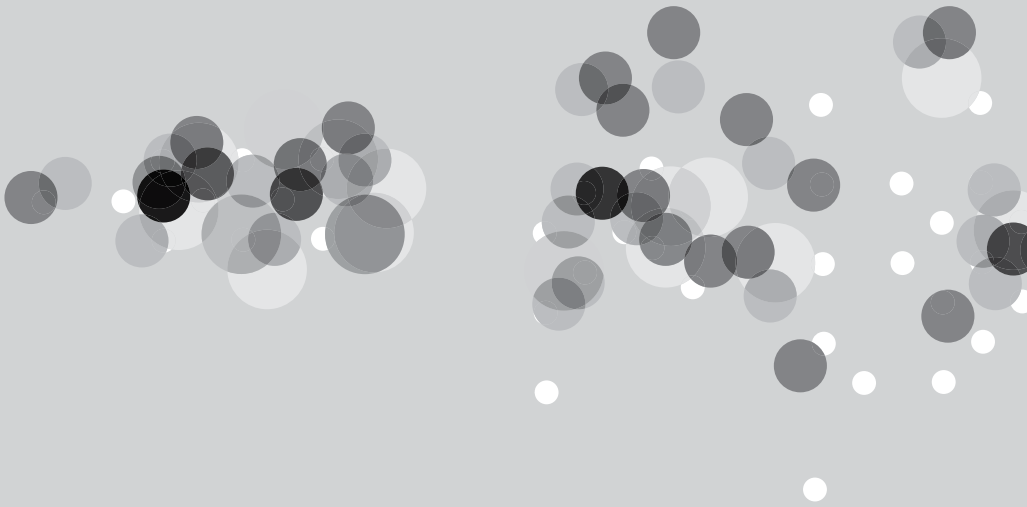
01. Full papers

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].

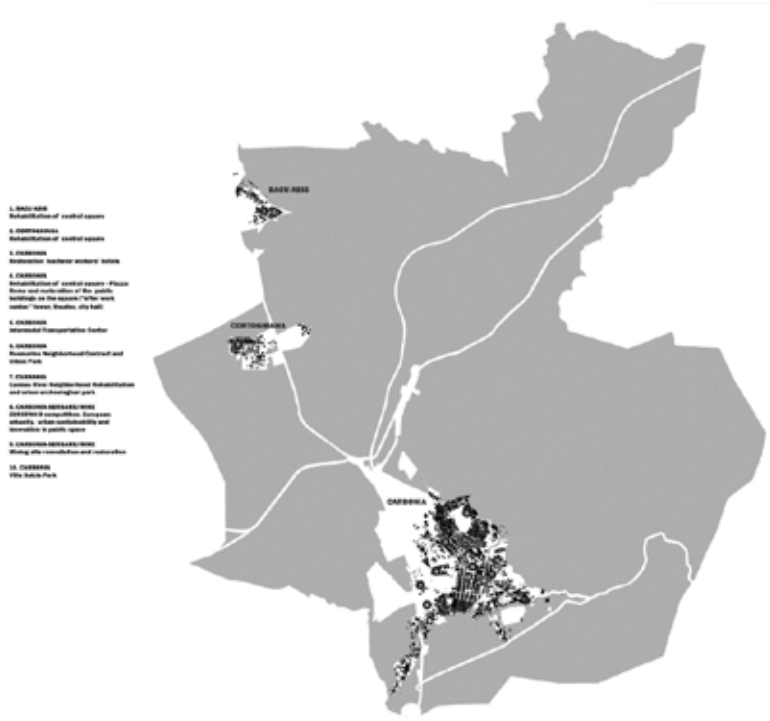

Fig. 4. The Carbonia district and protected landscape areas (A. Sanna, G. Peghin)

[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.

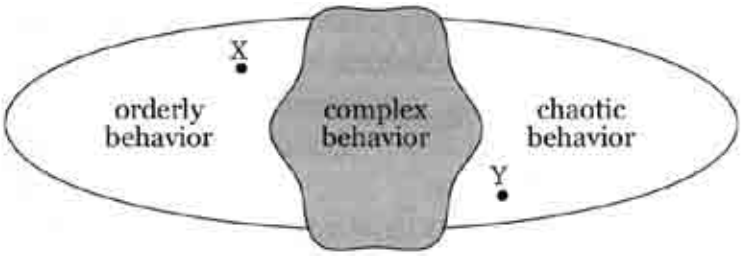


Fig. 1. Map of the states of a complex system according to the results of the study of Boolean networks (Kauffman).

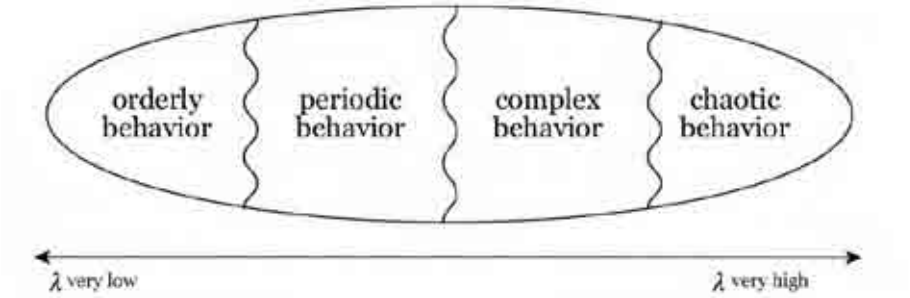


Fig. 2. Map of the states of a cellular automaton (Langton).

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:

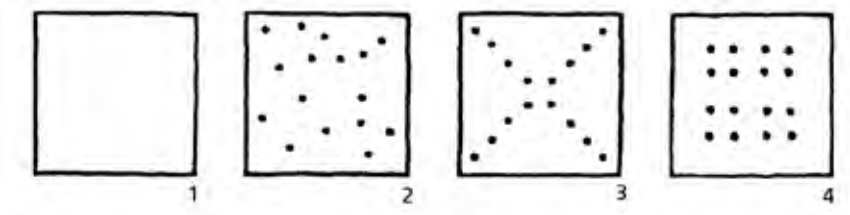


Fig. 3. Chaos-Order (Frutiger).

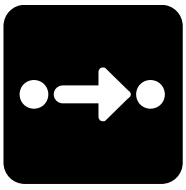
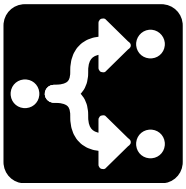
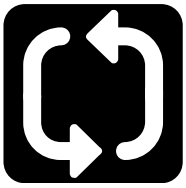
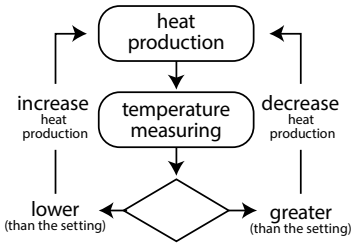
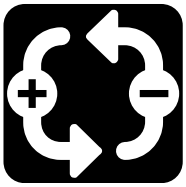
It is interesting to note that Frutiger's book does not deal with information design or the representation of complexity, but rather with the graphic history of signs. Frutiger deems it important to tell the story from the beginning, from the inherent human need to always assign a meaning to what one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

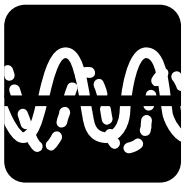
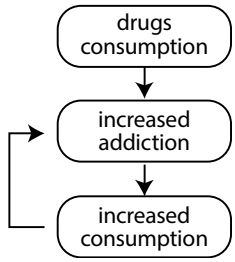
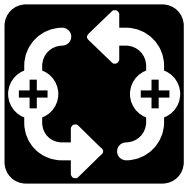
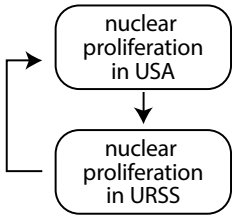
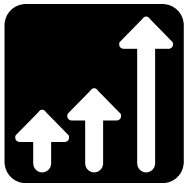
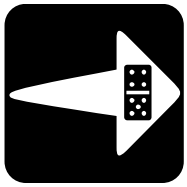
From this point of view, signs belong to the inherent human need to represent and communicate the meaning of things. Just as the concepts of complexity have advanced our understanding of reality by moving the border of what is understandable at the expense of the territory of chaos, the pictograms of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

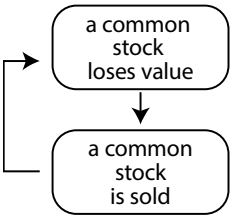
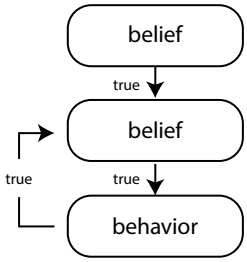
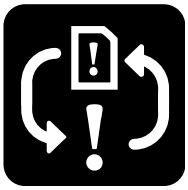
[3] «Für einen Menschen des 20. Jahrhunderts ist es schwierig, sich eine Leere, ein Chaos vorzustellen, denn er hat gelernt, daß im unendlich Kleinen wie auch im unendlich Großen eine Ordnung zu herrschen scheint. Die Tatsache des Begreifens, daß es um und in uns keine Zufälle gibt, sondern, daß die 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 → B	
Idem	A component affects another component, which affects a third component (and so on). Example: a star, a planet and a satellite.	A → B → C	
Linear interaction (Hub)	A component affects a second and a third component. Example: a transmitter and two receivers	A → B ↘ C	
Feedback	A component affects another component. In turn, the second component affects the first.	A ↖↘ 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.

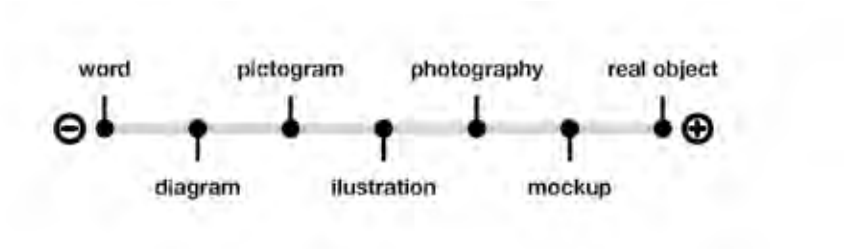

Fig. 1. Representation levels of iconicity.

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.

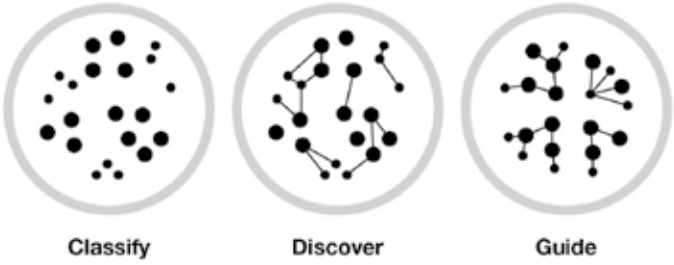

Fig. 2. Shows the tree phases in which is divided the process of study.

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?

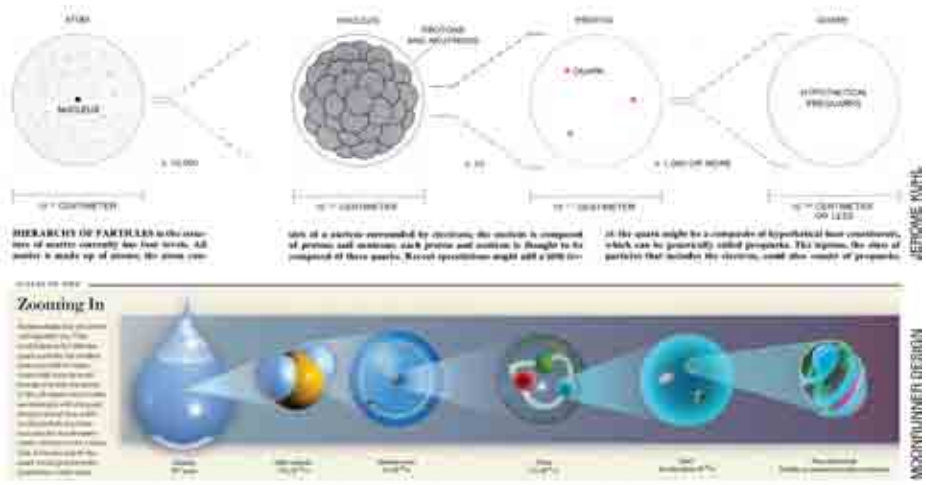

Fig. 1. Top: schematic representation of particle hierarchy (*Scientific American*, Apr 1983). Bottom: arguably a more engaging stylistic approach to the same topic (*Scientific American*, Nov 2012).

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)

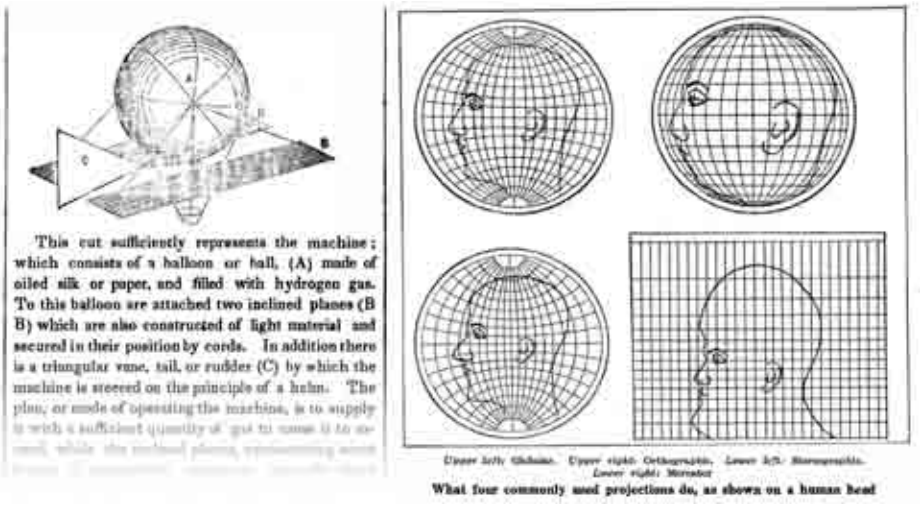

Fig. 2. Early graphics from *Scientific American*. Left: technical illustration in the first issue, Aug 28, 1845. Right: descriptive, clear & playful diagram from Dec, 1921 (artists unknown)

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)

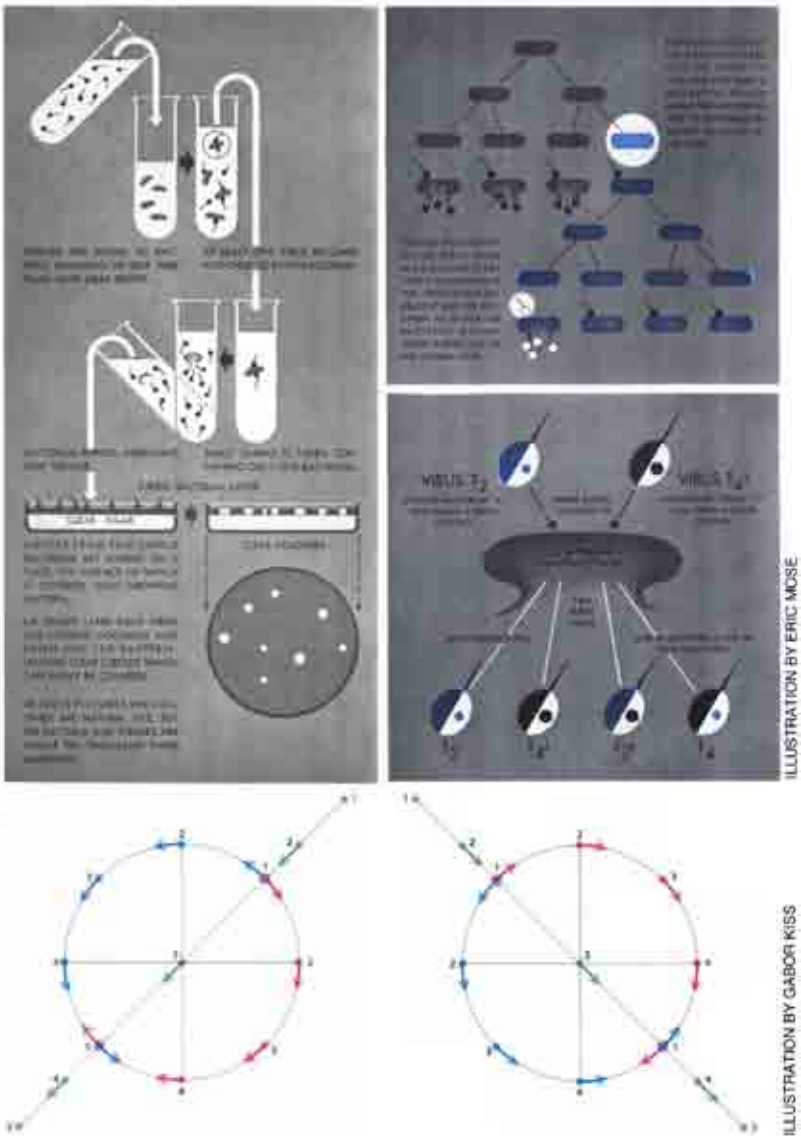

Fig. 3. Graphics from *Scientific American*. Top: authoritative & accessible, Nov 1948. Bottom: elegant but challenging, Dec 1988

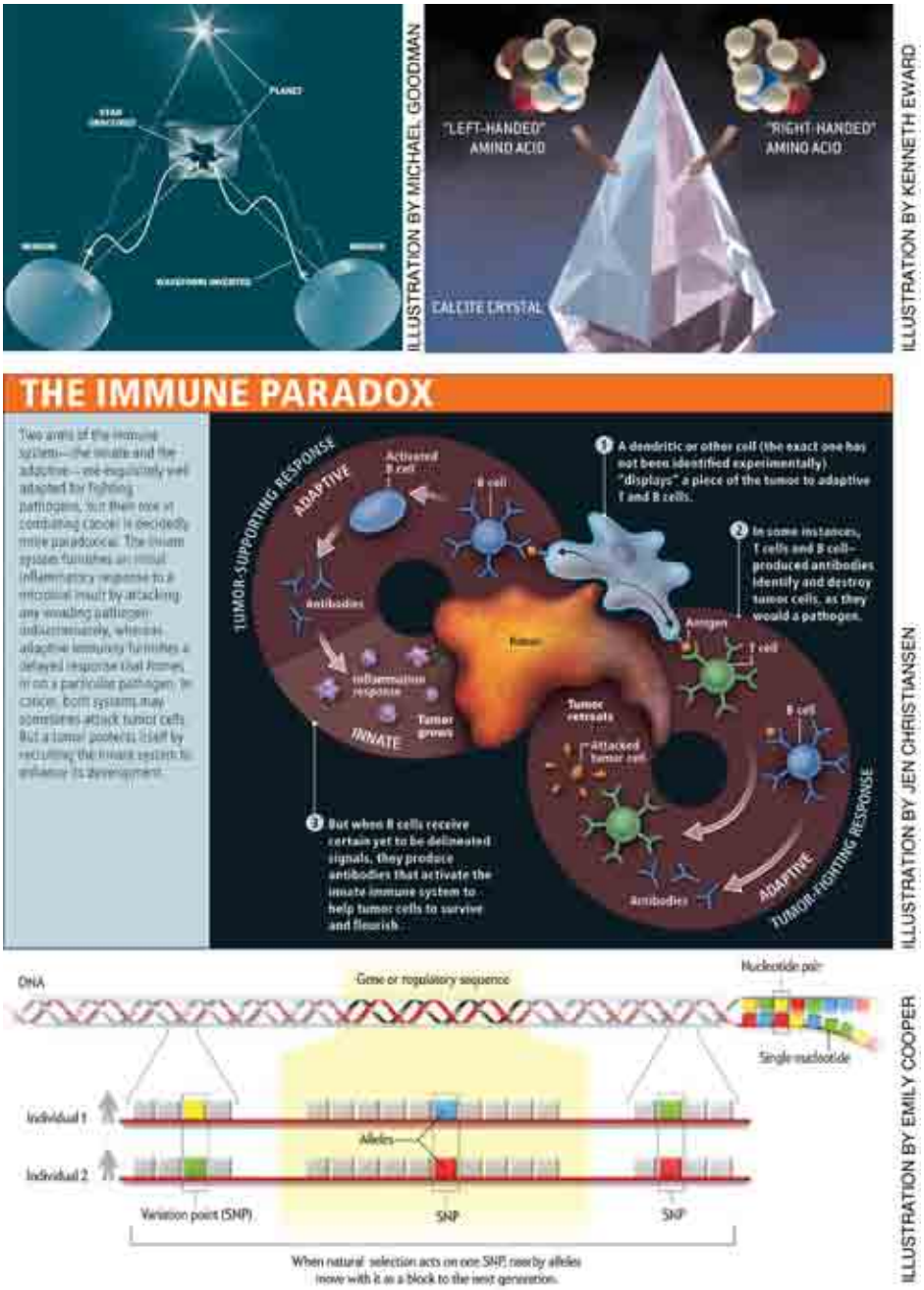

Fig. 4. Graphics from *Scientific American*. Top left: descriptive & clear, Apr 1996. Top right: visually rich but low on content, Apr 2001. Middle: lots of content but over-styled, Jul 2007. Bottom: authoritative & accessible, Oct 2010

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).

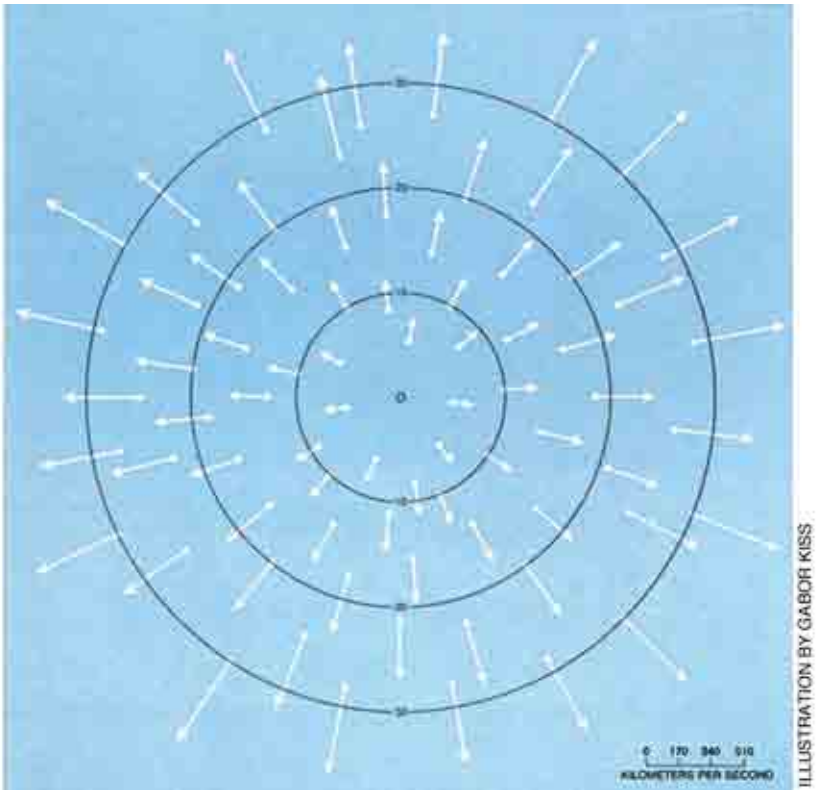

Fig. 5. Cosmic expansion, in which the observer seems to be at the center of the universe, with other galaxies zooming away (arrow length = velocity) *Scientific American*, Mar 1976

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.

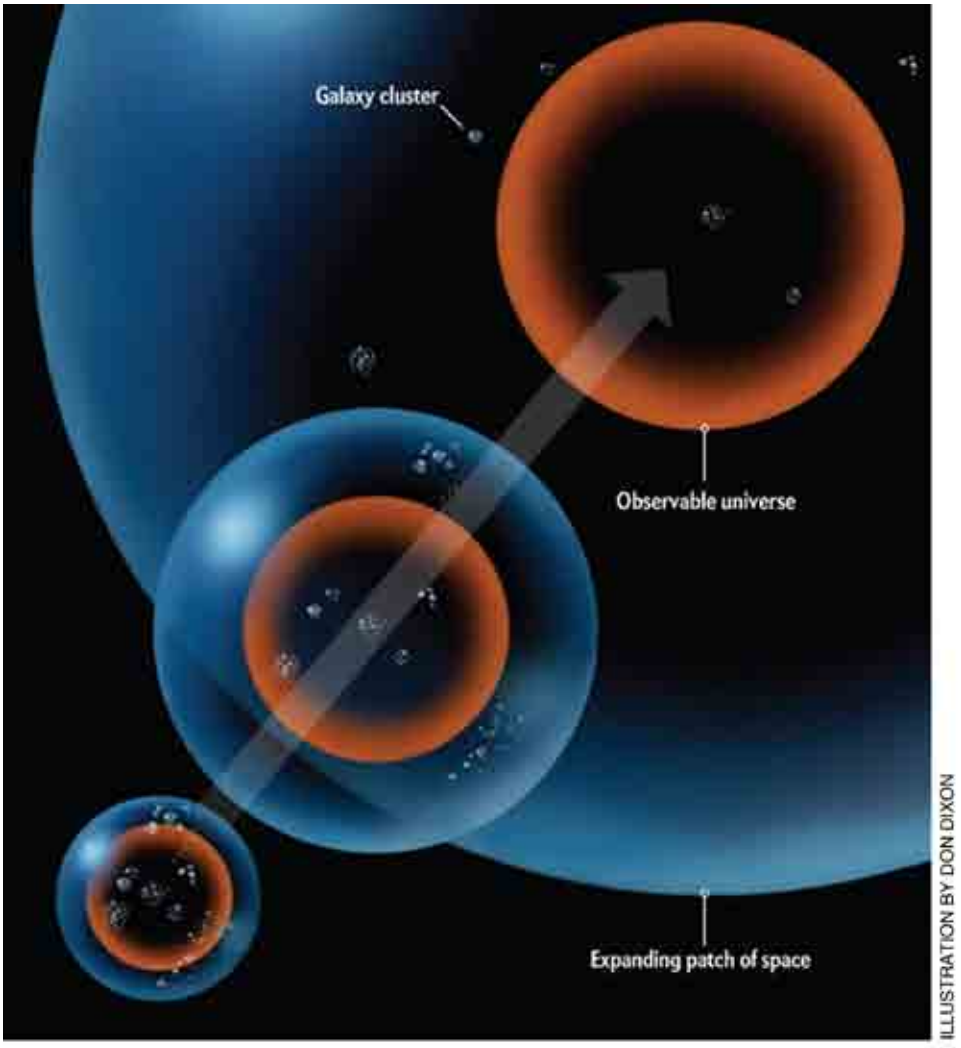

Fig. 6. As cosmic expansion accelerates, fewer galaxy clusters are observable from any given point. *Scientific American*, Jan 2006

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)

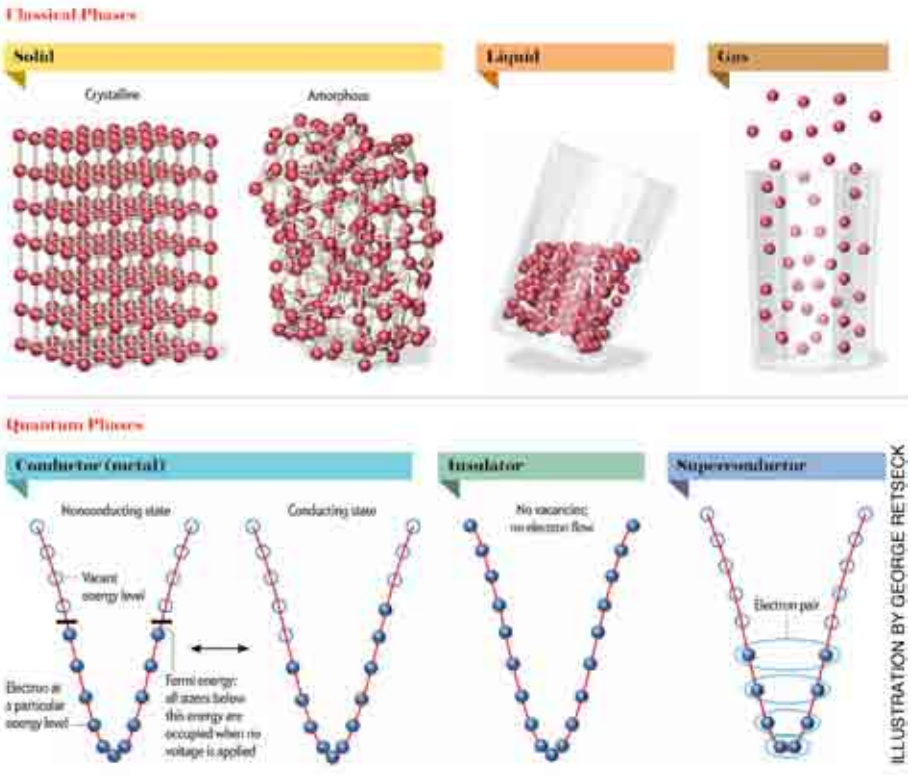

Fig. 7. Detail from a larger graphic about quantum phases. *Scientific American*. Jan 2013

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)

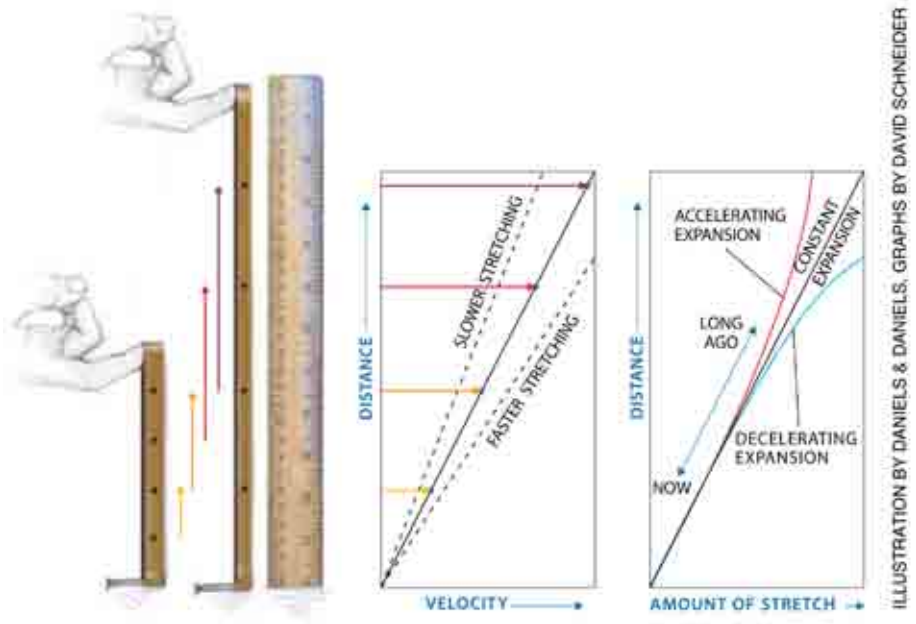

Fig. 8. "Rubber band experiment shows the linear relation between recession velocity and distance. Here two snapshots are shown of a rubber band pulled upward at a certain rate. The velocity of different points marked on the band is given by the length of the colored arrows..." from *Scientific American*.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

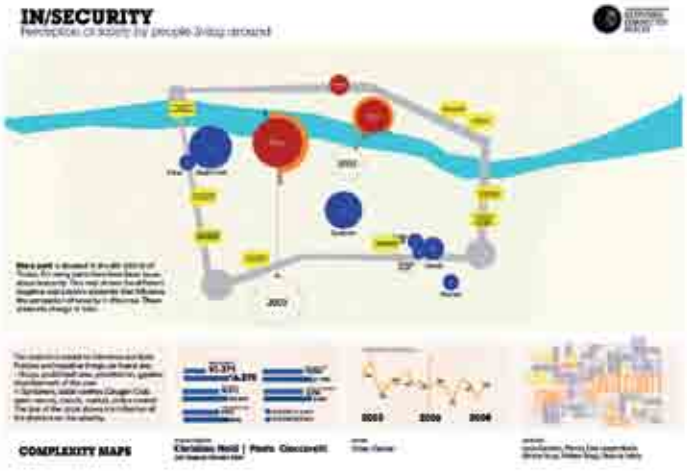


Fig. 1 The abstract conceived and written by the designers Christian Nold, Jim Sergers e Paolo Ciuccarelli, required representing people's perception regarding a certain location. The target site, according to the proposal, was the Stura Park, one of the biggest centres of heroine distribution in Central 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.

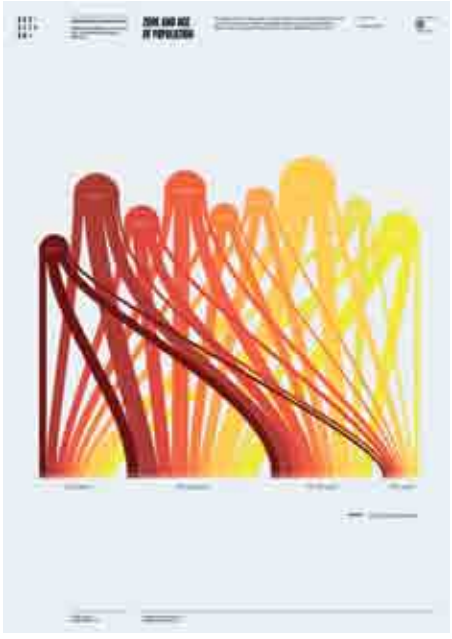
For the know-how of moving between the expressiveness of the interface and the precision of the information, on narrating interesting facts with sensitivity, by means of an unedited project style, CityMurmur Madrid is frequently considered a reference opposite to models of data visualization, not only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

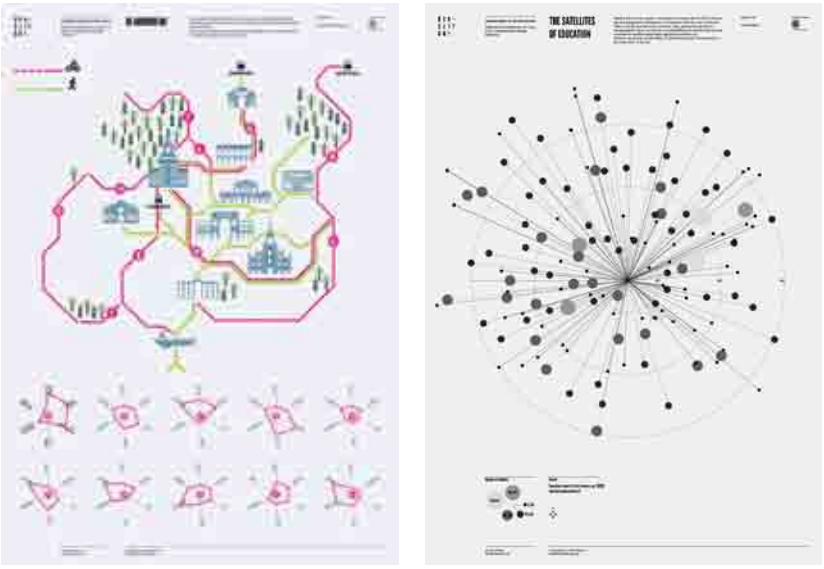


Fig. 3. A particular feature in the students' work is the fact that very often the geographic or symbolic reference to the City of Milan was left out, in favour of an objective representation of the data on a level completely separated from any other physical or geographical reference. Where the identification 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.

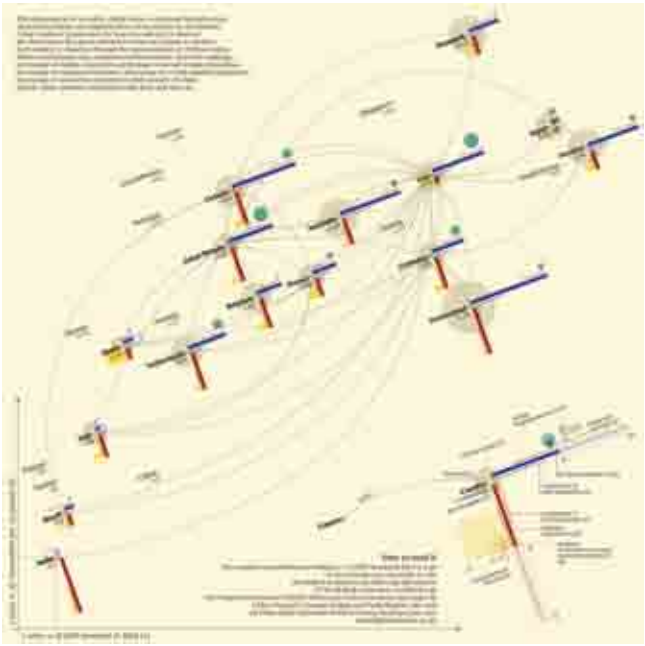


Fig. 5. Heterogeneity of the subject matters led the designer to look for a graphic solution of interdisciplinary inspiration. The key of solving the problem of representation, as Giorgia Lupi tells us in an interview, arrived at surprise, during the visit of the exhibition *Inventing Abstraction* at 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 smartphone or a tablet to increase the experience of the product in the dimension *outdoor of research* in real-time.

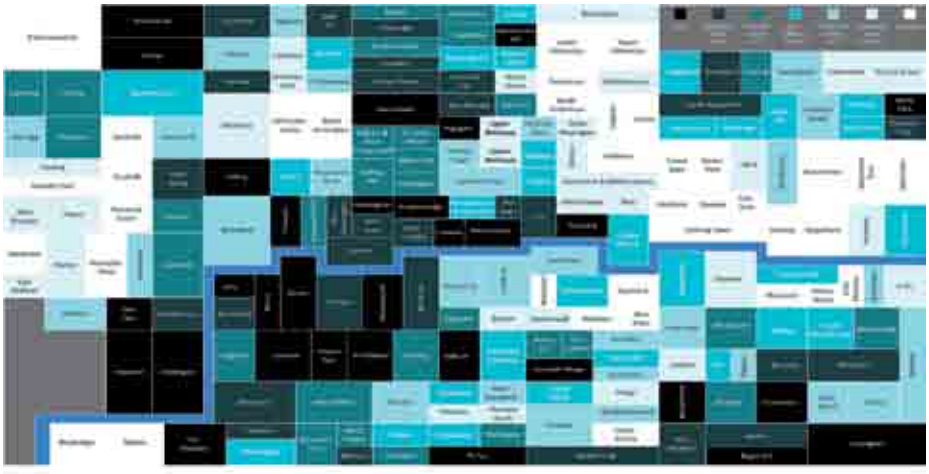

Fig. 6. Every quarter of London has a clickable entity equipped with a proper identity card that summarizes synthetically everything that may influence the choice of buying or renting a flat. The factors taken into consideration are not those dictated by the situation of the real estate markets, by prices 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.

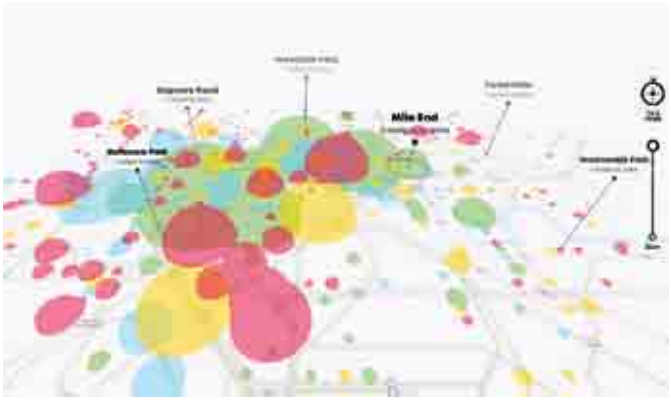

Fig. 7. The Mudlark Production Company planned a platform for virtual games, which can be practised in one's own territory : a special colour is assigned to every player or group of participants through which it is possible to monitor the single movements inside the map. This kind of a map is an authentic 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.

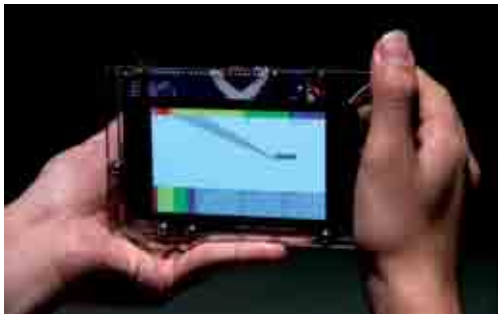

Fig. 8. Assembling a smartphone, a GPS and a hardware tab Arduino, generated a system that represents data collected by means of an extremely minimal interface. Although the system is rather intuitive, the whole apparatus still appears too much connected with languages of programming and with insufficient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

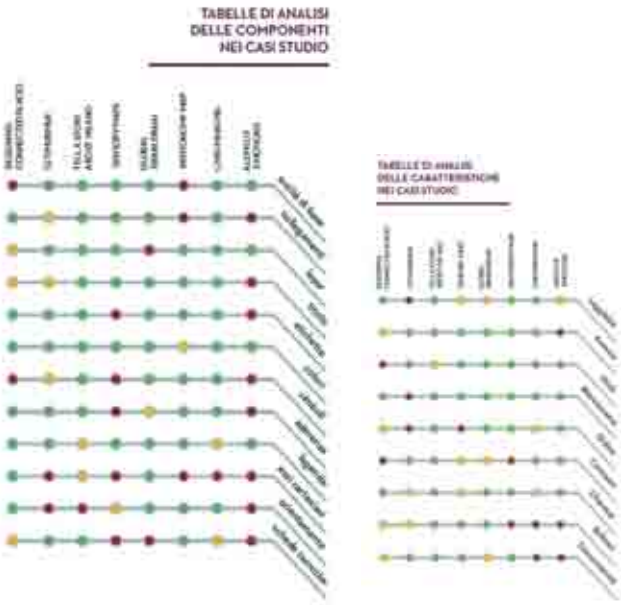

Fig. 9. The schemes represent the fundamental components and characteristics of the map and the respective levels obtained in the analysed case studies.

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.

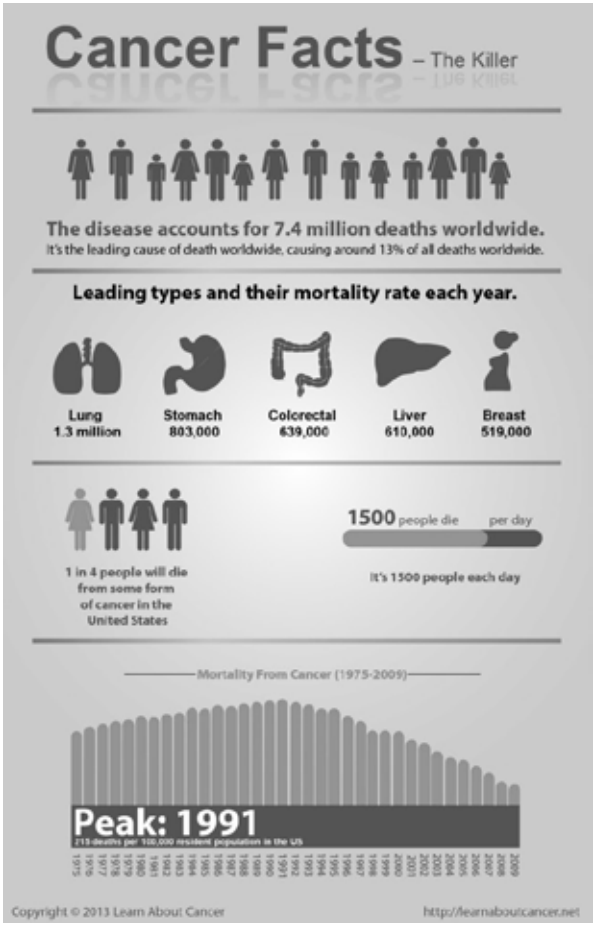

Fig. 1. 'Cancer Facts'. Learn About Cancer. http://learnaboutcancer.net/

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.

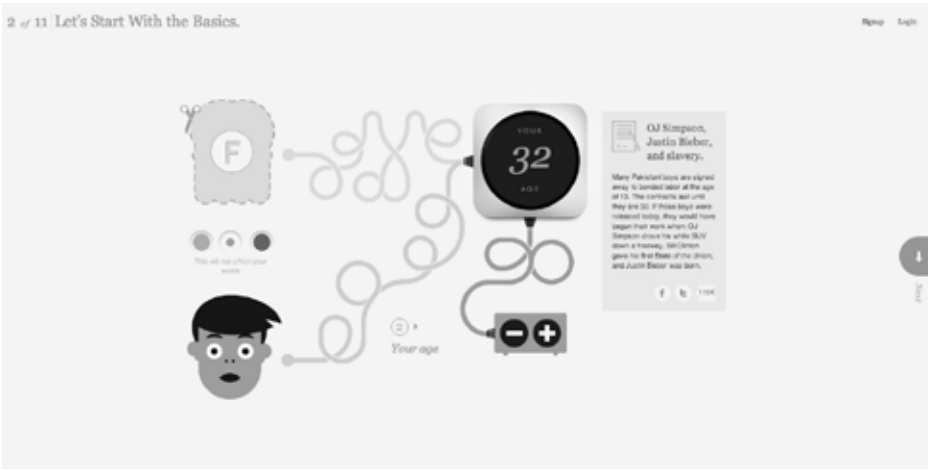

Fig. 2. 'How Many Slavers Work for You?'. Slavery Footprint. http://slaveryfootprint.org/

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.

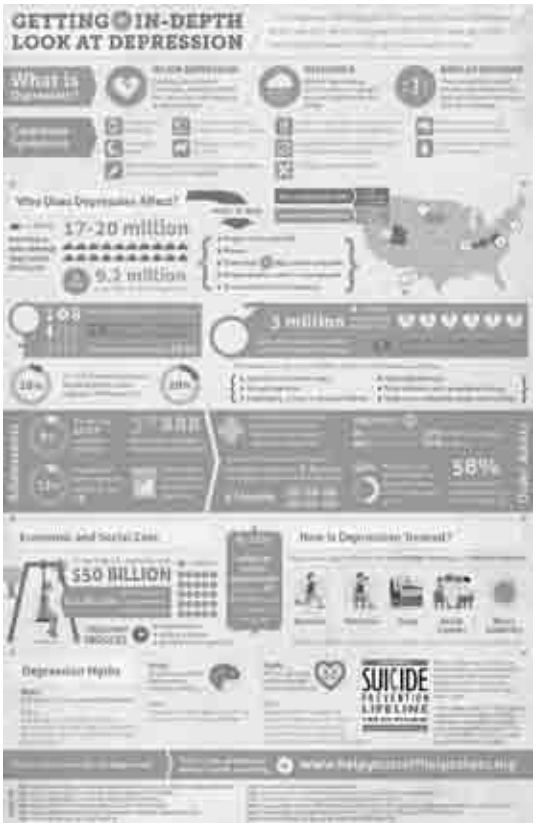

Fig. 3. 'Getting an In-Depth Look at Depression'. Help Yourself Help Others. http://helpyourselfhelpothers.org/

[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.

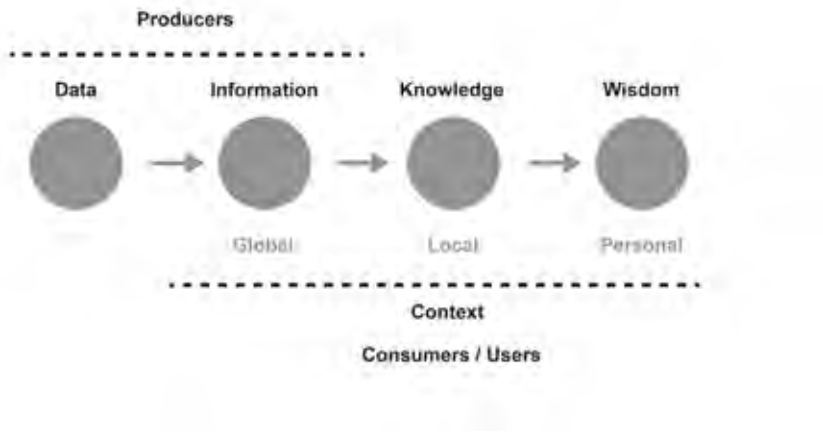

Fig. 1. Knowledge Spectrum. Adapted from Nathan Shedroff [3].

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).

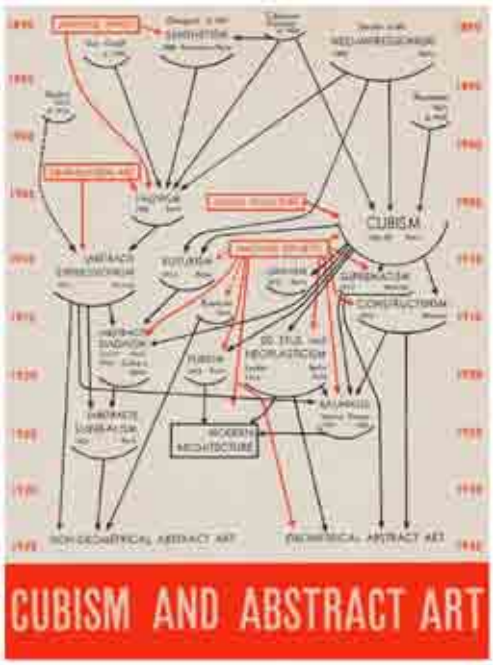

Fig. 1. Alfred H Barr Jr. c.1936. '*Cubism and Abstract Art*'

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.

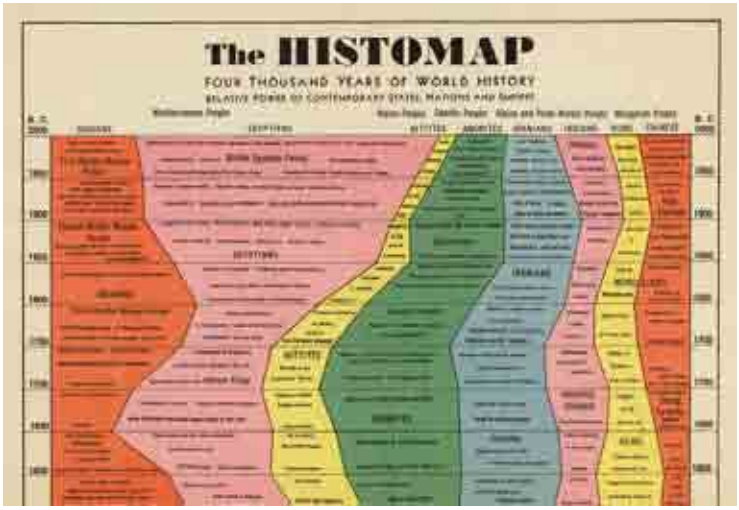

Fig. 2. John B. Sparks. 1931. '*The Histomap*'

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.

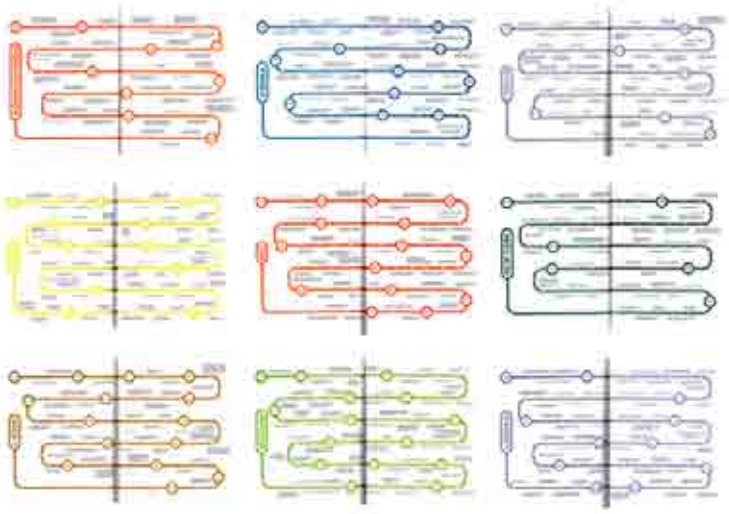

Fig. 3. Tate. 2001. '*Century City Timelines*'

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?

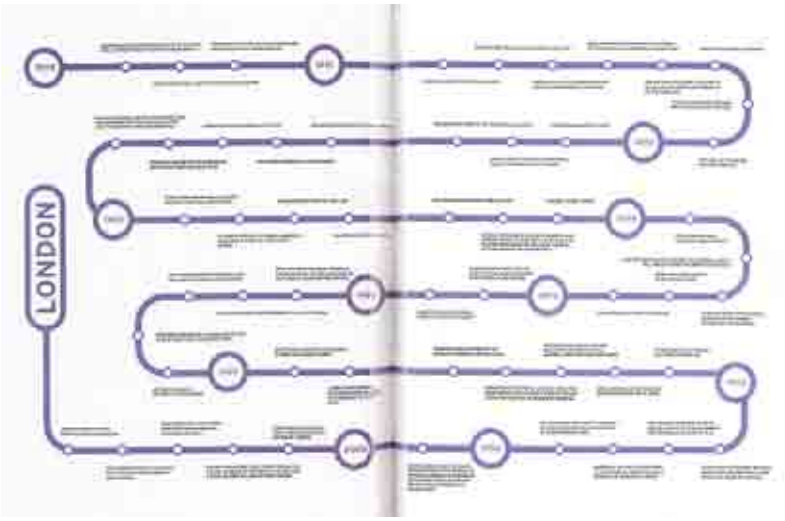

Fig. 4. Tate. 2001. '*Century City London Timeline'*

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.

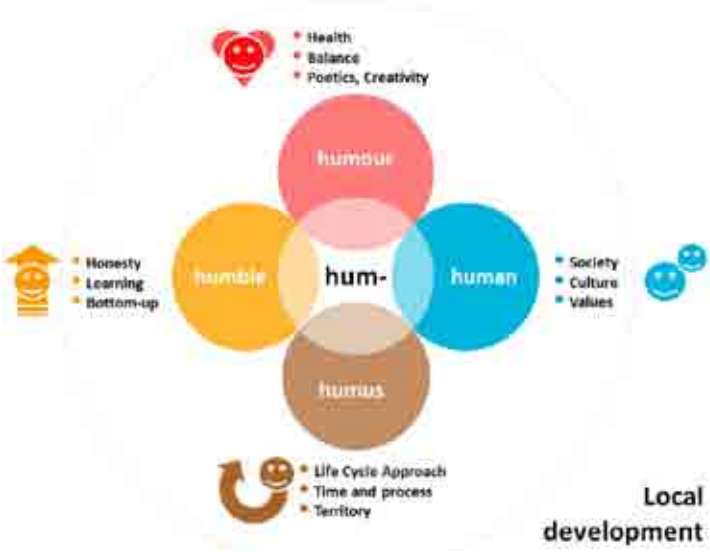

Fig. 2. First "4hum-" conceptual draft. Own elaboration.

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.

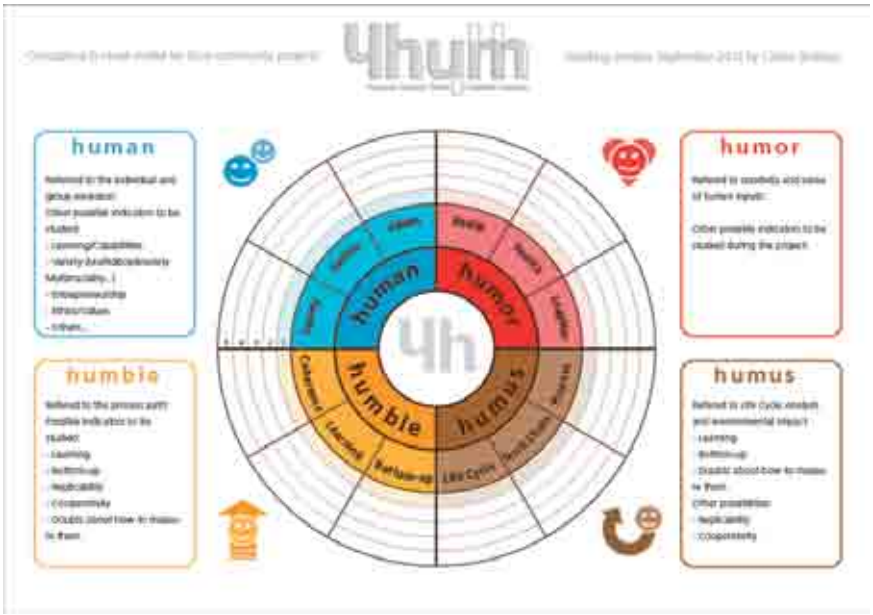

Fig. 8. Worksheets for participative discussion in order to refine the model. Carlos Jiménez.

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

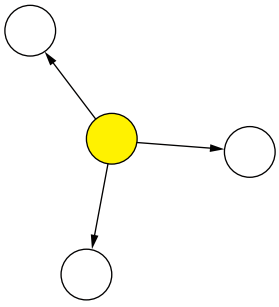

Fig. 1. A small directed graph representing a network.

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.

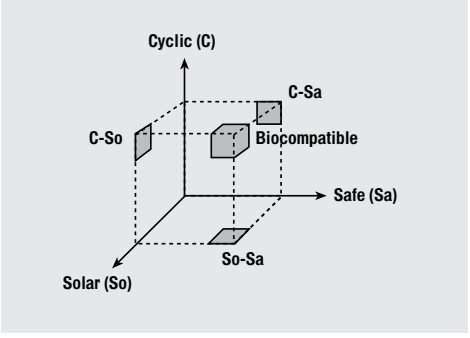

Fig. 2. The 'bio-thinking' Bio-design solution space (Datschefski, 1999)

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

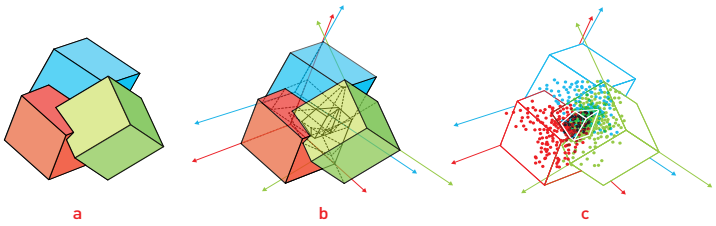

Fig. 3. Transdimensional solution space model: different disciplinary values are involved (a), identifying a common space (b); the more complex is the space, the more precise is the solution level of definition (c)

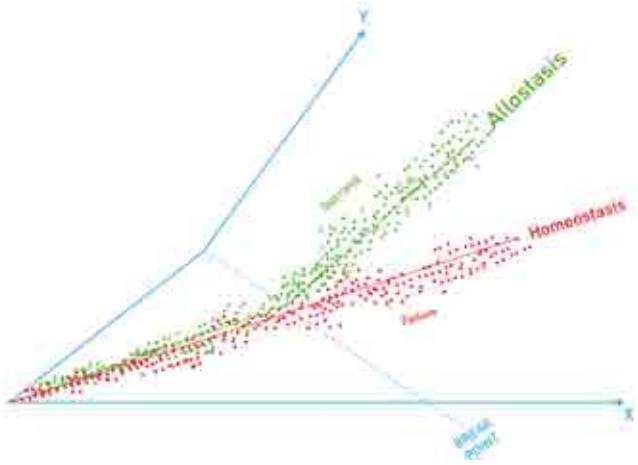

Fig. 4. The allostatic model: stability through change

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.

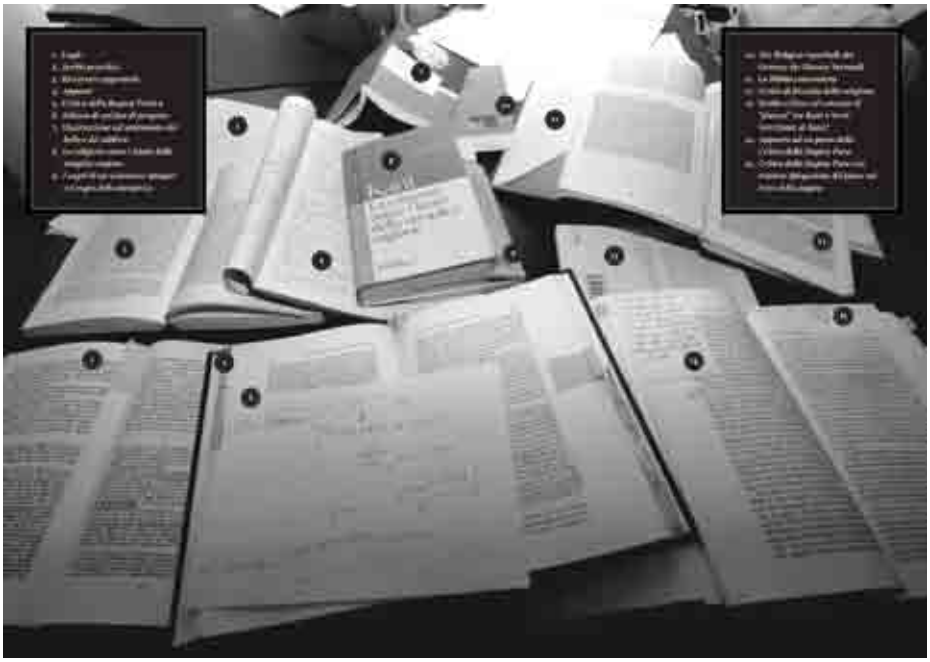

Fig. 1. A typical scenario for the researchers: a complex and intricate network of books, sketches and notes

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]

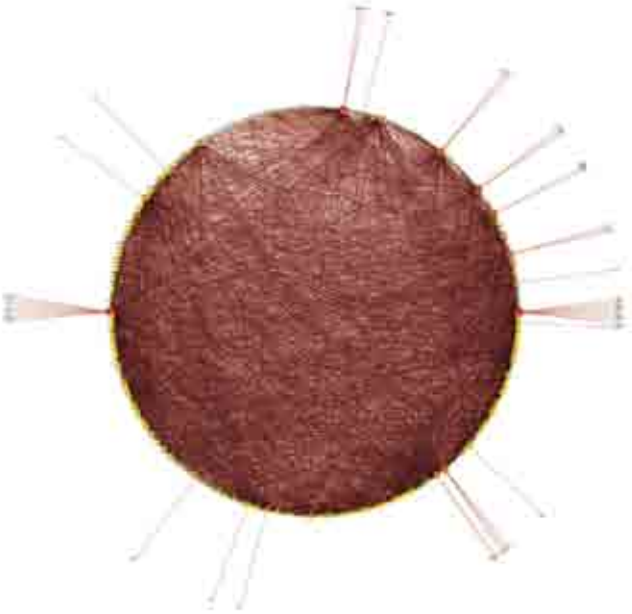

Fig. 3. A graph network showing "unicum"

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.

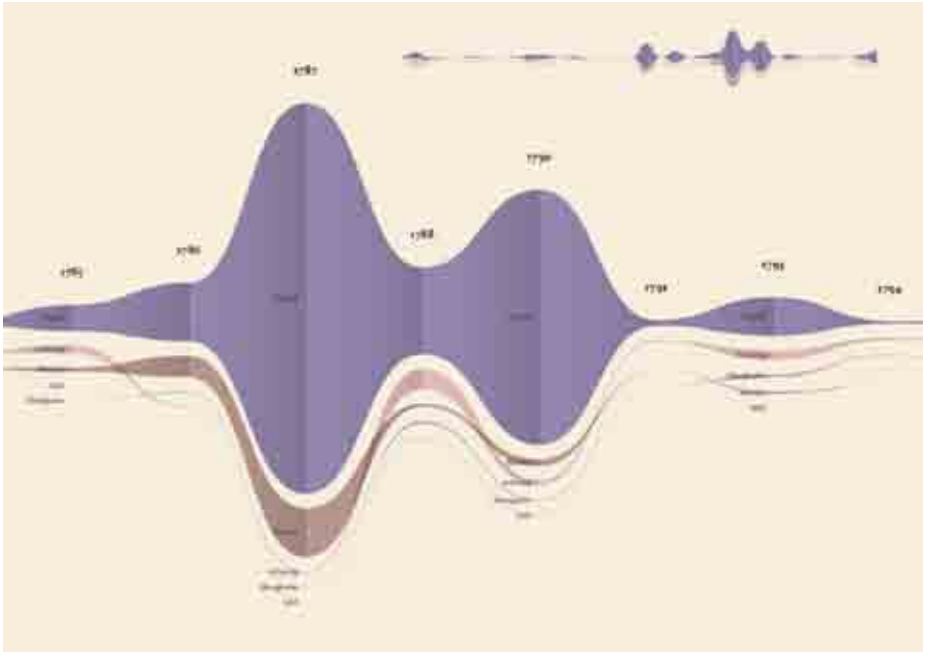

Fig. 4. Streamgraph of *Aberglaube, Absolut, Achtung, Adel, Begriff* from 1785 to 1794

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).

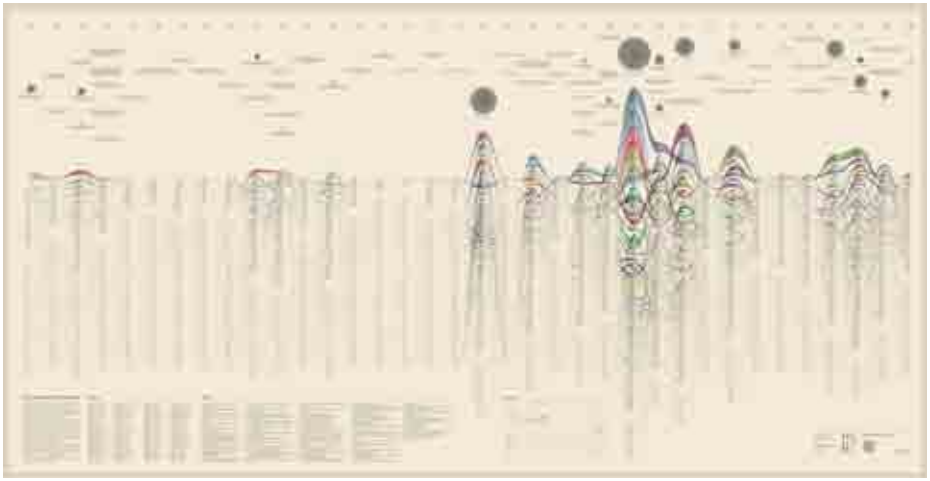

Fig. 5. The *Atlas of Kant's Legacy*

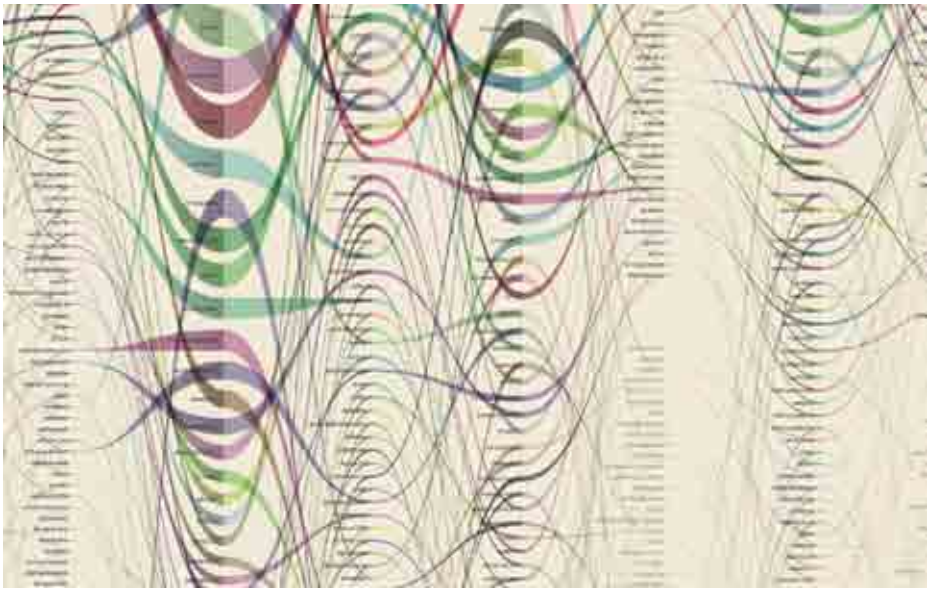

Fig. 6. A detail of the *Atlas of Kant's Legacy*

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

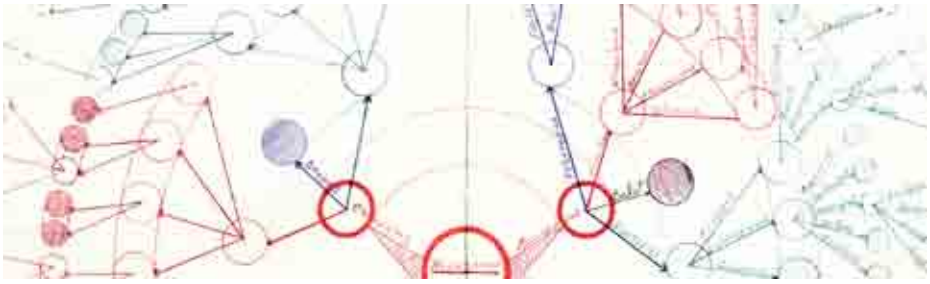

Fig. 1. Detail of the original design, by Panagiotis Tsampras (1934 - 2006).

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

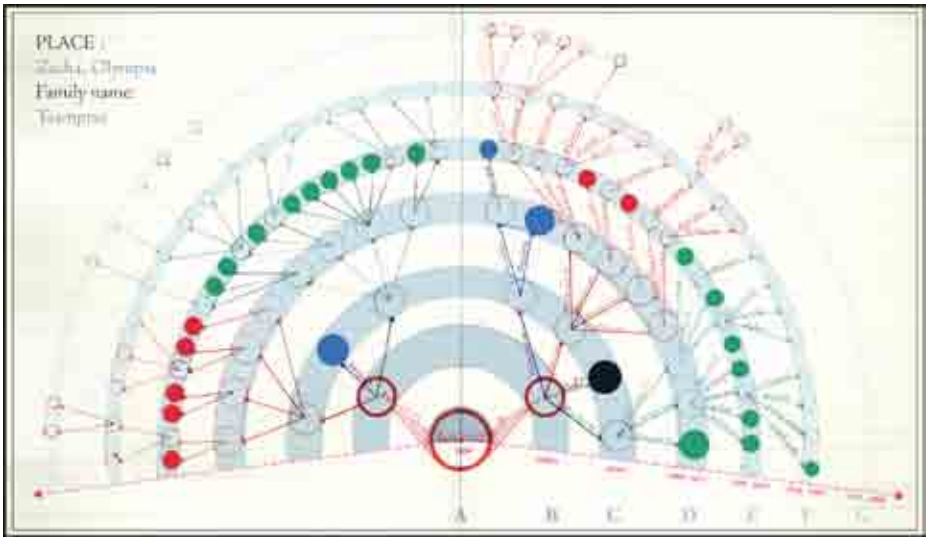

Fig. 2. The compete design. Color dots have been retouched digitally. Some other elements have been added: verbal information on top, the timeline and an extra layer in order to emphasize the concentric circles.

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]

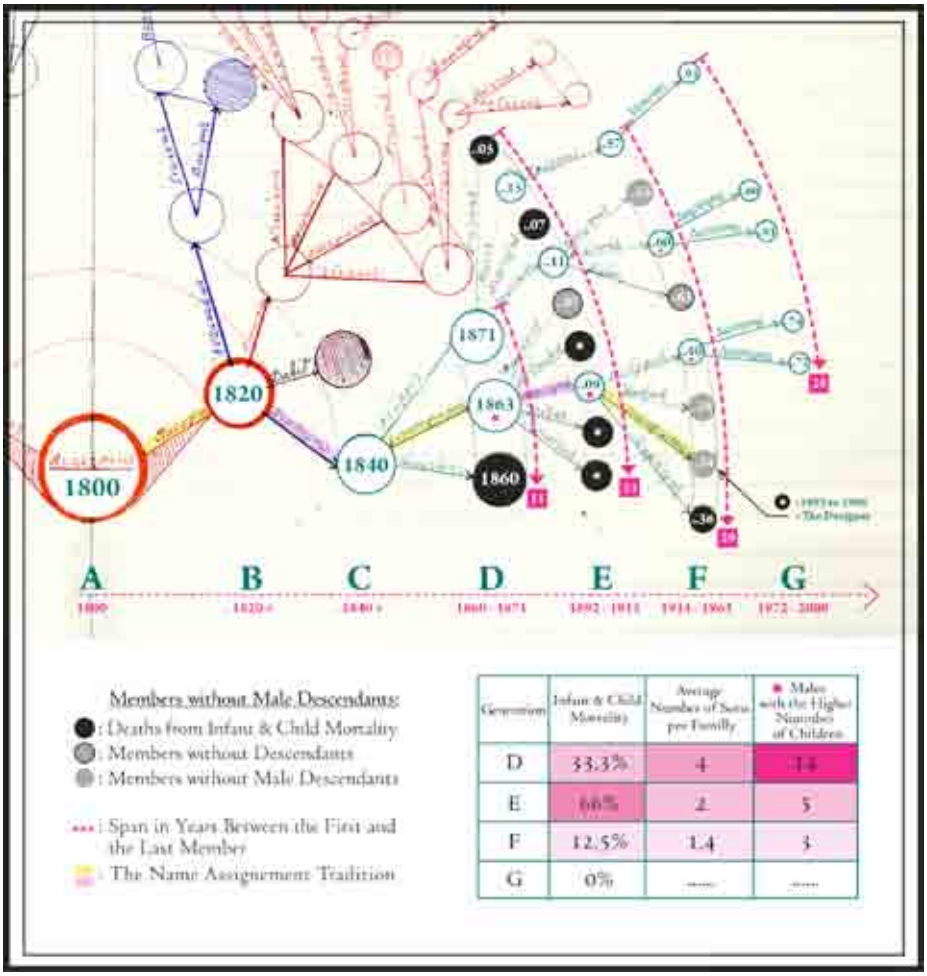

Fig. 4. The green sub-family: for Gen. E the basic cause of erased members is war related child mortality, while for Gen. F is the lowering of the total fertility rate. Males marked with a red star, are the ones that between their generation had the higher number of children, boys and girls included, 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

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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.