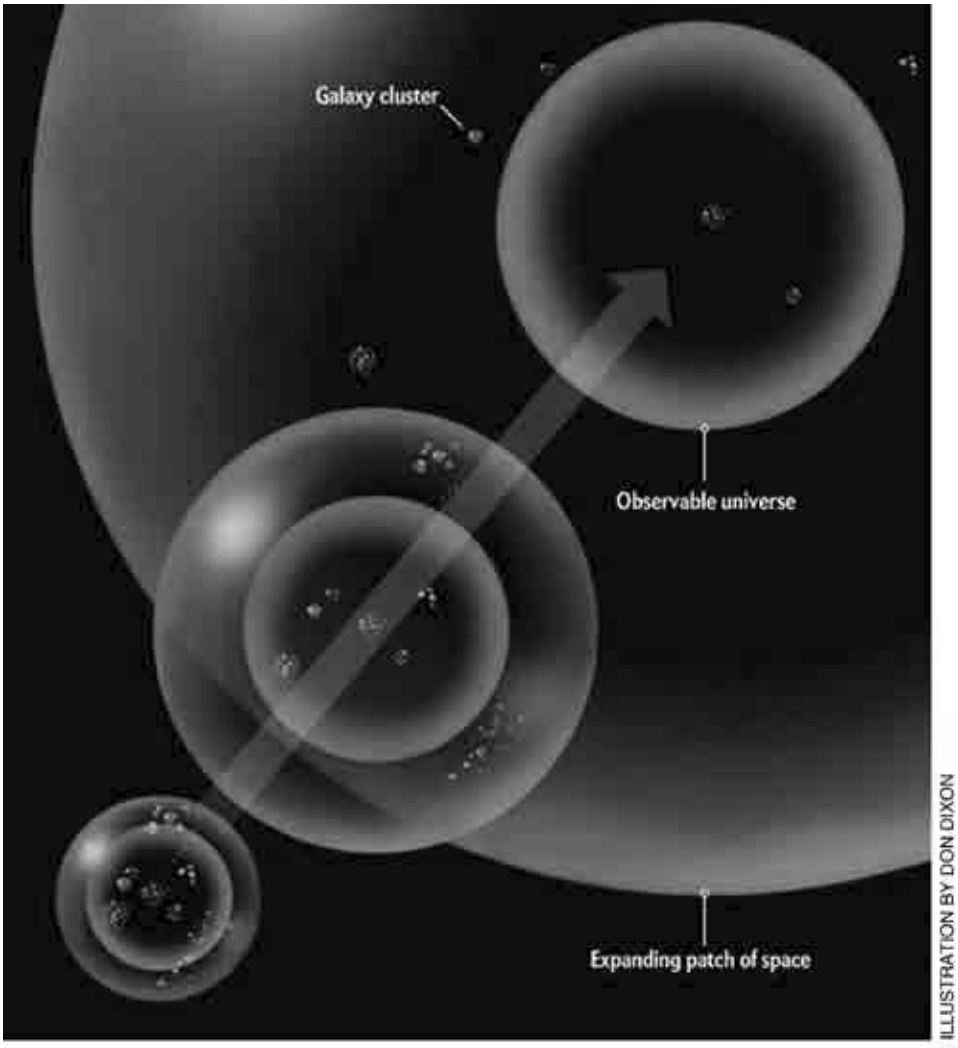

Fig. 6. As cosmic expansion accelerates, fewer galaxy clusters are observable from any given point. *Scientific American*, Jan 2006

3.2 Familiar Visual Vocabulary

To spark recognition and prime the reader for a less familiar concept, a graphic can lead-in with a comfortable and familiar visual. In this case, for an article on quantum phases of matter, the reader is set up for the topic with a well-established and ubiquitous schematic—the classical phases of matter (solid, liquid, and gas). This provides a framework within which to approach the less well-known concept of quantum phases. (Fig. 7)

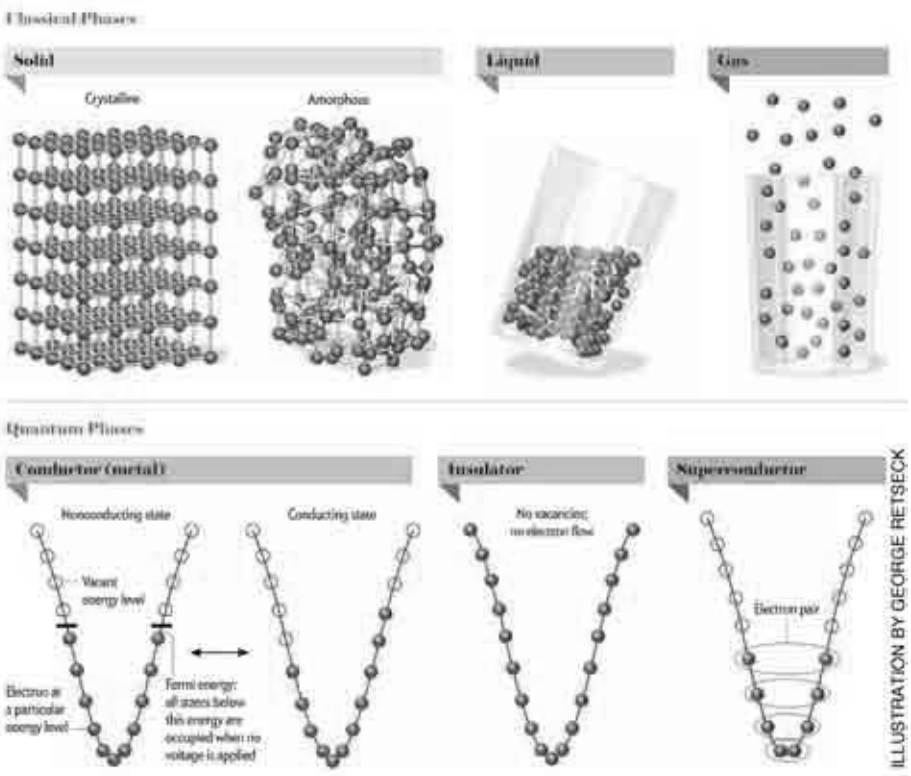

Fig. 7. Detail from a larger graphic about quantum phases. *Scientific American*. Jan 2013

3.3 Welcoming Gesture

In *Scientific American*, visual metaphors are often used in tandem with more descriptive, technical, and detailed charts. These friendly explainers provide an accessible entry-point for the non-specialist, without compromising the integrity or content of the core diagram. (Fig. 8)

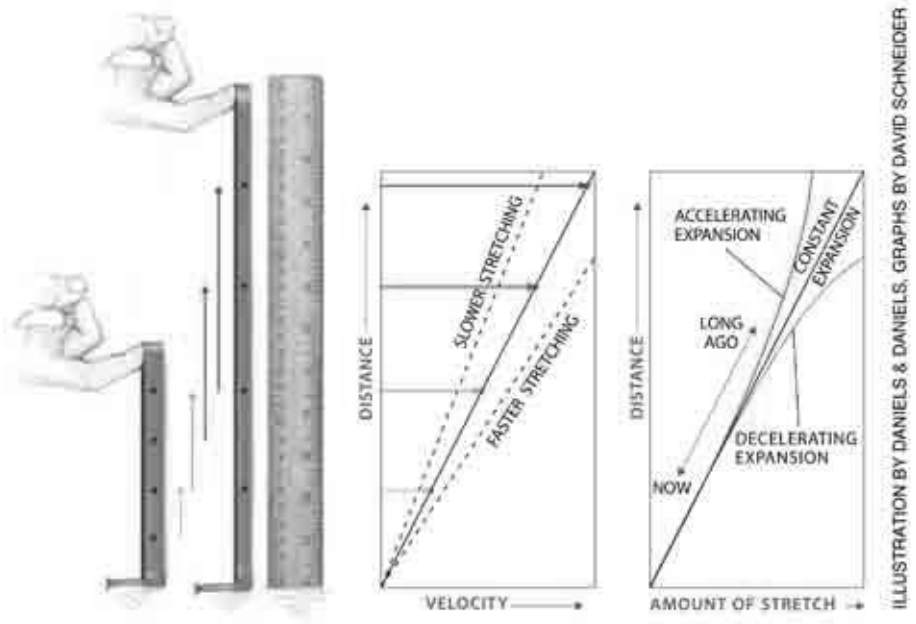

Fig. 8. "Rubber band experiment shows the linear relation between recession velocity and distance. Here two snapshots are shown of a rubber band pulled upward at a certain rate. The velocity of different points marked on the band is given by the length of the colored arrows..." from *Scientific American*. Jan 1999 [11]

4 Summary

On the topic of semantics and data visualization, Enrico Bertini wrote,

"Other than showing trends and quantities visualization needs to make clear how to create a mental link between the objects stored in your head and those perceived in the visualization: the "what", "who", "where", elements. The theory of visual encod-ing is so heavily based on the accurate representation of quantitative information that it seems like we have totally forgotten how important it is to employ effective encodings for the what/where channels." [12]

Similarly, I suggest that non-quantitative infographics can often benefit from more overt references to the "what," "who," "where" elements. By quickly and almost intuitively tapping into the objects/symbols already stored in most readers' heads, they are perhaps more likely to take the next step, and push on to learn more. The first obstacle — immediate recognition/connection — is surmounted, and deeper engagement with the more challenging details can ensue.

This is a particularly salient point when dealing with complex and counterintuitive topics. The specialist reader may be equipped with a pre-existing visual vocabulary that allows for immediate engagement with an illustration that aims to describe concepts in quantum mechanics or cosmology. But what about the uninitiated?

Adding more cues in the form of words can help with interpretation. As Amanda Cox shows in her 2011 Eyeo presentation [13], annotation layers can help guide the reader, and help them understand things that they might not already see. I propose that illustrated figurative details can do the same thing, perhaps with even greater immediacy than labels.

Information graphics should first and foremost convey information and honor the integrity of core content. But within the context of *Scientific American*, it is also critical that they engage and inspire the specialist and non-specialist reader alike. The trick lies in finding the perfect balance.

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Info-cartography: an Innovative Instrument to transmit Contemporaneity

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Abstract. The map is a complex cultural artefact that keeps together, in a single visual text, geography and human characteristics of an area. The process of transmitting information within the current landscape, however, is weak and should be reinforced while also taking into account the user's critical thinking skills and introducing the concept of "feedback", a communicative feedback loop of the communicational cartographic circuit[2]. In recent decades, technological progress and the so-called digital empowerment also reached the field of cartography, bringing a new scientific foundation for this field and its development. The graphical user interface plays a vital role in this, improving methods of access and use of information, as a representation of knowledge aimed to highlight structures and arrangements. The transfer of the cartographic approach to different and unexplored areas of knowledge, social and cultural dynamics, leads to the definition and communication of a map as a humanly complex object and with subjective connotations. Eventually through this approach the foundations were laid for a new cartography of complex spaces, open and without defined borders. From the graphical point of view this process binds very well with the rhizomatic structures or mind mapping, systems developed on interconnections with new possibilities of growth in multiple directions. With GPS devices, a static map transforms into a dynamic mirror of a fluid society, which was founded, evolved, and adapted itself constantly thanks to the traces left by individuals in the network. Equitable GIS - a Community-Integrated-System auto-adjusted by its own internal problem solving algorithm, was much discussed in the nineties. Once a mirror of the status quo, the function of the map in the ninenties evolved such that it could also serve the needs and deficiencies of a community. The contemporary view is to replace old patterns with something that better reflects its inherent fluidity and especially the renewed energy that comes from below: it is for this reason that there is a continuous search for representative models that first favour communities, sharing, and collaboration. There is a need to create and provide people with tools to easily share and reuse data in an open form for generating and disseminating knowledge, and carry out analyses of scenarios and resources (tangible and intangible). This ideal project, accessible, doable, and according to a variety of subjective variables, came into being thanks to the web and the possibilities of hypermedia, the open source, open data, open content, and open knowledge – all of which refer to the single idea large scale data sharing. It is clear that these new possibilities are in need of a graphical support equally open that would support them from the point of view of content, use and, possible associations. The problem that arises is that we are dealing with a system, as the map, which is currently being re-founded, does

not have a shared system of symbols for the social, cultural, and environmental issues equivalent to the system of geographical symbols that are universally recognized in the traditional cartography. Today the paradigm is semiotic-cognitive. According to Nathan Shedroff, a pioneer of the Experience Design, knowledge becomes wisdom when it internalizes the information to the point that we can discover meanings and structures that no one has taught us, through a process of introspection and reflection. The process behind the creation of a map - seen in this light- connects to the principles of Information Design by adding a new meaning, mainly the environmental information and social responsibility.

Keywords: Infocartographic / rhizomatic structures / mind mapping / communicative feedback

"A map is a form of graphic artwork that permits the spatial comprehension of objects, concepts, situations, actions and events connected with the world and with human beings."[1] It is sort of a complex cultural artefact keeping together the geography and the human characteristics of a territory in a unique visual text, with the aim of communicating available information according to criteria like visibility, coherence, effectiveness and usability.

Nowadays the transmission of information considers the recipient's critical capacity, by introducing the concept of " feedback ", which can be understood as a backstage action of the map's circulating communication [2]. Moreover the map, simultaneously, reveals its potential, manifests all its hidden unedited realities and consequently all unexpected connections, developments and solutions that normally animate people's life. This vision is constantly enriched by technological progress. This is why the so called *digital empowerment* did not even stop in front of this field, although, in the course of thousands of years, the design of the map has always been incorporated in its support. The result is a new essential role of graphic interfaces, regarding the methods of access and the use of the information, as also the images of knowledge focussed on structures and gadgets. Besides, the transfer of the cartographic approach towards unexplored fields of know-how and of social and cultural dynamics, leads to a definition and communication of an intricate map which is connoted by individuals and for this reason very subjective.

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1 " The reader's function is not the simple passive function of a " recipient " (...) There is the phenomenon of retro-action (feedback) between the map-designer and the user because the use and the estimation of the graphic document executed by the former may serve to the latter for the examination of the effectiveness of the medium – the vehicle for the transmission of data and information.

In Harley and Woodward, *The history of cartography* – 1987.

2 Stefano Torresani, *Storia della Cartografia* – 1996.

The practice of mapping something diverse from a simple topography seems to be in perfect synch with the" Theory of Genealogy " by Michel Foucault, which presents itself like a series of unifying accidents, oppositions, fragments, dispersions and " non-events ". From the graphic point of view, this process can be easily connected with a *rhizomatic structure* developing on the basis of interconnections and constantly new possibilities of expansion into various directions.

In a huge number of examples spatial analysis is linked with artistic research, as Dadaist and Surrealist actions demonstrate, but even before their period there was an increasing need of autonomy by comparison with the consolidated practice of territorial representation, as you may notice in Baudelaire, in Simmel, in Benjamin. Instruments of territorial and existential navigation, maps and cartographies were the protagonists of the *Map Marathon: Maps for the 21st Century*, London, 2010. Two days of conferences organized by Hans Ulrich Obrist at the Royal Geographic Society of London: artists, scientists, writers, astronomers, architects and web designers were invited to participate in a confrontation with the new borders of today's cartographic lay out [3] By putting into evidence the state of the art and its future perspectives, this event also highlights what compared to previous years, remains the same : in other words, the intent to sustain and to promote an empiric approach concerning a knowledge which is of pure notion, and concerning our expectations for the future, a rebirth of the map, semantically built like a panorama; a historical and anthropological archive; a cognitive diagram; a narrative gadget of communication and social declaration, as well as a key of artistic experimentation.[4]

Reproducing a map nowadays means the know-how of an entire system of technologies, such as the gadgets *GPS* which are not only capable of following the routes of all and everything but also to reproduce these in real-time.

In this way the map, as a product of static reproduction, becomes a dynamic mirror of a fluid society which comes into being and gets a shape thanks to the traces left by the single citizens in the network and which adjusts itself by continuous change. What once was defined a *Community-integrated-system,* should paradoxically power itself, beginning from its interior problems, the whole system of social weakness, anxiousness, unexpressed desires in order to get incorporated into an *Equitable GIS* system, like layers and objects.[5]

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3 Among the performance and the projects presented in occasion of the Marathon, the work elaborated by Anastas e Gabri merits particular attention as they created a conceptual map of Palestine in real-time, through the art of discussion. They asked the public to suggest some words associated with the Palestine territory. In this way, by means of " asymmetrical topologies ", " anti-geography " and " infiltration " a kind of linguistic gadget came into being which determined a cartographic polyphonic trace.

4 All those revolutionary situationist preconceptions regarding the urban space, which, in the Fifties, by the external world, were considered nothing more than an extravagant artistic performance of a small group of anarchic intellectuals, find now their space by virtue of the new concepts of community, sharing of subject matters and social environment.

5 Due to a new consciousness on behalf of the social utility of this instrument, around the Midst-Nineties, people started to talk about Equitable GIS, a geographic system which

Now we are at the point to identify the map as the first step of consciousness of the collective' s needs and lacks; moreover this map, after having fulfilled its function to be a mirror of the *status quo,* can be substituted by a further map where we can see emerge the opportunities and the possibilities to give life to a new order of the urban economic and social system. This vision roots in a solid theoretical foundation: first of all in the concept of an open artwork, the ideal of an accessible and viable project, according to a multiple number of subjectively varying routes, a project that becomes real by virtue of the web space and of the possibility of *hypermedia;* secondly, in the entire corollary of practice which circles around the concept of *open source*; *open data*, *open knowledge and open content* and which goes back to the principal idea of sharing the know-how on a large scale without any restriction .[6]

It goes without saying that these, until now, unused facts need a graphic support which is equally open to arrange and to reinforce them from the point of view of the contents, of its use and of all possible associations; the most adequate structure seems to be the mind map, capable of amplifying the potential of creative use on one hand and of contributing to the fertilization of innovative and free ideas on the other hand. The *data mind map* represents a kind of organism which powers itself by means of the free circulation of the subject matters and of the information, structures that evolve, change and get continuously integrated in the same way like the ideas move in the network. Through the progressive growing of connections and, in parallel, of the number of users and of the communities involved and intentioned to use them, this problem will increase step by step with the development described before: *we have already noticed how a rhizomatic structure can accelerate the circulation and the communication of ideas but it is clear that neither an individual nor a group will be able to catch up with this in a competent way in every single part* [7]. If knowledge, in this context, is neither central nor structured but fluid, diffuse and poly-morph, these features will render it even more unrecognizable. We are totally buried by information but we will never succeed in capturing it profoundly.[8]

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shall support, beside all territorial information, also social and cultural data as a basis for activating all the objectives which can improve and transform the quality of life, in terms of participation, equality and sustainability.

6 All data without license or copyright, from literature to the codes of programming, from territorial information (geodata) to the data of public administration, constitute a common heritage at disposal of whoever desires to use it, either for reproduction or for manipulation.

7 Harry Cleaver, The Zapatista Effect. The Internet and the rise of an alternative political fabric – 1994.

8 Deleuze and Guattari declare in Millepiani that “a rhizoma is not a subject of jurisdiction of any structural or generative model. It is outside of any idea of genetic axe, such as it is outside of a profound structure”.

Another critical point of the rhizoma concept is how its own scholars contemplate the phenomenon of contemporaneity: the rhizoma, like the mind map and the network, succeeds in highlighting the distributive complex of all the features collected inside but it continues to hide its own one. So the very contemporaneous celebration of communication leads less to a reduced evaluation of the contents but to a minimized capacity of recognition.

At this point it seems more than correct to discover where the instrument ends and where the artefact begins, and above all, which are and which will be the characteristics and the necessary conditions to transform the representation of the outside world incontestably into a Map. The problem that immediately arises is the circumstance that we find ourselves in front of a system, the system of the Map, which, during the last decades, has been in course of recovery, and does not yet have a shared system of symbols for social, cultural, and environment values, a kind of equivalent in terms of immediacy to the system of geographic symbols which are universally accepted in the traditional cartography. After having analyzed the mechanism of production and transmission of the message, cartography elaborated an appropriate theory and moved away from restrictive positions towards models of a finer and more complex texture. Today's paradigm is semiotic and cognitive and the map designer asks himself above all how these symbols work and how these can be perceived. The author of *Estetica Relazionale,* Nicolas Bourriaud, declares that this kind of representation " oscillates forth and back between two systems of meanings which continuously redefine their state. Even if they offer real indications, these objects remain destined to pure contemplation and not to a practical use, in opposite to the cognition of design which means instead to render an aesthetic object functional".

One more element in the debate about the quality and the sense or non-sense of a map, is the instrument's faculty to help the user to reach a higher levels of knowledge [9]. Under this perspective, the process behind the creation of a map is connected with the principles of Information Design , loaded with a new meaning and a new reason for its existence, or in other words, environment information and civil responsibility. From the observation of some case studies which were originally selected for the relevancy and the resonance, either for merit or not [10], we can extrapolate a corpus of recurrent clear and definite elements, even if the examination of several deviant cases lets perceive a certain discontinuity and discrepancies.

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9 At this proposal Nathan Shedroff, pioneer of Experience Design, states that comprehension should be understood as a process of wise and careful data transformation. This information becomes knowledge in the mind of who receives it, whereas it has already had a life before, through different experience and stories, animated by narration and by details. It is the story which makes information worthwhile to be memorized.

10 We may say that identification occurred more through the sampling of extreme cases and less typical ones as the examples showing very frequent variation and deep rupture in comparison to the previous experience, turn these projects into points of reference.

Designing connected places

During the International Summer School, organized in Turin in 2008, in occasion of its nomination as World Design Capital, several workshops on urban scale took place, focussing on the possibility to connect the invisible information with the visible territorial one.

The traditional forms of control and representation of information were considered inadequate to make the complex urban flow accessible. So the accent was set on the importance visual languages embody in their function of interface between knowledge and experience, between reality and its description. The objective was concentrated on the creation of a visual vocabulary to be shared with whoever may understand and interact with the invisible layer of information of a city, such as the network of communication and human activities. From an analytical and descriptive comprehension of the forces that model a local context, one had to pass over to the development of a visual narration being able to highlight the local urbanity and the political reality that keeps it going. It is an interesting experience to follow the project's evolution until it becomes a real process of *community mapping* that reveals the dynamics of a place beyond its physical collocation, and to make it visible and discussible for everybody.

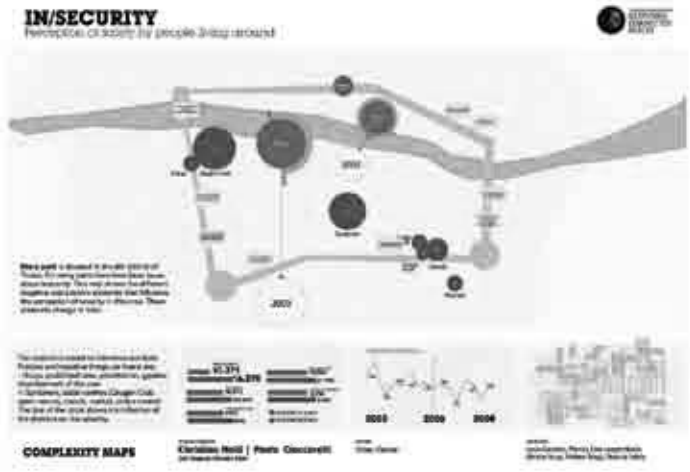


Fig. 1 The abstract conceived and written by the designers Christian Nold, Jim Sergers e Paolo Ciuccarelli, required representing people's perception regarding a certain location. The target site, according to the proposal, was the Stura Park, one of the biggest centres of heroine distribution in Central Europe. Students worked on five different topics. Mobility, History and Future, People, Safety/Insecurity, Environment. First they had to collect the different information by means of questionnaires and interviews with citizens from Turin; afterwards they had to concentrate on the elaboration of the synthesis, analysis and visualization of the collected data. On comparing the qualitative inquiries with the statistic data found in the archives and in the database of local and national newspapers, there emerged countless arguments, frequently transversal on the behalf of the five main subjects

CityMurmur

This project came into being in the context of Visualizar '08 Workshop in Madrid, by virtue of the group Writing Academic English (WAE) and it is based on the idea of a city map which changes in real-time according to the image and to the attention mass-media demonstrated.

Plotting the arguments and the topics treated by the media, this app has the scope to show how different media describe the space of a city. In order to get a dense and mobile layer of information beyond the city's topographic reality, the map does not only represent its data passively, but encourages at the same time a subjective interpretation. So it has become a very useful instrument for revealing hidden dynamics and for being a support to the critical analysis of media and politics, as well as to the socio-cultural research. CityMurmur can be an intersection of *mediascape* and of the geographic representation of the city, constituting what we may call *media geography*. On discovering all possible information about a certain city (news, sights, points of interest) the application designs semantic maps and experiments innovative cartographies based on news and discussions, rather than on the city's physical characteristics.

For the know-how of moving between the expressiveness of the interface and the precision of the information, on narrating interesting facts with sensitivity, by means of an unedited project style, CityMurmur Madrid is frequently considered a reference opposite to models of data visualization, not only in the academic field but also in nowadays design panorama.

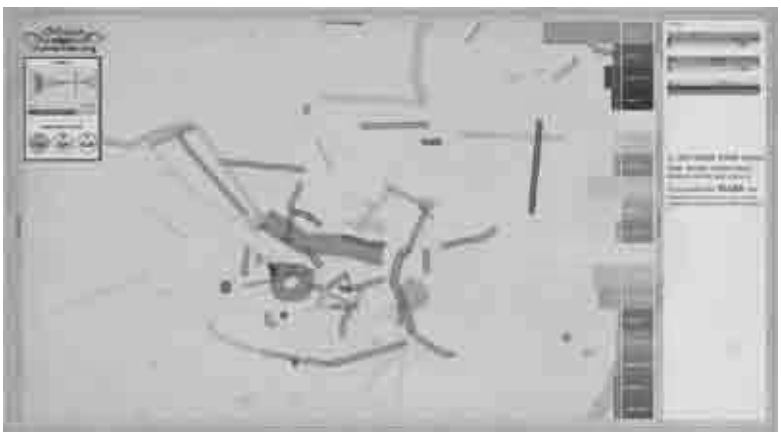
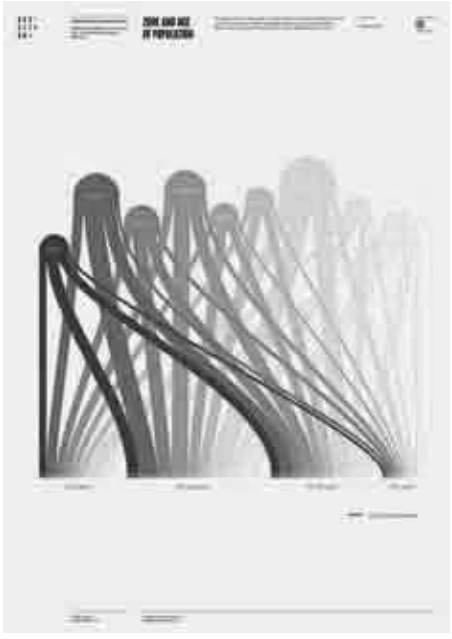


Fig. 2. The *media pool,* or more exactly, the entire official media of Madrid from which the application takes its resources, classifies such subject matters by means of connoting and denoting categories, until having reached two types of visualization regarding the range of streets of the city: so we deal with a topographic map and with a semantic one. In the first category, based on the technologies *GIS* and *OpenStreetMap*, a cartography of the new media gets traced, putting into evidence the different attention both maps demonstrate towards diverse areas of the city. It is interesting to notice how the focal points of the city often seem to shift in comparison with the geographic ones, and according to their social

function and their popularity in the media. Each value is associated to a certain graduation of colours that shall reflect the frequency of the news in the time and in the space inside the map of the city. The semantic map instead appears totally separated from the geography of the place and gets visualized like a grid where every node represents a key word of the news (*tag).* Its ties reflect the physical connections that join the several terms inside the city. The user may freely explore these two levels of representation, passing from one level to the other through a system of filters that can be activated and disconnected, and different panels of control that serve for the selection of the level of complexity and completeness of the route to be explored. Moreover every matter, characterized by argument, type and scale, can be analysed by means of specific diagrams that help to visualize the genesis and the diffusion of the news through the various media.

Tell a story about Milano

For many years, the reality DensityDesign [11] has concentrated its activity on the problem of representation of social complexity and on the organization of urban phenomena. The laboratory of research developed a pilot project entitled Tell a Story About Milano. In the course of this work students were asked to reorganize and to render visibly appetizing the information given by the City of Milan by means of the web portal *OpenDataMilano*.. The main problem that appeared was the missing identity of a story, a kind of fil rouge inside the enormous quantity of data on disposal, and secondly the understanding how all this could be effectively communicated in a clear and innovative manner.



11 Laboratiory of Research of the Department of Design, Polytechnic School, Milan.

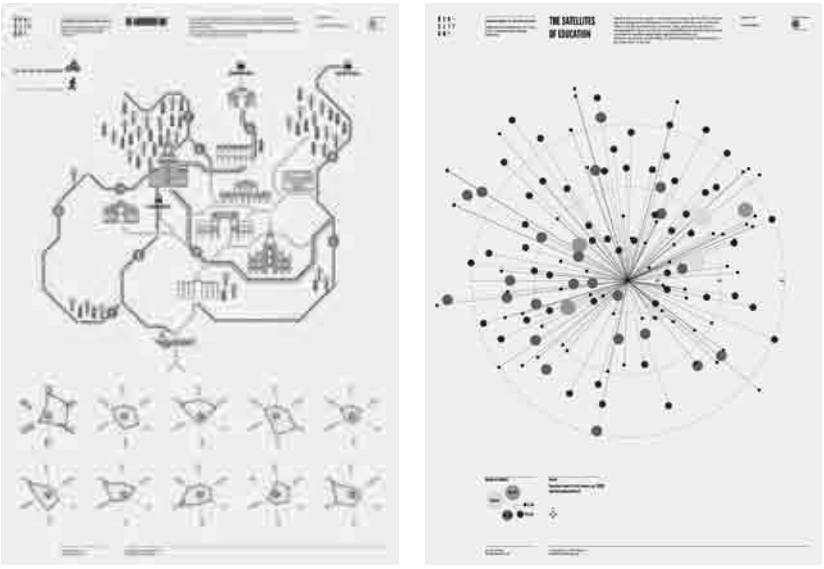


Fig. 3. A particular feature in the students' work is the fact that very often the geographic or symbolic reference to the City of Milan was left out, in favour of an objective representation of the data on a level completely separated from any other physical or geographical reference. Where the identification with the territory was however conserved, one can notice how this feature gets an iconic value regarding the detectability of the most distinct streets and places in the city. In comparison with statistic data, and with the numbers that were treated graphically, we may observe the massive use of pictogram which was universally shared to make the reading of the information as immediate as possible.

Sensory maps

Inspired by the idea to represent the urban environment through unedited sensorial routes, the British designer Kate McLean planned a series of perfumed maps in order to portrait the spaces of some British cities in a new way. In a surrounding which can be defined " eye-centered", Kate McLean desired to propose an alternative system of meanings, by not communicating on the visual level but by means of multisensorial routes which stimulate the collective and the personal memory of the users. Starting with cartographic contemporary pictures and with more updated ethnographic theories (the so-called *netnografia*), an instrument for the analysis of the perfumes' quality came out which is extremely useful to describe and to classify them on the level of perception. Each of the perfumes evokes a sensation, a more or less hidden memory that is deeply tied to the emotive personal background. From this point we can theorize a new tourism of perceptive memory based on the creation of a *smellscape*, a panorama of shared perceptions which can activate the experiences of individuals crossing the city for various reasons.

Fig. 4. Kate McLean, *Smells of Auld Reekie on a very breezy day in 2011*, Participatory Edinburgh Smell Map, 2011, Digital print (with nine accompanying scents), 66.2 x 46.8 inches. In the course of two years Kate McLean has gathered a remarkable collection of personal notes, sensorial perceptions, interviews made to passers-by, a fundamental mixture created to narrate the emanations of the city according to the seasons and to the direction of the wind. The traces of the map follow the intangibility and the volatility of the object, describe the elastic and winding flow that is the apparent shape of multiple variables such as the intensity, the direction, the quality of the wind and the architectural barricades. What we can see in the end, resembles to be a configuration of natural origin, like the geological representation of the curves or of the waves' movement in water. Colours play a fundamental part as they stimulate appropriate mental associations and serve to represent and to distinguish the various typologies of smell and their sources of origin.

Global brain drain

The supplement of Corriere della Sera *La Lettura* puts confidence into the group Accurat and into the information designer Giorgia Lupi for creating info-graphics as a support of journalistic inquiry. Among the big number of examples which, in a certain sense, have contributed to educate and to habituate Italian readers to this new kind of visualization of informative matter, there is also the attachment of a map analysing a global phenomenon entitled *Fuga di cervelli* , published in January 2013. The news that was introduced by this diagram, refers to the task to search for oneself in the combination of three sets of data[12]. Apparently this chal-

[12] Data originate from an analysis executed by Banca Mondiale, from a scientific research entitled Foreign Born Scientists: Mobility Patterns for Sixteen Countries,, and from the

lenge was how to face such an invading quantity of data without compromising the objectivity of journalistic inquiry. The most interesting aspect of this project is the attempt to analyse aesthetic qualities of things that seem quite pleasant at the first glimpse, in order to find out how they can be extrapolated and reused as founding principles and guides for the visual composition.

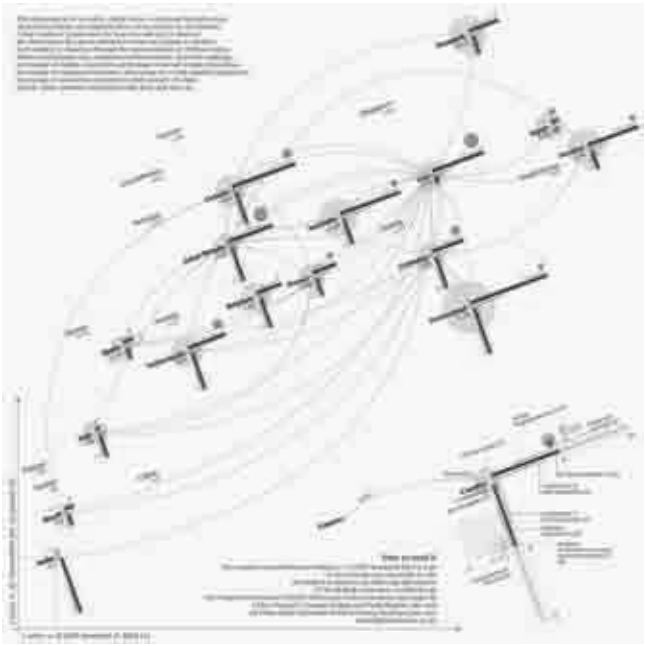


Fig. 5. Heterogeneity of the subject matters led the designer to look for a graphic solution of interdisciplinary inspiration. The key of solving the problem of representation, as Giorgia Lupi tells us in an interview, arrived at surprise, during the visit of the exhibition *Inventing Abstraction* at the MOMA of New York: " *abstract art and the visualization of data are two disciplines which are very near to each other, either in terms of the visual language, of the colours and the lines of composition, and for their independence regarding any visual local and cultural reference around the world.* " Repositioning the data under this new perspective and gaining starting points from the art works by Mondrian, Malevich e Kandinsky for the organization and the balance of the space, the designer conceived each of the countries under exam like a visual complex element which consists in the same parameters that would have determined its form, dimension and position, as well as the relation with other elements or countries.

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annual classification published by the Times on the world's best universities. This information has been gathered and put into a system, together with the number of research workers among millions of inhabitants (on the axe y) and with the percentage of PIL which every country invests into research (on the axe x) and with other registers of numbers like the rate of female employment and unemployment, the total percentage of foreigners and emigrants of the population, the emigrated researchers and those who return to their native country.

Rentonomy map

A totally different case study from the previous one is an interactive map offered by the website of research of the real estate agency Rentonomy.com for its own clients. This site was developed in a commercial context, absolutely outside of any scientific research work and far away from its instruments of informative dissemination. Its main objective is monitoring and rendering accessible the database concerning the rent of apartments in London, in order to make coincide the needs of who offers and who searches an apartment on the same digital platform. Although the graphic solution is not properly excellent, the map reveals to be an extremely functional instrument on the behalf of commercial features. This is why interactivity plays a key role for the discovery of data from the users' side, making profit of the diffusion of technological support such as a smart-phone or a tablet to increase the experience of the product in the dimension *outdoor of research* in real-time.

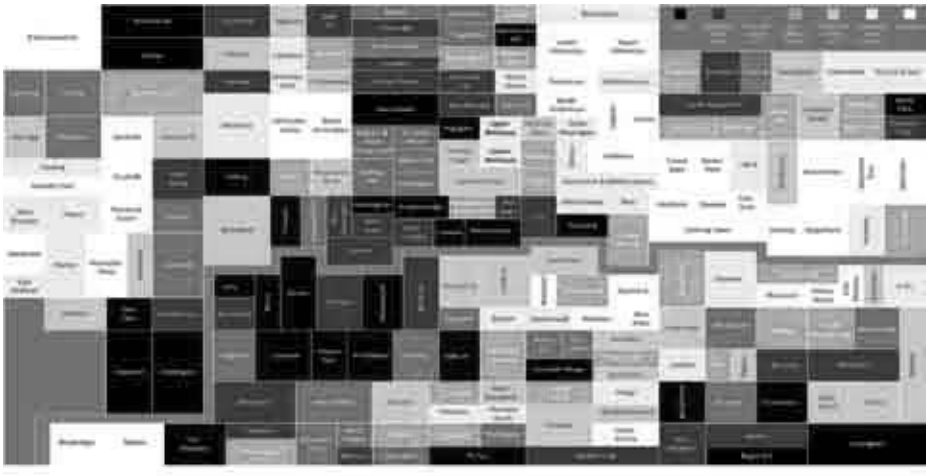

Fig. 6. Every quarter of London has a clickable entity equipped with a proper identity card that summarizes synthetically everything that may influence the choice of buying or renting a flat. The factors taken into consideration are not those dictated by the situation of the real estate markets, by prices or by the centrality of the area, but variable items, such as the quality of the network of public transportation, the level of cultural offers and of amusement (shops, restaurants and so on) and the profile of the inhabitants , their age and their nationality. All this gets updated in real-time. Diagrams and city maps are used as reference and support for all the information and blogs of support are created at a sudden in order to keep the system updated on the behalf of fashion style and tendencies London is famous for.

Chromaroma

Suggested like a *social game* based on urban movements inside London, Chromaroma embraces a particular and innovative visual system capable of tracing urban itineraries of registered users. In a few words, the game works through the use of public transportation, inclusive bicycles. One has to join the website by registering the own *Oyster Card* (the electronic rechargeable ticket of public transportation) and from this moment every itinerary a person experiences becomes an unedited exploration of the most particular sites of the city. Through the web it is also possible to join diverse groups of commutes and to start collective competitions, playing in theory like avatar immersed into a physical world. All this is in function of a potential repositioning of an activity of routine, like the movement of the masses towards the place of work, in the spectrum of a real game of society.

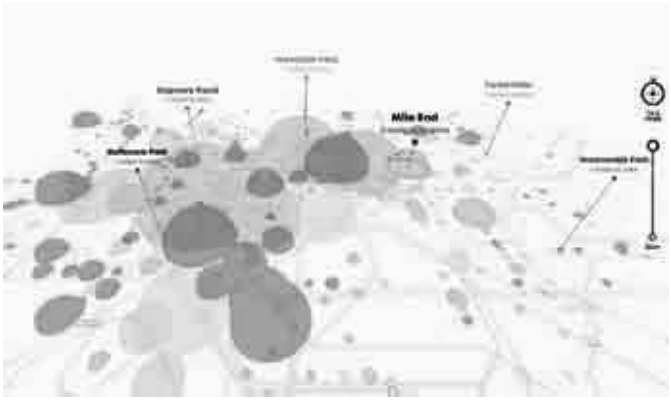

Fig. 7. The Mudlark Production Company planned a platform for virtual games, which can be practised in one's own territory : a special colour is assigned to every player or group of participants through which it is possible to monitor the single movements inside the map. This kind of a map is an authentic map of displacement and has the quality to use the third dimension for visualizing the stratification of different flows in real-time. The final result is sort of a coloured grid, very similar to a thermographic framing of the underground where the coloured domes represent focal points of data stock. This fascinating graphic performance, true to the target of identified reference, was accompanied by instruments of different nature, such as tourist information about places of interest and statistics on services.

Aleph of emotions

The gadget designed by Mithru Vigneshwara, student of Interaction Design in Singapore, permits to analyse tweets but also, in a more general way, the flow of information sent by a determined geographic position, with the scope of mapping graphically the mood of a certain place, minute after minute.

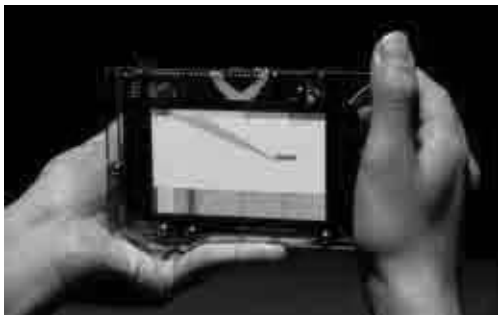

Fig. 8. Assembling a smartphone, a GPS and a hardware tab Arduino, generated a system that represents data collected by means of an extremely minimal interface. Although the system is rather intuitive, the whole apparatus still appears too much connected with languages of programming and with insufficient visualizations which are certainly functional but rarely usable by most of the people.

From the analysis and from the comparison of these projects it becomes clear that even the practice of mapping cannot evolve without common principles, similar to the rules of quality design and independent from the context and from the nature of data. What does not emerge transparently, and what certainly gets less shared, is the method with which these points can be faced and find solutions.

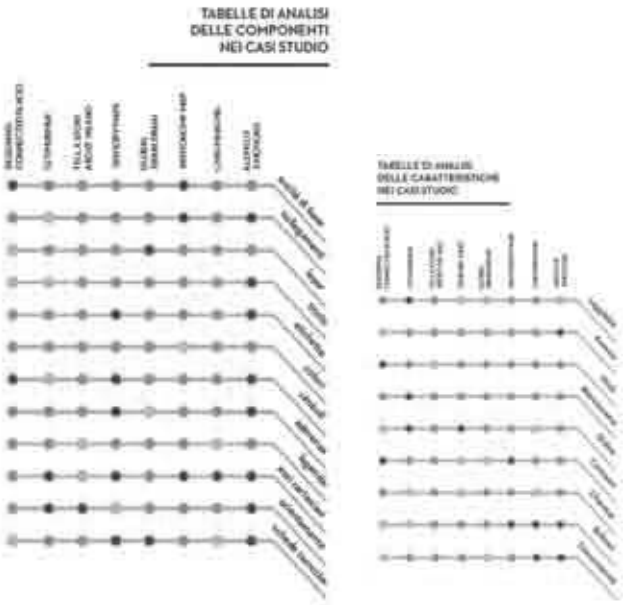

Fig. 9. The schemes represent the fundamental components and characteristics of the map and the respective levels obtained in the analysed case studies.

From the analysis of this complex transformation that is still in progress, nevertheless, the new role of the narrative structure of contemporaneity emerges from the map's aesthetics. The dynamism and the interactivity of the new visualizations on the screen dictate the application of a new visual language, rich of codes that are already diffused in different ways, like through the web and social networks, but more functional in the sense of a new representation of the world.

Being in the middle of emotive aesthetic and functional beauty, the map can be defined as an object of design in all respects, by covering a remarkable communicative and social role. The map is called to narrate the world, beyond its topological expression, and to describe those phenomena that otherwise would have remained unknown and unseen. Contemporaneity has taken conscience of the map's fundamental role: on one side as the first standardized form of information design; on the other side as a mechanism of giving sense to the world. and above all as a never ending source of visual creativity. Arriving from the past and having transformed its support, the map has not only become an integrative part of traditional media such as daily newspapers for the visual analysis of phenomena, but the map gets also more and more approved as an autonomous and self sufficient vehicle, provided with a language that often oscillates between science and art.

A Look into Depression

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Abstract. Major depressive disorder (MDD) is a mental disorder characterized by episodes of all-encompassing low moods accompanied by low self-esteem and a loss of interest or pleasure in what would normally be enjoyable activities. Depression is a common illness worldwide, with an estimated 350 million people affected. This mental disorder is different from usual mood fluctuations and short-lived emotional responses to challenges in everyday life. Depression can lead to serious health conditions if it persists for a long time with moderate or severe intensity.

The understanding of the nature and causes of depression has evolved over centuries. However, this understanding is incomplete with many aspects of depression still being a widely discussed and researched subject. Psychological treatments are based on theories of personality, interpersonal communication, and learning. Most biological theories focus on monoamine chemicals such as serotonin, norepinephrine and dopamine which are naturally present in the brain and assist communication between nerve cells.

Communicating this complexity requires media that adapts to a large amount of content within a framework that allows for qualitative and quantitative information to be expressed. Moreover, the framework needs to be designed with the user in mind to allow for absorption of information by such a diverse group.

The use of infographics on the subject of depression will facilitate the dialogue between the scientific community and the general public. Simplifying information will allow large audiences to become aware of this disorder, which although very common, is still yet unknown to many. Creating an understanding of the depression sufferer and their state of mind would assist in facilitating a journey to healing.

Based on visualization studies, infographics is preferred to text because it is capable of making complex processes, large amounts of data and information concise and understandable. Again based on cognitive science, it has been proven that humans simply learn better and understand more if tools are well designed and aesthetically pleasing to the eye.

A web-based infographic about depression will benefit the understanding of symptoms, causes, diagnosis, prevention, prognosis and treatments.

The contents collected and organized through the use of existing databases such as the database of the WHO (World Health Organization), a continuous dialogue with industry specialists combined with research into direct contact with people suffering from this disease, will configure the basis for a work of infographcis and data visualization developed on an interactive web platform.

A first observation of patients with depression highlights their fear of speaking about their discomfort. This user research is critical for outlining a profile of users that will determine the design choices of language used in the infographic project.
The primary goal of the communication method utilized will be to help people suffering from depression and to be better understood, in many cases avoiding extreme consequences and raising the attention of users who are not fully aware of the disease. Therefore, a web-based platform is the most appropriate tool for the dissemination of suggested infographics. This is not only because of the degree of interactivity of the project lending itself for multimedia support within such a network, but also because the web offers the opportunity for a wide distribution of information.

Keywords: Complexity / Infographic / Depression

1 Introduction

This paper explains the basics of the design process applied as a tool for the simplification of complex technical issues resulting in making the topic more accessible and understandable to those who are not familiar with it.

The project examines the study of psychological disorders and treatment options for prevention. The initial research revealed the need to examine the pathology of depression in-depth as it possesses characteristics of complexity, variety in events and in cases where this represents a real clinical condition, milder forms related to symptomatology.

The research of data and statistics outlined the structure and design process to be developed for the infographic project, which to date is still underway. The objective of the portal project based on infographic communication is the large-scale dissemination and education of not only those afflicted by the disease but also those surrounding them. The goal is to affect public opinion and to ensure that the topic of depression will be understood as being a concrete disease and not an abstract one.

1.1 What is Depression

Depression is a widespread disease affecting individuals, including families and peers, and should be recognized as a treatable condition. People should be aware of the first signs of depression and know that it can affect anyone from young to old.

Today it is estimated that nearly 350 million people around the world suffer from depression. The World Mental Health Survey conducted in 17 countries found that approximately 1 in 20 people have had a depressive episode in the last years.

Depression is a common mental disorder that exhibits mood swings, loss of interest or pleasure, decreased energy, feelings of guilt or low self-esteem, disturbed sleep or appetite, poor concentration and anxiousness. If these issues are

not addressed, they can become chronic or recurrent leading to substantial impairments in the individual's ability to care for themselves and partake in daily activities.

In extreme cases, depression can lead to suicide. There are almost 1 million suicides a year due to depression which equates to approximately 3000 deaths per day. For each deceased person, there are 20 or more people who have attempted suicide.

There are variants of depression:

• Depressive Episode

Symptoms are described as having a depressed mood, loss of interest or enjoyment and increased fatigue. Depending on the number and severity of symptoms, a depressive episode can be classified as mild, moderate or severe. Depending on the degree of depressive disorder, an individual will have more or less the ability to lead a regular life.

• Bipolar Affective Disorder

Typically consists of both manic and depressive episodes separated by periods of normality in mood. There is an alternating in depressive behaviour from moments of hyperactivity to extreme talkativeness and restlessness.

1.2 Causes

Comprehension of the nature and cause of depression has evolved throughout the centuries but is still not fully understood. Suggested causes include psychological, psycho-social, environmental, hereditary, evolutionary and biological conditions. Most biological theories focus on the monoamine neurotransmitters such as serotonin, norepinephrine and dopamine, which are naturally present in the brain for the facilitation of communication between nerve cells.

As with other psychiatric disorders, in-depth information and literature is not yet widely available for depression. In general, one can assume that causes of the disease are vary from person to person (heredity, social environment, early emotional relationships, family deaths, problems with work and relationships). However, research has highlighted two main causes: the biological factor with some having a greater genetic predisposition to the disease, and the psychological factor caused by acquired experiences leading to increased vulnerability to the disease.

Biological and psychological vulnerabilies interact with each other and do not necessarily lead to the development of the disorder. A vulnerable person may never be afflicted by depression unless something happens that may trigger the onset of the disorder.

The trigger is often a stressful event or tension disrupting the normal flow of life in which the vulnerable individual views as not acceptable. It may be a negative event such as a loss of a loved one, or positive event, however interpreted as

a loss (the birth of a child seen as taking away personal freedom and adding responsibility and others) or even a lack of positive events for which one worked towards but had not seen a result for such as a promotion at work. While it is fairly easy to tell the cause that triggered the initial depressive episode, it is very difficult to detect when the episodes strengthen.

1.3 The Contribution of Infographic

The data collected regarding the set of problems from those suffering from depression as well as friends and relatives caring for them is alarming. The project aims to create an infographic structure that simplifies data about this common disease, making it clear and understandable to all audiences. The goal is to emphasize that depression is indeed a real disease.

The aim is to make the topic less didactic, instead providing a plan of action to those suffering from depression, in turn providing support, analysis, understanding and an action plan to counter their condition. This information will also offer much needed guidance to their relatives, friends and colleagues on how to cope with the mental illness.

In addition to these two scenarios, the infographic will serve as a verification tool for those uncertain of whether or not they are suffering from depression. This will allow for a review of symptoms while building moral support, alleviating shame and assuring that this mental illness can indeed be cured.

Through the language of infographics, the connection between aspects and problems surrounding depression will be translated into a visual code. It is also possible to offer the patient and their immediate support system a common platform by which, through collaborative practices between patient and doctor, they can meet eye to eye using common information. The project also offers the possibility of communicating complex and delicate content in a simple manner in order to facilitate a fruitful dialogue for clear understanding.

2 Methodology

2.1 From Content to Visualization

The study of research materials based on the analysis of the *'DEPRESSION: A Global Crisis*' document issued during World Mental Health Day on October 2012 dealt primarily with depression. Information such as this along with experiences from specialists, doctors and additional industry texts have helped to clarify dynamics that have come along with this complex disease.

The information architecture of the portal is developed along a vertical and horizontal axis. On the vertical axis, information will be arranged in a sequential manner: definition, causes, symptoms, severity, treatments, etc. The use of infographics in the vertical direction will illustrate a general picture of the rela-

tionship between the different aspects of the topic. The consultation through the vertical axis will give an overview of the problem that aims at acquiring general measures to be taken by the user.

The horizontal axis will be characterized by an in-depth view of a single topic such as living with a depressed person or the behaviour one should exhibit with a depressed person.

The language of symbols and icons with which the infographic will be built, will be designed so as to avoid the appearance of 'clinical' communication which almost always comes across cold and detached. Instead of showing mainly scientific data, lacking empathy and involvement (Fig. 1), the infographic will be designed with an aesthetic warmth in order to communicate empathy. It will use a color scheme and graphic symbols typical of visual communication used in other subject areas that are more dynamic than usual scientific and medical communication.

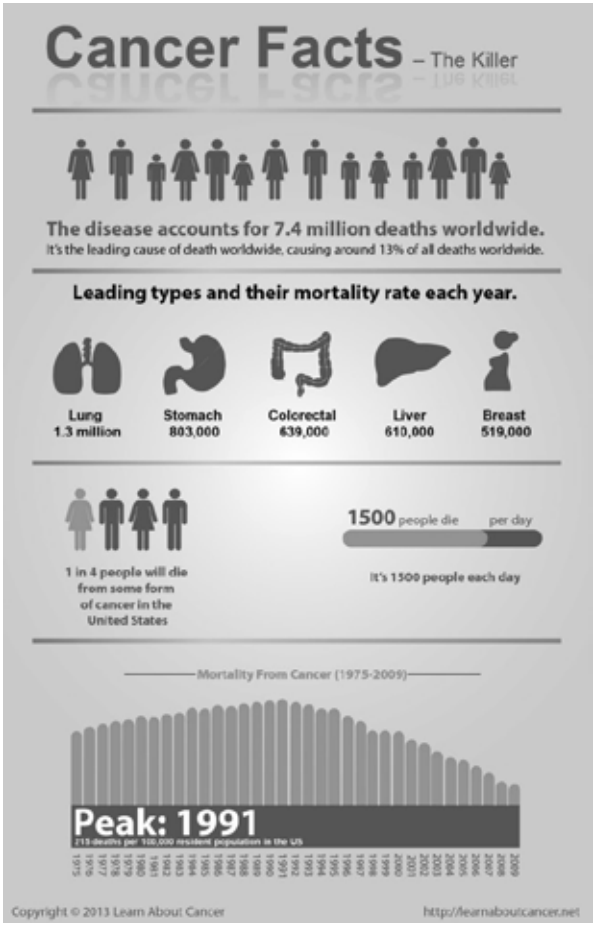

Fig. 1. 'Cancer Facts'. Learn About Cancer. http://learnaboutcancer.net/

2.2 Interaction and Touch Points

Dynamics between information dissemination and sharing via this communication tool will ideally follow a scheme based on four concentric categories: the first category being the patient in focus, the second category consisting of family and friends, the third category made up of experts and doctors and the fourth category which would include institutions and the general public.

Through this sharing scheme, the ultimate goal of this project is to introduce the idea that it is, indeed possible, to disseminate information around the complex topic of depression through web technologies pervasively in a simplified, less academic manner; all designed to reach a large consumer base within a short time span. For this very reason, the technological platform in which the infographic will live is particularly important.

The interactive functionality of the infographic will be controlled through nodes on a grid; horizontal reading / vertical reading, as seen in section 2.1. The user will be able to control infographics and their flow of information through on-screen controls and filters.

Another use of interactivity will include a self examination in which the user can evaluate their mental condition. This self examination will apply *gamification*[1] principles in order for the user to express any discomforts with ease, avoiding traumatic experiences. The process will be engaging, aiming to drive interest and curiosity in discovering results and experiencing infographics as they are displayed.

A good example of gamification is the project entitled "*How many slaves work for you?*". Using this form of communication, the project engages with the public on a difficult and contemporary subject, such as modern-day slavery. (Fig. 2)

At the same time, extracts from general infographics will be available to be mounted in educational mini-video for quick access and to spread throughout social networks, blogs and industry websites. Secondary uses like these deriving from the main scheme will serve as a way to further advise the general public and create empathy for those suffering from depression.

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[1] Gamification is the use of mechanical and dynamic games utilizing incentives such as reaching higher levels and earning points or prizes, in contexts outside of the game to create more interest in solving problems. It has been proven that the use of these methodologies stimulates active behavior. A recent study on gamification influence in society was made recently by Jane McGonigal in 2011. She noted that using such a playful component can have better understanding of today's society and encourage positive social behaviors. Another approach to gamification is to make existing tasks feel more like games.

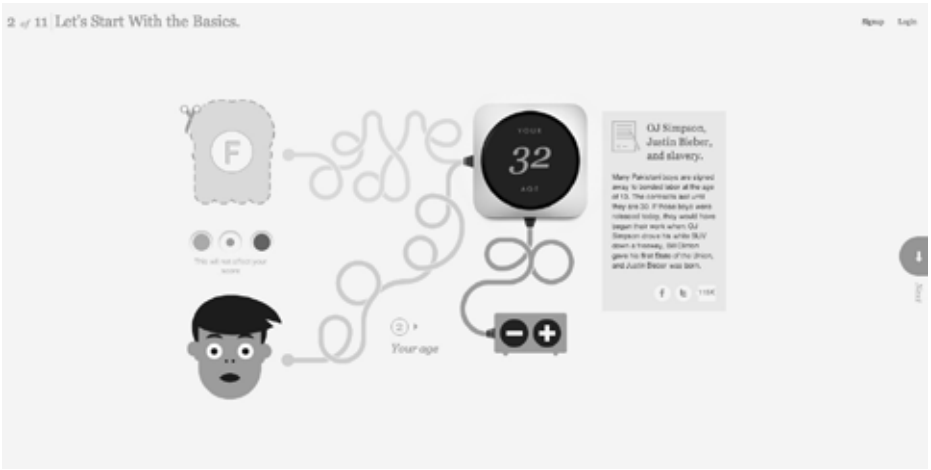

Fig. 2. 'How Many Slavers Work for You?'. Slavery Footprint. http://slaveryfootprint.org/

2.3 Technology

The use of a web-based platform is not only appropriate for the communication of these infographics since it would require engagement and interactivity, but also because the web offers worldwide access to this information in a rapid, most viral way.

The platform will be set up to receive input and produce output of various kinds and in different formats, through tracking of online habits and behaviours of users. It will provide statistical, geolocated data on contents displayed. There will also be available output files of project sections and infographics extracted for specific reasons which will be suitable for most print sizes.

3 Case studies

In addition to the literature and articles in the field, there are innovative approaches to self-help available on the web and via mobile platforms that can help reduce or treat depression. There are some online platforms such as Moody Gym[2] which is an interactive web program designed to prevent depression. The program consists of five modules each taking between 20 to 40 minutes to complete; all modules to be completed in order. The modules serve to inform users about their moods and how to change them.

[2] Centre for Mental Health Research, Australian National University. https://moodgym.anu.edu.au/

There are also apps available for smartphones like Moody Me[3] which acts as a virtual diary of moods. One can record daily feelings and link them to images or emoticons in order to absorb them into their memory and visualize them through monthly charts.

Some industry websites allow downloads of PDF manuals that provide information and advice on the identification and treatment of depression. These PDF's also contain guides offering common treatment methods and coping action steps in order to support those suffering from depression.

There are also some infographics made for printing that report mainly on depression statistics, as well as causes and effects of the disease. An example of this is the project "*Getting an In-Depth Look at Depression*" (Fig. 3) which provides information about the disease (causes, symptoms, treatments, economic and social cost and statistical data) but mainly refers to data and research collected from the United States.

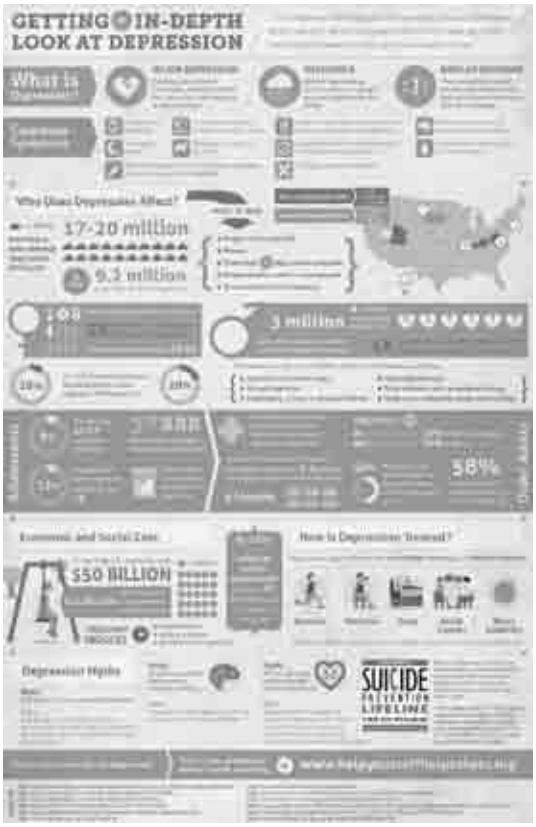

Fig. 3. 'Getting an In-Depth Look at Depression'. Help Yourself Help Others. http://helpyourselfhelpothers.org/

[3] MedHelp. http://www.medhelp.org/land/mood-diary-app

4 Conclusions

Depression is a mental disorder that has spread throughout the world and affects almost everyone. There are many treatments available for the improvement of the health and lives of millions of people battling with depression. However, this disease is still unknown and underestimated even by people suffering from depression themselves so it's time to educate the greater society about depression to build support for those who are suffering from this treatable mental disorder.

Thanks to the infographic platform people can use a simple approach in detecting depression, helping them to identify it and even detect it in themselves. This project aims to support both physicians and patients along with their loved ones to improve their lives whilst suffering from the mental disease. It is especially useful since depression is notorious for having quiet symptoms that go undetected resulting in the lack of or delay of medical attention. The visual communcation design doesn't just produce forms using infographics but also supports other disciplines with the aim of creating a better quality of life, not only for physical things, but also for immaterial realities.

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Visual Archives and Infographics: new Connections

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Abstract. The present article is part of a broader study that frames the concept and creation of visual archives for online press, in relation to infographics. In addition to being an operative discipline, Design presents itself as a theoretical response, through the analysis of conditionings in society and the anticipation of new communication processes.
By presenting and promoting the practical and theoretical investigation in areas such as design and visual literacy, with specificity on infographics – a multidisciplinary area in constant evolution –, we intend to reveal how we can communicate complex information content visually.
Focusing on online press infographics, we propose to establish a new role by relating it to visual archives.
Nowadays, the Internet offers various resources for online archives and databases. In the interest of preserving content and data, various archives are, currently, committed to digitizing their information. Various governments, in a methodical manner, have made budget and government decisions available online. Other examples, like Google, are also a vital source of information. However, correlations are dispersed and its logic is presented based on textual parities or presented in datasets that only make sense to a scarce number of people.
Archives, as a specific field in information, should propose systemic constructions between content and meaning. This is the underlying premise, when we question in what measure can archives, by becoming visual, solve flaws in communication. At the same time, the subjacent objective of most information visualization is to organize and clarify mass volumes of data. Based on this definition, it is a field that has impinged it self in the concept of archive. We will begin explaining the connections that make information visualization fertile ground for this concept, by decoding the definition and objectives of archives. After, through authors and case studies, we will analyze how they can influence new platforms of communications and reinforce new options for online press infographics.

Keywords: Visual Archives / Infographics / New Media

1 Introduction

The present article is part of an on-going investigation within a PhD programme in Design that frames the concept and creation of visual archives for online press, in relation to infographics. Methodologically we present reference to case studies and authors who develop work within information visualization and infographics.

It is a research within the areas of design, visual literacy and, in particular, infographics, where we discuss how we communicate visually. Focusing on the specificity of online newspaper infographics, we propose to establish a new role by relating it to visual archives.

In addition to being an operative discipline, Design presents itself as a theoretical response, through the analysis of conditionings in society and the anticipation of new communication processes. More and more, we face a new reality, a mutation in the relations between people, objects and images, witnessing what Lipovetsky refers as a "new phase in the history of western individualism" [1].

We move into a new paradigm, where we abandon a period of automation of processes – a feature present since the Industrial Revolution – and walk towards an automation of information. One of the consequences is the need for greater clarity and progressive information systematization when we are in the presence of the multiplicity of data to which we have access. In the age of "information overload"[1] [2] we can say that the abundance of information and how we organize it is, above all, a problem of Design and, in particular, of Information Visualization.

2 Archive

Following an initial premise, we question how archives and knowledge are structured and created.

Theoretically we explain the acquisition of wisdom following, traditionally a sequential model: Data > Information > Knowledge > Wisdom (DIKW) (Fig. 1). We see that this operative model calls for itself certain types of logic, where data is presented in a linear manner, in sequence, like the information we find in books. However, something different occurs when we are confronted by the diversity of sources available online.

[1] Information Overload seen as an acceleration of technology that results in a change in the social fabric.

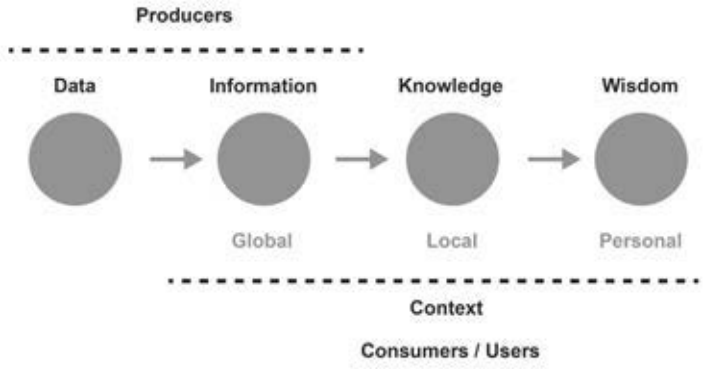

Fig. 1. Knowledge Spectrum. Adapted from Nathan Shedroff [3].

On one hand, whether on the computer or Internet, we're in the presence of an automation of data. On the other hand, its constant presence and accessibility does not make data easier to locate. Database search presents disperse references in various sources, decentralized, our without a hierarchical order. The structured order that commonly inhabits books is not a certainty in online context. As the amount of information increases, our ability to distinguish and attribute meaning decreases reciprocally.

According to Kryder's Law[2][4], the ability to storage (bits) in smaller and smaller computer hard disks doubles every eighteen months. When we are faced with the moment our computers have the ability to store or contain every book ever written, it should be recognized that the means of organization available might not be adequate to facilitate access to such data.

This fragmented reality intersects with what Lipovetsky [5] mentions as a tendency of 'interactive' systems to increasingly customize access to information and images.

In the words of Weinberger [6], a new paradigm is recognized when our foundations of DIKW are shaken. The orderly logic presents itself, in post-modern era, and especially with the apogee of the Internet, increasingly frail. The increased of diversity, interaction and information through private options is privileged.

However, following the notion of archive, the dynamics of classification, connection and relation to data are essential to the caption of content and meaning. The logic needed to acquire knowledge is not necessarily altered, but the means available are. Producers and Users are active pieces in the "management and creation of new knowledge: they classify, connect, comment, correct, edit" in-

[2] Mark Kryder – Professor in the Electronic and Computer Engineering Department at Carnegie Mellon University.

formation [7]. We can go further and add that they store and archive, since the human condition has a latent need to register and store diverse types of data for posterity.

Based on a definition by Schuller [8], archives are considered "a place to systematically record, sort and manage documents, images and media for permanent preservation". This methodical and professional information retrieval is usually performed by a group, society or nation and often influenced by "economic and political interests, and presented as a social act in our changing society" [9].

In the interests of preserving contents and data over time, there are currently several archives involved in digitizing their information. Several governments have release their budget decisions online, as is the case of *Data.Gov.uk* in the United Kingdom (Fig. 2).

Fig. 2. Data.Gov.uk.[10]. Website that presents UK's government budget decisions.

The internet, associated with the need to preserve data, allows online access to multiple databases and forms of archive, like Google, but does so based in textual parities, and presents them mainly in the form of text our datasets[3]. Again, data is always present, but reading it constitutes a difficulty. The datasets are usually accessible only to experts who know how to transform and interpret. It is necessary to create languages that translate it into more readable formats.

Archives, as an information domain, should propose systemic constructions between content. It is essential that new models appear, and in that context, information visualization can be seen as a solution.

[3] Datasets are present in many newspapers. The Guardian not only presents infographics but also releases its datasets.

3 Information Visualization and Infography

In the 1980's the development of computer desktop publishing implied new practices that revolutionized editorial creation in the publishing world. Likewise, the World Wide Web implies new practices in information distribution [11].

It is common to hear that we live in a visual culture, and received our information from images, due to a long and steady textual heritage. It is not common to see it taken as a form of literacy, in other words, information conveyed "through images as well as texts and numbers" [12].

Information Design represents visual data with the intent to "communicate, document and preserve knowledge. It deals with making entire sets of facts and their interrelations comprehensible, with the objective of creating transparency and eliminating uncertainty" [13]. Also, Media has become increasingly interactive, capturing the human tendency for network communication and individual appropriation of meaning. The visualization of information is a visible response, a new medium and "new scale that is introduced into our affairs by each extension of ourselves, or by any new technology" [14].

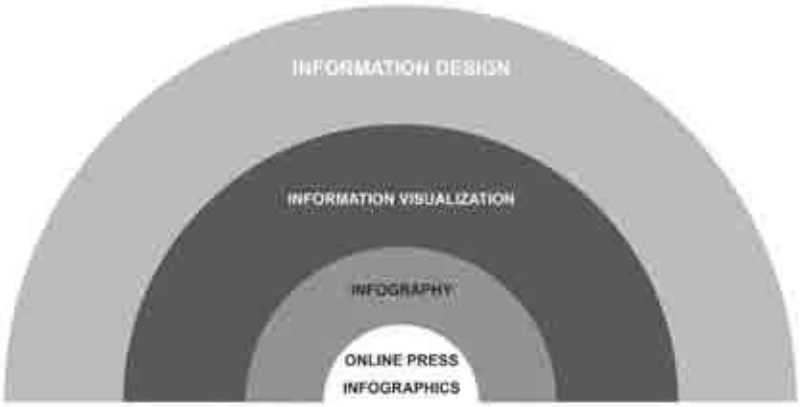

Fig. 3. Dynamic relation between Information Design and Infographics for online news. Adapted from Alberto Cairo [15].

The fields of information and infography (Fig. 3) constitute a multidisciplinary aggregation[4] and a growing discipline. Information needs to be contextualized and infographics tends to solve our 'thirst for data', in other words, the human tendency to catalogue and collect information.

The power of infography is to transform data into knowledge and to access it visually (Fig. 4). By associating the concept of archive and taking it as an ad-

[4] Combines disciplines such as visual perception, color theory, psychology, sociology, engineering, design, among others.

vantage to create infographics we highlight a facts, but also to take assume a new path.

Just as with archives, infographics always arises from inseparable historical, socio-cultural and political context, which are essential to create knowledge, as well as recognize the value of the content associated with the information available. We are not referring to static infographics or a traditional presentation of information, but as indicated by Cairo [16] a tool for exploration and interaction.

Fig. 4. New York Times. Senate results for the 2012 Elections in the United States.

4 News Infography

So how can archives prevail in the context of infographics? It is assumed that they do so by becoming visual.

The notion of archive that is proposed here is compatible with Cairo's vision [17] of an analytical conception[5] of information stating that an infographic is based on the revelation of complex data through visual structures.

News infographics is assumed, not as a tendency to degrade or merely decorate data, but as a guaranty of a "structure so that patterns and hidden realities become visible" [18].

[5] Analytical conception is proposed as a characteristic that augments the cognitive ability of readers by making evident what has been hidden, being it, a chaotic set of data, a list of numbers or an object whose structure is excessively complex.

Pattern design, in this respect, should not be seen as a finite system, but a living structure in constant evolution. This search, widely disseminated, is expressed by Chaomei Chen, who indicates that a "the taxonomy of information visualization is needed so that designers can select appropriate techniques to meet given requirements" [19]. Other authors have reflected on pattern decoding and information visualization. The continuing analytical approach is revealed in the work of authors such as Jacques Bertin, Eduard Tufte and most recently Manuel Lima. Bertin in his 1967 book '*Semiologie Graphique'* reflects on the organization of graphic elements according to the relation between data and function [20]. His work, oriented to semiology studies, is a fundamental attempt to see graphs from a "global and structured point of view, producing a consistent theory for symbols and representation modes" [21].

Tufte, in turn, was critical about the media tendency to embellish rather than achieve visual representations from the transparency of their data [22]. His analyses allow us to understand that the history of any communication device is "entirely a progress of methods for enhancing density, complexity, dimensionality, and even sometimes beauty" [23].

Finally, the work of Manuel Lima [24] shows the evolution on a network perspective rather than the printed world. It reveals a tendency to create similar patterns within different fields of knowledge such as biology, music and politics and continues the discussion of taxonomies that can be applied to specific types of work.

4.1 Aim and Expected Results

All these points connect on our proposed analysis. It has allowed to link specific types of infographics, specifically those with recurrence and online presence and that deal with one of the elements most difficult to represent, and one, that potentially increases dynamic and allows it to be linked to archives. That element is TIME. For most of recurrent news such as Elections, Olympic Games, Nobel Prizes, there is a surge of many forms of online infographics, but there is scarce continuity. They are made as isolated pieces of work, and past information within a topic is not reactivated and availed. A continuum of information is lost.

Take the examples given below (Fig.5 -10) focusing on elections; past information is considered but the structure is not conceived for continuity. Our aim is to discuss possibilities of retrieval within topics and reveal past data, thus connecting the presented definition of visual archives as a new path for online newspaper infographics.

4.2 Case Studies

The election of Barack Obama in 2008 and 2012 is an example of how information can be retrieved and adapted. If we look close, there are more correlations in 2008 (Fig. 5, 6). The map vision can compare results from 1992 onwards. In 2012 (Fig. 7) that ceases to occur; the map presents the 2012 outcome and a 2008 fluctuation analyses (Fig. 8). There is no similar visual comparison of results. The overall visual structure is similar on both, a positive point, but part of the information available in 2008, did not meet continuity.

Fig. 5. New York Times. Presidential results of the 2008 Elections in the United States.

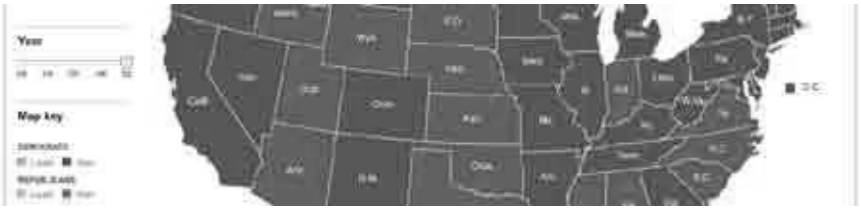

Fig. 6. Detail.

Fig. 7. New York Times. Presidential results of the 2012 Elections in the United States.

Fig. 8. New York Times. Change in votes from 2008 to 2012 Presidential Elections in the United States.

The *El Mundo* example presents the opposite. The 2012 election (fig. 9) offers an amount of information made available that compares previous elections, since 1977. The 2008 compares only to the previous one, 2004 (fig.10).

Fig. 9. El Mundo. Congress results on the 2011 General Elections in Spain.

Fig. 10. El Mundo. Congress results on the 2011 General Elections in Spain.

The design and information quality presented in the case studies are not at stake. They are reliable infographic visions of the reality of that moment. They are taken into analyses for being recurrent news that offer the possibility of a new approach on the continuity of design and information. We proposed here to begin a discussion about the future of this specific type of news. In that specificity, infographics and visual archives can find common ground.

Another aspect is the notion of continuity proposed with patterns and taxonomies. With any given design object, continuity and familiarity with graphic elements allows quick understanding of the information conveyed. When the New York Times website was redesigned, layout indications where given so that user could adapt and adjust their personal navigation to the new design. This is key in infographics. Design stability allows better navigation. Within the same subject, once the learning curve is achieved, it can be sustained over time.

5 Conclusions

The research implies that it is necessary to create visual devices that deal with, on one hand, the visual code. On the other, that can retrieve and optimize the creation of multiple visual options with online infographic visual archives. Coherence in terms of database and metadata introduced must also be achieved.

This, we expect, is the new role for design and infographics with relation to visual archives. The invisible aspects also interfuse the final outcome, which reveals design as a response that bonds technology and visual practice.

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End of the Line?

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Abstract. This paper analyses the timelines used in the *Century City*[1] exhibition and its accompanying catalogue. Through the formation of two perspectives; Art History and Graphic Design, this paper examines the methods for communicating the complexity of nine cities spanning a century of time. '*End of the Line?*' outlines the use of chronology within History of Art examining its use within the exhibition medium. The case study *Century City* was chosen because of its attempt in presenting defining moments of the modern through a global perspective; communicating nine specific cities that acted as sites for innovating visual culture. This study aims to develop the interpretation of art, providing meaning and place to *'cultural flashpoints'* in a global context in both contemporaneous and historic terms in relation to modern metropolis.

Background

The History of Art is traditionally taught by studying the chronology of art from cave painting to the present day. Within it one studies 'isms' and movements examining the progression of art and artistic practice over time. The complex multifaceted narratives and histories of art are often difficult to understand. Timelines and diagrams are a common tool within Art History; Alfred H. Barr's *'Cubism and Abstract Art'*[2] is regularly used to teach the complexities of the foundations of Modern Art.

Although now used as a teaching tool Barr's chart was initially drawn to assist him in curation of the exhibition of the same name at Museum of Modern Art (MoMA) which opened March 1936[3]. His initial draft was used to also formulate the supporting articles for the exhibition catalogue; appearing in the dust jacket of the publication. Barr revisited the chart many times; referencing it to his curatorial decisions in the subsequent five exhibitions at MoMA[4].

[1] Century City exhibited at Tate Modern, London 1 February – 29 April 2001.
[2] C.1936
[3] Cubism and Modern Art exhibited Museum of Modern Art, New York 2 March – 19 April 1936
[4] The series also included Fantastic Art, Dada, Surrealism (MoMA Exh.55, 7 December 1936 – 7 January 1937) and Romantic Painting in America (MoMA Exh. 246, 11 November 1943- 6 February 1944).

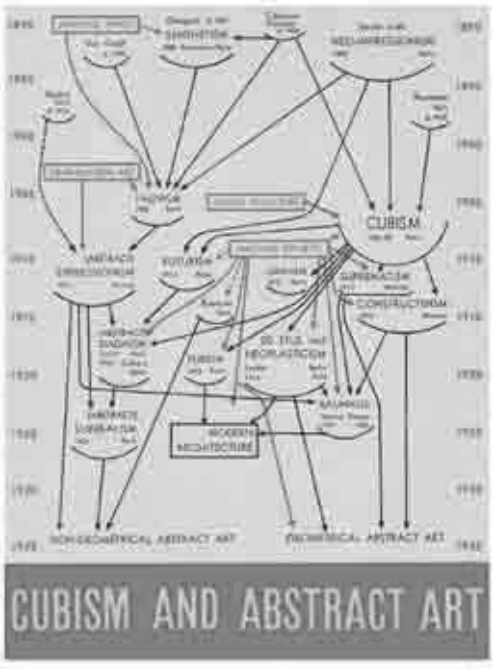

Fig. 1. Alfred H Barr Jr. c.1936. '*Cubism and Abstract Art*'

Barr and his curatorial practices attempted to expand outside the traditional 'isms'; connecting work through the artists' use of medium and the art's political and social impact. In the field of Exhibition Histories and Curation Practices; Barr was a pioneer. Despite his influence most galleries around the world remained to confine themselves to the traditional chronology hang. Much like the restrictions of a traditional timeline this hang is rigid, it is often hard to visualise the connections between works other than their placement in time to one another. For modern audiences this is hard to understand as Barr's curatorial practice is now common place most institutions especially in modern art galleries.

When Tate Modern opened in May 2000; they disregarded chronology, challenging the entire notion of Art History with its collection displays and temporary exhibitions. *Century City* examined the historic relationship between the 21st century metropolis and the production of art. The exhibition focused on *'cultural flashpoints'* of nine cities through the period of 1900 to the present day. It examined both the traditional centres of artistic production, such as Paris, New York, Vienna, London and Moscow, but also the contribution made by cities such as Tokyo, Bombay, Rio de Janeiro and Lagos.

Century City promised nine idiosyncratic perspectives attempting to make transparent the way museology and curatorship work demonstrating there is no single narrative. The exhibition attempted not only to curate the social, political and artistic production of art within the nine cities but our relationships with cities themselves. *Century City* established how the exhibition itself is a medium

for communicating the complexities of not only Art History but nine metropolises.

Each city was curated in isolation and there was an obvious decision by the curators to attempt to compartmentalise and liberate art from the confines of chronology, providing them the flexibility to contextualise and make connections. In contrast to this, the exhibition's delivery of contextual cues took the form of timelines in each gallery, itemising the critical artistic, social and political events that took place during the period under scrutiny. These were designed in a traditional linear chronological manner, with no consideration for how particular movements interacted, overlapped or influenced each other, segregating rather than setting each of the cities in a global context. However, the accompanying catalogue with its provocative and wide ranging reflections made more sense of the brief than the exhibition.

While the content of the timelines in both the exhibition and catalogue play homage to the spirit of Barr; the form, presentation and structuring impedes this intention. The timeline can be an effective interpretive tool however its use is often a decision made late in the curatorial process. One could argue that there needs to be a more conscious decision to integrate design in the initial stages of exhibition planning.

Deconstructing the Timelines

The nine cities of the exhibition are represented on timelines that share basic structure, typographic hierarchy and contextual information types. These, on average, decade long maps of the modern metropolis reference the visual language of Harry Beck's map of the London Underground, large year markers dominate the winding line while events throughout the year are shown as smaller white nodes. Progress, scale and modernity are implied.

Timelines serve as a familiar framework for cataloguing and presenting information in a range of contexts. In Barr's chart time flows downwards in an understandable and consistent manner, rubricated five yearly markers are evenly distributed and allow one to understand at a glance when art movements took place relative to each other. Likewise, in John B. Spark's *'The Histomap Four Thousand Years of World History'* time is delineated at regular intervals, the lifespan of empires can be measured in centimetres at any point in time with the surety that the periods maintain a relative accuracy. In these cases the timeline functions as a temporal axis, there is no physical line to be followed but time progresses in a logical consistent manner.

Fig. 2. John B. Sparks. 1931. '*The Histomap*'

The timelines of *Century City* lack this consistency of navigation, the reader is asked to wind their way down a recurring s-bend, first left, then right, doubling back on themselves until finally reaching the end. The distance between year markers differs dependent upon the number of events chosen for that particular year, time expands and contracts. Rather than anchoring the information it disorientates, making it harder to derive meaning, to construct a schema of events and their contextual relationships.

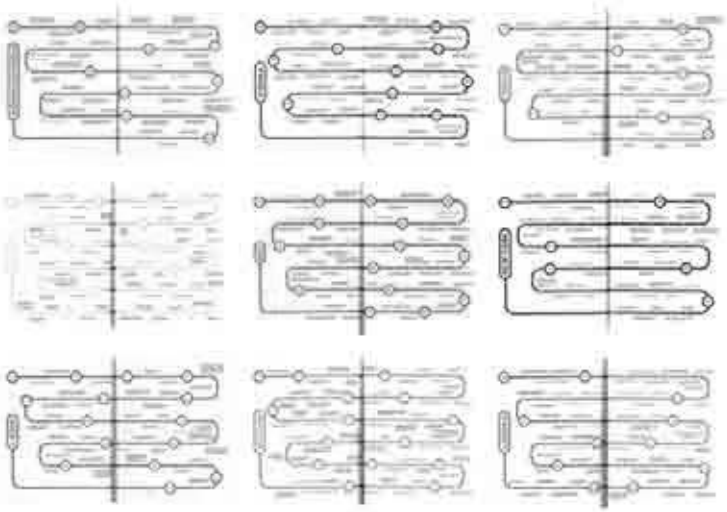

Fig. 3. Tate. 2001. '*Century City Timelines*'

London 1990-2001

The timelines contain the supporting content; each interpreting the 'cultural flashpoints' of the city under examination. They are made up of three categories; social, political and artistic production. Each timeline represents these categories with the same use of typeface, font size, weight and colour. The design of the timeline has no reflection of the city it is interpreting; nor does it reflect or best communicate the three categories.

By deconstructing the timelines one can analyse the effectiveness of communicating the complexities of the chosen city. How does the timeline contribute in understanding art and culture of the modern metropolis? How could the timeline be improved to provide readers with a deeper interpretation of the art that was curated in the exhibition?

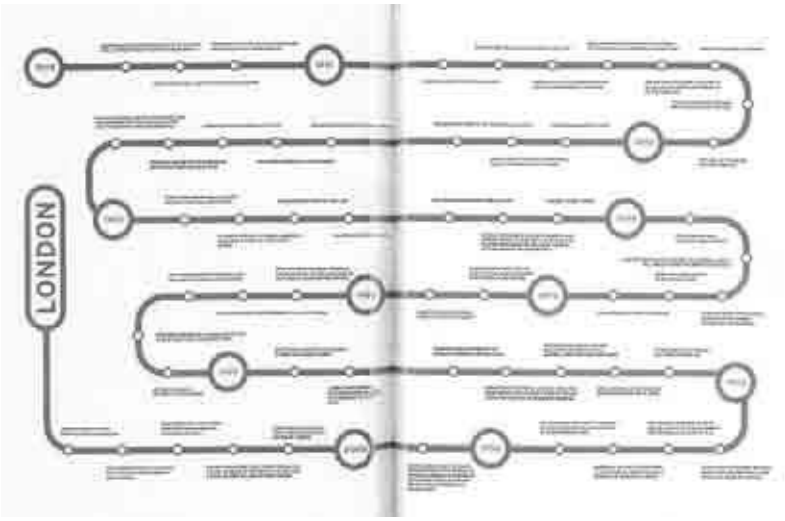

Fig. 4. Tate. 2001. '*Century City London Timeline'*

This paper focuses on London within *Century City* which examined the relationship between the city, its people and creative industries and studied how the fabric of the city entered into works of art and design. Emma Dexter, London's curator, made a conscious decision not to re-curate a chronology of the city's art scene; but instead to create encounters with the cultural practitioners that live there. Dexter was heavily influenced by Henri Lefebvre's theory that a city is a living work of art, collectively created by its inhabitants.

The space echoed its essay counterpart in subheading sections; *'Picturing the City'*, *'The Street or Love at Last Sight'* and *'Melancholy Objects'*[5]. The sections depicted the working processes and lives of artists, their networks, and their contribution in making London an important site for the production of contem-

[5] P70-96.

porary art, design and fashion in Europe. The period covered in *Century City* was framed by the events and ideologies of the 1980s that saw the implementations of Thatcher's policies that directly influenced the cultural sector in London. The works in the exhibition highlighted the freedom of speech, expression and the people's right to demonstrate in and about the city through the medium of arts.

The exhibition attempted to show the formation of collectives in London in the period such as the pairing of Tracey Emin and Sarah Lucas[6] or the creation of the Young British Artists (YBAs). Similarly the text in the exhibition catalogue, suggests the importance of these networks for the production of art and development of the London artistic and cultural scene. However, the timeline although has suggestions of these connections through its poor design does not communicate this clearly.

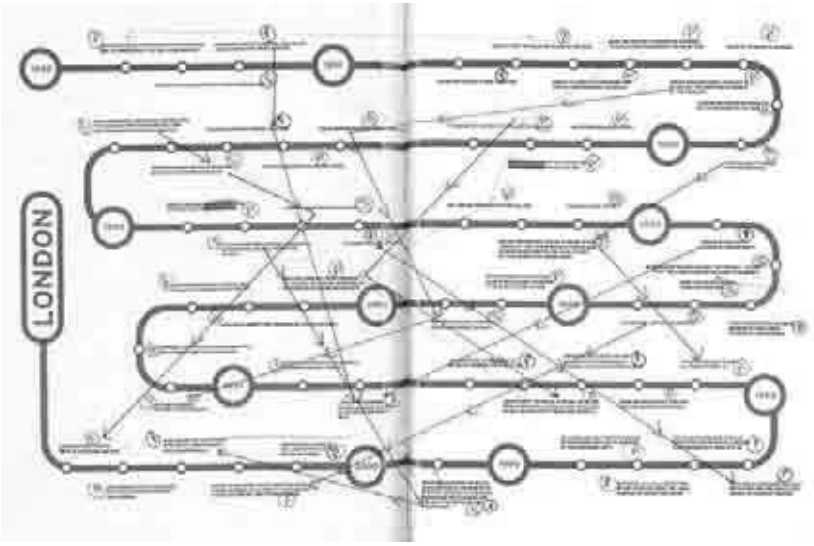

Fig. 5. Tate. 2001. '*Century City London Timeline – annotated*'

At first glance, it is hard to connect the events; they appear independent however with further reading mini narratives become apparent with the timeline. These mini narratives reflect the three categories than form the foundations of analysis to the modern metropolis; social, political and artist production. For example; embedded in London's timeline there is a mini narrative which indicates the changes in the political climate, including the resignation of Margret Thatcher and Labour winning the general election in 1997 ending an eighteen year reign for the Conservative Party. Layered on the political mini narrative are many others such as; the formation of the YBAs from their first appearance in *Frieze*[7] to the exhibition that made them an iconic art brand, '*Sensation'*[8].

[6] The exhibition included photographs and documentation around the work by Tracey Emin/Sarah Lucas *'The Shop' (*2000).

[7] *Frieze* magazine was established in 1991.

However, these mini narratives are not communicated clearly through the timeline; it is only after much reading and analysis that these narratives become apparent. By annotating the timeline, one can categorise the events into social, political and artist production; from this simple act the mini narratives start to become clearer. By drawing on lines and arrows to connect the events to create the mini narratives; one can start to understand the full extent of the complex information that is collated to construct the timeline.

Once annotated the timeline becomes a hybrid of mini timelines; displaying an array of colours, lines and arrows connecting events, people and themes on the diagram. In order that we might reveal these micro narratives to the reader in an effective manner we must consider how to organise the information so as to form a visual group. As the stories tend to be causal in nature, an event is a consequence of a previous event; we might consider continuation using single headed arrow lines to communicate the flow. Closure and proximity are likely to cause unresolvable tensions within the timeline's structure but similar placement on the horizontal or vertical axis or within a denoted zone or banding could be effective.

Without these annotations and graphical representations the timeline is too simplistic and actually fails in communicating any information effectively. The timeline's ability not to communicate the contextual information easily and not taking advantage of design resulted in a lack of interpretation in the exhibition. This was a failure of the curatorial team in not recognising that by attempting to curate nine cities, nine histories over a century period is almost impossible to do without providing the correct interpretations to assist audiences. They relied too heavily on traditional text panels that had to attempt to contextualise a period of a city within two hundred words. One believes that the curatorial team believed that crudely inserting a timeline would help audiences to understand the complex histories of a city; its social, political and art scene. Although the timeline has the potential in communicating complexity and could be an excellent way to interpret context of Art History in an exhibition setting this is only possible with effective design.

If we look at London's timeline there are a number of design decisions that impede its effectiveness. There is no variation in the presentation of the three subject types of the information provided so no immediate visual connection is able to be made. As the information is presented as equal in its contextual value then colour would seem to be the most effective way at grouping the information types while retaining their chronological position on the timeline. We can see this working in practice from Barr's use of red to signify external influences; *'Japanese Prints'*, *'Machine Aesthetic'*, upon the art movements. They are immediately distinct as a set from the art movements while remaining logically consistent in their placement.

Poor typesetting and typographic choices also flatten out meaning and render the information homogenous. Setting the typography in all caps removes the

[8] *Sensation* exhibited at the Royal Academy, London 18 September – 28 December 1997.

distinctive shapes of the word forms, all words are shown equal with proper nouns and verbs indistinguishable.

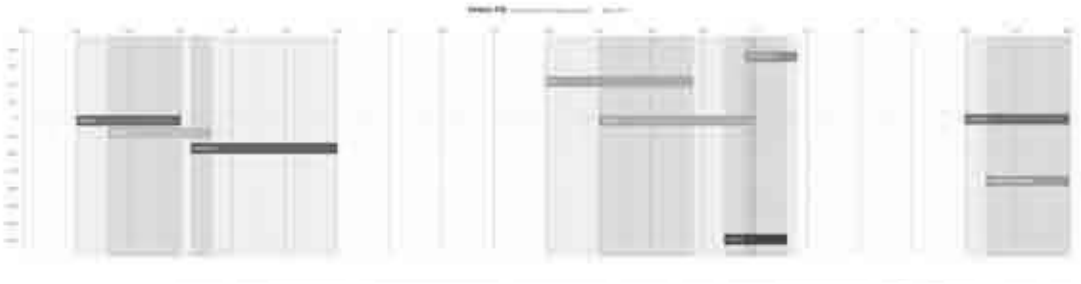

Fig. 6 Macro view of *Century City's* timelines

One of the main shortcomings in the creation and deployment of Century City's timelines is the inability to see them together and get a sense of how these events, taking place globally, fitted together and had an impact or influence on the art of a particular city. The timelines were only presented at the entrance to the gallery space of their own city leaving the viewer seeking to know events from other cities no recourse.

To reconcile these elements, in addition to the micro level of the individual timeline and it's contained narratives we must also take the macro view to get a sense of how all these timelines and cities relate. A study of the timelines reveal there are three distinct periods covered; 1905-1930 (Paris, Vienna and Moscow), 1950-1974 (New York, Rio, Lagos and Tokyo), 1990-2000 (London and Bombay/Mumbai). By breaking and presenting the century into these periods we can show multiple timelines in situ, communicating the information, if not in a holistic manner, then at least in a contemporaneous one.

Ultimately the choice of how to structure the timelines will be inextricably tied to the format used. While an A0 chart might contain all the information it is neither practical nor feasible to expect the gallery viewer to carry it around the show, consulting it as they go.

Final Thoughts

'End of the Line?' is not intended to be a study into creating the perfect timeline. Instead it was proposed to highlight areas for improvements in timelines situated in the exhibition of *Century City.* This is not to say that findings from this paper and its subsequent designs could be used to create more effective timelines generally but this paper forms the foundations of on-going research between the authors. The findings established from this study are being used to design more effective ways of communicating the information displayed in *Century City*. These new designs will form part of the case study on the exhibition within Emma E. Ashman's PhD entitled *'Curating Tate: A Study into Exhibition Histories'. Century City* was chosen because of its curatorial ambition to curate nine cites over a

century; Ashman is interested in the inconsistent relationship between design and curation that exist with exhibitions at Tate. This paper has demonstrate the lack of consideration for design in the exhibition planning process; highlighting how it is often a late decision to include info-graphics through timelines or visual design in exhibitions. In the case of *Century City* this resulted in a lack of coherency in interpretation and contextualisation of both the art and city on display. The quantity of complex information to communicate to audiences meant that the exhibition had jarring juxtapositions that provided only a vague snapshot of the cities instead of an in depth analysis.

Visualizing Intangible Heritages: Challenges for Design Communication when considering "Humor" as a Territorial Asset

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Abstract. This paper presents the theoretical background, methodology and preliminary outcomes oriented to test how humor can be conceptually and visually modeled towards its strategic consideration in community local development initiatives. This model called "4Hum-", digs into etymology to address the research question about how to embed the term's multidimensionality by re-connecting "humor" with "human", "humility" and "humus". This info-graphic is permanently evolving as part of an on-going process. The working hypothesis has been tested previously in the frame of "ASSIST 2010, Summer School of Arts and Sciences for Sustainability in Social Transformation", that took place in Gabrovo (Bulgaria). This city is being gradually recognized as an international capital of humor and satire, reinforced by its existing cultural institutions such as the House of Humor and Satire. These positive results led to enlarge the scope of the research. Thus, nowadays, the "4hum" conceptual and visual model is being tested within the European project "Happy-Nests: Incubating and connecting creative communities for social innovation as a means to improve local wealth in peripheral regions", for 2013-2015 period. Finally, the author aspirates that humor, through info-graphics and visual communications, could become a weapon of "mass construction", for further investigations in this field.

Keywords: Theory of Humor/Intangible Heritage/Local development.

1 Introduction

Humor is an intangible cultural heritage. It can be exchanged for free, consuming no material resources nor generating waste while acting as a wellbeing catalyzer. Thus, humor can also become a territorial asset for regional development if valorized conveniently. Such a goal represents a challenge for design communication as it has to tackle both with its inherent complexity and polysemy, in order to select the milestones to create a shared repertoire together with citizenship.

This paper presents the theoretical background, methodology and preliminary outcomes oriented to test how humor can be conceptually and visually modeled towards its strategic consideration in community local development

initiatives. This model called "4Hum-", digs into etymology to address the research question about how to embed the term's multidimensionality by reconnecting "humor" (health, laugh, creativity, being-well) with "human" (society, culture, values), "humility" (bottom-up perspective, honesty) and "humus" (territory, process, life cycle thinking).

This info-graphic is permanently evolving as part of an on-going process. The working hypothesis has been tested previously through a series of workshops in the frame of the first edition of "ASSIST 2010, Summer School of Arts and Sciences for Sustainability in Social Transformation", that took place in Gabrovo (Bulgaria). This city is being gradually recognized as an international capital of humor and satire, reinforced by its existing cultural institutions such as the House of Humor and Satire, for whom "the world lasts because it laughs".

These positive results led to enlarge the scope of the research. Thus, nowadays, the "4hum" conceptual and visual model is being tested within the European project "Happy-Nests: Incubating and connecting creative communities for social innovation as a means to improve local wealth in peripheral regions. Case studies in Gabrovo (Bulgaria), Canary Islands (Spain) and Lodz (Poland)", supported by the European Cultural Foundation for 2013-2015 period.

Finally, and according to clown master Jango Edwards, the authors aspirate that humor, through info-graphics and visual communications, could become a weapon of "mass construction", for further investigations in this field.

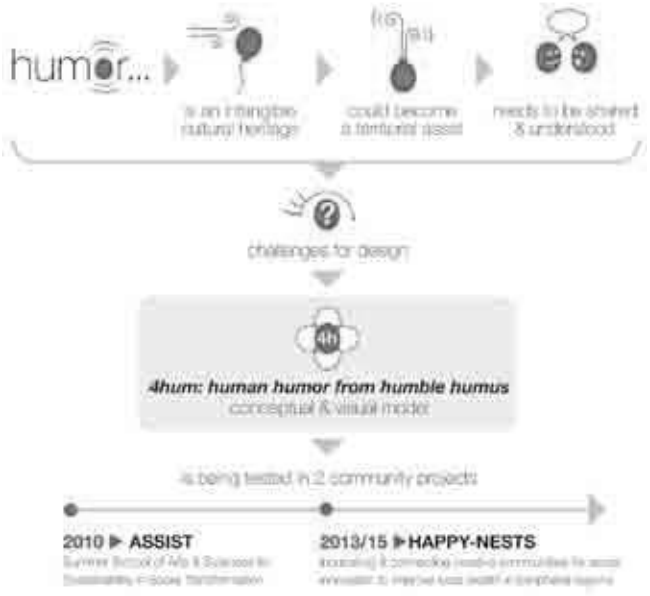

Fig. 1. Article's diagram. Own elaboration.

2 Humor's Inherent Complexity and its Potential for Community Development Initiatives

Why do we talk about humor's inherent complexity? And, how can it be harvested and valorized for community development initiatives? In the following paragraphs, we intend to give answer to these two questions.

First, the word "humor" encloses a rich and vast phenomenon from an anthropological point of view, which seems to have been frivolled or simply misinterpreted often in recent ages. Just by taking a look under its epidermic meaning, we can find previous researches suggesting that the words humor, human, and humility share the same Indo-European root, "ghôm-" or "humus", related to fluid and earth[1]. In ancient and medieval physiology, humor was considered as any of the four body fluids -blood, phlegm, choler and melancholy or black bile- whose relative proportions were thought to determine state of mind -good humor- (Hippocrates, V b.d.). Later on, Galen (II C, a.d.), found in humor the physiological reasons for nine different temperaments, thus developing a matrix that combined hot/cold and humid/dry with the four elements –water, air, fire, earth-, resulting in characters such as sanguinary, choleric, melancholic or phlegmatic. In conclusion, good humor's notion was linked to good health and good mood or disposition. According to contemporary authors, such as Umberto Eco's The name of the rose, humor is deserved a special relevance. Here, Aristotle's Second book of Poetics is jealously hidden by clerics due to the fact that laughter is elevated to a higher art, capable of getting rid of fear, thus exerting a liberating effect on individuals and society, by subverting the establishment and domination hierarchies. It eases hard to handle situations, favoring the empowerment to become transformative agents for society, beginning by ourselves.

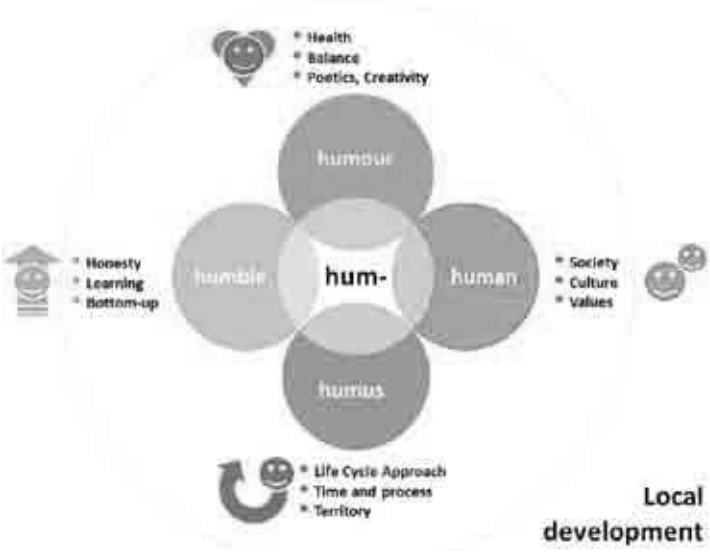

Fig. 2. First "4hum-" conceptual draft. Own elaboration.

So, etymology, philosophy and history provide us with key signals to reconnect humor with human, humility and humus. Addressing the second question, this humor's multidimensionality becomes a guide principle upon which an agenda for local community projects could be set up, commencing from this intangible heritage. Accordingly, the first drafts of the "4hum-; human humor from humble humus" model were thus conceived for the city of Gabrovo in 2010.

3 Challenges for Design

Just a brief clarification beforehand: our approach to the Design activity is that of projecting "from vertex to vortex"[2][3] and vice versa. That means evolving from the traditional form configuration skills (vertex) towards a role of creativity flows catalyzer (vortex) [4]. Thus, design process for local and community development can be properly understood as a strategic activity referring to different disciplinary levels (services, communications and products) to promote systemic innovation processes (environmental, social, economic, technological) starting from the territorial resources[5].

Therefore, once the model's main dimensions and complexity levels have been conceptualized –which it also implies a Design task-, it is time to address the more specific dares attached to the role of the designer as visualizer.

Visualizing the model is a crucial design challenge at this point, as:

- it makes the intangible heritage perceptible,
- it allows the concepts to become operative,
- it defines the segment of users able to understand, manage and decode the model,
- it educates, or at least, it provides the basements.

And in sum, it determines the success of the model itself and its applicability to reality.

4 References and Previous Experiences in Visualizing Humor for Social Means

In order to reinforce this transversal aspect around humor phenomena and its potential when applied to social innovation, existing references worldwide have been analyzed during the research. The following are only an excerpt of them, listed according to its preponderant ambits:

- Health. Theodora Foundation's study of hospital clowns who showed the positive impact of humor in both sick children and their families[6].
- Energy. Play-pump is a playground that uses the energy generated by children playing to pump and store water for the community. South Africa, 1996.

- Planning. Christian Nold proposes San Francisco Emotion Map, a map of the different emotional states of the city according to the different neighborhoods.
- Landscaping. Urbanarbolismo proposed participatory reforestation playful "Battle Green", adapting the technique of clay with seeds (Nendo-Dango, M. Fukuoka), to the popular Spanish festival of "tomatine" (battle with tomatoes).
- Tourism. A. Muller proposes a souvenir consisting of a Dutch tulip bulb packed in a box of cow dung, converting the waste into resource.
- Community Development. "Smiles per Hour" measures hourly smiles in neighborhoods as an indicator to improve the health and welfare of its residents (Port Phillip, Australia).
- Burial. The Merry Cemetery of Sapanta (Romania), it is customary to create humorous epitaphs that highlight aspects of the deceased, written in first person.
- Wealth indicators. The Happy Planet Index (HPI) provides a new "compass" by measuring what truly matters to us – our well-being in terms of long, happy and meaningful lives – and what matters to the planet – our rate of resource consumption. By the New Economics Foundation.

Besides, during the ASSIST Summer School in 2010, a deep research was carried out in the city of Gabrovo, to collect diferent samples of its local heritage, both tangible and untangible, as we will show here. The citizens of Gabrovo are notorious for their unique sense of humor (Table 1). Regarded to be both good at moneysaving and bargaining, due to historical crisis, they've learnt how to get something out of nothing with humor. Theirs is a profitable lesson to deal with emergent paradigms, such us sustainability and uncertainty.

Table 1. Some examples from Gabrovo's Oral Heritage. Source: Gabrovo Anecdotes, 1978 [7]

It is said of the Gabrovians that they...
• Cut off the tails of their cats so they can close the door quickly and save heat when letting a cat out; hence, the black cat with a cut-off tail has turned into a long-lasting symbol of Gabrovo town.
• Fit taps to the eggs to tap as much as they need and no more for a soup, for a whole egg seems too much to them.
• At night they stop their clocks to save wear on the cog-wheels.
• Put green spectacles on their donkeys' noses when they feed them shaving so as to make the poor beasts think that it is hay.
• When they invite people to tea, they heat the knives so the guests can't take any butter.
• Why don't people from Gabrovo buy refrigerators? Because they can't be sure the light goes off when the door's closed.
• Why do people from Gabrovo switch the lamp on and off every now and then when they're reading a book? To save energy while turning pages.

At a visual level, there exists a rich collective imagery representing the above mentioned jokes and funny stories, becoming brilliant examples of visual poetry in some cases. In Fig. 3, we include some samples from the House of Humor walls.

Fig. 3. Mosaics from the House of Humor walls, representing typical local funny stories and jokes.

Moreover, this intangible heritage has been materialized in different varieties of common objects. Samples from local material culture closer to the "4hum-" model, have also been analyzed. Briefly, we include here a kind of crafts made by potters near Etara Ethnographic Park, also available at House of Humor (Fig. 4). There's a wide range of products, from a mug to keep the moustache dry, to a coffee set for guests (which are separated in two halves), tablespoons with a hole in the middle, misleading or jars (high but with very little background to host liquid), or jugs only for left-handed.

Fig. 4. Funny local craft. Gabrovo's House of Humor.

Within the ASSIST, I was in charge of the "humor for local development" workshop. There, all these samples were explored and analyzed to evolve and give sense to the first "4hum-" draft. In order to transcend the rational and private dimension during the transition phase from analysis towards creative synthesis, disinhibiting group dynamics coming from clown and theatre were introduced. This playful atmosphere was critical for getting a proper physical and emotional predisposition to work with humor. The multitude of proposals generated, from the most concrete and immediate to the more strategic long term, were collected on a large map, geo-referenced and classified by areas (mobility, health, waste, education, public space, energy, etc.) to be eventually displayed at the Municipal Art Center, where they were shared and discussed in a festive environment with local community (Fig .5).

Fig. 5. Different stages of work: group dynamics, discussion of proposals, parades and community return.

5 The "4hum-" Visual Model in Progress. Current State

The results and dynamics from ASSIST 2010, served as a basis upon which to continue developing and testing the model. The current European project "Happy-Nests" tends to give continuity to those preliminary hypothesis for 2013-2015 period. The paradox that Bulgaria ranks 123rd among 151 countries included in the Happy Planet Index, is one of the triggers hat gave birth to this project, exploring issues such as the relationship between arts and wellbeing, inter-disciplinary, cross-sectorial cooperation between scientists, artists and cultural workers in order to develop new sub-indicators or guide principles. Firstly, it has been created a logo and a seal, which it will be placed on initiatives and organizations promoting social joy and well-being according to "4hum-" model (Fig. 6).

Fig. 6. Logo and rubber stamp for the "4hum-" model, shaped from "h" letters. Carlos Jiménez.

The former "4hum-" draft has evolved into a spider diagram in order to measure the performance achieved in the different parameters related to its four main dimensions (Fig. 7). The final parameters and indicators still have to be discussed among the participants along the following meeting (expected for mid-October, 2013). In this sense, a worksheet has been created to help in this deliberation process (Fig. 8).

Fig. 7. Example of "4hum-" model in spider diagram, in order to measure and visualize the performance for each parameter. Carlos Jiménez.

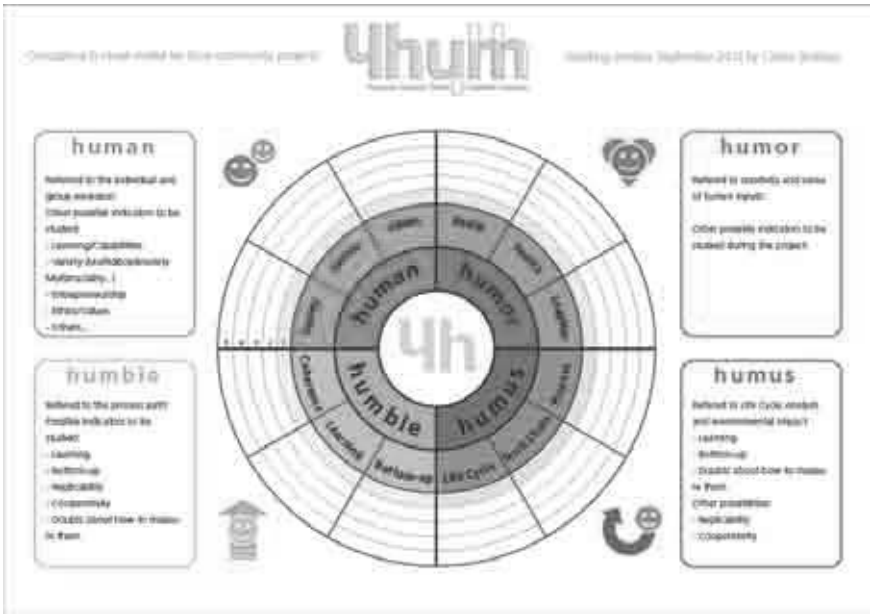

Fig. 8. Worksheets for participative discussion in order to refine the model. Carlos Jiménez.

6 Discussion and Work in Progress

As we have seen, there is still much to be done here. This is just a humble contribution of what it can be developed, including the first preliminary versions. The future updates of the visual model, should accomplish at least, the following criteria and process considerations:

- to engage local support groups, as communities of practice, to test the model further in its different dimensions, counting also with Design schools,
- to improve the indicators, its characterization and metrics,
- to cross and adapt findings from existing similar initiatives for the creative and cultural sector,
- to improve the visual model, both its appearance and visual ergonomics (by finding proper metaphors, aesthetic languages) and its dynamicity (testing modularity, formats…),
- to make it easy to use and available to general public, though it is primarily intended for social agents such as cultural managers, local entrepreneurs, NGOs, researchers and "artivists",
- to develop an easy-to-handle physical version and an online one together with a discussion community.

Next steps will imply more social actors to make this advance together. Citizenship needs to be engaged by having in mind that community processes are an end in themselves, not just a means. Being able to talk, to dialogue thus enriching assemblies and sharing horizons is a worthy design success. Projecting humor-based cultural policies is such a "serious" (i.e., rigorous), complex and worthy task that needs to be fed up with those tools and techniques able to rescue us from boringness and solemnity. Communication Design has to echo from that in order to support it and being significant. In peripheral contexts such as Gabrovo, humor can become a commuter to shift from a disappearing classic industrial map, towards something so-called creative and cultural industries. It's something still very blurry, not excessively modeled yet, that needs to be designed and spread as well. To a great extent is up to us, the visual communicators, by invoking also at our role of catalyzer of creative flows, to make things happen.

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Managing Complexity in Bio-Design Practice

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Abstract. Bio-design is a field where design and biology work together: Bio-designers can take inspirational sources, principles and strategies from the environment to imagine new products or find ways to connect people. This approach is suitable in fragile environments, providing innovation independent of location and technology level, given its foundations on self-evolving nature. Innovation is introduced through the detection of local peculiarities, even in the absence of a structured socio-technical system.
Bio-designers borrow strategies and solutions that provide multidisciplinary innovation and network diffusion. This is usually necessary because designers build their works within complexity and sort complex information. In this paper, we explore how complex information management evolves in the field of Bio-design. Complexity originates mainly from human and socio-cultural aspects. In case studies regarding the emerging countries, we show that a practical approach derived from Participatory Design can develop new solutions to include marginalized people and invigorate economy, supporting development. Each application field is an experience of its own, being the feasibility of collaboration practices extremely variable: certain customs and religious beliefs can limit people's willingness to share opinions, whereas different local ethics can promote a participatory approach to development. Here, communication tools are crucial to make every stakeholder properly understand his role. We take into account communication strategies for involving users and other kinds of stakeholders into Participatory Design projects within the Bio-design approach. Other case studies concern a product space analysis within complex economic systems, translational tools to share information between scientists and designers, and divulgative approaches to explain Bio-design to the people. The goal of the paper is to determine how complexity is faced within bio-design, combining strategies from scientists and designers.

Keywords: Bio-design / transdisciplinarity / ecosystems

1 Introduction

In this paper, we define the concept of Bio-design, a novel approach to design whose aim is to embrace, and not to fight, complexity.

Design specifies objects, intended to accomplish goals, in a particular environment, using a set of primitive components, satisfying a set of requirements, subject to constraints. By its very definition, design is a process that has to deal with a large amount of factors: goals, environments, communities, components, requirements and constraints. Human progress has greatly enlarged each of these factors: technology gives us more goals and components; we have access to more diverse and evolving environments and constraints; requirements are continuously pushed to the edge.

In this present scenario complexity arises. Complexity is the fundamental property of complex systems, systems for which the global behavior cannot be understood by the behavior of the single parts composing it [1]. We unveiled the presence of complex systems in many aspects of our world. Complexity theory [2] now percolates throughout many disciplines. Examples are ecosystem analysis, where patterns like nested structures of species and ecosystems [3] and food webs [4] show the huge repercussions of small changes in the nexus of interacting biological elements. This causes a paradigm shift in contemporary natural sciences [5], together with a new conception of nature-culture relationships, acknowledging the human dependency on a healthy biosphere [6] and the vision of "nature as culture", aiming to re-establish an intrinsic human connection with nature [7]. The same paradigm shift happens across other disciplines: equivalent nested pattern of ecosystem can be found in the ecology of international trade [8] and in the micro-behavior of supermarket customers [9].

Design cannot be considered immune to this paramount paradigm shift. It has to morph into the Bio-design concept that we present here. By its very definition we have presented, design is intrinsically a process characterized by complexity. According to Ken Friedman, *"design is not central but is part of a network that can regulate the network itself"* [10]. Designers often act in a parasitic way: design solutions emerge and give results when working together with other disciplines. Mediating these disciplines is complex, and it is much more so when these disciplines are marked by complexity themselves.

Mentioning networks is not by accident. Complex networks are one of the principal tools used to tame complexity [11], and one of the central aspects of Bio-design. Networks are used to map the interactions between entities, even many interactions at the same time [12], and they have been used to demonstrate the emergence of ubiquitous complexity in many fields: social relationships, technological networks and biological networks all show the same patterns of scale free connections and bursts of activity. In Fig. 1 we provide a small example of a network, where we can see how entities are represented as nodes (circles) and they are connected with edges if they are interacting. Rich infor-

mation like the direction of an asymmetrical relationship and node attributes can be included in the model (in this example, with arrow heads and colors).

A paradigmatic example of complex network usage is in networks of scientific collaborations. An objective inter-textual analysis based on the papers presented to the SEAD Network was used to build project networks involving scientists, engineers, artists and designers. In these networks, scientists-engineers are not recognizable from artists, whereas designers are. *"[Designers] overcome the non-separation, acting as hybrids and standing out as network hubs: they reveal to have more connections than expected by chance alone [...] they are probably better at collaborating with each other, [...] they could also collaborate with artists and scientists at the same time, bridging the gap between the two cultures"* [13].

We now present in detail what Bio-design is, and how it represents a promising way to overcome the resistance to complexity.

2 The Bio-design methodology

2.1 Approach

As hubs and connectors, designers deal with complex project networks and environmental complexity around the design goals, including socio-technological factors. It has been proved that these issues can be faced with laws coming from the biological field, such as metabolic laws and tools for ecosystem analysis.

The Bio-design approach emerges as a design methodology based on nature, whose expertise can be used for design purposes. It can be defined as a project philosophy and strategy that poses its basis on a participatory relationship with nature, as environment and the design object are part of the same complex system. Both in individual designs and complex systems, growth, effective settlement and long-term stability have to be driven by collaborative networks [14] along with competition. The connection is then approached in a collaborative perspective: nature can provide design solutions as well as design material. According to Bio-design, nature and design should have a mutual connection and a

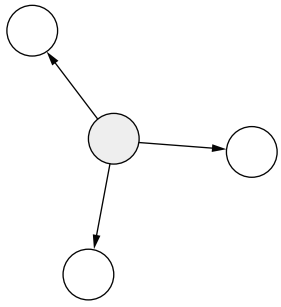

Fig. 1. A small directed graph representing a network.

tight grade of coexistence, thus design goals can be part of natural phenomena and natural processes can support design.

Its methodology allows projects to be set up and sustained by the ecosystem where they take place, integrating into its metabolic balance. Metabolic qualities of homeostasis and system coexistence can become design criteria and generate tools to improve participatory design by adding a complete environment awareness.

2.2 Solution space

The Bio-design approach aims to overcome the difference between man-made and natural designs, by exploring a solution space drawn by multiple axes of symbiotic qualities and integrating principles of evolution, metabolism and stable conditions within ecosystems. According to the "bio-thinking" approach, meeting values of safety, cyclicality and "solar" sources of energy1 means to reach bio-compatibility. When having to meet complexity, the solution coordinates have to be set within a more articulate, trans-dimensional space, where different goals unify to set an optimal area of transdisciplinary bio-compatibiliy, constantly repositioning itself over time and over change.

The dynamics of optimal Bio-design require project goals to undergo continuous variations. The goals move from reaching stability through constancy, within a set of changing parameters in a constant environment; to reach stability through change, within changing parameters in a transdisciplinary evolving space. This model is deeply based on the idea of fitness constraining adaptation and the allostatic model, as an alternative to homeostatic regulation under stable environmental laws [15] and allows to improve the definition of the design goals coordinates by enriching their space definitions, thus enclosing the focus in a more contextualized space.

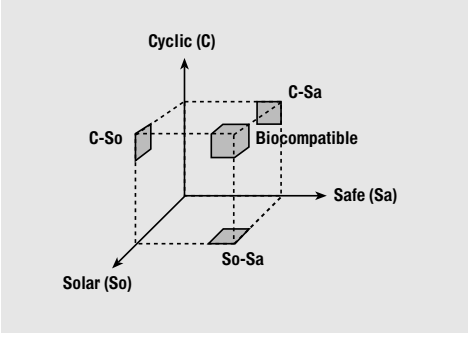

Fig. 2. The 'bio-thinking' Bio-design solution space (Datschefski, 1999)

1 Energy sources can be defined 'solar' only when all the energy and materials flows are powered by photosynthesis, muscles or renewable energy [16].

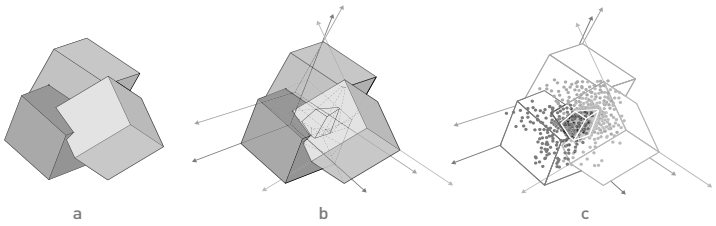

Fig. 3. Transdimensional solution space model: different disciplinary values are involved (a), identifying a common space (b); the more complex is the space, the more precise is the solution level of definition (c)

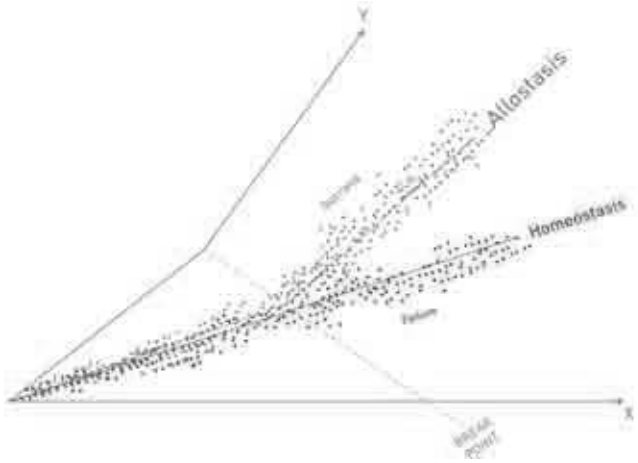

Fig. 4. The allostatic model: stability through change

2.3 Environmental factors

In socio-eco-systems, multiple factors intervene at the same time, often unpredictably. Environmental factors are complex to gather and express, and their relationship with the final effects involving single artifacts and people is difficult to find. However, social factors do influence complex behaviors, such as citizenry health. Social disruption causes afflictions such as stroke and heart disease [17]. This can only be understood by overcoming complexity with a systematic approach, as Bio-design does. With the same approach, it has been possible to explain phenomena of apparently overwhelming complexity, such as synesthesia: brain paths rewiring towards a different sensory ability has still to be explained in neuroscientific terms [18] but if we include the external environment as part of a unique experiential process [19] it is clear to understand.

Coincidences are often serendipitous, events linked beyond complexity [20], explainable with an integrated theory of complexity. Bio-design is based upon a

comprehension of complex systems derived from the analysis of nature, therefore examples reflecting its methodology can be found even before its theoretical introduction as expressions of success adaptation to complexity and change.

3 Origins and early adopters

The rules of 'good design' have been anticipated by collective design and improvement of archetypal domestic objects. The result was an experience that both design historians and critics call "anonymous design" [21]. This experience has been successful lately, especially with the project and exhibition "Super Normal" by N. Fukasawa and J. Morrison (since 2005). In the same way, the Bio-design methodology has been anticipated by popular wisdom in integrating man-made objects, systems and landscapes into the natural environment as parts of a stable, collaborative system. Many of these projects still exist or find place in the shared memory.

A very early example of successful Bio-design principles implementation can be found in the traditional cave houses in Cappadocia, now protected by Unesco. Constructed by carving rooms into the soft stones of basalt and tufa at the feet of the local mountains, shaped by wind, sand and rain into, letting the rock harden after contact with air, they are still providing a space dynamically integrated into the changing natural environment. Besides reflecting the evolving aesthetics of the local inhabitants, they have been made to protect from harsh climate conditions, ranging from -20°C to nearly 40°C, while keeping the internal temperature almost constant, usually from 7°C to 15°C [22]. Albeit having issues related with the limits of this building technique, such as acoustical comfort and space rigidity, they offer an optimal temperature and air quality and reflect many among the Bio-design principles:

– integrated instead of additive construction
– optimization of the whole instead of maximizing individual parts
– energy saving [23]

– can be recolonized
– mimic and integrates nature's materials (rock and wood)
– have been planned in advance of future, resisting to variations [16]

Along with structures, other examples of an early Bio-design vision can be found in artifacts and functional infrastructures. In Mediterranean countries, especially Syria, Morocco, Spain, Portugal and Italy, the design of water-wheels is almost unchanged since the introduction of the *saqiya* and *noria* archetypes in Egypt from the I century BC. Water-wheels successfully combine nature and technology, optimizing the human gathering of natural resources and setting a dynamic relationship with the environment [24].

Whereas water-wheels have been successful in integrating technical activities with the social life of people, to introduce a socially sustainable water pumping

device in the arid regions of Zimbabwe has proven to be a slower process. The so-called "Zimbabwe Bush Pump" has been introduced in the 90s and is a remarkable example of visionary system thinking.

The pump design is successful because entirely thought for the African environment, and not just in terms of climate and soil. It is not the result of any adaptation: it is a device that works well by mechanical adaptability and social participation. It produces innovation by meeting society and promoting local networking forms, by encouraging village level participation while respecting the natural equilibrium.

"Village women push the iron crossbar to drive the auger into the ground, while village men sit on the bar to weigh it down and children dance around" [25].

The successful adaptation of these devices has been expressed with the term *fluidity*, which is not only a stable system network model but a model for dynamic, complex networks and a key value for an allostatic coexistence of technologies in emerging countries. In all the examples shown, the effectiveness of a Bio-design-like methodology is proven by a good, changing relationship with a specific local environment. This has happened also at wider scale after the Industrial Revolution. We witnessed the growth of manufacturing districts as forms of auto-organization [26] towards a symbiotic coexistence of various stakeholders. Another example is Todmorden, a town where in 2008 the inhabitants spontaneously started to work for a viral urban gardening project based on self initiative and cooperation. Like in the case of Italian districts, that have not been able to find a proper spreading strategy worldwide, the main issue to their survival is the scale passage from the local to the global.

4 Local scale

When taking into account the Bio-design methodology application in local contexts, the most insightful case studies come from the emerging countries, where socio-technical systems are less structured and the cultural environment is often different from the common reference model. There, designers can contribute from the first analysis to the development of a stable network. Firstly, society is analyzed as an ecosystem and innovation is foreseen as a metabolic improvement of the whole. Design practice has to set itself the goal of improving the environment it stands in, working in a context of metamorphosis, dealing with change. Society is expected to undergo continuous change, as ecosystems do. Designers should then recognize existing attitudes towards collaboration, like in the case of Ubuntu, a widespread African ethic valorizing the power of communities, collaboration and interdependence [27].

Starting from the local experience of communities, they can start to build networks, to make people collectively participate to innovation processes that they will develop without the necessity of external guidance. Community building can start from local resources, coming from the natural and socio-cultural environment. The Bio-design approach allows these communities to act as networks and to be shaped according to natural laws of collaboration. Social net-

works are built as allostatic systems, promoting a stable coexistence together with transformation. Network building and management permits innovation by fluidity: in emerging countries, design constraints have to keep flexible limits. Designers should preserve flexibility, as well as nature does. An example of this can be found in the Shack/Slum Dwellers International[2], where local communities are empowered with technological and organization tools to improve the quality of their lives.

A relevant field study is the one lately conducted in the context of developing a context-based device for enabling children who use prosthetic legs to walk in mud in the rural areas of Cambodia [28]. This research project aims to test Participatory Design methodologies on field, involving marginalized people of different social position, together with doctors and technicians. Whereas they find a structured set of barriers, that they mapped and tried to overcome with the tools of psychological empowerment, the prototypes developed by the participant groups reveal the extreme need for more advanced designs and the big potentialities of emerging countries.

5 Global perspectives

The scale passage from local contexts to global perspectives, along with the origination of complexity from transdisciplinary issues and connections, bring out a critical complexity. Bio-design methodology aims to solve it with an integration of natural strategies and system view. The socio-cultural context is viewed as "natural environment" of the project to be developed. The focus is on making connections and building networks for communication, fostering innovation by removing requirements that would be bonds. This approach puts socio-technical and socio-ecological systems on the same level, with user participation intended as a natural process and not an option, according to a systemic thinking. The quality of design and communication depend on heterogeneous skills, therefore participation is essential and the contribution of Participatory Design tools is an advantage.

There are some limitations. For instance, there are no user participation strategies applicable to specific, local contexts. Also, Bio-designers do not have a clear profile as regulators of transdisciplinary networks yet. Their role is often confused with that of "bio-makers", emerging skilled professionals that can merge nature and design but do not have the disciplinary abilities to deal with different contexts, scale passages and long-term planning. The field of healthcare research is especially relevant because of a critical information flow between designers and doctors/biomedical engineers [29]. Nevertheless, it is promising when taking into account regenerative medicine, where smart materials are being conceived thanks to a Bio-design methodology for applications in devices such as scaffolds [30] and placing designers in the initial phase of research can expand market opportunities [31].

2 http://www.sdinet.org/

6 Conclusions

In this paper, we presented a new design process called Bio-design: a new design methodology aiming to embrace complexity, rather than fighting it. Bio-design is needed due to the deep level of complexity we currently face. Complex issues have to be solved by transdisciplinary teams and these teams need new paradigm with which operate, and Bio-design is one of them. It is based on the relationship among complexity theory and ecosystems behavior. According to the Bio-design approach, designers can take inspirational sources from nature and its laws, such as the collaborative networks supporting coexistence and the allostatic model, to solve complexity. We presented ancient predecessors of Bio-design, namely anonymous design, environmental architecture and fluid socio-technical structures. We detected in each of these examples the main issue of moving from a local to a global scale, meaning increased complexity. We finally provided the example of Participatory Design, that teaches what are the social barriers to overcome and provides hints to do it through participation, whereas the transdisciplinarity model refines the solution space, helping to clarify the goals.

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Minerva: an Information Visualization Tool to Support Philosophical Historiography

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Abstract. In this paper we introduce and discuss Minerva, a collaborative effort between communication designers and humanities scholars in understanding how information visualizations can support philosophical historiography studies. Proceeding through a concrete case study, we present an investigative process that has led to a first iteration prototype of a digital tool for the exploration and the interpretation of large text corpora combining term frequency visualizations with text annotations. What distinguishes this project from more traditional approaches to text analysis and visualization in the digital humanities is its foundation on an open-ended and collaborative experimentation rather than on a requirements-driven development. As part of a broader research project, this work aims also at exploring opportunities and challenges of bringing together scholars, designers, and computer scientists in the definition of novel research practices in the humanities, involving data visualizations and rich graphical interfaces.

Keywords: Information Visualization, Philosophical Historiography, Digital Humanities

1 Introduction

Although many humanities disciplines have traditionally found it difficult - if not impossible - to integrate computational tools, based mostly on quantitative approaches, with their research methods, in the last years new research areas and activities are increasingly emerging from the intersection between humanities and computing. Today, terms such as “digital humanities” or “cultural analytics” indicate a growing and diffuse effort in understanding the implications and the opportunities that digital technologies can provide as media, tools, or objects of study in the humanities [1, 2]. Within these new disciplines and initiatives, information visualizations and rich graphical interfaces are increasingly adopted to explore and make sense out of big and heterogeneous amounts of data [3, 4], contributing to lead “some of those who have held numbers, calculations, and computers at a safe distance for a long time to warm up to new computational possibilities” [5]. However, in a context where most of the methods and the

technologies are still adopted from other disciplines, the biggest challenge seems to be imagining new genuine research tools and methods capable to embed and valorize humanities endeavor [4, 5]. Moreover, the design community appears today barely involved and poorly interested in the discussion and designers are nowhere to be found [6].

Stemming from these considerations, the work presented here moves in the direction of better understanding how humanities scholars, designers and computer scientists can collaborate in the definition of new research processes involving digital technologies, information visualizations and visual interfaces. In particular, we introduce and discuss a project involving design researchers from the Politecnico di Milano and humanities scholars from the Università degli Studi di Milano, aimed at investigating the use of information visualizations to support the exploration and the interpretation of text corpora in the field of philosophical historiography. Working on a specific case study - Immanuel Kant's text corpus - the project has moved from the design of several visualizations to the definition of a first prototype of a digital tool for the exploration of large corpora of texts.

Focused on the evolution of one author's lexicon, the tool - Minerva - provides two main views on the text. The first one is a visual representation of the whole evolution of the lexicon across the different works of the author, showing and comparing terms frequency. The second one is the ability to access and work on the text by searching and highlighting terms and creating annotations at different levels of scale, such as words, paragraphs, or chapters. Beside simplifying and speeding up the research process in the context of philosophical historiography, Minerva aims also at providing new ways of looking at the texts and generating new possible paths of investigation, combining a direct and 'close' access to the text with a 'distant' view provided by the visualizations.

2 Background and Motivation

This work is part of a long-term research agenda focused on understanding the role that design - in particular communication and information design - can play in the 'computational turn' [2] that humanities disciplines are currently experiencing and that involves an increasing and heterogeneous set of initiatives by humanities scholars and institutions on the use (and the study) of digital technologies. With this goal in mind, in the last years, the DensityDesign Research Lab at the Politecnico di Milano has established a series of collaborations with other universities, research groups and scholars [7, 8] with the specific intent of deepening the relationships between design, humanities disciplines and computer science. More practically, focus of these collaborative efforts is the study and the design of information visualizations and visual interfaces to support humanities research. The work presented here stems from the possibility of extending this dialogue to the discipline of Philosophical Historiography, by working together with a group of researchers from the Università degli Studi di Milano working on Immanuel Kant.

The discipline of philosophical historiography is part of what we can call literary historiography, which implies dealing with texts - written works - and which is, in turn, part of historiography in general [9]. Philosophical historiography differs from those "histories about material factors" and thus concerning facts, since it is focused on those "ideal factors", such as ideas and theories, mostly contained in written texts [9]. In this sense, as history of ideas, theories and texts, philosophical historiography is, basically, hermeneutic: the interpretation of objects endowed with meaning and resulting from an intention, an expression of a subject (author), with whom we need to establish a dialogue.

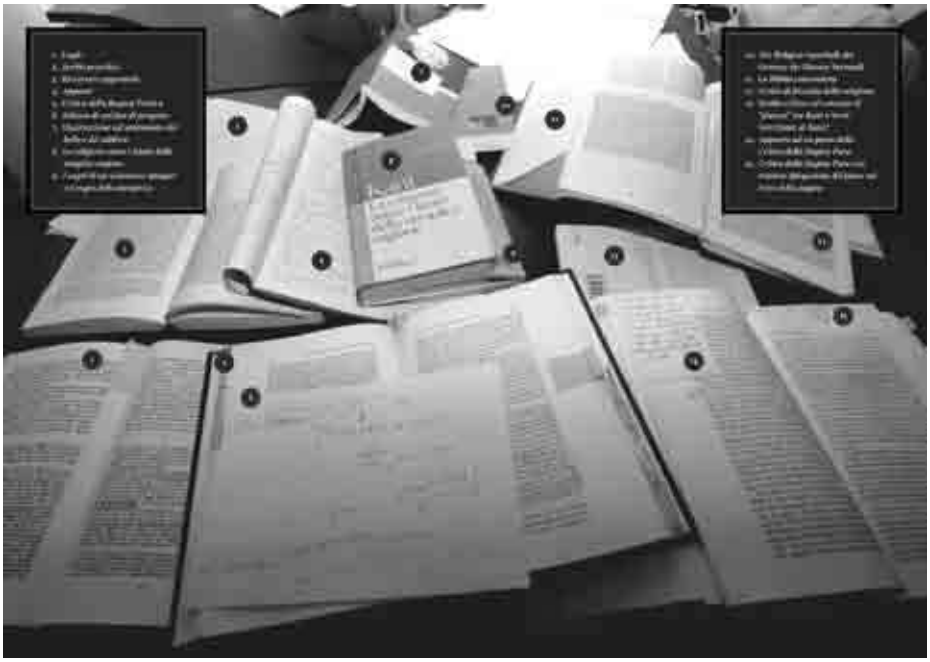

Fig. 1. A typical scenario for the researchers: a complex and intricate network of books, sketches and notes

The "Centro Ricerche Immanuel Kant" at the Università degli Studi di Milano, aims at developing researches about Kant's thought, with particular attention to his sources in previous centuries and significance for contemporary debates [10]. The main purpose of the center is to create research groups, workshops and seminars concerning issues connected with Kant: "Quellengeschichte" (i.e. "history of sources"), contemporary interpretations of Kant's thought, immanent readings of his works. Luca Valzesi and Nicola Patruno, the two researchers mostly involved in this project, have been collaborating with the center directed by Prof. Piero Giordanetti for five years now.

Their research on Kant moves through an accurate analysis of the historical, political, social and psychological realities the author lived in and was surrounded by. Each single term used by the author in his work conceals semantic, social

and psychological implications that play a substantial role in understanding author's thought. The usual research work is based on browsing thousands of book pages, looking where and how terms appear, identifying sources the author refers to and analyzing his background, the library and cultural context (see Fig. 1). This process, which moves through a continuous observation of structures and patterns of evolution, represents the primary tool for the reconstruction and the interpretation of author's thought.

Fig. 2. The result of a query on Korpora.org

As a first step, collecting and cataloguing the data represents a huge effort for the researcher, especially due to the high heterogeneity of both the collecting methods and the data sources. Moreover, since each researcher develops his own strategy to deal with the complexity of such a network, sharing both data and results with other researchers becomes often very difficult, if not impossible. In order to speed up the research, the group at the Center makes use of Korpora.org [11], an online digital edition of Kant's works, for searching across the entire corpus and accessing the actual text, organized in chapters, sections and verses (see Fig.2). The tool is particularly helpful to the scholars, since its ability to search across the entire Kant corpus, saving a significant amount of time and effort.

However, a tool like Korpora.org, even if it represents a huge step forward in speeding up and improving the research, it suffers from some limitations. In particularly, moving through subsequent search queries makes it difficult to have an overview of the whole distribution and evolution of terms across the texts. This affects both the exploration of a single term as well as the relationships between two or more terms. While identifying each term occurrence in the corpus and looking at the original context in the text is certainly an important feature, the reconstruction of this fragmented view is never recomposed within the tool: researchers have to assemble the pieces by their own, outside the tool and through time-consuming efforts. Moreover, this query-driven approach forces the research to start from a specific term. Instead, looking at different terms at once

and at their relationships and evolution could represent a complementary view that is now particularly difficult to obtain. This is especially true if we think at the lexicon of an author as a dynamic structure that is continuously evolving over time and where each term assumes a specific meaning according to the whole system it lies in.

3 Related Work

While philosophical historiography does not frequently appear in the countless discussions and initiatives within the digital humanities panorama, texts, as the primary media and objects of observation for many scholars and disciplines, have received great attention both in terms of analysis and visualization. Historical and Literary studies, in particular, have a long tradition with this kind of tools for exploring and working with texts [12]. The TAPoR website [13] represents a rather exhaustive and updated collection of research tools for textual studies. The 300 and more projects presented and reviewed on the portal provide a very heterogeneous set of analytical and visual tools that differ by task (i.e. gathering, cleaning, editing, searching, visualizing), discipline (i.e. literary studies, library science, computational linguistics, natural language processing), data (i.e. single documents, text corpora) or language. About one third of the tools involve the use of information visualizations, applying traditional visual models (e.g. tag clouds, network graphs, bar charts, bubble charts), as well as expressly created ones (e.g. TextArc, Voyant Lava, Voyant Flowerbed).

Among these, the Voyant tools appear as one of the most popular and complete tool. More than a single tool, Voyant is a web-based text analysis environment. It allows performing lexical analysis (e.g. study of frequency or distribution data), accepting several text formats from different locations. A set of additional tools allows to perform further analysis or to visualize the results through different visual layouts, such as Voyant Links [14], showing links between terms by using graphs, or TermsRadio [15] and Termometer [16], deploying term occurrences within documents and over time through graph lines. Voyant appears particularly helpful in providing and juxtaposing a series of visualizations on the texts and thus offering several points of view at the same time. The possibility to look at the text where an analyzed term or piece comes from is a valuable feature, since, as we have seen before, a deeper understanding of the context is an essential for the kind of research carried out by historiographers.

The collaboration between designers and scholars in this project has been characterized by an open-ended process, inspired by the idea that "rather than redeveloping tools based on principles of unity and coherence we should rethink our tools on a principle of research as disciplined play" [12]. From this perspective, the research, more than complying with well defined requirements, has moved from a rather generic set of heuristics and needs coming from both the specific case study (see ¶2) and an analysis of the current literature (¶3). Involving continuous discussions and exchanges between the participants, we

encouraged an approach based on "trying something, seeing if you get interesting results, and if you do, then trying to theorize why those results are interesting rather than starting from articulated principles." [12]

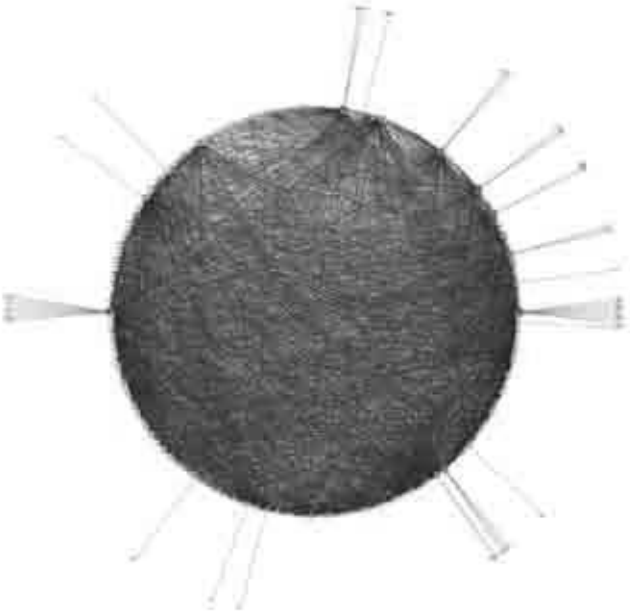

Fig. 3. A graph network showing "unicum"

The research started with the selection of one thousand of the most relevant words - according to the scholars - in the Kantian corpus (58 works, 4500 pages) that have been searched using the Korpora.org tool we have previously described (see ¶2). After numerous attempts, characterized by a progressive refinement of the search criteria, a list of all the term occurrences in the respective pages and works has been obtained. From this list a first words-works bipartite graph has been developed, by connecting each term to the works it has been found in. The graph provided the researchers with a first - rough but comprehensive - view about the relationships between the terms across the entire corpus, offering them a new perspective from which to look at Kant's work. Despite an initial moment of skepticism by the researchers, mainly due to the high density of elements and relationships in the network and after trying different graph layouts, several interesting aspects emerged. For instance, one of the force layouts applied on the graph showed at a glance those words that appear only once in the Kantian corpus - called "unicum" (Fig. 3).

As a next step, we decided to focus on the evolution of Kant's lexicon, making possible for philosophers to examine the data, validate assumptions and provide new insights for future research, the research has moved in the direction of finding a proper visual model capable to display terms occurrences over time, at

a glance. As we have seen in chapter 3, the current state of the art of analysis and visualization tools provides some valuable examples to proceed from, to move in the direction of increasingly supporting the experience by the researchers.

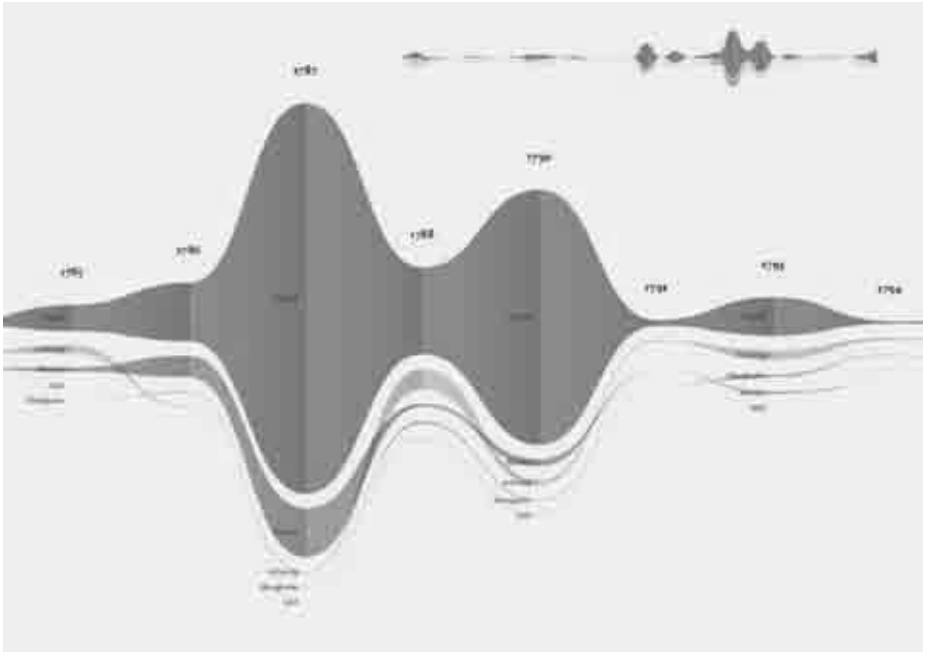

Fig. 4. Streamgraph of *Aberglaube, Absolut, Achtung, Adel, Begriff* from 1785 to 1794

After some attempts and experimentations, the streamgraph has been figured out as an effective visual model, since its ability to show the evolution of lemmas (in quantitative terms) across the works (and the time) and, at the same time, to compare them work by work. A version of the streamgraph has been developed to better isolate and identify the flows and highlight terms frequency. After structuring the data for the visualization, some first drafts have been realized, aiming also at collecting some first feedbacks from the researchers, about the visual model and its readability (Fig. 4). As a first result, the visualization has confirmed already known patterns (as the evolution of key terms in the Kantian corpus, such as "Ding an sich" and "Noumenon"). But at the same time, the complex architecture of Kantian vocabulary, immediately assumed a tangible shape. From the streamgraphs, a poster, sized 200x100 cm, has been printed to work as an *historical atlas* of the terms, representing a privileged point of view to examine the top 100 most important words of Kant's production, showing the relationships between terms frequency over time at a glance (Fig. 5 and 6).

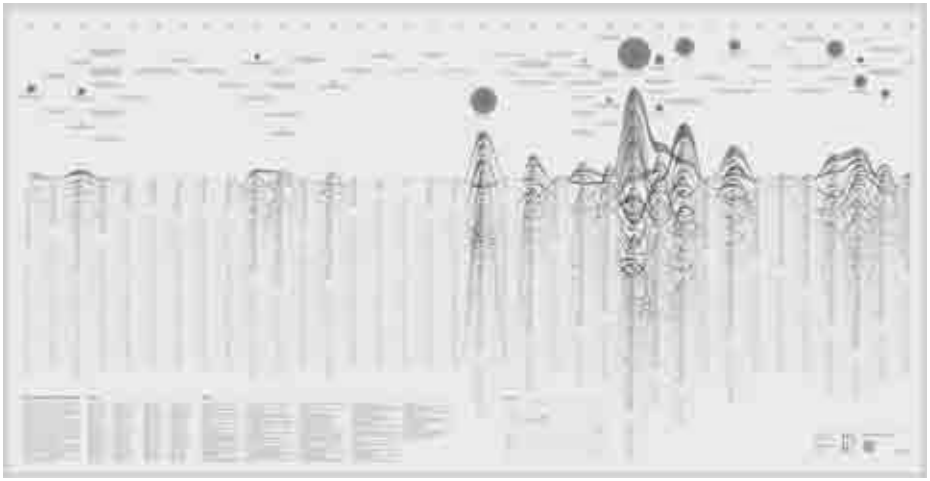

Fig. 5. The *Atlas of Kant's Legacy*

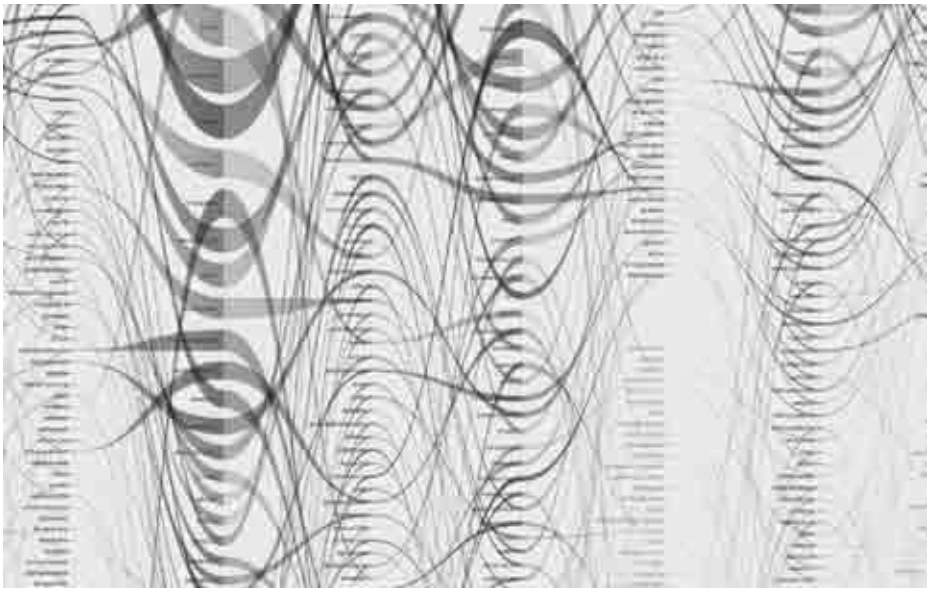

Fig. 6. A detail of the *Atlas of Kant's Legacy*

While the poster has been received positively by the researchers, it allows to examine the evolution of only 100 selected word and it does not provide a direct access to the text, which is essential for the kind of work carried out by the scholars. Thus, the next step has been the design of an interactive tool to browse and view all the terms and, at the same time, to directly consult the text. Starting from the positive results of the previous visualizations, and in particular the streamgraph view, we had the idea of combining in a single environment the ex-

ploration of the words stream, with the ability to work directly on the text. In this way it would be possible to search, trace and study the words in the context they have been used and to add comments and annotations to the text. From these considerations, Minerva has been conceived.
Minerva is a web tool that aims at integrating *close* and *distant* readings of a text using data visualizations and text annotations. A streamgraph allows to look at the evolution of an entire corpus's lexicon, work by work, with the possibility of focusing on specific work or terms. An annotation system, instead, makes easy to approach the actual text in an incremental way and to add notes to any part of it.

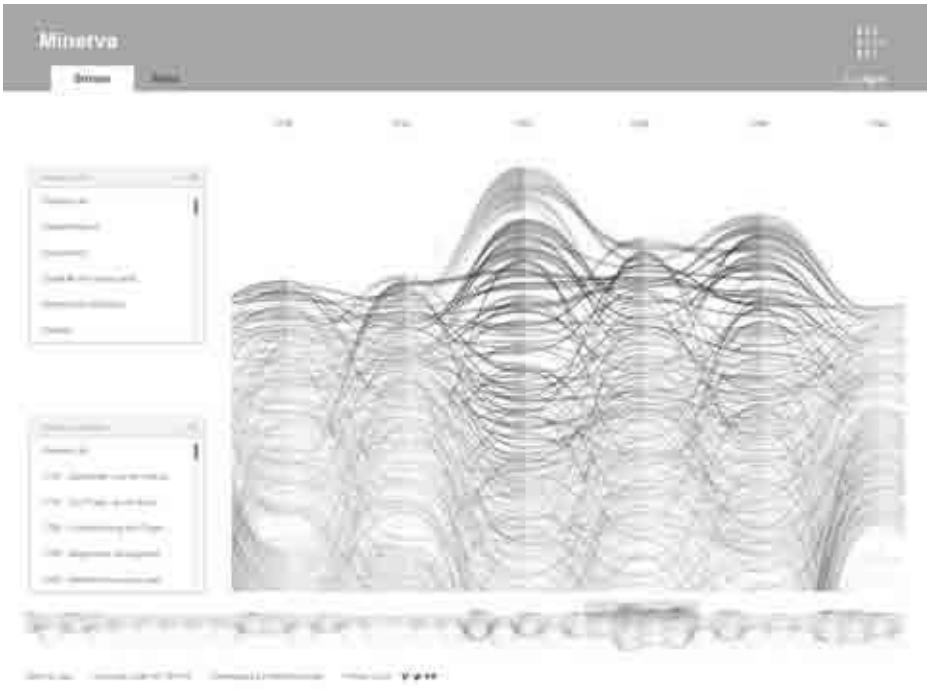

Fig. 7. Streamgraph from the Minerva tool

Selecting one or more streams of words (see Fig. 7), the researcher can observe in a second moment in which parts of the works they appear, progressively approaching the written text (each square corresponds to a verse) (see Fig. 8). Selecting a square then he can enter the text and read the verse (this step allows to switch from the synoptic view of the presence of the words in the verses to the corresponding verse, fundamental aspect for the researcher). Once in the text, notes can be attached to the verses, which will enable the scholar to build its research process (see Fig. 9).

Fig. 8. The synoptic view in Minerva

5 Discussion

One of the aspects that have been emerged from the design of the visualizations and the tool has been the observation of a certain distrust of digital technologies by the researchers in the group. This can be mostly explained by the lack of confidence about the implications of using such technologies as a means for collaboration and publication. In this sense, Minerva aims at providing a valid compromise between the public and private dimensions of research, in allowing the users to decide what to share.

Concerning the specific solutions we came up with, in terms of the tool and the visual models, we have to some that deserve attention. In particular, the specific topic of visualizing terms evolution provided interesting challenges that deserved an higher attention and that have been somehow in this work. In fact, while initially, we tried to build a visual system to highlight not only a single term distribution over time but also the mutual relationship between terms and their lexical evolution, at the end we decided to avoid this and considering terms as separated flows that never merge.

6 Conclusions

In this paper we have presented Minerva, a collaborative effort between communication designers and humanities scholars in understanding how information visualizations can support philosophical historiography studies. Minerva has provided a very interesting opportunity to experiment with data visualization within a disciplinary context, the philosophical historiography, where the use of visual languages has been poorly investigated. We have experienced and presented a design process that has not been simply limited to the technical implementation of pre-established requirements but has moved across a continuous and dialectical collaboration between the participants involved, generating a fertile and agile research environment. The achievements reached so far by the two actors involved are a promising starting point for further investigations and a confirmation that communication design can play an important role within the development of new humanities research tools, based on digital and visual environments.

Currently, Minerva is still under development, but as soon as the tool will be completed, we plan to test it and improve it, gathering feedbacks from philosophical conferences and communities, at both national and international level. Moreover, we would like to better understand the contribution that Minerva can bring outside the specific context of Kant's corpus and philosophical historiography, as a support for the analysis of texts by other authors and within other domains.

Acknowledgments

The authors want to express their thanks to all the people that have participated in the project and sustained its development. In particular, we are especially grateful to Luca Valzesi and Nicola Patruno from the Centro Ricerche Immanuel Kant at the Università degli Studi di Milano and Bernhard Schroeder, Bernhard Fisseni and Hans-Christian Schmitz from the Universität Duisburg-Essen.

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An Information Design made by a Non-Designer: a Visual Representation Based on Experiential Logic.

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Abstract. There are certain cognitive tasks that come built in: organisation of ideas in categories and subcategories, employ of analogies and metaphors, narrative thinking, analytic and synthetic thinking. Information designers, based on theories of visual perception, intentionally develop design strategies, that aim to evoke or facilitate the above categorising and reasoning processes.
By contrast, this case study presents a graph of a family tree made by a non-designer, whose qualities are not products of learnt convention, but results of exquisite organisation and a clearly defined purpose. By referring to visual perception theories I will briefly describe these characteristics.
I will also explore how this work seems to have a biological basis: its structure, at the same time that helps information to reveal, stands as visual metaphor of the human body. Forms and colors were intuitively arranged in ways that it "felt right" to do.
It also stands as a proof that every design, like all human productions, is not only an external manifestation of certain mind or biological procedures, but also of the value system of its creator, the ways and the specific conditions under which it was developed.
Simply by organizing logically its complex content, the designer of this work, even if he has left it unfinished, not only provides information about a certain genealogy, but also narrates stories and provides insight and evidence about several ethnological and sociological facts that occurred in southern Greece in the last two hundred years.

Keywords: information design / non-designer / family tree / experiential / logic / gestalt / image schema / metaphor

1 Introduction

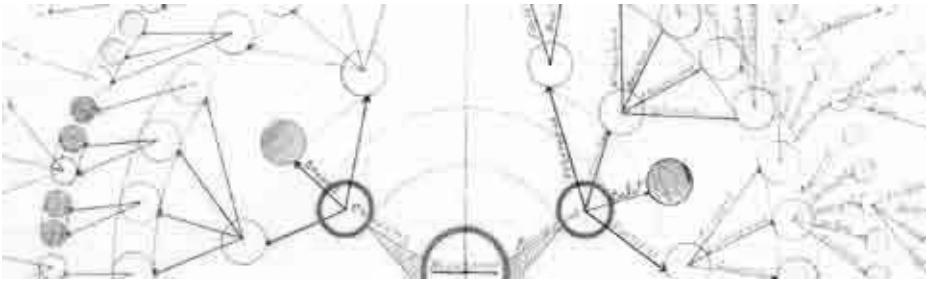

Fig. 1. Detail of the original design, by Panagiotis Tsampras (1934 - 2006).

Some years ago, while arranging some old family records and papers, I found a tree visualisation, of my family. Obvious by the handwriting, it was made by my father, P. Tsampras, probably in the early seventies. The purpose of this genealogy chart, which was not meant to be an info-visualisation in the strict sense of the term, was to show a particular surname's itinerary in time, also the people who played a role in its continuation. It was not looking its origin in terms of etymology, but in terms of heritage: from who to whom it was given, who kept it until the present day and more importantly who would transfer it to future generations.

What stuck me, was the clarity by which the data were depicted. This information design was made by a non-designer, in fact he was a veterinarian. Though, it seemed to be more "correct" in the sense of efficiency, than dozens of others I have seen in the press, on the internet, or even in the graphic design department of the university I worked the last four years as an assistant professor. It is likely that my father had been exposed through his education and career to graphs, so he knew how to read them. Still, knowing how to read a graph is a necessary but not always a sufficient condition in order to design one. What is necessary, no matter how simple or self-evident the task might seem at the beginning, is to to have a clear idea about its purpose in order to choose which data are important to show, what is relevant or not. Also to understand what are the relations between these data, meaning their inner "structure", and how to depict it. Eventually this "how", is what I argue that comes intuitively, as a natural and also as an effective choice, as long as the conditions above are fulfilled.

The case study presented below does not aim to prove that all non-designers are capable of producing effective designs. It rather aims to show that this particular one possessed skills, deriving probably from his scientific background, that any professional information designer should have. Also, that a professional designer could have chosen similar visualisation techniques reinforced by learnt convention, experience and conscious intention. In order to support the above

suggestions, I will use as tools Gestalt and Image Schema theories as well as theoretical studies of R.S. Wurman and Edward E. Tufte.

Finally by analysing the morphology of this specific piece of work, I will make some observations regarding the personal value system of its creator and will extract interesting information regarding certain ethnological facts. In order to support my conclusions, in this last case, I will refer to specific demographic records.

2 Description and Observations on the Tree

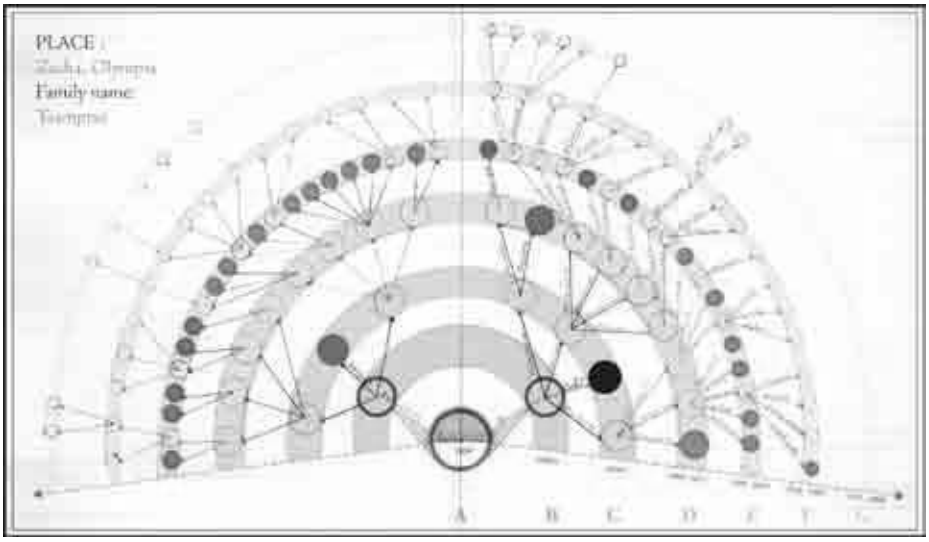

Fig. 2. The compete design. Color dots have been retouched digitally. Some other elements have been added: verbal information on top, the timeline and an extra layer in order to emphasize the concentric circles.

The design under scrutiny was made on a piece of paper with the help of a pencil, a compass and three color markers. Today probably these tools would have been replaced by digital ones from the palette of any advanced design software.

The rest of the "technical tools" that were used, remain indifferent to technology. They are the same that anyone may use today: organisation of ideas in categories and subcategories, analytic and synthetic thinking, employ of analogies and metaphors, and narrative thinking. [1] Below, I will describe how these cognitive procedures found their external manifestation in lines and colors.

2.1 Data Organisation and Structure.

In order to remember and, above all, understand data, the human brain has to classify them: to make categories and subcategories of things, ideas, faces etc. According to Richard Saul Wurman's *"LATCH"* theory, we organise information

by Location, Alphabet, Time, Category, or Hierarchy. [2] Information designers tend to create graphical representations that stand as visual metaphors1 to the above ways of data organisation. Depending the nature and the relations of the data, they will intentionally choose appropriate structures (linear, network, hierarchical etc), in order to better represent them.

In the same way the designer of this graph chose a hierarchical structure, specifically a tree structure: all nodes representing males are linked to their fathers, except one, the initial. This decision makes sense, since the question evolves around "who" - an origin - and not "when" where a linear structure (like a timeline) could have been used. The names of the members are written beside the lines representing the links. Surnames are not included at all, since all the members share the same one.

After the second generation, each son is marked with a different color, thus creating his own sub-tree or "category". Normally, when representing data, mixing different methods of organization, like time and hierarchy, ends up in chaotic forms. However in this case, describing something simultaneously in terms of hierarchy and category, seems to work. That way the overall structure of the design could be described as a *"tree-pie"*, where not only the hierarchical relations became obvious, but also the number of the categories created and the size of each one.

Finally, regarding the selection of data, what is interesting is the absence of female members: no wives or sisters are included. Taking into account the initial purpose of this graph, women's names would have really been "irrelevant data". As Edward Tufte proposes in one of his principles [4], in order to reveal information, designers have to *"erase non-data ink"*. Female names would lead to no conclusion, or would provide no evidence about something. At that time, they couldn't give their family names to their children, neither there was a way to "measure" the degree in which a particular woman was responsible in the continuation of the family name. Contrary, males who left no descendants and consequently didn't continue the family name, were included in the graph because at the beginning of their life, they were "carrying the promise" of doing so.

2.2 Visualisation of Data.

Beauty (or "good form" in Gestalt terms) in this graph is a side effect: it derives from the fact all elements have a functionality within the entire construction. They enable the viewer to distinguish groups of data and make comparisons between them. Some of these qualities, are products of logic thinking. Others, might have an image schematic biological basis, therefore an experiential logic:

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1 "Information graphics derive much of their power to inform and enlighten through the use of graphical (or visual) metaphors. For example, the length of a bar in a bar chart metaphorically represents a quantity of objects... As with linguistic metaphors, visual metaphors map the characteristics of some well-understood source domain to a more poorly understood target domain so as to render aspects of the target understandable in terms of the source..." [3]

a. Radial structure.

Hyperbolic trees contrary to binary trees, employ hyperbolic space which inherently has "more room" than Euclidean space. The structure of this graph similarly to a hyperbolic tree is radial, evolving around an ancestor viewed as the the origin of the surname. By using concentric circles around him, where each one represents a generation, the informant unwraps seven generations of males. Nodes depicting younger generations become successively smaller and smaller, both by size and width of line. Thus, the designer gains space in order to depict more data on the surface of the rectangular shaped paper.

Furthermore, as Gestalt Theory [5] argues, humans have a natural ability to group visual information according to their similarity. One of the Gestalt laws of grouping, the law of continuity, states that there is a tendency to group together elements of objects if they are aligned within an object. Likewise in this graph, members of each generation are grouped together, since they are all aligned within the same center and they follow the same curvy path.

b. Coloring and length of lines.

As mentioned above, different colors help the viewer create different groups of data. Cognitive scientists also claim that certain attributes, like color intensity or hue and line length, can be processed pre-attentively, which means without conscious effort. In this graph, after the second generation, different sub-families, are distinguished by the use of four different and distant in the color palette colors. They are perceived as “closed shapes” contained in the tree. The size of each shape demonstrates the size of each sub-family. This concept is common in cartography, where countries with common boundaries are given different colors in order to identify their territories unambiguously.

Also “line length” is one of the above attributes that can be perceived quantitatively, which is important, since quantitative perception enables comparisons. Since sub-families are also perceived as lines, by comparing their length, the viewer gets an idea of each sub-family’s span in time.

c. Orientation and Perspective:

Mark Turner, cited by Rish [3], points out that “if we had evolved as amorphous, one-eyed creatures floating in liquid we would have no basis for forming concepts such as LEFT-RIGHT, UP-DOWN, NEAR-FAR, etc. But because we have evolved as bisymmetrical, binocular creatures in gravity, we naturally employ our bodily experiences as the basis for conceiving and describing more abstract concepts”.

According to *image schema* theory, first articulated by Johnson, our bodily experiences play a significant role, both in the way we form concepts and in the way we express them. Risch speculates that human form is a possible experiential source for the visual metaphor employed in vertically oriented hierarchy diagrams originating at the top, since human body presents also a hierarchical branching structure originating at the head. Probably this tree which is oriented vertically but with the origin at the bottom, has also an

experiential basis. “Alive” is a condition that human beings are experiencing mostly in the vertical position than horizontally. Likewise in this tree, alive family members are UP, in the air of the page. Metaphorically they continue to “breath” and evolve like the branches of a real tree. Dead members in the bottom, are static*2*.

The “hyperbolic-tree” structure mentioned above, gives also a sense of perspective as we go more “far” in time, therefore it may derive from the NEAR-FAR image schema as well as from CENTER-PERIPHERY schemas. Other elements also can be explained in image schematic terms, like sub-families contained in the tree (by CONTAINMENT schemas).

2.3 . Narrative Thinking and Evidence.

Edward Tufte by explaining the case study of Dr. John Snow’s map [7], where black dots were used in order to represent cholera deaths, proved that properly designed information visualization can help in forming hypotheses and evaluating available evidence. Similarly in this case, nodes of members who left no descendants, are filled with different colors, depending the sub-family they belonged (fig 2). Last generation’s members that left no descendants were not erased, since at the time the graph was designed, they were alive. Still, most of these “deaths” appear in generation “E”. A natural competence of human brain is to think in terms of cause and effect, that is to say to create *narratives3*: dots represent facts or “events” that occurred in a specific place, Oreini Olympia, during a certain period of time. Their effect was the ceasing of the family name. But what was their cause?

After consulting living family members, I found out the dates of birth and death of the green sub-family. I noticed that its members of generation “E” were born between 1892 and 1915. By completing the graph following the same pattern it was initially conceived, I erased members of the next generation (F), who left no male descendants. Though, I distinguished in both generations, those who died from infant (or child) mortality from those who died from biological aging, and those who left no male descendants from those who left no descendants at all (fig. 4).

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2 ...“We will call these orientational metaphors, since most of them have to do with spatial orientation: up-down, in-out, front- back, on-off, deep-shallow, central-peripheral. These spatial orientations arise from the fact that we have bodies of the sort we have and that they function as they do in our physical environment. Orientational metaphors give a concept a spatial orientation; for example, HAPPY IS UP.” [6]

3 A narrative (a story) is defined as “a chain of events of cause and effect relationship occurring in time and space”. [8]

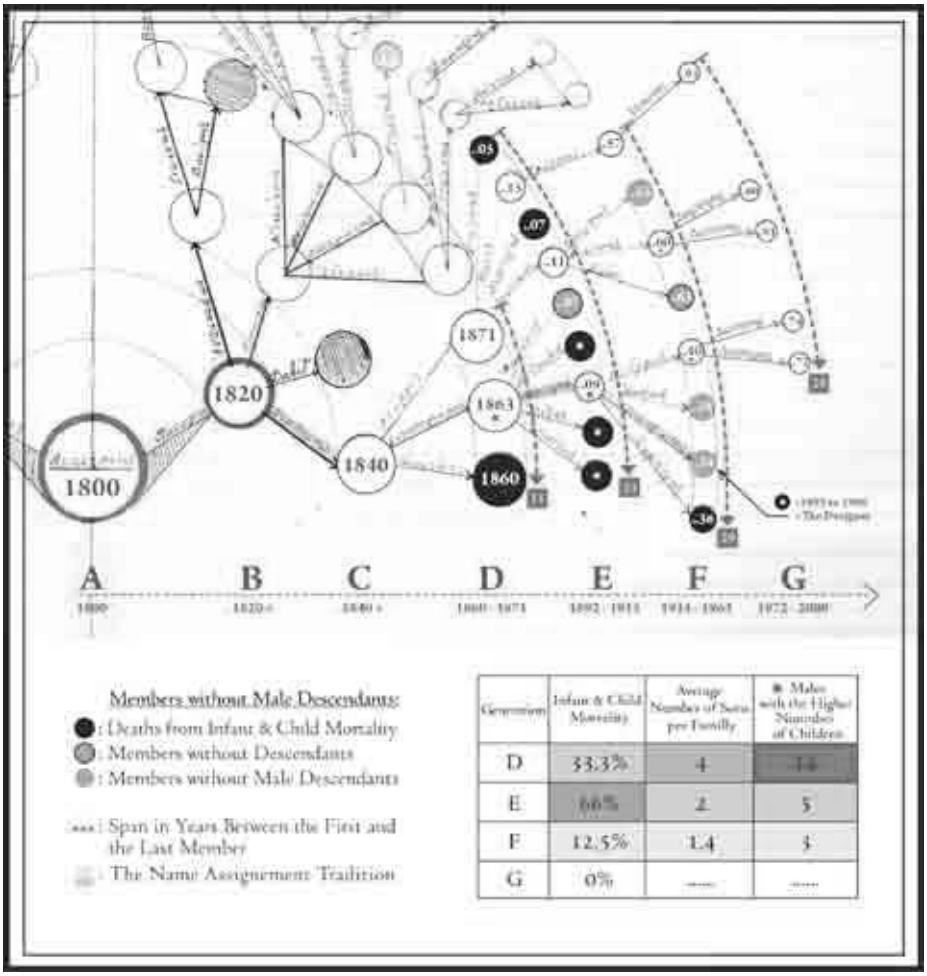

Fig. 4. The green sub-family: for Gen. E the basic cause of erased members is war related child mortality, while for Gen. F is the lowering of the total fertility rate. Males marked with a red star, are the ones that between their generation had the higher number of children, boys and girls included, as displayed on the table. (Dates on the timeline may "intersect" in other parts of the tree where data are not available. Dates of death are not included.)

(* One problem faced in this study, was that this graph has been left unfinished: dates and some of the names were missing. So, it could have been possible that people included at the same generation circle had the same degree of blood relation with the origin, but not at all the same distance in time. Dates added after research, proved that these people indeed lived around the same time.)

In this particular branch of the tree, generation E may had no direct deaths from war operations, however it had a high rate of child mortality related to poverty, illnesses and generally poor living conditions: only one out of the six erased members died old. Contrary in the following generation (F), five out of the six erased members died old.

Rates of child and especially infant mortality, as official statistics show[4], were high during that time, though they were also high before 1900, where life expectancy was not more than 36 years. So, it becomes obvious that both wars, as well as the 1918 flu epidemic, played a significant role in raising this number. Statistics also show that infant mortality indeed lowered after the 30's.

One more interesting fact visible in this tree, is that in successive generations, the number of sons per family is decreasing. Even if female descendants are not included in the graph, this gives an idea of the total fertility rate at that time in Greece, which indeed started lowering[5]. This is also a reason why some members had "fewer chances" in leaving male descendants. Hence, in this part of the tree, for generation E

the basic cause of erased members is war related child mortality, while for generation F is the lowering of the total fertility rate.

Finally, another element visible in the graph is the tradition of name assignment: the fist born son takes the name of his grandfather (fig. 4b). Though this last detail could have been better displayed, if brothers of the each family were always depicted in the same direction, from the oldest to the youngest.

The display of the above facts, were not among the designer's purposes when he elaborated this work. And this is exactly one of the most exciting things about information design: that it can can reveal, not just show information.

3 A Semiotic Approach.

"Hierarchy" (ιεραρχία) in greek, is a compound word: it is consisted by the adjective "ιερός" (ieros) meaning sacred, and the noun "αρχή" (arxi) that has several meanings: beginning, origin, principle and authority. The above term is not used only in order to describe the categorising method where data are organised by relations of relative importance to one another, but also the equivalent social phenomenon. Hierarchical relations can be traced thousand of years ago, between nations, social classes, families, or even members of the same family.

This organisational model is typical of greek families, where the older male is the most respected and the one in authority. Moreover southern Greece is characterized by patrilineality, a system in which an individual belongs to his or her father's lineage [11]. Still today, a very common question locals are

[4] Statistics about infant mortality in Greece: 1933:122.7‰, 1961: 39.8‰. [9]

[5] Number of births in Greece in 1931: 200.000, population of Greece in 1931: 6.500.000. Number of births in Greece in 1991: 98.000, population of Greece in 1991: 10.000.000. [10]

addressing to a foreigner when arriving in their village is: "whose man are you?" (meaning "to whom you belong?"). Even women's nicknames derive from their husband's first names. As strange as it seems, when it comes to define one's identity, ancestry and family name seem to be more important than one's first name or personal achievements. This possibly explains the motivation of the informant, why would someone at the first place was interested in creating a visualisation like this.

Finaly this father-line (patriline), with its well-defined organisation center[6], is a structure that finds applications in many centralized or authoritarian systems, though it could be "read in reverse": one could see the central node as a somebody supporting those around him. This suggestion is not very far from how parents perceive their role within the greek family. It is also a concept common to Christianity, where people understand god as the "shepherd", a supporter who offers guidance to his children. Typical orthodox churches depict this conceptual father in the center of their ceilings. George Lakoff claims that in the same way, the political arena in America reflects a basic conceptual metaphor of "the family" [5]. According to him, people understand political leaders in terms of "strict father" and "nurturant parent" roles.

The above thoughts are reinforced by the fact that this hierarchy, except its radial structure, is not inscribed in typical pyramid, but in a reversed one. The ancestor of the origin is bellow all his children. This model represents the idea - which many companies promote today as their organisational philosophy - that members of the higher rankings are responsible for the members of the lower rankings.

Conclusions

The above example shows that an amateur designer, having a scientific background, created an accurate design, a work of real beauty, after thinking logically. Then, shapes and colors, intuitively "popped from within". Professional designers don't work - only - out of intuition. They also follow methodologies, they know rules of visual perception and they intentionally apply them. Art universities tend to prioritize the teaching of technical aspects of design, poetic expression and intuition, over reasoning, analytic and synthetic thinking. But when it comes to information design, where organisation, accuracy in display of data and evidence are required, these last skills seem to be even more important.

Secondly, the designer under scrutiny, may created a hierarchic structure after the nature and the relations of the data he disposed, though specific underlying structural elements of this graph implied metaphors that probably he was not aware of. Professional designers should rather pay importance to which

[6] In graph theory, a branch of pure mathematics, "centrality" of a vertex measures its relative importance within a graph. "...and centrality, in turn, is one of a still larger set of concepts applicable to notions of communication and subordination in social systems." [12]

metaphors they choose to use. Because metaphors we create may have their roots in aspects of our experience, but in turn they can also create social realities [6], realities that later, like self-fulfilling prophecies, can not be escaped *7*.

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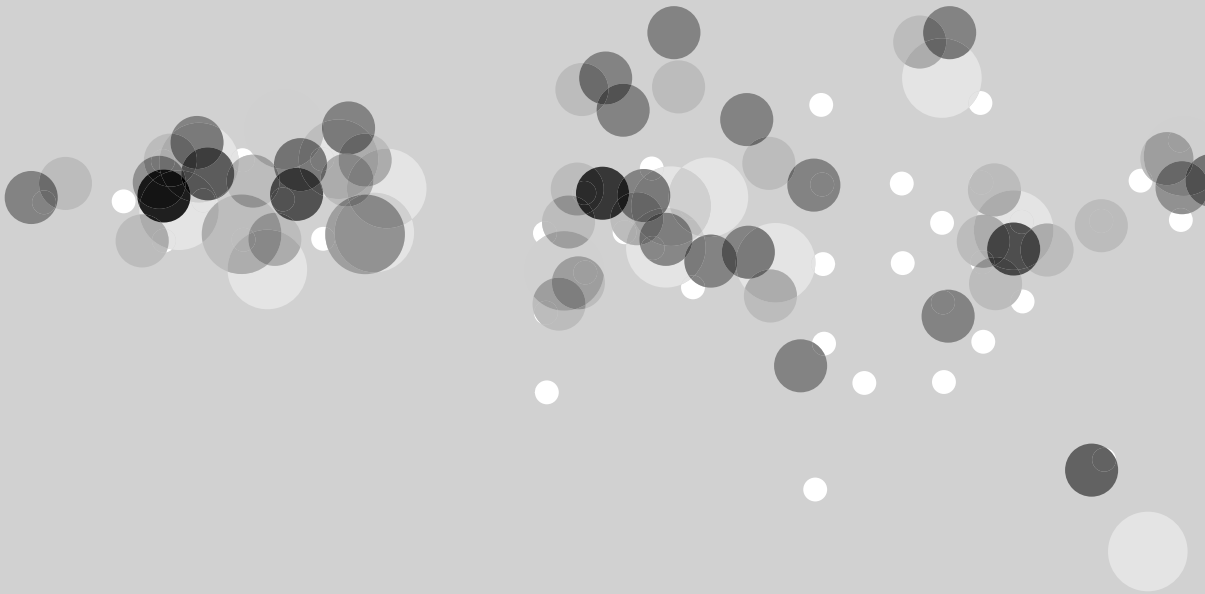
[7] Certain mathematicians would argue that there are ways to create graphs that can be accurate pictorial representations of abstract data, that they can carry the same “amount of information” with them. But will they carry also the same “type” of information? I believe that between two different codes there can not exist an absolute translation. In order to translate abstract informations in colors and shapes, designers will create visual metaphors. By choosing each time a different metaphor, data may remain the same but not also the overall meaning of the graph. Shapes and colors “add” information, because they have inherent characteristics and qualities that depending each time the context, they will carry connotations indifferent to the nature of initial data.

01. Full papers

2 : Interactive Data Visualization



Form follows what? Some Thoughts about Behaviours and Data Architecture in Dynamic Data Visualization

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Abstract. The aims of this paper is to underline the key role played by the way we "shape" data architecture especially when we try to visualize and communicate a complex process.

Keywords: Information Architecture / Ontologies / Narrative)

1 Introduction

What makes the difference between Interactive Data Visualization and the others two main topics of this "2CO Communicating Complexity Conference" - Informative Animation and InfoGraphics - it's real time and the ability of dealing with a huge amount of data.

Most of the times, Interactive Data Visualizations allows real time interaction for data manipulation (sorting, filtering, browsing ...), sometime they are dynamically built on real time data, in some occasion they show both aspects.

In most of these applications, the visual aspect of the "signifiers" is defined by a set of rules / behaviors that "translate" some aspects of the data architecture into graphics attributes (shape, position, color and so on).

This is actually the way all "data visualizations" have always been done; the only new thing is that, in a digital interactive application, we are now forced to describe those rules into an algorithm.

What users will see in our applications is the result of the combination between our visual algorithm and the data structure used to describe the process.

2 Why we visualize

We visualize because thinks are sometimes easier to understand (or to remember) in the visual - illustrated - format rather than as a text or a table of figures.

Cognitive sciences are there to tell us why but let's start considering the following examples:

Case 0: reverse visualization

We probably have all learned in our algebra classes that:
$(a+b)^2 = a^2 + b^2 + 2ab$

The formula above is not a very complex one but it's much easier to remember if we know what it represent.

But we have to admit that this example is tricky, the formula is a "compact" way of representing the same geometry showed in the illustration.

The abstract algebraic format may be harder to understand but it's easier to manipulate in others context.

At a certain point in human history it was an achievement to be able to represent geometric properties in a symbolic way rather than by drawing.

This case could be considered as an example of "reverse" visualization".

As many authors pointed out, we should never forget that texts, notations and images are all part of the same communication system [1]; Shapes and colors and lines, without a shared semantic agreement are not able to communicate by themselves. [2]

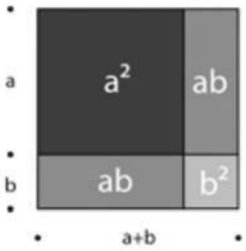

Fig. 1. (a+b)2 = a2 + b2 + 2ab

Case 1: dissemination: to translate into visual language

Not all the semantic agreements are equally easy to learn neither are they universally understood.

We still consider the language of images a more direct and universal one. Icons and visual metaphors have proved over the history their unique capacity to bridge linguistic and cultural boundaries.

So what makes experiences like ISOTYPE so different from, let's say, a romanic cycles of painting ? It is not, of course, the attempt to create a visual narrative for educational porpoises; it's rather the challenge to conceive a whole new communication system with its own grammar and syntax elements.

If we take a look at the classic ISOTYPE workflow, we will find on one side the editor (the curator), selecting the topic to be illustrated and the data to be showed.

On the other side we have the artist, who create the elements of the well none flat iconic alphabet.

And finally, in the middle, we have the transformer, the one who apply the ISOTYPE rules and give shape to the final illustration, searching for the best combination of elements to express the communication goal.

Now, this is exactly the role of nowadays visual algorithms, the ones we need to introduce real time data and/or interactive manipulation as part of this visual narrative.

The ISOTYPE method produced many beautiful illustrations, translating facts and figures into compelling visual metaphors, but very rarely suggest a "cause > effect" relation between the variables on display.

Correlation and causation, even if the first does not imply the other, are what statistic and scientific visualizations are all about.

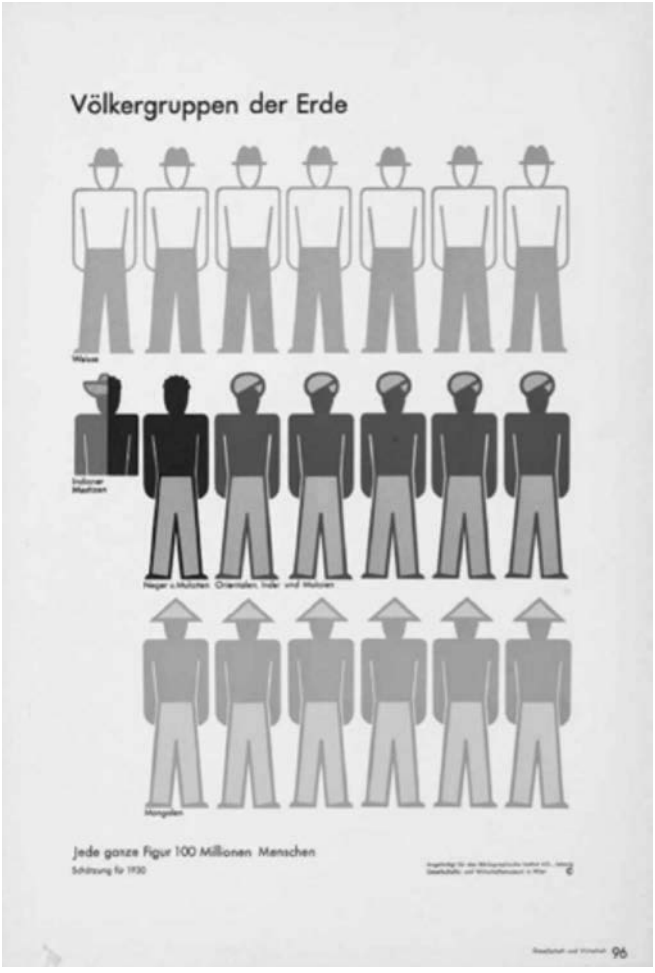

Fig. 2. Völkergruppen der Erde. - Gesellschaft und Wirtschaft

2.3 Case 2: analyze and discover, the statistic/scientific approach

Plot your data in a meaningful way and you may highlight the correlation between your variables.

It does not matter if you are testing your hypothesis, communicating your vision of a process, monitoring a system, or trying to discover something new.

John Snow's Cholera Map of London, in 1854, is the paradigm of many, sometimes much more sophisticated, diagrams used in statistic and, in broad terms, in science.

What all those diagrams have in common is not the lack of any kind of decoration, as Edward Tufte would suggest, but it's rather the attempt to describe a process showing the relations between its variables.

Scientific data visualization can afford some amount of illustration without any decrease in performance, it's just a matter of cultural / esthetic options; none other than ISOTYPE taste for flat icons and bi-dimensional diagrams.

Both approaches can lead to "dumb" visualizations when they just display a bunch of unrelated figures dressed with in an info-graphic esthetic.

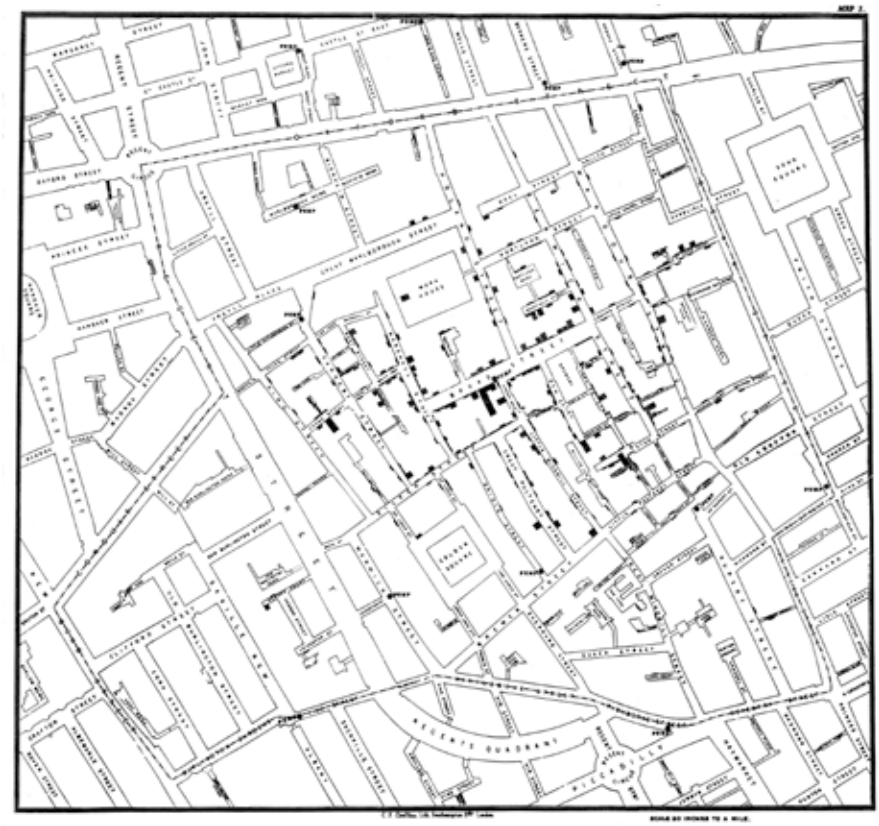

Fig. 3. John Snow – London 1854

3 Data wildlife - real time data in their natural environment

Real time data are often hard to hunt, even if thinks are now getting easier. If we look at the data visualization workflow proposed by Ben Fry [3]:
"Acquire > Parse > Filter > Mine > Represent > Refine > Interact"
more than half of the process has to do with how to get the data and how to make them work properly.

3.1 the post-desktop scenario

One of the most friendly environment to go for data is the "post-desktop" scenario created by cloud computing + web application and their respective APIs.

In this case data come in a very structured way and it's quiet easy to filter the kind of information we are looking for.

Flickr, Twitter ... but also other local "smart services" like bicycle renting network and so on, allows others to build their own "side" applications providing access to the same core data.

We all know so many examples fueled by data coming from those platforms but, among them, we would like to mention "Emoto London 2012", a project created by Moritz Stefaner, Drew Hemment, and Studio NAND with the aims of tracking the emotional response to London Olympics while they where still in progress. [4]

According to the authors: "... We track twitter for themes related to the Games, analyze the messages for content and emotional expressions, and visualize topics and tone of the conversation".

The result was a kind of a thermometer, shaped as a sophisticated origami-like diagram, ranging from "extremely negative" to "enthusiastic".

This was made possible by the "extra" algorithm that assign an emotional value to each twit; it could be a way to explore: 99% of API's structured data plus a few line of extra smart code.

3.2 semantic web and open data initiatives

The WWW have been semantic since the very beginning but most of the content is still "unlabeled".

Find the right schema for our contents, and being consistent in applying those rules every time we publish something new, is not a task for lazy people but it should be a must for every OpenData initiative.

Public data without a structured framework are better than nothing but they may result useless.

As an anecdote, the spanish house of representatives published for the first time in 2011 the "declaration of income" of each elected as a raster image of the income form, in pdf format.

A public crowdsourcing call, made by the association "Pro Bono Público", allows to transform all those almost unusable bytes into a proper database [5]. People was asked to "adopt" an elected and type the income form figures into a shared Google-Doc spreadsheet [6]. The task was completed in less than 4 days.

3.3 mining for data

Where existing structured data fails or when they are not available is the only alternative to explore.

3.4 your own data

Here is where we get to the crucial point; our opinion is that the quality of any data visualization rely mainly on the way we shape our informative architecture. By adding some smart features to data coming from an API, by crossing datasets coded in an "exchangeable" format, by mining the web or adopting the right standard for describing every variable we need to describe a certain process.

Let`s have a look at this "linear" example. Last year I was asked to create a 4 meter by 4 relations diagram for a public exhibit. [7]

The initiative, called "Territorio Archivo" and promoted by "Fundación Cerezales Antonino y Cinia",was about "collecting memories" among neighbors from 6 small villages close to Leon, in the north of Spain.

The structure of the graph is quite simple: a little bit more than 800 pictures connected to their owners (around 50 people) connected to their home village.

The goal was to give some kind of "synoptic" view of the photographic archive collected during the initiative.

A simple "force directed" algorithm was enough to produce the final result. Whats happened is that the "natural" configuration of the forces tended to put the biggest village in the center and this was considered *politically incorrect* by the curator who preferred a more *balanced* representation.

At the end the illustration was "manipulated" according to the curator wish for a non centric diagram.

But the key point here is that it doesn't matter what kind of algorithm you run; the more connected to the center, the heavier to the bottom, the biggest on the top ... the central role of Cerezales del Condado, the village where most of the pictures where collected, would emerge anyway because it's part the dataset and relations are shaped into the data architecture NOT in the visual algorithm.

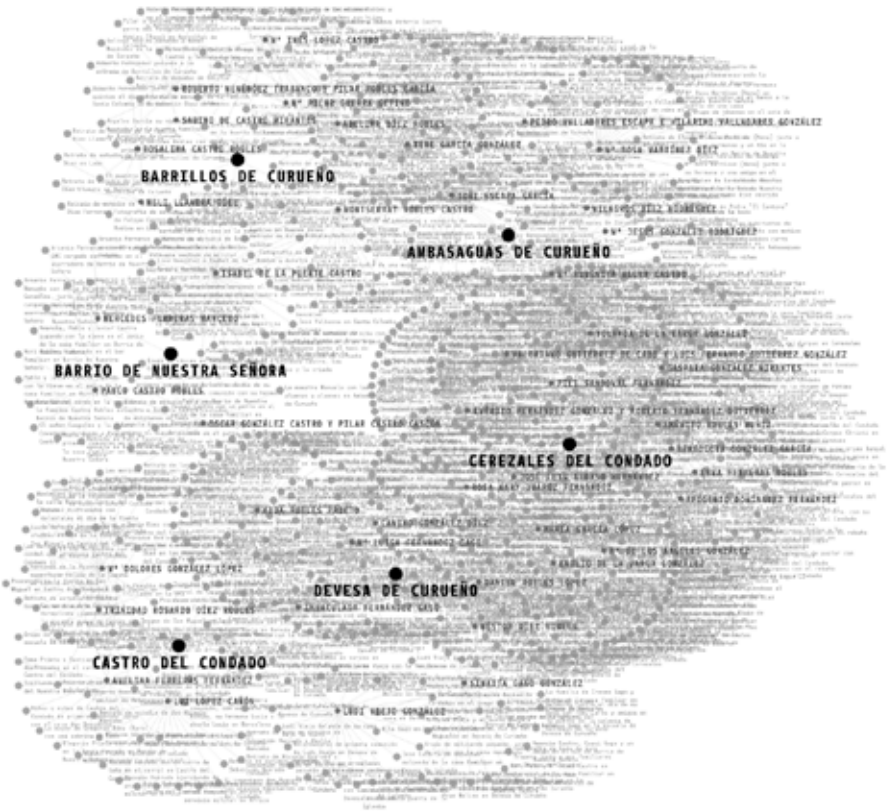

Fig. 4. Territorio Archivo – a force directed diagram.

4 Facing complexity

This is especially true when we have to deal with complex process.

Complexity is not difficult to manage, it's unpredictable. Most of Generative Art algorithms are able to create a complex / chaotic behaviour with a few line of code and starting from very simple rules. From an artist point of view, coding is a way to "loose control" over the final result, it's about creating a process and let him work.

In design, most of the times, we have a communication goal to achieve (even if loosing control over the result may still be a way to accomplish it). Complex processes are often difficult to explain because the cause > effect relation is no longer visible and this is because of the feedback.

Feedback is the "trademark" of complexity; the properties of a complex system "emerges" from the relations between its parts and they are no longer there when you split the system into its components.

In order to face complexity we have to put the focus of our attention to relations, rather than objects, to qualities instead of quantities and to patterns more than on elements.

For this reason, a semantic "labeling" of our digital content may not be enough if our goal is to describe the quality of those relations and the system as a whole (who is greater than the sum of its parts) as the the main future of our information architecture.

Conceptual Reference Models (CRM) and others kinds of Data Ontology may represent a more promising approach. Let's consider the CIDOC-CRM (ISO 21127:2006), developed by the International Council of Museums (ICOM) with the aim of: " … promote a shared understanding of cultural heritage information by providing a common and extensible semantic framework that any cultural heritage information can be mapped to". [8]

CIDOC-CRM can be viewed as a predefined catalog of Entities and Properties.

Almost half of the Entities are "Temporal entities" like Periods or Events, the other half describes "Persistent items" like Things or Actors, and the whole system is completed with other less articulated entities like Places or Dimensions.

Properties, that may be assigned to Entities, are in fact, relations like "took place at", "is composed of", "is carried by" or "was produced by".

This paper, for example, could be described as a: CRM Entity (E1) a Persistent Item (E77) a Conceptual Object (E28) carried by (P128) a Physical Man Made Object (E24) … and so on … filling up entities and properties like the author's name or the dimensions of the proceeding book.

Without getting into further details, there are two aspects we would like to underline, first: CIDOC-CRM is time / event based, it allows to describe "objects" all along their life, from the conception, to the production, to the conservation or others aspects of cultural heritage management. Second: it's not a dataset itself, it's rather and attempt to allows interoperability among existing data.

To consolidate datasets belonging to different cultural entities is not an easy task neither from the technical or the conceptual point of view. This kinds of ontologies may represent a solution for the conceptual part.

A good map of entities and relations is probably the best starting point for any attempt to explain / visualize complex processes.

You may not need it if your communication strategy is based on linear media, as animation, and your work is to translate the dynamic of a complex system into a story.

In other interactive visualization strategies, like "simulators" or "complexity browsers", that allows users to discover by themselves complex behaviors and the appearence of emergencies, all the performances have to be well shaped into the data architecture.

5 Conclusions

Narrative, in the broad sense, is as a sequence of cause > reactions facts (acts) that take place in time and space.

On the other hand, the mind and our cognitive system seams to be driven by "action", we explore our environment looking for affordances for our planned or potential activity. Doing so we tend to create interpretations of what happens around us as a chain of cause > reactions sequences of facts.

Even our memory work quiet well remembering stories. Many memory techniques, like the "journey method", uses sequences of places to help us storing information.In this mnemonic system ... "The items to be remembered are mentally associated with specific physical locations. The system relies on memorized spatial relationships to establish, order and recollect memorial content." We still say "In first place ..." when we have to point out our opinion on a certain subject.

We may say that Knowledge itself may be, at the and, based on stories.

Now, if we look at some of the most promising data ontologies, like CIDOC-CRM we realize that they are events / time based.

They don't just describe how things are but rather whats happened to them, they focus on the process that bring then to life and transform them over the time.

Is the connection between storing data and telling stories much stronger than we supposed ?

Notes

[1] ELKINS, James; "The Domain of Images"
[2] FALCINELLI, Riccardo; "Guardare, Pensare, Progettare, Neuroscienze per il Design"
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[4] Emoto: Visualising the Emotional Response to LONDON 2012
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[5] Pro Bono Público: adopta un senador
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[6] adopta un senador.
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Interaction Design and Data Visualization for Future Digital Cars

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Abstract. Driving a car is becoming more and more complex. This does not happen because the functions that are necessary to drive are more difficult to perform: on the contrary, for example, electric and hybrid vehicles do not have any manual transmission gear. However, complexity lies in the fact that cars shall provide information on their current status, projections on their future state, optional information related to infotainment, to points of interest for the driver or the passengers, to the mobility system, to the connection with other subjects and objects outside the car etc.
In such a variegated scenario, it is necessary to design a new space and several types of visual and interactive languages able to show and guarantee both pieces of information that are necessary to drive a vehicle in a safe way, and the accessory ones. Space and information shall then be designed in order to be adaptable to the user. The paradigm of adaptability has often been confused with customization. In this case, it aims instead to provide an intelligent car-system able to understand both the attitudes and the needs of the driver and to provide real-time answers, as appropriate to the situation.
Modern cars are characterized by the constant effort to prove their potential in terms of performance and new integrated accessories, such as the protection from external agents, impacts and noise; to this end, visual languages can conform to this trend or they can express new forms and representations of data through which they can describe an increased need for communication with the external environment, a new awareness in the use of the car or a desire to focus only on driving etc.
Moreover data visualization is changing thanks to a new mode of interaction between man and commands, as signs and their directionality cannot be inconsistent with the new input mode based, for example, on the use of gestures. In addition, on one hand, the introduction of gestures and other interaction modes inside the car can be a way to find a solution to the growing presence of controls and buttons which can often distract, especially if they are operated through a touch screen; on the other hand, it could become part of the driving pleasure, something that today is more and more difficult to feel. In this way, data visualization and interaction design can cooperate to provide a new sensory experience to the user.
The research lead by the HMI team of the Polytechnic of Turin in collaboration with CRF seeks precisely to give solutions to these challenges in a Human Centered Design approach.

Keywords: Interaction design / Sustainable Mobility / Visual Languages

1 Introduction

Technology applied to the automotive sector allows to insert a huge amount of data and information inside a car. The ability to manage this flow and make it accessible to both the driver and the passengers is one of the most complex research areas of interaction design.

In particular, the fact that the interior compartment of a car is now packed with several digital screens is raising many issues in terms of usability, and specifically in terms of interaction and visualization. It is possible indeed to interact through complex tools, like multifunctional rotary knobs, or through touch screens, which however require observation. Moreover, information displayed is often redundant compared with actual needs, it is located in separate areas, distant from each other and - which is more concerning - far from the user's focus of attention: the road.

This can often cause an information overload having an impact on the perception of the situation, the mental workload and the knowledge of the car status and the surrounding environment. [1]

Despite these undeniable problems, technological skills should not be limited to the mere visualization of indicators and gauges that are strictly necessary for driving. On the contrary, they can be used to show useful information according to the users, the surrounding environment and the current situation, through the identification of the correct methods and timing. [2]

Among its multiple goals, the research project aims to design a graphical interface concept and study its interaction inside the interior compartment of an EV. The actual result of the research is presented in this paper: it consists of a hierarchically structured information map, which is adaptable according to the driver's requirements, the situation and the context. The adaptability can also be managed, automatically by the vehicle storing daily data and driver's demands, or consciously by the driver. Compliance to strict and rigid safety margins will be guaranteed during the whole work. The project, currently in the prototyping phase, needs user's tests and feedbacks which are not yet available.

2 Scenario

Despite the different type of engine, EV formally maintain the same characteristics of a vehicle with combustion engine, both externally and internally. The current structure still stems from the morphology adopted and consolidated in the 1920s. Nevertheless, if cars can, or perhaps have to, interconnect the vehicle and the user with the external world and with other users simultaneously present in the street , the information they have to show is very different, both qualitatively and typologically. In fact, while it is true that information regarding battery life can be compared to the one related to remaining fuel, implications are very different. Today the autonomy of an EV is very limited, charging stations are far fewer than normal gas stations and there is a huge difference between charging

and refuelling time: a few minutes in the latter case, up to several hours in the first one. This example shows that additional support information is required in an EV, such as the distance from the nearest station and possible alternatives, the availability of charging points, energy cost and quality, and maybe also information on the energy source which can be more or less sustainable. For these reasons, EV can represent an excellent research area, given the quantity and complexity of available information and the time needed to display them.

EV should also be considered in the framework of a complex mobility scenario in which the relation not only between different means and modes of transportation, but also with infrastructures, political support or opposition, emotional factors affecting the daily choice of a means of transportation and the geographical and cultural context should be taken into consideration.

The main actors of the system and their relationships, according to which the driver is placed at the centre of the system, are shown in Figure 1 [3].

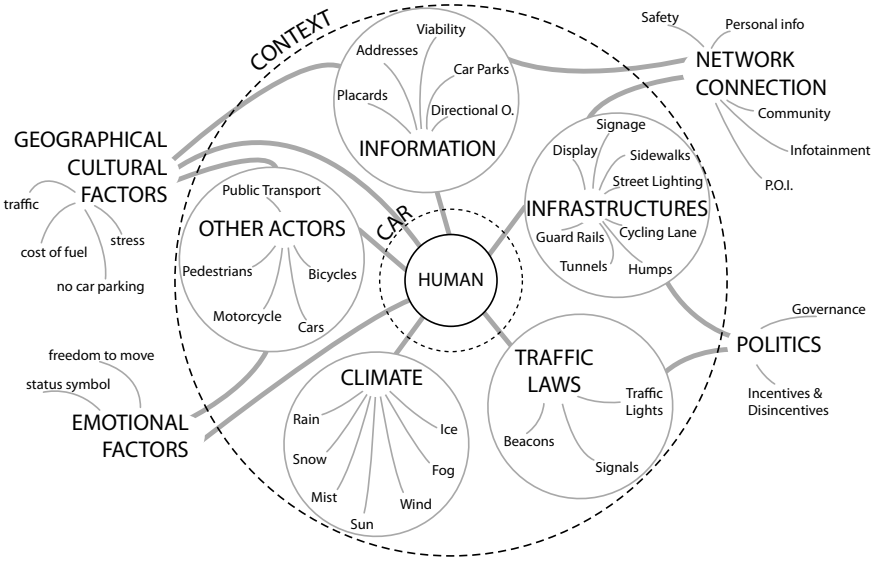

Fig. 1. The main actors of the mobility system and their relationships

Until a few years ago, cars could provide information only on the state of the vehicle, often not in an exhaustive way. Today, thanks to the use of sensors, cameras and the ability to connect to infrastructures V2I, other vehicles V2V, networks or other systems V2X, many factors can be detected and brought to the driver's attention through visual interfaces. Cars are then proposed not only as protective shells but also as cognitive and perceptive filters. The filter in some cases can act as a bottleneck, filtering and selecting only some of the incoming data; in other cases, it can increase the perception and the awareness of the situation, providing real-time data.

The massive introduction of technological devices into electric and hybrid cars has transformed these products into some kind of laboratory where to experiment new possible functions. However, there are several attempts of integration with the car: the complete implementation of car-system devices or the connection of user's nomadic devices, able to communicate with the vehicle system. Applications using the camera of the device to provide information on, for example, braking distance and lane departures, are already available on Google and Apple online stores. A solution does not exclude the other. The main differences lie in use, in computing capacity - which today is higher in smartphones, compared to on-board computers - in data storage, in portability, in integrated components and in the ability to continuously update the software.

Fig. 2. iOnRoad App Screenshot

3 Methodology

The adopted methodology combines the design culture [4], the interaction design [5] and the human centred design [6]. The first phase of the analysis deals with the critical comparison of dashboards and their interaction tools currently available on the market, widening the scope of investigation to also include, for example, concepts presented during exhibitions and workshops. First of all, a study of interfaces currently appearing on electric and hybrid vehicles has been conducted. On one hand, the decision to consider also hybrid vehicles has been taken to enjoy the opportunity to analyze a wider number of case studies and, on the other hand, because dual power supply increases the level of complexity, with many implications. The critical analysis focuses mainly on two aspects: highlighting similar communication structures and identifying the relationships between different types of information. At this stage, the investigation does not critically analyze the symbol itself but it limits to the information conveyed by

the symbol, without going into stylistic or aesthetic issues concerning, for example, the line including the dashboard.

As shown in Figure 2, the information is organized in very different ways, but it can be summarized into three categories: symmetrical models with respect to the y axis with the speedometer at the centre, models based on concentric circles and models that divide the information into two reading levels, using HUD or similar systems.

One of the highlighted problems is the lack of clear connections between the driver ‘s behaviour, the vehicle status and the surrounding environment. The attempts to communicate more or less virtuous driving styles are, in fact, often disconnected from the system and they use metaphors taken from the greenwashing language, for example a plant that grows or decreases, or a ball that has to be kept in balance.

Another weakness is the crowding of too much information, which generates confusion in users. It should also be emphasized that in most cases the infotainment information are positioned at the centre of the dashboard and are editable through a touchscreen. If Norman stresses the difficulty of interaction with hard buttons, also due to parallax problems, in this case we believe that without the aid of physical constraints, such difficulties are exacerbated.

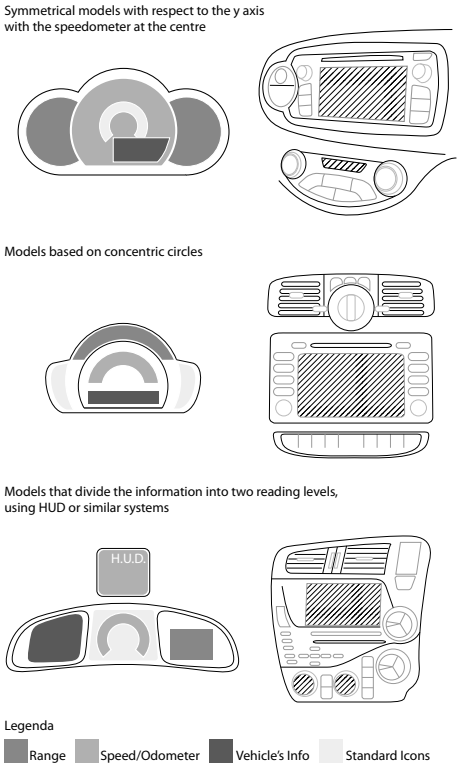

Fig. 3. Critical comparison of dashboards and their interaction tools

SmartGauge [7], designed for Ford by Ford Motors, Smart Design and IDEO, represents a case study focusing on adaptable interfaces for EV. The interface is designed on the basis of studies on actual readability and on visual and cognitive impact, around a digital speedometer from which, according to the user's request, several windows containing data and indications appear, helping the driver to focus on his or her driving style in order to reduce fuel consumption. In this case, information can contract or expand and this solves the problem of cognitive load in a simple way. However, they do not show any data different from the ones that are usually shown.

Fig. 4. The SmartGauge Interface

Usually, information regarding navigation or infotainment is placed on a central panel, also accessible to passengers. In recent years, perhaps to adapt to smartphones interaction modes, these panels have often been operated through touch screens. In the case of complex and branched menus, instead, rotary commands are preferred. They can be rotated to scroll through the different functions in the menu, and they can be pressed to select the desired function, as with the following devices: BMW iDrive[8], the Audi MMI System [9] and the Mercedes COMAND systems [10].

Several studies have suggested that these commands, despite appearing very simple in their external aspect, are very difficult to use because of the menu structure itself [11].

The research continues with an information categorization.

Unlike Tönnis et al. [12], who draw up a hierarchy of tasks, in this case the information itself is divided into primary, secondary and tertiary information. Primary information is always visible and necessary while driving, also in full compliance with current regulations. Secondary information can be displayed on demand while driving and includes, for example, navigation and parts of the infotainment system. Finally, tertiary information is the one retrieved when the vehicle is not moving or when the engine is switched off.

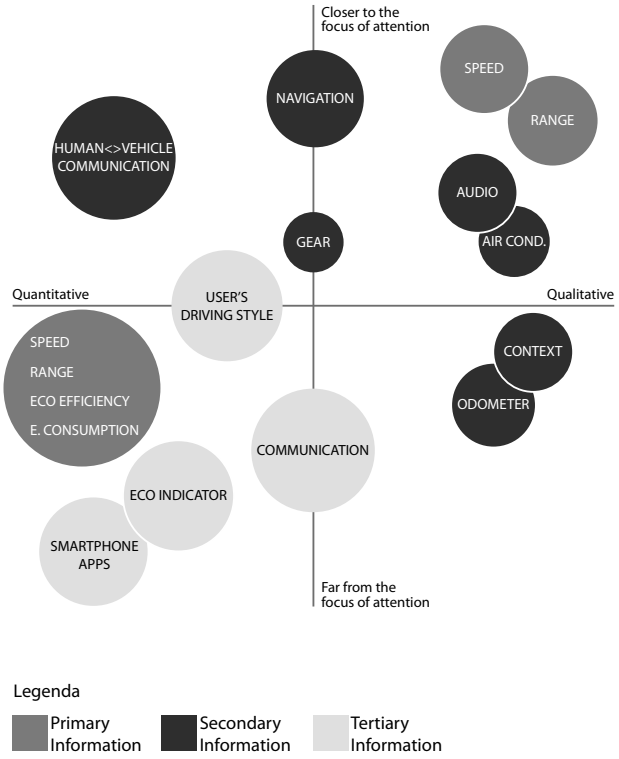

Fig. 5. Hierarchy of Information

This hierarchy has to take into account a rapidly-expanding feature, that is network connection, allowing people to have potential access to an infinite amount of data in potentially dangerous situations. These data are now accessible in most cases from external devices such as smartphones, tablets, satellite navigation systems and multimedia data storages.

On a sample of 118 people aged between 18 and 65 years, 80% of those interviewed said they constantly use these objects; out of these, 65% of them admitted that sometimes, while driving, these devices distract or confuse them.

Following this first analysis, researchers tried to model users' behaviour through the use of questionnaires and the Personas method.

Four Personas were identified and 8 relevant factors were taken into consideration: technological attitude, driving style, mileage, destinations, cognitive load, approach to mobility, level of education and lifestyle.

The questionnaires and the Personas method proved to be excellent design tools, despite being very different from a real ethnographic observation in the field. In this way, it was possible to draw a frame of users' perceptions and to obtain a number of indications about possible uses and wishes.

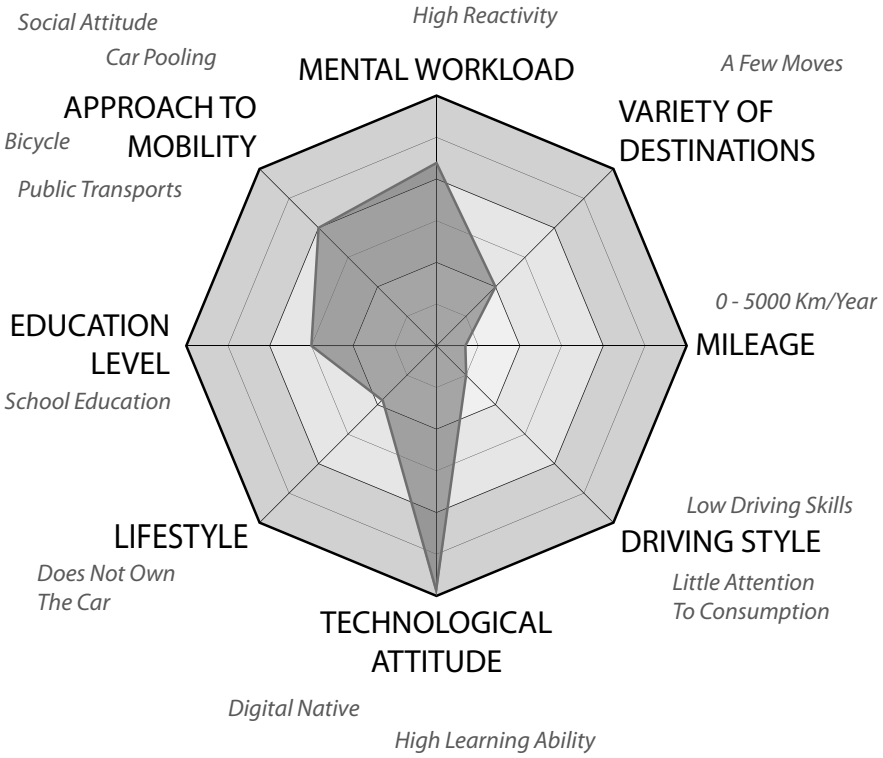

Fig. 6. Eight relevant factors of Personas

4 Project

The designed interface consists of two components: a HUD showing quantitative information that can be read and understood with quick eye movements, and a HDD that shows qualitative information with more detailed data.

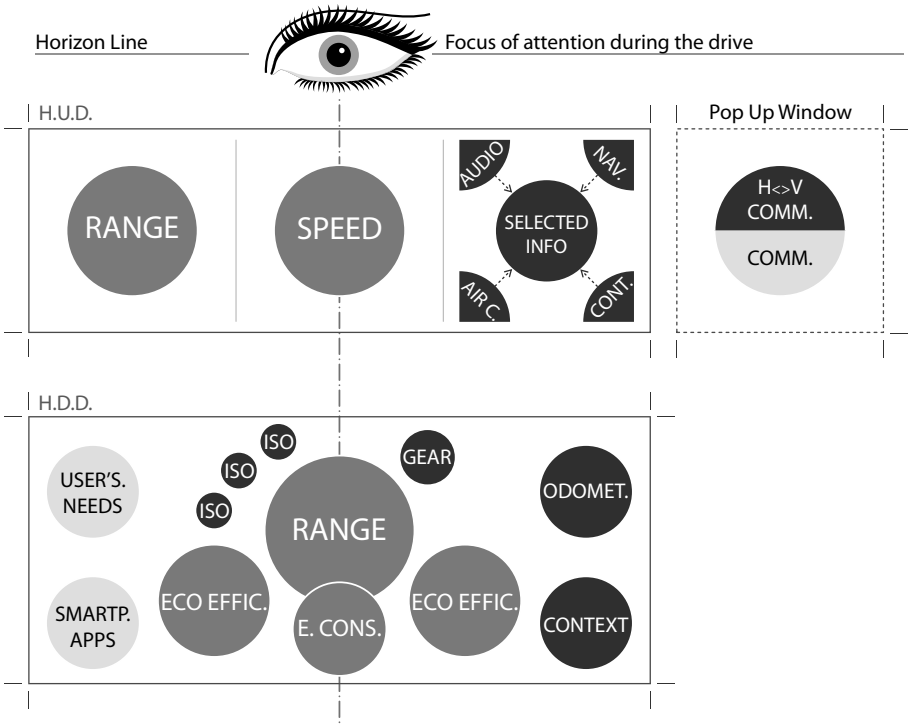

Fig. 7. The new designed interface

The choice to divide the display into two parts derives from two considerations: first of all, the driver's focus of attention, despite being in constant motion to scan the surrounding environment, as necessary, remains on the road during most of the driving; secondly, the results of a test confirm that the driver's reaction time to potentially dangerous situations is one second shorter using HUD than using HDD (1,323" with HUD and 1,327" with HDD) [R13].

The HUD is divided into three parts, plus an optional fourth one that the driver can retrieve. The three parts that are always present show the basic data for a safe drive of the vehicle: speed at the centre, state of charge on the left, and audio, air-conditioner and navigation data on the right. The fourth portion of the HUD is the most interactive one and it contains information about possible emergencies, driving suggestions from the system, synchronization with nomadic devices (like the agenda) and communications with the external environment (like phone calls but also e. g. points of interest).

Today, secondary information is often arranged in the central area of the dashboard. In this system, it is concentrated in an accessible area, open to immediate vision, eliminating the need for the driver to rotate the head. In the HDD, instead, pieces of scalable and customizable information are arranged around basic information: the state of charge, when the car is moving, or eco-indicators, when the vehicle is switched off.

Other information can be added according to user's demands and characteristics, leaving of course the appropriate space to indicators required by law. Visualization is based on an interaction that is completely different from the currently available one: in fact, it should be totally blind and based on consolidated gestures. This type of interaction is very simple and due to its nature it clearly limits excessive branching in menus, thereby preventing the proliferation of unusable menus and submenus. As already said, information has been divided into three categories, however it is necessary to allow a certain degree of customization according to emerging differences in Personas features, self-learning ability of the system and present needs, still preserving priority and security. A person who has just obtained a driving license, for example, will be willing to receive more suggestions, will need to visualize potentially dangerous parameters in a clearer way and will want to connect his or her technological devices to the system, which will filter information according to the driving style.

The system is programmed to react to three types of inputs: the voluntary ones, the unconscious ones and synchronization inputs. Voluntary inputs are specific requests of the user who needs to obtain some specific information in a precise moment or to change the display in order to suit his or her vision needs. HUD and HDD settings can be calibrated to change focus, size, brightness, contrast and saturation parameters, in order to obtain a dashboard that is not only usable but also accessible.

Unconscious inputs are defined like those parameters that can be detected by the system, for example through sensors and data analysis. Physiological parameters of the user can be monitored through sensors on the seat belt, for example, analyzing the heartbeat to perceive stress, or through cameras, analyzing the dilation of the pupil and the number of blinks. The on-board system instead can analyze the driving style and judge it as too nervous and careless of fuel consumption, for example, if it detects sudden cornering, acceleration and braking, or if it perceives excessive pressure in commands activation .

Synchronization inputs represent the chance to connect the car system to the agenda and to possible requests not only by the user, but also by his or her network of contacts.

The system is designed to learn from user's behaviours, and clearly the more it will be used, the more it will become reliable and pleasant to use. At the same time, it does not want to be an annoying assistant and the basic state can be restored at all times.

5 Open issues and future works

Although the whole project has not been evaluated by a remarkable number of users yet, the adopted methodology is based on an iterative process which is characteristic of human centred design. Future works will deal with the new display mode, its acceptance and the evaluation of usability and accessibility, even in critical driving phases.

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Shaping Organizational Complexity

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Abstract. The increasing complexity we are experiencing at a societal level is undoubtedly and inevitably affecting also organizational systems, with emerging issues related to their specific function. The vast amount of data available thanks to the current practices and technologies became a ubiquitous factor and is giving rise to a whole range of complementary questions related to the way we access information, that in complex environments always occur in a selective way. Both the scientific community and organizations are therefore drawing their attention towards the importance of visualization and the benefit of design tools for organizational systems. Nevertheless, theoretical research is rarely applied and remains basically confined within the disciplines where it has been conceived. Similarly, several techniques and tools have been developed in order to deal with organizational complexity and support decision making through models that attempt to highlight the structure of the system. Current tools though, result in technical representations, applying very rigid and standardized models that rarely convey the complexity and dynamism of the system, thus providing a sole and strained access point to multidimensional information.

Considering organizational complexity as the result of an observation of information and social complexity we also highlight the distinction between the formal and informal aspects of organizations. In this paper we present two different research projects, with the aim of visually exploring both aspects of organizational complexity within large business companies. The first project (SICHT) examines the human and social aspect of organizational life, which is strictly related to social roles and the network of informal relationships between individuals. The method most commonly used to understand staff social networks is Social Network Analysis, a technique that employs software tools that lead to graphical analysis summaries in the form of static graphs. The project presents the design of a visual interface, suggesting the utility of a diverse way of visualizing the results of such an analysis, through an interactive and more flexible model, with different display patterns to reveal peculiar aspects of the data. The second project (NOTON) focuses on information complexity, which is directly related to the problem of information accessibility and materializes in particular into formal organizational processes and workflows. NOTON concerns the design of a visual interface for the exploration of innovation processes. By exploiting innovation specific properties, analyzed through its objectives, context, time dimension and uncertainty level, the project outlines some possible directions to be explored for the design of process visualization tools.

The proposed projects represent an opportunity to highlight the importance of design principles and techniques for the visualization of organizational constructs, both at a social and informational level. By claiming a diverse approach to the design of tools for organizations we focus on the complex, evolutive and ambiguous nature of organizational data. In particular, this contribution aims at emphasizing the need of a more prominent role for the design disciplines such as communication design, with specific reference to information visualization and interface design, to function as a bridge between different research fields.

Keywords: information visualization / organizations / interface design

1 Introduction

Besides the implications of complexity theory have been studied for quite a long time, the application to organizational life came just recently, together with the awareness of the uncertainties associated to activities and communication. Emerging difficulties in decision making have been attributed by organizational studies to a bounded rationality principle, which introduces the concepts of risk and information cost and considers the empirical nature of the decision process. [9]

The problem of information accessibility is recently becoming particularly relevant as the possibility to automatically collect and store large quantities of data and information of various kinds is by now a current practice in organizations. [16] However, these huge repositories remain largely unused and inaccessible to decision makers and stakeholders in general. Although the problem has been explored by several disciplines, claiming for methods and tools to support decision making, most of the current research does not take in sufficient consideration the conceptual and operative nature of the design discipline, with specific reference to diagramming techniques. In our vision, organizational systems and diagrams share the same original purpose, that is structuring and managing complexity. Diagrammatic representations embed the capability of shaping and communicating complexity by abstracting form in time and space, overcoming language constraints of different disciplines by giving a visual shape to a problem space. The interaction with a visual interface represent an additional mean of establishing a connection between the different aspects of a complex system such as organizations, by stimulating a mechanism of knowledge amplification and consequently a support for decision making. [15]

Our considerations start from the assumption of organizational complexity characterizing knowledge production and knowledge sharing, and consider the large number of elements and their rich and nonlinear interactions over time. Multidimensionality of elements and the overall uncertainty that characterize data and information associated to them is therefore an intrinsic characteristic of all organizational constructs. Social and informational complexity represent two aspects of the same phenomena that is usually studied by different disciplines autonomously. These conditions reflect the distinction between the two sides

that compose organizational systems, which are respectively informal organization and formal organization. [8] While the formal side comprehend the official and visible structures of the organization, such as roles and processes, the informal one is related to the human component and the communication that exist between members. Both aspects contain numerous sources of ambiguity and complexity, which have been explored through two different projects that allowed to develop some considerations on representational issues for complex systems.

2 Visualizing the Informal Organization

While dealing with the visualization of the organizational structure, one of the main sources of complexity is the social component, which reflects in the form of the informal organization. The intricate network of relationships existing among participants is not usually created on the basis of official criteria such as roles and hierarchies, but of subjective principles that establish a communication preference, related to concepts such as affinity and trust. The formal side or the organization, while defining roles and procedures, create the institutional foundation of all activities and communications, but numerous studies demonstrate that 79% of the total workflow is actually performed through the connections established by the informal organization. [14]

The representation of social connections in groups has been studied in social sciences starting from Moreno's sociometry in 1953 [12] and the lattice structure is considered by numerous disciplines as a preferred solution for the representation of complex systems in general. [4] The current Social Network Analysis (SNA) [5] is the discipline that operates between sociology and statistics that studies the structure of relational data in social contexts, by considering the characteristics of the single units as emergent from the relational structure. Mapping the interaction between individuals helps the understanding of the system behavior and in Organizational Network Analysis (ONA) is often used as an indication to produce modifications in the formal structure in order to match organizational goals [14]. The network analysis performed in organizational contexts generally implies administering a survey to employees, which results are organized and represented with specific software, such as Ucinet and Netdraw. The resulting visualizations though are generally presented to stakeholders in the form of printed reports, thus eliminating the fundamental concept of dynamism and constant transformation of the social network. Moreover, the representation of the relational structure doesn't go beyond graphs, even if they represent just one possible solution among several different visual models [3]. Another important aspect concerning the visualization of social networks is the multidimensionality of data, which reflects the complex nature of the phenomenon. The possibility to explore the social structure from different points of view and with different levels of detail allows both a better understanding of the phenomena and knowledge creation. Several studies also demonstrate that multidimensional stimuli produce better results in cognitive performance. [11]

2.1 A Case Study: SICHT

The SICHT project has been developed as a conceptual design in collaboration with an Human Resources consultancy in order to analyze the peculiarities of an organizational social network and to explore alternative visualization techniques and interaction patterns capable of providing a dynamic and meaningful way to access the results of ONA. The analysis highlighted the necessity of a tool with specific characteristics:

- *context specificity*: most of the tools commonly used for the visualization of organizational networks are generic and are directed to analyst instead of stakeholders and decision makers;
- *interactivity*: due to the scarce usability of the current tools and their overcomplicated interfaces, HR consultancies generate static reports that obviously can't be manipulated and explored by final subjects;
- *time*: taking into account the unstable and spontaneous nature of relationships that bud between people, the structure of the social network needs to be analyzed over time, both to program and to observe the effects of the informal events that fill organizational life;
- *perspective*: considering the organization, and therefore its network of relationships, as a complex entity, its social structure needs to be considered from different points of view, providing diverse visualizations to highlight different aspect of the phenomena.

The interface. After a first step that concerned the analysis and the elaboration of the dataset provided by the consultancy in the form of square matrices [17] (the typical format for network data), the interface has been structured in three views, which reflect the main perspectives of organizational social networks according to the interviews conducted with HR managers of different companies.

The main interface allows to explore the different nested levels of the social network, that articulate from a superficial "know network" to a deeper "trust and problem solving network". The possibility to filter the different attributes is always present in all views, as the indication of the network metrics, such as the tie strength or the path length (the number of intermediaries between two given nodes). The evolution of the network structure can be explored along the time dimension in the bar at the bottom, where different organizational events help to keep track of the possible situations that could modify the social structure.

The first *Network* view reflects the typical graph pattern used by organizational network analysis. The nodes have been represented by combining the three main qualities of the resources (role, department and base) into a single glyph, in order to keep the overall view of all node attributes. The filtering panel on the left allows to select the attributes that the user wants to compare, simplifying the visualization by eliminating one or two of the three node layers, thus allowing a better comparison.

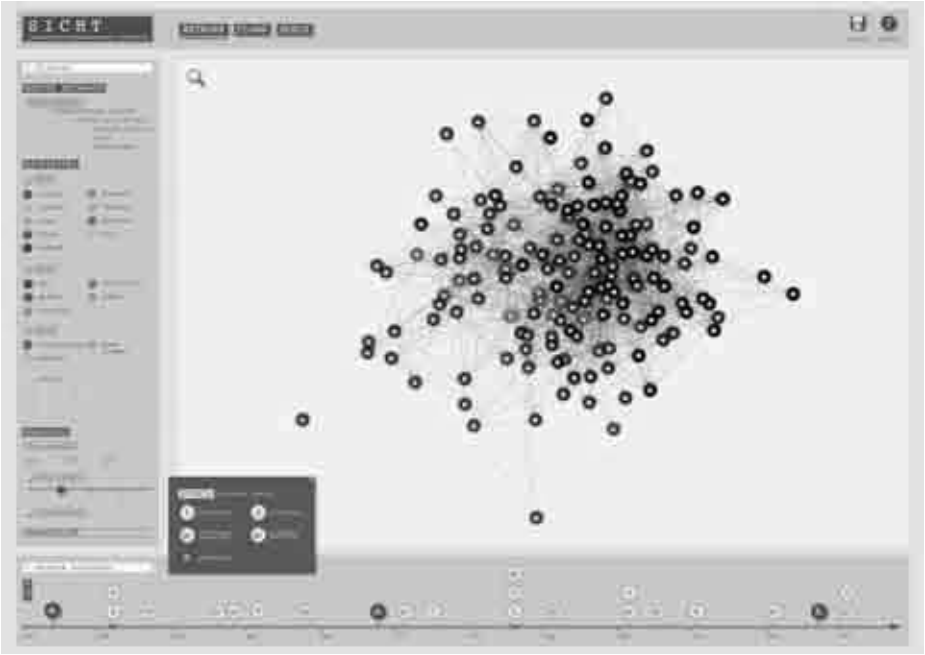

Fig. 1. SICHT: The Network View

Fig. 2. SICHT: A node expansion

The *Flows* view highlights the departmental network, through a sunburst visualization model [18]. Data have been hierarchically aggregated according to the base, department and role of each employee. Each ring represents an attribute of

the personnel and the order of aggregation can be set through the filtering pane from the outside to the inside. By selecting single blocks the user can then discover the relationships between specific areas of the organization.

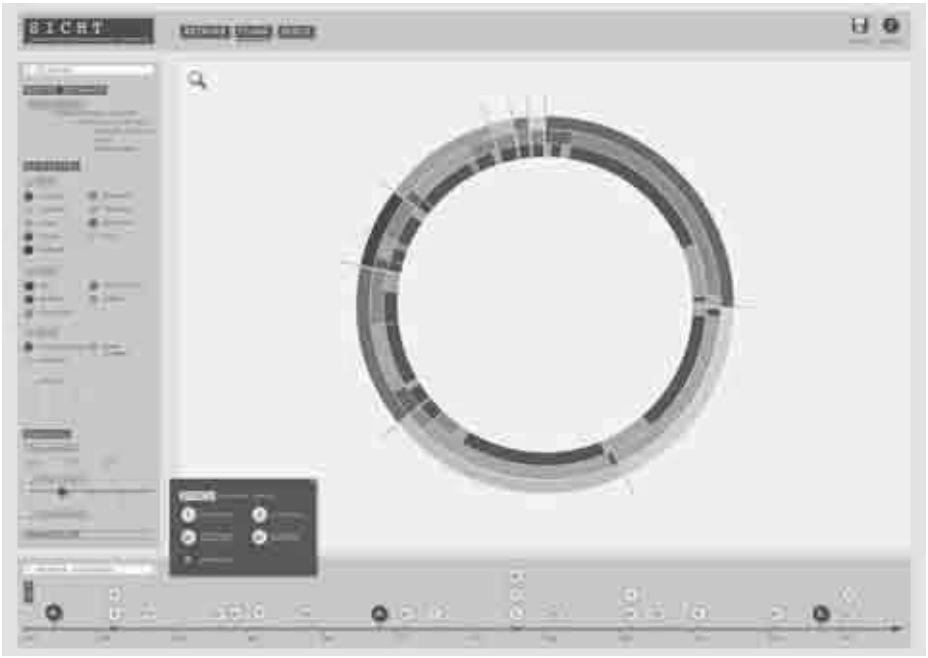

Fig. 3. SICHT: The Flows View

Fig. 4. SICHT: an example of flow selection

The third view *Space* concentrates on a geographical dimension that generally is not considered by the tools for social network analysis and represents a way to compare the nature of relationships with the actual distance that separates people. The network is visualized through a quantum treemap [2] for each base, subdivided into offices and coloured by department. This visual pattern allows to keep the single units within the aggregated representation, providing also an indication for space planning.

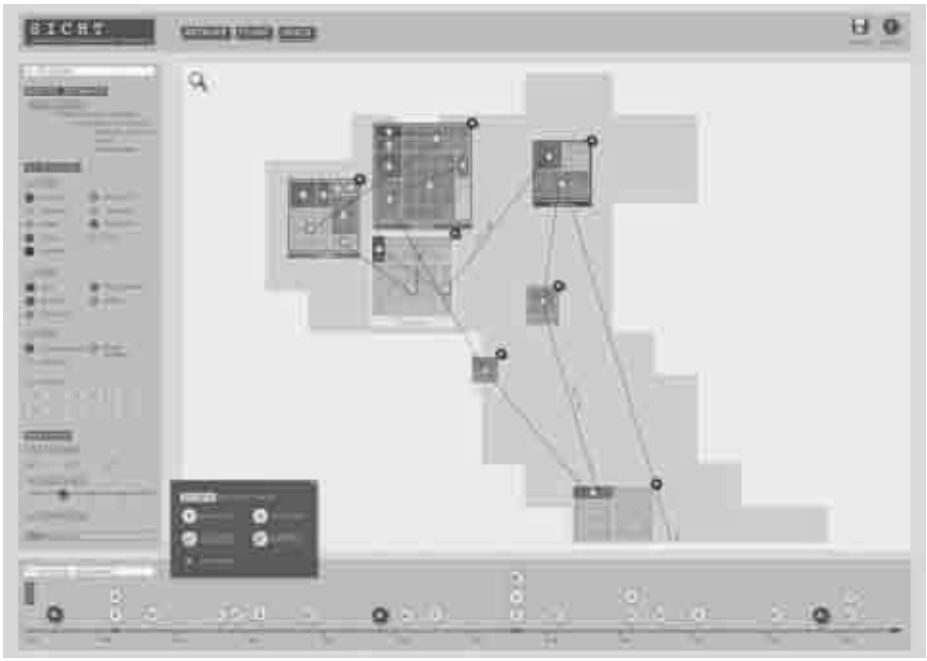

Fig. 5. SICHT: The Space View

3 Visualizing the formal organization

The representation of formal organization can be assimilated to the representation of processes, a practice that has been a subject of research for a long time in different disciplines, mostly related to engineering and computer science, developing several methods, such as flowcharts, state transition diagrams and Petri nets.

While business processes have been studied for a long time both in organizational sciences and computer science, innovation processes don't benefit of the same attention, they are studied in different fields and don't have the use of adequate ad hoc software tools to represent and manage activities. [19] Current tools for process visualization, while applying to business processes, mostly concentrate on performance and consequently on process enactment, following a

quantitative approach and looking for data accuracy. Simultaneously the development of notation standards, such as UML, have had undoubtedly a functional role, to enhance interoperability and to simplify entities definition, but results too rigid and constrictive for knowledge-intensive processes. Processes related to innovation activities, as oriented to the exploration and dealing with uncertainty, feel in fact the need of a more loose set diagramming rules, with the aim of showing process inefficiencies and addressing process redesign.

By examining the peculiar properties of innovation processes, this research relate them to the design of a visual interface for the exploration of innovation processes.

3.1 A Case Study: NOTON

NOTON is a research project that the research lab has been carrying on with the innovation department of a manufacturing company. The general aim of the project is the creation of a shared representation of the innovation process among the different stakeholders, through the design of a visual interface to explore the process itself.

Dealing with the company datasets and confronting with the innovation department, we were able to draw some considerations on different dimensions of innovation processes, which characterize specifically the examined project:

- *objective*: being a multi-actor system, innovation processes need to be explored through multiple perspectives, with a different level of analysis and different goals;
- *context*: innovation processes are more based on projects then task execution. Projects articulate in phases, delimited by milestones, which are likely to be to be skipped or abandoned at any stage;
- *time*: innovation projects live a different time dimensions, as they can last for years or for a few weeks, depending on different conditions (market push, technical feasibility, etc.). They can also experience iterations and contain feedback loops;
- *uncertainty*: the nature of information is generally qualitative and many properties are ambiguous, not defined through a single or a closed set of indicators, but described along different dimensions [10].

The project we are presenting here is to be considered a preliminary mock up which is not intended to respond to all issues and challenges presented, but serves an exemplifying purpose, to confront how some of the concepts highlighted can be observed and tackled by means of visual design.

The Interface. Considering the preliminary stage of the project, a first activity has focused on the abstraction of the process structure, in order to highlight the critical aspects to be discussed with the innovation department. The characteristics of the specific context reflected in the interface design by concentrating more on the reproduction of the overall view than on the analytical and operative function. We decided therefore to adopt a system of alternative multiple views, to be distinguished from multiple coordinated visualizations [1], in order to enable the exploration of processes through different perspectives, representing different specific communication goals.

As the original representation of the process used by the company was a static funnel chart containing a selection of projects for each period considered, the first concern of the interface design was the dynamic representation of the time dimension. A specific need was the possibility to explore projects over time, both in analytic and aggregated way, in order to see the trend of projects along certain periods, and detect possible spaces to intervene with strategic actions. In Business Process Modeling Notation (BPMN) [13], the discipline that studies the graphical representation of process models, processes are generally represented as a sequence of tasks, and their specific properties are defined within the notation itself. NOTON instead is working on the intersection of two different temporal dimensions: the analytic one, which follows the regular course of time, and the structural one, which concerns the passage from a phase to the next one. Observing the process progression simultaneously through these two different dimensions, allows to create a visual comparison and to assess the compliance of the two trends.

Within the *Timeline* view (Fig. 6, 7), the analytic visualization at the center displays the projects through a line chart. On the x-axis we plotted the time dimension, to display the singular dates for each milestone, which are shown on the y-axis as an ordinal variable. Visual perception experiments discovered in fact that spatial position as in a scatter plot, bar chart or line chart, facilitate a better understanding of data, with respect to other visual variables such as angle, length, area, volume, and color saturation. [6] Every dot in the line chart defines the date of transition from a phase to the other, which is described by a milestone (M0, M1, etc.). The data however show a certain complexity, registering up to two different dates for each milestone, depending on the accounting accuracy for each project. The first date is described as the “expected date” and represented as a smaller light grey square, while the “real date” is displayed as a bigger and darker square. As a first indicator of uncertainty, the use of a line chart plotted on two axes allows to draw attention towards the compliance of the project path with respect to the expected one. The shifts from a regular straight line going from bottom left to top right to a broken line, can indicate in fact a return to a previous step, possible feedback loops or some kind of data inaccuracy.

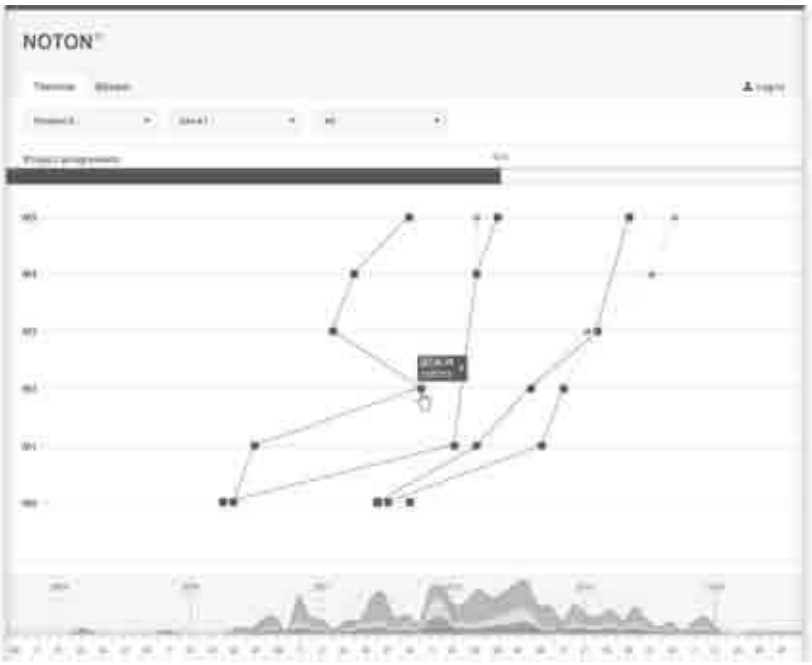

Fig. 6. NOTON: Timeline view with filtering

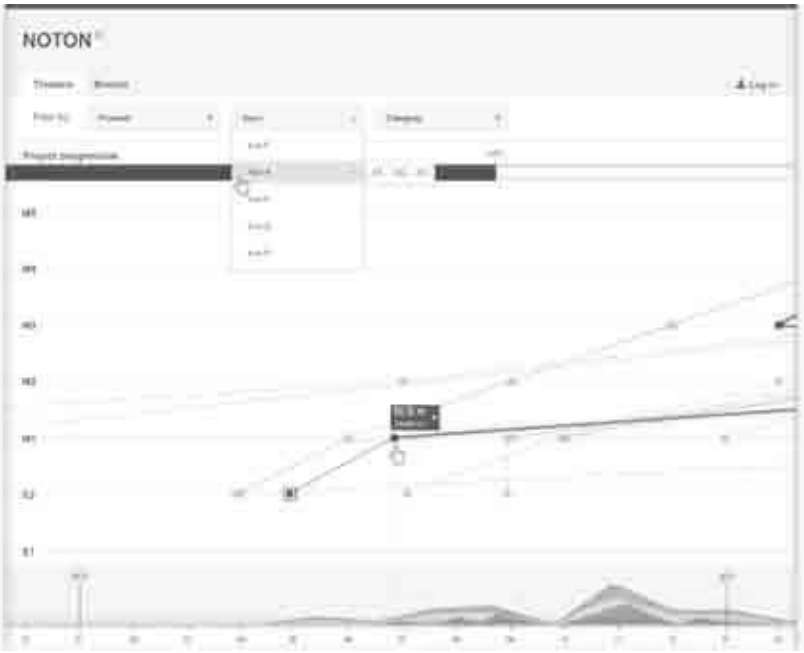

Fig. 7. NOTON: Timeline view with zooming and highlight of risk level

The *Stream* view (Fig. 8) provides the big picture of the process, by aggregating projects by type and by level of risk in a stream graph. The milestones here are switched and displayed in the x-axis in order to establish a connection with the time meter at the bottom. In this case the previous timeline has been changed in favor of a more abstract one, to allow the measurement of the average duration of each phase in terms of weeks or months, selecting the period of interest from the top menu.

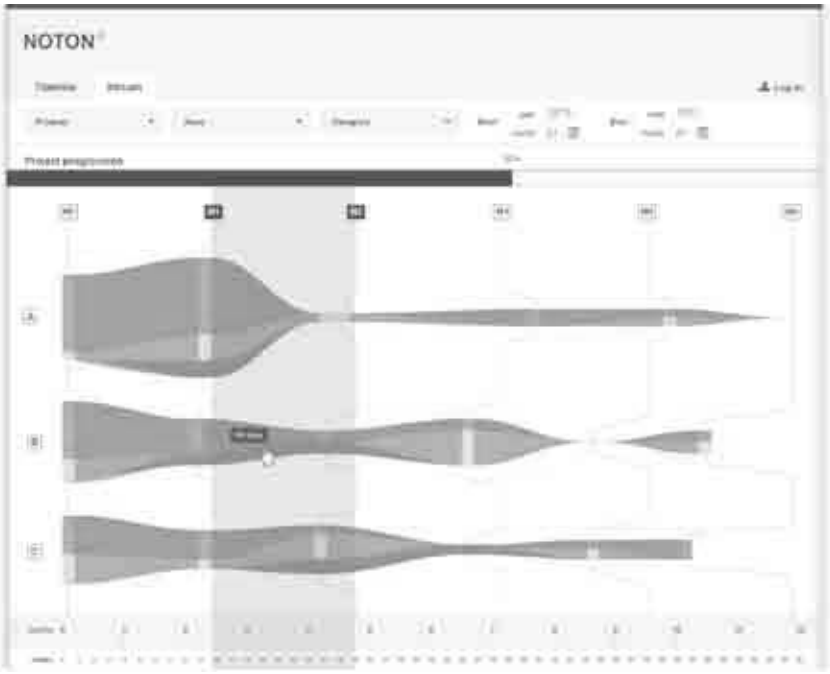

Fig. 8. NOTON: the Stream view

Conclusions

Our contribution tries to set a new possible and profitable area of applicability of communication design within organizations, with specific reference to the design of visual interfaces.

The complexity of organizational systems has been observed separately from two different points of view, the social and the processual one, in order to analyze the peculiarities and the analogies of the two aspects to be expressed in the design of visual interfaces as decision support systems.

Constitutionally design operates with the aim of motivating the emergence of new perspectives and different modes of observation, through a nonlinear approach. Thus we claim that researching on the modality of visual representation

through interactive interfaces would be particularly valuable both as a support for decision making and as a comprehensive communication tool.

The possibilities for a tool capable of visually represent the structure and the evolution of complex phenomena such as informal relationships and innovation processes would be important not just as a support for current decisions, but also as an indication for organizational redesign and as a representation and communication tool for organizations.

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Small Data Visualization Toolkit

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Abstract. In this study I describe an open-source toolkit for the visualization of small data. Three main areas are discussed in the paper: artifacts, data and people. Today, communication is supported by numerous interactive artifacts. The omnipresence of interactive artifacts increased the production and the storage of data. The huge collections of data produced, mainly online, are defined "Big Data". Opposed to this, a more recent concept has appeared: the "Small Data". Small Data are roughly defined as "everything that can be processed in Excel". In order to reach at a more operative definition it is appropriate to define the characteristics of the Small Data as distributed, detailed, decelerated and democratic. These characteristics make Small Data look more understandable, manageable and in the end useful for common people. It is a common interest to understand which data can be useful for people, which are recorded, and who is using them and for what purpose. Designers should work more on enabling platform to help people transforming data into knowledge. A toolkit proposal could be useful to highlight some priorities that designers should consider for a better involvement of the people.

Keywords: small data / social interaction / generative design / design toolkit

1 Introduction

Human being started to record information around 8000 years ago through writing and painting. By the time, the message's carrier changed several time from stones to walls, to clouds and bones, to architecture and paper. Today we are back to cloud. The aim of the Internet at his birth was the exchange of information. A feature of the so-called information age is the capacity of data storage and the easier production due to diffused presence of computers. Since Arpanet to today, in less than fifty years, the net spread all over the world and with new artifacts, sensors and services the amount of data produced augmented to 2.5 quintillion bytes daily [1].

Today, numerous interactive artifacts support communication. Manufacturers embed computers and sensors in products that were not conceived as computational devices before. The more classic examples are fridges and washers, but also cars are "mobile observatories" [2] as smartphone, tablet, eBook readers

and so on. The number of products that embed some computer is continually increasing with the aim of improving, at least nominally, people experience.

We ended up having a symbiotic life together with these devices [3], but I believe that this continuous attachment and this dependency are unbalanced and clumsy. Devices and artifacts surround people's life recording it and 'helping' them to keep communication with others humans. Now, we should ask ourselves if these computers are help or obstacles. Artifacts change people's behavior and today it is not uncommon, and often not perceive as unpleasant, using a smartphone in any occasion from metro to meeting, from classrooms to the dining table. They are always on forcing people to be up to them. Their capacity of catching attention and absorbing time are immoderate. Sometimes the continuous distraction becomes an insult to the people physically around [4].

Nonetheless, people use mobile devices to share their life, show emotions, spread ideas, sometimes still for call and speak with someone and keep contacts with people that are not next to them. These devices compress space and time around us, so it is much easier to catch up with people on the other side of the world than with the ones right next to us [5]. It is a fixed binocular on eyes; distant friends look closer, but who is next to us disappear in blur. People get so accustomed to these prostheses that we feel their absence when we lost them or when they just go out of charge. We suddenly become alone. Disconnected from the world we cannot share information anymore.

This can be correct only for the conscious information, but there are a lot of unconscious ones that we still leave as tracks of living, from the use of credit card to the last cell that recorded the phone. Many are the data that we produce through devices without even being conscious of them. Sometimes these data can be used immediately or recorded. A use for stored data can be found later, from the company or for other companies interested and allowed to access the data [2]. "Big Data" is the definition used for the large amount of data owned by large companies.

Next paragraphs will discuss what are Big Data, and consequently a proposal for a Small Data's definition. The definition of Small Data will make emerge the problem of Small Data visualization. In the end, a practice example will show a toolkit that try to make Small Data understandable by people which is the aim of this study.

2 Big Data

The concept of Big Data comes in our days as natural consequences of the increasing amount of data produced thanks to the recent digital technologies. Big Data can be traced back to fifties, but only recently Big Data received great interest, mainly because of the economical results and more obvious examples from Google Flu Trends[1] to Ford Silicon Valley Lab[2] just to name two of them.

[1] Using the data collected from the research on his search engine Google developed an algorithm to analyze the diffusion of influenza.

Big Data it is "a meme and a marketing term, for sure, but also shorthand for advancing trends in technology that open the door to a new approach to understanding the world and making decisions" and for this reason it is relevant to analyze and try to understand it better [6]. Big Data can be defined by three main characteristics employed by Laney: volume, velocity and variety [7].

Volume. Volume is the first and maybe more significant mark; Big Data are big, if 2.5 quintillion bytes is not already impressing, it is the same of saying 576 billion times the bible, 531 million DVD, 2 million of commercial 1Tb hard drive and so on. This is the dimension of Big, and obviously this means that not everyone can store them. Only large companies can afford these specifications. The sources of this large amount of data are the movements of GPS, credit card transactions, social network updates, photos, videos, and metadata recorded in forms; but also click on web-pages, the time spent on a page, the appreciated books and the music listened or produced. Friendship is been digitalized. Shopping online and fidelity cards record the people's preferences. Everything is stored somewhere.

Velocity. People cannot manage these large amounts of data without computers, and the computational power requested is huge as the storage capacity. Velocity is the second character. The rapidity of digital life, but most of all the quickness of market, asks for instant answers. Data analysis needs to follow the same speed, also because many of the mined data involve real-time variables and a real-time response can be required.

Variety. All these collections can be also unpredictably various. Data mined from social network can contain relevant professional photo shoot as the worst auto shoot, from the author's cite to irrelevant sentences, from musicians to unlistenable track and everything is in between and all of them together. Data can be structured or not they can be in a different form and contain different modalities. This variety is the third and last of the main characters that define the "Big Data".

Other authors try to add V in order to update the Big Data definition[3]. Veracity, contested by Laney in a comment of IBM's infographics [8], is an interesting mark that shows not a value but a birth defect that comes with volume. Veracity is the uncertainty of data. On a widespread data mining, there is no space for selection; all the data are gathered and collected, mixed and stored adding quantity and inevitably subtracting quality from database.

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[2] Ford has a Big Data analyzing center to research on improvement or problem solving for his cars thanks to the data received from the multiple sensors installed inside cars.
[3] Other than Veracity, online it is possible to find Viability and Value http://www.wired.com/insights/2013/05/the-missing-vs-in-big-data-viability-and-value/ and http://www.pros.com/big-vs-big-data/, a discussion on the topic is proposed by Seth Frimes in the article Big Data: Avoid 'Wanna V' Confusion on http://www.informationweek.com/big-data/commentary/big-data-analytics/big-data-avoid-wanna-v-confusion/240159597

Big Data can be a dream for marketing where large amounts of number seems to match with huge amounts of money, but is not easy to work on these data. Volume has his pros and his cons: only "Big companies" own resources to store and manage Big Data. Recently, starting from this observation, and maybe trying to surf the same wave of Big Data, the idea of "Small Data" emerged [9][10]. Under the following title, we will see some examples, and I will try to reach at a definition for this new concept.

3 Small Data

Rufus Pollock, economist and co-founder of the Open Knowledge Foundation Labs, define Small Data as "everything that can be processed in Excel" [11]. This sentence underlines the opposition in terms of computational power between Small and Big Data. Clearly the aim is to propose something that everyone can process on his own computer without any special equipment.

Small Data is also an expression used to define what was before the Big Data [5], but that would be a restricting definition. Was it a small data world because people were not measuring it? Was a small data world because people did not have the tools to elaborate large amount of data?

It looks more reasonable to talk about Big Data of the past, maybe through the analysis of archeologists and anthropologists. Big and small data do not seem divided by the time. In fact, Small Data's use in the last months shows some substantial marks in opposition to Big Data. The computer scientist Deborah Estrin shows how individual digital traces help for medical care [12]. All the data recorded can shows not only medical state but also behaviors, helping doctors to understand how a treatment is affecting us or what can be the cause of an illness. She claim that all the data generated by mobile technologies and recorded by search engines, social networks, internet providers, mobile carriers should be given back to the person that generates them. Small Data is a piece of Big Data that refer to ourselves.

Pollock define Small Data as "the amount of data you can conveniently store and process on a single machine, and in particular, a high-end laptop or server" he proceeds: "What's interesting (and new) right now is the democratization of data and the associated possibility of large-scale distributed community of data wranglers working collaboratively. What matters here then is, crudely, the amount of data that an average data geek can handle on their own machine, their own laptop" [11].

I believe that after this analysis a definition of Small Data can be expressed through these marks: distributed, detailed, decelerated and democratic. These characteristics make Small Data look more understandable, manageable and in the end useful for common people.

Distributed. Small Data are by chunks of relatively small amount of data that a single person or small groups can store and manage. The distribution of data is conceived as he opposite of the volume the concentration of different data from

different sources in databases owned by single large companies. I can decide to share my own data with my doctors, lawyers or friends and coworkers for functional reasons or for recreation, creating my networks.

Detailed. Small Data are specific to a context. This selection at the beginning avoid useless or too generic data. The data collected in Small Data are coherent and solid. Their definition and size allow an easier check of anomalies and the resolution of them.

Decelerated. The quickness requested in Big Data can be softened in favor of a better certainty. The calculation power requested to process Small Data are by definition moderate and fulfilled by common commercial machine. This mark makes Small Data decelerated.

Democratic. Democracy is a controversial term, but here we mean that the Small Data are thought to be owned by a person who generates them, not by the company that supplies the service or product in use. The democratic value of Small Data is strictly related to the idea of sharing and collaborating, giving to the people the freedom to open, manage, store, edit, visualize and share their own data.

Designers should start to think to help people in this change. Small Data are definitely smaller than Big Data, but it is still impossible to understand them without a proper visualization. In the next paragraph, I will propose a toolkit developed starting from these observations.

3 A toolkit proposal

Information for Social Emancipation. Collecting and producing data does not mean create either knowledge or information. Data is information translated into a form understandable by computer. Knowledge is the understanding of information for human beings. So information can be seen as a communication level between computer and human beings. Designers have to shapes data in a convenient way for humans, through information visualization. As Bonsiepe pointed out [13], this interest in information visualization can be just a growing trend, it can be senseless consumption of information for instant satisfaction, but it can also be a growth in consciousness for the importance of information. Sharing information can be a way for emancipation that needs a coherent, understandable and pleasurable visualization.

Towards the definition of the toolkit. People are trying to obtain the data that they should own already, but a real understanding of the information will be missing without a proper visualization. In this study, I will try to define a toolkit for people to understand data through data visualization. The analysis of several different toolkits for data visualization, already available online, has raised a

main issue: they are developed for programmers or skilled designers, not for common people. The selected toolkit for the comparison were: jscharts 3.0, Harry Plotter v0.9, Toxiclibs, gRaphaël's, morris.js, MilkChart, jQuery Sparklines, JavaScript InfoVis Toolkit, D3.js, Highcharts 3.0, Flotr2, Google charts,. Most of them are released under the MIT license so they are open source, but the requested skills in order to use them are far beyond the medium level skills of a common person. Specific skills in programming, mainly in javascript and html, are requested. Some of them like D3.js, Google Chart and Highcharts 3.0 offer a wide choice of graph and diagrams; other are more specific like the Tufte's ispired jQuery Sparklines. The possibilities of creating interactive and/or animated chart are common but unlike some of them claim "good-looking charts shouldn't be difficult", actually it is. The emerging needs of data visualization and these observations defined the aim of the project.

The purpose of Small Data Visualization Toolkit is to enable a low skilled user to transform data to visualization with simple steps: data loading, purpose's selection, visualization of results, customization and saving. The division of the screen into three portions allows the person to see all the procedure at once. An enlightenment of the title will suggest the focus. A dark grey pattern will overlay the other portions. Proceedings trough the phases will turn on the next portion and put in a stand-by the previous one. Because it is useful to move back and forward during the editing, a light white overlay will weaken but not hide the edited portions. The effort is to keep the screens as simple as possible, to make people feel to be in the middle of an easy process.

Data Loading. In the first portion of the screen starting from left, there will be the data loading process. Data can be loaded on the toolkit platform by simple drag and drop the file on the portion of the screen designated. Many software and services offer the same procedure making it widely known by common people. Otherwise, a click on the upload data area will open a dialogue screen that allows choosing the file. The toolkit accepts the most common formats like the comma-separated file (csv), or Microsoft Excel (xls). A direct connection is allowed with a Google Drive Spreadsheet. When data are loaded, the first portion of the screen will show the content of the file in a spreadsheet like mode. A small bar on the bottom will appear to allow going back and changing the data selected.

Purpose's selection. The portion in the middle of the screen will be showing some questions relative to the purpose of analysis. Supposing that the person does not have any skill I thought to suggest different ways of selection. A list of concepts and sentences will help the person to choose a graph typology. I believe that moving the attention to the aim will help the person to solve his problem and understand the information. IBM's Many Eyes propose an approach in this direction classifying his graph under these areas: see relationships among data points, compare a set of values, track rises and falls over time, see the parts of a whole, analyze a text, see the world. This IBM experiment for data visualization

works online producing visualizations but also recording and publishing all the data submitted. In this experiment, the chosen verbs are comparison, composition, distribution, relation and trend. Each one will offer a selection of diagrams that could be used for the purpose. For example a Pie chart for a composition, or a classic column graph for a comparison. In this first attempt the offered diagrams and charts are basic, but due to the possibilities of expansion of the open source platform and the availability of examples from designer that use Processing as tool for their data visualization is not hard to believe that a wider implementation can be achieved.

Results. The third and last part of the screen shows the result. Before the selection of the chosen graph, the gallery of graphs and charts will filter his content according to the purpose selected. After the selection, the entire portion will show the graph allowing some customization. At this point, a small bar will appear on the last part of the screen on the right allowing saving and exports the file.

The result is a vector file that can be used as it is or integrated in a wider workflow by designers and professionals. A toolkit designed for common people don't need to have limitation in usage by advanced and skilled users.

3 Conclusions

In this study, I tried to reach an operative definition of Small Data. This emerging concept seems to achieve a good acceptance through media, and I believe can be part in the process of creating and enhancing a creative mindset in opposition to the consumptive mindset [14]. The project proposal, working on the same direction, tries to propose to designers a broader way of conceiving toolkits that can be generalized to other artifacts. The early stage of development and testing of the toolkit, cannot allow a more critic position, but I believe that as open source platform the development can be wide. A future development can involve the number of charts available but also a mobile version for tablets.

In this study the restricted area of experimentation allowed a more theoretical reflection on data and the relation with people; a further analysis will be more carefully point at the successful and unsuccessful choice of the toolkit design.

This study starting from a preliminary example wants to open some general perspectives for other designers and developers. I think that the role of communication designers is to spread information and support people. Designers should work with contemporary tools and regarding contemporary needs to enhance people emancipation.

Figures

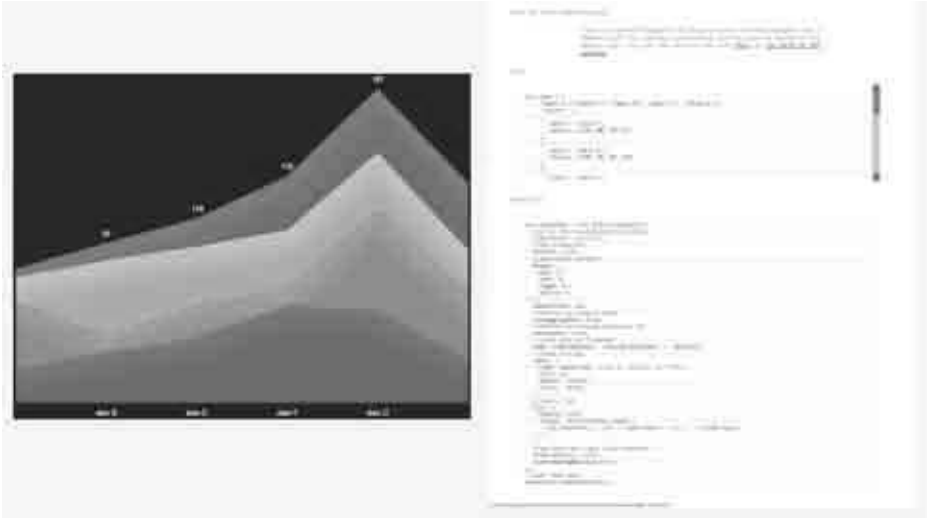

Fig. 1. An area chart with its relative code in JavaScript InfoVis Toolkit. In the upper right the data loading, followed by the code for the visualization.

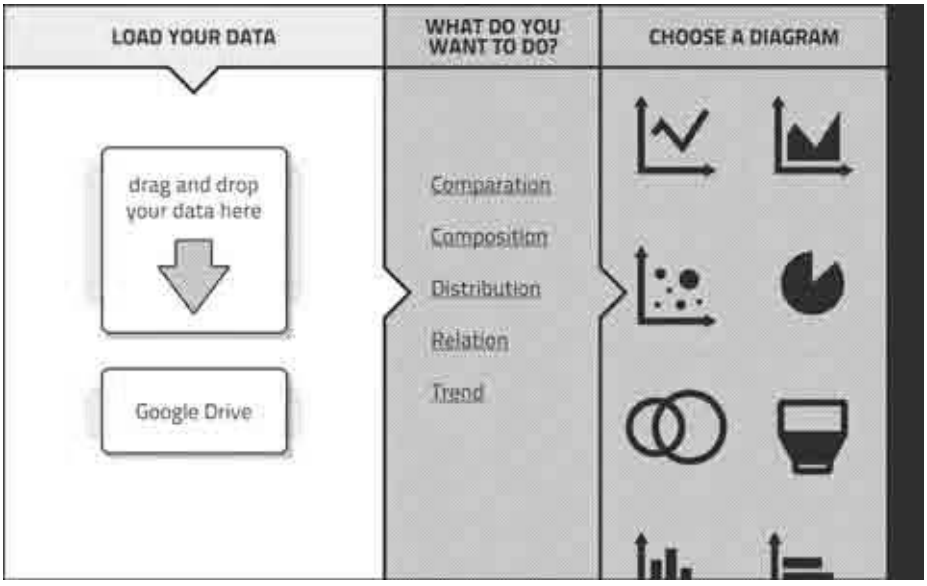

Fig. 2. The opening screen of the Small Data Visualization Toolkit.

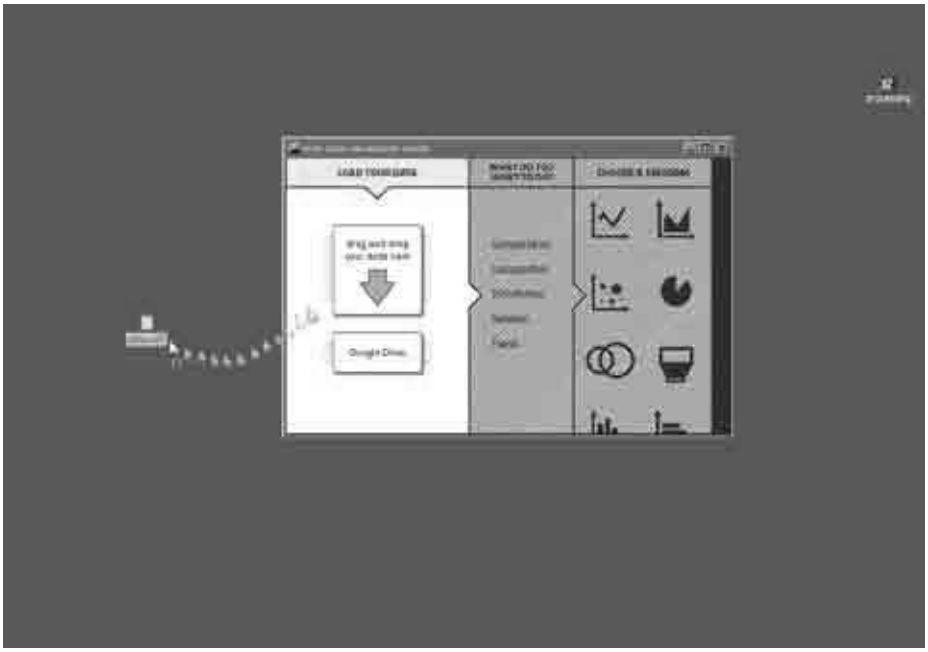

Fig. 3. Loading a data set from file in Small Data Visualization Toolkit.

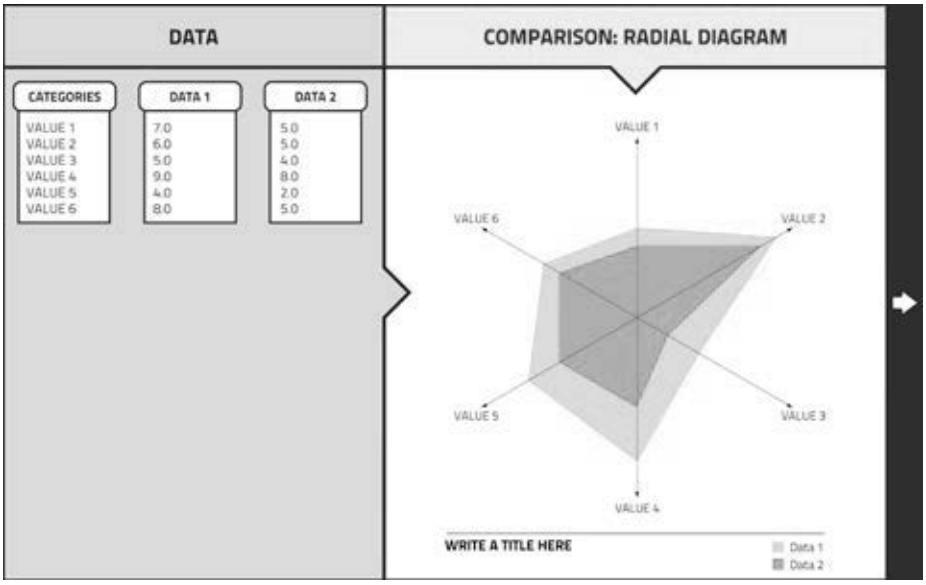

Fig. 4. A finished graph in Small Data Visualization Toolkit, ready to be saved.

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Relation Visualization for Semantically Enriched Web Content

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Abstract. Many methods for web archiving include semantic analysis of the archived content. Texts from social media provide a rich feature set of analyzed data, such as topics, opinions, events, and more. One of the main challenges is the successful utilization of the semantic and raw data for an optimized search and retrieval approach. This work reports on the user needs for semantic relation visualization and the experimental approaches for creating visualizations that answer to specific user queries, based on the user interaction monitored by a dedicated semantic search tool.

Keywords: Semantic analysis / Twitter data / visualization

1 Introduction

Social media is a source of abundant user-created information that exhibits certain characteristics. The content is diverse, multimodal, opinionated, and can be classified according to popularity, influence, and other social factors. Current applications try to harvest social media content and present aggregated results to users. For Twitter data, there exist many applications that analyze and visualize sets of data according to user location information, Twitter post language, hashtag mentions, user mentions, post volume over time, keyword tag clouds, top X influencers, sources, URLs. The data that are used are meta-information already provided by the Twitter API and can be used for a helpful quick overview of statistics from data samples.

Recent approaches, mainly in web archiving, include social media content collection and analysis. Some of them, such as the ARCOMEM[1] approach, include a thorough post-level analysis on the semantic level of the content, identifying persons, locations, organizations, opinions expressed on them, topics discussed and events identified, clusters of semantically related entities, hashtags and users, and so on [1,2]. Applications may use the semantic meta-information to an-

[1] ARCHive COmmunities MEMories, www.arcomem.eu

swer user queries such as “return all positive opinions on President Obama” that can also, with the use of faceting, be refined to “return all positive opinions on Obama from European politicians on the economic crisis”. Such queries are concrete and clearly formulated to retrieve web and social web data that match one or more parameters, either from raw data or semantically analyzed meta-data. Results can be visualized in the form of bubble graphs and timelines using frameworks such as D3 and present the current common practices [3].

Semantic analysis is a key feature in web archiving. In the cases where social media content is also archived and analyzed, the abundance and complexity of the semantic information provides a key advantage for retrieval tasks as well as high complexity for user interaction. Semantic-centric approaches to data visualization may provide a direct mapping between user and data semantics [4]. That can be used to guide navigation over large collections of documents through semantic visualization [5]. However, one of the most important issues is the unobtrusive integration with the user interaction [6].

Semantic analysis has also enabled the design of semantic search and retrieval methods and applications that utilize the semantic information to a great extent [7]. Such approaches provide results that combine raw data (such as hashtags and users), semantic data (such as opinions and topics) and statistical figures on combinations of the above. This work examines two case studies. The first uses the #BostonMarathon #Bombings of 2013 Twitter data and examines how specific data may stand out during visual exploration. The second uses the US Election 2012 web archives and the ways of building semantically related content visualizations that can be used to display search results that correspond to semantic queries such as “show me everything on Obama and Romney” and follow up.

This section provided the introduction, motivation and related work while the next sections discuss the social media and user interaction driven visualization problem, experimentation, implication and methodology for search and retrieval from big data archives. Finally, conclusions and further work are presented.

3 Twitter Data Experimentation

The first part of the work was aimed at establishing a base of user understanding on the importance of Twitter specific features, such as hashtags, with topics and sentiment. The generic problem that is faced in this domain is that Twitter posts are by default too small to extract topic information. As such, it is impossible to align Twitter data with topics identified in the web documents.

In the search and retrieval tasks, accuracy is of paramount importance, so specific solutions must be applied in order to associate Twitter data with topics, entities and sentiment values. One way would be to group similar Twitter posts and treat them together as a web document. The hashtag information can be used in this set up. However, this could result in large numbers of posts under each hashtag, manifesting itself in the visualization of the search results, since it would be impossible to return all data from one or more hashtags. To add to that,

the nature itself of the Twitter data, governs the expectations of the users. In that respect, the users expect to be able to retrieve keywords/catchwords, opinions over time frames of events, events that the posts refer to, influence information, in effect a reply to the question of what have people been talking about regarding an event.

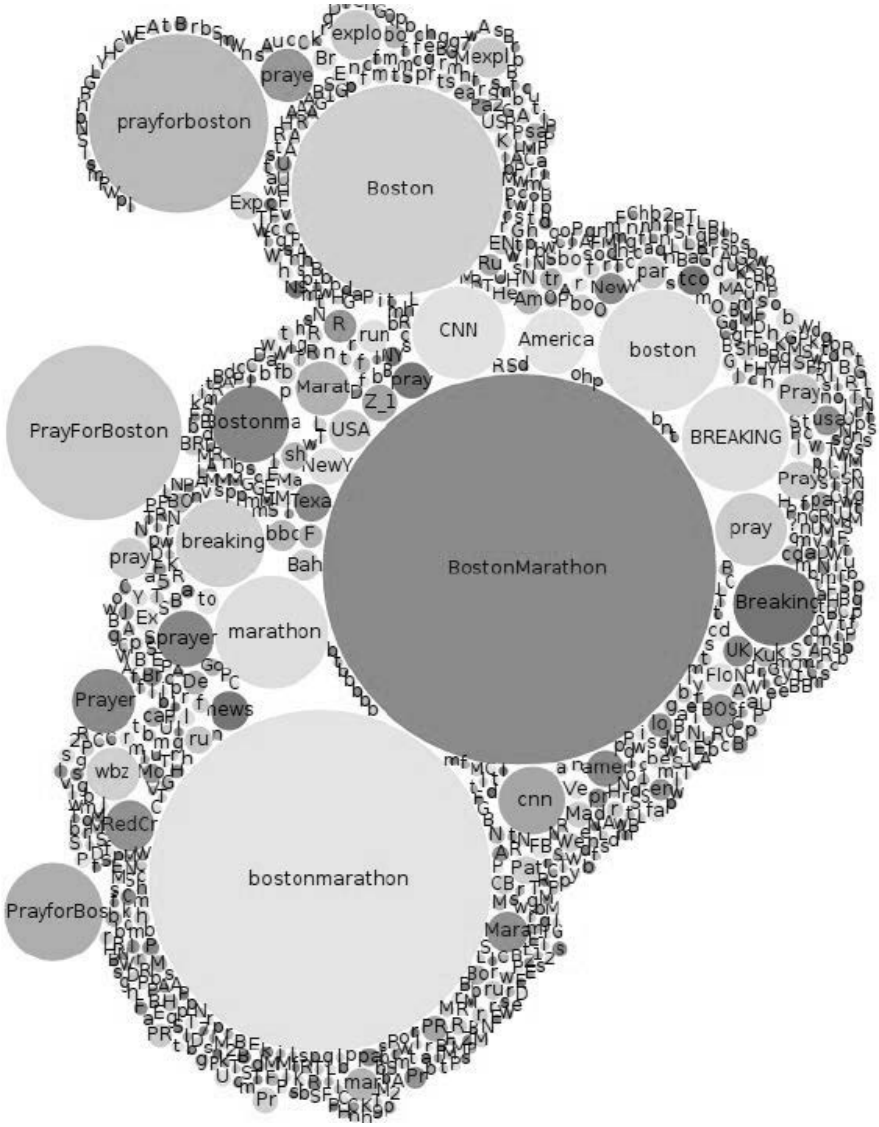

Fig. 1. General Hashtags Bubble Graph

The dataset used for this exercise contained 5000 tweets related to the Marathon event and the bombings that took place in Boston on 15/4/2013. The Mara-

thon started at 09:00 and the explosions occurred at 14:59. The tweets were collected in the timeframe between 14/4/2013 at 21:00 and 15/04/2013 at 19:46. Each of these tweets was annotated for polarity (positive, negative, neutral) according to its content. Some examples of the tweets are:

a) Excited for the #bostonmarathon tomorrow #makeitcount #findgreatness
b) Best of luck to all those running #bostonmarathon today! Have FUN and enjoy!!
c) #bostonmarathon explosions! Horrifying site :(let's pray for the may affected
d) #PrayersforBoston our prayers go out to Boston this afternoon.

With the above considerations, two types of data graph visualizations were considered: the hashtag graph and the sentiment chart. Since topic detection for single tweets is not recommended, hashtags could be used for the top-level visualization. The main tool that was used to create the various implemented graphs is JavaScript and more specifically the d3.js JavaScript library [3]. D3 is used for manipulating database documents using HTML, CSS and SVG components displaying JSON-formatted data.

As seen in figure 1, each topic may correspond to a set of twitter hashtags whose names may exhibit similarities as close as very minor lexical or stylistic transformations (e.g. “BostonMarathon”, “bostonmarathon”). These hashtags are detected using simple heuristics or Levenshtein distance [8] and are consolidated as shown in figure 2.

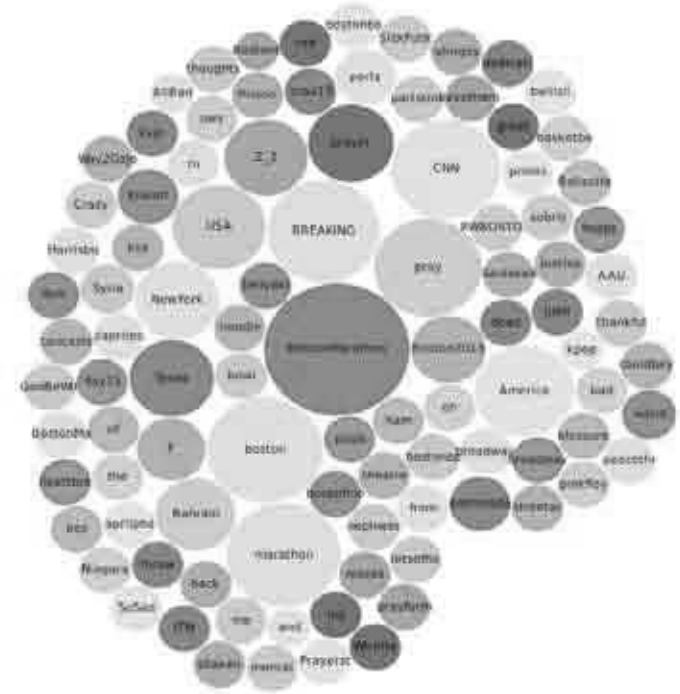

Fig. 2. Bubble Chart of consolidated hashtags using logarithmic scale for radial size

Sentiment charts are also one of the standard requirements. Clicking on the hashtag of interest can access them. They present the frequency of the positive and negative tweets over time. As shown in figure 3 below, the number of tweets for the Boston Marathon was relatively small in the beginning, however, after the bomb explosion it was rapidly increased. As was also shown, the negative tweets dominated over the positive ones as time was passing, since more people expressed their sadness or anger about the event. The fact that many positive tweets are detected (as shown in the graph) is mainly due to many people expressing hopes and wishes (e.g. "Best wishes to those at #BostonMarathon", "I hope everyone is ok").

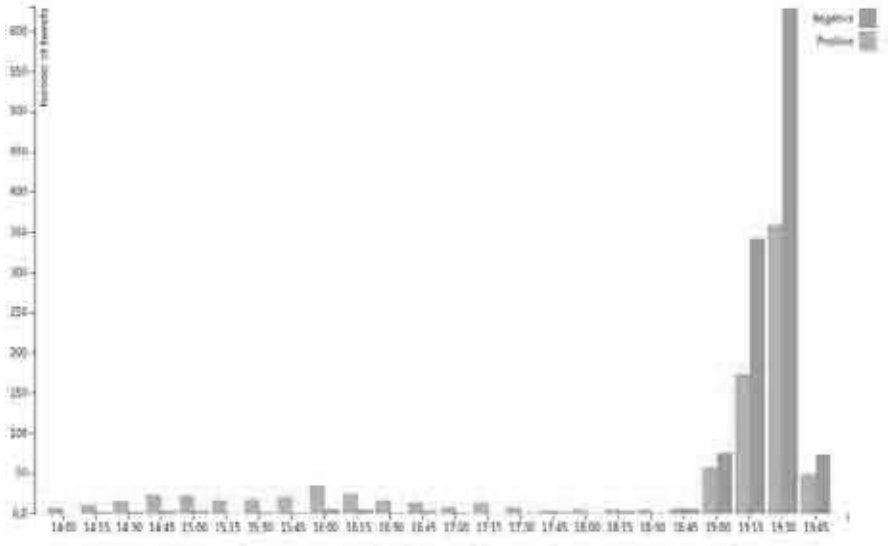

Fig. 3. The distribution of positive and negative tweets per hour

4 Semantic Relation Visualization

For the purpose of this task the Search and Retrieval Application (SARA) was used to measure user interaction [4]. As part of the heuristic evaluation, the users were asked to search using both a scenario that was designed to cover all functionalities and features of the SARA interface and as free search using any means necessary to complete their tasks. Their interaction was automatically logged and their intentions were recorded using the think aloud method.

The archived web documents were indexed in Solr [9] as semantic data including named entities, opinions, events, topics, as well as post-processed entries such as clustered entities. One of the major findings of the users was the fact that, after the initial search by one or more entities of interest, filtering by topic is the optimal way of retrieving the required information. However, only the

nearest topics are suggested since that process is search-specific. Follow up queries on topics and information contained in the topics has to be explored. This can be remedied by visualizing the map of the detected topics and, even better, as a follow-up requirement, provide a high level visual of all topics for a whole set of collected resources. Figure 4 shows the top level visual regarding topics. The distance of the topics between them is provided by the layout itself while the number of contained web resources by size of each topic bubble.

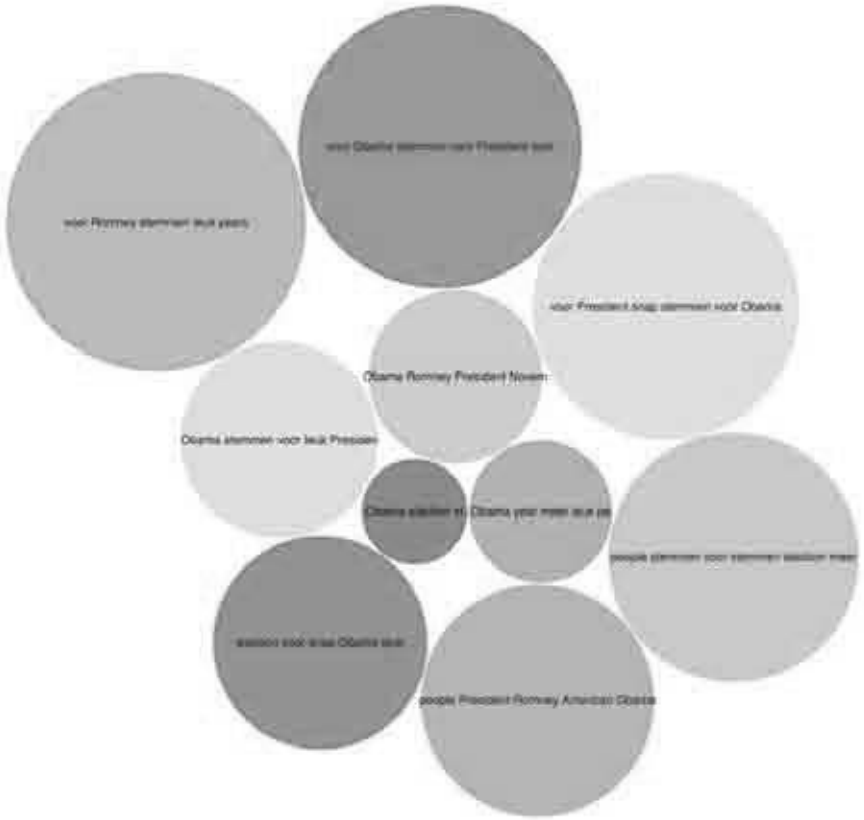

Fig. 4. Topic influence display

The users may click on the topics to explore them. By doing so, the major associated entities of the chosen topic can be viewed as well as indicators on detected opinions on each, as shown in figure 5. That, in effect, projects the overview of the entities of a topic that span all the web resources of that topic. At that point an entity may be clicked or the topic in order to zoom out to the figure 4 overview. By choosing an entity, all the topics that contain that entity as a major entry can be viewed as in figure 6. In effect, the users may always go forward in their search by either “zooming out” to topic view or “zooming in” to entity/opinion level.

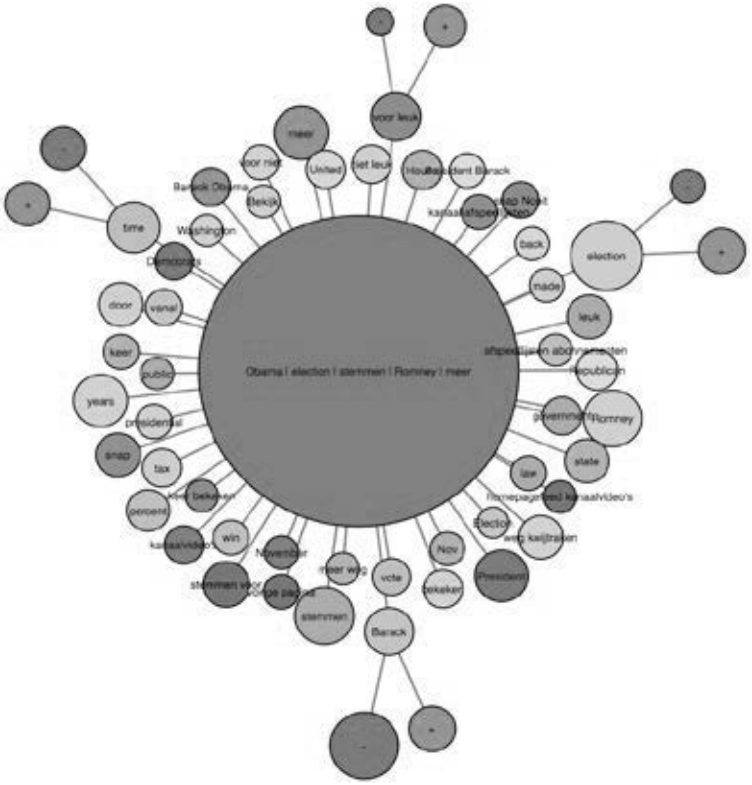

Fig. 5. Topic, entities and opinions

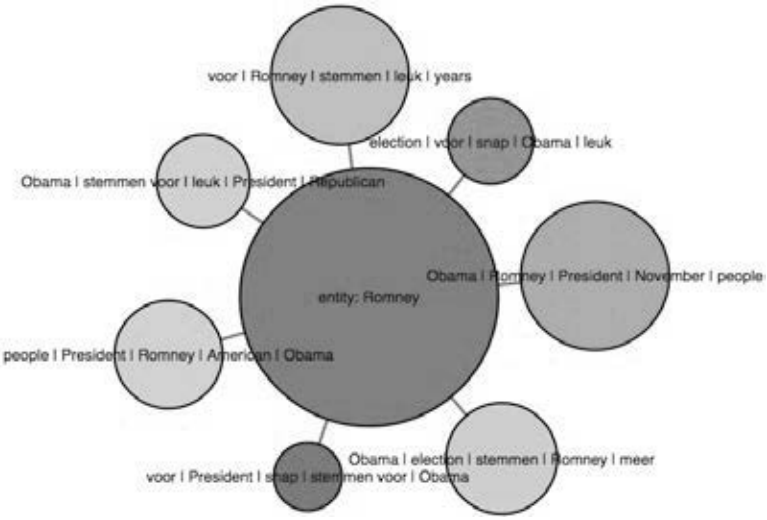

Fig. 6. Entity and relevant topics

5 Evaluation

The US Election 2012 dataset was used for the evaluation. The interactive visualizations were made available through the SARA web interface from the start of the search process. The purpose of the usability evaluation, at that point, was to measure user engagement with the newly introduced visualizations, changes in the key performance indicators regarding the search and retrieval core tasks, verification of the findings of the heuristic evaluation mentioned in section 4, and evaluation of impact and acceptance by the end users on the interaction level.

The typical scenarios for search and retrieval used in earlier iterations of usability evaluations were slightly adapted to include optional use of the topic-based visualizations. The hypotheses for the above were:

i. Taking into account the clear preference that users have shown to the introduction of topics in the ARCOMEM data and respective semantic search functionality, it was expected that the end users would actively show clear preference to using the interactive visualization process. The drawback is that using the visualization exclusively would yield results for certain typical search expectations, but it was not designed to single-handedly replace the traditional features of such application. For example, the user cannot filter or facet the results, by other entities, source network, nor rank the results according to opinions. Furthermore, many users may search by topic or by entity, entity being the norm for non-experts or non-archivists.

ii. There was already a significant improvement in accuracy and minimization of exploratory or corrective backtracking with the introduction of topics. Given the fact that, by design, the visualizations provide an accurate overall view on topics, it was expected that the indicative times to reach the same state would be even shorter.

iii. The visualizations were fine-tuned on the interaction level, based on the heuristic evaluation that was also used to establish the baselines for visual interaction. The findings were expected to verify the previous conclusions, however, this time around it was the end users of all levels that participated.

iv. The impact and acceptance was expected to be higher than the text-only interaction that was evaluated at earlier stages. Items and actions of interest were flagged for further investigation such as the topics/entities/opinions relation view (figure 5) regarding over-information and understandability.

The feedback from the users indicated that the topic-centered approach was welcomed and accepted by most users, however, an additional request was to provide a higher-level relation of entities and topics at the start of the search. This was expected, since it is common, especially for targeted search, to use entities for searching archives and move to more abstract level, such as topics, later if further search is required. A simple response to that was to include an entity word cloud (figure 7) at the same time, connecting the major entities of the web documents to other entities (i.e. clustering) or topics by colour.

The speed and accuracy were also improved since the visualizations allowed the users to engage in topics and described entities is just two clicks while, pre-

viously, topics were made available only during the search, whether at web resource level (lowest) or as prediction based on the interaction. The users now felt that they had more choice, especially true for the experts.

Fig. 7. Entity word cloud, clustering is indicated by matched colour

For the topic/entity/opinion view, some users had difficulty scanning the graph. There is clear feedback that the type of entity should be shown, preferably by color while only the most opinion-heavy entities should be visualized, resulting in less clutter. On the interaction level, the process was deemed highly acceptable. It was also mentioned by a large percentage of the participants that the social media results should be also visualized as part of a comparative view with the traditional web results or aggregated.

6 Conclusions and Further Work

The idea behind this work was not to build an ontology visualization toolset [10] but provide an interaction-aware interactive visual way for optimised semantic search and retrieval. Users perceive the potential of interactive visualized content by making semantic inferences [11] and the main task was to meet those efficiently on the interaction level. The described approach does not require a query formulation by the user at the start of the search and retrieval process but rather automatically generates the queries needed during the interaction.

Further work includes experimentation on a combined semantic relation visualization of social media meta-information, such as hashtags, with higher level semantic descriptions such as topics. That is expected to result in

realizations of summative results, like topic-ver-time, topic influence over hashtags, and so on. It is also expected that nested levels of topics or other interemediate semantic levels may be expressed, especially for very large collections and broader domains.

Acknowledgements

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Analysis and Visualization of Personal Data: the Value of Images in Social Networks

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Abstract. The goal of this research project is the analysis and development of tools to highlight and interpret personal data that is freely shared on the social networks of the web. Starting from the premise that images taken by mobile phones can be considered to all effects personal data representing values that can be displayed through a system of interactive maps, we will develop a strategy to identify the means for comparing different sets of data in order to reveal temporal and geographical information. The current project is an online platform for collecting and displaying interpolated data obtained by cross-reading the social networks Twitter and Instagram. The comparison between tweets and the pictures shared on Instagram will find some correlations that will be read and interpreted through an interactive interface. The results will be visualised on the basis of their hashtags and geolocation. Given a defined time interval, a geographical reference located in metropolitan areas, and a matrix of different hashtags, the software will create interactive maps by collecting different sets of data. This will provide the user with a tool for analysing and interpreting certain complex phenomena related to certain specific sociocultural aspects. The selection of case studies for the research has been carried out mainly within the social context that revolves around fitness. The underlying reason is that the use of camera images is strongly linked to personal motivation and self-confirmation. The correlation between the satisfaction of achieving a specific performance in sports (though not a professional one) and the temporal and geo-referenced context becomes a tool to analyse and understand complex dynamics evolving within a multifaceted environment such as the one that orbits around sharing online pictures of the results as self confirmation.

Keywords: personal data / interactive maps / hashtag

1 Introduction

In recent years there has been a growing trend in the collection and use of the increasingly ubiquitous *Big Data*; as a consequence it is becoming more and more important to analyse this flow of data, drawn from a growing variety of sources. This data is universally collected and recorded: sources of "production" might include, for example, sensors for collecting information of various kinds, GPS and RFID signals, posts on social media websites, digital videos and images, commercial and financial transactions.

In particular, major Internet companies such as Google, Amazon or Facebook, are interested in collecting and extracting vast quantities of personal data about people and their activities. Individual users are also active in the digital recording and storage of events and personal experiences thanks to personal informatics tools [1], systems for monitoring and collecting personal data that help the individual user track his everyday life from various psychophysical points of view. Recently, a growing number of applications and online services have been developed that can offer direct support to users thanks to the data they diffuse publicly: examples might include the real-time roadway traffic conditions provided by Waze[1] or the social network based on geolocalization, Foursquare[2].

As stated by Viktor Mayer-Schonberger and Kenneth Cukier [2], we have now entered the era of "datafication", understood as the quantification and relative transformation of reality into data: we have shifted from understanding the causality of events to correlating and predicting them. Because these data flows are acquired and generated by many different sources, they appear structured in different ways. To be able to use them, it is essential to design effective ways of selecting, elaborating and presenting the mass of available data on time, in terms of both quantity and quality: an exercise in interpretation that plays a primary role in the processes of interaction with specific contexts.

2 Areas and methodologies of the research study

This research study may be framed within the context of interface design; its ultimate goal is to design a tool to collect, compare and visualize data and information that may be of use to the user. Specifically, it will be interesting to explore how the design of this web-based tool may allow non-specialized users to focus search queries finalized towards acquiring data and making it easier to understand. For example, while individual users of Instagram rely on the application merely to store and share images, their collective activity reveals an astounding quantity of geographical and visual information on the world. The above-mentioned tool would make it possible to search this type of information, chang-

1 http://www.waze.com/
2 https://foursquare.com/

ing the approach to searching complex data and improving the tools available to users for their visualization.

In the process of searching for the sources of the data, we tried to identify the most appropriate social networks for acquiring shared data, not influenced by the way the connections between users are managed. During the initial selection phase, in addition to Instagram and Twitter, we had also included Facebook, but from the analysis of its API we realized that it was forbidden to read user data, even anonymously, for obvious reasons of privacy. For the same reason, in 2010 Facebook forced an earlier very similar project created by Pete Warden[3] to shut down, because it broke the rules for using the social network, and above all it was unclear how the data was acquired. Whereas in the case of Instagram and Twitter, because of the very nature of the two social networks, the data is public: only Instagram later allows the user to decide to protect his images.

Social media are being studied by many disciplines and from many different points of view, with specific attention to the analysis and visualization of large groups of digital images and the relative geo-spatial and temporal metadata they contain. On this subject, see the recent project entitled Phototrails[4] [3, 4] on the visualization of millions of images captured by Instagram, or the considerations on tracing behavioural patterns by associating geo-referenced visual data [5, 6].

3 The technological context: the rules and limits of social network APIs

The concept of open platform and its capillary diffusion in recent years has led to greater communication between social platforms and a multitude of web services that have gradually been built into many areas of communication.

The importance of the value of social data, consistently underlined in many analyses conducted by economists [1], emphasizes how personal data is increasingly becoming an economic asset for the major social networks. From a technical point of view, the integration has been made easier by the constant development of new APIs (Application Programming Interface) that simplify software integration by standardizing the data between the various social platforms.

To search and store the data, the tools offered by the social networks are not all alike in their services and calls to the server. The heterogeneity of these methods makes it impossible to complete all types of searches on all the social networks. In the case of Instagram and Twitter, all the data is public and may be searched by default. In other social networks such as Facebook, personal data is not public, in order to guarantee privacy. The data owned by Facebook is available to individual companies but may not be consulted freely.

3 Pete Warden, "How to Split Up the US" http://petewarden.com/2010/02/06/how-to-split-up-the-us/

4 http://phototrails.net/

4 The project and project phases

During the development process of the project, several working tools were conceived and created to guarantee a different approach to the understanding of personal data freely available on the web.

The first tool to be created was a system for acquiring data stored on an online server. This software, which was developed using the APIs of Instagram and Twitter and other open-source libraries, serves to collect and record the data on a dedicated database. In the case of Instagram, the server downloads and temporarily records a smaller format of the image, so that it can be analyzed in terms of possible dominant colours and in its histograms. Once the data is saved, homogeneous values are selected and recorded in the fields of a spreadsheet of the database. For each element downloaded from Internet, the original text format is also saved for possible data elaboration in the future. The decision to preserve the raw data was made to guarantee that in the future, a specific phenomenon can be analyzed with new processes and different interpretations.

There are several existing projects similar to ours, ranging from commercial to consumer applications. One of the most famous and freely accessible services is *Statigr.am*[5], a research engine based on the Instagram API, which allows searching by hashtag. In the case of Twitter, many websites support various search modes, like *Twitterfall*[6], for example, which tracks tweets in real-time by hashtag and location. Other tools such as *Hashtags.org*[7] and *Tagboard*[8] are research engines that perform wide-ranging searches by hashtag on multiple social networks. There are also open-source projects such as *QIS (Quick Instagram Search)*[9] by Al Shaw, which have developed advanced research routines in Instagram; by using this algorithm, the author was able to find pictures taken at the site of the Boston Marathon bombing in 2013, just a few minutes before the explosions went off. *Datasift*[10] is a commercial alternative founded in 2010 that stores the activities of multiple social networks on its servers, and allows them to be searched for a fee.

The analysis conducted during phase one of the project showed that many of these services are generally limited in their approach to searching: they only search small quantities of data and make no attempt at visualizing them rationally to offer users instruments of analysis.

The project, renamed *ReverseHashtag Project* for this phase of experimentation, is developed on three levels: a tool for acquisition (Fig. 1), one for data post-processing, and one for visualization. Each of these tools represents an element of the design process in the development of the project.

5 http://statigr.am/
6 http://twitterfall.com/
7 http://www.hashtags.org/
8 http://tagboard.com/
9 https://github.com/propublica/qis/
10 http://datasift.com/

4.1 How data is searched on social networks

The *ReverseHashtag Project* is based on minimal units of acquisition defined as "nodes". Each node is an action that defines a query to a data source. For example an acquisition node could be a query to Instagram based on a specific hashtag. Another possible research typology on Instagram could relate to specific geographical coordinates, to a specific date, or to a combination of these elements. Each phase of data collection is a delicate process of calibration and as such requires the visual feedback provided by the interface. Before being stored, the acquisition is interpreted as unprocessed raw data.

Fig. 1. User interface of the tool for acquisition during the storage phase.

During the storage phase, users become anonymous to protect their privacy and to respect the legal terms of the licenses to use the two social networks.

During the testing phase of the process, a data collection project was initiated to record the activity of the social networks Instagram and Twitter inside the Luzhniki Stadium in Moscow during the World Athletics Championships in 2013. Approximately 11,000 elements were acquired from Instagram and 1800 messages from Twitter. On the closing night of the event alone, 1875 photos were posted and 237 tweets were sent. To explain this difference, it is important to understand the nature and the intrinsic characteristics of the data, which in the case of a photograph is easily motivated by the user's desire to document himself and the sports event.

The interface for managing the data is designed to be used by either a common browser or a mobile application for real-time data collection.

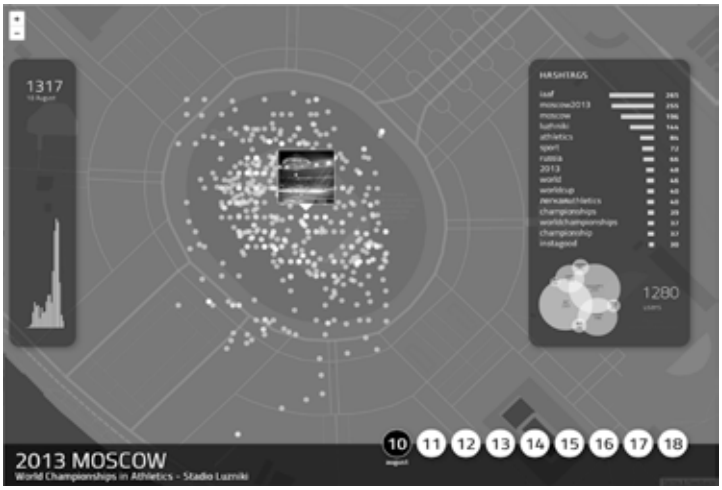

Fig. 2. The activity of the social networks Instagram inside the Luzhniki Stadium in Moscow during the World Athletics Championships in 2013.

4.2 The construction of derived data: how the elements are rendered homogeneous

Every collection process requires a further phase of elaboration to acquire derived data, which can be obtained by interfacing the system with other APIs, to localize the data with greater precision for example, or to assess the evolution of given users.

When a tweet or an image is shared online and is freely accessible, it becomes part of our reality, which for the most part takes place within a precise geographical location. This simple action, which may appear irrelevant in the long term, constitutes an invisible but real complexity. To understand and study this complexity requires the creation of tools that can bring it to light and build logical routines to transform the data, making it homogeneous and suitable for comparative visualizations. Extremely interesting contributions may be found on the theme of elaborating data from photographic images in Lev Manovich's research studies [7]: with his experimental software *Imageplot* he searched correlated data in the information contained in the images themselves in terms of chromatic dominants and colour thresholds.

Reading complex data in business has always been a specific task performed by professional figures, trained to interpret values that in most cases carry no significance for ordinary people. These figures, who are capable of understanding the complexity of the data, are becoming increasingly important in many strategic and decision-making areas. This makes it necessary to create tools to simplify the association and comparison of complex data for people who are not experts in this field.

To achieve this result, the data in the *ReverseHashtag Project* must be reconstructed and integrated before being visualized. This process of enrichment and of simplification at the same time, is based on a continuous process of re-elaboration, which takes place both during the acquisition of the data and in later post-editing processes.

4.3 How the data is visualized

The final phase of the process in *ReverseHashtag Project* is the visualization of data collection. This is a critical issue in reading the data, which can go in two possible directions: the first is to comply with the visualization presets defined by the project, the second is to export the data in a format that can be used by the most common visualization platforms in exchange formats such as CSV (comma-separated values) or JSON (JavaScript Object Notation) to create a visualization by means of an interface developed in HTML5.

In either case, every dataset obtained in a specific collection process, for obvious legal reasons, cannot become public because this would violate Instagram's user agreement, but the conceptual maps and the resulting visualizations could on the contrary be freely published as the result of an effort to interpret public information freely accessible on the web.

To guarantee adequate support for the visualization of the data, an analysis was conducted on case studies for the representation of photography-related personal data, with the purpose of defining which presets for the use of the data would be most appropriate for this project.

The results show that three principal tools are required to understand the collection process in the initial phase: the first is a geo-referenced representation (Fig. 3), the second will be based on the curve of hashtag repetitions, and the third on linearly-distributed chronological elements. The integration and co-existence of these three presets should make it possible at any moment to create increasingly complex visualizations, to progressively simplify understanding.

Fig. 3. Instarunners community: geo-referenced representation of users activities.

5 Case studies

Following an initial testing phase on various locations within the project area, the decision was made to apply the *ReverseHashtag Project* to a first case study in the field of outdoor fitness.

There is a large Instagram community linked to the hashtag #instarunners with over 120,000 shared photographs of which 40,000 were uploaded over the past year (Fig. 4). Within the group of data tied to a specific hashtag there is, depending on the cases, a certain quantity of elements that that are actually a type of advertising, often devoid of GPS coordinates and associated to too many tags. By filtering the results it is possible to obtain a sample of data that plausibly represents real people. First, the totality of the data was represented on a map in an attempt to understand the geographical distribution of the individual photographs. At a later phase the visualization tools were fine-tuned to identify words or hashtags that recur in the contents of the items.

Fig. 4. Instarunners community: chronological distribution of the elements.

The time factor in relation to this type of community is very important: filtering and representing the data based on the element of time, can help to understand the habits and changes in the behaviour of the users over an established length of time. The repetition of a ritual action, such as posting an image, becomes a motivating element in which the users seek confirmation from their own community [8]. This complex phenomenon currently has no forms of representation because, in the mass of information, the semantic content cannot be interpreted and the only action that an analysis software algorithm is capable of is cross-referencing and highlighting the repetition of specific words or hashtags. The final visualization that will emerge from the case study will highlight, in relation to a global context, the habits of a specific community of people who practice

outdoor fitness (Fig. 5). Our approach to the understanding and visualization of this specific reality was to design a tool that could obtain comparable data which could be represented and used to study and observe this complex phenomenon.

Another application of the project associated with the world of fitness was performed by running a search on the tag #running on Twitter and analysing the results over a week's time. This case study is still in the elaboration phase and its goal is to investigate the user's daily routine, in order to verify whether the project's visualization models can provide an exhaustive representation of the changes in the users' training habits over the course of the week.

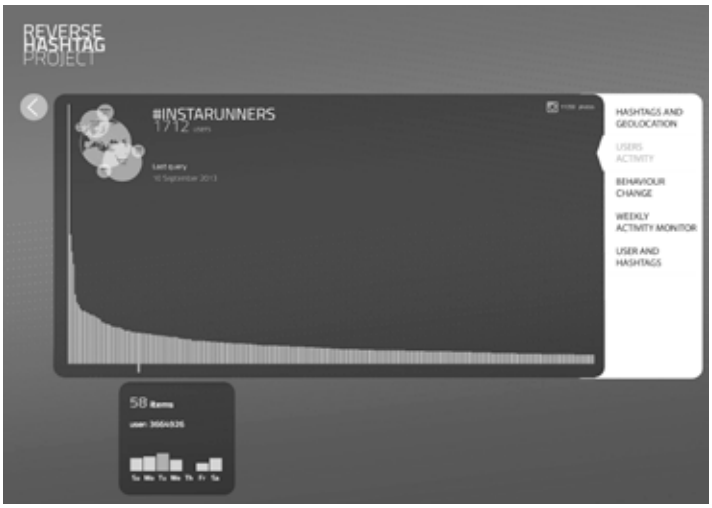

Fig. 5. Instarunners community: visualization of users activities.

6 Future developments of the project

The *ReverseHashtag Project* is currently in an experimental phase that requires a series of case studies to complete the development of the model of representation and the visual tools for the analysis of the evolution of the individual users. Another field in which to pursue experimentation is the development of a model for acquiring data in relation to complex locations not circumscribed within a localized area, but along an itinerary such as a marathon route, for example.

A further development of the project will involve the model used to collect the data, with a change in the logic for recording the elements. The current model reads the history stored in Twitter and Instagram, and made public through the API. To avoid any filters for reading the data that might have been created to support the technical management of the social network databases, a system will have to be developed to collect the tweets and photographs on Instagram in real-time streaming. This change in the acquisition mode will make it necessary to programme the data collection beforehand, but the results will be more complete than what the social networks' own research engines make it possible to acquire.

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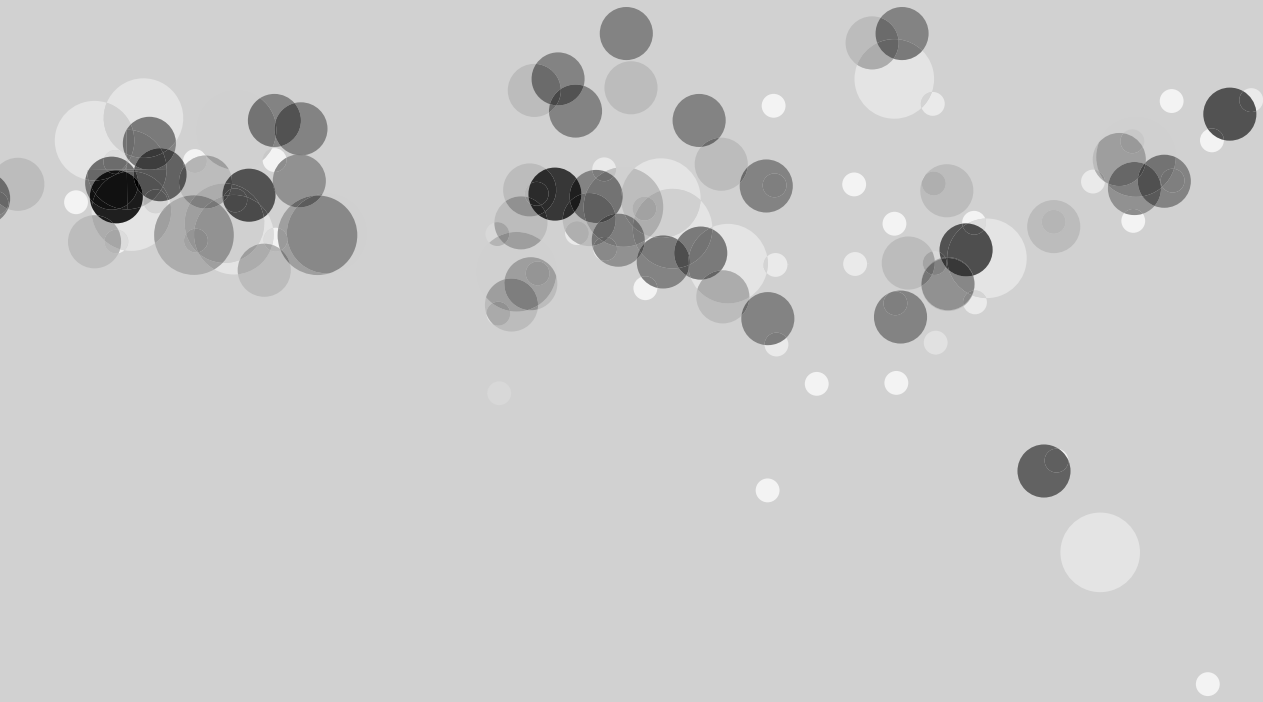
01. Full papers

3 : Informative Animation



Animation to explain Constructive Geometry

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Fig. 1. Palau Güell Chimney Stacks examples

Abstract. Development and widespread deployment of digital technologies, CAD and CAD-CAM systems, have modified not only the way we work but also the way we think . This fact, which is extensive to all design areas, is even truer in some branches, such as architectural design, sparsely identified with industrial production processes. Having a good CAD system, formalization capabilities are almost limitless. In the planning stage we can conceive all sorts of formal solutions in a relatively easy way. But in most cases this free creativity will clash with the reality of traditional production processes that are still predominant in the field of architectural construction. This contradiction is not important for middle-aged architects, still trained within the framework of a traditional culture, but it is important for young people, and especially for students.

Digital culture is fully integrated into the way new generations think. Today young people are used to generating forms very easily by using a few tools from some CAD software. It is not easy for them, though, to accept that those forms must be rethought from a completely different viewpoint, if they want to build. But this different viewpoint, from the constructive geometry, is rarely found on the Internet, where geometry is usually dealt with from its more mathematical side. We must go to some construction old treatises, where these topics are shown by an anachronistic visual language that is difficult to read for people of the 21st Century. In this context, we believe that animation can be a good resource to show how you can carry out a wide range of constructive forms, only helped by a ruler, a set square and some strings; a range of forms we could see, from current viewpoint, as impossible to be conceived and constructed without any digital system.

Gaudi's work is full of formalizations that from current thinking may seem as inexplicable as the Easter Island statues. However, the fact is that

all of them were designed and executed without any of these instruments which seem so essential today. The project we are working on, and the one we want to present to the Conference, aims precisely to show, from a constructive viewpoint and by means of animation, what the geometry that supports the design and construction of several elements of the Gaudi's work is. In particular, we are planning to present a video clip showing the constructive control of geometry of one of the Palau Güell's chimneys. Through the visual capability of the animation, this clip goes to show: how the hat of this chimney is governed by a logarithmic spiral and in which way we can control its construction only by means of a ruler, a set square and some strings.

Keywords: Constructive Geometry / Visual Communication / Antoni Gaudí / Architecture

1 Introduction

Precedents. Our first contact with animation, not only as an exercise but with the clear intention of putting forward our message was in 1999. The preparation of a programs series about the centenary of the foundation of FC Barcelona [1] took us to take an order from a TV channel to our school. Thinking towards the future, they asked students to draw up an architectural hypothesis about how the club stadium would look like in fifty years' time; that is about 2050. The proposals were to be presented in one of the series programs, and the exhibition format seemed obvious. In a TV channel, especially if it is the most popular and best high-rated channel in the country, rhetoric presentations or graphics with professional looks are not appropriate. We needed a moving images language that, talking about future projections, couldn't be other than animation.

Fig. 2. Frames of FC Barcelona Short Film

Any television channel, obviously, has both professional people and facilities to produce any sort of audiovisual formats, real or animated. However, they understood that the project required some knowledge exceeding their own field of expertise. It required somebody with some knowledge of architecture and architectural geometry and being able to translate to a visual form the expressions – often vague and emotive but not much actual – as students express their proposals. So our position as teachers of architectural representation, specifically

interested in exploring new expression forms arising from the use of computer systems, pointed us as the right team for this task.

Since then, the situation of having the required conditions to carry out the animated explanation of a particular topic has been repeated several times. We did the visual discourse on the geometry of Gaudi "Gaudí. Exploring form[1], "or the explanation of building systems and architectural elements of Catalan Romanesque churches, or virtual trip to the historical transformation of a territory, or the submission of proposals for the creation or renovation of a neighborhood or the explanation of the basics of Catalan brick vaults, or…

Fig. 3. Gaudí, Exploring Form Exhibition

All are job orders we have had because our expertise, as architects and teachers, about the concepts they wanted to explain and how to do it in a didactic way. But this expertise was not the only reason why we were the right people to do these jobs. A certain capability to express ourselves in a visual speech by animation was the main reason. Therefore it is because of this combination of factors that we could carry out these experiences.

[1] "Gaudí. Exploring form"[2] the central exhibition of the several cultural manifestations organized in Barcelona because of the "International Gaudí year", in 2002. Conceived as itinerant exhibition, it could be later seen also in León, Genova, Tokyo, Sao Paulo, Napoli, Peking and Shanghai. The exhibition contents can still be seen by means an interactive DVD, published in 2008[3]

Nevertheless we must make clear that we are not professionals in the animation field, we cannot even say that we are experts in it. Our specific area of expertise is architectural representation. And our experiences in the field of animation must be seen as exploring some new expression in this area. Ways in which we feel more and more interested and we are more confident about its potential. However, these ways do not seem to attract much attention among colleagues of our specific knowledge field. We can define ourselves as "frontier people" between two adjacent fields of knowledge perhaps disjoint excessively.

Communicating with Students. For years, our animated works were always motivated by external requests. We were looking for any solution to some communication problems coming from outside. But a few years ago we observed, also in our daily work as teachers, important communication problems. Retaining attention from students for an hour lecture has practically become an unattainable desire, like trying to make them read, carefully enough, any academic text, either a lesson or a simple instruction manual. New student generations have grown into an audiovisual culture, and we can say that they do watch the world through a screen. Our awareness of this fact, among other reasons, has led us to change our lessons model. We do not do theory sessions any longer and we have channelized its contents towards a collection of 50 video tutorials [4] with an average duration between 8 and 10 minutes.

Fig. 3. Students in a working session

In the same work line, we want now to take a new step forward. The present project aims to contribute to finding solutions to a more general problem: the libraries of our schools are losing their readers. Students use the library books only to make some photocopies from their pictures or drawings, but they rarely pay attention to the text, to the narrative or argumentative discourse. In most cases, if the text is not read, those photocopied drawings and images become

nothing but a few graphics without any meaning. A substantial amount of information is lost.

For many teachers, the first reaction is to complain about the apparent lack of interest from students. But complaining does not change anything. We need to find solutions for this problem. The experience of our video-tutorials system demonstrates the interest of the students to acquire knowledge has not diminished at all. What has really changed is the way to connect with these skills. If you succeed in finding the way, students respond and, at least in our case, they respond very well.

We do not believe there is a magical and universal formula to deal with this problem. We think that, right now, what we need is trying new experiences, testing new ways to transmit knowledge to students. Therefore, the project we present aims to be only a contribution to this experimental path.

2 Key Features of the Project

From Communication by Text to the Audiovisual Communication. Geometry and construction processes are subjects traditionally transmitted by means of texts together with some drawings illustrating them. So they are publications where graphics or visual parts already play a key role, because the text cannot be completely understood without the picture. However, in a printed edition, the reading flow is channeled by the text, whereas in an audiovisual this flow becomes governed by the image. The voiceover plays the role of guiding the eye and it complements the image. But voice can pause and "disappear" whereas image cannot. It has a constant presence. If the voice extends his speech, the total time will grow and, therefore, the temporary space to fill with images will grow as well.

We cannot expect that, while the voice is completing a long speech, the reader remains looking at the same static picture or watching some actions or processes having a predictable ending. If it happens, our reader is likely to give up. In contrast to the textual reading, where readers impose the rhythm (they decide when to stop and when to do a quick read), in audiovisual media tempo is already established previously. Thus, image carrying a reasonably strong rhythm will be a required feature, without temporary delays that cause boredom and make our reader disconnect.

We must accept that an audiovisual with these features cannot have the same ability to contain information as a theoretical conventional publication for teaching. This fact, let us face it, is always painful for teachers, because of our natural tendency to more rhetorical speeches. The counterpart lies in the expectations of significant capabilities improvement of connecting with the reader and getting concepts better understood.

Narrative Proposal. All chapters of the collection we are projecting follow the same plot pattern. We report a real architectural element, showing a geometric

structure evident but not trivial. After a description of the chosen item, we explain its main morphological features. Then we expose, from an abstract viewpoint (what we call "digital thought"), the geometric concepts being behind these morphological features. Concepts belonging to the mathematical universe, but that they do not seem to have any direct transcription into the material world, beyond the industrial production environment. Therefore, next step proves this is not true and shows in which way the same shape can be rethought from the tangible world of constructive geometry. Then, we show how that geometrical definition can be controlled, by hand and on site, only helped by instruments that builders of Gaudi's time could use, as rules, triangle, strings…

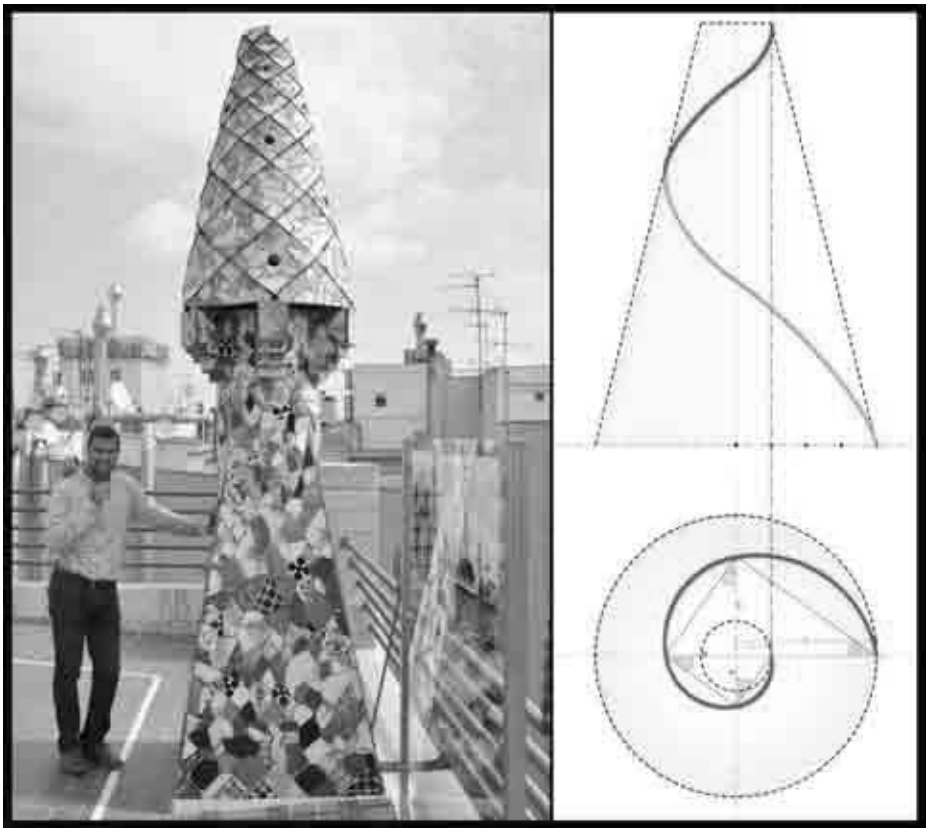

Fig. 4 Fotography Chimney number 13 and helix projection of a logarithmic spiral

In the specific case of the example we are taking as prototype, the chosen element is chimney number 13 on the flat roof of Palau Guell in Barcelona [5]. When this element is examined in detail, a disconcerting point appears: the surface treatment of its top section is ruled by a helix that is a projection of a logarithmic spiral. As its name suggests, this curve is the graphical expression of a logarithmic function. It has an immediate drawing using CAD systems (just enter

the start and end radii). But, at first appearance, the way to draw this curve on site is not evident. Even if we achieve its drawing with a reasonable effort, obtaining the projection on a cone does not seem an easy thing. So this video clip tries to answer these apparent enigmas.

Dark Points. In brief, this is the plot of the story. But, told like this, this story leaves several dark points. For example, we claimed that this Gaudí's design was ruled by a helix that is a projection of a logarithmic spiral [6]. Obviously this statement must be argued, because we are into an academic context and, therefore, unreasoned statements cannot be admitted.

The point to be discussed then is: how much extension and depth we must give to argue these dark points? As teachers, we can consider very interesting making a comprehensive explanation of arguments. But we must consider the aforementioned limitations of this media, and be aware that excessive scholarship can easily ruin our global discourse. How to get out of this dilemma?

Browsing Reading. In our project, animating audiovisual is the main component, but it is not the only one. By means of these clips we will try to capture the reader's interest on a set of chosen subjects, but without any intention to make an exhaustive discourse. The voiceover and images should refer to those aspects which we called dark points. So, readers can see that there is a statement without being argued, but also without being hidden.

If the clip captures the readers' interest, we expect them to want to increase their knowledge about the subject. And here, in this second level of information, keeping audiovisual support is no longer needed. Now the matter is providing some easy access towards the answers to the questions that the clip has left opened.

So, our idea is that a set of links are joined with the video clip. These links will lead to complementary pages where, already in a conventional form (text and graphics), the arguments will be widely explained. This is a mixed format that, in fact, is matching the model of reading through hypertexts. And we are all used to this model already.

Abstract Geometry and Constructive Geometry. As is clear from all that has been said so far, comparison between abstract geometry and constructive geometry is the common element for all chapters in this collection. We want to get the message that, in Gaudí times and even now, abstract geometry, which is essential for conceiving forms, is not enough to accomplish their construction. To materialize these forms, we should think them again from a different geometry, this is: the constructive geometry.

From one or other viewpoint, the story focuses always around geometry. Therefore some perceptible differences in their look, between both discourses, seem necessary. With this aim, when the explanation refers to concepts of abstract geometry, we adopt a drawing look, cold and neat; however, when the sto-

ry is at the constructive geometry universe, its look is changed to visually express this difference through environment.

Changing looks does not mean giving up abstraction. If we have chosen to operate with animation instead of real video, is only for its capabilities to make abstractions. Keeping the abstract aspect, the change of scenario is expressed by several strategies such as the adoption of perspective viewpoints or the use, in an iconic expression, of some hands and tools masonry (set square, straightedges, pencil, strings, etc.), to try to communicate the manual character of the building processes.

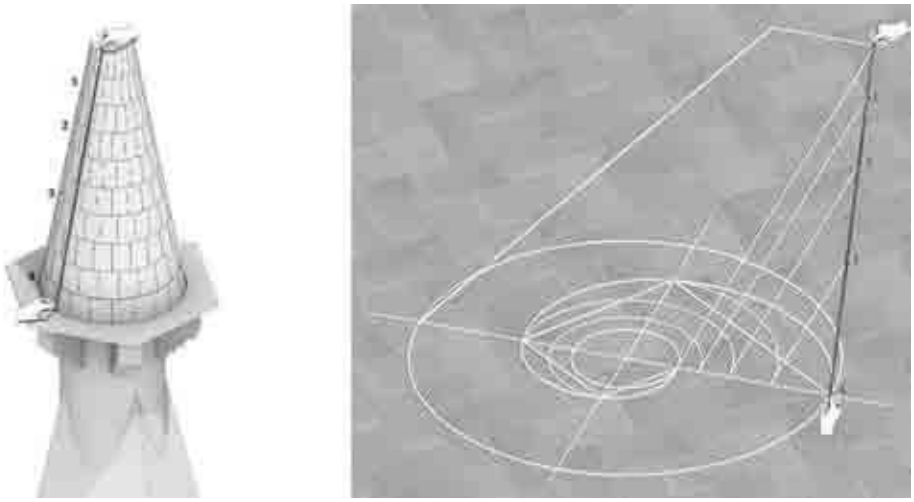

Fig. 5 Visual Expression to communicate the manual character.

3 Conclusions

In the current stage of the project development, there are still many questions to solve. Questions such as, the most appropriate support to contain and run this collection is not decided yet. We think, right now, this support could be any university multimedia website, either as MOOC form or as a multimedia collection for students.

In fact, this is not a question of first importance, right now. Producing some early chapters is now the priority. This will allow us to follow a process of trial and experimentation. A certain amount of experiences, both in production and in reading, will allow us solving several communication issues, which we are aware, and other ones which we still ignore. The reviews, advices and all that can bring us ideas to improve the prototype will be welcome inputs.

It is even possible that, after these experiences, we conclude that this path was not a good solution for the problem we wanted to solve. It is a risk we should accept. What we cannot accept is complaining without looking for answers.

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The CB3 Method.
Or how to train an Art Director against the Straight Line

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Abstract. During my vast experience teaching and coordinating programs on Art Direction, I have found myself in more than one occasion with the situation that when the students have to deal with a new project, they resort to the bank of images already in their minds. With the goal of conceiving the way of avoiding this easy path – the straight line – I have carried out an investigation that ended up into a method that pursuits to distance the student from the comfort zone in order to –using a spiral trajectory – force her to face the accidents and the surprises that will enrich the process and which will allow to contemplate it from a total different perspective. In the end, it is about generating a method that obliges to transit not planned ways, a systematised way to distract them from the usual path and, therefore, provoke those fortunate accidents in which a great number of times new forms have been discovered.
What follows next is the formula that we have invented to involve the students in this complex process.

Keywords: Art Direction / Project Methodology/ Generating Ideas/ Design Investigation/ Non Conventional Thinking

1 Introduction

During my years as a teacher in Pompeu Fabra University and in Escola Superior de Disseny i d'Ingenieria de Barcelona (Elisava), I had the chance to confirm two significant questions that restrict the quality of the creative proposals made by my AD students: the usage of previous mental images and the non conscious imitation of professional patterns.

Using previous images limits the possible discoveries that could widen their creative frame, while the trend to unconscious imitation trend shows a evident "lack of poise" in the investigation / discovering phase and a "no pleasure" in the process, which induces to a quick and easy solution for the trouble on hand.

2 Working Hypothesis

By means of encouraging the AD student to go throw a broad investigation field that would involve the use –metaphorically– of all their senses, accidents will be produced as well as surprises that will result in not expected ideas, and finally in much more original conclusions at the time to find solutions to given problems.

The formula will have to dote the AD student of a specific method that would allow her to get some distance from the first thoughts. By thinking with the feet (moving away from the working space in order to elaborate a field work), with the hands (drawing, sketching and creating prototypes), and thinking with the eyes (connecting images and concepts, and creating visual minds maps), she will be able to go beyond her primary mental images and a whole new world of possibilities for the problems will be created.

3 The Investigation

3.1 Used Methodology

In the major part of the bibliography consulted to carry out this study, we have realised that the authors have focused mainly in the AD in advertising: Odejo (1998), Rom (2006), Mahon (2010). None of them went in depth into a precise method for the AD in general. Many of them proposed logical paths in design, marketing and advertising, but never adapted to a kind of professional that –as a responsible of an aesthetical strategy– will have to interact with architects, graphic artists, video makers, fashion designers and photographers, as well as having to participate in interior and design projects, selling points, creating visual universes for brands and products or even collaborate in considerable institutional and social ventures.

The lack of particular bibliography forced us to lean towards a methodology of investigation more focused on the Art Director praxis than in theoretical questions, working with interviews, tests, and samples taken from professionals and students.

3.2 Description

The investigation was divided into two principal sections:

A. Procedural tests with professionals and students

B. Samples taken with two different groups of students

A. Procedural tests with professionals and students

A. 1. Testing with professionals

We worked in two distinct ways with the professionals. Firstly, we held a Focus group and we continued with individual samples.

Focus group: The group was composed by seven professionals coming from advertising, communication, graphic design, interactive communication, computer graphics and product design. We asked from all of them if they usually use any kind of method for develop their AD projects and, if positive, which was its procedure and development.

One of the most concluding results was that in the professional world the methodology only exists and the beginning of the process (client commissioning) and at the end (the AD commissions to a specialist collaborator), meanwhile in the more creative phases based on generating ideas and concepts, no other process it has been realised but the model seeking.

Another evident fact was the difficulty of the professionals trying to talk about their manner of working: there were not aware of applying a specific methodology neither following a defined written or visual process. One of the few procedures that they were actually conscious about, was referred to the existing contact with "the other", being who were giving then the instructions (client or planner) or to whom they must passed them.

Individual samples: In this case, individual semi-structured interviews were carried out.

The most interesting observation in this modality lies in the fact that the professionals widened considerably – from a qualitative and quantitative point of view– the results obtained during the *focus group.* They put more effort in detailing their working manner and they add more diversity of important words and concepts – not very methodological, although– that contributed to the enrichment of the method that was elaborated after the investigation.

A. 2. Procedural test with students

The study of the project process about the practice of the students proved that this one was taking place in a mixture between the design process, communication process and marketing methods. During the testing frequently appeared concepts straight from the marketing world, but none was referring to aspects related to the context of the project, the management of ideas, neither the chosen information nor the follow up of the work carried out by the collaborators.

When asked about the source that they were looking for the information and the examples in order to deal with a project, the first answer was Google, being followed by magazines and the environmental public space. They never mentioned libraries or places with a specific interest for the project in question, the use, purchase or consumption of the product by the consumer either.

Everything above showed that the student follows a previously established guidelines and that searches for safety lines during the whole process without

any proper systematization. This is to some extend positive, because it helps avoiding the student to get lost or forgetting something important, but from another hand it is not contributing finding new, distinct and distinguishing elements. The majority of times they try out formulas or successful cases with a "professional tone". And in the end, without a project protocol that would lay on an initial solid phase of investigation, the creative cannot address the complexity required by the projects to generate innovation.

B. Samples taken with two different groups of students

B. 1. Sample 1

It was required to a group of seven students to develop a project of conceptualization and designing a visual universe of a new perfume providing them with a series of essences. It was said to them that they must stick to the process exposed by the authors Oejo (1998), basically focused on the advertising world, Martí Font (1999) with, from one hand, some set up phases and, from another, opened to the generation of divers hypothesis– even though very linked with the design process– and Mahon (2010) more focused in the expression and execution than to generation of ideas and to the direction, combined to a proposal realised by the same students than in the test, what we have named the "Hierarchic Scheme" by its step by step process.

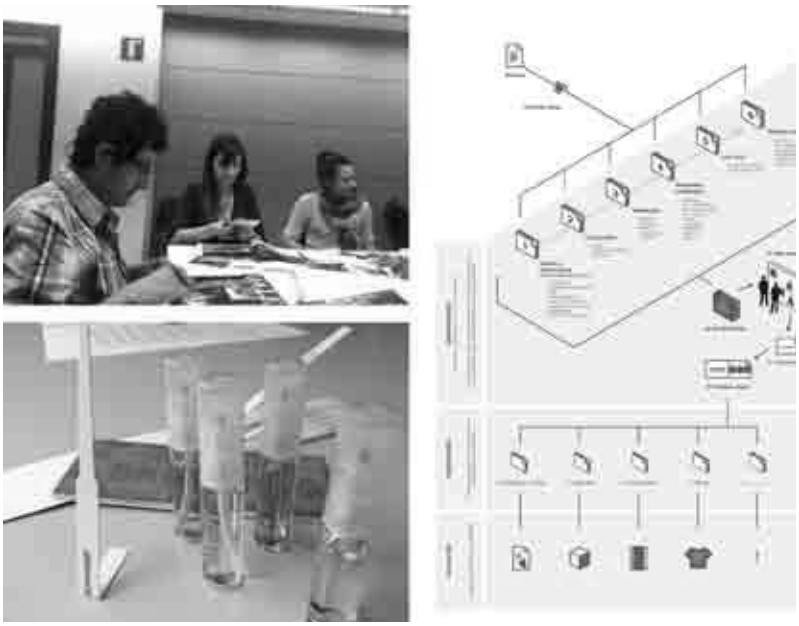

Fig. 1. The process test, done with the "Hierarchy scheme", a process involving a series of steps.

The answers of the students were very predictable and uniform, full of topics related to the world of perfume.

The results brought up as naming samples were:

Moi
Miroir
Toxique
Blue
White city (referring to Lisbon)
Désir
Oximor

The results for the images/places were:

Paris (five of them)
New York
Lisbon

The results for the imaginary/context were:

Urban. Fall or spring (never summer or winter). Parks or streets not very crowded with single-family and flat houses. Floral environments. Two of them include a river. In three of them there is a hotel.

Fig. 2.

The results for imaginary/ context were:

The perfumes are, in some cases, ambiguous. Not explicitly masculine neither feminine. The students even doubted that the gender could be used. In five cases the character was a young female, blonde and dressed up in casual clothes. In four cases was driving a bike or at least the bike was somewhere the proposed image. The men were rough and exotic. (Figure 2)

B.2. Sample 2

Equally than in the Sample 1, we worked with a group of seven students to which we proposed the same wording: creating the concept and the visual universe of a perfume after the same essences given in the Sample 1. In this case the method applied was the elaborated after the results of the investigation (the CB3 method, that will be discussed in detail in the up coming section), which is what we have named the "Liquid Scheme".

The difference between the results with the Sample 1 was quite surprising. If in the first case they were not stepping out the established conventions, in the second one they achieved creating personal and well-defined universes.

The results brought as samples of naming were:

Tasmania
Öwel
Wonder woman
Revolt
Revolt dolce
Confidence
Armand

The results for the imaginary/places were:

Tasmania
The invincible Spanish armada
California
Big cities in general
Norway
Paris
Italy

The results for the imaginary/context were:

All the above mentioned during the four seasons of the year. Parks, forests, roads, festive streets, bottom of the sea, sea battles and the interior of a classic painting.

The results for the imaginary/character were:

In four of the seven proposals were men: Nordic, revolutionary, conservative and surfer respectively. The other three were females very different between each other: funny and radical, delicate and sophisticated, independent and provocative.

4 The CB3 Method

The CB3 method (applied to the work as in Sample 2) consists, as we have already pointed, in searching the way of marking the distance between the student and the comfort zone – the straight line– in order to separate her from the mental images that would drive her to commonplaces.

In the eagerness of visualising and systematising this complex process, was the moment were was created this map that consists in threw phases of work, THE CONTEXT BOX, THE CONCEPT BOARD and THE THREE STAGES:

CREATIVE BOOK, in which four steps are clearly defined: Thinking with the feet, Thinking with the hands, Thinking with the eyes, and Thinking with the head.

CONTEXT BOX: **Thinking with the feet**

The CB3 methods starts with the research in spiral through the areas of investigation and the archive from which the AD generates new ideas and proposals: the context, the models, the trends, the field of work, the image, the word, the narration, the expression, the challenges, the *nots* and the held intuitions. Everything is combined in a path that privileges an opened and curious attitude, against the straight line.

Thinking with the feet means moving away from the comfort zone in which the AD carries out her work in order to trace a hazardous route for every basis of the investigation above mentioned, with the intention of getting back to the desk with the backpack full of unexpected new references. This might certainly be the most fertile part of the CB3 method.

THE CONCEPT BOARD: Think with the hands and with the eyes

The discovery of the concept is always one of the key moments of the process, and perhaps one of the most creative. The concept will help organising and rationalising the creativity and doting it with a long course afterwards. It will be the nuclear idea, the DNA of the project, the seed of *How.* Is in this point when the students extract all the compiled elements in the CONTEXT BOX and the spread them in front of themselves.

Thinking with the hands means operating this material and disposing it in a thousand different ways to allow the concept to pop up out from this research.

The physical relationship with these objects horizontally disposed (on a table) introduces the proxemics, very stimulating when it comes to discern new forms. Thinking with the eyes means reading these shapes in order to extract from them all their potentialities. Summing up, in the end it is about COpying, COmbining and TRANSforming this material into something else (COCOTRANS).

Once the concept has been found, it will be expressed on a CONCEPT BOARD, the visual synthesis, inspiring and triggering of the creative project, which contains as well a brief explanatory – and inspiring– text filled with various images that are referring to the public, the aesthetic, the tone, the light, the emotions, the values and the context desired.

THE CREATIVE BOOK

Once the concept has been defined, we spread the CREATIVE BOOK, a synthetic visual universe that will show the lines that the team will have to follow.

Thinking with the head means defining, after all the work of exploration carried out during the previous sections, such complex aspects as the brand territory, the tone of the "conversation" between the brand and the user, and the attitude of the models responsible of communicate the image and to interpret the roles that will represent the communication and the persuasion of the discourse,

The CREATIVE BOOK is the tool of communication by means of the AD will transmit to her collaborators all the parameters that they will have to take in consideration at the time to develop and formalising the aesthetical strategy. It will be inspiring and regulating, but it will keep an open space to ease the creative contribution of the collaborator and specialists.

5 Communicating the Method: the explicative supports

Aiming to explain the functioning of the CB3 method, we have created a document that combines conceptual texts, protocols, instructions, and graphic visualizations that pretend to refer, by means of the colours and shapes, the sequential developments, which describe the dynamics of the processes.

The goal was to find the way to express graphical and synthetically the idea that in the end a process in a trajectory.

To be able to accomplish our commitment we attend:

- A map that contained the whole process that we intended to reflect, in a single image, the global evolution of a project, from the briefing until the final perception from the user's point of view. (figure 3)
- Nine working areas, a field work and a creative book, as exploration tools assigned to involve the student in this path in spiral and try that this one creates some distance from the comfort zones and their usual process and therefore get her close to the peculiarity and surprise.

- Four phases or manners of reflexion that have to do with starting from a more distance beginning than the mental images of the student, the feet, and from there build a ascendant tour that, by means of the hands and the feet, finally arrives to the head.

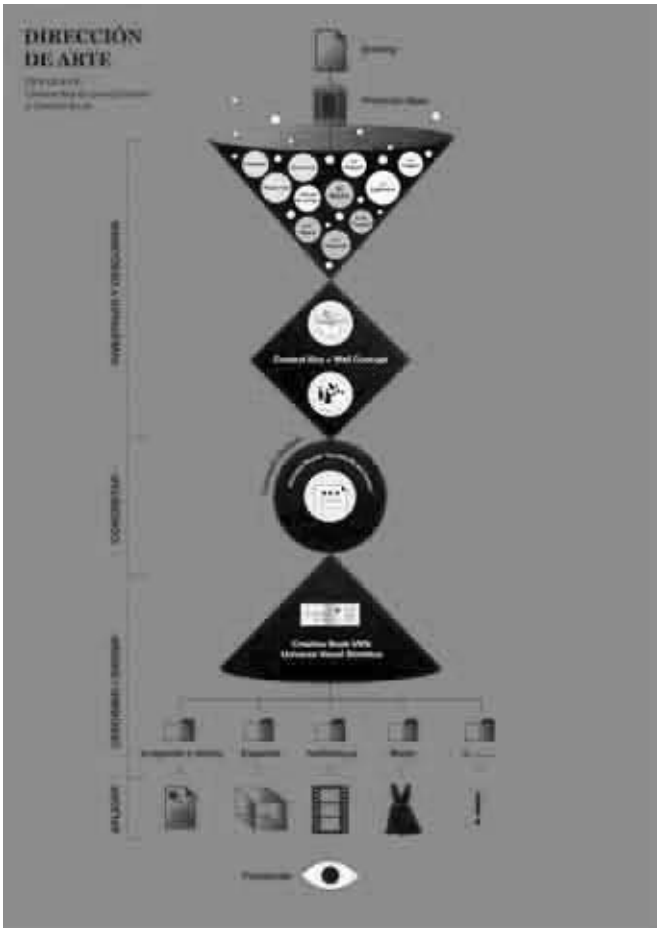

Fig. 3. Map of the whole process in a single image, from the brief to the final presentation

During the following stage we wanted to explore the audio-visual medium as a way to present the CB3 method, for what we made a four minutes long animation video that shows the different stages for which a project moves forward.

Its confection included a fieldwork in which, after the study of more than seventy videos that communicated educational content, we identified the characteristics of each kind of language (computer graphics, data, stereotypes, key concepts, lettering in motion and transformations) and we selected the ones that were more convenient for our case.

The video was shown as an efficient tool when presenting the method and helped understanding the philosophy of itself – the idea that a project is in fact a trajectory that it is not moving forward drawing a straight line –, but we considered that a support that would have ease the interaction with the user would have resulted much more efficient to deepen in the comprehension of its particularities.

6 Conclusions

The students, after being thrown into a new challenge, they use to turn to the images that they already control. This leads to a very limited space for novelty. However, when they are being encouraged to explore areas that usually they would not have *walked thru*, the proposals get much more rich in originality and *personal touch.*

Many times happens that – in Design, but also in science and in all the creative processes in general – that the best results – the best discoveries – are found by pure chance, when one is standing far enough from what she was looking for. The technical term that names these fortunate accidents is *serendipity.* An unexpected discovery that it is produced when something else has been searched. Then, How can we generate a method that assures and systematises the appearance of these enriching detours? In the end, how can we program the hazard?

The CB3 method pretends to contribute with an educational tool that would cooperate in this direction.

Regarding the elements that have been developed for the communication of it, we consider that the ideal support would be the one with what the user would not be just a mere spectator of the shown contents, but someone that could interact with them, opening windows which would lead to different levels of explanatory depth. In a future stage we will direct to develop the material that it is going to this path.

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Animation as Boundary Object. Promoting Cultural Changes through Audiovisual Design

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Abstract. The paper will address the issue of dialogue between actors with different skills, starting from some evidences: 1- TRANSLATION. The growing need (in the scientific field and dissemination) to display and shape ideas, information, data, to communicate results and findings making them accessible, interpretable and sharable [1] by communities that are heterogeneous in terms of skills or operational contexts; 2 - TRANSFORMATION. The interdisciplinary nature of transformation design, that has its great strengths in its ability to mediate diverse points of view and facilitate collaboration due to the assumption that complex problems cannot be addressed from a single point of view [2]; 3 - ENVISIONING. Communication design therefore takes on the role of promoting cultural change using tools for listening and expression, that are common or shared between disciplines, and able to activate a dialogue for social innovation. It has to face and drive change by developing processes, tools and forms of communication that assume listening and storytelling activities, and the relationship among people as the real engine of innovation.
The paper proposes an approach that considers the audiovisual artifacts, especially the "informative animation", as "Boundary Objects", artifacts produced in the context of decision-making and collaborative processes that involve actors with different skills and heterogeneous expectations: "Their boundary nature is reflected by the fact that they are simultaneously concrete and abstract, specific and general, conventionalized and customized" [3].
Will therefore be proposed examples of animations created over the years (since 2009) by the IMAGIS research team and some students in communication design (School of Design, Politecnico di Milano). These short forms of audiovisual communication are dedicated to the theme of urban transformation and are part of a process of dialogue between stakeholders (citizens, city users, associations, businesses, schools, institutions), giving shape to their expectations and the collective aspirations in order to build shared visions of the future [4] [5].
These audiovisual artifacts will be analyzed from the point of view of aesthetics and languages, focusing on the complex relationship between live action and animation. As far as animated images have been created rather than captured, they foster people to reflect on what is represented and not simply observe what is shown [6]. For this reason animation can be account as "boundary object", being characterized, at the same time, by *con-*

structedness [7], and by the high flexibility given by the reactivation of a rich toolbox [8].
According to the state of the art, our experience highlights how communication designers often use forms of animation to activate a dialogue with other disciplines. Therefore, the main goal of this work will be to bring out an aesthetic of the so-called “video scenario” as a "boundary object" and going beyond the definition of the 4 types proposed by Star and Griesemer (Repositories, Ideal type, Coincident boundaries, Standardized forms).

Keywords: Audiovisual Communication/Animation/Boundary Objects)

1 Towards Transformative Communication

This instruction file should be used as a template. The research on social innovation has been investigating the role and impact of creative communities and ordinary people developing good practices to solve everyday life problems related to housing, food, ageing, transports and work [9] [10] [11]. Design is getting more and more involved in promoting actions and providing solutions coming from a collaborative process with actors and specific competences coming from various fields, each one of them advocating different perspectives and expectations. Collaboration among individuals can vary widely in nature. When applied to the fine arts the term usually describes a diverse set of creative interactions between two or more people: «the most common and traditional use of the word within art history refers to […] collaborators (who) are essentially hired hands, not necessarily true creative or intellectual contributors to the project» [12]. However, here we refer to participatory processes of change involving communities and groups within organizations or among society and organizations not necessarily having a role in the realization of artifacts but just sharing visions and ideas. According to the definition by Burns, Cottam, Vanstone, and Winhall (2006), the concept of transformation design suggests that: «Because organisations now operate in an environment of constant change, the challenge is not how to design a response to a current issue, but how to design a means of continually responding, adapting and innovating. Transformation design seeks to leave behind not only the shape of a new solution, but the tools, skills and organisational capacity for ongoing change» (p. 21).

Burns et al. (2006) summarize six key characteristics of transformation projects. The following ones are particularly interesting for us: «Collaborating between disciplines […] Recognising that complex problems cannot be addressed from a single point of view»; «Employing participatory design techniques […] that involve users and front-line workers in the design process»; «Creating fundamental change […] Leaving the participants with the tools and capacity to continue to adapt and innovate means». These processes of change are funded on the imagination of a possible and better future. Which contribution communication design can provide to the dialogue about possible worlds and sustainable innovation? The transformative role of design is combined with the potential transformative role of communication due to its capacity of translating between

viewpoints. Our paper proposes the analysis of audiovisual forms and artifacts as part of a process of dialogue for societal transformation. The production of images is a design practice for sharing, producing and nurturing collective knowledge: a continuous interaction between the images themselves and their multiple interpretations, which gives way to a collective dialogue. Envisioning ideas and making them explicit through their representation leads the actors involved to develop it in the light of their perceptual and evaluative frames and to give feedbacks according to these patterns. The images produced within this kind of collaborative processes get added value as they represent tracks and evidences of social practices, a catalogue in memory of the creative process that becomes always available for further reflections. «Image has an operational identity: it configures our vision of the world and things» [13].

2 Audiovisual Artifacts as 'Boundary Object'

The need to support a dialogue among people with different perspectives brings out a new cultural paradigm that is grounded in audience participation in the meaning-making processes: «[...] the shift from a culture shaped by the logics of broadcasting toward one fostering greater grassroots participation» [14].

The IMAGIS research team (School of Design, Politecnico di Milano) starts from the assumption that audiovisual artifacts are capable of promoting dialogue among people, relying on the storytelling ability to foster multiple perspectives. A research able to combine methodological development and participatory design in order to propose an innovative point of view on social communication flows. This process allowed us to use the audiovisual language as a knowledge instrument capable of activate and nurture the "socially produced images": the iconic archive that has been forming over time and from which we can draw on to produce knowledge [15] [16].

Indeed, Manovich states that «[a] hundred years after cinema's birth, cinematic ways of seeing the world, of structuring time, of narrating a story, of linking one experience to the next, are being extended to become the basic ways in which [computer] users access and interact with all cultural data» [17]. Therefore, the audiovisual artifacts from one of the most popular languages are «[...] becoming the cultural interface, a toolbox for all cultural communication, overtaking the printed word» [18].

For this reason, when it is inserted in a participatory design process it is possible to consider it a *boundary object*. This concept has been developed in the sociology field by Susan Leigh Star and James R. Griesemer: they identified an analytical framework for those objects that can reside in different social worlds and that are described as «[...] objects which are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites» [19]. The application of this concept to their case study allowed them to find four types of boundary objects. First of all, there are the repositories, that are «ordered 'piles' of objects» and where «[p]eople from different worlds can use or borrow from the 'pile' for their

own purpose without having directly to negotiate differences in purpose» [20]. The second are the ideal type, objects «such a diagram, atlas or other description which in fact does not accurately describe the details of any one locality thing», «'a good enough' road map for all parties» [21]. The last two objects are the coincident boundaries, that are «common objects which have the same boundaries but different internal contents» [22], and the standardized forms, shared methods and guidelines for collaboration among diverse work groups.

According with these thoughts, it is possible to consider the audiovisual artifact as a boundary object for its ability to maintain the identity when goes through different social worlds (as a common language understood by all), and being at the same time adaptable and open to different interpretations (becoming a dialogs activator). In agreement with these thoughts, it is possible to consider the audiovisual artifact as a boundary object according to the ability to maintain its identity when goes through different social worlds (as a common language understood by all), and being at the same time adaptable and open to different interpretations. Therefore, it becomes a dialogue's activator because the relationship between viewers and audiovisual artifacts provokes the development of appropriation practices that are filtered from personal reference imagination.

Starting from the assumption that collaborative processes need the sharing of the design objects and methods (coincident boundaries and standardized forms), for this work we focus on repositories and ideal type because they can be linked to the audiovisual language. Specifically, the former are related to the concept of collective imaginary, the latter are objects similar to those audiovisual artifacts whose primary goal is information, and whose linguistic style is based on the elements' stratification ranging from photography to graphic design, from illustration to typography (motion graphics, information-animation).

In the following section we propose the analysis of audiovisual artifacts produced during the years. Examples able to highlight how the digital age has resulted in the return of the animation techniques in the filmmaking production, and capable of underline the emergence of a new stylistic choice between live action and animation: the aesthetics and ethics of remix [23] [24].

3 Communication Designers Working with Animation

Since 2009 the IMAGIS research team and some students in communication design (School of Design, Politecnico di Milano) has been involved in the project and production of short videos dedicated to the theme of urban transformation. The forms of audiovisual communication are part of a process of dialogue between stakeholders (citizens, city users, associations, businesses, schools, institutions), giving shape to their expectations and the collective aspirations in order to build shared visions of the future. The main areas of actions were, specifically: listening, envisioning and promoting, leading to the productions of short videos of documentation, scenarios, advertisement.

In all these audiovisual projects it is possible to observe the use of animation. Often, even in cases where the work is on documentation and listening, the designers have decided to use techniques and forms related to animation. If the choice of using animation doing video scenarios looks quite natural - sometimes the designers decided that they could achieve their communication objectives coherently through the animation also when they had to show the results of their process of listening, observation and analysis.

Sometimes the intentional choice of the communication designers was to make a fully use the animation. In the case of the video scenarios dedicated to the walkability in the Isola area, the designers have used, from the beginning to the end, the stop motion technique, and they added successively digital animations. The public space in the Ticinese area is the subject of another video scenario, where the animation is a entirely digital, and the movements are created by a 3D technique. Among other things and in different ways, both the scenarios play with the trick of opening and close a book (in this case a pop-up) to tell a story, a trick with a long tradition in the field of animation.

Fig. 1. (1st row): Frames from 'L'Isola che ci sarà' - Francesca Cattaneo, Annamaria Greco, Francesca Pasini, Marta Pucci - Laboratorio di sintesi finale "Cammina Milano", 2° LM, School of Design, Politecnico di Milano. Lecturers: Marisa Galbiati, Francesca Piredda, Walter Mattana, Katia Goldoni, Paola Bocci; tutor: Marco Ronchi, Andrea Corti, Elisa Bertolotti a.a. 2009-10

(2nd row): Frames from 'Ticinese, un nuovo mondo' - Francesca Foglio, Shirin Nekoei, Luca Pecori, Giulia Pozzetti, Esther Zanon - Laboratorio di sintesi finale "Racconti di strada", 2° LM, School of Design, Politecnico di Milano. Lecturers: Marisa Galbiati, Francesca Piredda, Walter Mattana, Katia Goldoni, Paola Bocci; tutor: Marco Ronchi, Mariana Ciancia, Davide Grampa, a.a. 2010-11

Beyond these cases where the use of animation is clearer, it is possible to observe in many other videos the reappropriation of traditional animation techniques through the use of postproduction softwares. The previous listening activity for the district of Dergano becomes the starting point for its video scenario; the negative aspects of living in the area are challenged through positive pro-

posals; the narrative is largely based on the presence of key words of negative valence that are animated and replaced by new key words, which are propositions for a new way of living the area. The change between before and after is done through the introduction (often by hands) of small objects in the scenes. The animation of hands is a great classic of traditional animation, retaken here in a minimal way, as if the screen was almost a large touch screen where everything is possible. The live action for the scenario dedicated on how the Navigli district can become a pedestrian area in the daily time is the basis for a post-production work; what is not there in the current reality, is then made through the introduction of digital forms, typography, colors that in the video come alive and relate with people filmed as if they were themselves actors. In the scenario dedicated to the construction of a possible public space in the Buenos Aires area in Milan, the live action footages are the basis of a work in post-production with key words, to strengthen the story.

In addition to the examples mentioned above (Dergano and the Navigli by day video scenarios), other video projects stress the relation between live action and animation: in the video scenario dedicated to a different way of experiencing by walking the Navigli area by night, the students choice has been to focus on a great work on the still or moving images using digital post-production softwares; the photographs of the neighborhood are often used to be drawn and become the scenes of the video; the actors, shot in green back, are processed in post-production to become silhouettes; other elements animated into the scenes are completely drawn. The video scenario dedicated to the Sarpi area alternates moments of live action with raw animated moments. The transition from one world to another is given by the editing. The animation comes into play when the characters look at projects or articles on the newspaper, so when they are confronted with new ideas. The live action is thus experienced as a material from which suggesting debates, hypotheses, reasoning, and proposals for possible futures. The new scenarios and ideas are represented by a work on the taken pictures, a work always declared and never hidden, not seeking for realism.

Fig. 2. Frames from 'Navigli di notte. Un bagno di cultura sulla riva di Milano' - Gabriele Carbone, Martino Cazzaniga, Angelo Chiacchio, Francesca Ferrario, Ilaria Mariani, Arianna Vandea, Laboratorio di sintesi finale "Cammina Milano", 2° LM, School of Design, Politecnico di Milano. Lecturers: Marisa Galbiati, Francesca Piredda, Walter Mattana, Katia Goldoni, Paola Bocci; tutor: Marco Ronchi, Andrea Corti, Elisa Bertolotti a.a. 2009-10

The use of semi-finished audiovisual forms (such as storyboard or animatic) can be a way to talk about some ideas and open possibilities. For example, the video scenario *Commando Jugendstil* (a project for a master thesis) uses the trick of moving a storyboard drawn by hand. The traditional storyboard boxes and the drawings just sketched and animated with a few frames become the stylistic atmosphere of the short film. The animation, rough until almost the end, is supported (as often happens in the limited animation) by an inventive screenplay played by a professional actor. Towards the end the drawings become digital, the color is introduced and more frames are animated. It is the time when the story opens and shows the possible scenario. The fact, however, to have shown for most of the time an animated storyboard provides tools to read the technical skeleton of the film and its construction.

Sometimes the use of very simple animations, deliberately rough, is a choice for envisioning scenarios very open to debates and dialogues. The digital animation, with geometric shapes, spot colors and rough movements (always with the support of typography) is used in the case of video scenario *Agriequo* to describe a system that could be created among farming communities to support the local economy and culture.

From *Spread*, an international workshop on social innovation, came the need to show some scenarios imagined by the working groups on how it would be possible to live in 2050, starting from promising practices (entrepreneurial and self-aware society connected wealth; alternative economies for dense communities; happy sharing communities; the convenience of trust). The result is the construction of very short video formats. After an initial animation of texts introducing the project, the videos are animated with stylized digital drawings, in which the movement is given mainly by moving objects, change of focus or camera movements. The videos are not looking to give a sense of realism, but they want to illustrate synthetically the ideas developed within a few days of workshops.

In this experience, where communication designers are using audiovisual as a tool to activate processes of listening and dialogue, it is possible to see how the choice of employing animation works very well to achieve the goals. Animation in fact allows to work on unfinished forms (such as storyboards and animatics) that give a sense of how a project is open and under discussion; it opens to a whole range of tricks from limited animation experience. It is the possible to build audio-visual artifacts that play with the limits and the few resources available, and that consent to keep the story open to further proposals; by being so openly constructed and declared and for its self-reflective nature, animation can also help on the meta-discourse level, allowing to use audiovisuals as open tools for dialogue.

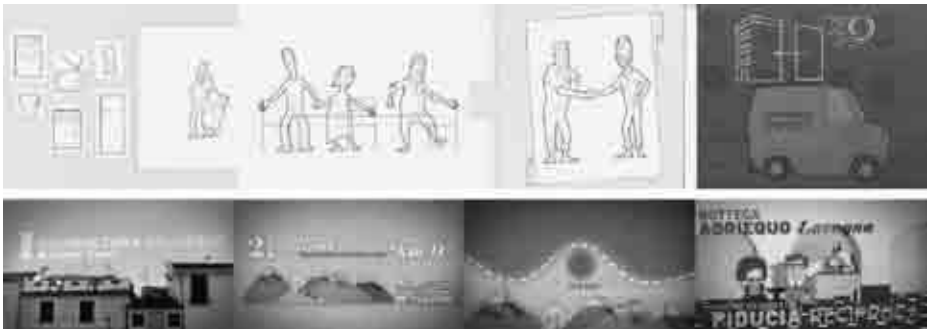

Fig. 3. (1st row): Frames from 'Commando Jugendstil. Cartolina di un mondo possibile' - Guglielmo Miccolupi, http://cargocollective.com/mikeoloopie/Commando-Jugendstil. Master Thesis, supervisor: Francesca Piredda, School of Design, Politecnico di Milano, a.a. 2011-12
(2nd row): Frames from 'Agriequo' - Giovanni Montuori, http://vimeo.com/8601353. Master Thesis, supervisor: Francesca Piredda, School of Design, Politecnico di Milano, a.a. 2008-09

3 Conclusions

Communication designers have historically used the animation within their projects: for example, since the fifties, Ray and Charles Eames worked with several animators for the realization of audiovisual artifacts as *A Communications Primer* (1953), *The Information Machine* (1957), *The expanding airport* (1958) o *Powers of Ten* (1969).

However, the audiovisual artifacts should represent not only the final outcome with the aim of communicating and disseminating results, but they also should be integrated in different phases of the design process, both as tools and as evidences of the unfinished work in order to open possibilities and future actions.

Using these artifacts as tools for dialogue within participative processes, it is possible to define them boundary objects, items that «are simultaneously concrete and abstract, specific and general, conventionalized and customized» [25].

What emerged from the analysis is the definition of an aesthetic of the so-called video scenario, whose main feature is the use of animation techniques able to re-activate the memories of traditional animation, thanks to a more accessible digital technology. The audiovisual artifacts are taking, indeed, the shape of sketches and dynamic memos, thanks to the accessibility of production tools.

The linguistic consequence is the arise of a hybrid language between the two opposing tendencies of mimesis and abstraction [26] [27]: an aesthetic of the semi-finished able to enhance processes and instructions for use, and that is well suited for a format open to dialogue and negotiation.

In conclusion, we suggest to consider the video scenario as a boundary object that is characterized by a hybrid language based on the relationship between real (*repositories*) and ideal (*ideal type*): not mutually exclusive categories, because the «animation's essential "abstraction" tends to make the viewer aware that s/he is watching something other than a mimetic recording of an external reality» [28]. Furthermore, as the audiovisual artifact is characterized by the highest degree of internal construction (*constructedness*) [29], it pushes people to make reflections on what is represented: an effective "toolbox" able to convey at the same time tools for decoding and transcoding the message (*coincident boundaries* and *standardized forms*).

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Communicating Complexity and Simplicity: Rediscovering the Fundamentals of Information Design

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Abstract. As more data has become available through open data initiatives, and as barriers to access have decreased, interest in and demand for new ways to visually communicate data and other content has risen dramatically in recent decades. This situation, compounded by the rapid pace of technological development, has caused a shift of attention towards the perceived problem of "complexity" and ways to manage it. At the same time, "simple" communication challenges suffer from undue complexity, as displays of basic information sacrifice clarity and human-centeredness for other priorities such as marketing appeal and self-interest.

While visualization in its many forms has become widely recognized as a powerful means of presenting complex and simple information, quite often the visual solutions themselves tend to create more complexity than address it. Information graphics, informative animations, data displays, and visual analytics tools have achieved an unprecedented level of technical sophistication and intricacy in visualizing content, yet beneath the surface, a fundamental sense-making sensibility is missing.

In this paper, we argue that facilitating understanding is not related to the size or complexity of a problem, nor is it a function of the tools and techniques used. Foundational information design principles are the same for all kinds of problems and should underlie all visualization tasks, but when creators of visualizations do not learn and thoroughly apply these principles, the risk of misconceived solutions and confusion increases. This paper discusses case studies that demonstrate how the absence of basic information design principles may produce negative outcomes and presents recommendations for improvement.

Keywords: complexity, simplicity, understanding, information design, visualization

1 Introduction

Complexity has always existed in different forms throughout history [11, 17], but only in recent years has the "complexity crisis" caught widespread attention. Accelerated by the explosion of computer technology, the present Information Age is characterized by more, better, and faster access to information [6], which continuously challenges us to manage the growing volume of information that fills our screens, printed pages, and environments. Access to vast data sets across numerous dimensions of business and society has opened possibilities we are only beginning to understand, and our facility to work with "big data" is still in its early stages. While technology may help us create, store, analyze, and display data and other content, the real work of making sense of complexity and determining the most appropriate way to represent it requires further attention.

Equally important is the task of communicating simplicity. Everyday examples such as furniture assembly instructions and airline safety cards attempt to convey step-by-step tasks to the broadest audience possible, but the variability in execution and effectiveness from one to the next demonstrates the persistent lack of universal guidelines for presenting even minimally complex information.

Visualization has long served as a means to help us understand the world. It allows us to process more information by distilling it into a form we can rapidly perceive and process [6, 25]. However, as visualization methods have evolved over time, and new languages and technologies have emerged, the core purpose, practice, and process of visualization have remained largely undefined at a high level. The inner state of complexity that exists in the field of visualization is reflected in the wide variation of approaches and outcomes that characterize visualization today, especially in the ways complexity is regarded and handled.

The notion of visualizing complexity presents a host of challenges for creators of visualizations, from concerns about what level of simplification is appropriate for a given audience to decisions about which graphic techniques and formats to use. Tangled together are issues of content, process, audience, tools, techniques, and other factors, all with competing priority evidenced in final design solutions. Many current visualizations have become too complex, as a result of the following:

- Clear guidelines for "appropriate" visualization are largely absent from education and professional practice. No consensus exists on what "appropriate" means when dealing with complex or simple subjects.
- Product overshadows process, and as a result, displays of complex information tend to be overly elaborate and indecipherable [22, 26, 28, 29]
- Intentions and methods are not aligned with outcomes: visualizations focusing on novel tools and techniques fail to address complex material appropriately for the intended audience [8]

To effectively visualize complexity, we need to understand what "effective" means and work towards achieving it. We will discuss the current state of com-

plexity and simplicity in the context of technological advancements, then argue that establishing understanding is the primary goal in managing complexity, by way of information design. We will propose a fundamental set of information design principles drawn from existing literature [9, 20, 27, 11, 18, 14] to guide visualization practices. We will then apply that set of principles to an analysis of several information visualization case studies (information graphics, interactive data visualization and informative animation) to illustrate ineffective as well as effective practices. Finally, we will propose broad guidelines for visualization education and professional practice.

2 Methodology

We used literature review to gain a general overview of information design-related simple and complex problems. This review was complemented with secondary research and case studies. Books, papers and PhD theses of the last 30 years provided in-depth understanding of the current state and evolution of complexity. We analyzed 14 case studies using a set of information design principles that emerged from our research and are discussed in Section 4. A Likert scale of three degrees was used to measure how well each case study addressed each principle (3 is "strongly," 2 is "moderately," and 1 is "poorly."). In addition, we built on [15] framework to structure the analysis.

3 Related Work

3.1 Understanding Complexity in the Information Age

Before discussing ways of managing and visualizing complexity, it is important to note that complexity is as normal and necessary in everyday life as simplicity [10, 28]. Complexity itself is neither good nor bad [10]. Rather, the confusion, ambiguity and lack of understanding that may result from complexity are bad. While complexity is described as an ordered and reasoned combination of various interrelated "things," highly related to context and experience, among other factors [10, 17], simplicity refers to the *right* amount of those things [13]. When all parts (e.g. purpose, details, difficulties) are assembled together in an appropriate way, complexity is perceived as simple, because there is a "sense of clarity" and that each part is in the *correct* place — that is, it has meaning [13].

The role of technology in shaping our perception of complexity is significant. We live in an "information age," with high amounts of information being produced, freely transferred every day, and instant access to knowledge [12]. Consequently, "the volume of information to which people have access is growing at an incredible rate, vastly outstripping [their] ability to find, assimilate and manage it." [3] With the higher volume of available information, more sources and formats, and faster production of information, the benefits of greater access can

be quickly overshadowed by the amount of time and effort one must expend to find relevant, useful information.

3.2 Managing Complexity

In business, government, and daily life, the need to manage complexity requires first an *understanding* of the complex situation or content — finding patterns, making associations, and ultimately extracting personally relevant meaning — in order to accomplish a goal or task [3]. This activity of *making sense* of complexity is in some ways distinct from *visualizing* complexity, as the underlying structure or organizing principle must be revealed *before* (or in the process of) creating the visualization. The challenge is learning those underlying principles that give order and reason to an apparent chaos, and help us determine which parts need to be removed, which ones to be kept and how they need to be arranged to achieve clarity and understanding [2]. However, as we discuss in this paper, the tools and techniques employed to visualize complexity erroneously *precede* the deliberate application of principles and frameworks to make sense of a situation or content, as seen in the numerous ill-conceived design solutions being produced today. Without a clear governing framework, a visualization is just an arrangement of graphic elements without a coherent message or story.

3.3 Information Design as a Means of Understanding Complexity

Information design plays an increasingly important role in the communication of complexity and improving understanding [12]. It is a multidisciplinary field of study, drawing from a varied range of academic disciplines [11]. Some of the disciplines that have a closer influence on information design are graphic design; communication sciences and journalism; interface and user experience design; information and media production technologies; cognition, perception, behavior and applied psychology; information science and management, and sociolinguistics [11, 24]. A rich, robust body of knowledge underlies the information design field, and as such, we draw from this foundation to establish a rationale for making sense of complexity. In the next section, we introduce a set of information design principles as one way to manage, understand, and visualize complexity.

4 Information Design Principles

Literature revealed prior studies concerned with defining indicators of effective information design. [10] suggests that ineffective design is related to both the lack of understandability in the design itself as a consequence of a lack of underlying logic and strong foundation, and a lack of designer's understanding of the content, needed to manage complexity. [11] states clarity as the fundamental aim of information design and suggests four sets of principles to achieve that aim:

functional, administrative, aesthetic and cognitive principles. Also highlighting clarity and understanding, [4] stresses three aspects to consider when visualizing information: functionality, multidimensionality and beauty, the latter one in the sense of credibility and transparency. Similarly, [17] present a three-part approach to simplification of complex material: empathize with others' needs, distill an offering to its essence, and clarify the structure and presentation of content. In line with other studies, [1] and [11] point out misleading analysis and information organization as main actions that may lead to unclear or superfluous content. [7], [8] and [4] add that poor problem framing and ill-defined hierarchical structure may result in dysfunctional and unintelligible visualizations. Similarly, [14] introduced the concept of octolinearity, initially discussed for map design and related to the number of trajectories that should be present on a line to facilitate navigation and understanding, as a way to determine visual organization to minimize cognitive load.

Expanding on previous work and our own experience as information designers, we present a set of foundational information design principles:

1. **Unambiguous problem definition:** Adequately defining what information challenge or problem exists (what is the intended purpose or goal).
2. **Human-centered approach:** Identifying and learning as much as possible about the target audience. In-depth understanding of and commitment to the audience is needed.
3. **Constructive synthesis of information:** Dissecting and reconstructing data and other forms of content to find patterns and make associations.
4. **Clear organization:** Defining hierarchies, systems, and structures to inform the design solution.
5. **Content-driven design:** Translating and coding content using a graphic language (color, shape, orientation, etc.) and determining the most appropriate medium and format for the design solution (static/dynamic, print/digital, etc.).

In the next section, we use these principles to analyze case studies from the fields of information graphics, interactive data visualization and informative animation. From the analysis, we highlight diverse current problems resulting from the presentation of complex information through ill-defined visualization practices.

5 Case Studies and Analysis

For this analysis, we selected 14 cases deemed as effective and as ineffective by peers, but also based on our own experience. In both instances, we prioritized those cases dealing with complex content, or displaying relatively simple content in a complex way.

Case Study 1: Calendar Redesign (2007). This visualization (Fig 1), designed by Eliazar Parra Cardenas, was part of an information design challenge to fit a full year on a card. In this case study, simple content — the months and weeks in a year — has been depicted in an inventive but rather complex way to solve the initial problem.

Fig. 1. Calendar design by Eliazar Parra Cardenas

Case Study 2: Health Plan Organizational Chart (2009). This graphic (Fig 2) shows U.S. Congressional Republicans' view on the health system that would have been created by Democrats in the House of Representatives' proposal. A high degree of complexity is depicted and emphasized to bolster opposition to the plan.

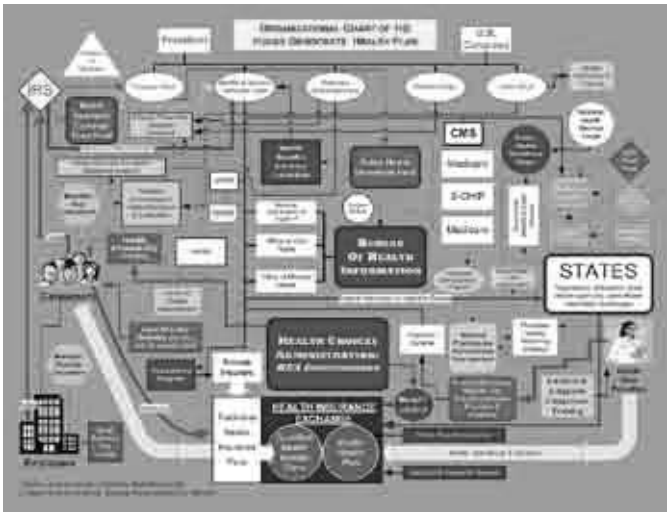

Fig. 2. Organizational Chart of the House Democrats' Health Plan

Case Study 3: Discrimination against women. Created by the Union of International Associations, a research institute that seeks to understand the complexities of international civil society, the visualization (Fig 3) is meant to "create a visual index to show the complexity of relationships between (data) profiles and reveal the data rich domains" surrounding the world problem of discrimination against women.

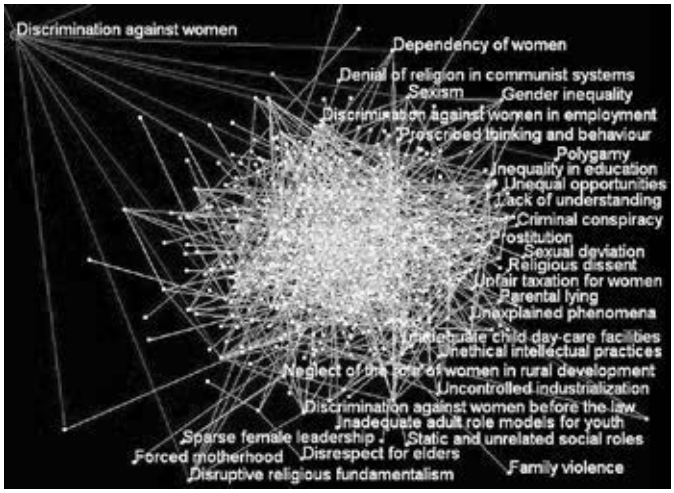

Fig. 3. Discrimination against women

Case Study 4: Global Internet Map by Cisco & TeleGeography (2009). This map (Fig 4) shows traffic between world regions via major routes. There are several layers of information that contribute to the overall complexity of information depicted.

Fig 4 Global Internet Map by Cisco & TeleGeography

Case Study 5: GOOD Magazine infographic: Are You Done in There? (2007). A comparison of simple data becomes complex in the maze-like orientation of people representing quantities (Fig 5).

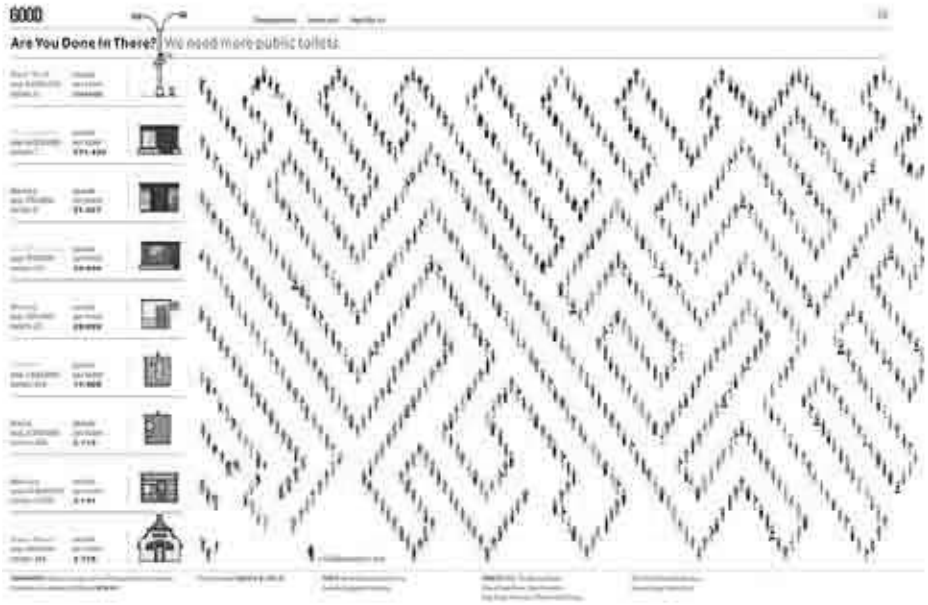

Fig. 5. GOOD Magazine infographic: Are You Done in There?

Case Study 6: GIGA-maps Comparative Map (2012). This timeline compares the evolution of major operations of two different companies. The top half of the schematic map represents one of the companies, while the bottom part displays information about the other (Fig 6).

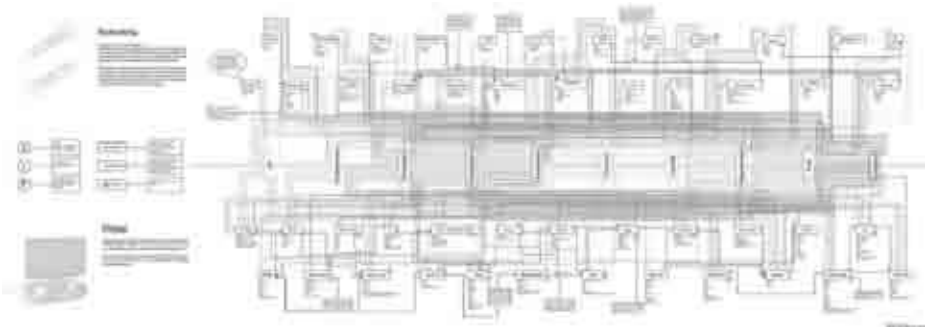

Fig. 6. GIGA-maps Comparative Map

Case Study 7: Ben Fry – Valence (2002). Using software sketches, this project by Ben Fry visualizes the structures and relationships of large biological sets of data (Fig 7).

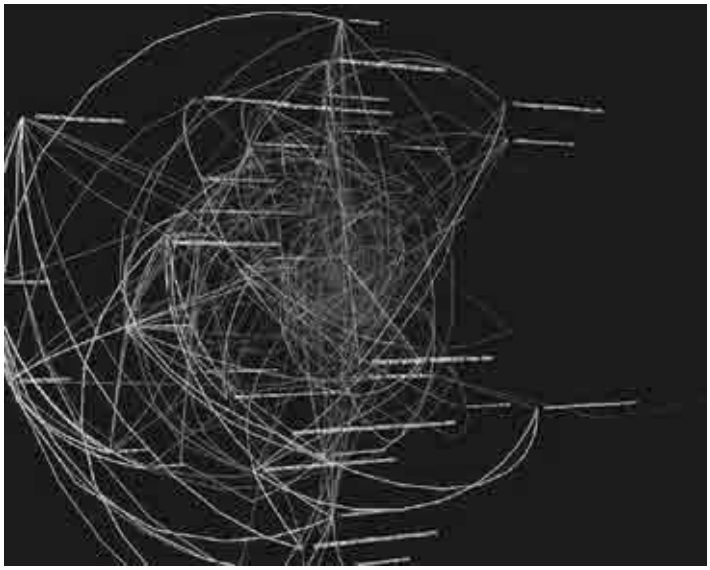

Fig. 7. Valence by Ben Fry

Case Study 8: Software Evolution Storylines (2010). Michael Ogawa's interactive software development timeline looks at several dimensions of activity involving developers and files committed to a project repository (Fig 8).

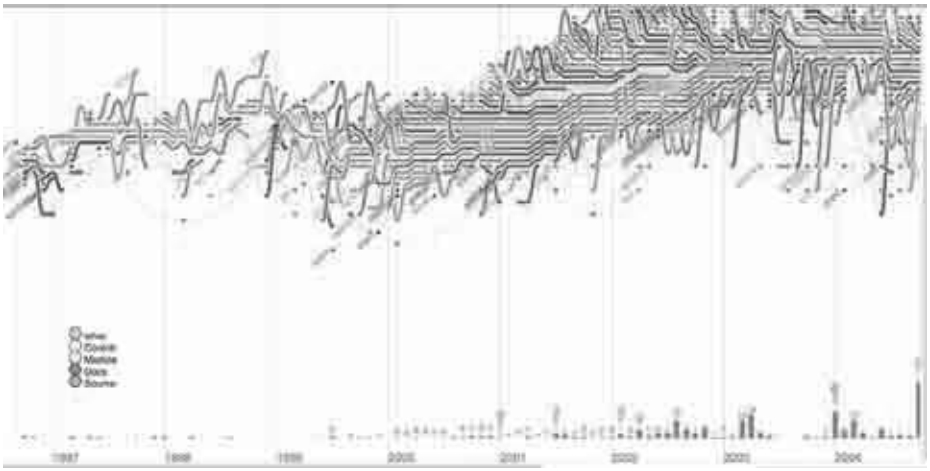

Fig. 8. Software Evolution Storylines

Case Study 9: Cascade (2012). This interactive data visualization by Jer Thorp looks at how information is shared through social media, aiming to reveal patterns in how

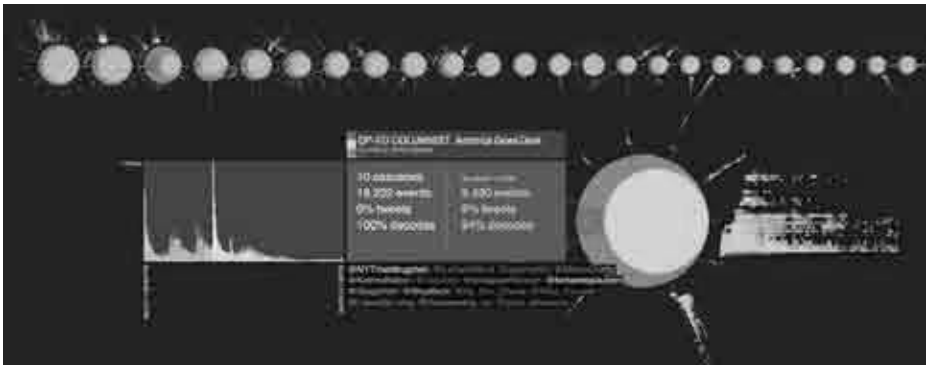

Fig. 9. One view of a Cascade visualization of news stories and their cascade through the web

Case Study 10: Football match data visualization (2012). This animated information visualization created by Andreas Bardenhorst shows football match data such as field position, duels, and passes (Fig 10). The graphic approach is highly abstract, which makes the data labels and supporting text even more essential in understanding the visualization.

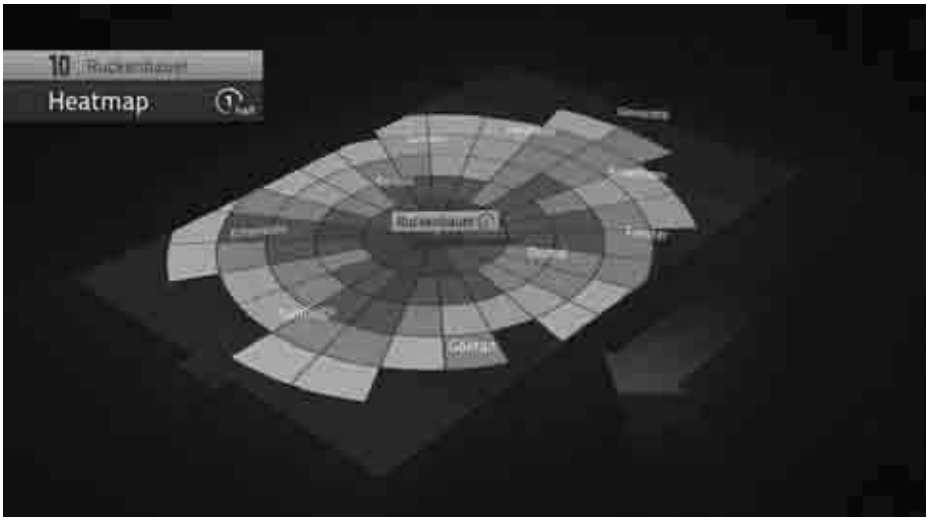

Fig. 10. One screenshot of the Football match data visualization

Case Study 11: Goldstar Beer Infographic (2009). This simple visualization cleverly presents the difference between male "simplicity" and female "simplicity" when it comes to choice of alcoholic beverage.

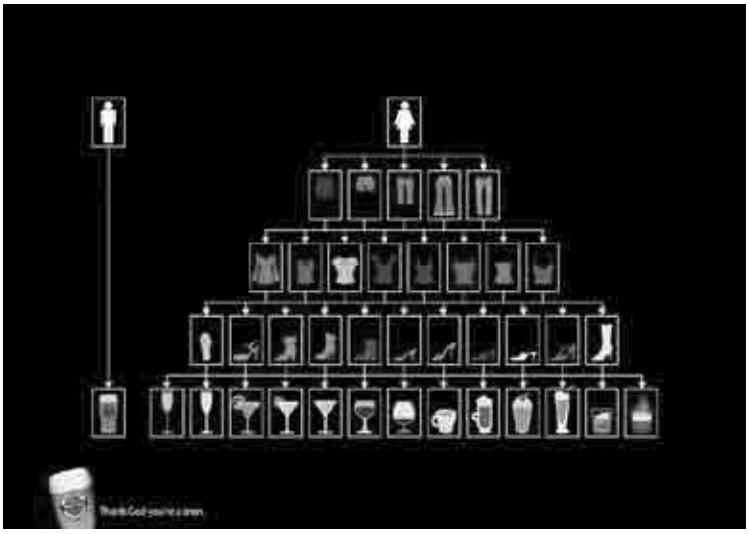

Fig. 11. Goldstar beer infographic

Case Study 12: Guantanamo Detainee infographic (2012). This interactive *New York Times* shows a comparison of detainees held versus transferred along a timeline (Fig 12).

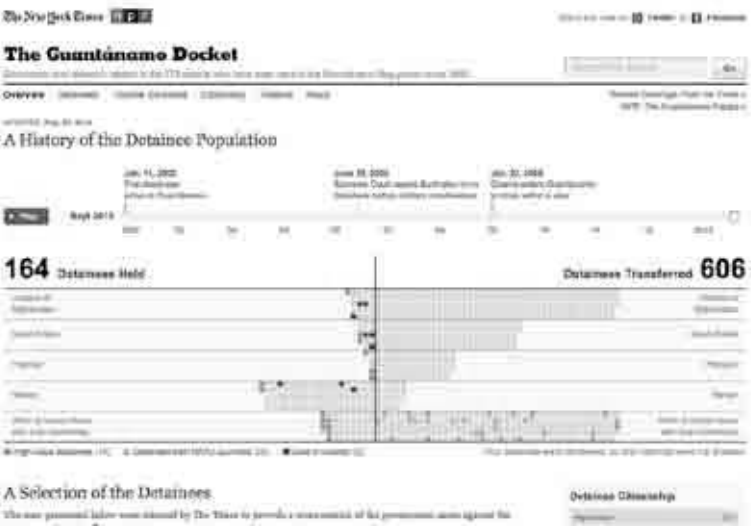

Fig. 12. Guantanamo Detainee infographic

Case Study 13: Obama election infographic (2008). Another *New York Times* example, this data-rich infographic presents a breakdown of electoral votes across the U.S. in the 2008 presidential election.

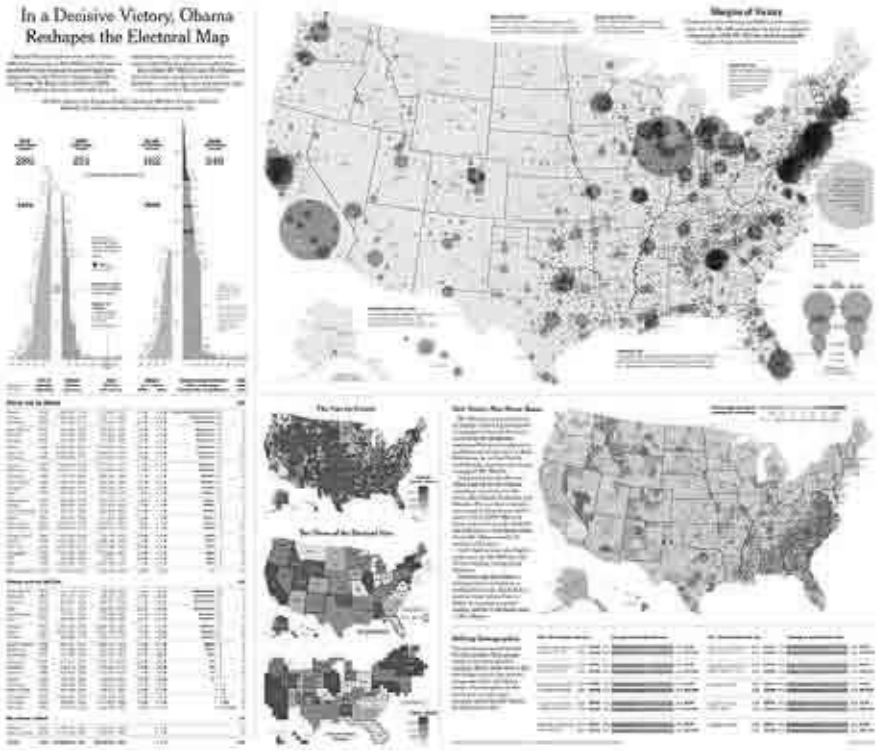

Fig. 13. Multiple maps and charts in New York Times

5.1 Case Study Analysis

The analysis discussed in this section is not meant to be exhaustive, but to provide initial insights into ineffective visualization practices. Table 1 shows the analysis derived from the information design principles explained in Section 4 and used to investigate each case study.

Table 1. Analysis of case studies using information design principles.

	Calendar	Health Plan Organizational Chart	Discrimination Against Women	Global Internet Map	Are you done in There?	Comparative map	Valence	Software Evolution Storylines	Cascade	Football match data visualization	Goldstar beer infographic	Guantanamo Detainee infographic	Obama Map US elections
CASE STUDY (CS)	1	2	3	4	5	6	7	8	9	10	11	12	13
VISUALIZATION CATEGORY													
Informative animation							X			X			
Interactive data visualization			X					X	X			X	X
Infographic	X	X		X	X	X					X		
INFORMATION DESIGN PRINCIPLES													
1. Unambiguous problem definition													
Is the intent or purpose clear?	3	1	3	2	2	1	1	1	1	2	3	3	3
Does it present content that supports the purpose?	3	1	1	2	2	1	1	1	1	3	3	2	3
2. Human-centered approach													
Does it generate interest?	2	1	1	2	2	1	2	2	1	2	3	3	3
Is the information accessible to a broad audience?	2	1	1	1	2	1	1	1	1	1	3	3	2
3. Constructive synthesis of information													
Does it present the content in a new or improved way that reveals underlying connections or systems?	3	3	2	2	2	3	2	2	3	2	3	3	3
Does it make sense of content better than the raw content would by itself?	1	1	2	2	2	2	2	1	2	2	3	3	3
4. Clear organization													
Is there a visible structure?	3	2	2	2	3	2	2	1	2	3	3	3	3
Is there a hierarchy of information?	2	1	1	2	2	2	1	1	2	2	3	3	3
5. Content-driven design													
Does the graphic execution reinforce the content?	2	1	1	2	2	2	2	1	1	2	3	3	3
Does the medium or format facilitate understanding?	2	2	1	2	2	2	2	2	2	2	3	3	3

The first principle is addressed for mostly all case studies, but three of them addressed it only moderately, while five of them very poorly (CS2, CS6, CS7, CS8, CS9). As shown in Table 1, the second principle was the least addressed, with eight of the 13 case studies addressing it poorly. Three were cases (CS11, CS12, CS13) that seemed to have considered the audience when creating the visualizations. Interestingly, principle 3 was to some extent taken into account for most of the cases analyzed, as only CS8 does not display a constructive synthesis of information. From the remaining 12 cases, seven addressed this third principle in a moderate way, while five in a much stronger way. The last two principles present similar trends, with almost the same cases only addressing them poorly, CS2, CS3 and CS8 for both principles, CS7 for principle 4 and CS9 for principle 5. However, principle 4 was strongly addressed for almost half of the cases, while the last principle for only three cases.

5.2 Addressing Principles

Overall, in the reviewed case studies we found complexity being displayed in random and arbitrary ways (e.g. CS1, CS2, CS3), but also insightful ways of visualizing complexity (CS11 to CS13).

Four types of visualizations emerged from the analysis:

- Complex content, simple display: (CS11)
- Complex content, complex display: (CS2, CS7, CS9)
- Simple content, simple display: N/A
- Simple content, complex display: (CS1)

Some visualizations defined the problem clearly and unambiguously by including a title (CS3, CS5, CS10, CS12, CS13,) or using visual elements related to the topic (CS10, CS11). However, many of them neither had a title nor a description of the problem they are aiming to address (CS1, CS7, CS8, CS9) or what they are displaying is not clear enough (CS2). Mostly, interactive information visualizations appear to be omitting the inclusion of this type of information (Is the intent or purpose clear?). Conversely, CS12 is an interactive case that introduces the purpose right at the beginning and does not generate confusion or ambiguity.

The above paragraph relates to principle 2 too, and the need to consider the audience's needs and create visualizations with a well-defined entry point to first engage the intended audiences and then wider audiences.

Particularly, in CS7 is hard to understand from where to start making sense of its content, as in addition of lacking an entry point, all elements are at a similar visual level making hard to distinguish connections. When connections between elements are ambiguous (CS5, CS7, CS8), information lacks context and users/readers cannot construct "a mental information and relationship structure" [2] for the visualization. This supports the relevance of principle 3 for visualizing complexity.

Moreover, visualizations with lack of clear organization and deficient content analysis, principles 3 and 4 respectively, demand heavy working memory load to be understood [14]. CS1, CS2 and CS4 exemplify this problem as many of their elements require long periods of time to be understood demanding more than one processing action in simultaneous: identifying each component type, identifying the relevance of each component type, connecting each component type to the whole visualization.

While defining a clear structure is an important aspect towards creating an effective visualization, defining hierarchies is equally essential. Even though elements in a visualization are displayed in a visible structure (CS2, CS5), that does not always result in elements being well organized or having a well-defined hierarchy. This finding is in line with previous studies [12] which found that incorrect establishment of hierarchies may result in ill-defined visualizations. Similarly, some of the visualizations display strong structures (CS1, CS6), but those structures are not communicating the message clearly as they display lack of hierarchy of information or misleading hierarchies. CS1 is an example of the latter situation. This visualization displays simple content, in a complex manner. While information seems to be structured in a conventional calendar format (days, weeks, month), on closer inspection, those same components are organized in an unclear way. Other case studies failed to address this same principle as well.

CS4 and CS6 present a similar problem: dysfunctional chromatic coding. CS6 displays 10 variables coded with 10 different colors, but not applying content-driven design (principle 5). Paradoxically, the use of excessive broken lines to connect elements makes it harder to see the connections between elements and pay attention to the three different meanings of each line, explained in the key: arrow line, two-arrow line, and circle line.

CS4 appear to display robust content-driven design, but the way content is structured does not seem to be related to its subject matter. Satellite graphics and tables on the edges are visually disconnected from the core elements of the visualization (three big circles). The chromatic palette is highly varied, demanding high cognitive levels to connect each color with its meaning. [14] Conversely, in CS13, content is clearly structured: each graphic, table and map is visually connected. The use of a reduced chromatic palette facilitates the connection of content and elements.

5.3 Nested Principles

When content analysis and synthesis (principle 3) are not thoroughly conducted, information hierarchy are not properly defined (principle 4), and consequently visual hierarchies are not achieved (principle 5). This is exemplified with CS2 in which visual decisions do not seem to be governed by principles of information design. Shapes, scales, orientations and colors do not appear to respond to informed design choices, as squares of various sizes display similar types of information. In addition, this visualization lacks an entry point as all elements (struc-

ture, content) are at the same visual level: all elements are emphasized, therefore, nothing is emphasized. The design also looks "noisy, cluttered, and informationally flat." [22] This indicates how poorly CS2 is addressing principle 5, but also how strongly interwoven these three principles are.

In short, a visualization should address most (if not all) of the information design principles to be considered effective, as the principles are tightly interconnected.

6 Recommendations

In the previous section, we reported how, by applying foundational information design principles, complex information becomes more accessible, and when these same principles are not considered even simple content can be displayed in a way that generates confusion. This indicates that when foundational information design principles are not thoroughly applied, in-depth understanding is not achieved and confusion is created [12, 14]. In an attempt to reduce complexity, many visualizations seem to be missing their main purpose: to improve understanding [10]. Case studies demonstrated how the absence of informed decisions produces misconceived outcomes.

We present the following recommendations to encourage the application of information design principles:

- Standardize and add rigor, process, and methodology to visualization education programs
- Introduce foundational information design principles early on in the courses
- Teach future visualization creators to think more critically about when and why information design principles need to be applied [2]
- Avoid blindly applying generic design principles or rules
- Shift the design process emphasis away from later-stage implementation (tools and techniques) and towards early-stage problem definition and understanding
- Critically examine each step of the design process
- Understand how people interact with and make sense of information [2]

These recommendations are meant to improve visualization practices from their foundations, rethinking current related education programs, but also serve as a call to action to visualization creators with many years of experience to rethink their current way of visualizing information. In the words of [22]: "Clear and precise seeing becomes as one with clear and precise thinking."

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Image Sources

Image 1: http://www.flickr.com/photos/eliazar/407605908/in/set-72157594507810147/
Image 2: http://www.healthpolcom.com/blog/2009/07/21/health-reform-hyperbole-heightens/
Image 3: http://www.uia.org/archive/visual-gallery
Image 4: http://www.telegeography.com/telecom-resources/map-gallery/global-internet-map-2009/index.html
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Image 9: http://nytlabs.com/projects/cascade.html
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Image 11: http://flowbrewing.com/repost-of-flowing-data-infographic-of-beer/
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Technical Development of Different Forms of Narrative Art, from Sources such as Data Visualization and Info-Graphics.

Case study: The communication method 'THE NO PROJECT' organization develops, to disclose that human trafficking.

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Abstract. This abstract presents the collaboration between TEI of Athens and the humanitarian 'THE NO PROJECT' organization in the development of informative visual material. The artifacts, mainly animated films, will be discussed in order to demonstrate the power of the communication method developed by the organization.

Scenario: Human exploitation and illegal labor are two main contemporary plagues producing extremely negative conditions of sexual exploitation, very hard working conditions (domestic service, agricultural, industrial, mining and construction works, child soldiers, forced begging and so on are the sign of very critical conditions for many human beings.
Large organizations such as UN or UNICEF, International Labor Organization, etc. internationally active in addressing the problem, collect and publish statistics.
These information are re-published by organizations battling human trafficking, often in the form of data visualization artifacts and info-graphics.
The objective is to offer to the public the highest, clearest and more direct possible information.

Project:
An independent initiative against Trafficking in Human Beings, 'THE NO PROJECT' organization aims to raise attention on human exploitation. The objective is to present an accurate picture of reality in relation to trafficking in Greece promoting awareness of young people to influence our society in order to change attitude.
The organization operates in schools, universities, youth groups; collaborating with various representatives in order to highlight the problem of human trafficking. Various materials such and documentaries, statistics and data are used in this process.
The organization asks from his supporters to offer time, knowledge, experience and skills in order to acknowledge the problem through music, arts, education and social networks. By this way, statistical data collection and other information are being developed in different narrative struc-

tures and communicative forms. The main objective is the dissemination of knowledge and awareness in this sensitive area.

The TEI of Athens worked with the organization by following the method below:
All involved teachers decided, that the students of story board courses will work on the given subject in order to create original scenarios and to allow different options.
The organization's representative Mrs. Judy Boyle, came up at the start of the course at TEI and presented the issue of human trafficking and the ways the' NO PROJECT' organization, prefers to communicate.
The students created storyboards which are finally presented in the lesson with the presence of Mrs. Boyle. Of course during the creation, from concept to final presentation, communications and feedback between all parties (the organization, students and teachers) were continuous.
Then during animation course, students after one semester of cartoon lessons, realized part of storyboards, so that they produced animation movies.
Test screening was made at TEI theater with the presence of TEI students, teachers and Mrs. Judy Boyle in order to be selected the most popular and understandable movies.
The chosen movies delivered to 'NO PROJECT' organization, as part of communication material.

Key Words: Data / infographcs / animation films.

The problem

"The recruitment, transportation, transfer, harbouring or receipt of persons, by means of the threat or use of force or other forms of coercion, of abduction, of fraud, of deception, of the abuse of power or of a position of vulnerability or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person, for the purpose of exploitation" [1]

"The Article 3, paragraph (a) of the Protocol of United Nations Convention against Transnational Organized Crime (UNTOC) to Prevent, Suppress and Punish Trafficking in Persons, defines Trafficking in Persons as the recruitment, transportation, transfer, harbouring or receipt of persons, by means of the threat or use of force or other forms of coercion, of abduction, of fraud, of deception, of the abuse of power or of a position of vulnerability or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person, for the purpose of exploitation. Exploitation shall include, at a minimum, the exploitation of the prostitution of others or other forms of sexual exploitation, forced labour or services, slavery or practices similar to slavery, servitude or the removal of organs". [1]

On the basis of the definition given in the Trafficking in Persons Protocol, it is evident that trafficking in persons has three constituent elements;

The Act (What is done)
Recruitment, transportation, transfer, harbouring or receipt of persons
The Means (How it is done)
Threat or use of force, coercion, abduction, fraud, deception, abuse of power or vulnerability, or giving payments or benefits to a person in control of the victim
The Purpose (Why it is done)
For the purpose of exploitation, which includes exploiting the prostitution of others, sexual exploitation, forced labour, slavery or similar practices and the removal of organs. [1]

"Trafficking in persons is a serious crime and a grave violation of human rights. Men, women and children are trafficked within their own countries and across international borders. Trafficking affects every continent and every country. Every country is affected by human trafficking, whether it's an origin country where people are trafficked from; a transit country where people are trafficked through; or a destination country where people are trafficked to. Often a country will be all three". [2]

The statistics

Due to the hidden and illegal nature of human trafficking, gathering statistics on the scale of the problem is difficult. The following statistics may represent an underestimation, but are the most credible and frequently quoted. [2]

People trafficking, is the fastest growing means by which people are enslaved, the fastest growing international crime, and one of the largest sources of income for organized crime. — The UN Office on Drugs and Crime. [2]
The headline facts

An estimated 2.5 million people are in forced labour (including sexual exploitation) at any given time as a result of trafficking. *[1]*

Of these:
1.4 million – 56% - are in Asia and the Pacific.
250,000 – 10% - are in Latin America and the Caribbean.
230,000 – 9.2% - are in the Middle East and Northern Africa.
130,000 – 5.2% - are in sub-Saharan countries.
270,000 – 10.8% - are in industrialized countries.
200,000 – 8% - are in countries in transition. *[2]*

161 countries are reported to be affected by human trafficking by being a source, transit or destination count. *[3]*

People are reported to be trafficked from 127 countries to be exploited in 137 countries, affecting every continent and every type of economy. *[4]*
The Victims

The majority of trafficking victims are between 18 and 24 years of age. *[5]*

An estimated 1.2 million children are trafficked each year. *[6]*

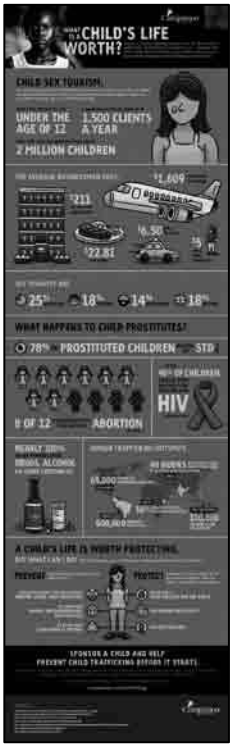
95% of victims experienced physical or sexual violence during trafficking (based on data from selected European countries). *[7]*

43% of victims are used for forced commercial sexual exploitation, of whom 98 per cent are women and girls. *[8]*

32% of victims are used for forced economic exploitation, of whom 56 per cent are women and girls. *[9]*

Many trafficking victims have at least middle-level education. *[10]*

[4]



[5]

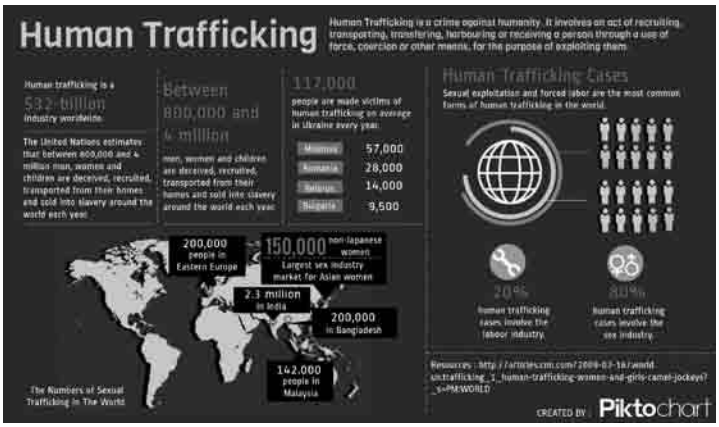
Fig. 1. Infographic from "The Dream Center volunteer organization", with information for the sex trafficking in USA.

Fig. 2. Infographic from "Christian Child Sponsorship", named "Compassion" about child's prostitution.

52% of those recruiting victims are men, 42% are women and 6% are both men and women. *[11]*

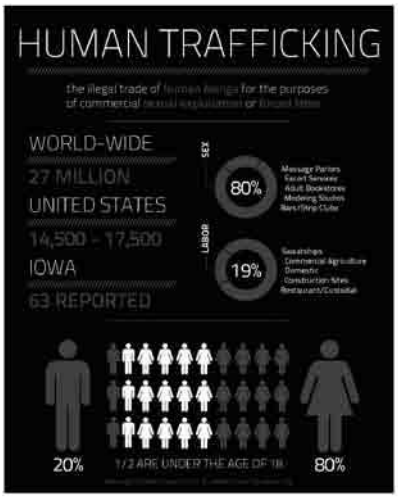
In 54% of cases the recruiter was a stranger to the victim, 46% of cases the recruiter was known to Victim. *[12]*

The majority of suspects involved in the trafficking process are nationals of the country where the trafficking process is occurring. *[13]*



[6]

Fig. 3. Inforgaphic based on the statistics of United Nations Office on Drugs and Crime. From *"Piktochart Design Easy Infographics".*



[7]

Fig. 4. Infographic based on the statistics of National Human Trafficking Resource center. From *"Polaris Project for a world without Slavery".*

The Profits

Estimated global annual profits made from the exploitation of all trafficked forced labour are US$ 31.6 billion. *[14]*

Of this:

US$ 15.5 billion – 49% - is generated in industrialized economies.
US$ 9.7 billion – 30.6% is generated in Asia and the Pacific.
US$ 1.3 billion – 4.1% is generated in Latin America and the Caribbean.
US$ 1.6 billion – 5% is generated in sub-Saharan Africa.

US$ 1.5 billion – 4.7% is generated in the Middle East and North Africa. *[15]*
Prosecutions

In 2006 there were only 5,808 prosecutions and 3,160 convictions throughout the world. *[16]*

This means that for every 800 people trafficked, only one person was convicted in 2006 *[17]* [3]

The No Project Organization

The NO Project is a global public awareness campaign against human trafficking and modern day slavery. The soul of The No Project is the Founder, Judy Boyle, who first encountered human trafficking through reading a newspaper article in Greece, in 2001.

The article described an 18 year-old girl who hanged herself in a toilet using her own stockings. The young woman from Eastern Europe was a victim of Human Trafficking who had been recruited, trafficked to Greece and forced into prostitution. "My world turned upside down that night," Boyle says. "I couldn't sleep. It did my head in."

After extensive research and collaboration with various NGOs against Human Trafficking, Judy Boyle decided to establish the anti-slavery public awareness campaign, The No Project.

The aim of The NO Project is to raise awareness in young people through education, arts, music, dance, film and social media. “Sustainable change lies with a well-informed, proactive youth generation. They are the consumers, the policymakers, the educators, parents and role models of the future. They are also the potential clients and traffickers.”

The NO Project collaborates with artists, musicians, film-makers, educators, writers, academic researchers, and even hip hop dancers. The campaign also works closely with the corporate world through Corporate Social Responsibility.

One reason Boyle targets youth is because of her own background as a teacher, teacher trainer, and writer of educational material. “History books say that Slavery no longer exists. Wrong. Slavery is not history. It is behind our daily products such as chocolate and coffee. It is behind closed doors in our neighborhoods - domestic workers and people enslaved for commercial sexual exploitation. But educational institutions are out of touch and turning a blind eye.

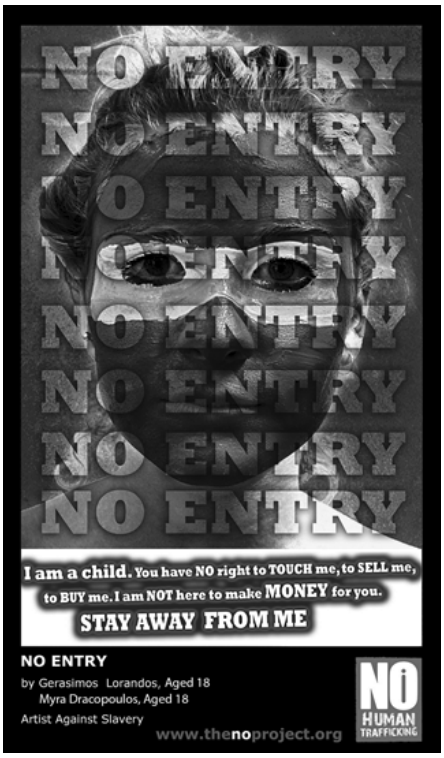


Fig. 5 and 6. Posters created by scholarships in Athens. *From Judy Boyle's archive.*

That's unacceptable," says Boyle. "You can't pick up a school book today that does not talk about the Ecological crisis – but no educational books are talking about the fastest growing crime on the planet- human trafficking and modern day slavery. That's what we do – try to reach young people but not only through formal settings. We reach them in ways that have personal meaning – on line, videos, music, dance, animation."

Supporters of The NO Project are extremely diverse – from the world champion Hip Hop Dance Crew, Request, to a Harvard University Professor and global expert on Human Trafficking. However, fundamental to all the work of The No Project is Art and Film produced by youth activists.

In the summer of 2011 Boyle came across an animation on youtube by Effie Pappa, "1.2 Million Children". She was intrigued by the work of the young Graphic Art student in Athens, but more importantly she thought, "Who are the tutors of this student – I want to work with them." And that is exactly what she did.

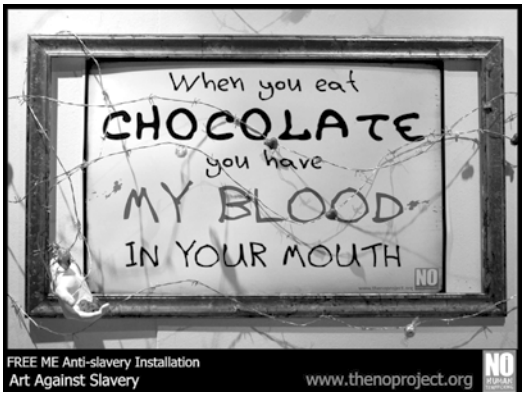


Fig. 7. The world champion Hip Hop Dance Crew, in collaboration with The No Project organization. *From Judy Boyle's archive.*

Fig. 8. Installation Judy Boyle, Illustration Effie Pappa. *From Judy Boyle's archive.*

The Technological Educational Institute of Athens (TEI), Collaborate with The No Project Organization.

The TEI is a public university with many different schools. One of them is the Faculty of Fine Arts and Design, in which the Department of Graphic Design is included. The courses of the department include a series of choice courses in animation. These are three courses of the last semesters. In the 5th semester there's a story board class, within the 6th and 7th, a cartoon and animation class. The lesson of the story board, in theoretical part, includes visual communication via cinema, especially the principles of cinematic language. In the laboratory part, students are required to create a complete story board. The theory of the cartoon course includes the expression of movement through one or several characters. During the laboratory session students have to create different movements or their techniques. The theory of animation includes visual communication via animation and its various techniques. In the laboratory session, students have to create an animation film with their premade story boards. These movies are uploaded on www.youtube.com/teianima.

Judy Boyle had decided to contact with the teachers of the department. Given that 'The No Project' organization collaborates with teachers and young people, this collaboration has been set within the framework of the organization. Accordingly, the teachers, Eleni Mouri (assistant professor) with Stelios Polihronakis and Eleni Tsampra (lab assistants) call at the beginning of each semester a specialist to present an issue which addresses to the students. Boyle's proposal was discussed by us and it is considered by everyone to be matching to the course aims.

By the start of the course Judy Boyle came to TEI of Athens and with her personal radiation and passion, analyzed the problem of Human Trafficking. Students were shocked by this problem and teachers discovered that the issue is almost unknown among the young people, just like the organization highlights. The questions were straight and the answers led to new questions. The presentation lasted for 3 hours without any break. The recruitment of such shocking information motivated our students to thoroughly investigate the matter, through sources given by the speaker, or other that found on themselves. These sources are the different international organizations that act against Human Trafficking as the United Nations Office on Drugs and Crime, Stop the Traffik, Antislavery, Free the Slaves, Not for Sale, Slavery Footprint, The A21 Campaign, Priceofsex, GEMS, Walkfree , etc.

The images of abused and frightened people who have suffered by violence, opposing to the personal life of the carefree youth (20-22 years old), prompted students to ideas based on contrasts. It led them to ideas that collate the light and color of the beauty of life with the darkness and fear which brings slavery.

Besides, as Rudolf Arnheim wrote, «The privilege of observing everything in connection with something else, elevates the understanding to a higher level of complexity and validity while it simultaneously exposes the observer to an infinite number of possible connections [....] This is because the controversy highlights the dimensions, in which things can be compared, and consequently sharpens the perception of these particular qualities "[8]

Here are five examples coming from the story-board and animation courses. These examples have later, projected by the organization 'The No Project'.

	REAL (Chronological narrative axis)	FANTASTIC - PLOT (Non-chronological narrative axis)
Set up Reveal of a conflict	Freeloaders lure a Third World child, into the promise of a better future.	A child from Africa gazes the stars. A star shines and the child follows it.
climax	The child is persuaded and follows traffickers; feeling joy and optimism.	She flies free in the sky, up in the clouds, she meets a family of birds playing vigorously.
	The danger is sensed, but repelled because of the powerful desire for freedom.	She's riding a grasshopper. A flower closes safely its petals and elevates.
crisis	But the dream turns into a nightmare and overpowers.	The cloud where the kid is, pops and the child falls. She encounters a large carnivorous plant that swallows her.
conclusion	The child captured by the circuit of traffickers and the dream becomes a nightmare.	Located in a flatbed truck along with other sad children. The truck is moving to an industrial western city. The child has been captured by smugglers.

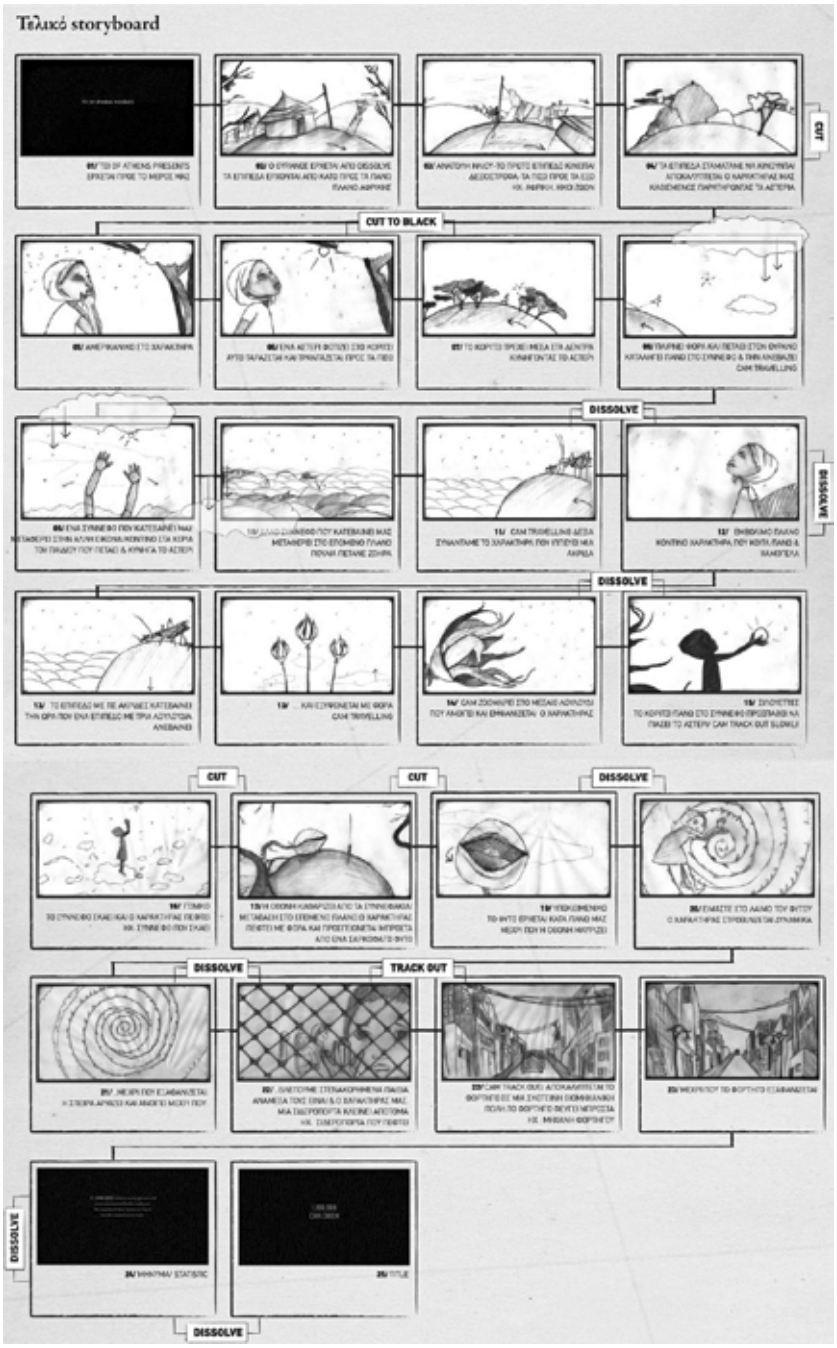


Fig. 9. The story board of "1,2 million children". *The film: http://www.youtube.com/watch?v=JwmZ6dhxRyE*

The first example is the movie called “1.2 million children”, by Effie Pappa. This student chose the topic for her thesis before the collaboration between TEI and The No Project. She work up to the statistical basis for the creation of the script, comes from the UNICEF, UK Child Trafficking Information Sheet (January 2003). An estimated 1.2 million children are trafficked each year. During the structure of the script, we observe the controversy. On the one hand, the reality is placed in a fully chronological axis and on the other hand, the fictional side of the way the child sees the world around them, the plot.

Another element used by students in creating their scripts, was the use of coding and tales that have become codes. Andersen’s “The little mermaid”, is widely developed in Western society and overthrow them.

"The Codes are forms of social knowledge from social practices and beliefs although they are no sign fortification. They organize their understanding of the world in terms of "dominant paradigm meaning", standards vary according to culture and time, but in general it’s taken for granted when we interpret or think about something. "[9]

The second example is Natalia Qadreh’s film; The father sells his daughter to the wolves. The term "father" is decoded on the concepts “love”, “warmth”, and “protection”. The symbol of wolf in western society is decoded in very negative terms. It is a dangerous creature that lives in darkness, eats children and is generally voracious. The overthrow of the concept father relied on statistics that showed that close relatives are, in most cases, the children traffickers.

Fig. 10. A part of “Wolf Market” story board.
The film: *http://www.youtube.com/watch?v=qEGtki1tIiY*

Third example, is the film of Aspasia Hatzirvassanis; The prince of the well - known tale of Hans Christian Andersen «The Little Mermaid" is actually the

trafficker. The tale is well known to every child grown up in the West and it works here as a code.

The ruling view is the one of the Disney's film "The little mermaid" and not the original version of Andersen's. The mermaid is a girl who is sacrificed for her love.

Fig. 11. A part of "Wish" story board.
The film: *http://www.youtube.com/watch?v=WpuoS-hjHwE*

In the 'Factory' example, of Argyri Aronis, the concept factory dominates. In Mythologies theory, Roland Barthes speaks for the first reading level , of denotation and connotation of the second reading level. The denotation is the literal level of significance, the 'objective' present that is easily recognizable by our senses. It is the unencrypted message, direct and obvious, closed to interpretation and belongs to the recognition level. The connotation refers to meanings that are beyond the denotation and depend on it. By connotation, comes the meaning of the Code and symbolism…. It is the level of interpretation, wherein lies the secret, hidden reason, where the reader actively introduces cultural codes in order to interpret it. [10]

In its first level meaning, 'Factory' is the building where products are manufactured. The children are feared to entering the factory and they come out as consumer products. The connotation importance lies in linking consumption - profit, demand - production, child-product. The key elements lead to the human Trafficking.

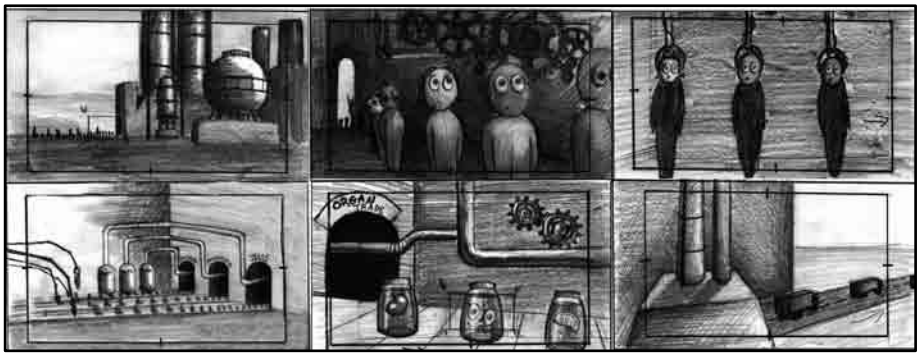


Fig. 12. A part of "Factory" story board,
The film: *http://www.youtube.com/watch?v=EBcWp7yo7DQ*

In the example of Maria Douni, the emphasis is given on the ignorance of sensitized citizens of Western society. It is an ironic comment on our practices. Denotation is the forcible transfer of girls in factories, where they produce clothes, and the woman protesting against Human Trafficking.

Fig. 13. A part of "Stop Human Trafficking" story board.
The film: *http://www.youtube.com/watch?v=asE9nkd9bWc*

The comment is on the link between women laborers and typical western bourgeois. It is a yellow blouse. A color connotation, for a practice that theoretically causes repulsion, yet we are all potential buyers of these exportable products.

The story boards, created in the 5th semester, were delivered to Judy Boyle, who helped with some observations. In the 7th semester in the animation course, students perfected their story-boards and worked on the film production.

At the end of the semester, Test screening was made in front of the presence of students, teachers and Judy Boyle. Attendees' voting criteria were the power of communication, the script, the aesthetics, the expressiveness of the characters and the use of film language.

The movies were delivered to 'NO PROJECT' organization, as part of communication material, and showed by TEI, at Greek animation festivals, 'Animasyros' and 'Be there'. At the same time these films have made an independent course in various festivals which have been sent by their authors.

Conclusions

Human trafficking is a global problem, communicated mainly by data, infographics and documentaries. The students of TEI, at the department of Graphic Design, used this material and created animation storytelling films out of it. The aim was to raise awareness of the audience towards the problem and not to transmit the knowledge that was acquired from the analysis of data, which would result to the creation of informative animation. The most important characteristic of the animation film is the narration of the unrealistic in favor of creating emotions. For this reason suitable means of communication and from the cooperating organization, The No Project and from the teachers of the course. The result proved that this collaboration has benefited both the educational process as well as the organization. Students worked in order to communicate a real problem and find solutions for it, while the organization projects these films to an international audience in order to sensitize. At the same time the university and the students are notified.

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Playing with Data: an Experience in Creative Infovis

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Abstract. Information Visualization (Infovis) methods provide an effective way to make sense of the vast amount of data flowing around our everyday experience. Using creative Infovis designs is possible to convey the meaning and enhance the understanding of complex topics. The purpose of this paper is to present the design method adopted in a collaboration between Polytechnic of Turin and Telecom Italia, whose goal is to devise novel and useful Infovis concepts to deal with data. Powered by the sharing of different skills and experiences, this method led to the first results presented in the paper.

Keywords: complex systems design, information visualization

1 Introduction

We are living in an era of exponential increase in data production, collection and usage in every sector of human life, about people, ideas and object. Nowadays more data is produced in a single second than the entire content of the Internet of twenty years ago.[1] As a result data, seen as a complex system, provide an important opportunity to enhance the cognition of our environment. For this reason the ability to collect, understands, communicate and make sense of information is going to be a very important skill in the next decades [3], in the professional field as well as in the educational and research field [4][5]. Under this premise, a collaboration has been established between the Department of Architecture and Design (DAD) of the Polytechnic of Turin and the Innovation and Re-

[1] An ordinary person today could generate more data in one afternoon's trip to the market than a person born in 1912 would produce in a lifetime. [1] Considering the Internet's content generation rate today, a growth of 44 times in the digital data generation rate in the next ten years could be a reasonable expectation [2].

search Projects department of Telecom Italia S.p.A. This collaboration, involving the authors of this paper (DAD and TI researchers) and a selected group of students from DAD, pointed out, shared and explored new creative design and Infovis methods coming from the experience matured in DAD and TI. Main insights gained in this phase are presented in sections 2,3 and 4 of this paper. In the unfolding of the research activity a pair of case studies, coming from recent Infovis projects in TI and described in section 5, were presented and analyzed by the research group in order to inspire and support the Infovis concept proposals of the students presented in section 6.

2 Data, Complex Systems and Systemic Design approach

Complex systems are those systems and phenomena made of many components or agents interacting with each other in countless possible ways, where the overall behavior is not given by the simple sum of the behaviors of their constituent elements, but depends strongly by their interactions [6]. Therefore, our capability to understand complex systems is not only due to our knowledge about the single system's components and features, but especially to the ability to recognize and validate the overall relations among these components and features. This is the case of the analysis and visualization of complex data sets, especially when the number of data is very large (the so called "big data"). In order to reach the Infovis project's goal, we establish a design process methodology starting from the Systemic Design Approach able to organize, optimize and understand all the actors and parties involved in the phenomenon under consideration.

The Systemic Design approach is a new way to face the design activity in complex systems, used and taught in design courses at the DAD. Defined and verified in different design fields as a way to create innovation by the research group, it is focused on designing the relationships between people, activities and contextual features to enhance knowledge about complex systems. It begins with the collecting of broad and tangential information in order to examine the vast array of issues and features surrounding any given complex topic. The study of this overall picture guides the designer into a deep understanding of the topic outlining the real role of all the actors involved within their scope, their development and their relations in their operational context [7]. As a result, using this approach is possible, in one hand, to become aware of the value of the relationships, expressed in the system’s behavior, creating the given topic’s identity, while in the other hand, the interaction between this identity and the operational context creates the culture of the considered topic. Operating in this iterative process, innovation can be driven using awareness, information and behavior within the system itself [8].

3 Information Visualization

While Infovis can be simply defined as the representation of information in visual form, it is nevertheless a complex multidisciplinary field, ranging from data mining to visual art, from psychology of perception to graphic design. This is because effective Infovis projects try to exploit the great power of human visual perception, creating visual data representations allowing the navigation, understanding and useful pattern discovery in data sets [9]. In other words, the quite ambitious goal of Infovis is cognitive augmentation, i.e. the extension of the capabilities of the human mind with respect to data, allowing to make sense of complex data-driven concepts [10][11][13].

In the collaboration between DAD and TI described in this paper, we've been strongly oriented to the creation of information visualization methods and concepts where one can "play with data", i.e. where aesthetic, creative design and interaction factors [12] are an essential part of the understanding of complex data, in a way that, quoting Andrew Vande Moere, "should appeal both the mind and the soul"[13].

4 Infovis design process methodology

The Infovis design process can be thought as composed of three main phases: analysis phase, encoding phase and display/testing phase. According to the Systemic Design approach, in the analysis phase the designer considers the overall picture of the topic to be visualized, taking into account the different data and elements involved and their relationships in the domain context. In order for the Infovis project to be effective, an important aspect is also the individuation of the target audience and the related communication style. An important design choice is the selection of the actual data to display in the visualization [10]. In this analysis phase is also important to assess data retrieval / extraction / structuring techniques needed in order to actually build the data flow needed by the intended visualization.

In the encoding phase, the most important aspect and design choice is the envisioning and definition of the mapping from data to visual elements, such as shapes, colours, animation, typography, and so on. Effective Infovis projects often make use of creative metaphors in order to convey meaning in an immediate way. The display/testing phase closes a single cycle of the Infovis design process, providing feedbacks and insight for the assessment of the visualization project.

5 Infovis case studies

The case study called "Politics" (fig.1) is focused on gathering, processing and visualizing data and information from Italian newspapers' articles and Italian po-

litical structure. Data are obtained by analyzing articles using Natural Language Processing (NLP) tools, by extracting useful concepts and matching them to structured information (using semantic web techniques) and by classifying articles on a pre-built taxonomy of arguments. That set of tools produces additional information (annotations) for every article: date of publication, people, organizations, places mentioned into the article, and relations between annotations based on their co-occurrences into articles. All of the annotations generated is our dataset, which can be continuously updated. Our visualization design approach is to use simple visual forms and different visual modules to show data at different

Fig. 1. Screenshot of the "Politics" Infovis project.

levels of aggregation. At the higher level of aggregation we use a donut chart to represent articles by argument. For more detailed information on deputies and their mentions in articles we use still images of the deputy to identify him. Moreover, to represent all the politicians whose information we deal with, we use the metaphor of the Italian Parliament drawn as a circular sector composed of tiny circles, one for every deputy; the colour of the circles can be arbitrary or the one traditionally associated to the party.

The “Colours of the Vineyard" (fig. 2) is a visual recommender system on the domain of Italian wines from the Piemonte region, based on a database of these wines and their properties related to smell, taste, grapes and production locations. When the user chooses a wine from the list, the system extracts from the database a set of wines with similar properties and creates an interactive visualization of this set, allowing visual exploration of wines' properties. Visual layout creation is driven by a fitness function taking into account not only data relationships, but also aesthetic, perceptual and graphic design factors. This method follows the approach of generative visual art and generative graphic design, where the artist/designer, after envisioning a set of aesthetic, functional and semantic criteria, models them as a process and lets the resulting system organize into the actual, emergent visual patterns [14]. The flexibility and modularity of the fitness function allows the designer to experiment with different aesthetic criteria and styles. Moreover, the generative approach naturally leads to the creation of a diverse set of visual solutions for a given data set, enriching the user's experience with a source of visual novelty. A detailed description of the project can be found in [15].

Fig. 2. Screenshot of the “Colours of the Vineyard” Infovis project.

6 Playing with data: Infovis design concepts

The design concepts produced by students follow the systemic design methodology explained before and embrace a range of different domains.
Every concept is briefly exposed hereafter:

Realtime Communication (authors: Pallaro Agnese, Rudà Elisabetta, Schioppetti Marzia, Tron Valentina). This work presents (fig.3) the concept of a system for realtime, interactive visualization of data flows in worldwide telecommunication networks. The key metaphor used is the sea, evoked by the color palette (also in line with the "control room" overall layout of the visualization) and by the wave-like shapes of several graphical elements. This, jointly with the envisioned advanced navigation features in (geographical) space and time of the visualization, effectively addresses the current need of surfing the ocean of data in a way that allows awareness and understanding.

Fig. 3. Screenshot of the "Realtime Communication" Infovis concept. Authors: Pallaro Agnese, Rudà Elisabetta, Schioppetti Marzia, Tron Valentina

My Energy Consumption (author: Altobelli Claudia). This work presents (fig.4) the concept of a system for the monitoring and visualization of home energy consumption. The metaphor and key graphical element used in the visualization is a little plant, whose different leaves represent different days, while the degree of filling of each leaf is proportional to the energy consumption in the associated day (in alternative visualizations, the leafs can represent different dimensions, e.g. the consumption of different household devices). This results in an intuitive and immediate method for becoming aware of the often quite elusive data about personal energy consumption.

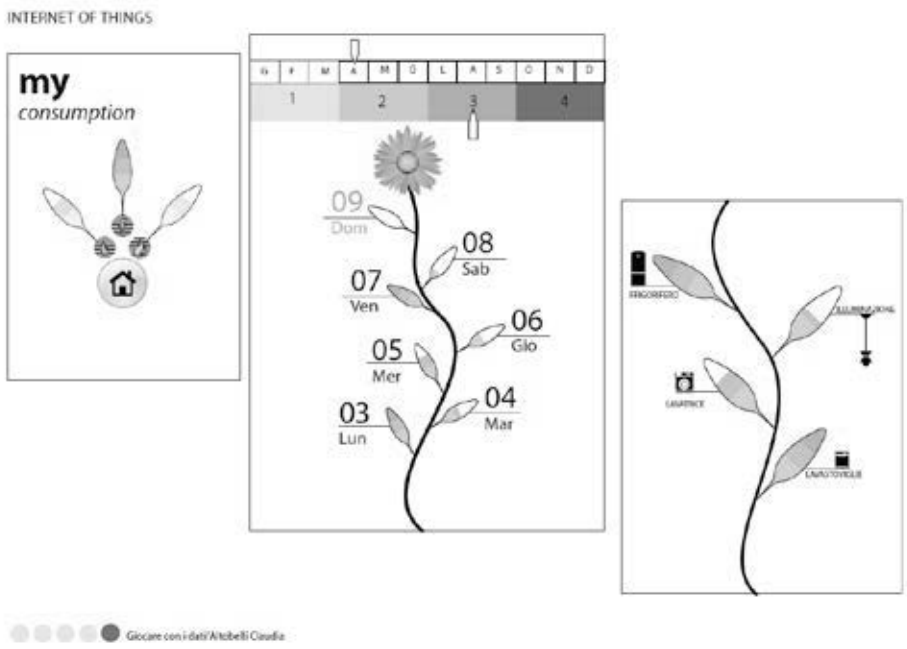

Fig. 4. Screenshot of the "My Energy Consumption" Infovis concept. Authors: Altobelli Claudia

Data to Think About (author: Altobelli Claudia). This work focuses (fig.5) on the goal of raising the awareness about the problem of violence against women. Key design factors are the navigation of statistical data in an interactive way, a clean, stylized graphic layout and the use of evocative shapes metaphorically related to the problem analyzed (e.g. the pointer indicating a particular statistics about feminicide has the shape of a gun). This results in a work having a strong emotional impact while allowing a clear understanding of actual facts and social factors related to the analyzed problem.

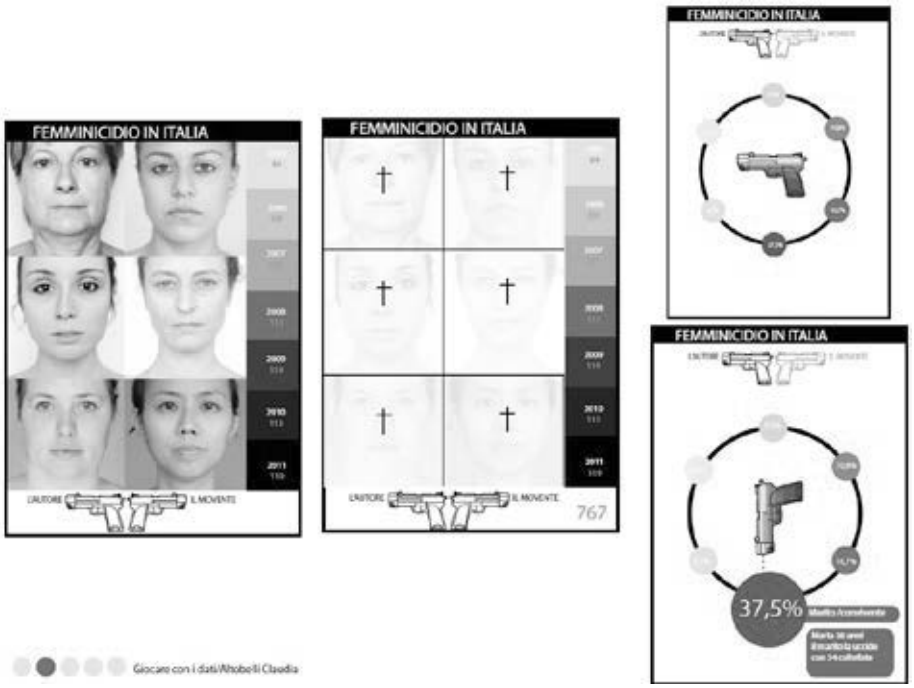

Fig. 5. Screenshot of the "Data to Think About" Infovis concept. Author: Altobelli Claudia

Who is the Fastest Sprinter of 2012 in 100 Meters? (authors: Amouzad Khalili Hamid, Khorramian Kaveh). This work presents a visual comparison of the speeds attained by top athletes in different sports, using as metaphors a clock/timer wheel and a virtual "speed contest". The visual comparison is integrated in a video showing the protagonists of this contest in action. This results in an immediate and effective way of explaining the concepts of speed and time (in an educational setting, for example) in different contexts.

Smart Cities (authors: Casale Enrico, Conte Fabio, Lopez Eliana Paola). The focus of this work (fig.6) is on improving the visual presentation of open data about cities. Key design factors are the switch from traditional infographics to a more intuitive and appealing design (like the radial layout proposed) and the improved navigation among the data, in order to easily move between their different levels of aggregation and categorization. This results in a easy-to-use tool allowing rapid understanding of complex data sets about the cities and their inhabitants.

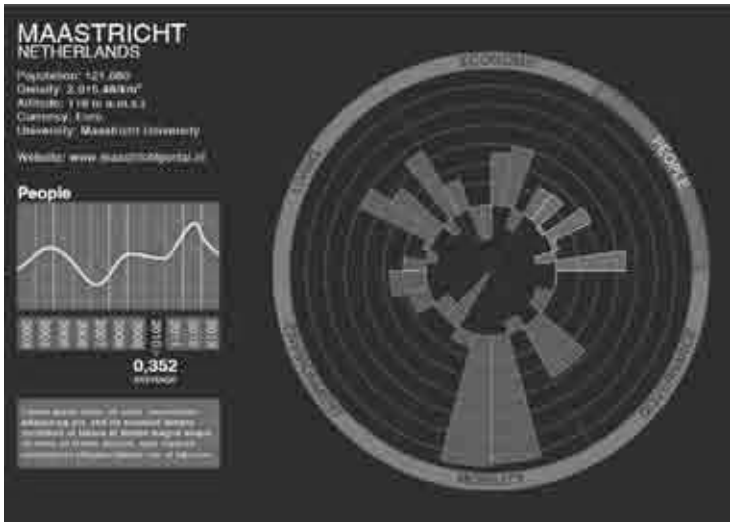

Fig. 6. Screenshot of the "Smart Cities" Infovis concept. Authors: Casale Enrico, Conte Fabio, Lopez Eliana Paola

ToriNoi (authors: Guataquira Sarmiento Nataly Andrea, Rugeles Joya Willmar Ricardo). This work (fig.7) proposes a tool for social networking / information retrieval with the goal of helping people, coming to Torino from foreign countries, to get the right information on travel, healthcare and legal documents required to live in Italy. The key visualization/navigation metaphor is a stylized shape of the Mole, Torino's iconic monument, composed of the stylized shapes of the users' avatars (the name of the concept, "ToriNoi", is the fusion of "Torino" and "Noi", the Italian word for "Us". Hence, the meaning is "Torino for Us" or "Torino are Us"). This design results in a warm welcoming feeling and in a great immediacy in the user experience when looking for information.

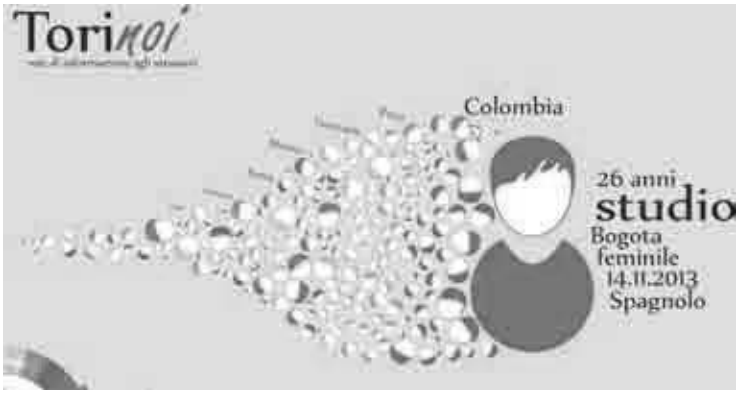

Fig. 7. Screenshot of the "ToriNoi" Infovis concept. Authors: Guataquira Sarmiento Nataly Andrea, Rugeles Joya Willmar Ricardo.

Italian Political History (authors: Cirillo Letizia, Sorgente Livia, Spagnuolo Anna). This work (fig.8) envisions a visualization tool on the data about the complex domain of Italian political history. Key design elements and metaphors are: 1) a "time wheel", i.e. a timeline with a circular layout organized in circular segments, representing different periods of Italian political history; 2) a schematic drawing of the Italian Parliament, showing the composition of the political forces (overall and in detail) in a interactively selected time period; 3) a graph layout visualizing the links among political actors, their parties, the available information about them, their media appearances, and so on. This results in a powerful, yet easy to use, analysis tool to explore and understand the past and present Italian political situation.

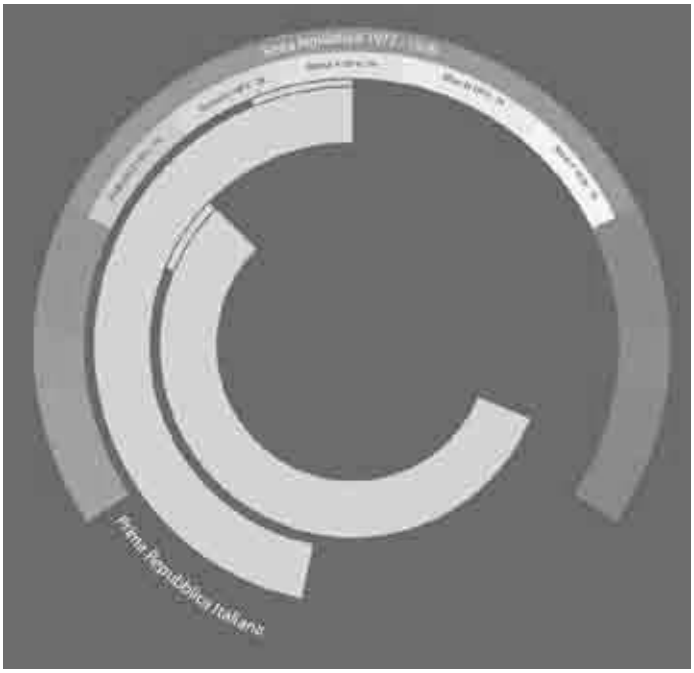

Fig. 8. Screenshot of the "Italian Political History" Infovis concept. Authors: Cirillo Letizia, Sorgente Livia, Spagnuolo Anna

Augmented Journalism (authors: Basile Carmine, Dellalibera Mattia). This work (fig.9) envisions a tool for the spectator of talk shows and similar TV programs, allowing to more easily understand important and complex themes. The key metaphor is the scientific optical instrument (e.g. microscope or telescope), penetrating under the surface of the visible TV show and visualizing in a realtime, accessible way the information linked to persons and themes present in the show, making use of information extraction, information matching and image recognition technologies. This provides the spectator a "augmented view" layer for an improved understanding of what she/he's seeing.

Fig. 9. Screenshot of the "Augmented Journalism" Infovis concept. Authors: Basile Carmine , Dellalibera Mattia

7 Conclusions

First results of the collaboration between our research groups were encouraging, because the students, guided by the systemic design approach and by the insights gained during the projects meetings, were able to produce high-quality visualization designs and "play with data" across the different phases of the design process, giving us a very strong positive feedback.

The future of our collaboration will explore the application of these design methods and insights in other domains, especially focusing on visualizations with strong interactive and aesthetic features.

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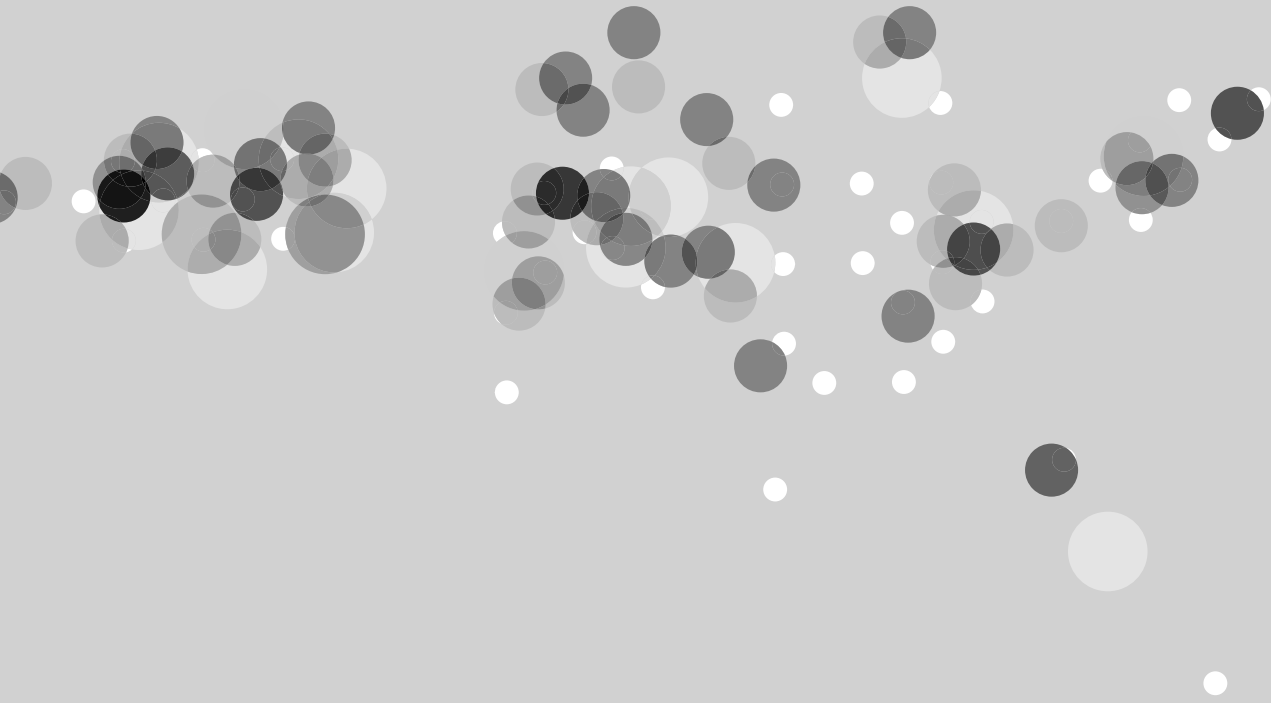
02. Junior track



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ItalyCaps

ItalyCaps is a tool to explain the assignment of zip codes in the Italian territory. The visualization is based on the conversion of the zip codes' values (ex. 90139) into hue values (HSB color mode). Starting from this conversion it is possible to work on different supports: a video to focus the zip codes' progression (from 00010 to 98100), a synthesis image like a poster map to focus the density of population in different areas, and an atlas to observe in detail the zip codes' position referred to administrational borders. The project is realized with Nodebox1 (Python Programming Language), FFMPEG and Adobe Suite. Algorithms and outputs are licensed under Creative Commons 3.0 Attribution – Non commercial Unported license.

https://github.com/roberto-arista/Italy-Caps

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Affiliation
ISIA Urbino

Title
Italy Caps

K-words
Cartography, Quantitative visualization, Python Scripting

Abstract
The project proposes an useful instrument to explain the assignment of zip codes in the Italian territory. The visualization is based on the conversion of the zip codes' values (ex. 90139) into hue values (HSB color mode). Starting from this conversion it is possible to work on different supports: a video to focus the zip codes' progression (from 00010 to 98100), a synthesis image like a poster map to focus the density of population in different areas, and an atlas to observe in detail the zip codes' position referred to administrational borders.

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uniss
UNIVERSITÀ DEGLI STUDI DI SASSARI

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Taking the twinkle out of the stars

“Taking the twinkle out of the stars” is an informative animated short film developed in the InformAnimation 2013 Erasmus Intensive Program, organized by the Alghero School of Architecture (University of Sassari) in collaboration with a consortium of European academic partners.

The project was commissioned by the UK Astronomy Technology Centre (UK ATC), a first class design and technology centre, located in Edinburgh and part of the Science and Technology Facilities Council, UK ATC is in charge of the development of specialized instruments for many of the world’s major telescopes, as well for project- management of many UK and international collaborations. UK ATC scientists carry out observational and theoretical research on keyquestions such as the origins of planets and of galaxies.

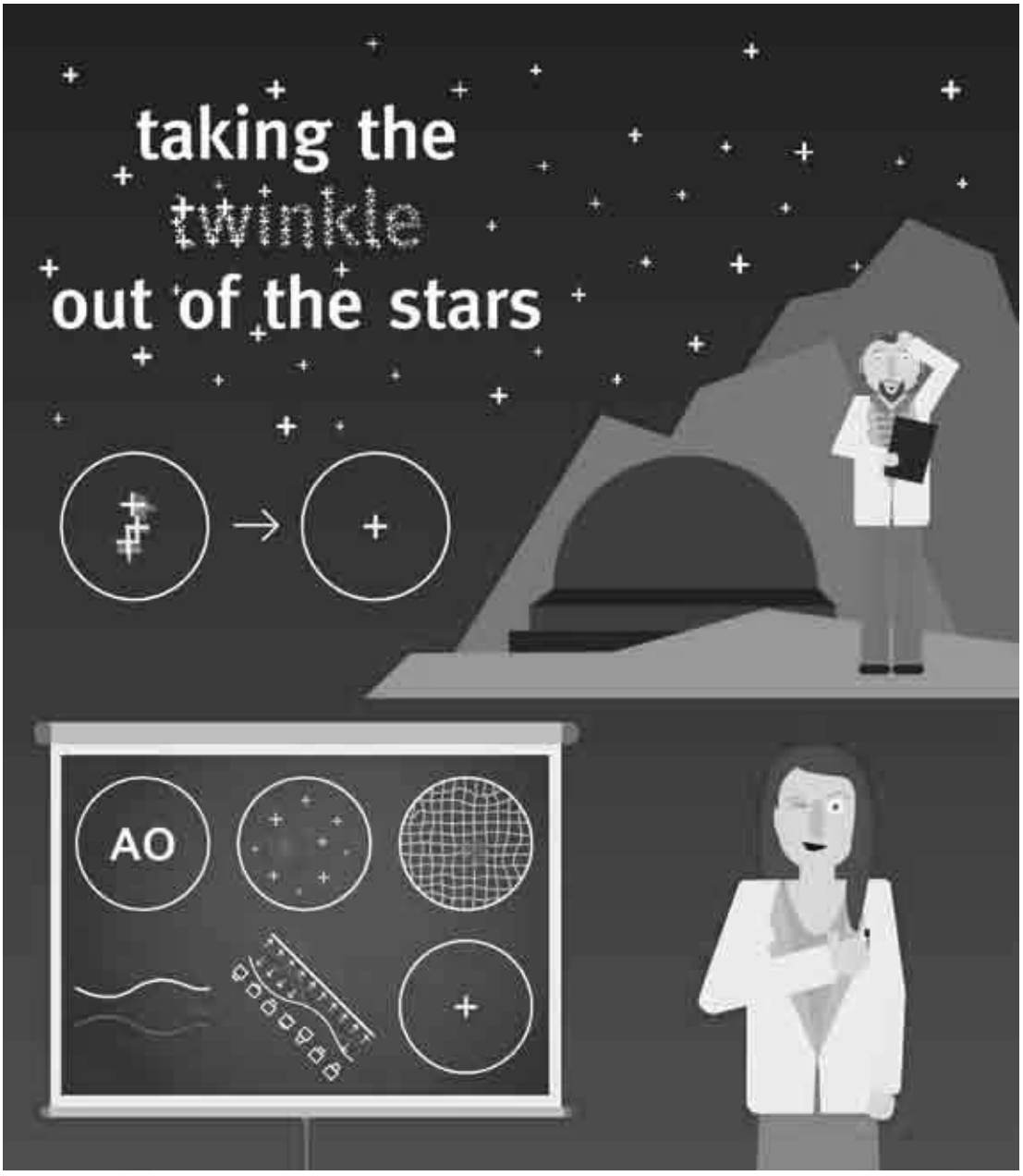
UK ATC provided to the Informanimation IP team a design brief highlighting the need to explain problems caused by the atmosphere during the scientific observation of the stars and galaxies through telescopes. As the atmosphere around us is turbulent, it moves continuously and in different directions.

This produces the twinkling effect on stars: something that is very nice to look at but that actually causes many problems to astronomic observation, that is based on the need for sharp, and clear images, offering a great deal of detail. The atmospheric turbulence makes it difficult for telescopes to get crisp images of objects, like a star or galaxy. Often two distinct objects which are close together in the field of view, look like one object with this atmosphere-caused blurring.

In order to solve this problem, astronomers developed a technique called Adaptive Optics. Used in ground based telescopes AO involves shining a laser into the sky to create a fake star for the telescope to focus on. The movements are then calculated, and a ‘deformable’ mirror is moved in realtime to correct distortion producing a much clearer and sharper image.

As the available technical visualizations on this concept are very technical UK ATC needed a short film capable of making this process easy to understand to non-scientists, the general public from teenagers to adults.

This paper describes the informanimation short film developed during the IP by the “Taking the twinkle out of the stars” design team formed by Argiri Aroni, Ella Greyson, Joe Hornsby, Pablo Rivero Bernal and me.



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Title
Taking the twinkle out of the stars

K-words
Informative Animation, Adaptive Optics, Astronomy Technology

Abstract
Our atmosphere causes the stars to twinkle, which can be very nice to look at but causes lots of problems for astronomers. The movement in the atmosphere makes it difficult for telescopes to get a clear crisp image of an object, like a star or galaxy.

A technique called Adaptive Optics is used on ground based telescopes and involves shining a laser into the sky to create a fake star for the telescope to focus on. Then, the movements are calculated, and a deformable mirror moves very quickly in an opposite direction to cancel out this twinkling, and creates a clear image.

"Taking the twinkle out of the stars" is an informative animated short film commissioned by the UK Astronomy Technology Centre (Edinburgh) that needed to make this process easy to understand for non-scientists.

It is developed in team in the InformAnimation 2013 Erasmus IP (Alghero).

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Save Jericho's Oasis

"Save Jericho's oasis" is an informative animated film on the importance of water in the city of Jericho, Palestine.

The city of Jericho is built on an oasis in the Jordan Valley. Here spring water has always been a key element visible by everyone, flowing on the ground and reaching every house.

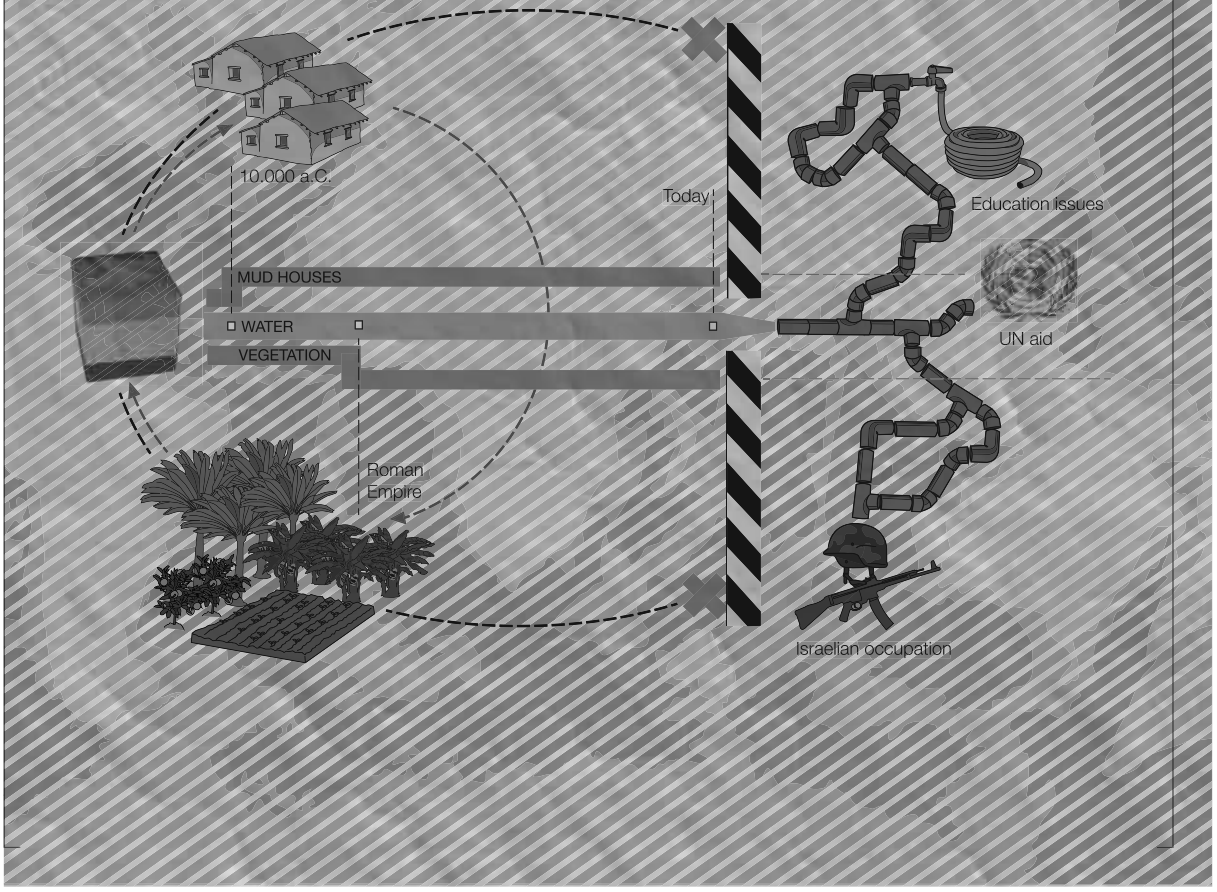
But after the development of a water piping system, carried on by the municipality of Jericho with support from the Italian government, thought as a modern solution common to many western cities of the world, a series of probelm arose.

The now empty surface conducts where water used to flow have been filled with rubbish becoming a potential sanitary problem; meanwhile the lack of surface water, that used to evaporate producing the peculiar microclimate of the oasis, has generated a crisis in the production of fruits and vegetables.

The Israelian occupation around the city is even worsening the situation; the military are now extracting the water from the springs and from Jordan river, before it reaches the city, causing long periods of scarcity or even total absence of water resources.

"Save Jericho's oasis" is thought as a way to respond to the need to inform and communicate about these problems. The short film, developed in collaboration with the Palestinian Riwaq NGO agency, is directed to local population and is meant to stimulate a sense of pride about living in one of the oldest cities in the world. Directed to young generations, the key message is to show water as a precious resource and to explain how fragile, unique and precious is the ecosystem of the oasis of Jericho.

SAVE JERICHO'S OASIS



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Visual Exploration of Open Data. Graphic interface study for exploring datasets in Open Data Portals.

The project presents a Web interface, based on Data Visualization, meant to improve user experience in the exploration and research of information within Open Data Portals. The project experimentation has been conducted on dati.piemonte.it, one of the brightest example among the italian open data landscape.

The interface, designed by leveraging methods of Data Visualization, aims at displaying all the fundamental features of datasets in the same time.

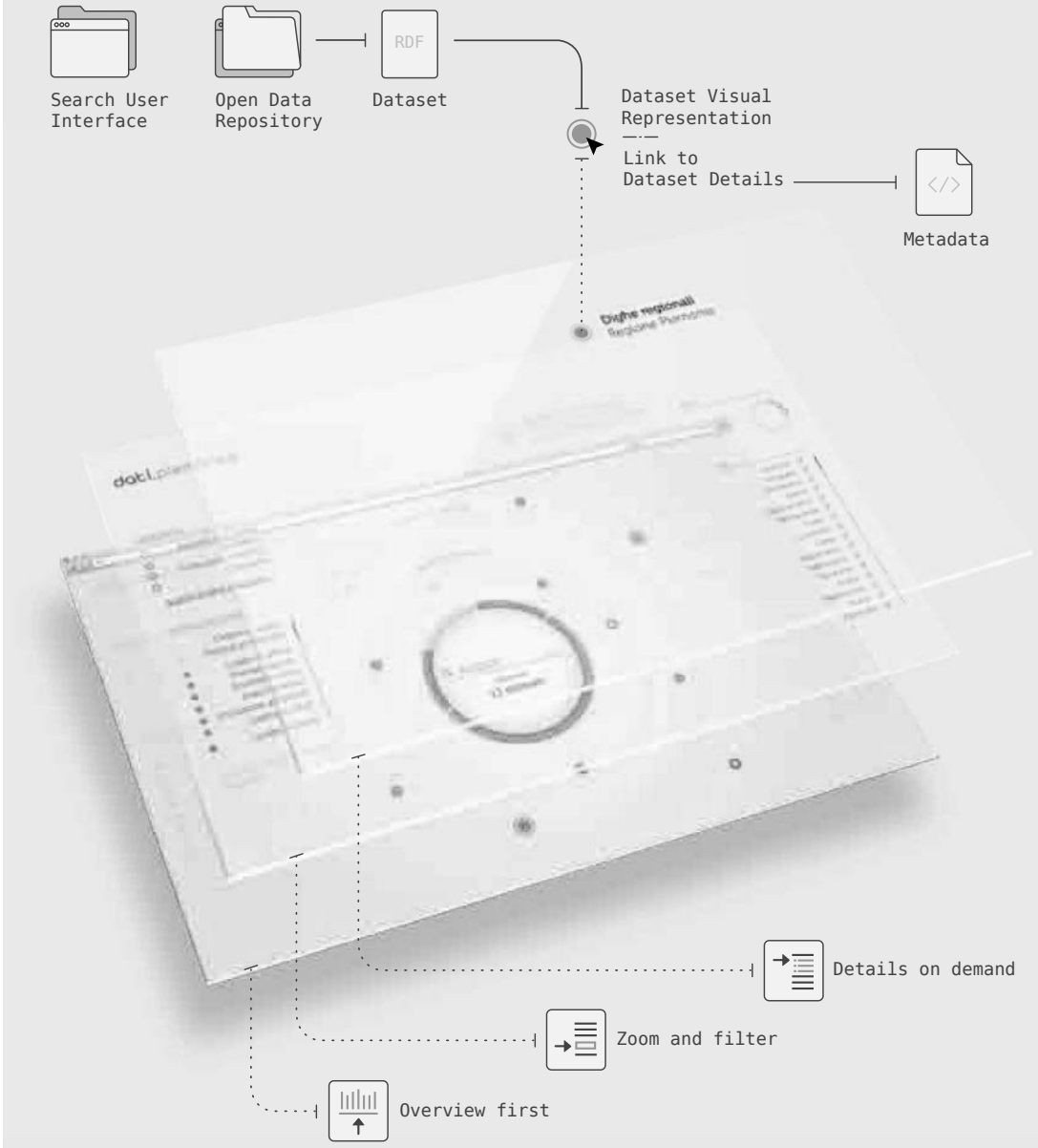
Following this approach it is possible to obtain the three key features of Schneidermann's mantra: overview first, zoom and filter, details on demand.

This design solution allows a comprehensive view of all datasets content in a simple and user-friendly way, while facilitating the comparison and the creation of links that improve dynamic navigation.

These features are particularly valuable during research process: users can simultaneously navigate throughout different parameters of the datasets and identify which correspond to their needs.

Data Visualization application to sensible context such as Open Data portals provides a real tool to research and analyze facts and figures. It gives access to get data otherwise difficult to obtain and unravels information complexity.

The project the final thesis project by E. Giovannoni e L. Pippinato, in Graphic Design Virtual - Polytechnic of Turin, 2012.



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Laura Pippinato

Affiliation
Politecnico di Torino - Italy

Title
Graphic interface study for exploring datasets in Open Data Portals.

K-words
Data Visualization / Interface / Exploration / Datasets / Open Data Portal

Abstract
The project presents a Web interface to improve user experience in the exploration and research of information within Open Data Portals. The project has been conducted on dati.piemonte.it, one of the brightest example among the Italian Data portals. The interface, designed with DataViz methods, aims at displaying all the key features of datasets at the same time, obtaining the 3 key features of the Schneidermann's mantra: overview first, zoom and filter, details on demand. That solution allows an overview of datasets in a user-friendly way, facilitating the comparison and the creation of links that improve dynamic navigation. These features are valuable during research process: users can simultaneously navigate throughout different features of datasets and identify which results correspond to what they need. Data Visualization application to sensible context such as Open Data portals provides a real tool to gather and analyze facts and figures. It allows to retrieve non-trivial data and unravels information complexity.

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Communication of sustainable values related to the local business: a case studies of a group of agritouristic companies in Sardinia

The area of 'Agritourism', rural hospitality in country farms is a growing phenomenon in the touristic industry, a key economic sector in Sardinia.

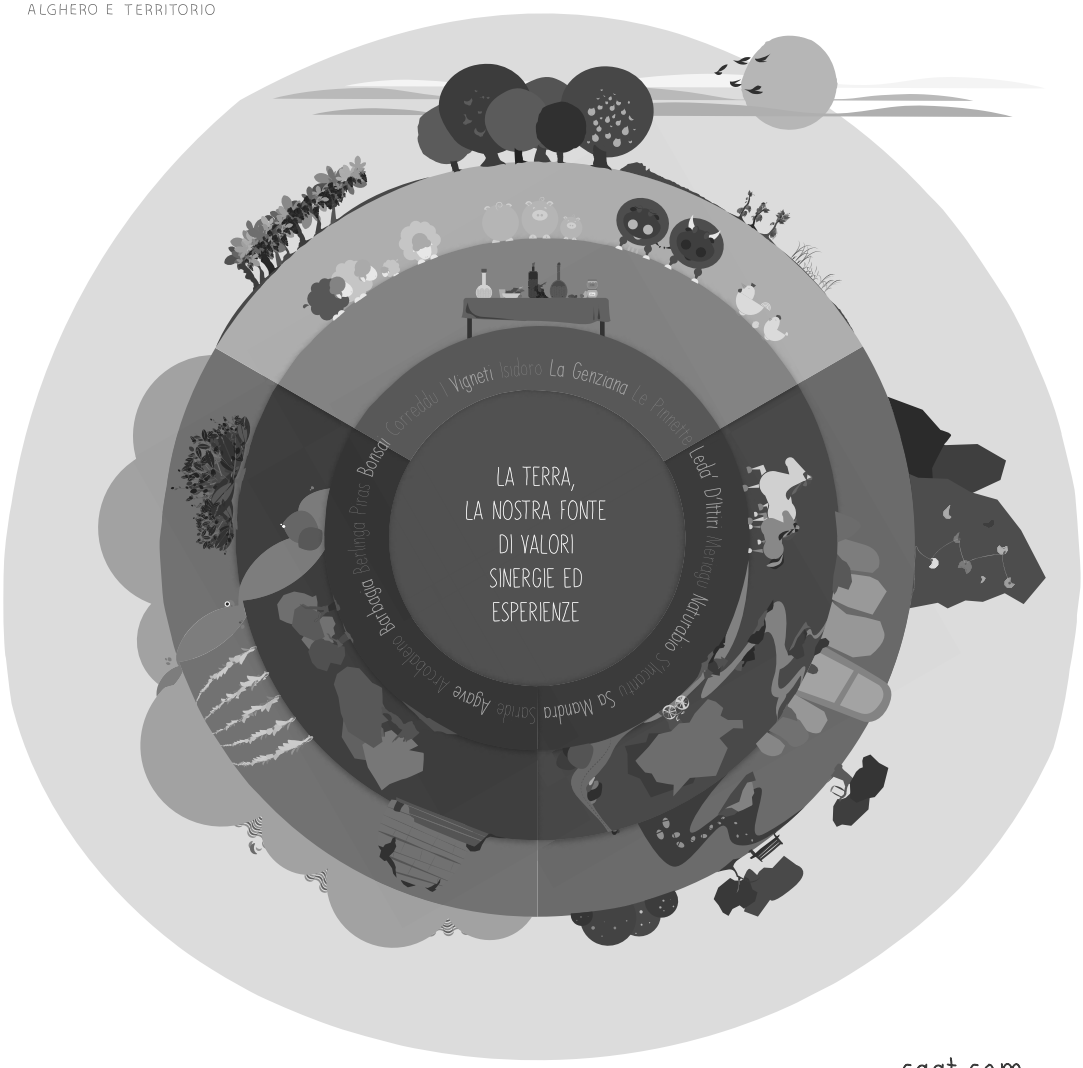
Despite its importance, the sector lacks of communication infrastructure: people working in this field seem to underestimate the high potential of improving their businesses with new tools of communication.

This abstract describes a project carried on with a consortium of actors operating in Agritourism in the Alghero area. As the combination of several different actors, providing hospitality, catering and food, services for tourism the consortium shares some key "values" that represent its identity: the quality of locally produced food, renewable energy, a natural environment, and a specific focus on the common sustainable practices compatible with local territory. Within this framework, in order to increase this specific approach to tourism in Sardinia, our challenge was promoting a positive behavior of a community of the "green" companies part of the consortium: in other words, to communicate a different concept of farm, not only for what concerns local production (by law, agritouristic farms in Sardinia must offer only self and locally produced food and goods), but also as a new approach to a natural and balance management of the natural environment, aiming for a more "sustainable" relationship with the society.

The design we developed to express this identity revolves around graphic illustration as a key communication tool.

After gathering project information through interviews and benchmarking analysis, we designed a communication system encompassing: a logotype, the consortium's corporate image and website, which together constitute the marketing strategy we devided to help to reach two main types of potential users: tourists who already appreciate "sustainable' rural tourism and the potential audience that knows the consortium's bid. In parallel, the consortium presents itself to potential partners that could join in, and to other companies in the area that produce semi-finished products or provide services, which can enter the circuit of the consortium to enrich the offer.

CONSORZIO AGRITURISMI
ALGHERO E TERRITORIO



caat.com

Name & Surname
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Title
Communication of sustainable values related to the local business:
a case studies of a Group of Agritouristic companies in Sardinia.

K-words
Sustainability/ Sardinia / Agritourism.

Abstract
The consortium has some "values" highly sustainable representing his true strengths; quality of food, renewable energy, the natural environment, and some practices that benefit the territory.
The graphical illustration is used to promote good behavior of "green" companies and increase a specific type of tourism in Sardinia who appreciates this different concept of the farm, not only in matters of self-produced food, but especially a new relationship with the natural environment.

We have designed a communication system that includes the logo, graphics and a website, which constitute the marketing strategy that we believe it's useful to achieve two types of users: tourists who already appreciate the "sustainable tourism" and the potential audience who knows the consortium's bid. Also there is presented to potential partners who can join the group or to other local companies that produce semi-finished goods or providing services, and that can extend the consortium's bid.

communicating complexity
Alghero | 25, 26 October 2013

DIPARTIMENTO DI ARCHITETTURA DESIGN E URBANISTICA
uniss
UNIVERSITÀ DEGLI STUDI DI SASSARI

Sabrina Melis
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The animated informative journey of the Egyptian vulture

As part of its institutional tasks, HOS, the Hellenic Ornithological Society participated as 'content provider' to the last edition of the Erasmus IP InformAnimation.

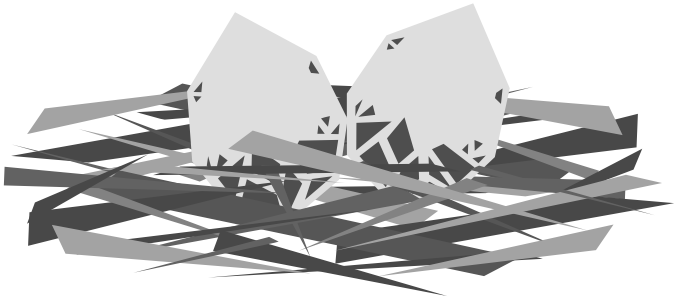
A non-governmental conservation organization for the protection of wild birds and their habitats in Greece, HOS promotes a wide series of actions ranging from protection and research, through education, to raising of public awareness and policy making, the Society's mission is to ensure a sustainable natural environment for birds and people.

HOS wanted to develop a short video that could inform about how some rare bird species-such as the Egyptian vulture-are endangered by human activity, an informative piece that could be used to explain and make more accessible a complex series of facts that put these animals at risk.

During their migration, in fact, birds such as the Egyptian vulture encounter many perils such as wrongly insulated electricity pylons and direct persecution. Furthermore, these animals often-and especially as they cross Greece, fall victims of poison baits, that although not originally aimed at them, but at unwanted predators such as foxes, wolves, bears or feral dogs, end up being a severe threat to their survival during the breeding period.

A mixed team of students participating to the IP InformAnimation project: communication designers, animators and journalists, from various European Schools, joined forces to produce a short informative animated film aimed at presenting the tale of migrating couples of these rare birds, bringing into light the need for more selective solutions and protection plans for rare and vulnerable animals. This presentation aims at describing the creative process that brought to its development and production, and the choice of a strongly illustrative visual language to reach this goal.

The animated informative journey of the Egyptian vulture



www.ornithologiki.org

Name & Surname

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"The Egyptian Vulture, Neophron Percnopterus"

K-words

Greece, migration, Egyptian Vulture

Abstract

A non-governmental conservation organization for the protection of wild birds and their habitats in Greece, HOS promotes a wide series of actions ranging from protection and research, through education, to raising of public awareness and policy making, the Society's mission is to ensure a sustainable natural environment for birds and people.

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uniss
UNIVERSITÀ DEGLI STUDI DI SASSARI

Gianluca Monaco
ISIA Urbino, Urbino, Italy

Aìtna

Aìtna is an interactive visualization of the Mount Etna's volcanic activity from 1600 to 2009, based on data developed by the National Institute of Geophysics and Volcanology.

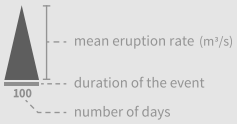
The aim of this study is to tell the history of the volcano, making accessible a huge amount of informations through the convergence of variables such as duration, intensity and location within the same visualization. Interactivity makes it possible to filter the events by danger and to easily move along the centuries.

ETNA

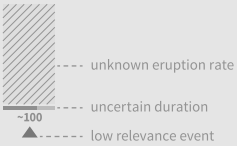
Mount Etna's volcanic activity from 1600 to 2009

Legend

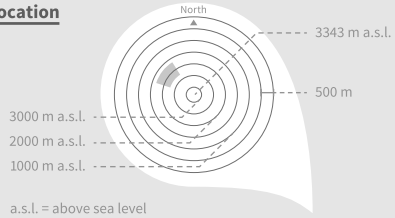
Single event



Uncertain data



Vent location



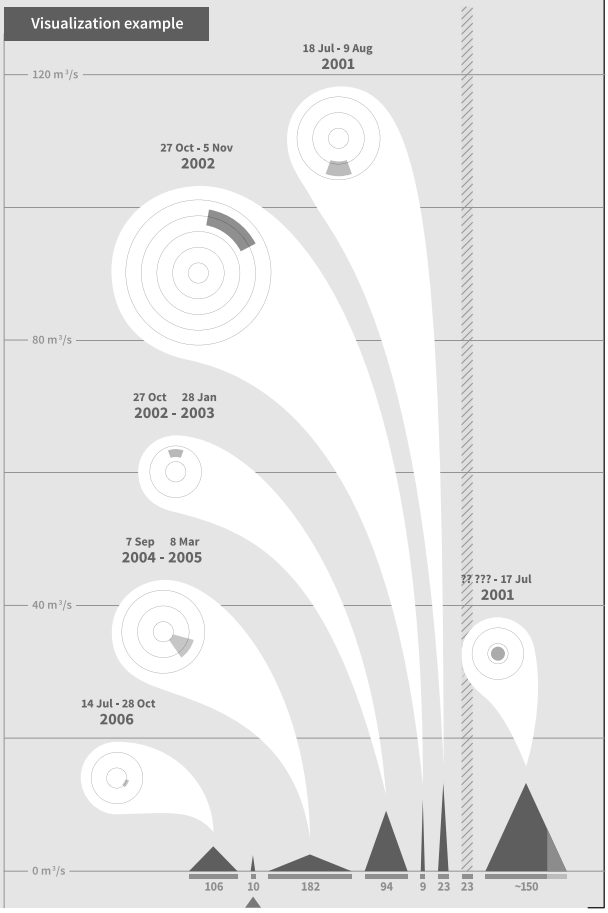
a.s.l. = above sea level

Filters

Event danger

Centuries

Visualization example



Emanuel Serra
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Alghero, Italy

Territorio Archivo

This short animated film project was developed during the ERASMUS Intensive Program 2013 Informanimation to be a presentation of TERRITORIO ARCHIVO, a work in progress project aimed at creating an archive about the ecosystem and cultural relationships of six neighboring towns is Leon, Spain.

Name & Surname

Emanuel Serra

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Title

"Territorio Archivo"

Abstract

the project was designed during IP 2013 (inform animation course) to be a video presentation for TERRITORIO ARCHIVO that is a work in progress aimed at creating an archive of the ecosystem and cultural relationships of six neighboring towns is Leon, Spain.

K-words

Art, Memory, Culture, Territory, Archive

communicating
complexity

Alghero | 25, 26 October 2013

DIPARTIMENTO DI ARCHITETTURA DESIGN E URBANISTICA

UNIVERSITÀ DEGLI STUDI DI SASSARI

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**Visualising Sustainability.
The pop-up book as a sensorial
and experiential communication
tool of environmental problems**

This contribution presents the design of a series of small books, developed as the final thesis project in the BA communication design degree in Alghero.

The key idea behind the project is to combine the language of infographics with the technique of pop up books to convey information about sustainability and environmental protection. The challenge to transform the relationship between author and reader, offering a richer involvment and participation by the user has been pursued by combinaing the static appearance of the printed paper with the marvels of paper craft In this way the message becomes increasingly interactive, tactile and dynamic-and hopefully-more effective and memorable.

The project took the form of four books tackling distinct, although strongly interconnected-key topics: global warming, emissions, resources, forests, water, energy, food.


ACQUA
FORESTE


PRODOTTI
USO


PRODOTTI
USO


RISORSE
2030


2030


VIENE UTILIZZATA?


COSA SI PUÒ FARE


COSA SI PUÒ FARE

Nicola Vargiu, Matteo Ruggiu
AAA.MA_Communication Design,
Alghero, Italy

Towards Wind Power

Wind power is nowadays acknowledged as the most efficient and the cheaper technology for renewable energy. Diffidence and prejudice towards this kind of energy conversion technology are the main barriers against its full development. Nevertheless, the 'Aeolic option' may be able to revitalize the economy of a region like Sardinia, which is one of the last regions of Italy for installed wind power capacity. Towards the wind power is a short informative film developed within the 'Communication design for Sustainability' Master, commissioned by Giuseppe Frongia, Administrator and Technical Director of IAT srl.

Through the language of animation and motion graphics the film,wishes to dispel common myths while informing viewers about the potential benefits of "good wind power".

We decided to use a minimal and a synthetic style for information, designing out informative animated film to anyone interested about sustainable energy in Sardinia.

Name & Surname

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Affiliation

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Title

"Towards the wind power"
"Verso l'eolico"

K-words

Renewable energy, green energy, aeolic, wind, Sardinia

Abstract

Wind power is nowadays acknowledged as the most efficient and the cheaper technology for renewable energy.
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communicating complexity

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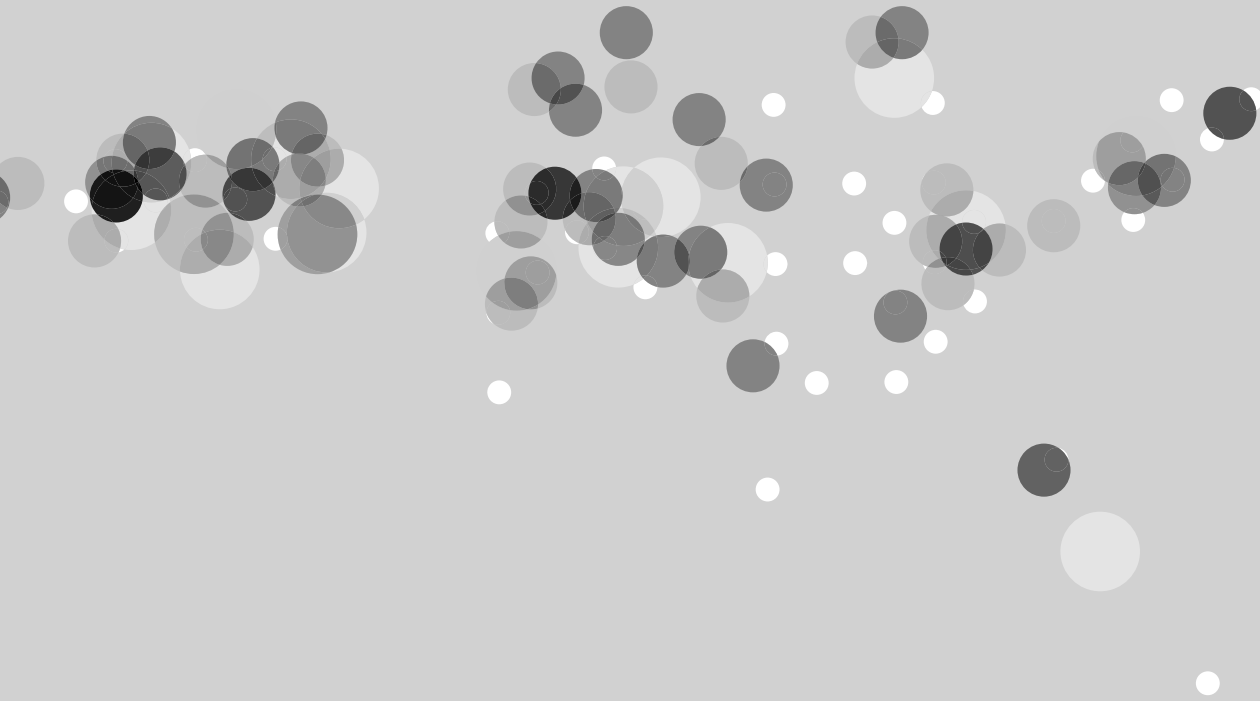
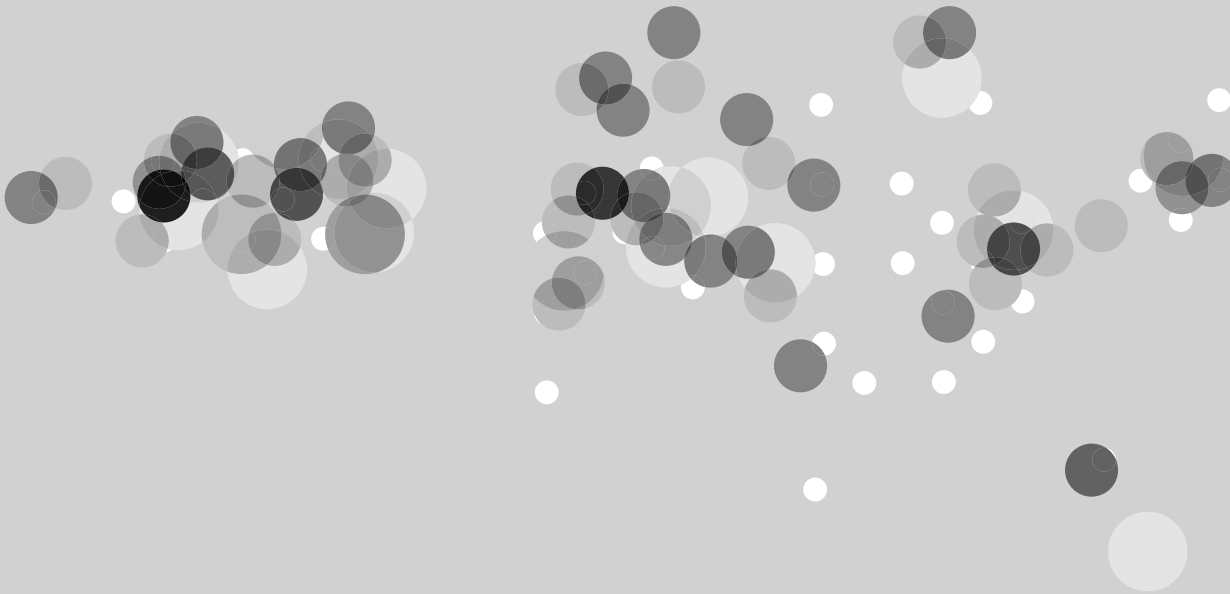


03. Posters



Francesca Cozzolino
École Nationale Supérieure d'Arts Décoratifs (ENSAD, Paris), Associated researcher, Centre anthropologie de l'écriture (École des Hautes Études en Sciences Sociales, EHESS, Paris).

A case study of Public Data Design. Thinking Design Information in Public Space

An ethnographic enquiry that was processed in the research laboratory of the industrial design school ENSCI-Les Ateliers de Paris allowed us to draw the genealogy of an information design project, and to follow the experimentation of a prototype that was built in the framework of the call for projects from the Paris City Council named "Intelligent Urban Equipment". This case study revealed two issues related to this project of information design in public space: the importance of thinking the situational setting of the object, and the necessity to think about the political issues raised by an object that is meant to help seeing the city.

Autreville was the name of the "disposiitf" (apparatus)[1]. It was conceived and was designed to work as a mediator between the inhabitants and the city. As he claimed to set up a physical relationship between residents and the digital city, the designer had envisaged a material encounter between inhabitants and the digital city. This encounter had to be facilitated by a design object.

During the experiment of the prototype (February-April 2012), it was observed that the use of this object was strongly conditioned by its surroundings and by its setting. We observed that the most recurrent users are children. They started to get familiar with the device and to discover its playful features. Whereas they only made it turn around and discovered its mobility during the first observation, then they got aware of its transparency and of the touch-screen aspect. Thus they experienced greeting each other for each side of the device, or they searched for touch-sensitive zones on the screen surface, waiting for a graphic element to appear. Most of the time, children took their parents to the device in order to play. The parents didn't have time to use it: they had to take care of their children.

This device is set in the kiosk of a public square in the centre of Paris; it becomes familiar and is used through derived ways, most of them are playful and different from the uses that the designer had planned in his schedule. Four types of possible actions were planned in the designer's schedule: to be informed, to be positioned, to discover and to be surprised. They had to correspond to either a practical use (to get information, through the interface "map" page), or to a play function (to discover, through the interface "window"[2]). However, all these situations do not happen naturally. Possible users need be stimulated, must be invited to use and to experiment the device. Some mediation appears necessary to make people become familiar to a device that seems to be changing depending on its surrounding context.

The data collected through the observation of situations where it was used show us that when it is set in a particular situation the device becomes emancipated from the original concept and becomes contextualized: the setting becomes more important than the affordance of the object.

Thus, this case study suggests that it is necessary to think differently about the importance of the shape and the uses of devices, but also about the social practices that adopt the device. Such reflexion

seems to become increasingly important when it deals with a device designed for urban space that has been elaborated in order to assist citizens and help them orientate in a complex public space.

This digital interface displays public information, and works as an editorial product that necessarily imposes a policy as regards its contents. As regards information about the city, being interested in touch screens that display written material is like being interested in the policy of the city's written productions: what should be displayed? Which services or guidelines may be detailed for passers-by? Which should be made salient, and why? What audience is targeted ? Who are the readers of such information? What average citizen should we imagine in the city?

At the time when the ideas of the digital town[3] and of the information town[4] have appeared as a statement in current policies and appear within many projects that promote the idea of a "smart city"[5]; the kind of information that is put forward is crucial because such biased public data will consequently shape the experience one can have of the city[6]. Data visualization and data design consequently become politically and citizenly significant.

1. Here we voluntarily refer to the notion of "device" as defined by Giorgio Agamben, who links Foucault's notion of "device" to objects belonging to modernity (mobile phone, television) and reflects on the way these devices can change our behaviour. See Agamben G. (2007), Qu'est-ce qu'un dispositif ?, Payot&Rivages, Paris. English version : Giorgio Agamben, What is an Apparatus? And Other Essays. Stanford: Stanford University Press, 2009:

2. The basic outlook of the interface is to show a "window sight", that creates the aspect of a transparent screen, above which graphic icons that are superimposed. These icons represent places that are geographically located in the surroundings of the device with precise arrows. In the "map" interface, we are facing the sight of a neighbourhood where all the places refered to in the interface can be seen.

3. See the review Urbanisme, « Air numérique », janvier-février 2011, n° 376, pp. 37-70.

4. Eveno E. (1997), «La ville informationnelle et ses avatars, ville numérique, prothétique, pandataïque», EMPAN, décembre 1997, pp. 20-26.

5. Many project conceptualize a "smart city", and see users as renewers of the city: it is the case of the City Wall in Helsinky, or of the "New York Talk Exchange" produced by the Sensible City Lab. See: Caroline de Franqueville, « Urbanisme 2.0 », in Urbanisme, Dossier « Aires numériques », n°376, janvier-février 2011, pp. 58-63.
Jacucci, G., Peltonen, P., Morrison, A., Salovaara, A.,Kurvinen, E., & Oulasvirta, A. (2010). Ubiquitous media for collocated interaction. In Willis, K. (Ed.), Shared Encounters. Springer Series on CSCW.
Also see: "It's a smart world " articles about smart cities in The Economist, 4 novembre, 2010.

6. Vedel T. (2000), « L'internet et les villes: trois approches de la citoyenneté », Hermès, n°26-27, p. 247-262.

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Stoppage Time

Introduction

> "After the game is before the game". (Sepp Herberger, German football player and manager).

A sentence that makes you think, not only for statisticians. Right after the final whistle they have to present data about the game. To the coaching team and the fans not only the scoring matters but also factors like percentage of ball possession, or how many times a goal has been tried to kick. With the help of this statistical data, a team can get ready for another game.

Football offers the oppotunity for countless statistics. Some are used by coaches to analyse its own team. Fans would like to know, which player has been the strongest on the field. Others use these statistics to bet on the best team. But how do these statistics work? What kind of techniques exist to collect such data? How can this collection of data be 'wrapped up' nicely? And what websites offer unique collections of the datasets?

Examples

"Whoscored.com" is an English website, which stands out by showing simple infographics. On the homepage, infographics can be easily found under the related button. Here one can find the current most active players and their game analysis. In some graphics presentations players are being compared accordingly to passes, running distance, goals and so on. There are analyses for single players as well, but also for whole teams. Many of the infographics share a similar structure: The players which are shown in the graphics, are pictured by a photograph in the background of the presentation. In the centre stands the infographic, plain and simple.

For the most parts the infographic consists of bar and pie charts. Sporadically heatmaps depict the players's track or their positions. The info graphics give the viewer relatively little data, but therefore there are more than six hundred of them. So fans of the English Premier League and of the Spanish division get their money's worth.

"Squawka.com", also a British website, wins with its simple and graphical visualisation. The website makes statistical data available for many European leagues and their teams. So single teams can be analysed, be compared with each other, or single players can be studied. The amount of data for each existing team and player is worth mentioning. There are infirmation about, from which position a goal has being shot, or how many 'chances' were created in a game. The statistics about the yellow card are particularly captivating . They show the reasons for which a player received a yellow card. Players once again are based on the battles they won, or on goals they scored. The already mentioned simple, graphical visualization plays to the entire amount of data. This illustrates the viewer in a really great way how many enormous and complex data sets can be presented with ease and overview. By clicking the top individual points a new graphic opens and displays the favoured records. So the

viewer doesn't look at a big pile of data but gets them served in small portions.

A similar visual design offers the German website "Bundesliga.de". This site studies as the name already suggests the German Premiership. In the foreground are the German Football League teams and their players, but there are also statistics about the last fifty years of the League. Who scored the most goals during this time? Which player has been the best joker? Or which goalkeeper contested the most games with zero goals in these past fifty years in the German Soccer League?

Like on Squawka , most of the illustrations here are of good quality. Bar graphs dominate the picture. The comparation gets very interesting when it comes down to comparing the teams. Here it shows in an impressive way how many games a team has won against the other team, how the goal balance looks like and how many points they got on average against this team. The whole thing is beautifully packaged in interactive infographics that show by clicking on individual factors, more and more desired information.

A very special collection is that of "ZEIT". This is a national German newspaper, that is published weekly. It provides on its website a nice collection of infographics. Among them are fascinating graphics about football. Those appear not only during important events like the World Cup or Champions League, but also for the general topic football. Among them are themes like the look of the footballs, which will be played in the championships? How does a throw-in succeed? Or how dangerous is this sport? By looking at this several graphics as a totality, they result in a brief overview about the topic football, easy to be understood even by a layman. Together these infographics led you, to grapple with this issue. A further topic is women's football. Is women's football comparable to men's football? Do they run the same distance? Is the game of men more dynamic? What about the success of women's football in the world? These infographics of "ZEIT" are in their design clearly distinguishable from the aforementioned statistic websites. "ZEIT" designed more inventive and rather devoted, than others, what doesn't mean, that they are less exciting or informative.

The strength of the "Gazzetta dello Sport" is to represent a traditional way of football analysis. It is a newspaper that only deals with sports and is dominated by tables and numbers. Nevertheless, here and there a few small but very beautiful infographics smuggle in between. So you can learn, for example, which part of his body the players are using the most to shoot the goal and how many goals they have already shot with each foot? What about their defensive work? Or how individual does player data for Euro 2012 look like? It should be made clear that the website of "Gazzetta dello Sport" is primarily reporting about sports.

Although this kind of reporting is common, it is possible to achieve the same content by using infographics, as the following example shows. "Marca" is a daily puplished newspaper in Spain with a fascinating website. Here, the viewers can click through over two hundred, mostly interactive infographics

and immerse themselves in it. There are always the current topics converted into graphics, trying to explain. In this case the design space seems to be almost limitless. From an interactive calendar to the current sporting events, where you can not only follow your favorite team, but also see at the same time the matchdays, as well as the games on the current day, or a list of the arenas in which the events take place, until the subject, how does the Africa Cup influenced the Spanish league. Marca offers a huge variety of well-developed, illustrated, and informative infographics.

But they also go one step further than the others. They give the possibility to the viewer, to communicate the informations interactiv, which he is intressed in. By clicking on the mapped buttons, the webside allows, to split informations into little pieces, and to decide on the quantity of knowledge and depression in a subject. This is a major advantage of the interactive infographic, you are free to decide on how deep thirst for knowledge is. tracking - How does that work?

So much data, but where do these come from? There are several ways to determine player data. In most cases, there are large tracking companies to do this analyzation, but there are several alternatives for the amateur athletes to collect their own performance data and evaluate them.

The techniques of these companies are different, but they all promise the same thing, to suppport the team reaching the top and be able to compete with international opponents on the highest level. According to “Technology Review” there are 25 different measurements only in one second. This measuring includes over 4.5 million positions points and more than 3000 ball contacts per game. To capture this volume, three cameras are needed, which are mounted under the stadium roof and record the entire field. In Addition, a fourth camera is recording the substitution area. Not only the players are analyzed, but also the ball and even the referee. This system must be installed and of course all the measurement points entered manually by hand before the game. A disadvantage of this type of tracking is, are duels between the players, because the program has often problems to restore automatically the measurement points again . This is why it always needs to be corrected in retrospect. Later, the data are then divided into different categories and sorted according to passes, ball contact, etc. by hand.

Another technique of tracking is the LPM (Local Position Measurement). In this case, the player is provided with a chest belt, containing a transponder. Another strap measures the fitness values of the player. The data is then sent to base stations, which are mounted round about the footballfield. In addition, cameras are mounted on the sideline rage. These are used to retrace several game situations, so that those can be analyzed and reconstructed after training. Thus, the data of the players and the ball will be collected and sent to a central computer, which calculate those accurate to a few centimeters. With this method, the trainers are able to obtain already during the game access to the data, and respond immediately to it.

The whole measuring can be converted into two - and three - dimensional graphics and also can be used for training analyzes. This system is used exclusively for training anaylsis, since it is prohibited for competition use.

The so called “beMeister” set contains a ball, a clock and an insole for the football boot. Both, the ball and the insole are provided with a sensor and transmit data such as sprinting, running distance or speed of the shot to the clock. The system, which was developed in Germany, also offers the possibility to evaluate its data on the computer. The clock can be connected by USB to the computer and retrieved and displayed in the Performance Center. BeMeister is therefore also suitable for youth and amateur athletes. For the first time it represents the conditions to compete with your teammates or the pros.
Infographics in Football - Why?

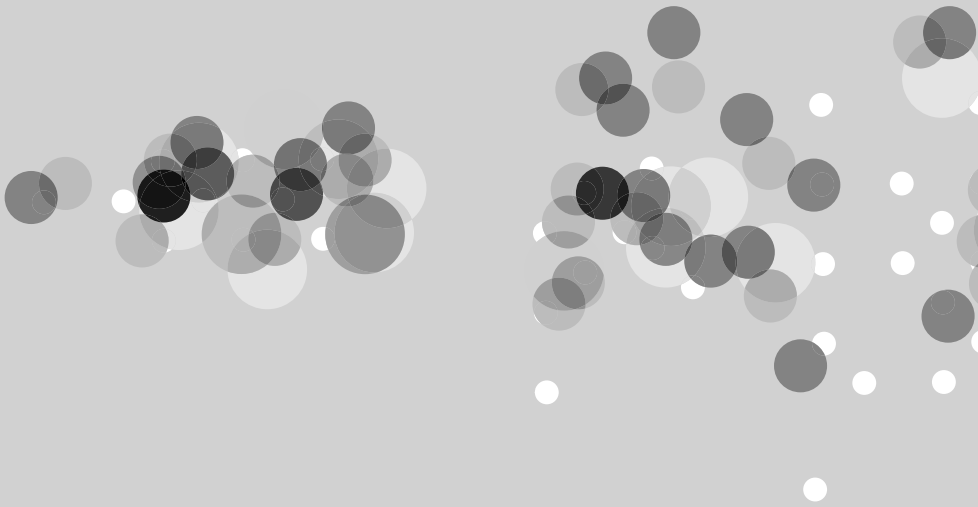
How can you explain a game situation to a person, without showing the original part of the game This seems to be the main question behind the whole data and infographics in football. Situations such as shots, duels and offsides are processed and formed into tables, consist of numbers, which are getting grouped together later. This might be the classic translation style for these situations. In addition to this classic style, there is also the infographic. These attempt to bring the translation closer to the original gameplay, or better said as exactly as possible. It is important to weight up the points of design and the focus on the content.

How important is a good survey for the single user? Or is the content, the focus of the infographic? The best case would be of course, if both points harmonize together. A good graphic can help the user to interpret the shown situation correctly and even more important, easily unterstand it. The textual description of the situation can lead to errors or omissions in the understanding. Properly applied information graphics are able to minimize these errors, while they depict what is described. As a result, the viewer has the opportunity to understand a game scene not only by his experience, but he gets a second level of interpretation through the design. An example would be a game situation in which a goal is created. In a textual description, as it is known from live scores, only your own understanding or imagination remains in the interpretation. A graphical representation of this situation leaves no space for misinterpretation, because it comes as close as possible to the original game scene. Therefore a creative solution would be beneficial because this type provides an easy - learn knowledge, that the viewer could use later. An impropriety in the interpretation of the game action would’nt support the original thought of information graphics.

The potential of this topic-with the increasing interactivity of interfaces used by smartphones and tablets, the possibilities to accommodate infographics about football-is tremendous. The interesting thing here is, that the users are able to decide for themselves how much information they want to recieve and how complex they can be. There is no need any more to work through the entire infographic,

instead it’s possible to obtain just the required piece of data which is essential for the user. Thus, the graphics of the newspaper “Marca” are a great example of how this approach might work. At the present time, in which everything has to be fast and news are only glanced through or viewed collectively, is this type of summarized information exactely what the user wants to see. For instance there are informations where everyone is interested in, like the player data about Gareth Bale, who changed for a record sum from Tottenham to Madrid this summer. Why was the transfer actually so expensive? Is it justified to pay such a huge amount for one single player? On the website of the newspaper “Marca”, is the fact how much Bale has developed during recent years at the Football Club “Spurs” implemented, by using an information graphic. And the figures speak for themselves. While having a look at this infographic, it’s possible to build a own opinion and acquire the desired knowledge. The benefits of a interactive infographic is, that it provides a minimum of space, for a data collection that would probably never even fit on a huge billboard. Further, this offers Informations, adjusted to the preferences of every single user, because of the possibility to choose their individual way through the graphic. In summary, you might say that these interactive graphics are offering a new dimension of data acquisition and processing.

For this specific kind of data visualization, football is in possession of a huge depository of information.



Keynote lectures

Santiago Ortiz
Moebio.com

Dynamic Visualization of Complex Systems

The interest in networks and complex systems visualization continues to grow, as new uses and tools emerge.

In this young field, however, there are many common problems and unsolved challenges, such as the fact that network visualizations tend to be good at displaying overall and abstract patterns, or helping identifying very local facts, but are poor building structured narratives. There exist two main visualization strategies: the global one, that often reproduces a shape known as hairball, in which relations are unreadable; and the local one, that gives rich information about specific relations yet loosing the context.
Complex Systems are often interesting because of the relations and communication flows between global and the locality.

I propose a series of advanced interactive techniques that connect the local view and the global view, and that build narratives out of subsets of nodes: partial linearities out of the non-linearity. My techniques, based on graph theory, topology and geometrical algorithms, include the use of interactive back and forth transitions between local and global views, simulations and stimulations that help to understand the spread of influences and information in a system, and the use of the “reenactment mode” in which dynamical and temporal behaviors are reproduced in a way new stories are created. By using these techniques the interactor has a complete experience of exploration and obtains insight from local, global and intermediate scales.

In my presentation I’ll be featuring several examples of interactive projects that visualize networks and complex systems such as genetic networks, conversations, books, system maps and even a television series.

Santiago Ortiz is an information visualization researcher and inventor. He uses his background in mathematics and complexity sciences to push the boundaries of information visualization and data based story telling.
He was born in Colombia and currently lives in Argentina. In 2005 he co-founded Bestiario (Barcelona), the first company in Europe devoted to information visualization.
Now he works as a freelancer and he specializes in visualizing conversations and knowledge.

Michael Stoll
Augsburg University of Applied Sciences, Germany

Infographics as Interfaces to level Complexity

Conveying complex facts through information graphics has become a huge trend over the last years. Todays range include datagraphics, explorations of all kind of objects and cartographic displays. It is time to take a closer look on how infographics work: intentions behind, the triggers and selectors, the visual display

and specific visual methods. Not to forget about the effects of infographics on us.

Prof. Michael Stoll graduated at the University of Applied Sciences in Konstanz with the thesis "A Classification of Infography". After a freelance career as designer and infographic artist for German newspapers, Michael started teaching infography in various Schools in Germany. Since 2005, he has taught media theory and infography at the Augsburg University of Applied Sciences, where he is currently Head of Information Design in the Department of Design. He also teaches in the Universities of Darmstadt and Neuchatel. Thanks to his research work Michael Stoll is often invited to participate to international conferences, lecture in partner universities, attend events such as the Pamplona Malofiej infographics competition, where he was jury president in 2009.
Michael Stoll serves as the Educational Director (Intl. Affairs) for the SND Society for News Design (USA), is member of the International Institute for Information Design IIID (Vienna, Austria) and is part of the editorial board of its Information Design Journal.
A long time collector of historic infographics Michael Stoll owns one of biggest collections on the topic, the highlights of which have become the travelling exhibition "History of Infographics".

Paul Wells
Animation Academy - University of Loughborough, UK

Between Documentary and the Deep Blue Sea: The Case of Industrial Animation

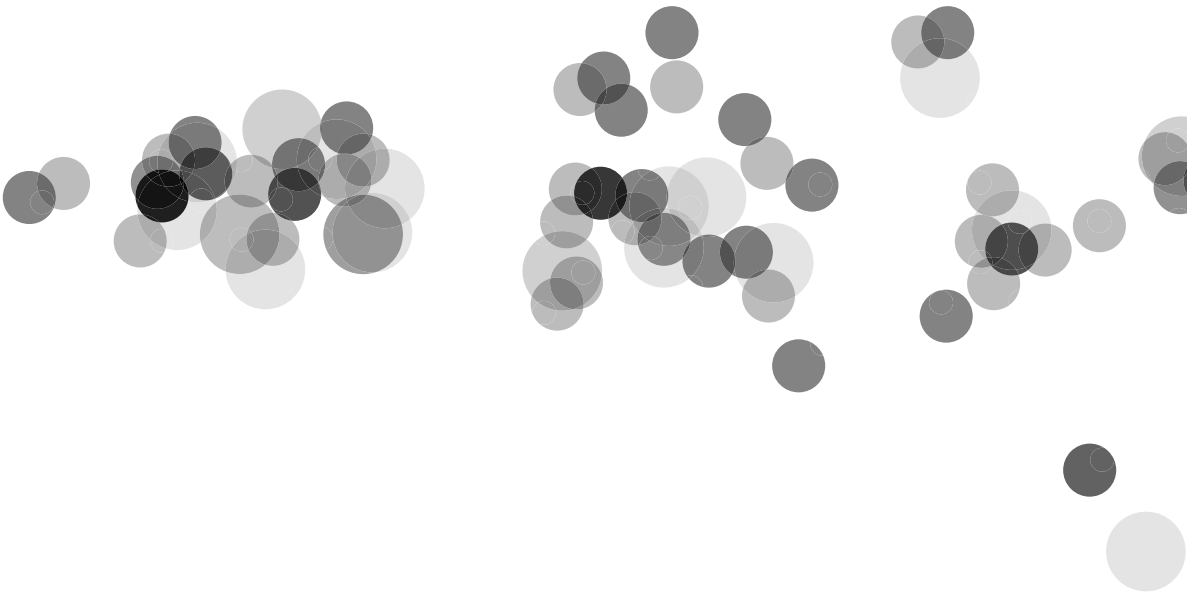
Animation has highly specific techniques in communicating complexity. Looking specifically at the case of animated industrial films, this discussion will address how information and instruction is constructed using the particular vocabulary available in animation. As well as referring to historical examples by Len Lye, Halas & Batchelor, UPA and George Dunning, engaging with the methods by which ideas, aesthetics and techniques are brought together to illustrate and elaborate educational and training concepts, I will also draw upon my own experience in writing for 'industrial animation', addressing some of the approaches used in the forthcoming film, The Oil Kid. It is hoped that the talk will refine some thoughts about theories of practice and practices of theory, and how these come together most effectively in animated film.

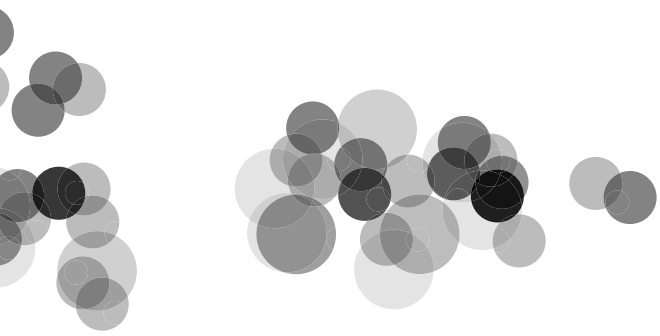
Paul Wells is Director of the Animation Academy, a University of Loughborough research group.
An internationally established scholar in the areas of Animation and Film Studies, Paul Wells is the author of many seminal books in animation theory, among which Understanding Animation, and Re-Imagining Animation.
Besides his long-term teaching experience in the area of animation, Paul also has vast professional experience in projects for theatre, radio, television and film.
He recently authored a series of documentaries on John Coates, Geoff Dunbar, and John Halas, and was a consultant for the BBC's Animation Nation program.
Paul is Chair of the Association of British Animation Collections (ABAC), a collaborative initiative with the BFI, BAFTA and the National Media Museum.

Guest speaker

Dave Daniels
Designer and Animator, London

David Daniels was born in Norwich, England. He studied graphic design at Canterbury and Central School of Art and Design. David has worked in Paris and London in areas ranging from print to stage set design to directing television documentaries and commercials. His films include Colour Keys produced by TANDEM, the critically acclaimed documentary Greetings from Beirut, produced for BBC2 and the multi-award-winning series of short films for Johnny Walker, Personal Journeys.
His recent work included a William Hill campaign with the creative team of Ben Walker and Matt Gooden, the same creative team he collaborated with on his award winning Honda Campaign produced by BMB, and a worldwide Nokia campaign produced by Wieden+Kennedy. His commercial work has been just as varied and include his D&AD winning campaign for Honda produced by Wieden+Kennedy,
his D&AD winning VH1 Television idents and recent campaigns for Whole Grain and Learn Direct.
Concert work includes designing the sets, stage and graphics for the Rolling Stones Urban Jungle Tour, The Wall Concert, in Berlin for Roger Waters, the stage, sets and graphics for both the Nelson Mandela Birthday Concert and Nelson Mandela Tribute Concert to celebrate his release and most recently, the animated graphics for the Led Zeppelin Reunion Concert at the O2 Arena in London.
He has been Visiting Lecturer in several Universities: London College of Printing, Norwich School of Art, Croydon College of Art, and has given lectures at Chelsea College of Art, Kingston College of Art and Ravensbourne College of Art, and at the Alghero School of Architecture and Design, Italy.





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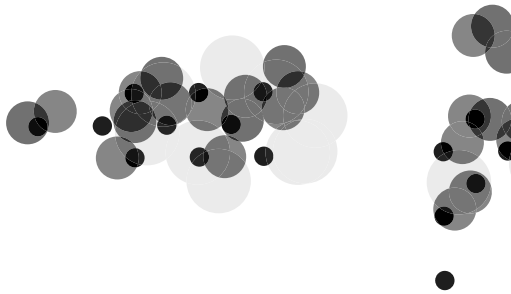

2CO COmmunicating COmplexity is the international design conference aiming at exploring languages, approaches and technologies to respond to the emerging need for making complex information accessible through design.
2CO's first edition (25-26 October 2013, Alghero, Italy) has gathered an international community of professionals and scholars active in this area to share experiences, points of views and methodologies, focusing on three main areas of interest: informative-animation, interactive data visualization, info-graphics.

This volume collects their contributions in the three conference categories: full papers, posters and 'junior track' special session.

Generated by a consortium of European Universities that in 2011 started collaborating on the InformAnimation project, and by fellow Universities active in visual design teaching and research, **COmmunicating COmplexity** aims at becoming an international reference point for research and education in the area off communicating complexity through new media.