Designing with Data in Mind: Designer Perceptions on Visualising Data within Editorial Information Design Practice.

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Whilst registered as a candidate for the above degree, I have not been registered for any other research award. The result and conclusions embodied in this thesis are the work of the named candidate and have not been submitted for any other academic award.

Dedication

To my parents and sister: Eleftherios, Alexandra and Konstantina.

Acknowledgements:

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Abstract

This research identifies and addresses a critical knowledge gap on the discipline of editorial information design, a new area of data visualisation within the editorial environment. Due to the paucity of literature of the specific area at the moment of writing, this study aims to bring explicitness to design practices that remain, in research terms, largely unexplored.

Literature supporting the emergent research, was examined from two key areas. Firstly by investigating general design theory and principles from well-developed design fields, and secondly by examining selected material from the established area of information design, reviewing essential concepts of information visualisation. With both areas combined, this ensured breadth and depth of research perspective and sensitised the researcher on critical issues later used to evaluate emerging material.

To fulfil the aims of the study, interviewing was the primary method of data acquisition, with the Grounded Theory Method the selected methodology to analyse the data, as it was perceived as the most effective to capture tacit and empirical knowledge and connect it with practitioner activity. As a qualitative method it consists of practices that interpret data and makes the world visible, encouraging the researchers to be active and engaged analysts, utilising abductive reasoning on findings, even during the data collection. This effect informs and advances both areas as through forming iterative process, the abstract level is raised and analysis is intensified.

The material highlighted the tacit, embedded in the act of designing, knowledge that practitioners of editorial information design possessed, informing the observed knowledge gap. The combined material was coded, juxtaposed, and refined through multiple analytic cycles, seeking emergent elements of critical activity of editorial information design, with the potential to define practice.

The outcomes of the analysis are presented in structured form: emerging codes construct themes of designer activity, delineating essential operations and producing in-depth descriptions grounded on empirical data. Cross-theme conceptual structures also emerge through further analysis, as abstract categories that capture designer operations in continuity and offer insight on how practice transitions between key stages.

This study concludes with the presentation of a set of grounded theories, elucidating areas of editorial information design absent from the existing literature. While previously the design area remained obscure and implicit, leaving a lot to speculation, through this study key areas and activities become visible: elements directly associated with tacit designer action and design epistemology become explicit, revealing and defining the area under investigation.

Chapter 1:
Introduction

1.1 Introduction

The power of the diagram rests within the potency of the visual: our cognitive ability to draw connections, rethink and juxtapose with the graphic representation is unique. As described by Wittgenstein, a picture "presents a situation in logical space, the existence and non-existence of a state of affairs" (1961, p.35), becoming directly relevant and interconnected with the viewer without need for descriptions.

During the 20th century, visualisation of information proliferated in diverse platforms of expression: aided by innovation in print, electronic and digital media. During the same time, information became a central concept in areas including information theory, architecture, artificial intelligence, computer science and cybernetics (Von Bayer, 2003). Visualisations of information became a way to communicate vital information in a complex and fast paced world and designers were called, along with other practitioners, to find theories, formulas and principles to bring data and information to large audiences. This effort culminated in the realisation of a discipline under the name of Information Design, a term invented and popularised by the publication of the Information Design Journal in 1979 (Waller, 2008, p.1).

As the practice of information visualisation became progressively cross-disciplinary, the demand for informational charts and graphics grew, combining and experimenting on word/image and word/diagram combinations. Miniaturisation and portability of computers and the establishment of the world wide web developed a complex, information rich environment that raised new challenges on how to understand it, communicate it and navigate through (Sless, 1995), (Passini 2000, p.84), (Wurman, 2001, p.3). Classification, management and display of information became a primary concern for a group of disciplines that up to this point had diverse backgrounds and methodologies, making dialogue to test and refine elements critical to the communication of information (Horn, 2000, p.21). The result were new and emergent theories of creation, understanding and circulation of information design outcomes, facilitating this scientific and cultural change.

At the beginning of the 21st century, information design practices found an increasing number of fields for application that follow the proliferation of data in western societies; the release of editable, process-able information from global institutions, governments

and local authorities created new areas of expertise and new demands on meaningful visual schemata (Rogers, 2012, p.59).

The area of this study is editorial information design: the rich, colourful and comprehensive diagrams known as editorial infographics or simply infographics. Their presence within newspapers as an organic and indispensable part of the publication to communicate a news story is visible, but remains largely unexplored within academic literature.

The focus of this study is designer knowledge and the tacit, personalised understanding that editorial information designers have for their area of expertise, but remains unseen from a research perspective.

The aim of this study, is to use credible research methods to expose tacit designer knowledge of editorial information designers, frequently communicated within personalised language and implicit terms with explicit and articulate means.

The outcomes of this study are grounded theories localised on editorial information design, describing designer processes and practices stemming from designer interviews and pertinent primary data. Theory produced contributes to design epistemology by illuminating critical behaviours, activities and multi-layered operations that escape personalised practice-based observations, largely missing from the discipline's literature.

In the following chapter, information about the history of information visualisation affecting information design and editorial information design will be presented, describing the recurrent themes and relationships. Following the timeline connecting the precursor practice with present day, descriptions of origins, identity and characteristics for information design and eventually editorial information design will be reviewed, introducing the subject areas. Finally the knowledge gap will be presented providing examples of current literature and additional reasons as to why empirical data, such as interviews from designers are necessary to fulfil the aims of the study.

1.2 Tacit Knowledge and Grounded Theory

Central to this study are two elements with defining characteristics: the first is the concept of Tacit Knowledge and the second is the Grounded Theory method of research. The first is descriptive of the epistemological status of knowledge of the area under investigation affecting examined literature, data collection and data analysis permeating the study. The second is a method of inquiry allowing researchers to enter uncertain or ill-defined research environments and through empirical means to structure theory that ventures beyond description and higher abstract value. It is imperative to make a brief acquaintance with both within the introduction, even if a thorough analysis will ensue with the literature review chapters and methodology chapters accordingly.

Tacit Knowledge is a form of knowledge which is empirical and embedded in action. It is summarised by the inventor of the term, M. Polanyi, as a status of knowing that *"we know more than we can tell"* (1983, p.4). It refers to a state where as humans, a range of activities can be undertaken having the knowledge of how to do them, but without necessarily being able to provide a complete or coherent account of the actions, or to explain to others how to undertake them.

This area of knowledge is lacking a widely accepted definition; yet becomes a central point for discussion across a large number of disciplines (Toom, 2012, p.621). Theorists and researchers acknowledge its complexity and ambiguity as immanent in the human activity, especially in the development of skills and practice related knowledge.

Consequently tacit knowledge is also central to design practice and design theory (Friedman, 2003; Mareis, 2012) as a phenomenon influencing epistemological inquiry of design. Cross (2007, p.25) argues that what designers know about their processes *"remain largely tacit"* and hints that the *'Designerly ways of knowing'* are embodied within the *'codes'* of the design profession, which if externalised can constitute a *"deep structure"* allowing deeper understanding of design proceedings.

Grounded Theory, is a method of qualitative inquiry and theory building presented by Glaser and Strauss (1976) that develops conceptual categories from empirical data, discovering and illustrating evidence to support these generalised conclusions capturing essential truths of the area investigated (ibid, p.24)

In Grounded Theory method, "data collection and analysis reciprocally inform and shape each other through an emergent process" (Charmaz, 2012, p.360), building an analysis from the data and forming analytic categories that are directly 'grounded' on the data.

The method is deeply analytic, encouraging constant comparison, restructuring and critical perspectives for the formation of new theory, especially in areas where little material already exists:

> *"[it]… favours analysis over description, fresh categories over preconceived ideas and extant theories and systematically focused sequential data collection" (Bryant & Charmaz, 2007, p.608)*

The method has a strong characteristic: it encourages the researchers to be active and engaged analysts, utilising abductive reasoning on findings, even during the data collection. This effect informs and advances both areas through forming an iterative process, the abstract level is raised and analysis is intensified (Charmaz 2012, p.361).

In that sense the researcher can enter unknown or ill-defined territory, and through the gathering and analysis of empirical data, can develop meaningful relationships of perceived phenomena. At this point the grounded theory method allows understanding of the phenomena during investigation, informing researcher's knowledge and evolving research as the uncertain ground of inquiry is shaped by the comparatory and reflective process; the theoretical outcomes retain pertinence via the connection with the data and directly link to the phenomena.

The relationship between these two key elements and the object of study clarifies the research perspective: as designer knowledge is tacit and embedded within practice, the expression of this knowledge remains personalised in forms of application and definition, retaining incompatibility with hypothesis testing and objective assessments of data. At this point the grounded theory method allows for critically viewing the empirical data with consistency and methodological rigour, constructing valid theoretical outcomes of research.

1.3   Historical context and practices of visualising information

This part of the introduction offers a view on key practices and themes shaping the literature of visualising information via a short timeline, contextualising editorial information design and displaying the diversity of methods employed. It also underlines the communicational character of information visualisation and the ways that designers and theorists have invented and deployed certain methods to overcome challenges on visualisations. As the majority of the precursors mentioned remain relevant to the present day as main contributors on essential aspects of information graphics, their contributions are perceived as exemplar theories that affect and define literature.

A point in history with great significance and impact on today's practice is the end of 18th century: visualisation of data coming from statistical research converted mathematical/statistical concepts into shapes and diagrams, clarifying and succinctly making a visual argument. Additionally, visualisations of the period had strong characteristic: they were constructed in a way that would successfully reach a wider audience and communicate expert knowledge of subjects in simple terms, informing and simplifying dimensions with visual mechanisms.

The methods employed at this time were far from systematised: some of the precursors placed emphasis upon visualising statistics, while others built a theme around a story or simply communicated a story in potent ways, others used cartography. Regardless of intent and application, visualisation of data from the earliest stages had a plurality on means of expression and theory of production.

Following the precursor figures, influential theorists of the 20th century will be briefly introduced as personalities that influenced, and continue to influence, information design discourse; some of their critical contributions will be examined closely in chapter two.

1.3.1   18th and 19th Century, invention of visual formulas and introduction of visualised information to the public sphere

In 1786, the Scottish engineer William Playfair presented his famous *'Commercial and Political Atlas'* in which many traditional views in statistics were reworked, refined and transformed in visual form. The work, produced in full colour print, was unlike the usual atlases of the era, as Playfair chose to narrate his statistics through a series of well-designed charts communicating the statistical data via visual means (Wayner & Spence, 2005, p.1) (Figure 1.1). Playfair's innovation of charts and diagrams had to overcome strong oppositions of the time, as the established medium at that point was the statistical table, (Wayner and Spence 2005, p. 10) avoiding graphics entirely. Taking considerable distance from the established practices, the third edition of the Atlas relied entirely on graphics, creating for the first time a complete work on statistics, with visual representation. This achievement was the outcome of continuous work spanning decades of experimentation advice from experts of the era and revision of visual tools. Playfair invented and implemented fourteen new visual tools on his last edition of the Atlas (Wayner and Spence 2005, p. 23-27) where among the most recognised stand the *'Time-series linegraph'*, the *'Bar chart'* and the 'Pie chart' many of which are still widely used today (Friendly, 2009, p.14) as testaments of his long-standing contribution to the area of visualisation and statistics.

Almost half a century later a prominent figure in the public life of the Victorian age, Florence Nightingale, known for her activities on social reform and critical contribution to nursing, turned her attention to the use of statistics to display the cause of deaths of expeditionary army forces. This was a product of collaboration with the statistician William Farr (Sioban and Nelson, 2010, p.121), demonstrating crucial but 'unseen' facts thus far by the authorities: such as the astonishing fact that three times as many soldiers died at home and abroad during peacetime than at times of war, due to overcrowded living spaces and filth in the industrialised cities (ibid, 123). Nightingale's 'polar area graph' or 'coxcomb' graph was her visual legacy on information visualisation: a development of Playfair's pie-chart, the circle was segmented in twelve equal angles, each displaying causes of death for each month of the year (figure 1.2). This collaboration made extensive use of diagrams and pictorial aids, understanding the

potency to communicate content to those unaccustomed to data and tables (Huxley, 1975, p.171).

The visualisations produced by Nightingale were employed in pioneering ways: primarily the invented visual formula and following statistical data were used to draw sophisticated conclusions on a situation that even statisticians where unable to see. Secondarily the visualisation made content accessible to a wide and significant audience: 2000 copies were sent to personalities of influence including Queen Victoria, enabling the much needed army reform (Huxley, 1975, p.171), with the clarity of the design providing additional impact.

During the same period in France, a civil engineer and cartographer was developing the concept of thematic maps, merging statistics with visual analysis and visual representation. Charles Joseph Minard pursued mapmaking not as a tool of absolute precision, but was using data to create a strong narrative within his maps with effective reasoning and argumentation. In his first published work named "Traffic volume between Dijon and Mulhouse" Minard's intentions were to display traffic of passengers via railway between the areas of two cities and display the analogies of expected revenues (figure 1.3). While the numeric elements were transferred on the surface of the map with precision, the use of flow lines whose widths were proportional to the traffic made clear his analysis on estimates through a journey, avoiding direct references to any tables of data. (Konvitz, 1987, p.155).

As Minard's career continued, he became "a visual engineer – designing informative data displays" (Friendly, 2002, p.33). Carefully using the tensions building within thematic cartography to make intelligent trade-offs between the confines of the map on one hand, and accuracy of the data on the other, he managed to bring forth the essence of many important subjects and facilitate decision making with great success - an insightful and pioneering perspective that has striking similarities with today's practice (Robinson, 1967, p. 95). The technique of the flow lines as well as the proportionate geographic shapes on the surface of the map were Minard's innovations, and can be frequently be seen also in today's practices of visualising information.

1.3.2 20th Century proliferation of visualising information, and theorists of data visualisation

During the 20th century as print technologies evolved and became even more accessible, visualisation became central to the dissemination of information and mass communication. Theorists from different fields of expertise worked on methods to systematise the production of meaningful visualisations and provide successive visual outcomes. These contributions serve as precedents in literature and remain even to the present day.

At the beginning of the century, Otto Neurath, a social scientist and philosopher, placed another landmark on the timeline of communicating information visually with his systematic attempts to build a universally understood visual language (Burke, 2009, p.214) that through the use of iconic images (Lupton, 1986, p.51) (figure 1.4) would be able to create localised visual statements - visual sentences that would ignore barriers of literacy and make even complicated subjects accessible to a wider audience. The visual legacy of Neurath was accompanied by a set of supporting texts with insightful perspectives on the nature and aims of the visual communication and mass media.

In the post war period and as various information theories were developed, visualisation of information became a subject of a greater number of practices and disciplines. The new interactive media of presentation used in conjunction with traditional media were used by Charles and Ray Eames (Kirkham, 1998, p.264), in the exhibition 'Mathematica: a world of numbers' (figure 1.5) on 1961, fusing ideas about: "*Learning, illusion, toys, mathematics, science, technology and new ways of 'seeing and glamour' of ancient entertainment and some of the earnestness of nineteenth century learning" (ibid.264).* Although not strictly working on two dimensions, the exhibition displayed methods of information dissemination that contained critical comparison and interactivity, balancing well between clarity of the information and conceptual complexity.

In 1967, Jacques Bertin, a professional cartographer, challenged the traditional cartographic practices (Dürsteler, 2013; Fields, 2011 p. 79), merging further the notion of information transfer and argument in visual forms and overcoming traditional barriers. Within his publication "*Semiologie Graphique. Les diagrammes, les reseaux, les cartes*" he articulated a complete theoretical framework of visualising information,

complete with examples of how data can be communicated within a two dimensional surface (figure 1.6). The work established clear hierarchies of relationships of data, content, as well as context to develop a clear argument for the reader, providing a coherent theoretical work through all the stages of production with visual examples.

As digitalisation of information and visualisation was underway, Edward Tufte, an academic with a background in statistics published his seminal work of *"The visual display of quantitative information"* (1983) exploring the functional principles emerging from selected critical examples of graphics (figure 1.7) slowly building up a base of references through multiple publications (1990; 1997; 2006). The series of works developed have continuity on visualising information and delving deep into aspects of presentation.

The writings of Neurath, Bertin and Tufte are critical works of data visualisation literature, each of them creating a shift on established paradigms and are pioneering works that evolved all corresponding disciplines, serving as core points of references for the practitioner and researcher of information visualisation to the present day. Part of the theoretical underpinnings, contribution, and rationale of these prominent figures will be examined in Chapter 2.

1.4 Information Design

At the end of the 20th Century the growing technological infrastructure and exponential use of data (Wu, 2011) made societies undergo a radical transformation, becoming information based (Sless, 1995) and creating a complex environment for the individual to comprehend and interact with (Visocky O' Grady & Visocky O' Grady, 2008, p.9) for action. Passini (2001, p.84) outlines some of the characteristics and effects below: it is important to see how tasks, considered trivial in the past, require a fair amount of problem solving today.

> *"Who could dispute the fact that during the last two decades information, its access and its use, has had a strong impact on our society? More and more of our work depends on the effective use of information. New possibilities to access information are affecting our daily lives, not only at work but also at home and*

during leisure time. Social functions have become more and more specialised, creating greater complexity and consequently, new needs for information. The urban and architectural environment has also grown more perplexing; just finding our way around our built environment, a trivial task in the past, is now a distinct challenge. Thus the design of information and its efficient communication are more critical than ever before".

The overabundance of information and channels of information traditional and new, permeating daily activity, are complicating things even further; Wurman (2001, p.3) argues that as individuals are faced with an increasing polyphony, choice and contradiction their potential for knowledge and understanding decreases:

"Information anxiety is produced by the ever-widening gap between what we understand and what we think we should understand. Information anxiety is the black hole between data and knowledge. It happens when information doesn't tell us what we want to know" (Ibid p.14).

Present day Information designers are called to overcome this lack of knowledge and create visual outputs of thematic and contextual clarity for subjects with pervading complexity (figures 1.7 – 1.11), understanding audience, environment and mediums of expression. Using platforms of communication varying from traditional, new and digital media (Whitehouse, 2000), the objective of Information design is critically concerned with elements of "accessibility and use by people" (Sless, 1995) in physical and virtual space. This includes a responsibility not only for the choice of aesthetics and functionality but also more complex, positive effects that the outcome has to the users (Passini, 2000, p.87).

Multidisciplinary in nature (Horn, 2000), the Information Design area often raises concerns when outlining practice (Jacobson, 2000; Dervin, 2000; Raskin, 2000) due to the plurality of mediums and areas of activity. However, the same group of scholars agree to the existence of a practice of communicational character and common objectives. Through time, the identity of the discipline is shaped, forming a characteristic

body of knowledge and attaining self-realisation (Jacobson, 2000; Raskin, 2000; Pettersson, 2002, p.ix; Baer & Vacarra, 2008, p.12).

The term 'Information Design' was originally introduced and popularised by the launch of Information Design Journal in 1979 and the formation of the Information Design Association in 1991 (IDA origins, 2014; Waller, 2008, p. 1), naming the design area and defining the new field of practice, gaining preference over other competing terms (Wurman, 2001). Within this newly formed group, interaction of diverse professions, disciplines and backgrounds was observed, coming closer as the isolated areas of origin failed to deliver appropriate design solutions (Horn, 2000, p.21).

Definitions of information design are rare in literature: the rapid changes within the area, as well as the many expressions of the mediums produced, make a single description impossible to maintain for long – at least so far. It is characteristic that the Information Design Association offers no strict definition for the area of practice but a set of recognisable characteristics (What is Information Design, 2014), pointing towards the evolving character of the discipline. Nevertheless, it is beneficial for the purposes of the study to observe one of these attempts to characterise practice as it offers a synopsis of aims and outcomes.

Horn (2000, p.15) presents a description for information design, focusing on three main areas: cognitive elements in document designing and readiness of action, enhanced interactivity with technology or technological artefacts and ease of movement in both physical and virtual space:

> *"Information design is defined as the art and science of preparing information so that it can be used by human beings with efficiency and effectiveness. Its primary objectives are: To develop documents that are comprehensible, rapidly and accurately retrievable, […] To design interactions with equipment that are easy, natural and as pleasant as possible […] To enable people to find their way in the three dimensional space with comfort and ease.*

> *The values that distinguish information design from other kinds of design are efficiency and effectiveness at accomplishing the communicative purpose."* (Horn, 2000, p.15)

Similarly the Information Design Association offers a set of examples of information design in use:

> *"Navigating from 'You are here' display panels (wayfinding)*
> *Getting around on the transport system (maps and information)*
> *Taking medicines in the correct dosage and time of day (healthcare information)*
> *Choosing a pension, mortgage or investment product (financial information)*
> *Understanding utility bills, bank and card statements (clear language and typography)*
> *Moving through an exhibition or public space (signage and design)*
> *Checking the weather, election and sports results (charts and data graphics)."*
> (What is Information Design, 2014)

It is worth noting that the above definition uses the term 'document' in a broad sense, incorporating the use of image and text as well as diagram, in communication context and objectives. The research foundations of information design for Horn rest on a variety of research fields: cognitive sciences, educational psychology, computer interface design, performance technology, documentation design, typography research, advertising, communications and structured writing (Ibid, 2000, p.22). Also interesting is the dual nature of the reference of 'art and science' mentioned, making explicit the relationship of the information designer with the scientific structured and data aspects, while simultaneously engaging aesthetic and visual qualities. These will be argued as 'design qualities' in Chapter two.

However the observed diversity of backgrounds within information design does not indicate a fragmentation within practice, but a strong tendency of practitioners to find common ground and exchange vital cross-disciplinary information. 'Information Design' is a valid, yet necessary umbrella term for common reference of the emerging profession (Passini, 2000, p.84), capturing the essential communicational, informational and design elements of the discipline. Concluding it is the very multidisciplinarity of

information design that produces difficulties about identity, as it is difficult for practitioners of such diverse fields to find appropriate vehicles for articulation. Yet enough common ground exists for this diverse group to have meaningful interaction, peer-reviewed journals and regular conferences.

Within information design, visualisations are prevalent as a means to easily and effectively communicate data and the connected information. Visual artefacts of information design provide high density platforms of communication towards large audiences, frequently carrying specialised and complex data forms. Information designers seek practical and tangible expressions of the abstract, in their efforts to successfully materialise the design task (Westendorp & Waarde, 2003, p.103). As previously discussed, the term of information design covers a large number of areas, of which their diversity in mediums and uniqueness in ways of expressions, can obstruct research. However by focusing into a specific discipline, such as editorial information design, many of these obstacles are lifted through specificity and operations, as well as concepts describing these operations can be identified and critically compared.

1.5 Editorial Information Design

Editorial Information design is one of the most recent manifestations of visualising information and, by the author's opinion, connected with information design: an area of practice focusing on the creation of visual schemata, communicating meaningful high density information to audiences. The outcomes of the design process of this area can be referred to as infographics or information graphics reflecting the close connection of the artefact with the data. Text, image and geometric shapes are indissolubly interlaced to produce single entities (Rendgen, 2012, p.9) in a series of processes that is far from automated; the construction of an information graphic is more about development and negotiation of visual forms, schemata and data than a mere application of visual formulas. Bertin argues that a good graphic is a responsible graphic.

> *" A graphic is not merely a drawing, it is a responsibility, sometimes a weighty one,*
> *in decision making. A graphic is not 'drawn' once and for all; it is constructed and*

reconstructed until it reveals all the relationships constituted by the interplay of data. The best graphic operations are those carried out by the decision-maker himself. A graphic is never an end in itself; it is a moment in the process of decision making. (Bertin, 1981, p.16)

The use of infographics and informative charts towards a wider audience has significant presence in media history as a potent carrier of information. However it was only recently that the use of graphics in news media has increased due to the availability of data from global organisations and government departments: journalists and designers seize the opportunity of a global initiative on open access to critical data to inform the public. This was first made possible with the launch of the US based data.gov website in 2009, as one of the first legislative acts of President Barack Obama making statistical material public in editable forms. Shortly after, the UK version of data.gov.uk was launched, providing unrestricted access of crucial information also in fully editable formats. Simon Rogers, the former editor of the *Guardian's* newspaper datablog, summarises the recent point where data sets, the tool of the statistician up to that point, became a critical tool for journalism:

"It reflects the new transparency movement spreading across the globe, from Washington DC to Sydney, via California, London, Paris and Spain. It's hard to know what came first: the data or the demand for it. Or maybe the two have grown symbiotically. But it seems there was a tipping point where a number of factors combined to form an unstoppable movement. I would argue they were:

- *The widespread availability of of data via the Internet*

- *Easy to use spreadsheet packages on every home computer*

- *A growing interest in visualising data, to make it easier to understand*

- *Some huge stories we might never have heard of, without data-based reporting". (Rogers, 2012, p.59)*

From civil servant salaries, treasury spending and crime, to hospital performance, a detailed list of pertinent data for analysis became available, allowing careful examination and meaningful data-based hypotheses. Transparency of sources and the ability to make

cross-references between tables led to the revelation of news stories crucial to the public interest that previous realisation was impossible to attain. (Rogers, 2012, p.61)

As the interpretation of data and data comparison became a tool for journalist research, newspapers in printed or digital formats also evolved visual ways to communicate these forms of data. Graphics departments during this period evolved to match the new demands of graphics, and designers from various backgrounds found themselves actively engaged with processes examining and refining data, processing and communicating visualised findings of complexity with their audiences. The popularity and effectiveness of this practice was so welcomed by the public that soon major newspapers such as the 'New York Times' and 'The Guardian' made, ever since and to the present day, infographics a necessary part of the presentation of important news articles.

1.6 Considerations on publications of Information Design

Peer-reviewed publications for information design visualisation are rare, as the multidisciplinary nature of the area provides a serious challenge: a strong collaborative effort across several fields to adequately cover the necessary ground. The latest such publication was 'Information Design' (Jacobson, 2000) and included design perspectives on information visualisation in two or more dimensions with relative theoretical frameworks.

The 'Information Design Journal', the peer reviewed medium of discourse for the discipline, in the previous years has infrequent publications of relative theoretical material often from a practice-as-research perspective. The discussion on visualisation of information revolves strongly around themes described by prominent figures of the area, such as Otto Neurath, (Burke, 2009, p.211; Macdonald Ross & Waller, 2000, p.190) and Jacques Bertin (Bertin, 2000, p.5; (Daru, 2001, p.20) and newer publications that attempt to clarify areas of focus (Westendorp & Waarde, 2003, p.103) or bring individual perspectives on information design practices (Karabeg, 2002/2003, p.88; Andrews 2002/2003, p.95 - among others). The presented arguments explore properties and principles of information communication, as well as visual structure and

representation. Both areas explore context and characteristics of the intended message in two dimensional space and how this is interpreted by the readers.

Beyond peer reviewed material, further publications on visualisation, present a narrow approach where the visual outcome becomes dominant. The supporting theoretical material is not always adequately developed and often takes the form of short general statements often borrowed from other disciplines, frequently non-specific or without methodological testing or verification; this is a trend persisting to the present day.

To provide some characteristic examples on the source materials, on 'Data Flow 2: Visualizing Information in Graphic Design' (Klanten, Ehmann, Bourquin, & Tissot, 2010) infographics were placed under the general scope of graphic design with a set of descriptive concepts such as "simplexity" (ibid, p.7), "visual metaphors" (ibid, p.5) or the "power of the sphere" (ibid, p.11) The contained visual material is impressive and the synoptic descriptions can be helpful as introductions, but yield no in-depth explanations or insight. Similarly in the "Information Design Handbook" (O'Grady & O'Grady, 2008) quotes and explanations are provided about the mechanics of the discipline without analysis or critique (p.17-19) often without detailed reference of sources and short descriptions. Again we encounter useful material that draws from multiple sources to make a synopsis providing self-explanatory examples useful for introductions, but not in-depth frameworks.

Another category of publications focuses almost entirely on the visual outcome, displaying the infographic as a self-explanatory entity. In 'Information is Beautiful' (McCandles, 2009) and 'Knowledge is Beautiful' (McCandles, 2014) only a short introduction precedes a large body of visuals, displaying each design 'as is' without any form of theoretical commentary. Similarly in 'Information graphics' (Redgen & Wiedermann, 2012) a collaboration that brings to the reader a vast collection of visualisations, the balance of between theory and visual example is overwhelming towards the infographics.

These gaps in practices were not left entirely unnoticed by researchers and scholars of Information Design: As early as 1989 Macdonald-Ross, based on previous work on the

model of the 'Transformer' (Macdonald Ross & Waller, 2000) develops a graphic ecology where the skilled information designer – the "Master Performer"- is situated within a production model (1985, p.150-p.151). The work drawing from empirical evidence suggests the characteristics of effective communicators and attempts to highlight rules for successful graphic production (ibid, p.152) highlighting the importance of missing designer knowledge. This type of empirical studies, remain a minority however and the majority of published material consists of prescriptive, descriptive or self-explanatory visual collections leaving large areas of designer activity unaddressed.

1.7 The paucity of literature in Editorial Information Design

Editorial information design at the time of submission of this thesis has paucity in peer-reviewed discipline specific publications. Some material from publications on journalistic practice exist such as "A five-volume manual of English, typography and layout" by Harold Evans (1972) but remains unclear if these practices are still up to date with contemporary practices. At the same time, successful designers working on news graphics provide only sporadic insights, but these views remain isolated - such as of Nigel Holmes narrative via the 'Society of News graphics' website (Can, 2015).

While information design has a substantial critical tradition that stems from designers observation's and practices, there is little insight on how the existing material relates to the specific area of editorial information design.

Lacking rigorous primary research, defining characteristics of editorial information design can emerge with clarity by the inclusion of data from designer narratives into the research material and analysis through careful methods of constant comparison, coding and thematic structuring following the Grounded Theory method. In such manner, the primary tacit material from designer description can be examined side by side with the secondary material, ensuring relevance and integrity, creating ways to cover the perceived gap of knowledge.

In the literature review chapter (Chapter 2), the knowledge gap will be identified and critically connected with knowledge from general design theory and information design theory.

1.8 Aims of the study

a) To gain insight and clarity on design practices of editorial information design by using methods recording and documenting empirical data from multiple designers, allowing the researcher to transcend the barrier of isolated narratives or methods.

b) To analyse the recorded primary data and extract designer knowledge through methods allowing the emergence of editorial information design practices from data minimising bias, bringing to light a 'slice of life' of designer activity to the research community and illuminating previously unseen methods and operations.

c) To examine existing theoretical material from general design theory, as well as information design theory and through familiarisation with the area, to establish pertinence and appropriateness of this material with the discipline under investigation.

1.9 Objectives of the study

a) To present grounded theories that enable access to practices and activity of editorial information design, offering critical descriptions grounded to the data. This will be new, empirically attained theory and a genuine contribution to knowledge for the selected discipline.

b) To offer a critical review of key literature examined, and in conjunction with emergent elements of research, to collate a basis for discourse for the discipline under investigation.

1.10 Basic terms of the study

From the early stages of research it became apparent that terminology was far from unanimous both in theoretical texts as well as in the area of practice. To facilitate the transference of contents and simplify communication, it is necessary to offer clarification on the use of three key concepts frequently used within this study: **Information Design**, **Data Visualisation** and **Infographics**.

Information Design: Is a term used to describe the broad design area, which manifests in many backgrounds and mediums. Multidisciplinary in nature, it has a sphere of influence expanding to diverse fields of expertise and practice.

Data visualisation: Is the design process of visualising quantitative, data related information. These data are often results of independent scientific research.

Infographics: Are the outcomes of the process of editorial information design. While editorial information design artefacts can be considered also as information design artefacts and data visualisation artefacts by examining their characteristics and merits, the term was chosen to increase specificity and reduce repetition of terms.

1.11 Summary

Through this chapter an introduction to the area of study was delivered and key concepts have been introduced. Editorial information design, a design area with increased presence within today's news mediums has very little presence in research publications. For this reason, Grounded Theory, a method of qualitative enquiry with emphasis on empirical data, was chosen to collect and present material on design activity.

Subsequently, context was provided via a short historical timeline of practices of visualising information. Editorial information design displays the consistency of the communicational aspects of the graphic representation of data, as well as the plurality and multiple ways to approach design practice. The areas of information design and editorial information design were outlined, providing synoptic descriptions of formation and evolution of areas, preparing the more detailed descriptions and in-depth analysis of the following chapters.

Following the identification and introduction of the discipline, challenges and shortcomings of the existing literature were presented, effectively highlighting a problematic area in research terms: literature on the creation of information graphics is scarce and heavily oriented towards the dissemination of artefacts, forfeiting the critical aspects of processes and making.

The aim of the following chapter is to use material from general design theory and information design theory to bring together critical material which will inform and raise the awareness of the researcher on the data gathering and analytic phases of the study. Taking into consideration the overlap of theory and the transferable nature of design knowledge (Cross, 2007, p.25; Visser, 2009), insight of the practices of information visualisation become available to the researcher. However these are also the limits of how existing literature can provide information for the area of study under investigation: attaining a support role by developing a critical, informed network of ideas and a legitimate body of theoretical material to support the researcher on the data gathering and analysis stages. As theory cannot inform the study about undocumented practices, it therefore must be used to support the effectiveness of method and methodology of the study: ultimate aim of the research design is the emerging material from empirical research unbiased in the form of Grounded Theory Method.

The compiled material acts as a way to raise sensitivity necessary for the development of grounded theories: it is used to offer an initial perspective for the researcher that will "help him to see relevant data and abstract significant categories from his scrutiny of the data" (Glaser and Strauss, 1967, p.3).

Chapter 2:
Literature Review

2.0 Literature Review

2.1 Introduction

Information design, multidisciplinary in nature, has a sphere of influence expanding to diverse areas of expertise and practice, both in traditional two dimensional graphics as well as interactive digital media. Its purpose is the "systematic arrangement and use of communication carriers, channels and tokens to increase the understanding of those participating in a specific conversation or discourse" (Jacobson, 2000, p.4), connecting practice directly with concepts of communication, transferability and interaction.

With the discipline's theory not fully developed and each project heavily dependent on context, Jacobson maintains that exact patterns of development are impossible to predict scientifically as the factors leading to success or failure are connected with specific settings and practices (ibid, p.5). Designers of the area so far incorporate tacit elements to define the effectiveness of the design artefacts, resembling methods of transmission of knowledge similar to a craft, or apprenticeship.

> *"… Nonetheless, the skilled information designer and the trainee with an aptitude will be able to distinguish between what works – what makes sense- and what does not. The more training he or she receives, the more skilled the information designer will become. This method of learning describes a profession in its youth, a craft as it were, devising compacts and curing "bad ethers," as in the early days of jurisprudence and medicine." (Jacobson, 2000, p.6)*

Taking into consideration the difficulties rising from making tacit elements of design communicable, designers and design education often resorted to forms of apprenticeships to make knowledge transferable (Cross, 2007, p.25). A series of authors offer a critical approach to the principles of the discipline and attempt to articulate in clear and well-defined terms theory that elevates information design from a purely empirically driven practice, clarifying and articulating areas of importance. Designers are identified not for the problems they tackle but for the solutions they produce (Lawson, 2006, p. 53), resulting in the identification and categorisation of theory under specific fields but also allowing use of design knowledge to conterminous disciplines, making these solutions available to a wider group of practitioners. The ways of knowing design, embedded within the codes and pattern languages developed within a specific area imply a deeper connection with design practices (Cross, 2007, p.25; Visser, 2009) allowing the transference of useful material from one area to another.

One of the major challenges of this study regarding literature is that currently literature on editorial information design is scarce, denying the usual exchange of ideas and evolution of theoretical material that would position the researcher directly into an environment with well examined precedents of research. In order to establish a frame of reference that critically informs research and allows evaluation of the material following in later stages, it is necessary to examine material from information design as well as more general design theory: On one hand information design material has direct relevance with editorial information design but often comes with flaws deriving from designer authorship, on the other hand design theory is more distant, but allows critical perspectives and higher levels of abstraction, supported by rigorous research methods.

Literature relating to the two dimensional aspects of information design is examined as it presents strong similarities on communicational rationale, mediums of development and ways of reception from audiences. The content of these theories is presented and critically evaluated for application on the examination of the existing knowledge gap, highlighting areas that need exploration and aid on issues on the localisation of theory. Also, under the circumstances it was deemed necessary to revisit credible peer-reviewed research with a twofold strategy: First to relate key concepts of tacit knowledge with design research and the practice of design, while simultaneously delineating critical areas of design practice that remain unseen within information design discourse. Secondly as a basic structure to explore key theoretical positions examining the activity of design and connect credible theoretical material with the field of inquiry.

The two areas of literature information design theory and general theory of design have a supplementary character, allowing the articulation of design knowledge relative to the discipline under investigation. Whereas general design theory allows realisation of context shaping the inquiry and providing breadth to support the research field, the selection of material from information design allows a focus on in-depth knowledge of practices and essential material connected with visualisation. The former type of theory allows communication of the personalised yet pertinent views to practice, while the latter offers support and alignment towards credible research practices. In such way existing knowledge is allowed to be expressed with support of peer-review material, granting layers of depth and further connections to the often personal narratives.

Lawson (2006, p.53-54,) and Cross (2007, p.25) support the idea that design principles and designer's knowledge are transferable to fields that share common interests: under this premise, critical material from areas with evidence based research can be drawn from established disciplines and inform research on editorial information design.

2.2 The knowledge Gap

As previously indicated, editorial information design at the time of submission of this thesis little discipline specific publications, on either peer reviewed journals or extensive personal publications by practitioners. While information design has a substantial critical tradition that stems from designers observation's and practices, there is little insight on how the existing material relates to editorial information design.

There is so little known about the environment, operations and objectives of this particular group, that verification through hypotheses contains the risk of not addressing critical aspects of activity. As the design area has a growing body of practitioners that evolve practice, it is better for the researcher to seek the emergence of critical elements through methodical analysis of empirical data, without leaning too heavily on preconceptions.

Editorial information design practice is connected with the existing literature of information design on both historical as well as practical ways, as visual objectives and rationale on the field of communication coincide between the two areas. The use of information design principles and literature will help to establish an informed base of operations scrutinising the analyst, allowing delving further into the selected area of focus.

Lacking rigorous primary research, defining characteristics of editorial information emerge partially from second hand sources; yet a more clear view can be offered by the inclusion of data from designer narratives into the research material and analysis through careful methods of constant comparison, coding and thematic structuring, following the Grounded Theory method. In such manner the primary tacit material from designer description can be examined side by side with the secondary material, ensuring relevance and integrity, creating ways to cover the perceived gap of knowledge.

2.3 Data and Information

Central to all publications of information visualisation are the concepts of data and information, yet designers rarely address the exact meanings of the terms or how these are perceived during practice; the terms are used without further explanation, often with implied consent towards the reader. Although defining information is by no means an easy task (Von Bayer, 2003) the lack of effort from designers to define some of the most basic components is indicative of the tacit connection of designers knowledge with components of practice.

Historically deriving from the Latin '*Informatio*' meaning conception or idea, today 'information' can be found in everyday language as well as specialised contexts to signify a variety of meanings, often diverse or seemingly dissonant. Petterson (2002, p.1) argues that information is a richly varied concept negotiated by a plethora of disciplines and areas of knowledge, synonymous with "data, details, facts, and intelligence"; providing a list of use in human activities, such as behaviour and law, applications in psychology, science and technology. The separation of the meaning of information for the specific area of practice is difficult as the list seems perplexing or even conflicting, yet the connection can be established between these interpretations in action:

> "The verb 'inform' means to supply or convey information or to provide knowledge of something and is therefore an unidirectional process, e.g., from one person to another" (Petterson, 2000, p.2).

In Petterson's view, the action of communicating entails interplay between two or more persons, and underlines the anthropocentric relevance of information in relation to design. Raskin, (2000, p.342-343) analysing the same subject, recognises similar characteristics, inherently connecting information with meaning and attributes of strong communicational and representative character. Information should not be considered synonymous to data that essentially are the 'raw commodities' or the building blocks of meaning but not the meaning itself (Shedroff, 2000, p.270).

In a similar manner Kazmierczak (2003 p.46) contests the notion that data alone have meaning, becoming self-explanatory in graphic forms making a clear distinction between data and information and arguing that data become informative within the graphic via the mediation of the design process and the conceptual relations and intelligently developed within the page.

> *"Such a view implies that data has a meaning and that the task of design is merely to make it available… However this judgement must be re-examined by addressing the distinction between data and information. Data per se is meaningless. It merely is a collection of symbols/interfaces."* (Kazmierczak 2003 p.46)

It is in the very act of designing the elements that allows the conveyance of information, not attributes inherent to the data.

> *"The core of design or graphic presentation is not graphics per se, but information is 'what the graphics are doing or saying'. The distinction stresses the fact that the essence of graphics lie not somewhere outside design, but in the graphic itself".* (Kazmierczak 2003 p.46)

In the area of visualisation, information and meaning co-exist and both belong to the human domain, validated by human experience and communication. Orna (2011, p.1) presents information integrated within human activity as *"…what we seek and pay attention to in our outside world when we need to enrich our knowledge in order to act upon it"*, transforming and internalising this information into knowledge through guidance of *"actions and interactions"* with the outside world. When the need comes to communicate what we know to others *"we have to make it visible or audible to them, by transforming it and putting it into the outside world, in the form of Information"* (ibid). The designer throughout the process internalises and externalises information to a personal level of understanding via methodical and cognitive operations and an equally implicit graphic negotiation.

The above views on information (Kazmierczak 2003 p.46; Petterson, 2000, p.2; Orna, 2011, p.1) are in agreement with the description of tacit knowledge (Polanyi, 1983, p.4; Friedman, 2003; Mareis, 2012) as the act of transforming data to information acquires internalised characteristics, under the constant effort to communicate content. An explicit and clear mention of the terms supported by peer reviewed sources is often omitted in design publications in favour of more generic descriptions, creating an epistemological ambiguity on how the concepts evolve or interact. The three concepts of data, information and communication exert major influence on design activity and for the purposes of this study act as key points of entry for the conversations with designers.

2.4 Information Design as a transition between Data, Information, Knowledge and Wisdom.

Nathan Shedroff (2000) connects information design with user experience and gradual comprehension of information visualisations as a transition from data, to information, knowledge and ultimately wisdom. Epistemological positions on various levels of understanding as a way to maintain focus are examined, enhancing knowledge, providing context and confidence for the reader to engage the artefact and achieve design goals. Shedroff (2000, p.270) agrees that graphic elements contribute to the formation of information design today, highlighting the importance of refinement and clarity in the design process; however he maintains that information design should neither banish aesthetic concerns nor focus on them either, as it is no substitute for the rest of the visual disciplines but a separate way to provide a framework for expressing their capabilities.

In a data abundant environment, the designer focus aims towards the comprehension of observer understanding, keeping distance from simplistic concepts and presentations of data having little or no personal value. The process is divided between four stages, transforming 'data' to 'information', subsequently 'knowledge' and eventually 'wisdom' (figure 2.1). In such a way knowledge is a phenomenon that can be built for others through meaningful experiences forming a continuum that the audience will follow: Shedroff analyses each of the four critical stages further and describes potential use of these elements as part of the process with communicational character.

Data are the minimum, necessary elements for production of knowledge, usually products of research, creation, collection or discovery. By nature data are disinteresting, incomplete or inconsequential and poor carriers of communication without further work or adaptation. In fact most of what is called information technology for Shedroff is only data technology, because it does not address understanding (Shedroff, 2000, p.272). Communication of information is not addressed merely with storage, processing, and transmission (ibid), but successful communicators must venture beyond this point, providing context and further building meaning.

Information is presented as the first level of communication appropriate for wider audiences. It represents the transmission of thoughtful messages that reveal the

relationships and patterns among the data presented. Transforming data into information is accomplished by organising them into meaningful form, presenting them in appropriate ways, projecting internal meanings and communicating the context around them (Shedroff, 2000, p.273). It has to be noted that these perspectives on information are aligned with the anthropocentric and communicational views of Petterson, (2000, p.2), Raskin, (2000, p.342-343) and Kazmierczak (2003 p.46), on creating information design artefacts.

Knowledge is described as the pay-off of any experience generated, and is built by compelling interactions with others or with visual systems in a manner that patterns and meanings of information can be assimilated.

> *"It is the holding of accurate information or warranted understandings and beliefs about the universe and any thing or idea or concept that resides within it. This includes understanding of material and nonmaterial phenomena, characteristics of these phenomena, and relationships among these phenomena." (Johnson, 2008 p.487)*

Shedroff (2000, p.273) analysing these dimensions on information design context presents three types of knowledge: At the beginning of the spectrum, lies personal knowledge, unique to each person's experiences, followed by local knowledge that is shared by a small number of people, and reaching global knowledge, shared by a global community. Global knowledge, relevant to the aims of information design, is process based and necessarily limited due to its reliance on high levels of shared understandings and agreements about communication. Effective communication, which must take into account the audience's knowledge base, becomes more difficult with larger groups as the pool of shared knowledge is less detailed and far more generalised. As knowledge is gained by a process of integration through presentation to the mind of the audiences and has participatory nature, this is a state that all communicators should strive for. It is also the highest level of understanding that designers can affect directly as it is the responsibility and capability of the audience to move beyond this point (ibid).

Wisdom is described as an intimate form of understanding, a metaknowledge highlighting the inadequacies of personal knowledge (Sterberg, 1990, p.3) difficult to be articulated fully in explicit terms. An attempt to summarise qualities of wisdom on information, knowledge and decision making is presented by Srernberg (2003, p. 147) as the:

Elusive and philosophical in nature, wisdom blends all the processes and relationships that become understood through experience (Shedroff, 2000, p.273). It is the result of contemplation, retrospection and interpretation, a process different for each individual. Designers can not directly transmit this level of understanding, yet indirectly can create experiences that describe processes, facilitating comprehension of the subjects of the designed artefacts.

For Shedroff, the beginning of a process of transformation and change of data into more meaningful and organised forms is critical: the choice of which organisation is more appropriate relies on experimentation and reflection rather than strict formulas. Eventually organisations can be combined forming larger structures, with each structure containing multiple organisations where the application of metaphors can be used as a strategy to establish context and benefit the user experience within the representation of information. Clarity, not necessarily simplicity, should be a constant goal throughout the process; focusing on particular messages and goals at the time as maintaining focus on the designer goals.

A basis for understanding the relationships of data, information and knowledge in a design context is offered in the form of transition: by explaining a gradual evolution from data to information structures, knowledge and eventually wisdom. To achieve this, a conceptual model is provided by exploring the potential of personalised understanding, while at the same time stimulating reader's interest. This is important as it forms a basis for further theory building in the area under investigation, including the designer as an editor and organiser of content through the design process. Moreover, Shedroff underlines the importance of the process during practice by providing the essential characteristics of each stage, characteristics that are rarely mentioned within the literature of information design.

However, Shedroff's theoretical explanation, even if makes clear a rudimentary map of activity for the editorial information designer, remains vague and surprisingly non-specific on the details of how this transition is happening. The theoretical standpoint remains away from any form of empirical research or study or any form of detail of the

stages; the theory lacks the support of specific examples based on practice that would confirm or disprove the pertinence of the proposed model, offering valuable key points for further investigation.

The problem of offering precise examples, articulating specifics on design practice, is connected with the implicit and tacit nature of design and the fundamental differences between the role of the design researcher and the design practitioner, worth exploring in detail.

2.5 Designer Knowledge and Design research

Archer (1981) provides a simple but useful definition of research: "Research is a systematic enquiry, the goal of which is knowledge" phrasing in one sentence the aims, objectives and outcomes of research. However, in the area of design practice an entirely different set of objectives exist, aligning towards the production of innovative artefacts with exploratory and experimental methods, of which the components, aims and objectives rarely need to be spoken or explained. The designer is focusing on the production of outcomes with the accumulated design knowledge remaining personal, developing understanding through the act of making (Heyligen, Cavalin & Bianchin 2009, p.103)

In contrast to design practitioners, by employing explicit and articulate structures describing critical processes, researchers of design communicate design knowledge making it available to others in re-useable forms. In this difference lies one of the main issues that researchers need to overcome: to carefully examine and understand a set of strategies, practices and applications of special significance to the designer group that fails to conform to conventional or scientific classifications, frequently defying logical structures or expected outcomes. A classic example of these difficult to foresee situations is the Primary Generator by Darke (1979): In a series of interviews conducted with architects describing methods of designing housing in a complicated environment of legislative and economic controls, the participants defied scientific analysis, latching onto relatively simple ideas early in the design process to initiate iterations of modelling – revealing a major divergence from the expectations of the time:

> *"Designers do not start with a full and explicit list of factors to be considered, with performance limits predetermined where possible. Rather they have to find a way of reducing the variety of potential solutions to the as yet imperfectly understood problem to a small class of solutions that is cognitively manageable. To do this they fix on a particular objective or small group of objectives, usually strongly valued and self-imposed for reasons that rest on subjective judgement rather than being reached by a process of logic. (Darke, 1979, p.43)*

The Primary Generator was indicative of the unseen, self-imposed and up to a point illogical from a conventional sense practices; implicit yet highly effective in their application.

Designer strategy, practical and exploratory, evolves in a different direction to the researcher's strategy; the latter pursues theoretical outcomes in the form of explicit and articulate arguments, identifiable and practically verifiable. The gap between tacit knowledge which is embodied and inarticulate on the one hand and formulated theory on the other, is described by Michael Polanyi in his classic study 'Personal Knowledge':

> *"It seems to me that we have sound reason for... considering theoretical knowledge more objective than immediate experience … a theory is something more than myself. It may be set out in paper as a system of rules, and it is more trully a theory if it can be put down in such terms"* (Polanyi, 1966, p.4)

This immediately outlines the challenge that design researchers have to overcome through conscious use of methods and methodologies: Design knowledge can be unfamiliar or even entirely unrecognisable to the researcher as it is expressed in a diversity of forms, it first has to be located and defined through detailed examination of primary material and take explicit and articulate forms complying to the current forms and practices of knowledge dissemination. A central concern of this study is to convey part of the implicit knowledge of editorial information designers in explicit terms through credible and tested design research methods and methodologies. In order to fulfil this objective and build a platform where material is complicated to outline the knowledge gap, the relations of tacit knowledge and design research must be examined.

2.6 Tacit knowledge and design Research

Tacit knowledge is a guiding principle in contemporary design research; researchers frequently draw from the concept to describe generated knowledge from research activity (Mareis, 2012, p.61), as the process of design is frequently non-standardised and

potentially incorporating unseen characteristics not easily detected by hypothesis driven testing. (Darke, 1979) (Lawson, 2006, p.46). The different ways of operation, objectives and outcomes make design processes a rapidly changing landscape, with each group of designers developing their own "language" to describe the material of their work (Lawson, 2006, p.54-55) and posing a considerable challenge to overcome, when attempting to communicate this knowledge especially in non-designer audiences.

The idea of the tacit speaks of the speechlessness to which designers have often attested when they have to submit their knowledge on processes and practices in normative language (Polanyi, 1983).

Containing elements of knowledge which cannot easily be articulated or verbalised, the above literature acts as an indication and explanation as to why expert practitioners can demonstrate their technique in the form of design artefacts, but aren't always able to succinctly narrate the details of their craft. At the same time, and by recognising the effects of the tacit, an uncomfortable realisation surfaces: Processes and practices essential for knowledge production remain undocumented by the works of practitioners-authors, compensating for this lack of explicitness by focusing on self-evident visuals.

The design outcome speaks little of the actual processes transpiring within the creation of infographics: Each visualisation is built within a framework of ideas, actions and relationships that modify content, acting as indicators of personal design practice, but they also contain the potential to be descriptors of characteristics that define a discipline, parts of a continuum, verifying a greater theoretical framework.

More specifically as Heyligen, Cavalin and Bianchin point out there is a gap in the artefact centred analyses unable to describe crucial concepts of the design process necessary for the transference of knowledge.

> *"In other words, design as such is not a form of research, but may incorporate concepts that need elucidation through research—precisely because their source is not so much design practice, but a much more complex network of reflective thinking or implicit cultural learning. These concepts are part of the tacit knowledge designers use as a kind of cultural know-how, or even make explicit in a kind of know-how. Yet making these explicit is not part of the design process."* (2009, p.103)

Although practitioners evolve the design discipline by continuous action, to accept the production of artefacts as self-explanatory and the following post-production analysis as self-evident research is erroneous, there is a risk of accepting a common set of concepts in literature without effective critique, establishing a circulation of theory on an a priori basis, stagnating discourse.

Accepting the same sets of actions as self-evident research can also have another adverse effect: To accept them as natural and thus allowing a place in literature without examining the potential virtues or flaws. As Mareis (2012, p.71) describes:

> *"The currently targeted nexus of design practice and design research seems to indicate a vulnerability that would allow conveyed historical and socially standardised (self-)conceptions to flow into design research as 'naturalised' findings to be perpetuated without being questioned." (2012, p.71)*

This naturalisation has the potential of creating epistemological ambiguities in design research and the subsequent articulation of designer knowledge. By reducing specificity at the conceptual and practical levels these notions are perpetuated without questioning, becoming implicit statements used to discuss a subject without truly addressing it. The real practices and motivations of designers remain largely unseen and unaddressed.

Also within a limited field of discourse, these implicit notions can degenerate into statements of self-validating nature in which effective testing is impossible, acquiring a status of philosophical tautology: meaningless on their self-determining character (Temple, 2013). Through repetition, as these concepts gain increased presence within design discourse, they hamper the practices of knowledge production, making investigations less critical and more descriptive in nature. Thus the researcher, in order to establish a framework of validity for the study, has to carefully select and examine primary material stemming from designers and look at the areas of epistemological blind spots by approaching the precedents with critical intent, focusing on designer narratives in conjunction with artefact analyses.

There are established types of research where reflectivity and participation are essential components of the research method: Examples of this research direction are Autoethnography and Action Research. In Autoethnography, the autobiographical and personal connects with the social and political bringing new research material, *"making*

the life of the researcher a conscious part of what is studied" (Ellis, 2008, p.48) and generating new and valid research outcomes. Similarly Action Research is a methodology suited to research and support change, "*integrating research with exploratory action to promote development*" having an *"ongoing impact on changing practice for participants and on a wider audience through its publications"* (Somekh, 2008, p.4) providing solutions to transfer research knowledge into changes in practice (ibid). Both of these areas are examples of how difficult areas of inquiry can become 'visible' in research terms.

While design practitioners of the area under investigation are not yet in a position to fully articulate the reasons and connections of practice, they are aware of the importance and implications of their activity, as their activity is verified by success of their work. Within the above lies the knowledge gap within the current literature of editorial information design; the literature could benefit from a combined examination of the middle ground of material from various backgrounds and gain insight in research terms grounded on designer intelligence and the intelligence embodied by the designer within the artefact itself.

2.7 Areas of investigation for design research.

In order to successfully investigate the highlighted knowledge gap, a categorisation of the area of practice must first take place, describing designer activity adequately in research terms. Cross (2007, p.125) delineates the area of theoretical investigation, providing categories of sources upon which design research can focus to detect, develop, articulate and communicate the needed knowledge: People, processes and products, three areas of investigation that evolve into a threefold taxonomy of 'design epistemology', 'design praxeology' and 'design phenomenology'.

In the first category, of design epistemology, lies the human ability of designing which includes both anonymous vernacular design as well as the 'high design' of professionals that is valuable to investigate. It is oriented towards the *"theoretical deliberation and reflection on the nature of design ability. It also relates strongly to considerations of how people learn to design"* (ibid, p.124)

In the second category, of design praxeology, lies the tactics and strategy of designing, practices that facilitate and characterise practice: *"the study of the processes of design, and the development and application of techniques which aid the designer. Much of this research revolves around the study of modelling for design purposes".* (ibid, p.124)

In the third category, of design phenomenology, lies the knowledge contained within the artefact as a product of the previous stages, instilled with some latent but highly effective solutions on design challenges. *"Design knowledge resides in products themselves: in the forms and materials and finishes which embody design attributes… design work entails precedents or previous exemplars … [that] actually contain knowledge of what the project should be".* (ibid, p.124)

In the following sections of the chapter the three areas described by Cross (2007, p.124) are used as thematic categories to present material drawn from the existing literature. These elements situate, explain and outline context, activity and cognitive mechanics of editorial information design allowing for in-depth understanding of the intrinsic strengths of design, providing validity and transference on some of the most tacit or inarticulate elements of practice. The separation that comes as a result of the three categories is critical for structuring the literature review of this study, because it is the most apt to categorise design activity and bring together diverse elements from design theory that would otherwise be impossible to align with information design practices: It is a holistic mechanism of classification with the potential to connect layers of activity defying narrow disciplinary barriers. Moreover, the openness of the classification permits the emerging literature material to enter the knowledge accumulated from this study with independence and impact; facilitating constant re-examination and reflection of findings in a way compatible with the chosen methodology: The study is about uncovering details of editorial information design practice, without presence in existing literature, the literature review in that light becomes a tool to make sense of emerging elements via critical perspectives.

At the same time, the categorisation also has a few points worth considering in research context. The three areas of epistemology, praxeology and phenomenology are large areas of philosophical enquiry (Stone, 2008. p.264; Tierney & Sallee, 2008, p. 676 and Adams& Van Manen, 2008. p.614 respectively) with extensions and localised forms in multiple disciplines. The use of the synonymous terms by Cross (2007, p.125-126) is

selective and necessarily reduced in breadth: the question of their applicability or appropriateness of use over others, soon surfaces while undertaking a research study. For example epistemology and praxeology are terms more familiar with introductions in design research, while phenomenology is more abstract and less used in relation to the designer and the act of designing. However the full definition and clarification of design activity is far beyond the scope and limitations of this enquiry; for the purposes of this study the precedent offered by Cross, a classification that stems from empirical studies on design, is considered suitable and sufficient.

The three territories of knowledge form thematic categories where theoretical views are examined and discussed within the literature review, allowing categorisations and clarity on an ill-described area of practice, strengthening research knowledge and awareness for the data gathering and analysis phases.

2.8 Elements of Design Epistemology

Design epistemology consisting of a set of methods were designer knowledge is generated, considered and successfully transferred is the first major category examined, bringing together abstract theoretical material as well as frameworks of action. This section examines selections of theoretical material in an effort to clarify critical areas relating to activity and elucidate designer practice.

From general design theory the dimensions of medium, as well as the design characteristic reaching between different kinds of cultures of knowledge and literacy is explored. Initially the medium of practice, a rarely discussed issue within literature, is examined. The use of "designing by drawing" allows designers to maintain extensive multi-level interaction of elements within the page: the visual outcome is contained into the printed or digital forms of the newspaper and necessarily plays an important role. Designing in two dimensions acquires special significance for designers, contributing to a high degree of experimentation, allowing for the refinement of multiple parameters within the same area, creating inferences and correlations with impact on process and knowledge production. Subsequently the special connection of designer work with elements from the sciences and the humanities is an area with equally great interest for the researcher, as design expresses and connects material from both areas and different

types of literacy. Situating design activity and establishing context is essential for an in-depth inquiry on practice legitimising the design perspective as a unique carrier of information between humanistic and scientific ways of representation and communication.

On the other hand, epistemology of information design reaches to dimensions and areas within the discipline where knowledge is embedded. Each epistemological framework developed offers a unique perspective linked to a paradigm of structuring and understanding outcomes. A system that points towards a constantly shifting environment for designers and audiences is presented by Dervin (2000) , in effect co-constructing understanding. Linguistic and naturalistic notions are used to describe the basic principles of visual language where commonly accepted concepts allow perception to translate the message of the graphic by Neurath (Neurath, 1983; Uebel 1995). Principles of a structured-semiotic perspective, where the careful selection of data creates an environment of inference for the reader, are presented by Bertin (2011, 1984).

2.8.1 Designing in two dimensions

Editorial information designers design mainly, yet not exclusively, in two dimensional space. Whether on a draft stage where the subject is investigated or the final stages, the shapes interact freely, having no physical constraints. The actual forms of the graphics can be diverse and experimental: by introducing formulas of representation, designers produce a constantly increasing amount of visual strategies, covering the needs of new challenges, rising with individual projects.

Lawson (2006, p.26) discusses the practice of designing 'by drawing', establishing a set area of inference where high density information is contained and objectives can be reworked continuously until a satisfactory conclusion is reached.

> *"Compared with the vernacular process, the designer working in this way has great manipulative freedom. Parts of the proposed solution can be adjusted and the implications immediately investigated without incurring the time and cost... The process of drawing and redrawing could continue until all the problems the designer could see were resolved. ...Such a design process then encourages experimentation and liberates the designer's creative imagination in a quite*

revolutionary way making the process almost unrecognisable to the vernacular craftsman." (2006, p.26)

In this way the designed artefact is not only a medium to communicate with the audience and provide basic instructions, but also a way of connecting the visual with the cognitive to a "very thinking process that we call design" (ibid). Within this method, negotiation with the subject indicates a deep thinking operation of problem solving, holding "large bodies of information to interact" (Cross, 2006, p.57) and enabling designers to handle "different levels of abstraction simultaneously" (ibid.) The act of designing is at the same time, experimentation in progress as well as the final piece; a situation often leading to new and unexpected solutions (Lawson, 2006, p.182) (Cross, 2007, p.65).

The above are similar to the critical-reflective approach presented by Schön (1983) as 'a conversation with the drawing' or 'a conversation with the situation' (Schön and Wiggins, 1992). Making the physical spaces of designing an area where important series of operations are taking place in different conceptual and practical levels. For information designers the medium of formulation, effectively is also the medium of development and the medium of final expression, where self-informing strategies and reflectivity are used to realise and overcome design problems.

The outcome of these processes, which is captured in information diagrams leads to detectable characteristics between key properties, in the form of patterns embodying design qualities, as a way of describing commonly-occurring document design solutions to particular problems. This theoretical approach stems from the framework originally set from Christopher Alexander (Alexander, Ishikawa & Silverstein, 1977; Alexander, 1979), which had successful application in a variety of fields including Architecture, Human-computer Interaction and Design. As Waller, Delin and Thomas maintain:

"For Alexander, and for followers in other disciplines, a pattern is a format for capturing insight into common problems and their solutions, and for understanding the relationships between them." (2012, p.6)

In such way the graphic structures of discourse become more visible and the shifts in the clusters of visual and linguistic features that occur and recur as regular solutions to particular problems can be well documented with the use of software (Ibid, p.24). The discovered patterns can be stored in online libraries or repositories, such as

InfoDesignPatterns.com (Behrens, 2008) and can be critical to the exploration of information design practice, allowing visibility of designer activity and processes; however, at the point of the writing of this thesis the corpus is currently too small to support general claims (Waller et al., 2012, p.24).

At present there it is unclear how editorial information designers utilise two dimensional space, how the refinement of multi-layered content is harmonised to achieve desired results, or build effective structures to convey information: although there are some prominent theoretical perspectives, their pertinence remains to be confirmed. The process of designing in two dimensions, rarely agreed upon and containing numerous shifts of thinking and exploratory tendencies (Cross, 2007, 99-116) is too complicated and personalised to be completely accounted for. Nevertheless by obtaining primary data from designer actions and critically analysing those in new categories, tendencies and tensions emerge, outlining the basic characteristics.

One of the reasons of this gap on explicit mentions in literature is the very way that designers create content: frequently material from the sciences or the humanities is used for design purposes successfully communicating a given subject, yet designers are not experts of those fields. Design is a separate culture with its own methods and strategies, worth investigating further.

2.8.2 Design as a culture

Information designers are called to visualise specialised concepts and to disseminate large volumes of information in simple, cognitively manageable ways to their intended audience. This often raises concerns about the status of design practice and appropriate use and validity of the conceptual tools used during the act of designing.

Cross (1982, p.221; 2007, p.17) identifies humanities and the sciences as dominant cultures influencing social and educational systems, while design is presented as an emerging third culture to cover the gap between them.

Cross builds an argument for design in two parts: The first is that design can stand as an independent culture in social, cultural and educational levels with distinct goals and methods. The second is that elements constituting the design culture has often been

wrongly attributed to the other two and not easily recognised, "simply because it has been neglected, and has not been adequately named or articulated" (2007, p.17).

The first two cultures besides societal recognition have long been integrated and researched, while the emerging third culture of design is still lacking educational background and acceptance. Drawing from the conclusions of the RCA report, 'Design with Capital D' (1979) Cross summarises core characteristics of the design disciplines

> "The central concept of design is 'the conception and realisation of new things"
>
> "It encompasses the appreciation of 'material culture' and the application of the arts of planning, inventing, making and doing"
>
> "At its core is the 'language' of modelling; it is possible to develop students' aptitudes in this 'language' of sciences (numeracy) and the language of humanities (literacy)".
>
> "Design has its own distinct 'things to know, ways of knowing them and ways of finding about them".

Cross (1982, p.222; 2007, p.18) further elaborates on the characteristics that compose each of these cultures by providing the phenomena of study, methods and values:

> "The phenomenon of study in each culture is:
>   in the sciences: the natural world
>   in the humanities: the human experience
>   in design: the artificial world"
>
> "The appropriate methods in each culture are:
>   in the sciences: controlled experiment classification, analysis
>   in the humanities: analogy, metaphor, evaluation
>   in design: modelling, pattern-formation, synthesis"
>
> "The values of each culture are:
>   in the sciences: objectivity, rationality, neutrality, and a concern for 'truth'
>   in the humanities: subjectivity, imagination, commitment, and a concern for 'justice'.
>   In design: practicality, ingenuity, empathy, and a concern for 'appropriateness'."

From the above we observe the qualities of design practice, forming its own ways of literacy, standing on even ground with the sciences and the humanities. With the synthetic, practical and empathic characteristics design can act as bridge, connecting the two other cultures and combining elements to draw different sets of conclusions. Designers are found often in this position, bridging through design activity separate perspectives, in for example the natural world of science, with the human experience of

the humanities. This is achieved by adopting tools and materials from different areas to deliver outcomes, driven by experience and creativity and balancing between knowledge and expression.

Harland evolves the argument developed by Cross and originally conceived by Archer by presenting design as a pendulum swinging between the sciences and humanities (figure 2.2) resulting in a merging of concepts from the three cultures into the design artefact (2009, p.3259, 2011, p.30).

> *"In doing so we are able to elevate Design to a position of prominence more in keeping with the notion that Design is a bridge between the Science and the Arts. This reorientation has been described and depicted as Design being at the fulcrum of a pendulum that swings between Science and Art."*

Ultimately Harland suggests that design not only connects diverse concepts between sciences and humanities but also connects the core of the underlying ideas of writing systems and pictorial representations to convey ideas as a culture of equal standing (2011, p.31) (figure 2.2, right).

> *"This is demonstrated using three hexagons. In constructing the diagram, Science, and its association with left-brain activity, is positioned accordingly on the left. Humanities is on the right, with Design helping to form a triangle of 'human knowledge and ability."*

As at the time of the writing, a theoretical basis that contextualises and connects phenomena, methods of study and core values is missing from the literature of editorial information design. Lacking the basic legitimisation on the use of concepts of the other cultures, the theoretical material avoids a close examination of practice and retains in obscurity and outside the developed discourse, core elements of the discipline.

The separation of word and image, abstraction and detail, technicality and accessibility is resolved by designer intervention and arrays of practices that display characteristic design awareness and design intelligence (Cross, 2007, p.126). The design intelligence, personalised and private in design practice, can be exposed by the perceived interactions with the other two cultures: The relations of designers with experts, the level of engagement with data, and the methods employed to make meaning accessible to the audience in humanistic ways. All these are key areas that when properly developed increase awareness and potential for knowledge production by tapping into tacit designer knowledge.

Designers are experts in their own area, but are not yet fully accepted by the global community, in equal terms such as the sciences and the humanities (Cross, 2007, p.17). However the same group, through artifice and a successful combination of concepts, makes communicable and accessible complicated content via design methods. One of the abstract views on why and up to an extent how, comes from Dervin (2000), negotiating chaos, order and individual understanding in design.

2.8.3 Chaos, order and sense making

Brenda Dervin, (2000) challenges the traditional view of natural communication and information as part of an ordered reality with instructional properties. For Dervin, pervading theories consider information as an element ready to be distributed: as a set of concrete objects ready to be exchanged from time to time, place to place, and person to person. Instead the idealised, representative and isomorphic relationships of information with reality are rejected, and a hermeneutic, constructivist approach is developed, arguing that information is in fact always designed from human entities, providing multiple possible interpretations for the individual.

To provide further context for the proposed alternative, a simplified history of treatments of information in the western tradition is presented, through rough chronological narratives (Dervin 2000, p.37):

1. *Information describes an ordered reality.*

2. *Information describes an ordered reality but can be "found" only by those with the proper observing skills and technologies.*

3. *Information describes an ordered reality that varies across time and space.*

4. *Information describes an ordered reality that varies from culture to culture.*

5. *Information describes an ordered reality that varies from person to person.*

6. *Information is an instrument of power imposed in discourse on those without power.*

7. *Information imposes order on a chaotic reality.*

Three themes are presented regarding the nature of reality, the nature of human observation and the involvement of power. Regarding the first, Dervin claims that the ontological assumptions of information to describe reality have first been tempered and then directly contested. The tempering came first from the growing limits of human observation (no 2) and the growing understanding of time and space (no3), until the very foundational assumptions of reality were shaken (no 6-7), eventually creating a duality with one opposite that of the ordered universal reality and on the other, the chaotic and inaccessible reality.

Through this abbreviation of philosophical history, Dervin suggests that narratives from no2 to no 7 are in fact struggles to maintain narrative no1, the information as descriptor of an ordered reality. Within these narratives reside a number of polarities that generate elements impacting on the design and implementation of information systems. Alternatively these narratives can be perceived as inherent contradictions, a part of a greater whole, reconceptualising the narratives as parts of a larger picture. By the acceptance of all the seven narratives as being useful, the inherent contradictions between them can be overcome, thus Dervin proposes an 8th alternative narrative :

> " 8.   Information is a tool designed by human beings to make sense of a reality assumed to be both chaotic and orderly" (2000, p.39).

The eighth narrative as presented places the human condition and perceptions on human life simultaneously in orderly and chaotic states, underlining the importance of this ontological position to how human and human systems handle differences in information making and information design. By Dervin's own words (2000, p.40):

> *"In contrast narrative No 8 forces us to a different resolution one with profound implications for information design. The resolution is that in the face of differences we must look for differences not in how humans individually and collectively, see their worlds but in how they 'make' their worlds i.e. construct a sense of the world and how it works. This view is more than just a mandate to understand how others see the world; it makes that understanding an ontological necessity. For if we conceptualise the human condition as a struggle through an incomplete reality then the similar struggles of others may well be informative for our own efforts".*

In such a way, human beings are unable to be completely instructed and attain full information through systems, mediums or designed artefacts. By assuming the co-existence of both orderly and chaotic states, what emerges is the understanding of the usefulness to conceptualise persons as *"information designers rather than information*

seekers and finders" (Dervin 2000, p.41). With each individual bringing unique perceptions on reality, ultimately the very idea of fact and concepts related to making facts is challenged and the process of "factising" i.e. continuously creating facts based on these perceptions emerges.

Information no longer resembles a packet to be economically and effectively packed for distribution, it becomes "in effect metadesign: design about design, design to assist people to make and unmake their own informations, their own sense" (Dervin 2000, p.43). As a consequence, this theory decrees that the main aim of designing an information system is to assist people in designing their own information and in particular share the ways to struggle through order and chaos to reach this point.

Sense making has a strong phenomenological position, having the actor inherently involved with observations , understood by the actor's perspectives and knowledge acknowledging a reality that is assumed to be both 'chaotic' and 'orderly'.

> *"Sense making, then, brings these assumptions together by asserting that - given an incomplete understanding of reality (ontology) and an incomplete understanding of what is to know something (epistemology) – we arrive at an uncompromising problematic for the human species: how to bridge persistent gaps in existence (gaps between self at time 1 and time 2) between person 1 and person 2, between person and society, organisation and organisation and so on). From this reasoning, Sense-Making extracts two assumed mandates for the species: one is to make sense without complete instruction in reality, which is itself in flux and requires continued sense making; the second is to reach out to the sense made by others, in order to understand what insights it may provide into our continuing human dilemma." (Dervin, 2000, p.44-45)*

Sense making makes a meaningful contribution to the epistemology of information design by exploring further the concept of information within the field of communication, bringing legitimate reasoning about the process of designing information and targeting wider audiences. The notion of metadesign: designing about design, creating structures for individuals to analyse and generate conclusions is a potent model on information visualisation. As attempts to create rigid systems of information transfer with visual characteristics were unsuccessful so far, acknowledging reality from the designers perspective in a state of flux has considerable merit, especially when considering the diversity of the readership of editorial information design and transcends the boundaries of instructional forms of information, shifting the attention

and energy of the designer towards anthropocentric understanding and aligning with Karmeziack (2003, p.46) and Petterson (2000, p.2).

However, Dervin's views coming from a background residing in the theory of communication haven't been tested in an editorial information design context, making them pertinent but at the same time questionable as to if they reflect designer knowledge. The theory refers to meaning in a too abstract way and completely bypassing the visual properties integral to information design and editorial information design as the design group rely on vision and perception to relay the message. This is critical for editorial information design readers: to make sense, is to 'see' the intended message through convincing visual mechanisms, transferring information and intended message via familiar, simplified yet potent means. For this type of inquiry, it is necessary to turn the focus on a philosopher and social scientist influential on visualisation of information and the idea of the intersubjective.

2.8.4 Naturalistic and intersubjective communication

Otto Neurath's contribution in the area of information visualisation and visual communication has a long standing presence in literature and conferences of information design. The epistemological stance of his visual method was influential to many design approaches on communicating information to public audiences. His work on ISOTYPE (International System of Typographic Education) was closely associated with the philosophical pursuits on language and communication, starting with efforts within the Vienna circle to explore in detail, the application of logical positivism as a method to analyse and communicate scientific observation and theory. The Logical positivist movement brought together two previously unconnected philosophical attitudes: The first one was rationalism, claiming that the access to knowledge was through logic, reality and mathematics rather than observation; the second was empiricism or positivism, claiming that access to knowledge is through direct human observation (Lupton, 1987, p.48).

In this context, the notion of intersubjectivity was debated and theorised as a condition between subjectivity and objectivity: The phenomenon that is personal, or subjective, can be shared and experienced by more than one subject thus emphasizing shared

cognition and consensus to shape ideas and relations (ibid). Language essentially adopted a character of mutual definition and understanding, instead of a private one, with individuals able to communicate and establish specific meanings.

Neurath in this debate supports the position of intersubjectivity as necessary in the use of language, the very act of human communication could not be defined fully in protocol sentences, as part of it will always be highly personalised. In the following example he defines the relationships between personal and public language and the use of 'protocol' sentences, sentences acting as exemplars in logical structures.

> *"The universal jargon…is the same for the child and for the adult. It is the same for a Robinson Crusoe as for a human society. If Robinson wants to join what is in a protocol of yesterday with what is in his protocol today, that is, if he wants to make use of language at all, he must make use of the 'intersubjective' language. The Robinson of yesterday and the Robinson of today stand precisely in the same relation in which Robinson stands to Friday…In other words, every language as such is intersubjective". (Neurath, 1983, p.96)*

He also supports that a full definition of language with protocol statements would be an impossible task, as the necessary mechanics of learning and speaking a language make it always a work in progress. In such way, imprecise, ill-defined verbal clusters can always appear within the language structure.

> *"There is no way to establish fully secured, neat protocol statements as starting points of the sciences. There is no tabula rasa. We are like sailors who have to rebuild their ship on the open sea, without ever being able to dismantle it in dry-dock and reconstructed from its best components. Only metaphysics disappear without a trace. Imprecise 'verbal clusters' [Ballungen] are somehow always part of the ship. If imprecision is diminished at one place, it may well re-appear at another place to a stronger degree" (Neurath, 1983, p.92)*

The above provide a naturalistic attitude towards language and knowledge in connection with its social roots and uses. Neurath followed his contemporaries such as Wittgenstein (Philosophical Investigations, § 253, 2009), examining the distinctions of personal and public language and how these can be interpreted in context. In this perspective, the individual acts as an epistemic agent, understanding himself, the surrounding and the environment, before needing to understand others (Uebel 1995).

As the philosophical inquiry progressed, Neurath turned to the research of visual representation as an alternative to written language, relying on the directness of observation and communication. The visual form is isolating the visual communication

from verbal communication by describing visual experience functioning outside culturally and historically determined systems of meaning (Lupton, 1987, p.47). The naturalistic and intersubjective perspectives of the ISOTYPE were refined and evolved giving a linguistic status in the broadest sense to this visual experiment (Burke, 2010, p.33); making the development of the ISOTYPE system a work in progress until the end of his life.

Although the aesthetic and visual aspects of the system have been covered frequently within design research, the philosophical and epistemological status of ISOTYPE remains less investigated in literature (Jansen, 2009, p.236). As Neurath's work became integrated with a series of visual disciplines and became part of corporate and bureaucratic identity, the visual style of Isotype fell out of style (Lupton 1987, p.55) in contemporary design. Yet the importance of Neurath's work remains an object of study in contemporary publications and research (Jansen, 2009; Burke, 2010; Stadler, 2010; Nemeth, 2010; Neurath, 2010) calling for a re-examination of his writings.

Intersubjectivity and naturalism are potent concepts on communication as the reader engages the visual with familiarity and immediacy and the subject is presented in ways that cognition can focus on the essential messages to be conveyed. Acting as potent carriers of ideas regarding information design perspectives, the metaphor of the ship repairing mid-sea is a way to perceive the production of information with realistic limitations. Structures based on culturally ingrained elements of literacy such as language make effective use of communication in a visual context, especially when communicating with large audiences (Vassoughian, 2008, p.59), where cultural and literary barriers have to be overcome. Through these views, information remains relative and attainable without effort.

On the other hand, Neurath's theory, circulated in peer-reviewed material and celebrated in professional conferences of information design, has a lasting impact on information design, but remains to be confirmed on the specific field of inquiry. The project of ISOTYPE as an immediately recognisable language with natural properties has been gradually less used over the years and rarely seen on information design or editorial information design, pointing to the issues of rigidity of the chosen visual expression: for each concept or object there should be a specific ISOTYPE (an isotype object) making the inventory of icons ever expanding. However traces of his work on

clarity, symmetry, data integrity as also the concept of the 'Transformer' is so closely connected with Information Design practices that manifestations will emerge.

Bertin, another influential theorist and cartographer, offers a way to structure information visualisations through semiosis and pre-defined concepts.

2.8.5 A structured-semiotic perspective

For Jaques Bertin the creation of the 'Graphic' (la graphique) is always part of a well thought system of analysis, homogenous and coherent, forming a graphic language to be analysed dependent on rigorous data perspective and selections for optimal results (Bertin, 2000, p.5; Bertin 1981, p.16). The coherent construction of theory is far more important than gaining the support of experimental proof, following the French academic traditions of analysis and logic (Daru, 2001, p.20). His theoretical standpoint was the development of a way to create an entirely new approach of representing concepts, data and relationships, linking to meaning making processes and semiology:

> *"This amounts to a transition from a simple representation to a "sign-system" that is complete and independent and possesses its own laws, thus failing within the scope of semiology" (Bertin, 2011, p.4)*

With superimposition, juxtaposition, transposition and permutation the graphic image makes available groupings and classifications emerging from it's own structure; becoming a research instrument in itself (Bertin, 1981, p.16) rather than a detailed extension of memory. The methods to handle information and display content bring liveliness and mobility into the production of the artefact as well as the later reception by the reader.

> *"Graphic representation constitutes one of the basic sign-systems conceived by the human mind for the purposes of storing, understanding and communicating essential information. As a "language" for the eye, graphics benefit from the ubiquitous properties of visual perception. As a monosemic system, it forms the rational part of the world of images." (Bertin, 2011, p.2)*

To underline the exact properties of graphic language, Bertin situates the Graphic as a monosemic system in contrast to other systems of communication that can be polysemic, or even pansemic (Figure 2.3). A system is monosemic when the meaning of each sign is known prior to observation of the collection of signs, resembling an equation that "can only be comprehended *only* when the unique meaning of each term

has been specified" (Bertin, 1981, p.179; 2000, p.5; 2011, p2); pointing to the importance of clarity on the semantic value of establishing data. For example a graphic legend is necessary to establish the properties of the sets of line in a cartographic map, maintaining monosemy.

As each sign is defined, and the study of an image commences, sets of questions arise regarding form, function and meaning of the elements. The reader initiates the process of exploring content and questioning the unfolding relationships. The more ambiguous the message, the more interpretation becomes dependent on subjective analysis on behalf of the reader.

> *"Who is this person? What does this mark or this element represent? To answer these questions each person will respond individually, since interpretation is linked to the repertoire of analogies of structures characterising the receiver. And this repertoire varies from one individual to another, according to personality, surroundings period and culture." (Bertin, 2001, p.2)*

Emphasising this solitary read of the image, the momosemic properties of the graphic become necessary to narrow down the possible meanings stemming from a graphic work. The questions forming on the reader's mind become rigid, grounded and well defined. The possible meanings are simplified in advance and set in ways that the comparisons drawn will point to specific, important evidence:

> *"On the other hand, in graphics, with a diagram or map, for example, each element is defined beforehand. The perceptual process is very different and translates into the question: 'Given that such a sign signifies such a thing, what are the relationships among all the signs, among all the things represented?' Perception consists of defining the relationships established within the image or among images, or between the image and the real world. The reading operation takes place **among the given meanings**." (Bertin, 2011, p.2)*

This delimitation of elements initially seems constricting yet as more variables are placed in the form of concepts or content, reader perception is making unavoidable juxtapositions of the elements presented within the page and makes further connections with the real world.

This is why a reduction of elements take place, allowing a "*reduction of confusion*" to take place, where "*for a certain domain and a certain time, participants come to agree on certain meanings*" and "*agree to discuss them no further*" (Bertin, 2011, p.3).The diagram contains the essential elements for presentation, taking advantage of the process of discovery

from the reader. The solidity of structure constitutes in two dimensional space, a "rational moment"(ibid) allowing discussion on the collected signs and propositions in sequence, similar to mathematics and logic. For Bertin, perceiving the medium in two dimensions is atemporal, in contrast to the rest of the human senses. Where for example in the sense of hearing there is a temporality, a continuity and an end; in the field of visual perception elements remain unchanged, static through time for the reader, allowing uninterrupted focus. The graphic utilises a larger palette of variation marks to relay information from the two dimensional space that resides: It has more variables during instantaneous perception, allowing for more effective manipulation of content.

> *"The sign-systems intended for the eye are, above all, spatial and atemporal: hence the essential property: in an instant of perception, linear systems communicate only a single sound or sign, whereas spatial systems, graphics among them, communicate in the same instant the relationships among three variables." (Bertin, 2011, p.3)*

Maximum utilisation of this perceptual power for Bertin within the framework of logical reasoning is the "true purpose of graphics" in the "monosemic domain of spatial perception" (ibid). The quality of the graphic to 'freeze' in time a specific argument, message or sets of connections can provide to the individual freedom to explore and potentially exhaust content if necessary. The printed or digital graphic can remain 'static' in vision allowing depth of analysis and emergence of variables. Rooted at an epistemic level on semiosis and meaning-making via comparison, the focus on the ability of the graphic as a structure to generate content has particular application for the field under investigation (Bertin, 2011, p.4): It provides in explicit terms large parts of the cognitive process that communicates information through given sets of meanings, informing this study on the issue of data and data interaction.

However, looking at the writings of the *'Semiology of Graphics'* (Bertin, 2011) with a critical eye, the researcher realises that theory is far too structured in comparison to other theoretical material on the visual. Bertin's emphasis on coherency over experimental confirmation creates an axiomatic system where key principles are self-evident and never questioned for validity, raising justified scepticism on the extent to which the system can be applied for the creation of graphics. Although offering viable strategies to visualise concepts and connections, geographical elements are dominating the writings and visuals, failing to explain the recent conceptual works appearing in information design. Bertin in an effort to offer a complete system of designing

information rich representations, underestimates the presence of the designer as a communicator and editor of content.

2.9 Elements of design praxeology

Editorial information design praxeology is explored mainly through descriptive methods within existing literature by processes, and sometimes methods or sequences to reach the final product. However, from design studies and information design material it is safe to assume that designers of this field enjoy the creative freedom and exploratory characteristics of designing in two dimensions (Lawson, 2006, p.26). This makes an exploration of the processes of design and development of techniques highly individualised, diverse and as previously encountered, connected with tacit knowledge (Mareis, 2012, p.61).

The exact sequences and causation of the formation of sequences is a significant challenge to overcome, as they are expressed by designers in personal language (Klanten, Ehmann, Bourquin, & Tissot, 2010; McCandless, 2009). On the other hand academic attempts to describe design processes use more complicated terminology and seem removed from design practice examining concepts and phenomena (Mareis, 2012; Heyligen Cavallin & Bianchin, 2009; Friedman, 2003). The researcher in order to discover patterns of practice has to carefully select material from all available sources.

From general design theory, intentionality as a means to achieve a design end is critical, as the outcome reflects the intention of designers to reach completion through a complicated process and embody specific qualities (Heyligen Cavallin & Bianchin, 2009). What is truly useful to communicate and stimulate the narration of tacit knowledge is the exploration of underlying drives and causes for the changes of design strategy. Within the following section the intentionality as a means to affect process will be investigated, highlighting points where designers make a critical shift on strategy, tracing conceptual and practical development of the design process through synthetic and analytic activities.

Information design theory and the theoretical perspectives developed by personal narratives of influential authors offer partial, but important methods of designing and are

effectively design techniques accepted by the design community (Jacobson, 2000, p2). Although none of the views present an optimal method for editorial information design, they can contribute genuine design intentions with clarity, as exemplars of information visualisation practices. Following the ideas on epistemology, the material of this section retains a level of abstraction but also reaches into the pragmatic values and needs of a design task, outlining areas and targets that the designer has to address and fulfil respectively for the designer task to be materialised.

Concepts of orientation and problem solving within the page are described in the theory of wayfinding, connecting cognitive functions with spatial movement by Passini (2000). The position of the designer as a 'Transformer' of information using sets of flexible rules used to deliver graphic results come from Neurath (Burke, 2009, p.211; Macdonald Ross & Waller, 2000, p.190), following the descriptions of visual language. In the same forms of structured rationale Bertin (2011) develops the concept of the 'invariant' as a focus point of relations to build a diagrammatic representation, making apparent classifications of elements and categories to the intended audiences and forming a base for the semiotic processes of communication. Subsequently is presented the concept of 'data-ink' and smallest effective difference, as part of the graphic operations on the page by Tufte (1997, 76; 2001 p.136), enabling unburdened reception of information and also reforming and reworking visual material improving the final output.

All the above perspectives are directly connected to praxeology by offering genuine intentions on the formulation of artefacts and make available critical insight on processes and development of techniques. The body of knowledge informs and further develops the awareness of the researcher towards the emergent elements that follow on the data collection and analysis phase.

2.9.1 Design in mind, design and designer intentionality

Heyligen Cavallin & Bianchin (2009) explore design through designer actions and intentions, used to illuminate some of the less visible areas of knowledge and design practice. Although directly affecting the outcome, such notions remain outside the documented material of design processes.

As the perceived world is reflected in designer perception and cognition through the design processes, the authors maintain that ways of interaction from the world towards design mind and from the designer's mind towards the world exist, having significant impact on ways of designing. The tools of analysis are the philosophical notions of intentionality as introduced by the philosopher John Searle (1983) placed in a design context. Intentionality refers to mental activities that are directed at objects or processes in the world, also reflecting personal opinions and beliefs about the world:

> *These activities result in beliefs, hopes and desires about the world but not, strictly speaking, physical properties of the world: Intentional states thus have a first person ontology (i.e. they exist only because some individual exists who enjoys mental phenomena) (Heylighen et al, p.95)*

This makes intentionality a property of individual mental states bound by two factors: the type of the state and how the state of affairs is presented to the mind (ibid), making intentionality a subjective and content related activity unavoidably linked with other beliefs and expectations of the individual. The states of intentionality can be both cognitive and conative, adopting a world-to-mind or mind-to-world, "directions of fit" (ibid, p.96), conditions which a state would be satisfied with, when matched with the world: These directions connect with the various stages of analytic, synthetic and evaluating operations that designers go through during production (ibid, p.96) (Lawson, 2006, p.48-49), creating a link that provides justification for action and activity. The formation of these intentions provides an asymmetrical view of the world, simultaneously co-existing within the mental process, cognitive and conative states have a different area of effect when related to the artefact:

> *"The content represents the condition under which a state would be satisfied when matched with the world. To satisfy cognitive states they must fit the world as it is; while to fulfil the conative states, the world must adapt to fit them"* (Heylighen et al, p.96)

The nature of these intentions can be area defining and still diverse in nature when looking into particular traditions of inquiry: The scientific way of reasoning is characterised by mind-to-world direction (ibid, p.97) while design is dominated by a world-to-mind direction of fit. Designers are not concerned with not only what is, but what should be (ibid, p.98) seeking innovation, change and progression of ideas:

> *"Their attention is focused on possibility: 'The search for new or better solutions to problems encountered in everyday living.' Thus even if design contributes to the*

> *creation of knowledge, the knowledge created usually is a by-product of an activity with another aim" (Ibid, p.98)*

The lack of compliance with observation and measurement or well established frames of reference, makes the intentional states subjective in the area of design. The solutions that designers produce cannot be true or false, but instead appropriate or inappropriate: "good or bad" solutions to be crystallised in a design artefact, changing part of the world to match the designer ideas. Individual experience evolves in context, as Buchanan points out:

> *"Change has always been an essential part of design, because designers are concerned with creating new possibilities in human experience, mediated or facilitated by human-made products" (Buchanan cited by Heylighen et al, p.98)*

Concluding, Heyligen et al, consider these ephemeral and malleable elements as integral parts of designer strategy: The sub-activities involving experimentation, modelling and sketching, reshape existing ideas about the world through holistic organisations of thought, and "depend on other states being tacitly entertained which, in turn, depend on an active background ability" (ibid, p.101). This is a conscious process for the designer, involving complex thinking to reach the desired goals via justified conceptual tools:

> *"Cognition is rather presupposed by design in two important ways: as a way to navigate the world in order to reach a goal, and as providing the conceptual tools, the knowledge, and the vision necessary to represent a goal."(Heylighen et al, p.103)*

This brings an inherent subjectivity to the design process, as practice depends on elements that remain 'hidden' during activity and the realisation of the outcome being internalised and tacit by the designer. The design formulas and development of strategy are personal in motivation and diverse on the ways of expression, enabling general areas of activity to be drawn, but hindering the effort to highlight the essential drives behind the problem solving process.

This fluidity in strategy and the unexpected shifts in the designed activity during the act of problem solving are also negotiated by Lawson (2006, p.48-49) by presenting a map of the design process after an extensive analysis of historic examples, in which he argues that the separation of problem and solution in design is questionable, suggesting a simultaneity of emergence of both problem and solution within the process of designing (figure 2.4).

"The idea however, that these activities occur in that order, or even that they are identifiable separate events seems very questionable. It seems more likely that design is a process in which problem and solution emerge together.

Often the problem may not even be fully understood without some acceptable solution to illustrate it […] This is all very confusing, but it remains one of the many characteristics of design that it so challenging and interesting to do and study." (Lawson, 2006, p.48)

The synthetic, analytic and evaluative activities of synthesis-analysis and evaluation that negotiate the problem and solution are without beginning, ends or specific flow, but co-exist and interact in the mirrored evolution of the problem and solution relationship of what is "clearly a highly complex mental process" (Lawson, 2006, p.49).

The not yet established body of literature on praxeology of editorial information design, results in much of the decision making and problem solving strategies remaining unmentioned for the area and leaving too much of the strategy relying upon the artefact production on speculation. Although theoretical positions such as intentionality are good starting points, providing substance and support to the argument, praxeology has to be informed and supported by research and study of contemporary practice drawn directly from designer knowledge (Jacobson, 2000, p.3).

The theoretical position of intentionality allows the perception of critical processes informing the study and builds awareness for the data collection and analysis phases. In the following sections the most influential and long-standing views of design intention on how to create two dimensional information visualisation outcomes will be presented. This material is pertinent to praxeology of information design and in extension editorial information design, offering an informed basis on praxeological issues, while taking into consideration the unexpected shifts and complexity of the design process. These are refined perspectives and techniques that revolve around the modelling and production of artefacts and are in consequence essential to the study, making content formation more clear and grounded in practice, thus available for analysis by the researcher.

2.9.2 Wayfinding

Romedi Passini presents a formal theoretical framework based on visual perceptions, cognitive functions and understanding of an individual's surroundings; by examining both

the designer's perspectives and the recipients reactions on information design, building a problem solving process named as "wayfinding".

Structuring information in a way appropriate for problem solving is a primary task, while immediately after comes the understanding of how recipients can realise and solve given problems. A designer provides the necessary elements for users by determining what kind of information is required and how it can be made accessible to audiences.

> *"If information is the issue there has to be only a source and transmitter of information but also a receiver . Respecting the receiver's information-processing characteristics is fundamental to transferring information. The ways people read and understand messages vary with the task and the individual . […] Understanding the ways we process different kinds of information provides the designer cues to the most suitable forms of presenting that information " (2000, p.86)*

Localisation and contextualisation is the key for this process, as a large number of variables affect the viewer, including cultural, social and age differences (Passini, 2000, p.86). This complexity, combined with the intended messages, threatens to bring a state of information overload, a condition that reduces the processing of desired information for the recipients. This is where wayfinding is introduced as a staged process of designing.

Defining the concept of Wayfinding, four stages delineate the overall process. The first one is problem solving, the second is determining the necessary information, the third is the placement of the artefact, while the fourth is the issue of the form that the artefact should take (Passini, 2000, p.88). All the above are used to build an underlying logic that will guide the design process in stages.

Referring to the problem solving properties of wayfinding, recognises three major processes: "(1) Decision making and the development of a plan of action to reach a desired destination, (2) Decision execution, transforming the plan into behaviour at the appropriate place(s) along the route" and "(3) Perception and cognition (information processing), providing the necessary information to make and execute decisions" (Passini, 2000, p.88). These processes incorporate mental representations and cognitive maps, forming a plan of action for the recipient to solve the problem at hand, leading to a successful navigation through physical or mental space.

Passini maintains that efficiency of information is a determining factor for content making and points again to the inherent connection of information with the viewer. Drawing from

observations on empirical studies, he describes two major categories of participants: Those that think in linear, sequential order, perceiving information as leading them from one point of a route to the next and others that rely on information on a spatial sense, to understand an overall picture of a setting and subsequently navigate through (2000, p.90). Designers should be cautious to include information for both categories of wayfinding styles and maintain the coherency of this system of information by also identifying the main access points, key locations and key functions of space from the user's point of view.

On the subject of location, form and presentation, the graphic elements and appropriateness regarding legibility, styles, spacing are acknowledged, as well as environmental situations. Perceiving and analysing the effects of an information design artefact within a quiet stable setting can be a very different experience from perceiving the same artefact in a populated, complex environment where all users are in motion. Designers must be aware of the basic perceptual and cognitive procedures, as well as conducting tests on information displays in real settings and real users, avoiding the generalisation of results obtained in non-typical conditions (Passini, 2000, p.92). This is crucial, especially in circumstances where the viewer is forced to multitask or have partial attention.

Through the presentation of structured ways of problem solving, the design task is materialised by exploring the logic that links decisions into a decision plan and information to information system, characterising the information system in such way that the process of designing is less arbitrary. Passini's theory allows an entirely new practice to emerge, as a "structured ensemble of information that corresponds to a way of solving a wayfinding system" (Passinin, 2000, p.94), providing a powerful metaphor and a structured methodology to process, design and problem solving for information design.

Although initially the aim of the theory was towards movement and orientation in three dimensional spaces, critical material can be extracted from wayfinding for the purposes of this study, as Passini's model is also descriptive of cognitive operations within two dimensions: Reader operations within the designed two dimensional surface can be viewed as a journey of identifying and reaching specific areas within the graphic to draw conclusions and attain understanding. Decision making, design execution and information processing are operations applicable to diagrammatic structures and subsequent navigation through the visual components and connected meanings. The designer can

facilitate reader attention and aid the cognitive shifts of meaning-making through the creation of an 'environment' within the graphic that can be followed to enhance the process of explication.

However, at the same time when 'wayfinding' is placed in context with editorial infographics and the two dimensional space of the news medium, the theory as described raises concerns on the effectiveness of its application. On the issue of problem solving the decision making and decision execution parts are difficult to define, as the presentation strives primarily for multi-layered communication of data and not the display of a single visual solution: the problem displayed in editorial mediums can frequently be multifaceted in nature, consequently what is described as execution is far more difficult to define.

In the same line of reasoning, location, form and presentation are reduced in dimensions and necessarily co-exist, becoming overlapping when the graphic occupies space of small dimensions within the page, raising concerns on the effectiveness of the theory on editorial design environments. The emphasis on navigation can eventually come at odds with the communicational character of the discipline under investigation, the position of the designer as a communicator of complex meanings, not only as a constructor of information, has to be investigated; yet only emergence of notions from primary research related to practice can offer indication as to if this is true.

For this reason we have to look into a view of practice where the visualisation becomes a process where information is not only managed and optimised, but also transformed to bridge the gap between experts and laymen readers, with communicational orientation.

2.9.3 The process as transformation

Otto Neurath while developing ISOTYPE defined a set of flexible rules of designing on how successful information visualisations can reach audiences, fulfilling communicational as well as design needs. Although the theory beyond visual language evolved during the modernist era, Neurath's idea of the 'Transformer', a visual communicator that understands scientific concepts yet provides consciously simplified graphic forms for the public, was characterised by many scholars as a "prototype of the modern information

designer" (Burke, 2009, p.211; Macdonald Ross & Waller, 2000, p.190) and as a consequence central for this study.

The sets of developed rules addressed the organisation of elements within the page: Using multiples of the same objects to provide reference on scale or quantity instead of size, or placing the objects in flat planes and isometric perspective instead of illustrated backgrounds were among some of them (figure 2.5, figure 2.6) (Lupton, 1983, p.54) taking distance from contemporaries of his time. A process of simplification or reduction was enforcing the naturalistic reception for the reader, maintaining a clear simultaneous clear output, governed by logical principles.

> *These rules have both explicit, practical functions and implicit, rhetorical functions. These constructive rules project an image of empirical, scientific objectivity; they also reinforce the "language quality" of picture signs, making individual signs look more like letters, and groups of signs look more like complete, self-sufficient languages. Reduction means finding the simplest expression of an object. It is not meant to stylize the retinal image, but implies the operation of logical, mechanical principles. The international picture appears to be necessary result of mechanized production and scientific method. Reduction does not actually strengthen the relationship between the picture and the object it represents; it can even weaken that relationship by making pictures that are too geometric to be easily read. The implicit, rhetorical function of reduction is to suggest that the image has a natural, necessary essence than a culturally learned sign". (Lupton, 1987, p.54)*

The process had an open ended character and was heavily subject dependant (Burke, 2009, p.211); Marie Neurath explains many decisions were made during the creation of the graphic, allowing the designer to use the sets of rules to make clear visual statements (Neurath & Kinross, 2009, p.9). The transformer, more than an artist or a decorator, was a skilled professional communicator, mediating between expert and reader. The aim of the process was to be multi-layered and inclusive towards every reader, taking advantage of the capacity of the visual medium to reach the viewer. It was important to make information accessible even to those lacking certain kinds of knowledge, overcoming issues of age and literacy. Marie Neurath recollects how children became absorbed by a chart in the Gesellschafts- und Wirtschaftsmuseum in Vienna: understanding scientific data that otherwise would have been impossible to comprehend; it is characteristic of the aims of 'transformation' in the field of communication.

> *"Occasionally I also watched children who came into the Museum on their own accord. I remember a schoolboy who worked quietly at a chart; the younger sister*

holding his hand was not yet bored looked at the symbols, counting them. This was an instance of the charts meaning something for everyone, that excluded nobody, that they allowed several levels of understanding" (2009, p.26).

As Otto Neurath valued the neutral qualities of the displays, immediacy and understanding were the primary ojectives, providing the objective facts in visual forms and leaving judgement and evaluation to the viewer (ibid.). This process of layering developed early on and remained a constant in the creation of Isotypes:

"A picture produced after the rules of the Viennesse Method shows the most important details of the object at first glance; apparent differences must strike the eye immediately. At second glance, it should be possible to distinguish the more important details, and at third glance, whatever other details are to be seen."

By studying the praxeology of Isotype it can be argued that the naturalistic and intersubjective perspectives persist during practice, with the designer balancing scientific and artistic qualities for an optimal output. Neurath reached similar conclusions on how design mediates between scientific and humanistic material many decades before Cross (1982, p.222; 2007, p.18) and Harland (2011, p.31), through empirical means. The criteria rest on how the essential message will convey the appropriate level of detail for the reader (Burke, 2009, p.215), and the application of these criteria fell on the transformer's discretion.

Ultimately the position of the 'Transformer' and its methods seem to incorporate numerous tacit characteristics, hinting but not truly illuminating the stages of the process, making the framework dependant on the specific subjects and artefacts to be communicated, leaving significant gaps by contemporary standards. The developed framework is prioritising experience, experimentation and tacit recognition of individual visualisation's needs over explicit descriptions; these are the same issues that hinder design research on information design and editorial information design today. On the other hand this displays clearly how the information designer has to make informed judgements and bridge mutually exclusive content, realising what experts of fields say and do (Macdonald-Ross and Waller, 2010, p.180) and communicate it to non-expert audiences in visual form. This is a characteristic remaining true to practice to the present day (ibid, 178) in the design field.

Neurath's writings even with some justified weaknesses are essential parts of the examination of the existing literature, providing insight and understanding of the role of

the designer, in preparation of the data gathering and analysis stages. In contrast to Neurath's implicit method of visualisation and creative freedom, centring to the designer as a mediator of content and expertise, another prominent figure of information visualisation focuses on the construction of the visual artefact through correlations within the page -offering a completely different view on practice.

2.9.4 The invariant

Jaques Bertin defines and utilises an explicit conceptual tool to describe the common ground connecting all the elements of the graphic and the characteristics of a graphic system: The "invariant", as it is coined by the author, becomes the core of the graphic, linking the formulation of the visual outcome with the selection of data and bringing together pertinent material, necessary to cover to the subject.

> *"In Graphic representation the translatable content of a thought will be called the INFORMATION. It is constituted essentially by one or several PERTINENT CORESPONDENCES between a finite set of variational concepts and an invariant." (Bertin, 2011, p.5)*

The invariant and its components act as a central piece for the sign system within the graphic and has three major attributes: The number, length and level of organisation of its components (Bertin 2011, p.6) and are presented in sequence :

The first attribute, "The number" of components is crucial as it is the first stage of the analysis of information for Bertin, this is the point that groups of data are selected to enter the visualisation. All "elements", "categories", "classes" and "steps" of the components become clear and distinct.

The second attribute, "Length" is used to describe the number of elements or categories which we are able to identify in a given component or variable. These are the numeric value, the proportion, and the numeric maximum or boundaries; it has quantitative character and identifies the useful and separable divisions of a component.

The third attribute "The level of organisation of components" helps to display the relationships established between components in three levels: The qualitative level, the ordered level and the qualitative level. The levels of organisation "form the domain of

universal meanings, of fundamental analogies, in which graphic representation can stake a claim." (Bertin, 2011, p.7).

From the invariant, a refined approach is presented to initiate and describe in explicit terms the design process, by building connections of information on the attributes connected with the data. The invariant can be considered as the central concept of the diagram or the essential array of information that needs to be communicated and by which exploration and delineation of the areas of the diagram are fleshed out (Bertin, 2011, p.140). What remains after this process is the selection of the most appropriate visual formula to 'contain' the information and in extent the message to be communicated.

Through the invariant, Bertin attempts to make explicit a part of the process only implicitly mentioned within large parts of the literature: The designer's preparation of the data and the steps needed to link and refine dimensions, effectively constructing the infrastructure for a visualisation. Yet two major issues overshadow the proposed graphic system: the first is the axiomatic and almost too well defined process for design practice; the second is the lack of mention of the designer within the completion of a visualisation, raising serious considerations about the extent that the system is indeed connected with design activity.

However even with these weaknesses the semiotic system presented, containing the invariant, is one of the most explicit and articulated attempts to define praxeological processes

> *"…permitting the isolation of the specific domain from the vast realm of human knowledge" (Bertin, 2011, p.140)*

providing strong theoretical background, strengthening the researcher's awareness and providing an informed basis to examine emergent elements of the data gathering and analysis stages.

While Bertin strived to produce a self-sufficient and complete system of graphic visualisation with step by step analysis from data to visuals, with theoretical deliberation, some authors focus solely on the capacity and improvement of two dimensional space and how visual outputs can be further improved.

2.9.5 Data Ink and Graphical Operations - The Smallest Effective Difference

For Edward Tufte, the surface of a graphic is an area of investigation and continuous improvement, as all elements within the page, which even to a basic level can be manipulated to contribute to an improved outcome. Through his writings he offers two concepts highly relevant to information visualisation, the concept of "data ink" and "smallest effective difference" as guidelines to improve design practice.

More specifically, the surface of the page covered by 'meaningful ink' creates relationships with empty space, which if used properly, improve the result: ink on the surface is equivalent to information and the analogy of data-ink must be carefully maintained to assist the absorption of information. Overly crowded surfaces, needlessly adorned or too thick in data descriptions are elements undesired for the presentation of informative Graphics.

> *"Data graphics should draw the reader's attention to the sense and substance of data not to something else. The data graphical form should represent the quantitative contents. Occasionally artfulness of design makes a graphic worthy of the Museum of Modern Art, but essentially statistical graphics are instruments to help people reason about quantitative information." (Tufte, 2001, p.91)*

The elimination of the non-data details within the graphic, allows more clear and more elegant displays to be produced even with similar design formulas, this process of elimination of unwanted material leaves the visualisation with a non-erasable core, defined as 'data ink'.

Data ink within the artefact should be maximised within reason while at the same time the non-data ink should be minimised or erased if possible (Tufte, 2001, p.96), applying intelligent criteria of design to reduce unnecessary descriptions, connections and carriers of information. Redundant data ink, relating to excessive descriptions of elements or unnecessary decoration must be removed as an unnecessary element.

In the example (figure 2.7) Tufte argues that a typical shaded bar, of a bar chart, repeats the same information within the graphic needlessly:

> *"The labelled, shaded, bar of the bar chart, for example, unambiguously locates the altitude in six separate ways (any five of the six can be erased and the sixth can still indicate the height): as the (1) Height of the left line, (2) height of*

shading, (3) height of right line, (4) Position of top horizontal line (5) position (not content) of number at bar's top, and (6) the number itself. That is more ways than needed. Gratuitous decoration and reinforcement of the data measures generate much redundant data-ink." (Tufte, 2001, p. 96-97)

These principles can be used to edit and re-design a graphic in a way similar to the action of an editor, removing the unnecessary words from a text to improve a document. Excess ink can be removed from grids, continuous lines, even surfaces of traditional formulas to produce fresh results that direct reader focus onto the critical elements of diagrams.

The concept of data-ink is improving the overall efficiency of the graphic and affecting the quantity of information that the 'ink' carries to the reader (Tufte 2001, p.136). The designs are becoming more legible and more scalable within the medium, improving the overall quality of the graphic (figure 2.8). More specifically Tufte (ibid) presents four reasons as to why this is the case:

i) Data ink is acting better within the principles of graphic theories as it allows for more information per unit of space displayed and enables the medium to carry additional relative information within the page. A significant contribution, as the history of devices for communicating information is written in terms of increases in efficiency of communication and production.

ii) Data ink, enables the continuous improvement of design alternatives or the improvement of original formulas at the time of genesis. Editing, revising, testing and directing the overall improvement of Graphics.

iii) Data ink also establishes a minimalist yet meaningful connection with the audience, creating a self-explanatory environment for the reader to carry the necessary information and also expand on it. Readers that have little statistic literacy are aided by the less cluttered, compact versions of graphic that the data ink process implemented, while at the same time aids the statistically literate to understand even more from a subject. The graphic improves on sophistication acting in synergy with the accompanying text.

iv) New formulas emerging from the data-ink process of maximisation are contributions to the area of information graphics. Either revisions of successful formulas of the past, or new concepts, are becoming the precedents of tomorrow, evolving an area that

heavily relied on rigid statistical representations. This contribution makes information more accessible to experts and laymen alike.

Data-ink connects data and surface directly: Changes to the graphic representation of data influences the ways that the graphic can be perceived by the reader. By reducing ink levels, the outcome becomes clear and the information contained becomes transferable with increased effectiveness. Data ink acts as one of the few explicit principles on how to improve the visual forms of the graphic and gives a very good example of the interrelations of graphic forms and data, as editing the form affects our perceptions on how we understand and connect data. It is again one of the few explicit examples describing with sufficient justification how to improve a visualisation, an area where designers-authors engage lightly-if at all. On the other hand, data ink remains exclusively focused on the design page, without providing further explanation as to why this is an improvement, leaving further argument to self-evidence which in research terms is highly problematic.

Tufte also argues that a key element to reveal information within a design artefact is the minimum effective difference, the "Occam's razor of information design" (1997, p.73). In designing information, good practice consists of using small but noticeable differences, visual elements that make a clear difference: contrasts that are definite, effective and minimal.

With the successful visual implementation of differences the designer removes the visual clutter of secondary elements within the page, graphically enforcing expression of primary data:

> "The smallest effective difference helps in designing the various secondary and structural elements in displays of information- arrows, pointers, lines, dimension lines, tick marks, scales, compass roses, broken lines for incomplete elements, grids, meshes, rules, underlines, frames, boxes, compartments, codes, legends, highlights, accents, bevels, shadows and fills defining areas and surfaces." (Tufte 1997, 74)

At the same time, careful control of differences between shapes, figures and negative spaces aid the visual hierarchies, improving the overall design:

> "Minimal contrasts of the secondary elements (figure) and negative space (ground) will tend to produce a visual hierarchy, with layers of inactive background, calm secondary structure, and notable content. And conversely, when

everything (background, structure, content) is emphasised, nothing is emphasised; the design will often be noisy, cluttered and informationally flat"(Tufte 1997, p.76)

Minimum effective differences are the essential graphic means of comparison, establishing a 'noise-free' environment for the reader to develop the connection of thoughts and establish hierarchies that will aid the understanding of complex subjects: An essential task for the graphic.

In the example of displaying the great trenches of the western pacific (figure 2.9) Tufte (1997, 76) analyses the effective differences for comparison: The first set of differences detected are contained within the colour separation, clearly defining the area for the reader. Within this primary mean of separation a second, subtle layer exists that develops a hierarchy within the map. In contrast the 'rainbow encoding' a technique frequently used in oceanography and scientific publications (figure 2.10) is almost illegible. The aggressive colours, unnatural and unquantifiable, render the map "incoherent, with some of the original data now lost in the soup" (ibid).

While derived from a single example and without further analysis, the concept of 'smallest effective difference' acts as a guideline to improve the resolution of graphics and if properly used, highlight the creation of hierarchies within a visualisation. Within editorial information design, where practice is innovative and rapid paced, effective differences can be a potent concept on the visualisation process, but answering the omitted critical questions of 'why' and 'how' is essential for design research and part of the knowledge gap.

Tufte's principles working on visualisation of data operations are pertinent and transferable to editorial information design research, informing the existing body of knowledge on methods to describe non-systematic and tacit operations that are rarely discussed. For the purposes of this study, the concepts become relevant by raising points that the researcher has to remain alert for, during the data and analytic phases.

2.10 Elements of design phenomenology

The creation of information design artefacts imprint on the outcome a set of visible characteristics with aesthetic qualities as well as design attributes. The audience when

encountering an infographic interprets and internalises the coded messages partly in a cognitive process of observation and partly as a visual entity or phenomenon. The content created by the designer through diagrammatic forms and textual/visual combinations acquires cognitive, iconic and linguistic dimensions for interpretation (Krämer 2010; Kazmierzak 2003).

The plurality of forms on artefacts of information visualisation and the diversity of formulas of depiction suggest an ad hoc selection of phenomenological elements, where compliance to systems or rules is unlikely. However, for the purposes of this study some high-level abstract elements directly connected with iconic depiction and linguistic structure will be explored, as they are representatives of cultures and key components of visual design activity (Harland, 2011, p.31). Phenomenology of information design examines the codification and strategy of imprinting the intended information in visual forms. The plurality of the mediums of expression as well as the context and content related visual solutions, shift the focus of discussion on generalizable 'phenomena' compatible with a wider view of practice. Following the development of the argument on general design theory, the literature revolves around concepts of image and language and hybrid iconic forms used on the creation of diagrams: descriptions balance between the practical and the abstract, sustaining a connection of the material output of practice with the concepts, governing practice and avoiding unnecessary complicated terminology.

In the following part of the chapter, abilities of the diagrammatic will be explored via theoretical positions, situating the visual on cognitive frameworks: The first on a cognitive-linguistic reference (Krämer, 2010) while the second on a cognitive-representational perspective (Kazmierzak, 2003), both delving deeper on the issues of functionality of the constituting parts of the visual and the issue of interpretation by the reader. Although theoretical and academic, the following ideas when simplified and combined with visual elements within data collection phase can reveal design tensions that the researcher locates, isolates and re-links with separately expressed theories. Additionally, these theoretical views inform with cross-disciplinary knowledge of more abstract nature the literature review, as designer-author views stay often too close to the artifice of design. Researchers' views on Phenomenology act as a bridge to the more

explicit, designer concepts that when tacitly expressed sound initially unconvincing, but after examination, offer valuable design knowledge.

Literature of phenomenology of information design addresses the design knowledge residing within the visual outcomes and authors offer their views on how to instil critical qualities that will make design artefacts successful in their roles and objectives. The views are diverse and covering different areas of practice, pertinent to information design and potentially relative to editorial information design. At the beginning of the section a 'tight-coupling' of word and image theory is presented by Horn (2000) describing the integration of word, diagram and image to the structure of the infographic, creating inseparable visual solutions and compiling a familiar 'vocabulary' in time. Subsequently the concepts of 'humanisation' and visual 'argumentation' of information is presented from Neurath (1973) enabling the reader to discover in a personalised pace the messages contained within the visual structures. Finally, from Bertin (2011) and Tufte (1990) two similar concepts are examined: 'elevation of content' and 'escaping the flatland' both addressing the issue of making the graphic escape the confines of the page and –in practitioner terms- lifting content towards the reader and unravelling additional dimensions through the coding of information on the page.

2.10.1 The diagram between the cognitive, the iconic and the linguistic

Sybille Krämer (2010, p.1) situates the diagrammatic artefact as a medium between "thinking and intuiting", between the "noetic and the aesthetic"; a situation where the reader conjoins qualities of both language and visual. The diagram acts as a vehicle for abstract or conceptual knowledge to be articulated simultaneously, without compromise or inferiority.

> *"By means of this interstitial graphic world, the universal becomes intuitable to the senses and the conceptual becomes embodied: the difference between the perceptible and the intelligible is thus at the same time bridged and constituted"* (ibid, p.1)

The outcome as a combination of the conceptual binaries is in the end superior as it addresses specific needs and phenomena that can't be explained solely by language or image. This distinct quality is coined by Krämer as "graphism of the line".

> *"Think of the notation as language made visible; unutterable formal languages; music spatialised in the form of the score; diagrams that synthesize drawing with notation; or maps combining the digital and the analog. The attribute shared by all these image-language hybrids is the graphism of the line. The graphism dwells on the far side of imagery but this side of language."*

In this endeavour, Krämer explicitly refers to the formalistic processes that "use the two-dimensionality of surfaces to depict non-visual matter by means of visual configurations and to operate syntactically with this matter" (ibid, p.2) including them in the group of the 'diagrammatic'. In this way not only diagrams in a narrow sense are included, but all forms of intentionally created artefacts: created markings, notations, charts, schemes and maps (ibid). This list is also inclusive of information design artefacts as they share the same 'diagrammatic' characteristics, in creation as well as outcome.

The characteristics of diagrams are inherent in human activity as they reflect deeply rooted organisational principles in human cognizance, thus making the diagram a tool connected not only with designing or problem solving, but also philosophy and ways of knowing; proclaiming two criteria:

> *"First the anthropological supposition that the graphism of marks constitutes a defining feature of the human species. As spatial-visual-tactile organizing form of thinking, arising from the coordination of eye, hand and mind, graphism is by no means secondary in significance to the cognitive role of language. Second the supposition of that not only sciences but even philosophy is twinned with diagrammatic structures. The diagrammatic features of the philosophical concept of reason remain largely neglected; reason then has to be reconstructed diagrammatologically"* (Krämer, 2010, p.2)

The artefact becomes a node for a multi-role analysis and discovery, containing linguistic, visual but also deeper meaning affecting thought processes. The form of the diagram reflects the complicated operations of construction that after visualisation interacts independently with the reader, each on a different level.

Elzbieta Kazmierzak (2003, p.49), also exploring the abilities of the diagrammatic, argues that graphics venture beyond depiction or simple representation: they form a cognitive link between the individual and the environment:

> *"During the evolutionary and the developmental process of individuation, humans have developed models for cognitive and functional connection with the world. That is to say, the mapping of the sensory experience develops in accord to perceptual, intellectual and operational schemas".* (ibid)

The patterns of interaction develop dynamic models of perception and experience, allowing to make the world intelligible, via the realisation of the visual schemas, internal mental diagrams of the individual that serve a special purpose according to Kazmierzak: allowing the individual to make connections with events and states of the world acting as mental maps of thinking. The embodiment of the diagrammatic characteristics in visual artefacts allows the expression of mental models, reflecting knowledge at a given point in time and space. Designer intervention shapes and creates the visual forms to communicate specific ideas and perform functions that go beyond immediate perception, enabling the reader to see further from what can actually be seen.

> *"Consequently design develops diagrammatic representations of mental maps. In other words, the design process is the process of actualisation of mental (internal) diagrams that takes place on two planes: on a mental plane of thought-shaping and on the material plane of its sensory (external) counterpart. Design brings into existence mental diagrams of our conceptualizations about objects and events (Kazmierzak, 2003, p.51).*

The two planes described, are two modes of diagrammatic thinking (approaches), defining the two aspects of the meaning making process for the individual as reasoning and representation. When perceived by a phenomenological perspective, the diagram is connected with natural operations of cognitive and sensory activity relating to personal experience of the individual; the personal perspective that individuals have with the diagrammatic connects with the processes of decoding the imprinted information. However, the area of phenomenology underlines the two way relationship pertaining to the design artefact: the coded message is also important for the designer as an exemplar of embodied attributes for study.

The artefact of information design is inextricably linked with the complex and multifaceted operations which are all part of human activity and connected with deeper thought-processes triggering linguistic, iconic and cognitive elements when perceived; In this respect it is worth looking at the connections that designers visually imprint into the artefact and how these emerge from primary data: To achieve this aim, the tacit and synoptic guidelines provided by designer authors must be examined, in conjunction with the often abstract but meaningful phenomenological research, finding how these are emerging within editorial information design practice.

2.10.2 Information Design as a visual language, a tight coupling of word and image

Robert Horn conceptualises Information design as a new manifestation of the profession of communication. Key elements of his theory are the link of structured writing and the development of a visual language that reflects a "tight coupling" (Horn, 2000, p. 27) of word image and shape in a similar way. The link is so strong that ideally all constituting elements should be irreplaceable within the designed artefact as everything would contribute meaningfully to the end result.

When redefined within the context of information, design emphasises on the interconnectedness that image and text acquire in a fully structured information design artefact:

> *"Visual language is defined as the tight coupling of words, images, and shapes into a unified communication unit. Tight Coupling means that you cannot remove the words or the images or shapes from a piece of visual language without destroying or radically diminishing the meaning the reader can obtain for it" (Horn, 2000, p.27)*

For Horn, visual language is already in development in specific areas of communication such as advertising, filming and newspapers, with certain ways of expression employed to strengthen understanding for the reader; these areas are now part of our visual culture. In a similar way, a development of a visual language specifically for information design is deemed beneficial, forming a structure of knowledge for further development. Horn emphasises that this type of language can stand separately and on its own, as understanding of the language requires new methodologies not found in the traditional areas of linguistics or the area of arts.

> *"Visual language is a language I maintain because one cannot understand its syntax, semantics, or pragmatics by using only the linguistic concepts developed to analyze spoken languages. Nor are the tools of analysis used by either the visual arts or linguistics sufficient to analyse what is happening in visual language. To create a true linguistics of visual language we need new concepts that focus on how words and images work together." (Horn, 2000, p.27)*

Through the exploration of the proposed view of visual language, a theory is proposed to build a coherent approach for the practice of information design, achieved through careful examination of sets of text and image within diagrams, and generating new visual solutions that can be tested to compile a more structured visual vocabulary. Further

progress will create new sets of guidelines and rules of understanding, needed to define this tight integration, quite separate from those of the past where word and image operated in isolation (Horn, 2000, p.29). Integration, unification of practice and respect to the internal tensions of the discipline, will in turn develop in-depth, self-conscious and well developed design practices.

Horn's notion of 'visual language', pointing to a synergy of text and image for the presentation of information, is a codification of the visual and visual elements creating a synchronous process of decoding for the reader, different from the theories pursuing a full linguistic syntax. However there is little support on these notions to provide details or tangible examples on how the tight integration can be achieved in practice, or the possible ways of development, as theory remains vaguely outlined and transferring the fulfilment of its objectives to future research and action. As there are no descriptions of these operations in practice, the theory of 'Tight-coupling' acts as a point of reference that can possibly emerge from examination of primary data coming from artefacts and practitioners of editorial information design.

2.10.3 Humanisation and visual argumentation

Another core concept described by Otto Neurath, affecting perceptions of readership and at the same time deeply influencing principles of designing is Humanisation: A way to convey knowledge without establishing the traditional expert-layman relationship, offering simplified solutions to the readers. The technicality and terminology of the word language creates a sense of frustration or even fear to the readers and should be avoided, whereas the visual language of artefacts containing information centring on individual perception and familiarity, makes understanding of such diagrams personal.

> *"Sometimes writers think that a translation of well selected terms into popular terms is sufficient, whereas it is common knowledge that the insufficiency of these terms was the main reason for the introduction of scientific terms. This kind of translation from the complicated to the simple, from top to bottom, as it were, I shall call popularisation of knowledge.*
>
> *In humanisation of knowledge one tries to avoid what may be called an inferiority complex as well as all kinds of frustration which so often appear when people try to grasp a piece of knowledge in vain. Looking at a book often creates a kind of fear. [...] Humanisation implies avoiding technical terms before they are really*

needed. The question is how far we can go without using more complicated expressions. " (Neurath, 1973, p.232)

The holistic and naturalistic character of Isotype, when applied to visual forms, provides equal opportunities for understanding and addresses different types of audiences, as interpretation is happening uninterrupted, largely by the individual.

"Literates and illiterates are more or less equal in the ability to grasp the main points of visual information and arguments.[…] Some people may see more in a picture of a building, of a social structure than others, but nobody feels gaps, as one does in reading sentences with strange words or technical terms." (ibid, p.235)

At the same time, within a well-constructed visual, a form of argument always emerges, presenting with clarity the connections of content to the audience. This is a visual argument that through the graphic forms cuts to the heart of the matter in need of explanation, establishing a narrative that simplifies and makes the necessary simplifications to display the essentials with integrity.

"A 'visual argument' is a combination of verbal and visual aids leading to the essentials. The visual aids, to be educational, have to contain networks of visual elements and arguments, they are language pictures. The technique which we have called Isotype (International System of Typographic Picture Education) has been developed to create narrative visual material, avoiding details which do not improve the narrative character, and to present easily distinguishable language pictures. To represent the essential element in visual style, each argument has to be reduced to its bones" (Neurath, 1973, p.240)

The visual argument also helps the reader to enter a reflective state, a mode of thought that is open to personalised interpretations and non-linear explanations about the presented subject.

"This application of argumentative charts supports a meditative atmosphere. People can seriously consider the pros and cons, a tutor can distinguish the contents of charts in leisurely fashion, evolve argumentative chains and link then together. Sometimes he and his pupils may abandon such a network and try a different structure of argument from scratch." (ibid, p.235)

An example of the above of these qualities is given in the 'Number of Men Living in Europe' chart, where the average density population of Europe in different eras is presented. (figure. 2.11). The purpose was not only to communicate these ideas to a wider public, but also to pass an active way of thinking, adding that such an "attitude was essential to the further development of democratic societies" (Nemeth, 2010, p.77).

The concept of humanising information or creating simple but effective graphic visualisations allowing inviting, argumentative and non-intimidating presentation of knowledge can be highly relevant to the area of editorial information design. The exposure of complex subjects, clarified enough and appropriately written to reach a wide audience are all compatible elements with the practices of the area under investigation. On the other hand, Neurath offers a general direction, a way of perceiving the design process with only partial support from visual examples; as the use of ISOTYPE from present day designers is rarely used, it is necessary to see if these concepts emerge in contemporary practice, directly from primary data.

In contrast to Neurath's idea of humanising information presented, Bertin and Tufte offer a different embodied characteristic as necessary for a design artefact: the elevation of content from the two dimensional space towards the reader, creating a meaningful intermediate level of communication between the page and the individual.

2.10.4 Elevation of content, escaping the flatland

Bertin offers a way to perceive the constituting parts of the visual and provides eight fundamental variables that the designer can manipulate for effect (1989, p.186; 2001, p.7; 2011p,42):

> *"Within these limits, we will consider that the graphic system has at its disposal EIGHT VARIABLES. A visible mark expressing a pertinent correspondence can vary in relation to the TWO DIMENSIONS OF THE PLANE. It can further vary in SIZE, VALUE, TEXTURE, COLOUR, ORIENTATION and SHAPE. Within the plane, this mark can represent a point (a position without area), a line (linear position without area) or an area."* (Bertin, 2011, p.7)

These variables (figure 2.12) describe the totality of the encountered permutations within the two dimensional surface, emerging within the page as points, lines or areas forming the world of images. The first two are self-explanatory and are the 'surface' that the designer works upon, the remaining six variables are placed by the designer and coined as "Retinal" (Bertin, 2011, p.42) variables relating to perception and the 'eye' of the reader.

> *"We will term elevation the utilization of the six variables other than those of the plane, that is, the RETINAL variables. A qualitative variation between two cities*

can be represented on a map by a variation in size, value, texture, color, orientation, shape, or by a combination of several of these variables." (Bertin, 2011, p.9)

The "Retinal Variables" corresponding to the eye, contribute to the process of "Elevation", lifting the subject from the space of the page towards the user, elevating the graphic "above the plane" (Bertin, 2011, p.42) and creating a pseudo third dimension within the two dimensional space (Bertin 1981, p.180). (figure 2.9)

In a similar line of thought Tufte argues that the two dimensional space is a "flatland" of paper and screen display (Tufte, 1990, p.12) that a good designer should overcome its limitations. The process of inscribing information on these visual mechanisms always comes with the intention of the designed to unfold into the reader's mind and at least mentally recreate the relationships and analogies that the imprinted surface has with the real world.

"Escaping this flatland is the essential task of envisioning information – for all the interesting worlds (physical, biological, imaginary, human) that we seek to understand are inevitably and happily multivariate in nature. Not Flatlands." (Tufte, 1990, p.12)

More specifically in the example provided, of 'The art of dancing, explained by Reading and figures' (Tufte, 1990, p.27) displays the way that extra dimensions are formed within the page, enabling the reader to re-constitute mentally spatial, temporal and motion characteristics. (figure 2.13) The graphic contains four dimensions: Floor, codes gestures in dance notation with body motion and time sequence: As the four elements are placed on the surface a series of connections emerge:

"The floor plan is linked to the airy music, two dimensions there, time and tone) by numbers, with varying steps for varying sounds. The numbers double-function, simultaneously sequencing steps and relating movement to music. Note that the enlarged dance-floor notation for the partner on our right, since he takes a front route to switching sides […] The two pulled apart by their mirrored pairing , become visually integrated through their nearly touching hands, mutual postures, overlapping paths of movement, and convergence of perspective lines radiating from the flatland floor to a vanishing point exactly midway between hands." (Tufte, 1990, p.27)

The diagram is a detailed map of instructions containing no text whatsoever, providing reader orientation and sensory synchronisation by developing mental maps of understanding and action.

The concepts of 'elevation' and 'escaping flatland' are phenomenological elements describing a tension existing on the creation of a graphic; both affecting presentation and reception of the visual outcome. The form and structure of the graphic imprinted on the two dimensional space, becomes a platform in which, with intelligent application of designer knowledge, information can expand in the cognitive dimensions, reconstructing content and essential components, where content is examined and clarified.

Although the process cannot be explicit, as the graphics depend heavily on the subject and audience, Bertin and Tufte provide a description of how graphics are built to unfold specific phenomena in practice, an issue rarely discussed. The terms 'elevation' and escape the 'flatland' are potent descriptions, fitting the metaphoric design language used by practitioners. It is necessary to see initially, if this metaphor emerges at all, through primary data and if so, how it is defined in editorial information design practice.

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2.11 Summary

Tacit knowledge and personalised designer language has a strong presence in the research area as well as the existing publications. The position of the designer as author of visualisation has lately produced material with emphasis on the visual outcomes but only synoptic descriptions regarding practice. At the same time, a number of independent approaches and personal perspectives on the critical areas of information visualisation communicate designer work to a wider audience without established terminology or even commonly agreed areas of study. These elements highlight the lack of research oriented literature utilising rigorous methods of analysis, underlining the separate aims of the designer and the researcher, with the former primarily a producer of design artefacts and the latter a producer of knowledge (Heyligen et al, 2009).

Existing literature on information design is sporadic and isolated in expression, often referring to core theories published decades ago, as contemporary publications lack critical perspectives regarding practice and make heavy use of self-exemplifying visuals. At the same time, discourse remains vulnerable to self-conceptions and elements that, gain acceptance become "naturalised" (Mareis, 2012) in literature and accepted as tautological statements impeding research efforts and critical investigations within the discipline.

Another observation on the literature of information design is the non-continuity of arguments developed in publications and books, with the majority of contemporary authors not producing further iterations of an original idea, denying from researchers the opportunity to see a research direction that will confirm or disapprove a line of thought. This contributed to a difficult research setting when examining bibliographies, where selection of quality material was difficult to gather; often interesting positions were ill-explained, or not at all explained, with writers compensating justification with large amounts of visuals, making obvious the disproportionate evolution between practice and research of the area. It is the researcher's opinion that both the perceived effects are closely related to the articulation of tacit knowledge and the position of designers as authors within literature, outlining strongly the knowledge gap.

However, literature of information design going beyond the descriptive or the self-exemplifying, in conjunction with the material gathered from general theory, had a positive impact on this study in two ways:

Firstly, to highlight details and relative information of the knowledge gap by developing an informed approach for the inquiry. Looking at critical theoretical content used to tackle design problems on information visualisation, knowledge is gained about effective practices of two-dimensional information visualisation; this is the material closest to outputs and practices of editorial information design.

Secondly, through the examined material, specific paradigms, perspectives and examples of theory on the issue of communicating elements of tacit knowledge were collected. The material was subsequently examined and compiled to act as an information-rich aid to facilitate designer reflection and narrative and maintain non-technical language during data collection from participants.

The study of material pertinent with information design also underlined the absence of the designer from the existing literature, with few exceptions on epistemological issues; this is an unexpected result, given the numerous subjective and individual judgements necessary to complete a design artefact. Designer activity needs to be examined and become integrated in practice, separating extant 'naturalised' concepts from valid theory, revitalising reflective principles and allowing space for new and relative knowledge to emerge.

Additionally, the existing theories cannot be fully relied upon to explore editorial information design as none were specifically written for this area: in fact the majority of the theoretical content was written earlier than the time that editorial infographics became popular in their current form, denying the researcher solid platforms to build critical material: Each part of theory offers insight but also has distance from the material of the same category, a necessity under the circumstances as it is the only way to build a literature review for a subject not yet researched.

These conclusions act as strong indications that research of the emerging area would benefit from the inclusion of analysis of designer narrative and activity regarding practice. Epistemology, praxeology and phenomenology of editorial information design must be researched primarily by the main actors evolving the discipline, the editorial information designers. At this point, contemporary practice takes precedence over existing material, being more informative and defining than the estimates and correlations offered by secondary sources: as rigorous research methods and methodologies are applied to data from editorial information designers, a new set of critically informed theory will form, elucidating and defining the currently inaccessible research field.

Chapter 3:
Method and Methodology

3.0 Methodology and Methods

3.1 Introduction

In recent years, research surrounding design theory and information design theory displayed the multidisciplinarity of information design practices which frequently remains theoretically underdeveloped. Editorial information design, as a sub-discipline of information design, is ultimately affected by the state of existing research and the weaknesses of the area as presented in the previous chapter: problems such as naturalised terminology, disconnected or ill-defined concepts and self-exemplifying visuals, all create a highly unstable background for the researcher. The existing material, while helpful providing context for the study, speaks little of the effective practices of the field under investigation; the meaningful, legitimising connections cannot be drawn without compromise and can only be partly justified.

At the same time, a secondary observation on literature relates to the absence of descriptions regarding designer activity and the positioning of the designer within practice, supplementing or testing the presented epistemological perspectives. Partly due to the diverse and numerous disciplines constituting information design, which can only be remotely connected with each other, activity and the role of the designers remain unseen in current bibliography.

In this particular study these obstacles are lifted by the use of research methods that discover and elucidate human activity: by focusing into the area of practice, editorial information designers' activity can yield a wealth of primary data for examination, departing from ill-definition of processes and moving towards conclusions directly connected with practice.

When groups of designers come under investigation, trends, focus points, key aims and objectives become clearer and a wealth of description about the nature of activity becomes explicit. Designer knowledge remains tacit, but the narratives regarding practice are generated with a 'thick description' of rich data (Geertz, 1973) (Denzin & Lincon, 2012, p.9) which can be scrutinised under rigorous research methods, allowing the emergence of elements that go beyond the descriptive. These elements grounded to the data offer views beyond personalised descriptions, testing existing knowledge and generating new theory

that venture beyond personal methods of designing, while at the same time remains uniquely connected to editorial information design.

At the beginning of the study, two more methods of inquiry were also considered as equal candidates with the Grounded Theory Method: 'Interpretive Phenomenology', and 'Narrative Inquiry' were reviewed and tested for methodological fit and results at the start of data collection phase.

Narrative Inquiry researchers *"attend to place, temporality, and sociality, from within a methodological three-dimensional narrative inquiry space that allows for inquiry into both researchers' and participants' storied life experiences" (Clandinin & Caine, 2008, p.544)*, unfolding a parallel meaning of narratives of a shared experience and understanding, examining and connecting gathered testimonies within a wider context. On the other hand 'Interpretative Phenomenology' aims for the researcher to enter a hermeneutic circle in the most *"propitious way to study the phenomena at hand"*, requiring *"a lot of thought about developing lines of inquiry in ways that will allow for extending, disconfirming, and/or expanding the researcher's understanding" (Berner, 2008, p462)*, unfolding the meaning of phenomena, challenging previous concepts or established meanings.

Both methods have a deep qualitative character and allow the discovery and explanation of phenomena and narratives, yet the Grounded Theory Method was finally chosen as the most pertinent method to enter an unknown area, as the continuous, comparative and analytic cycles allowed quick adaptation of the researcher in new material and rigorous connection with data. It was perceived as the most effective to capture tacit and empirical knowledge and connect it with practitioner activity, as a qualitative method it consists of practices that interpret data and makes the world visible (Denzin & Lincoln, 2000, p.3). This method was initially conceived and published by B.Glaser and A.Strauss on "The discovery of grounded theory: Strategies for Qualitative research", and is a method of collection emphasising on conclusions of conceptual nature drawn from systematic analysis of data (1967, p.5)

Grounded theory method has a history of application in difficult to define areas of practice, such as the field of nursing (Benoliel, 1996), an area where expert knowledge is developed in the field of practice with significant challenges on the articulation of the tacit, and embedded in action characteristics (Conway, 1995). Through analytic awareness, this methodology can

rigorously compare diverse 'world views' of practitioners and highlight the underlying, salient elements through the production of 'grounded theories' i.e. the theoretical outcomes that specify relations between the abstract yet critical points of emergence (Bryant & Charmaz, 2007, p.25). As the Grounded theory method is "an excellent tool for understanding invisible things" (Star, 2007, p.79), it was used for the purposes of this study to make visible the world of editorial information designers and the sum-total of activities that constitute practice.

The primary method of data acquisition was open interview and semi-structured interview, as with such means designer narratives had the potential to express and expand thoughts unhindered, narrating experiences with self-reflection and not simply responding to a set of questions. The interview technique was characterised by a transparent way of communication with questions subtly offering areas for a conversation to develop; however these were only starting points, pursuing the elements that designers themselves were considering important. Reflectivity was encouraged and facilitated after rapport was established.

The participants were encouraged to convey individual practice and activity without reservation, but the researcher had the ability to affect direction, or stimulate interest for the discussion with critical questions if it was necessary. By following the above, designers after a short period of unease, offered narratives with remarkable concentration, often withdrawing for moments in deep thought to reveal critical views on practices: these moments were the richest in description and the most productive parts of the interviews.

During the data gathering stage, the collected interview material was transcribed, coded, compared and analysed, passing through consecutive refining cycles of code and theme formations. The input of new material was enriching existing data but also triggering radical shifts of perspective, re-examining data and already attributed meaning and described operations. As the group of participants expanded, content and insights of emerging theory were subtly introduced and discussed with interviewees and gradually expanded upon.

The summative, salient, essence-capturing concepts of language-based data are crystallised into single words or short phrases named 'Codes' (Saldaňa, 2009, p.3), synopsising the important empirical data for further analysis and study. Coding was a lengthy process, essentially discovering and making explicit the research area.

Different coding methods were tested for appropriateness and results: initially the 'Open' or 'Line by Line' coding was used to understand and highlight key concepts, necessary to sensitise the researcher and locate the emergent elements. Subsequently, focused coding was used to explore the most relative codes emerging: how these data fit the empirical world and how they crystallise the participant's experience. Ultimately Axial Coding was used to further structure analysis, creating hierarchies and dimensions while simultaneously challenging disconnected or solitary structures within the analytic field. The purpose was to bring the data together into a coherent whole and achieve 'saturation' - a state where no new information seems to emerge during coding. Groups of codes eventually led to the construction of 'Themes', larger conceptual structures that offer more information about the intention of the key actors of the study. It has to be noted that Themes are more subtle and implicit structures, consisted by codes that are explicit and grounded (Saldaňa, 2009, p.13). In such a way the developed theoretical structure remains grounded to the data.

After the conclusion of the interviews, the analysis and continuous review of the data intensified, co-factoring knowledge gained from associates, on-site observation and visual artefacts linked with conversations. Although not part of the analysis of the study, these secondary elements gathered from the research field contributed to the understanding of the research area, allowing the researcher to immerse on everyday operations of editorial information design. Understanding key practices and developing an intimate connection with a wealth of gathered data was deemed essential to clarify the crucial conceptual areas of practice, influencing decisions: all these are evidence that sensitised further the analyst, transcending description and reaching untouched concepts from data (Glaser, 2001, p.5).

Upon reaching the state of "saturation" where no new codes or themes emerged, dominant patterns of themes and coding became visible, highlighting unique activities and perspectives of design practice. Ultimately the methodology followed, reflecting critical issues on a series of overlapping sets: practical, ethical and epistemological/ontological, to reflect in balance and essence the field of inquiry (Keats, 2000, p.164).

Within the following chapter, critical aspects of methodology will be explained in detail, including paradigm, methodology, method and development of data acquisition, offering a clear rationale of the methodological directions and describing necessary changes of strategy necessary to elucidate the research area.

3.2 Research methodology

3.2.1 Qualitative

Qualitative research is a situated activity that locates the observer in the world; it consists of a set of interpretative, material practices that make the world visible (Denzin & Lincoln, 2000, p.3). The researcher obtains data through empirical means, including personal experience, observation and interaction. Typically qualitative data are separated in two broad categories: verbal and non-verbal data (Schreiber, 2008, p.186) useable by the researcher to explore the field of inquiry.

Qualitative data are defined as material such as transcripts, field notes, records of conversations and texts such as books, newspapers, journals, advertising material and visual images (Hackley, 2003). This brings the qualitative researcher in a position to study things in their natural settings, attempting to make sense of, or interpret, phenomena and the meaning that people bring to them.

The process aims to bring to light and describe routine and important moments and meanings of practitioner activity. Without prior description of the research field, a flexible but direct link with the participants and phenomena of editorial information design was necessary, capturing the individual's point of view and securing thick descriptions. The detail of practice and tacit characteristics of designer knowledge made qualitative methodology the most suitable tool for understanding a continuously developing phenomenon.

The qualitative researcher can act as a "bricoleur" (Denzin & Lincoln, 2000, p.6) assembling and interpreting data through diverse tasks and self-reflection, utilising his own related experience to evolve inductive arguments. Corbin & Strauss argue that use of researcher experience in qualitative research can act as a powerful tool for critical realisations about the dimensions and realisation of the data (2008, p.80), moving inductively from specific data to more general patterns and commonalities. The findings can then be tested by relating to the literature and further data collection or analysis.

For this study, the qualitative method offered the only viable way to conduct this research: the area of investigation, ill-defined and evolving had to be discovered in research terms, with the researcher investigating and making sense of data through critical judgement and continuous comparisons. Additionally the qualitative approach was also considered

necessary, as from the early stages of the investigation it was made clear that the main actors, and simultaneously the main sources of data, were making heavy use of tacit elements and personalised terms that had to be closely observed. Each case revealed new meanings, activity and operations that gradually attested to more abstract conceptual patterns of practice, defining the research area.

3.2.2 Grounded Theory

Grounded Theory was developed by Barney G. Glaser and Anselm L. Strauss (1967). In their study of the social organization of dying in hospitals, their work 'The Discovery of Grounded Theory' influenced qualitative research and left a strong imprint in social scientific inquiry as well as the development of the grounded theory method in general.

The Grounded theory method comprises a systematic, inductive and comparative approach for conducting inquiry for the purpose of constructing theory (Charmaz, 2006, Charmaz & Henwood, 2007). Glaser and Strauss clearly state the close connection of the method with empirical data to reach the necessary generalised statements:

> *"To generate theory that fills the large order, we suggest as the best approach an initial systematic discovery of the theory from the data" (1967, p.3).*

Bryant and Charmaz (2010) argue that "the method is designed to encourage researchers' persistent interaction with their data, while remaining constantly involved with their emerging analyses. Data collection and analysis proceed simultaneously and each informs and streamlines the other. The method is systematic but with flexible guidelines for conducting inductive qualitative inquiry, aiming towards theory construction:

> *"This method focuses squarely on the analytic phases of research, although both data collection and analysis inform and shape each other and are conducted in tandem. The analytic strategies are inherently comparative and interactive; this method guides researchers to make systematic comparisons and to engage the data and emerging theory actively throughout the research process" (2007, p.374).*

Essentially, "grounded theorists develop analytic interpretations of their data to focus further data collection, which they use in turn to inform and refine their developing theoretical analyses" (Charmaz, 2000, p.509); allowing for a gradual immersion and subsequent recognition of the research area and research topic respectively. Researchers

following this process are able to take a "slice of life within a world that is always in process" (ibid, p. 522) realising previously unseen phenomena and work towards theory building.

The Grounded Theory method was selected as a methodology for this study as it allows discovery and analysis of areas of human activity with little or no prior knowledge. For the study of editorial information design it was important to move further from the solitude of designer practice and the so far disconnected views: the aim of the study was to investigate design activity in context and explore common ground on epistemology and practice, situating design activity as part of critical human action. The researcher pursued in a true sense a path to "make visible", as Denzin and Lincoln described (2000, p.3), the world of practice of editorial information design and present a "slice of life" as Charmaz (2009) mentions within a constantly changing professional environment. The outcome makes explicit some of the most difficult to describe, tacit in nature designer knowledge. This research method had positivistic influences by the school of Chicago from Glaser, as well as pragmatist influences from the Columbia school of pragmatism (Charmaz, 2011, p.365), schools of thought that evolved into the current objectivist and constructionist versions of the theory (Charmaz, 2000, p.523; Charmaz 2006, p.7).

The objectivist focus of grounded theory assumes that a neutral observer discovers data in a unitary external world: the data gathering process does not raise questions about assumptions or knowledge and the researcher stands outside of the Phenomenon.

> *"Both implicitly and explicitly, the analyst continually checks out his theory as the data pour in. Explicit verification beyond testing may lead to establishing major uniformities and universals to strategic variations of theory under difficult conditions, and grounded modifications of theory. A touch of generation may be included, **but the researcher's focus is on verifying;** he generates he generates theory only in the service of modifying his original theory as a result of his tests (Glaser & Strauss, 1967, p.27 – emphasis mine)"*

In that sense data are 'there' rather than constructed. Researchers can add some reflexivity about data if they wish, yet the stance of the researcher is *"neutral and passive simply gathering data to analyse as the authoritative expert and active analyst"* (Charmaz, 2011, p.366). Objectivist grounded theory aim for parsimonious abstract concepts that will explain the empirical phenomena and form general categories, defining phenomena not needed as their

existence is not disputed; rather the researcher has to develop theoretical sensitivity through constant comparison (Glaser, 2007, p.104) to discover them and bring them to light. The formed conceptual hypothetical outcomes are credible because they remain firmly grounded to the data (ibid.).

A constructivist focus within Grounded Theory seeks meanings both from the participants, perspectives as well as the researcher's by in-depth understanding and emergence. The inductive reasoning of the researcher is a point of entry to realise obscure phenomena and is highly susceptible to change and evolvement in time. Charmaz elaborates on this connection that surfaces the deep, often unseen meanings:

> *"To seek respondents' meanings we must go further than the surface meanings or presumed meanings. We must look for views and values as well as for acts and facts. We need to look for beliefs and ideologies as well as situations and structures. By studying tacit meanings, we clarify, rather than challenge respondent's views about reality (Charmaz, 2000, p.524)"*

This signifies an initial departure from preconceptions or forms of expertise that might re-enter the stage in a later analysis, the constructivist approach necessitates a relationship of openness of expression (ibid.) and gathering of data through extensive field notes, observations and compilation of narratives to achieve a 'thick', potent description of a subject (Geertz, 1973). The researchers' attention to detail in the constructivist approach sensitises them to multiple realities and the multiple viewpoints within them capturing a 'world made real' in the mind and through the worlds and actions of its members. As 'worlds' of designers are defined by personal activity and language, but daily exercised to offer visual outcomes, these multiple viewpoints had to be viewed from a moderate constructionist perspective: the phenomena are existing but some form of common ground had to be found converging the individual ways of expression.

However the two areas of focus are not mutually exclusive, nor they should be (Bryant and Charmaz, 2007, p.25), as grounded theory strategies allow for imaginative engagement with data rather than simple mechanistic application: "This engagement with data creates a space where the unexpected can occur" (ibid.) where new, unexpected and emergent material can inform the researcher for the field of inquiry. This study does not follow strictly perspectives of objectivist or constructivist focus, but evolved out of necessity on the middle ground between the two: on one hand the practice of editorial information design is

constituted by a set of existing but not articulated phenomena, defining activity and producing visible outcomes; on the other hand the personalised designer narratives and tacit nature of knowledge required a moderate constructivist approach for interpretation and theorisation.

For the selection of the Grounded Theory method, the current state on literature, as reviewed, also played a major role. With literature on the area being insufficient, a methodology that appreciates but not prioritises the study of literature was essential. Glaser advocates (1998, 2001) that literature reviews should be conducted after developing an independent analysis to avoid forcing data into preconceived categories, promoting a state of little exposure on the research subject before the data gathering and analysis phases. On the other hand Charmaz (2006) with Henwood & Pigeons (2003) argue that researchers rarely enter the research field without substantial knowledge of the literature, arguing that standpoints and research points influence and strengthen the research process.

However both objectivist and constructivist perspectives of the Grounded Theory method emphasise on the discovery of new theory: grounded theory describing general models and providing understanding in obscure phenomena. For the purposes of this study, literature was used to inform and provide context to the inquiry as the majority of literature was already reviewed. Yet at the consecutive data collection and analytic stages of research, a non-biased and explorative approach was constantly pursued as part of the methodological rigour.

3.2.3 Constructivist Paradigm

The Constructivist paradigm ontologically and epistemologically challenges the existence of an external objective reality from which knowledge may be collected or gained; instead, each individual constructs knowledge from experience through social interaction. Opposing the positivistic characteristics, claiming that knowledge of the world can be obtained objectively through observation and experimentation, Constructivism focuses on the human condition and descriptions of constructing meaning. Origins of constructivism can be traced to the early 19th century and the change within the humanities to seek methodological alternatives to the positivistic ways of enquiry.

This change, referred to as the interpretive turn, was initiated during the 19th century through the writings of Wilhelm Dilthey, Edmund Husserl, and Max Weber, among others. These philosophers, especially, articulated how human agency and meaning-making require an approach to the human sciences that is ontologically and epistemologically different from the positivist approach that had been derived from the empiricism of the natural sciences (Constantino, 2008, p.119).

Since then Constructivism gained increased presence within the 20th and 21st as a paradigm, influencing various schools of thought, especially within the social sciences. Social constructivism epistemology is based on the fact that knowing is not passive, but active and on-going for the individual.

"In this sense constructivism means that human beings do not find or discover knowledge so much as we construct or make it, We invent concepts, models, and schemes to make sense of the experience and we continually test and modify these constructions in the light of new experience". (Schwandt, 2000, p.197)

These models, concepts and schemes form the structural dynamics of the 'real', in relation to the background of shared understandings and practices. To communicate these practices, language is examined in a Wittgensteinean sense (Gergen & Gergen, 2008, p. 820), where language is "consisting of language and the actions into which it is woven" (Wittgenstein, 2009, p.7). Under these circumstances, language is the source as well as the medium to observe phenomena and study perspectives of the world. The relationships of these concepts, the rules underneath these narratives are an essential part to describe the phenomena and gain insight. When exploring social phenomena and meanings connected with activity, meanings are governed by the use of language both on expression, as well as interpretation:

"… meaning is understood as a derivative of language use within relationships. Given that games of language are essentially conducted in a rule-like fashion, accounts of the world are governed in significant degree by conventions of language use". (Gergen & Gergen, 2008, p. 820)

In this form, language games are embedded "within broader forms of life", making language conventions inherently linked the activities, objects and settings under investigation. As a consequence of this influence, discourse is the material practice that constitutes representation and description legitimising research.

In that sense the constructivist paradigm assumes: *"relativist ontology of multiple realities and a subjectivist epistemology, with the knower and the respondent co-creating understanding, along*

methodological procedures of naturalistic character" (Denzin & Lincoln, 2000, p. 21). Within the Grounded Theory Method, constructivists focus on credibility, transferability, dependability and conformability as criteria for valid research (ibid), enabling the study of material that cannot be objectively identified.

This study by research design examines key actors in their research environments, and connects with the reach tacit meanings of designing and extensions of design knowledge, standing closer to Charmaz's approach of "clarify but not challenge respondent's interviews" (2000, p.324). In that sense it stands closer to constructivism than objectivism, as tacit meanings cannot be tested or defined by strict objective stance. However the research takes the constructionist perspective in moderation as research focus examines phenomena with a flexible interpretation, co-factoring multiple elements describing actions and conveying designer knowledge. During the analysis of data, distinct phenomena emerged defining practice, all stemming through the tacit and implicit narratives. Thus the researcher had to apply a limited and cautious perspective of constructionism, always grounded to the data, in order to build the thematic categories essential for the grounded theory method, aligning with beliefs and testimonies of the participants.

Within the present inquiry, the author's aim was to construct an accurate description of designer views and practices mapping the editorial information design activity and form a substantiated, credible platform of criteria. Interrelations of designers with close associates, aims/objectives of the infographic and professional ethics were scrutinised. The epistemological stance was focused on the emerging description of practice and balanced in nature: not falling into severe forms of subjectivism or attempts to overcome any scientific, positivist or post-positivist criteria as this was not a real issue for participants.

3.3 Analysing Data in Grounded Theory

The purpose of analysis in grounded theory is to seek conceptual categories that offer a clear view of the relevant theoretical abstractions of the areas studied. The Grounded Theory method emerges from data but does not describe the data from which it emerges, it offers a description of the abstractions generated from the continuous analysis:

> *"GT is applied to the substantive area from which it emerges to explain the preponderance of behaviour in that area, which behaviour is the continual resolving of the participant's main concern. GT does not generate findings: It generates hypotheses about explaining the behaviour from which is generated. GT is conceptually abstract from time, place and people."* (Glaser 2001, p.4-5)

In this sense the researcher is active and continuously engaged, utilising abductive reasoning on findings, even during the data collection phase. This effect informs and advances both areas, as through forming an iterative process, the abstract level is raised and analysis is further intensified (Charmaz 2012, p.361), developing meaningful relationships of perceived phenomena. The researcher then develops sensitivity with the areas of investigation allowing insight and confidence for further awareness.

> *"[The researcher] should also be sufficiently theoretically sensitive so that he can conceptualise and formulate a theory as it is emerges from data. Once stated, theoretical sensitivity is forever in continual development"* (Glaser & Strauss 1967, p.47)

The continuous analysis and data gathering stages of research within the Grounded Theory method structure, provides evidence in order to illustrate the critical concepts discovered: evidence might not be accurate beyond doubt, but the concept linked with evidence is *"undoubtedly a relative theoretical abstraction about what is going on in the area studied"* (Glaser & Strauss 1967, p.23). The researcher through developing awareness and grounding concepts in the data ensures that the conceptual category is pertinent and fitting to the area of study.

The means to analyse these 'rich data' initially and develop categories and concepts are: Coding, Memo writing, and Theoretical Sampling (Charmaz, 2000; Charmaz, 2006;, 2007). Each of these tools was utilised during the course of this study as part of the analytic step to build theory.

3.3.1 Coding

Grounded theory coding is a means to ask analytic questions of the gathered data and allow further understanding. Charmaz noted on the process of coding that: *"These questions not only further our understanding of studied life but also help us direct subsequent data gathering toward the analytic issues that we are defining"* (2006, p.42). Underlining the continuous

evolving effect that coding has on interpreting data acts as signposts and guides for the researcher.

A **Code** in qualitative inquiry "is most often a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data (Saldaňa, 2009, p.3). Codes have an emerging quality and should not belong to any preconceptions -the categorisation and refinement of codes form conceptual categories, take place by interpretation of the data from the researcher in a rigorous approach of constant comparison. This constant comparative method, a major tool when forming codes and subsequently themes, compares different people on situations, views and experiences. It compares data from the individuals, compares data with categories, and categories between themselves in iterative cycles until satisfactory categories emerge (Saldaňa, 2009, p.45)

In the presented research, initial coding was in-vivo coding, also known as 'Literal Coding' and line-by-line 'Open Coding' to capture the designers' thoughts, understand indigenous terms or locate the special meanings to commonly used terms. These were critical entry points that allowed theoretical sensitivity on the subject to develop: by breaking down the data of the transcripts within printed pages allowed the immersion of the researcher into the world described by the narrative of designers. The reflective descriptions within the narratives, the pauses, and the effort to verbalise the difficult to articulate concepts were signs which highlighted the areas of importance drawing the attention of the researcher. Even while using metaphors, examples or indirect descriptions to describe tacit knowledge, designer testimonies when initially broken down through such fashion, outlined the broad, undefined yet critical areas, setting the research stage. Often the researcher compared transcripts to the original audio recordings to pay special attention on the tone of the voice and trail of thought to secure these impressions and initial ideas provided by the 'Literal' and 'Open' coding.

Participant narrative exclusively used everyday language with no technical or academic terminology, personal and casual described daily activity and practice with practicality. The researcher had to understand and familiarise with textual data and attune to the meanings of words and phrases to better capture the dimensions of the narrative. Saldaňa, describes the process as:

"...words and phrases that seem to call for bolding, underlining, italicising, highlighting, or vocal emphasis when speaking aloud. Their salience may be attributed to such features as impacting nouns, action-oriented verbs, evocative word choices, clever or iconic phrases, similes and metaphors..." (2009, p.45)

Effectively this stage is an immersion of the researcher into the audio and textual data, establishing foundations via comprehension and preparing further analysis. In-Vivo codes aided initial understanding of the research material "providing a crucial check on whatever was significant" for the participants helping to "crystallise and condense meanings" (Charmaz, 2006, p.57) an example is provided on appendix II.2.1.

Second cycle coding analysis was conducted under the scope of 'Focused Coding', searching for the most common or significant initial codes emerging through the first round of coding. The aim was to look closer on those categories that are most *"salient"* and *"require decisions about which initial code makes the most analytic sense"* (Charmaz, 2006, p.46, 47). The newly constructed codes were compared between participants' data to assess comparability and transferability, establishing common ground between designers of different work environments. At this point correlations were also made of how data fit the "empirical world" with code and category construction that "crystalize participants' experience" (Charmaz, 2006, p.54) an example is provided on appendix II.2.2.

In the third and final cycle of coding, Axial Coding was used to extend the operations of Focused Coding in which an array of categories emerged from the existing codes. These categories underwent further structuring and analysis, creating hierarchies and dimensions while simultaneously challenging disconnected or solitary structures within the analytic field. The purpose was to bring the data together into a coherent whole and achieve 'saturation' a state taking place when:

"no new information seems to emerge during coding, that is when no new properties, dimensions, conditions, actions/interactions, or consequences are seen in the data" (Strauss & Corbin, 1998, p.125)

Application of Axial coding ultimately shaped an analytic frame of reference for the data, delineating epistemic and practical directions for the dissemination of knowledge for this designer group – more information on this cycle is provided on appendix II.2.3.

Figure 3.1 below (also contained in the list of figures -appendix I) provides a synopsis of coding progression, through the stages of coding. A comprehensive list of codes and categories will be presented on the following chapter: Analysis.
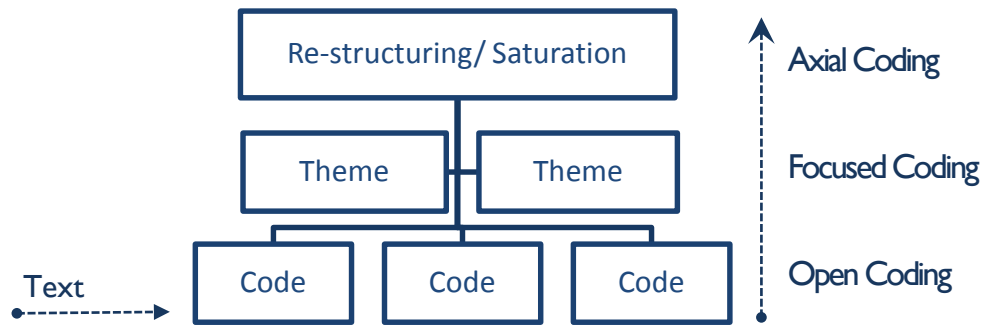
Figure 3.1: Synopsis of coding progression

During the formation of the codes and the development of theoretical categories both hardcopies and CAQDAS (Computer-assisted qualitative data analysis software) was used, but at different stages.

In the first and second cycle of coding, the use of hardcopies was carried out by the researcher: the ease of adding notations to the page, highlighting areas while able to make comparisons between transcripts prompted to this approach. At the same time the researcher was conscious to approach the transcript material without developing predetermined hierarchies or categories from accidental use of software programming, the analysis was focusing on immersion and exploration.

In the third cycle of coding where the main themes were to a great extent developed, and the researcher acquired intimate knowledge of the material, the NVIVO software package was used to draw additional connections and further refine coding and streamline the theoretical outcomes. The generation of reports used by the software tools was used purposefully to gain further insights and investigate possible insights with summaries of gathered material generated in great speed. Time efficiency was one of the strengths of software, as fine-tuning of codes and themes and corrections on names or transcripts were taking within minutes, allowing uninterrupted focus on analytic activity.

3.3.2 Memo Writing

Memo writing acts as a link between coding and analysis, and forms an intermediate step to encourage reflection and seeing data in new ways (Charmaz, 2006, p.72). Various forms of data, codes and categories (depending on the stage of analysis) are examined through a reflective scope in writing. The purpose of the analytic memo is to:

> *"… to document and reflect on: your [the researcher's] coding process and code choices; how the process of inquiry is taking shape; and the emergent patterns, categories and subcategories, themes and concepts in your data…" (Saldaňa, 2009, p.45)*

All with the purpose of theory building and deep understanding of data associations and connections existing within data analysis, memos serve as *"sites of conversation with ourselves about the data"* (Clarke 2005, p.202) triggering written reflection on deeper meanings (Saldaňa, 2009, p.45)

Memo writing was a substantial part of research analysis covering a wide range of questions such as participants and phenomena, the choice of codes, participant behaviour and dilemmas, connections, directions and ethical considerations among others. During the early stages, memo writing informed critical choices in participant selection, method selection and nature of conversation. Within the stage of coding, the writing of memos justified the emergence of codes, revealed direction of designer processes and defined priorities. In the final stage of analysis, memo writing enhanced the researcher's reflectivity, connected the patterns emerging from the material and aided the sharpening of categories.

Memo writing was vital and necessary for the connection of the more explicit in nature codes, to the more "subtle" and "tacit" themes (Saldaňa, 2009, p.13), developing, confirming or rejecting patterns. Analytic memos, personal and informal in nature act as forms of internal dialogue for the researcher, an example of short analytic memos between key stages of the development of a theme can be found on Appendix III.

As each individual participant had a personalised approach on the interview and distinct use of language, analytic memo writing aided the realisation of connections between designer groups and made clear commonalities that were obscure within the large quantities of text, or not well defined while in extract form. The techniques used were 'Clustering' and 'Freewriting' (Charmaz, 2006, p.71), the first for the graphic perspective and the quick

changes of clusters and groups offering alternative views; the second for the liberating and unhindered ways of expression, aiding the delineation of abstract elements.

3.3.3 Theoretical sampling

Theoretical sampling refines further the existing categories emerging from coding and memoing, by returning to data sources based on the findings of coding and clarify categories that appear ill-defined or abstract. This return applies to existing data or new data from sources focusing on the chosen category (Hoonaard, 2008, p.874). Within grounded theory method, theoretical sampling allows a progression of the line of enquiry based on the codes and themes emerging from data, affecting decisions about participant selection. This effectively allows the researcher to progress without a hypothesis or mechanisms of testing.

> *"Theoretical sampling is the process of data collection for generating theory, whereby the analyst jointly collects codes and analyses his data and decides what data to collect next and where to find them in order to develop his theory as it emerges. This process of data collection is controlled by the emerging theory, whether substantive or formal"* (Glaser & Strauss, 1967, p.45)

Describing the situation of the researcher after the cycles of coding and memoing and the need for Theoretical sampling Charmaz states:

> *"These categories are intriguing but thin, you have not yet defined your categories and their properties clearly. Too much still remains assumed, unknown or questionable. Instead you want robust categories that stand on firm, not shaky grounds. What do you do? How can grounded theory strategies advance your analytic thinking at this stage of the research?*
>
> *The answer is to gather more data that focus on the category and its properties. This is theoretical sampling, which means seeking and collecting pertinent data to elaborate and refine categories in your emerging theory"* (2006, p96).

Theoretical sampling is an essential part of theory building within Grounded Theory. In contrast to memo writing, theoretical sampling is concept driven, cumulative (Corbin & Strauss, 2008, p.145), and systematic (ibid, p.148), with each sampling contributing to future analysis. In this way understandings go beyond surface explanations, anchoring theoretical categories to the data and identifying various properties and dimensions through questions of relevance, precision, substance, generalisation, analytic links and parsimony (Charmaz,

2006, p.105). In that sense it was essential to to locate "excellent participants to obtain excellent data" (Morse, 2007, p.231) thus maintaining a high level of quality for the data.

The first series of interviews reached to participants without specific pattern, more out of available connections and positive replies by practitioners and were exploratory and open in structure. Participants list included academics of information design and graphic designers with graphic publications in editorial media. Visual material was gathered in addition to the interviews, contributing to connections of views.

However this group of interviewees quickly proved to be inappropriate candidates for this research. Due to infrequent rate of graphic publications, these two groups of designers were unable to respond critically to many of the questions, with an absence of reflective thinking being detected in their interviews. This in the opinion of the researcher was unsatisfactory and compromised the integrity of data, as the participant's knowledge was helpful but not entirely committed to the editorial information environment. In order to get data with thick description, distinguished professionals in known newspapers and exclusive producers of infographics should constitute the participant sample.

This marked an important point of participant selection and a continuous process of improving sources as well as content that persisted until the conclusion of the data gathering cycle. Theoretical sampling was used consciously from this point onwards to gather data closely related to the emerging codes and categories and inform emerging theory. The purpose was to critically apply focus on parameters of the population that was best for the result (Silverman, 2010, p.307). Seeking out *"groups, settings and individuals where […] the processes being studied are most likely to occur"* (Denzin & Lincoln, 1994, p.202)

The group of editorial information design practitioners displayed even from the early stages an increased level of identity towards the discipline and acute awareness of practice within their responses. Replies were hard thought and reflective, revealing accumulated knowledge that was surfacing even in introductory open-ended interviews, providing the much sought after, thick description of activity. An encouraging sign was the persistence of these characteristics given the diversity of backgrounds and previous professions of these designers. It has to be noted that from the designers interviewed, they ranged greatly in age and experience and operational environments. Some of them were designers in high

circulation newspapers and news agencies, while others where directors or even founders of editorial graphic agencies.

Within this group, the first key informants were detected: key individuals who are articulate and knowledgeable about their community offering insight and awareness to the researcher on the area of study.

> *"Key informants help to establish a link between the researcher and the community. They may provide detailed historical data, photographs, manuscripts, knowledge about interpersonal relationships, a con- textual framework in which to observe and interpret behaviour, and a wealth of information about the nuances of everyday life. […]*
>
> *Their views are compared and combined with interviews, observations, and survey data in order to make a complete study. More to the point, key informant and qualitative researchers are collaborators, using questions, answers, and probes to better understand how and why things work." (Fetterman, 2008, p.477)*

Some senior designers of infographics, working in nation-wide newspapers and agencies, have developed keen knowledge of the practices of the field, with their views converging, even working on different organisations and environments. These views became points of intense scrutiny as their testimonies offered rich description without hesitation. For example the head of graphics of a major newspaper, designer and art-director when critical subjects had to be visualised, was the first to provide a view of the processes and habits of information designers with clarity. The holistic perspective offered by the key individual, connected previously disconnected areas of practice and clarified the purpose of emerging codes, invigorating research drive. As more key informants presented, the effect was intensified and key concepts were validated.

Also from this point onwards, theoretical sampling offered a tighter focus on the emerging material, upgrading the standards of data acquisition as well as filtering material of minimal contribution. For example a participant's interview was removed from the analysis due to lack of reflectivity and in-depth description of elements; a junior designer with little actual experience of the area, making his descriptions 'thin' in comparison –thus rejected in terms of Grounded Theory Method as nothing new is added to the study. As data analysis progressed, codes and themes applicable to the rest of the design group could no longer be connected with his narrative, leading to the withdrawal of the material.

However the alignment of concepts towards specific directions of this diverse target group was an encouraging fact, especially given the evidence that theorists of information design were unknown, thus minimizing the chance of participants transferring theoretical preconceptions in their descriptions; the main characteristic of the group was that it was consisting by producers of editorial information design offering outcomes on daily basis.

When no more categories or relevant themes emerge from this process, data has achieved "saturation" signalling the end of the Theoretical Sampling cycle (Corbin & Strauss, 2008, p.145) (Charmaz, 2006, p.113). Glaser presents a definition closer to the concept of constant comparison used in Grounded Theory, considering the diminished conceptual yield as a sign for the end of this phase.

> *"Saturation is not seeing the same pattern over and over again. It is the conceptualisation of comparisons of these incidents which yield different properties of the pattern, until no new properties of the pattern emerge. This yields the conceptual density that when integrated into hypotheses make up the body of the generated grounded theory with theoretical completeness"* (2001, p.191)

For this study, Theoretical Sampling was a necessary step to return to participants as well as the investigated data to draw series of connections of designer narratives. The personalised views provided a rich description of the aims and objectives that shaped a series of codes in loose categories, however only with multiple iterations the categories achieved 'directions' towards the designer and intended audience with precision and parsimony. A comprehensive list of codes and categories will be presented in the following chapter: Analysis.

3.4 Ways of data acquisition

3.4.1 Interviews

The method of collecting data was face to face interviews with participants, on-site of their respective work environments, recording their views on design activity via a digital recording device and editable sound format. As producers of infographics, they were the main actors of this research, with the lack of domain specific literature upgrading their narrative of direct experience to a status of exceptional gravity. Within this process and under the constructionist paradigm, each interview became a separate topic

instead of mere resource (Silverman, 2010, p.119) positioned within a wider plan of action, establishing individual gravity but also connections with the totality of the material.

The design of the interviews was informal as participants were encouraged to discuss elements that even if practiced daily, they had to reflect upon and provide parts of information after completing thought cycles within the interview. Quite often key answers were given in questions asked earlier within the interview, or descriptions were given after lengthy effort; an informal attitude aided this sharing of information in more than one way.

The interviews were conversational and exploratory in nature, based initially on criteria from literature and open-ended questions, aiding the flow of the discussion (Roulston, 2010, p.15). There were also key points that formed a basic structure, as a contingency in case that the designer was reluctant to initiate a narrative. These were aids to allow entry points for dialogue such as:

- Questions about how they perceive and describe what they do.
- How data are perceived from the designer viewpoint, how they interact with the design process.
- How data visualisation can be described within editorial context, what defines a good infographic.
- The process before using software visualisation tools.
- The process using software visualisation tools.

However the structure was subtle and participants could manoeuvre around them freely, or ignore them altogether, offering alternate point of views or even freely direct the interview into matters that they thought were important. Although designed as one-off approaches, most designers were happy to respond to a second invite for a discussion and some even to a group discussion. All the interviews took place in participant work environments intentionally to aid recollection and boost confidence.

During data collection and as the "continua" of the discipline were presented by participants, the researcher maintained constant effort to be "self-conscious of the focus and design of research" (Keats, 2000, p.32) gathering further information on context but also realising his position within the process of the interview, facilitating participants'

expressions and establishing rapport, sensitivity and empathy to enhance the outcome, (Keats, 2000, p.33).

Nonetheless not all interviews conducted were used in the final stage of analysis, as material examined, increased the awareness of the researcher on the research field and phenomena developed. Some of the material initially showing promising contribution was later found lacking and not fitting to be included in the study. More specifically from the 11 interviews with editorial information designers, 8 made it to the final stage of the analysis.

One interview taken from a junior designer was removed from the analysis due to the lack of reflectivity as discussed earlier. The other two were negatively affected by the environment where the interviews were taken, affecting the final quality. In the first, large parts of the recording were made inaudible by background noise to the digital recording device, while the second was interrupted after the first few minutes due to unexpected work-related emergency, leaving material short and underdeveloped. Regrettably both participants were unable to provide interviews during the data gathering phase due to professional constraints.

Also during the data collection phase, a series of short interviews were conducted with close associates of designers to provide additional knowledge of the professional area. These included two categories of professionals: journalists and 'data gatherers' or 'data hunters'. The former prepared the written piece accompanying the graphs, while the latter were responsible to find accurate and credible data to support the creation of infographics. These interviews were conducted in open format, again in the participants' work environments.

All interviews were intentionally transcribed by the researcher, with the use of word processing software and audio playback, providing familiarisation and intimate knowledge of material, before any form of analytic process occurred.

3.4.2 Observation

Observation was also part of data collection and a way to further understand designers in the process of production. Observation of work environment produced field notes that described connections in operations of designers within the various working

agencies and newspapers, and in return informed the following discussions: as designers were observed in action, many issues regarding practice became clearer and in return sensitised the analyst further.

Although not part of the data analysis, observation served into raising researcher awareness in the field of study, affecting research direction and acting as "a self-correcting investigative process" for the analysis steps. (Angrosimo, 2000, p.676)

Initial observation of interviewees and work environments included digital visual recording, but was quickly substituted with hand-written field notes, as the use of visual recording devices was impacting designer narratives in a negative way, often disrupting participants' concentration.

3.4.3 Visual data

Visual data were also gathered during the interviews as designers recalled specific information design artefacts while their narrative progressed to provide examples of their ideas in action. Similarly during interviews where participants had difficulties to verbalise concepts, they were asked by the researcher to bring a recent work in mind, as a mean to strengthen recollection. Visual data stemming from the artefacts were reviewed in conjunction with the interview transcripts, strengthening the integrity of narrative sources (Silverman, 2010, p.241) and providing extra points of reference for the processes of constant comparison within the Grounded Theory Method.

However visual outcomes are not part of this analysis, partly because of the vast diversity of forms that make a broad categorisation extremely difficult, but mainly because of the inherent subjectivity of the post-production analysis, which testifies little of the actual process occurring during practice. In that light visual outcomes adopted the vital support role of enhancing awareness and sensitising the analyst further providing a deeper understanding of the emerging concepts. A selection of notable infographics is presented in **Appendix I**, figures 3.2-3.10.

Visual data displayed the correlation of theoretical elements with the practical outcomes in the professional 'reality' of the discipline, strengthening understanding and subsequent interpretation of thematic structures.

3.5 Conclusion

The methodology for this research project was a lengthy adaptation to the needs of the research question, constantly in an effort to select an analytic process able to capture and transfer the wealth of knowledge of the practitioners to an appropriate framework; displaying the 'described reality' of information designers in editorial context.

Although the intention of making a qualitative study was decided at an early stage, during a large period of data collection it was unclear under which method the research should be further analysed. Grounded Theory was selected as the project matured, due to the qualities of searching for in-depth meaning and ways of making meaning from designer descriptions. The paradigm adopted in the final stages of the study was one of moderate Constructivism as an immersive way to understand the critical questions developed, but employed a minimum and cautious interpretative approach necessary to elevate into higher conceptual categories the individual, personalised design approaches.

Interviews, visual data and observation were used to understand the different dimensions of the knowledge gap, contributing different perspectives on the same subject and strengthening the final textual analysis.

The Grounded Theory method provided the analytic tools to constantly compare these narratives placing them into perspective, building a larger theoretical construct that the individual contribution is highly valued but also contextualised, synthesising an identity for the better description of the discipline under investigation.

Chapter 4:
Analysis

4.0 Analysis

4.1 Introduction

Within the following chapter the analysis of primary data will be presented, displaying the emerging aims, objectives and pursuits of the designer participants and generating grounded theories that clarify and most importantly situate editorial information design practice within a consistent framework of action, allowing the articulation of tacit design knowledge. Theorising within the Grounded Theory method means developing abstract concepts and specifying the relations between them (Bryant & Charmaz, 2007, p.25), in that sense the analysis of the material sought to discover and clarify the critical concepts of practice and connects them in a well specified theoretical construct.

The individuals who participated in the data gathering phase provided a wealth of material, tacit in nature, with rich personal descriptions of activity. Their descriptions shared common characteristics about the editorial information environment as all professionals worked towards the exposure of complex, data intense subjects, towards a greater audience. Through the use of visual formulas and distinct practices complex content of statistical nature and specialist knowledge -often reaching hundreds of pages long depending on the subject- was displayed into a single graphic. Through active multi-layered processes during construction, the infographics offer comprehensive synopses of data-sets playing a critical part into the presentation of a news story - albeit this finding has to be confirmed by data obtained from the readers.

Through meetings of informal character and casual conversation, participants displayed a deep understanding of the processes of creating an editorial infographic and showed an overlap of focus on areas, existing through the narratives in the form of personalised statements, metaphors and visual examples. The interviews, exploratory in nature contained uncategorised knowledge, embedded in daily practice, causing initial concerns on how these isolated views could be transformed into exemplar abstract categories, elucidating practice.

The aim of the study and at the same time a major challenge, was to depart from descriptive operations of hypothesising and conjecture from secondary sources and enter into meaningful examinations of data via rigorous methodological tools, discovering the

essential underlying elements constituting practice, hidden within simple language and personal codification. At this particular objective the Grounded Theory Method proved invaluable, as the iterative processes of synchronous data gathering and data analysis stages formed a continuous process, illuminating the area under investigation while at the same time initiating processes of explication of perceived phenomena. Given the fact that the researcher entered the area of investigation with only estimates of what can be encountered during the primary research stage, the application of the method allowed an unravelling of the personalised designer language and discovery of common ground between narratives. As the cycles of grounded theory progressed and more pertinent data were accumulated, key areas of activity, existing on every narrative began to appear. The emerging concepts that persisted through the process led to the crystallisation of a core of concepts that remained grounded to the data: an aggregate of desired material under the scope of the investigation. This aggregate of basic carriers of design knowledge, form the **Codes**[1][2] of the analysis.

The surviving **Codes**, becoming more observable and robust after the analytic phase, emerged as almost observable phenomena even in abstraction, without any need to enter forms of constructivism for their formation. In that sense the epistemological attitude was not far from an objectivist viewpoint.

However the codes alone provide little insight on the actual connections of the concepts or how these elements can be integrated into a wider framework of theory or action. The next step involved the elevation of material into meaningful groups via comparison and memoing[3]; the purpose was to escape the descriptive nature of textual extracts or the implicit nature extract/artefact parallels and display coherent theoretical hypotheses, which alone or in synergy create a web of actions and interactions: nexuses forming a matrix acting as structure to explore editorial information design. These are the **Themes** of the analysis.

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[1] To avoid any possible confusion of codes and themes and make distinction of concepts and theoretical material from simple text, during the analysis and discussion chapters the names of codes and themes will be presented in **bold**.
[2] The groups of Codes constitute the emergent Themes, or conversely, Themes 'contain' Codes of the analysis. Codes represent explicit concepts grounded to the data, they are segments of the Themes which are more subtle, yet potent structures of meaning.
[3] Memo writing acts as a link between coding and analysis, a reflective step to seeing data in new ways in the form of series of informal writings.

The **Themes**, more elaborate and complex in nature were built from the grounded in the data codes, retaining close connection with concepts from narratives. At this stage the input from context, acquaintance with the literature and immersion in the research area, made the shift towards a constructivist focus necessary: In order to investigate the connections of the codes, the diverse phraseology and language of designers – even when operating in the same environment- required a measured application of interpretation to develop the thematic categories.

On the post-theme stages of the analytic process, a set of concepts of higher theoretical value was discovered, maintaining a thematic character, but transcending the limits of current theme structures. These are critical drives of practice emerging from contrast of the existing themes and cycles of theoretical conclusions, revealing concepts that maintained continuity through practice. The last two of the emerging grounded theories act as potent carriers of intention yet also identity for practice, illuminating elements pertinent to design epistemology.

4.1.1 Summary of themes and codes

In total seven themes emerged from the analysis of the textual and visual data of each designer, five from the analytic process working with the codes, and two during the final stages while examining further connections and continuity through the first five themes (tables 4.1 and 4.2, p.124-125). Each one connected to emergent codes constituted by exact phrases representing a set of narrated and observed phenomena, grounding the theoretical position with the transcript. Before proceeding to an in-depth analysis of the data, a synopsis is presented to provide a preliminary structure of findings and the overall rationale of emerging material. The five initial themes are:

i) Morphology of argument: A theme describing concepts and dynamics throughout the design phase. Designers underlined in subtle ways a core of concerns about clarity of the intended messages towards the audience having a great impact on the way of processing and thinking about the messages of the visual. Successfully creating this clarity on editorial information design retains a substantial amount of complexity, allowing the display of correlations and interactions of the existing components of a story, relating to

cognitive characteristics of design work. The theme consists of three emergent codes: **Visual and Cognitive Reconstruction**, **Establishing Critical Analogies** and **Underlying Patterns of Non-disruption**

Visual and Cognitive Reconstruction: The process of reducing the unnecessary dimensions of a subject towards an audience making the attached concepts accessible. In an act of translation of the data into visual formulas, the designer reduces the volume of information while simultaneously making the complex relationships clear without the need of expert knowledge on behalf of the readership.

Establishing Critical Analogies: The process of making an effective graphic runs through graphic variables within the page and manipulations on properties of visual elements. Designers displayed no preference in particular formulas but instead preferred to display an intense interest on the use, hierarchies and structures to build connections within the page. Simultaneously as patterns were expressed another concept was developed in parallel relating to critical differences, as a tool to underline the qualities of the developed structures via juxtaposition and effective contrast of visualised information. The outcome was to provide strong tools of analogical reasoning able to describe qualities, quantities and physical or mental properties in visual form.

Underlying Patterns of Non-disruption: The process of establishing and maintaining visual mechanisms to relay information without unnecessary interruptions. Investing with careful planning and time to the audience, designers build visual forms of familiarity via means of presentation and visual formulas of functionality to establish subtle understanding on the supporting elements of semiotic character.

ii) Data Struggle: A theme describing concepts and dynamics regarding the pre-design phase and early design phase. Designers faced with large amounts of frequently abstract data are engaging in intense personal processes of understanding and interpretation. As the data are not story specific, designers are immersed in the meanings and character of source material to produce the vital visual outcomes. The theme consists of three

emergent codes: **Establishing a Personal Connection**, **Dialogue with the data**, and **Acute Data Separation**.

> **Establishing a Personal Connection:** The process of understanding can take various forms for editorial information designers including personal research, group research, external advice, personal communication with sources, all revolving to the ultimate revelations of meaningful relationships within the news story which the infographic is connected with. The involvement is intense and focused to a degree that goes beyond the descriptions of client brief found within established graphic practice.

> **Dialogue with the Data:** After the initial understanding of the presented data set, designers seek ways to further shape the main concepts and components of the graphic. To achieve this objective, forms of personal or group dialogue are developed utilising visual schemata to exchange views, compare and cross-reference the data set, refining emerging ideas.

> **Acute Data Separation:** As the nature and aspects are becoming clearer and the connections are crystallising, designers go through a phase of gradual omission of unnecessary information from the graphic, to make content more visible and clear. This form of selection is taking place as the graphic is taking shape and has as a final objective to highlight the important parts of the story for the reader.

iii) Visual Exposition of Content: A theme describing concepts and practices during the middle and later design phase. Designers utilise a set of techniques to draw readers' attention to a particular graphic by exploring visual potential of guiding attention and creating incentives of sufficient gravity to explore the graphic maintaining interest and aiding the transference of knowledge. Simultaneously an effort to reveal the hidden or least visible aspects of the story surfaced whilst producing the graphic by shifts of perspectives or ways of comparison to the audience. The theme consists of three codes: **Incite Reader Inquiry**, **Nurture and Maintain Analysis** and **Impart Complex Analytic Outcomes**.

> **Incite Reader Inquiry:** The process of capturing first impressions and manipulating reader attention to focus on the graphic. The purpose of this is two-

fold, initially to provide reason to explore the visual artefact but also draw attention to the surrounding news story, as graphics accompany important pieces of journalism within the medium. As a tertiary effect the infographic is used to stimulate interest within the page as part of a greater whole. In combination, the elements peaque readers' curiosity and inspire further inquiry on the presented material.

Nurture and Maintain Analysis: The process of adopting strategies to guide reader attention following the initial reaction of locating the graphic and piquing interest on content with visual aid. Designers ingrain the visual representation with elements maintaining attention and focusing perception enough for the reader to absorb the main aspects of the story. This also acts an incentive for the production of formulas of representation and information display, nurturing continuous inquiry.

Impart Complex Analytic Outcomes: The process of analysing content produces often unexpected or unseen results, exploring modes of practice that provide insightful perspectives not only to the designers but also to the readership. The purpose of this strategy is to explore dimensions of the often abstract nature of data, surfacing unseen or complex realisations and contribute to the effort of democratisation of knowledge towards the readership. This extra layer of complexity, not immediately visible to the reader, is also an essential step for the designer to establish depth and breadth of data interpretation.

iv) Emergent identity: A theme describing concepts constituting an emergent identity for editorial information design. The nature of these concepts relate to characteristics prevalent to the practice of information design involving designer, artefact and audience in the context of editorial media. The manifestation of elements in this particular context reveal increased activity in interaction and communication with the readership, developing feedback channels that the practitioner can use to understand the needs of the audience through feedback. Part of this practice is the designer's connection with associates having expertise on complicated subjects, contributing to this feedback circuit. The theme is consisting of three codes: **Predetermination of Audience**, **Self-correction Perspectives**, **Delineation of Personal Knowledge**.

Predetermination of Audience: Designers voiced a strong belief on the knowledge of preferences of their readers, a significant yet perplexing belief, if we take into consideration the sheer size and diversity of readership on high circulation media. Designers produce their design artefacts as having a specific type of audience in mind, bringing into their narrative of practice elements that are not immediately justifiable but are not rejected by practice.

Self-correction Perspectives: Designers display an increased use of the channels to communicate and interact with the reader base regarding the structure and expression of graphics. As the visualisation is exposed in high circulation mediums and the weight is carried by the supporting stories, readers often express criticism that is always taken into consideration by the designers. The communication establishes type of self-corrective mechanism that maintains quality and appropriateness to the infographic.

Delineation of Personal Knowledge: As the objective of information graphics is to bring specialised complex subjects in visual form closer to the audience, the need for maintaining legitimate perspectives with expert advice becomes an imperative. The variety of subjects and the need to interpret data stemming from areas in which conclusions are difficult to be drawn, such as law, medicine, or finance, make designers necessarily dependant on the knowledge of external sources. These sources strengthen designer awareness on subjects and underline potential shortages of knowledge on the implementation of the visuals.

v) Medium awareness: A theme describing the awareness of editorial information designers on the medium, present throughout the process of designing an infographic. Designers displayed the ability to contextualise data and recognise the multiple paths to tell a news story through the exploration of material. Methods of comparison are developed, frequently refining and exploring a set of sub-stories that can be narrated to contribute to the completeness of the graphic. However with contextualisation comes the realisation of the limitations of the produced artefacts, as practitioners did not hesitate to position their artefacts within the plethora of perspectives of a news medium as a well-researched and justified perspective of information. The design outcomes act as a critical point of reference within the page: an important node where visual, textual and numeric

elements converge to work for the benefit of the reader. The theme consists of two codes: **Multiple Outcome Analyses**, and **Synergistic Visual Node**.

> **Multiple outcome analyses:** As data interpretation progresses the designers face a constant unravelling of presented data and correlations with real-life events, pertinent stories and unavoidable connections with more sets of data. Practitioners realise that within the abstract data exist multiple stories with variable gravity to readers' opinion and is part of their objectives to select a specific story or a cluster of stories to follow and present visually.

> **Synergistic Visual Node:** Practitioners displayed strong awareness of the position of the graphic within the page and the in-page connections of the infographic with the surrounding image and text. Although the production of the visual artefact concentrates a high density of information that could attain self-sufficiency, the intended purpose of graphic is to co-exist within the page and co-produce or cross-reference meanings with the written part of the story and synergise with the supporting images.

The two themes emerging from the analytic cycles on the original five (more detailed description on rationale and method follows on 4.7) are:

vi) Dual perspective of designing infographics: A theme describing the simultaneous view of editorial information designers while designing infographics: A synchronous view of two seemingly opposing perspectives co-exist during the artefact production -the expert view of the designer and the layman's view bringing together two seemingly opposing parts, creating poles of explication and reference that run through the process. The term "synchronous" is an approximate denoting the existence of two initially antithetical perspectives, side by side.

The first perspective is supported by the theme of **Data Struggle** while the second perspective is supported by the themes of **Visual Exposition of Content** and **Emergent Identity**, extending on the codes of **Incite Reader Inquiry** and **Nurture and Maintain Analysis** on the former theme and **Predetermination of Audience** and **Self-correction Perspectives** on the latter.

vii) Multiple visual methods of refinement: A theme describing the persistence of methods of analysis and comparison of data throughout the design phase. The data on editorial information design are far from given, they are carefully selected and analysed independently for each particular case. **Data Struggle** describes the stages where designers familiarise with the data, establishing personal connection, and making a critical separation of parameters.

Refinement however does not stop at this point: content selection continues until the late stages of graphic production. The theme of **Visual Exposition of Content** with the codes **of Multiple Outcome Analyses** persist in the medium to late design stages affecting the design outcome. As the graphic is constituted by elements that represent data, modifications on the visual patterns reshape the connected meanings. Changes and possible additions or removals of the visual entities trigger re-thinking on the data with meaning-defining implications.

Table 4.1 – Original five Themes emerging from analysis of Codes

Themes	Constituting Codes
1. **Data Immersion**	Visual and Cognitive Reconstruction Establishing Critical Analogies Underlying Patterns of Non-disruption
2. **Morphology of Argument**	Establishing a Personal Connection, Dialogue with the data Acute Data Separation
3. **Visual Exposition of Content**	Incite Reader Inquiry Nurture and Maintain Analysis Impart Complex Analytic Outcomes
4. **Emerging Identity**	Predetermination of Audience Self-correction Perspectives Delineation of Personal Knowledge.
5. **Medium Awareness**	Multiple Outcome Analyses Synergistic Visual Node.

Table 4.2 –Themes emerging from a lateral analysis of Codes and Themes

Themes	Constituting Codes and Themes
6. **Dual perspective of designing infographics**	Data Struggle Visual Exposition of Content Emergent Identity, Incite Reader Inquiry Nurture and Maintain Predetermination of Audience Self-correction Perspectives
7. **Multiple visual methods of refinement:**	Data Struggle Visual Exposition of Content Multiple Outcome Analyses

Within the following parts of the chapter a more thorough analysis of each theme and relative codes is presented along with the supporting extracts from the transcripts of the practitioners interviewed. The themes and respective codes are presented with the same order as in the above summary.

4.2 Morphology of argument

Designers described a group of concerns regarding the clarity of the intended message towards their audience. This form of clarity retained an underlying level of complexity on its description as designers used personalised terms to explicate a multi staged process. By mentioning the terms 'simplicity' or 'clarity' practitioners expressed concerns of what is intended to be contained within an infographic. The nature of the comments related to cognitive aspects of the designed artefact portrayed procedural steps of progress within a graphic; this group of ideas were repeated within the interview with emphasis and underlined as crucial for completion. The relevance of these concepts becomes obvious when examining the data density of a designed artefact, as the majority of the editorial information graphics contain a large volume of information, frequently in high concentration. Communicating successfully attainable and

clear messages unburdened by unnecessary complexity emerged through these characteristics as a priority, in the totality of the interviews.

In a similar way, a conscious approach of the functionality of components within the design artefact and how these would interact within the readers mind eye emerged. Designers displayed an awareness in the effects of interconnectedness and juxtaposition in regards to the meanings and representations of an infographic in a rigorous manner. Maintaining a coherent pattern and stressing the critical differences became a point of reference as a way to delimit the subject under investigation through contrast and comparison. This becomes in effect a non-verbal mechanism of explication with multiple levels of information where the reader enjoys a personalised narrative of data presented.

Gradually the above concepts outline operations relating to the function of the visual mechanics directing the attention of the reader unhindered through the contrasting elements that constitute a story. Designers build mechanics of functional character to focus the reader attention within the graphic facilitating the transition between visual elements. Simultaneously the same group displayed conscious methods to build components within the page that maintain familiarity and function via the visual tools of relaying information, both within the graphic and the page containing the graphics. The artefact is created ensuring that the relayed messages and corresponding volume of information will be conveyed without disruptions of the visual narratives.

4.2.1 Visual and Cognitive Reconstruction

This code emerges from references on the design process, reflecting a constant effort to present the graphic in a refined form, while containing the necessary critical information to adequately cover the subject. In contrast to the voluminous statistic data that the infographic frequently relies on, the graphic has to achieve a state of visual self-sufficiency and the main elements have to be presented in a way simple enough to be understood by the audience. The purpose of reconstruction is about bringing the core of the argument to the reader in the most direct and concise way possible and involves both visual as well as data refining techniques. This process was described as critical by

every designer interviewed, and was deemed a prerequisite for creating a successful visual representation. Clarity, understanding, simplification, and a strong desire to make obvious the obscure connections of data sets were, among others, parts of the potent descriptors of designers to describe the critical operation.

Extract 1, Visual and Cognitive Reconstruction.
148	And a lot of answers can come from that, it could be that it
149	is understood only by further explanation , and this is not good enough.
150	I'll have to change it and make it clear, more understood.

Extract 2, Visual and Cognitive Reconstruction.
186	I think that this is also a simplification,
187	a simplification in comparison to what this was before we started working
188	on it. Instead of giving 3 excel tables with 1500 cells each, I will just take
189	two minutes of his time to give him an accurate picture of what is going on... But when he
190	will get it... I guess that's simplification too.

Extract 3, Visual and Cognitive Reconstruction.
102	when I finish something and with everything complete it becomes so
103	much more apparent, the message

Visual and Cognitive Reconstruction was also described by senior designers as a point that could mark an infographic as a failed attempt if not implemented properly. Impact on the audience was emphasised as a deciding factor, along with the responsibility to reframe content in credible ways.

Extract 4, Visual and Cognitive Reconstruction.
102	Yeap this is very, very important, if the graphic is too complicated then it
103	is possibly failing

Extract 5, Visual and Cognitive Reconstruction.
409	what I believe is that good design is to make
410	things incredibly simple to understand and that's the most crucial thing of
411	what we are trying to do.

Extract 6, Visual and Cognitive Reconstruction.

| 49 | It |
| 50 | must be easier, simple on structure, towards the eye (of the reader) |

As the act of communicating information relies on an unhindered flow of information to the reader, simplifying has a dual nature: diagrammatic but also data related, visual but also connected to the core meanings that a story carries. Simplification is an act of translation in visual forms and visual formulas, allowing a different kind of awareness and accessibility for the reader to find the important parts. These data, colour coded and separated in categories, form groups of content within the page to ensure understanding. The reduction of additional dimensions and subtle outlining of conceptual territories within the page allow the audience entry points into the presented subject, as the complex relationships of categories become attainable without the need for expert knowledge:

Extract 7, Visual and Cognitive Reconstruction.

329	Well I might look, I might listen to the reader to look what I am
330	necessarily approaching with, in mind, which is kind of clarity,
331	visual interest and the ability of the eyes to rest on the otherwise dense that
332	would just give you a headache!

Extract 8, Visual and Cognitive Reconstruction.

31	The
32	idea was to keep them simple, so there were no three dimensional bars
33	on a bar chart, and everything is flat and simple and I think that's a style
34	that works for us. In fact it's a style that over the years more of the
35	broadsheet, the Times, the Telegraph and the Independent copied what
36	we have done. It works well.

The visual form creates an alternative way of communication, different from the established method of written text both in the non-linearity of exploration but also in the time needed for absorbing information. Time of transmission is significantly lessened and the particular parts of the story are relayed in a direct and concise way, providing a powerful synopsis through visual means without reducing dimensions (Figure 8.1).

Extract 9, Visual and Cognitive Reconstruction.

44	Actually this is the core of it. An alternative way to
45	perceive, understand and process ... and reach to a conclusion from a
46	large volume of data. For example if I show you the data from the game's
47	score, because I had to do that

Extract 10, Visual and Cognitive Reconstruction.

| 21 | The first, at a glance, with a visual |
| 22 | to see to see some things and draw a quick conclusion. |

Extract 11, Visual and Cognitive Reconstruction.

118	The designer area of
119	the graphic is the next part of the challenge as I am particularly interested
120	in simplicity... it could be one, two or three lines that constitute the
121	graphic and reflect the necessary qualities... all the rest (that is)
122	unnecessary must go.

However beyond the presented ease of transfer of material, adjustability of focus is also one of the strengths of the infographic. While a quick conclusion can be reached at a glance, complex data and meanings can also be contained within the same graphic with the visual mechanisms allowing transition from the simple to the complex elements of the story with ease. Retaining a holistic quality the main concepts emerge clearly with the attached data within the same space. Simplification is not a process of unnecessary reduction or blunt removal. Each element needs to be carefully elaborated and placed within the graphic reflecting the quality and meanings of the data set:

Extract 12, Visual and Cognitive Reconstruction.

100	So when I am saying to make something simple I
101	do not necessarily mean to cut it to pieces and sew it to fit us or
102	something. Um... you are accepting the fact that to make something very
103	complex into very simple still you might require quite a lot of complexity
104	to do that.

The code of **Visual and Cognitive Reconstruction** is focusing on a process making the graphic artefact an appropriate medium to carry conceptual/numeric dimensions of a subject, securing clarity via multi-layered actions of simplification and compacting the intended message for the reader. Simplification is held in a fine balance: if the graphic becomes an oversimplified version of original sources, this can result in a poor outcome as accessibility would be limited; if too much information is placed, then the design becomes cluttered and fails its communicational requirements.

4.2.2 Establishing Critical Analogies

This code emerges from the designers' attempt to describe the visual mechanics of an infographic, especially matters regarding size, dimensions, volume or quantity of a subject. It is worth mentioning that while there is a plethora of formulas available, designers did not single out favourites; instead they persisted on descriptions of patterns and differences that would illuminate the finer details of an infographic. For most designers the tools are not pre-determined or specific but chosen, or even in important cases created entirely new formulas for each particular graphic. The aim is to provide insightful analogies to the audience and remove the abstraction of the data by means of comparison: physical properties and numeric dimensions are displayed with mechanisms closer to natural understanding.

Patterns, a combination of effective representation of structures and interrelations, provide insight and comprehension on content and the extent that components of a story interact or align towards a set of concepts in need of communication. The visual expression of the structures is localised, depending on the type of the subject and the number of constituting components

By the utilisation of pattern, the connections of the main points of an infographic are imprinted in visual form; a web of references on the selected subject is carefully built to contain the particular meaning providing details. Boundaries, transitions, movement in time or progression of a story through time, are examples of patterns developed. Difference, on the other hand is used as a tool to transfer the critical information via meaningful comparison to the audience, pinpoint the major changes, compare the shifts

of quantity and quality through time and delineate impact and scalability, leading to comparisons that numbers can not represent. For example volume and length is compared with familiar objects, or multiples of a familiar concept, taken from everyday life.

Extract 13, Establishing Critical Analogies.

303	We'll try not to use
304	big dollar bills to represent money these are real clichés that we try to
305	avoid. But it really depends, people will always like to know how big is
306	something compared to a double decked bus in London, sometimes you
307	can't avoid it. And also scale is very important, how big is something? For
308	example let's say stretch to the moon and back, as most people can
309	visualise the distance to the moon or money that would buy the entire
310	NASA space program for the last 30 years

The combination of these elements makes numeric data comprehensible and manageable while establishing relevance within the reader's mind eye in visual forms. On the following example, the extract 14 describes in reflection the work on an infographic providing details to a basketball game. **Establishing Critical Analogies** is used to improve reading speed and manage the comprehension of selected moments in time with the period of the occurring events. Raw data presented in the numeric form of tables build forms of reduced narrative as a product of long and painstaking comparison; this is not the case for a well worked infographic (Figure 8.2).

Extract 14, Establishing Critical Analogies.

48	I was trying
49	to find the maximum difference (of score) from the excel... that was
50	impossible, I was reading the data and my eyes were moving around
51	without finding it... it was frustrating. If you go to the graphic you can
52	locate immediately the maximum difference, it is right... here (points
53	directly) it was on the 35th minute. You go back to the data on the 35th
54	minute and indeed you can see that this was true the maximum
55	difference. I think that's the key to the visualisation of data that you
56	can just in a glance

Through critical differences, the essential parts are outlined and a connecting pattern is build to display these qualities. By elaborating, designers reduce the load of information forming connections and relationships that can be subsequently isolated and followed by

the reader, generating more comparisons. Data no longer remain as part of an impenetrable whole but acquires levels of significance and layers of importance.

Extract 15, Establishing Critical Analogies.

110	One piece of
111	information was difficult to compare with another as the way to express
112	it was different, so the first level of that was to place all this information
113	into a compatible level to be able to make that comparison and think
114	of a reasonable way to present that secondary volume of information.

Extract 16, Establishing Critical Analogies.

9	it is not a copy as it
10	has no connections with it, content or design but ... to give an example...
11	to keep some colours clear and combine them ... or connect them into
12	categories in space, is a very good idea

The non-verbal nature of graphics acquires critical importance at reducing the cognitive load for the readers. Narratives maintained that if the infographic is built well, the established patterns and differences convey the basis of the argument succinctly even without the help of numeric values.

Extract 17, Establishing Critical Analogies.

56	you can
57	understand and this is the important bit... to reach to a conclusion far ,
58	far more easier than looking to the statistics that form the basis of the
59	graphic.

Extract 18, Establishing Critical Analogies.

148	but when you see it next to
149	each other, just to use the same example, on a world map even if the
150	world map has disappeared completely and we have just the circles left
151	representing, it is immediately obvious which are the top ones and also
152	how much they are.

This combination of strategies can be used in complex artefacts to establish hierarchies that form the core of the intended message or messages to be communicated.

Hierarchies act as visual editors of content, and direct the attention of the readers, aiding greatly the absorption of data in such way that even subjects of considerable length can be framed within a single page.

33	So who is first, who is second,
34	who is third? Where (in the) graphic?... Poom, poom, poom is there! First,
35	second, third ... they need it to see, use it to refer back to, use it to get into
36	your consciousness

Yet not all infographics have the same objectives in need of transference to the page. The graphic can narrate events, past or future, or other complicated forms of information via formation of meaningful analogies. In the following extract, a timeline is built to bring perspective a large number of events and provide a comprehensive connection:

110	I think part of the appeal of this particular
111	timeline was that human perspective, seeing of... where was the
112	beginning, seeing where this was going... Tunisia sets fire on itself and see
113	how that sort of snowballs end up in this kind of trans-Arab spring
114	revolution and ... um... and although this does not necessary gives you an
115	overview... the entire picture, gives you a sense of the unfolding history

Patterns also create a bridge to the written article, merging the textual explanation with the visual explanation, strengthening understanding. The visual forms can deviate from the accepted statistical formulas or scientific forms of presentation exploring intuitive and experimental forms that the readers respond well to. Designers create artefacts, translated on the moment as understanding takes precedence over the established form of literacy of formal methods of interpretation.

147	If you see the spread sheet the whole load of numbers you can't
148	understand if this is very large or very small but when you see it next to
149	each other, just to use the same example, on a world map even if the
150	world map has disappeared completely and we have just the circles left
151	representing, it is immediately obvious which are the top ones and also
152	how much they are.

Of course as these graphics are published and enter the public sphere, the proposed patterns and differences frequently draw arrows of criticism from specialists of fields with more strict scientific orientation. In the following example a successful way of representation that initially received criticism from statisticians is defended on the premises of different ways of understanding by the audience. If by a certain experimentation the message becomes more clear, without compromising content, then limitations of use imposed by other disciplines can be bent or entirely ignored.

Extract 22, Establishing Critical Analogies.	
248	having used that
249	device for years and always explained it in a way that they could
250	understand realise the difference between, um... you know a bar and the
251	volume and ... well that's an obvious example... why people say... why use those... why
252	use these because that's not um what they can't see is
253	that's an area that represents that figure.

The code of **Establishing Critical Analogies** addresses the stage in the design process where the designer builds a platform capable to transfer the appropriate meanings to the reader by forming groups of concepts and cognitive chains of determination to illustrate points of reference. Analogy as a means of comparison to immediately explain and clarify, has a central role to designer strategy and is illustrated through forms of meaningful differences gradually building patterns and hierarchies. Critical analogy takes effect in multiple instances within the graphic, both in compartmentalised sections where individual notions are explained, as well as cross-referencing between parts of the greater structure, providing in visual form connections of the data, forming a story to be told.

4.2.3 Underlying Patterns of Non-disruption

This code emerges from the designers' description of establishing and maintaining tones of **Underlying Patterns of Non-disruption** with the reader through the production of a graphic. The purpose of the described concepts is not to draw attention to aesthetic characteristics but communicate in subtle, familiar ways content. The purpose is to maintain uninterrupted reader attention within the surface of the graphic with the

exception of the surrounding text. Patterns develop highlighting the functional elements of the medium guiding the reader through the graphic, making content understood and reinforcing the patterns present.

Also working towards non-disruption, familiarity both as a concept and strategy is developed by the designers within the graphic medium, ensuring continuity within the series of publications from the newspaper and infographics. Familiarity ensures that unwanted questions regarding format do not surface: colour signifiers, typefaces, size of completed diagrams, are all parts of the subtle mechanism of stability and incremental changes with a stabilising effect on the intake of information.

Extract 23, Underlying Patterns of Non-disruption.

277	If they think this graphic is part of this
278	publication and value that publication then it covers that same picture, so
279	they comfortable recognise it. If it is just a photocopy, or something stuck
280	in the publication, then they might wonder a little bit: "Whats that? Why
281	they've done it that way?

Extract 24, Underlying Patterns of Non-disruption.

212	Yes definitely, I think that um, because our graphics tend to be very
213	simple, is an easy language for our readers to understand and I think they
214	are used to our style of graphics. We are trying to make sure that the
215	graphic produced for the web, the interactive graphic, the style is the
216	same within, the graphic of the paper.

Extract 25, Underlying Patterns of Non-disruption.

299	you are following this style of
300	information so the reader can be drawn into that from the style within
301	that publication, the brighter and the stronger piece of information, the
302	bolder type is telling me something as a pointer. It is a device in this
303	publication that points at something within the publication to tell me
304	something and I think a regular reader would understand that and follow
305	that.

Applying uniform visual styles within the infographic and surrounding area is a practical expression of the above concepts, where designers and audience gradually agree on a refined and functional basis for presentation. The designer actively seeks ways to create

a framework for reader perceptions, gradually making the audience more knowledgeable of the semiotic values of graphic elements and contained meanings.

190	And it is a two way
191	relationship that is taking place because you provide the graphics in the
192	best possible way, yet also the reader also becomes more familiar with
193	the way that you display this information. Essentially both parties evolve
194	through time...

This effect was not restricted within the confines of a single graphic. When designers had the opportunity to create graphics in continuity for a certain medium, graphic elements and patterns were placed in context with the choices regarding the style of the newspaper. Design artefacts are harmonised often with the design decisions of art directors on overall visual style, again focusing on non-interruption and continuity.

Extract 27, Underlying Patterns of Non-disruption.

319	to follow some
320	type of xxxxx style, which in general means that you won't generally
321	see... many drop shadows... we generally choose flat simple things...
322	people love circles here, um so and there are specific fonts which are The xxxxx
323	fonts, so we get to have these things on the interactive as
324	possible...

Extract 28, Underlying Patterns of Non-disruption.

10	... to give an example...
11	to keep some colours clear and combine them ... or connect them into
12	categories in space, is a very good idea...

With functionality, designers build up visual-logical perspectives serving as mechanisms to explore the created visual patterns with points of reference within the printed page, as well as interactive mediums. Functions serve as guides and waypoints to strengthen a framework, a rationale to look into something in visual and informational congruence.

Extract 29, Underlying Patterns of Non-disruption.

33	So I think with this graphic you could have a view of
34	the game in total. To be more specific, you had a temporal perception

| 35 | that described the ...evolution of the game and a spatial one that |
| 36 | described from where these points were scored |

Functionality also takes the form of a subtle visual perspective that does not restrict, yet provokes further exploration as a cognitive tool to unfold content for the reader engaged with the infographic. The visual forms and the interacting elements of emerging pattern formations can be used to encourage further interaction. As graphic perspectives are seldom linear in interpretation, functionality provides a rational, yet not restraining path to explore the infographic. In the following example the designer is describing the functionality of an artefact and how this helps reader's immersion, by triggering 'humanising' perspectives and natural processes of learning.

Extract 30, Underlying Patterns of Non-disruption.

106	This one here in some way, you know... you are seeing a
107	very limited... you see a very limited section of the information before
108	you move away with this 3D round thing and I think ... of... being there...
109	of seeing the history unfolding and I think that kind of perspective is
110	humanising understanding

By providing the mentioned functional paths, the cognitive load for the user is significantly lessened, establishing common ground that needs not to be re-introduced or explained in each new infographic, eventually building a mutually accepted mode of communication. Small parts of the personalised and tacit ways of representation are now passed into the public:

Extract 31, Underlying Patterns of Non-disruption.

282	but the reader
283	gets used to a language or a formula and they can think yes I have seen
284	this before, I am used to it, there is no surprise there, why do squares if
285	the circles work so well?

This code describes a factor both utilitarian and stabilising in the visual artefact: an objective of the designer, graphically expressed towards the user. The developed graphic formulas in the form of graphic tools of expression and chosen design constituents of the page merge in a form of functional aesthetics leaning towards

stability within the page. An experimental and adaptable visual platform is created in the form of precedent, to reduce elements of surprise and ease the information transference.

4.2.4 Discussion

Morphology of argument as an emergent theme describes the conceptual mechanisms that designers utilise to create forms of subtle but critical visual infrastructure and build the necessary meanings within an infographic. Effectively the combined codes of the theme, work in synergy to establish a set of guidelines that designers follow for a successful the creation of a design artefact, leading to the formation of the visual argument of the graphic.

The initial aim of the designer is to 'reconstruct' the chosen subject in cognitively manageable length, making content accessible and maintaining the critical elements of the topic. Subsequent patterns of information are built upon these elements highlighting the critical differences of the subject with the graphic methods and aid analogical reasoning. Building on the previous steps, mechanisms that preserve familiarity and subtle function are placed aiming to minimise interruption for the conveyance of the data consisting a news story. Visual styles utilise the medium and the continuity of designer work to inform the readership and provide familiar elements, meaningful perspectives and ways of comparison to ease access for the reader.

Themes of **Visual and Cognitive Reconstruction**, **Establishing Critical Analogies**, and **Underlying Patterns of Non-disruption**, are structural elements of the process of imprinting information on a graphic and creating a cognitive map for the use of infographics: a mutually established connection with the reader. While designers describe these processes as exclusively directed towards reader facilitation, it becomes quickly apparent that in reality these practices do not exclusively shape reader's perceptions as narrated but also become cognitive maps for the designer. They also become ways of articulating visually the ideas, actions or contained data in need of communication, gradually giving shape to the infographic.

4.3 Data Struggle

Editorial information designers presented within their narratives, a series of actions concerning the process of personal understanding, bringing to the surface the meaning of datasets. Forming a sequence of dialogues, internal or with fellow professionals, designers take great effort to understand the nature and purpose of the data before making decisions on the final form of the topic. In most cases data are collected from different sources and the argument of the graphic has to be made through combinations of data sets and careful consideration of voluminous reports.

Editorial information designers displayed a similarity on a series of methods to understand, commit and immerse within the data, a process necessary to acquire perspective and awareness. Actions described go beyond a casually defined task oriented process and display signs of a strong personal connection, with intense research characteristics. In the effort to visualise the subject and find the most appropriate facet of a news story, a strong commitment to understand fully the dimensions and relationships within the data is presented. This understanding is not an attempt to grasp something given, but contextualise, compare and test the data set, actively seeking ways to view, frame and reframe the material.

As sufficient understanding is attained, designers engage the data in a 'dialectic' examination, exploring narratives that stem directly from sources. Individually or as part of a team, the different data sets are brought together by the designer and the questions on the nature and purpose of the data are placed to test the potential of the material to provide answers. It is worth noting that not all data sets can be transformed in graphic form, as the process often brings to the surface discrepancies and incompatibilities of data with the subject; the struggle with data takes the form of an in-depth exploration of all the available material. Frequently a demanding information designer will notice deviations of data from the intended message during the stages previously mentioned, triggering a re-examination or termination of a project by the data team.

As answers are formed, data sources are verified and connections are established, designers face large quantities of data that can be linked with the subject of the infographic. The nexus of sources have to be further narrowed down into the 'essentials' of a story, by careful selection of the parts of data that seem more pertinent.

The designer adopts a position of responsibility and active engagement with the news story, as researcher of content, occasionally informing colleagues and editors with the realisations of the struggle with the data. Carefully and in a way that the included data and sources reflect the original meaning, a separation of available data-sets takes place to shape and sharpen the outcome.

4.3.1 Establishing a Personal Connection

This code emerges from references on the strong commitment of editorial information designers while working on a project and the commitment to understand in-depth and at great length the nature of the selected subject. This is a recurrent theme within the narratives, designers do not merely look into single sources of data; if necessary a cross-reference takes place with multiple data-bases and data sources to contrast data and determine possible differences in an act known as data-mining. Co-operation with journalist colleagues and external sources are also parts of this involvement seeking meaningful relationships for a story, grounding argument with data. It is worth noting that diversity of subjects is great and frequently has to display in detail various fields of expertise. Their understanding on the mechanics can be at times involved in diverse areas: Law, sports, medicine, economics, politics, are characteristic subjects. The designer becomes by no means an expert of a field, but the persistence to explore in detail and be involved in-depth with such a diverse material is a constant concern, emphasised on the narratives.

Extract 32, Establishing a Personal Connection.

69	Were these connected with poverty? Were these
70	connected with unemployment? With what this could be
71	connected? How these riots were distributed on the map of England?
72	The first thing we thought we should do is relate the events with
73	unemployment which we did and analysed. We coloured the maps in
74	order from lowest to highest, and we couldn't find a connection there
75	that was justified or clearly visible at least.

Extract 33, Establishing a Personal Connection.

54	There is an increased sense of
55	responsibility about what is journalism and its standards. Because the
56	mainstream media these last few years spin out of control sometimes
57	and journalism isn't exercised correctly or honestly so there is this overall
58	framework that we all try to do our best, something extra

Extract 34, Establishing a Personal Connection.

114	we were trying to apply
115	the previous (election) results to the new law and make comparisons...
116	that was lot of study for us, almost a week or ten days or so... we had to
117	speak with experts and specialists in Law to understand separate
118	(information) and make something reliable and meaningful, because it
119	was a system that we should learn about. Until now there isn't something
120	that we had to do it blindly, for example to do it in way that we wouldn't
121	understand it.

The need to connect and understand data is followed by a barrage of questioning, which will allow perspective and insight into the complicated subject. Frequently interim designs offer this critical perspective, utilising designer knowledge to test material and often becomes a serious and personal pursuit for the designer.

Extract 35, Establishing a Personal Connection.

43	Yes, definitely! I mean I think that in a science based graphic, I end up
44	correcting the science editor and his written copy, because I've come out
45	and researched it myself independently not just taking the information
46	brought to me because I... you know... I am interested to it. I have to be
47	interested in order to produce something that is visually interesting

Designers do not simply work on given data sets under instruction or follow rigid directions for application of data, but prioritise on the need to internalise this information, building confidence and acquiring knowledge. In big projects the effort can be overwhelming as it carefully unravels simultaneously multiple aspects of data, relating to a story, during the pre-visualisation stage of the process.

Extract 36, Establishing a Personal Connection.

250	Absolutely (emphasis) absolutely... I've made a graphic about the new
251	Acropolis Museum before the museum was actually finished, so in the
256	newspaper they told me to do it a two page graphic. And when you get a
257	two page graphic then it should cover all the elements that somebody
258	should see and understand it shouldn't just be 'artwork' and be a whole...
259	em... I was given a 60 page report and that was a complete study
260	covering every aspect of the new museum, it was everything literally
261	everything that someone could know... it took me one or one and a half
262	week to go through it and it was the only thing I was working at... In the
263	end it was like knowing already about the museum without even stepped
264	into the building.

Extract 37, Establishing a Personal Connection.

15	Um, often we get things that we don't understand so if we
16	don't understand it then our readers don't stand a chance, and we
17	have to get back to journalists, to the researcher and say… what this means?
18	We are looking at a report by the government or any organization and
19	often things are reported in such a bad way that are not immediately
20	clear and what meaning is. So we um, um, if we don't understand it then
21	the readers won't understand it…

Within the above narratives a fundamental process can be traced: through involvement the designer will initially shape and later refine the questions that will form and sharpen the main argument of an infographic and at the same time make clear connections with relative subjects; influencing heavily the form of the graphic. The often complicated material needs to be clearly communicated to wide audiences, avoiding technicality or confusion, critical in nature questions and the alignment of the argument.

Extract 38, Establishing a Personal Connection.

31	So with this mindset, to categorise these analyses by what they
32	truly talk about ... for example is it about the Euro? Is it about the
33	recession? Is it about the reasons of the recession? Is it about ways out of
34	the recession? Is it about society, or pure numbers?

Through commitment, and establishing intimate connection, the designer explores the breadth and depth of the message; this aids the possible ways to meaningfully inform the reader. The realisation of the components of a subject and their interactions are discovered to a great extent, allowing graphic representation.

49	turn the page... you know tell a story I want... I want to draw people in, so if I am not
50	interested in it, then no one else will be, and if I can't educate myself in the production of it
51	then you know you can't go through the final piece.
52	*(Researcher): So there is an active involvement of the designer?*
53	Yeah absolutely!

As this active involvement develops, the designer is able to choose, create, adapt the most relative visual strategies to communicate the message as to the subject under investigation, displaying successfully the underlying logic of the visual.

114	Yes I think on this example there were specific difficulties and specific
115	strategies... but... the main thing was to understand. Understand
116	ourselves that is if there is a logical explanation to what is happening.

The code of **Establishing a Personal Connection** summarises the efforts of designers to establish strong, personal connections with the data set and build sufficient understanding by allowing focus on further explication. The process is intense, immersive and intellectually demanding.

4.3.2 Dialogue with the Data

As designers familiarise with the data set, and locate the elements of importance, they engage into idiomorphous questioning and accumulation of answers to further shape the content of the graphic. This dialogue can be through comparison with other data sets, occurring events, or external factors, surfacing questions that explore and reframe the perspective on the data. Context and connectivity is important, and one of the aims of this activity is to avoid singular or predetermined perspectives. The following example refers to the 2012 London riots and 'dialogues' of a designer working in different environments, discovering that unemployment on the areas was not an issue.

Extract 41, Dialogue with the Data.

69	Were these connected with poverty? Were
70	these connected with unemployment? With what this could be
71	connected? How these riots were distributed on the map of England?
72	The first thing we thought we should do is relate the events with
73	unemployment which we did and analysed. We coloured the maps in
74	order from lowest to highest, and we couldn't find a connection there
75	that was justified or clearly visible at least.

Extract 42, Dialogue with the Data.

96	For example in our research for the London riots, until we find
97	the data regarding the benefits we couldn't reach a valid conclusion,
98	couldn't see something entirely justifiable... it could be something that
99	would end up to the bin. With a lot of effort, a lot of effort and
100	sometimes you need luck also... if the rest of the data fall into place, then
101	you can complete your answers… that.

By imposing a dialectic procedure on the understood but still amorphous data, the shape of the story takes form: erroneous assumptions are eliminated and the objective of dependable interpretation comes closer. As the data are gathered by external, independent and credible sources, designers have to follow the logical structures presented with a critical eye, the graphic becomes a tool of discovery. In the following extract, all the data was understood by the creative team, yet the story of the news piece and the infographic remained elusive until the parameters were discussed with the aid of visual presentations.

Extract 43, Dialogue with the Data.

257	so these
258	represent the beginnings of each of the riots and there basically we
259	wanted to see if there is some kind of increase of tweeter traffic before
260	the riots started or after... so um, and the xxxxx journalists keyed up
261	to write a story but they didn't knew what to write about, what the story
262	was... they had the data... and they couldn't write a story until they saw
263	the graph... we had get that graph sorted and then see if there was
264	anything else... so the story they told was that there was a kind of a big
265	spike that happened before the riots, so the idea that was social
266	media somehow involved in the sparking of the riots... was maybe exaggerated.

A similar graphic research took place on research for casualties in Afghanistan, based on multiple data sources. Forms of individual or group dialogue on visualisations were critical to develop content, which was thus far understood but disconnected from a narrative. It is worth noting that designers also employ in this code existing knowledge to their advantage: they utilise visual representations as a means of effective comparison, integrating the visual method to realise data within the research process of finding the story.

42	So with most
43	casualties on the South and West, this is the area that we know... are the
44	borders with Pakistan. And then you realise that the borders there are
45	quite problematic, very inaccessible places, difficult to monitor and given
46	the relations of these two countries we can assume that attacks can take
47	place easily.
48	So we create a map of Afghanistan with the provinces, we place the
49	casualties and essentially look how this evolves through time.

The sources in which to look and compare the data are open: as organisations increasingly make data access public and designers are able to access raw forms of information, drawing from additional sources if necessary, making this dialogue informed, focused and coherent. Cross-referencing of sources is often used to substantiate positions or display different sides of the idiomorphous discussion and establish points of reference.

Extract 45, Dialogue with the Data.

47	We will
48	look at reports from investigations, for example investigations from the
49	local authority –military, police, armed forces in general it is a unified
50	organisation there. We will also go and check reports from the United
51	Nations at some point.

This stage can take considerable time to complete and the results of dialogue indicate whether a subject is ready, or prompt designers and their colleagues to further scrutinise if necessary. This process makes designers rethink perspectives from the initial stage of understanding the data, evaluating new insight on the following topic and restructuring the argument of the graphic if necessary. In the following extracts drastic

change of designer perspective is observed, as scrutiny and realisation of meanings and dimensions of data can overturn initial or developed assumptions.

<table>
<tr><td colspan="2">Extract 46, Dialogue with the Data.</td></tr>
<tr><td>205</td><td>Ahh...and choosing what to take out and what to leave in can be quite...</td></tr>
<tr><td>206</td><td>quite awkward, so you might be explaining parts of the process, missing</td></tr>
<tr><td>207</td><td>out parts of what originally you might think it was quite vital.</td></tr>
</table>

<table>
<tr><td colspan="2">Extract 47, Dialogue with the Data.</td></tr>
<tr><td>104</td><td>So if you have something like this, then you have for the sake</td></tr>
<tr><td>105</td><td>of the idea you have to throw away half of the information then the idea</td></tr>
<tr><td>106</td><td>might not be so good. You need really to take all these layers of</td></tr>
<tr><td>107</td><td>information and still make it interesting and informative. Some things in</td></tr>
<tr><td>108</td><td>order to be simple are in themselves quite complicated, quite complex.</td></tr>
</table>

This code was narrated in detail by interviewees with confidence: **Dialogue with the Data** is a way to look at complex situations to support a story, but not in mere practicality. If the constraints of the story permit, the way to look into the data and the attached concepts becomes a research method in action with the design team utilising conceptual and visual tools to shape the story out of the data through comparison, reasoning and visual modelling.

4.3.3 Acute Data Separation

This code emerges from the designers' description on bringing the data findings into the page, following the process of **Dialogue with the Data** as previously described. **Acute Data Separation** deals with precise selection of data quantities, either combining them into groups or by keeping them in the final piece, the elements considered as the most meaningful and essential. In contrast to the code of **Dialogue with data** which is about discovery of the subject, this code addresses the issue of concise presentation towards the reader.

The act of selection is an on-going process that continues well into the visualisation phase of the artefact. It is not an act of purposeful omission of information from the reader; it is a process of selection of material to highlight the essential parts of the news story and the graphic.

Extract 48, Acute Data Separation.

403	So I think in terms of telling that story is about identifying the
404	facts that we need to tell, are they crucial to tell that story? Are the events of a timeline
405	significant? In our case there were no events don't
406	look in between there were no events [laughs] [both laugh]

Extract 49, Acute Data Separation.

122	I could construct something with many
123	unnecessary things ... well afterwards I will remove elements, discard
124	parts or lines that have no meaning to remain there, does not interest
125	me, they could give something more... of a decorative... but the result will
126	be better as the graphic will be simpler.

Having a surplus of data on the page works contrary to the concepts of simplification principles that we have encountered earlier on **Morphology of the Argument**, yet careful selection is also necessary for another reason. Within the data set a number of stories exist with a fair amount of overlap, but the purpose of each infographic is to develop a story with specific subject and details, unburdened by unwanted correlations. The reader can subsequently connect data with situations or events transpiring, drawing parallels between the information contained within the infographic and events in the world. The designer has to be very specific within the representation, displaying a limited amount of data, connected to a single story.

Extract 50 Acute Data Separation.

278	there is some selectivity from the data sometimes, the
279	story that you want to say, sometimes there might be two stories
280	happening on a particular country, on a particular day, um... and a
281	particular date, and so in that particular sense in need one story... So if
282	there are three stories for a country in a day then I need one story, so it
283	could be chosen... so there is selectivity and in that sense you are
284	transforming the data...

Selectivity works always towards a credible and reliable information piece that will not distort by any means the message, as all the processes described above are connected with notions of professional integrity and ethics; designers work towards the presentation of the essential message that has to be told

Extract 51, Acute Data Separation.

217	it comes to what I said before... selectivity... we are not selecting
218	things deliberately ignoring the data to tell a story we want to tell, where
219	taking data to tell a story the essential story...(gestures)...
220	
221	so then in terms of a process that follows that I suppose is selecting, selecting data. I think
222	that is the key if you can.

For this purpose, editorial information designers always present references and preferably direct links on websites of organisations that data come from, submitting all relative sources to the service of the reader. It is not uncommon to present copies of the data sheets of each project when the article and corresponding graphic is displayed on the medium's website.

The code of **Acute Data Separation** summarises the conscious and careful process of selecting the most relevant and representative data to display on a story; by reducing the amount of components within the graphic and groups of data associated with these components, the core of the story emerges unburdened by non-crucial elements. In this refined state the act of visualisation becomes focused and intensifies impact.

4.3.4 Discussion

Data Struggle as an emergent theme forms a staged process of familiarization, understanding and selectivity for designers. Facing the data sources, practitioners go through the mentioned stages to gain sufficient knowledge for creating a graphic.

Strong commitment towards understanding and knowledge is the first stage observed, not only in terms of data but also context related information. Reinforcement or verification of knowledge are solid aims, helping in the realisation of the true dimensions of a story and the implications of the subject in question.

Specialised dialogue takes place with the data on the next stage. Designers actively seek answers from these voluminous data sets testing the capacity to provide and look for the parameters of the story in a form of questioning and research; the action is reminiscent of dialogue, and can happen with one designer or within a group. This process also has expressions of visual character, where designed models are created to test, examine and clarify groups of information.

Careful omission of information takes place during the third stage, ensuring that the most critical parts of the relevant data – or groups of data – enter the graphic. The acute separation of data finalises the cycle of knowledge acquisition from the data sets as it concludes the process where the structures of the story solidify and can take visual form. This selective approach is a responsible, accurate way of representation, ensuring that the core concepts of a story are transferred without distortions to the audience.

4.4 Visual Exposition of Content

Through the examination of primary data, a series of concepts regarding the development of predetermined narratives for the readers was also made apparent. In a fast paced news environment, designers displayed intense concerns to develop a network of visual opportunities for the audience to engage a subject, following the designed mechanics and allowing absorption of information, revealing in the most appropriate yet fitting way the parts of a story under investigation.

The process of visual exposition does not remain strictly in the design plane of the page, but takes into account contextual elements that affect the reader's readiness to absorb the contained information. From the interviews conducted, a practical constraint of design became more apparent: reader's attention can be influenced by mechanics within the page including elements that draw attention and focus on the graphic. The main focus remains on telling a story with clarity via visual means and use all the available tools fit for this purpose.

92	There is nothing more important than that, you want from the very
93	beginning to realise and tell the story, the better and simpler you tell the
94	story... well that's your target. You have something in your mind that you
95	have to tell, it can be told or not.

However when designers were called to elaborate further on the details, responses were sketchy, containing incoherent description and limited reflectivity. This led to an early exclusion of the theme from the analysis, but this changed as codes referring to the theme independently emerged at a late stage, connecting with later findings.

The initial concept manifested in this process was to draw reader attention either within the written page or the interactive mediums on the web. Being appealing in both visual and cognitive ways was crucial, providing the opportunity to unfold content, analysis and data material towards the reader. Yet the strategy does not rest on initial impressions alone, it is a meaningful way to initiate inquiry and establish a starting point for examination.

Maintaining interest on the subject to develop the contained meanings was also important, both on the levels or elaborating on the written piece, as well as the infographic. The main concern for designers was to continue providing good cause for the audience to investigate the presented content in interesting and effective ways; balancing or even overcoming the problems stemming from the heavy use of numbers, complexity of the topic, or length of the supported news story.

The last code of the theme refers to the efforts of revealing the essential accurate meanings, "truth's" of the data to the reader regarding the particular subject. Designers strive to bring to the front the often unseen details of a data set or non-obvious arguments stemming from the data, granting an expert's view to their audience, but capable to communicate the particulars with competence.

4.4.1 Incite Reader Inquiry

A code relating to the designer perspective on readers' first impressions upon seeing an infographic, a strategy to incorporate in design practice a method of capturing reader attention within the page. Standing alone within the page and initiating a series of steps in which attention is increasingly drawn into a graphic, designers described the necessity of connecting the reader with content and simultaneously initiate a gradual procedure of explication.

Context is important, as the infographic can be part of a page, co-existing with other news pieces and information that readers rarely read in a linear way or strict sequence. The interest of the reader shifts between articles and graphics of importance and the designer has to utilise visual aspects of information to draw attention and subtly signify critical elements. It is an asset of the visual formula to capture the reader's curiosity, triggering a sense of further involvement.

Within the following extracts the designers are underlying the importance of an outcome to 'draw in' the reader (extract 54) utilising novel methods of representation, using the potency of the diagram not only as a way to attract attention but also create bespoke mechanisms to deliver the data related to the story.

Extract 53, Incite Reader Inquiry.

83	If the user goes further in, so I provide to the user an image [visual] to
84	understand what is happening there, from that point onwards if the
85	subject is appealing for him he will go further into the graphic. The user
86	will try to find his way, will click will mouse-over all these tools are ready
87	so up to a point he will be engaged, then depending on how much he is
88	interested will enter the rest of the content... and even the rest
89	afterwards.

Extract 54, Incite Reader Inquiry.

35	a layer between you and the information. It shouldn't get in
36	the way, it shouldn't get in the way... but it SHOULD ... uh... I think
37	visually should draw you in... that you want to... um... play with it...

96	I think that there is a design lead
97	in that to draw people in 'that's an interesting chart! um, what it is trying
98	to say to me?'... that design perspective? At sometimes the most
99	straightforward way might be to a bar chart and something like that, but
100	it is not going to grab any reader's attention and there will be only a
101	handful of people looking at it. But if you choose a different way of
102	showing it, you know ... make use of some ... aaa [effort in thinking]
103	[pause]... novel approach... people would look at that what otherwise
104	wouldn't, and might get something from it.

This code not only takes into account contextualisation, but also elaborates on the reader's readiness to absorb information within a fast paced, information-rich environment. It is not only a case of understanding the subject but this also relates to the speed of attaining the information that the graphic contains. Regardless of complexity of the subject, the infographic has a critical role within the page and its contents: it is a fast and effective way for the reader to reach self-generated conclusions at increased speed.

129	in the times we
130	live into we have increasingly less time to absorb information... for
131	example you read a lot more material in significantly less time, pushing all these stuff... so
132	visualisation is very important element in this process so
133	you trust it... and... you try to get the absolute essence of it in a
134	simple way.

55	I think that's the key to the visualisation of data that you can
56	just in a glance ...well in some subjects with a second... you can
57	understand and this is the important bit... to reach to a conclusion far,
58	far more easier than looking to the statistics that form the basis of the graphic.

Visual styles and the quality of the graphic can also be part of drawing attention, guiding the reader into a complicated subject. This can be systematised as a tool within a newspaper and in extension, the contained infographics: colours, shapes and methods of display are all valuable tools to reach these objectives. Designers seemed ready to use

these elements as long as they did not contradict with notions of visual succinctness and simplicity.

299 | I am
300 | drawing this to say that this is more important because this is a much
301 | brighter colour. "Why they used blue, grey or red on that bit? What did
302 | they try to tell me?" [Thinking] Yeah! you are following this style of
303 | information so the reader can be drawn into that from the style within that publication, the
304 | brighter and the stronger piece of information, the bolder type is telling me something as a
305 | pointer.

Extract 59, Incite Reader Inquiry.

133 | making things having an
134 | interesting behaviour, a behaviour like to the real world is another way to
135 | draw people in, because it is key to how they experience the world
136 | around them and people want to see...

Within the code of **Incite Reader Inquiry**, a core of ideas unfolds revolving to the potency of the visual artefact, acting upon first impressions and sustaining the process of exploration and understanding. Inviting the reader to further explore content acts as a powerful incentive to continue reading, infographics do not seek to attract attention, but use attention to initiate further investigation and deliver complicated meanings. The visual schemata of infographics while unadorned contain dynamic shapes and often impressive configurations working to alleviate possible reservations and encourage the audience to engage the subject with positive drive.

4.4.2 Nurture and Maintain Analysis

This code relates to the stages following the initial reader reaction and describes the concern that the graphic representation as an entity maintains interest, facilitating further investigation of content. Infographics ideally act as centrepieces within the page in which the audience will reflect upon the connections and details of the subject displayed, containing a wealth of data and comparisons. Following the spirit of the operations of the previous code, **Nurture and Maintain Analysis** evolves strategy of

presentation further and acquires continuity, using the capabilities of the visual to maintain and nurture interest and completing a transition from passing curiosity to a justifiable cause of analysis of content.

Extract 60, Nurture and Maintain Analysis.

78	It has to be
79	clear, It has to be in style, it has to be um… if this is a big graphic, must be
80	able to hold the interest, hold the page

Interviewees were explicit on their descriptions, nurturing elements of mental inquiry to encourage further investigation. As a reader can switch attention to another article if interest diminishes, designers ingrain elements to maintain attention on the inquiry of the visual representation. This can be a focused and guided narrative through key points, connecting reader with subject if necessary via visual means and prompt to the investigation of the supporting article.

Extract 61, Nurture and Maintain Analysis.

148	Will they
149	follow it? Will they read what's important? Will they investigate? That's a
150	matter of choice … and this environment sometimes we have to pursue
151	nurturing the curiosity of the public to enjoy this stuff, you do have to
152	sometimes to have an element of impact, an element to encourage
153	people to investigate it visually compared to other methods and this type
154	of method offers that. Hopefully people will have the point of it instantly
155	and secondly will take to trouble to investigate it.

Extract 62, Nurture and Maintain Analysis.

52	we realized that when people come here don't
53	read it from cover to cover, I mean I work here and I don't read it cover to
54	cover, so I read headlines and um… and maybe the articles that I want to
55	read, hopefully a graphic will draw them in… to an article…

As reader behaviour on examining content is unpredictable, the graphic not only aids the investigation, but allows entry points to engage content as data and connected meanings are offered in alternate form.

Extract 63, Nurture and Maintain Analysis.

83	If the user goes further in, so I provide to the user an image [visual] to
84	understand what is happening there, from that point onwards if the
85	subject is appealing for him he will go further into the graphic. The user
86	will try to find his way.

Extract 64, Nurture and Maintain Analysis.

296	Again a lot of people will go straight on the chart... as far as you keep
297	consistency in anyone graphic that's, thats good. You have to vary things
298	just from the point of view to keep people interested in the story

Extract 65, Nurture and Maintain Analysis.

202	this has to
203	hold the whole spread so my primary concern is that the information has
204	to be beautifully represented, um that's just a given...

These elements work subtly without emphasising the full numerical character of the data, a trait that is not very popular to the majority of the readers, or forms of advanced scientific literacy. With graphic language, intelligent use of visual formulas, colours and links, a smooth transition between the main elements of content that graphics represent is achieved. Narratives make evident the improvisation taking place, which regardless of the subject, focus was maintained on connection and interaction with the reader.

Extract 66, Nurture and Maintain Analysis.

156	it is very simple
157	to get something without looking at the numbers... because you look into
158	something when you are really interested about it... The number comes
159	to complete the seriousness (veracity) of the information and define
160	quantities and understand information on something that you saw earlier
161	and you consider important or not.

375	Sometimes you are looking at what would
376	work with the audience, how that would relate with them. So there is a
377	kind of a visual element here too that is going on which is about: Are
378	people going to be interested? Will they be able to grasp this or they will
379	be switched off by it? Because it looks dry and dull, sometimes you can
380	add just a little bit of dynamics to it and humour! Um... in which case you
381	could do chocolate drops you know, why not?

This aspect of design work encourages the creation of new mechanisms to display information, over the conventional ways employed by statistics, relying more on the directness of the infographic with the audience. Visual outcomes stray from scientific appropriateness and remain acceptable as long as the graphic communicates the message well to the readers.

346	We do not have a preconceived
347	idea of what the graphic should be because that might stop us from
348	finding appropriate ways of representing it. It may not be the most
349	appropriate way, but the most interesting way of representing it, being
350	interesting is very important.

114	A good
115	example to begin with is a spreadsheet... a spreadsheet is a very, very
116	economic, very simple very well designed information piece but sadly it
117	is very BORING!

The code of **Nurture and Maintain Analysis** capitalises on the appealing side of the visual to maintain reader attention and continue the process of information transference. Without elements which would distract the reader, or any use of visual elements at the expense of content, designers seek a delicate balance where the immediate, expressive and improvising qualities of the infographic are employed to support the purpose of the article and visa-versa, forming opposing poles of information transfer. Reader concentration is maintained in synergy with the codes of **Morphology of argument** and **Data Struggle** as previously encountered.

4.4.3 Impart Complex Analytic Outcomes

Revealing the complex meanings of the data to the reader with responsibility also has a strong presence within the interview material. Designers strive to provide to the audience as much as they can from the research findings of the chosen topic. Often facing an overwhelmingly detailed subject for the public to fully realise its dimensions, the designer cuts through the series of data to allow the reader to engage with the core of the data-set.

Extract 70, Impart Complex Analytic Outcomes.

44	Actually this is the core of it. An alternative way to
45	perceive, understand and process ... and reach to a conclusion from a
46	large volume of data.

Extract 71, Impart Complex Analytic Outcomes.

90	But
91	this is a kind of example to display that from various graphics and
92	visualisations of information you can reach valid conclusions. It is
93	certainly a tool to reach these conclusions. After that it is all about the
94	integrity of the data, it is a strong visual argument.

This can be a shift in common perception by reframing perspectives, looking at the data from different viewpoints, bringing into the analysis easily understood comparisons. In other cases this can be categorisations of the data in themes for the readers, revealing a higher point of abstraction such as numeric projections and presenting a broader view of a state of affairs. The benefits of such process might not be immediately obvious: as the data tables of some graphics reach hundreds of pages, a shift in perspective or an insightful method of comparison can reveal unseen aspects of the details and lead to a restructuring of data and new findings.

The following example describes the revealed meaning of a centre piece about pollution between the US and China on a different tangent on the subject of pollution. This was part of a wider discussion in news media about environmental impact in developed and developing countries in 2009.

140	apart from the carbon dioxide there will be another part that will say
141	' and here it is by... per capita' per person in that country then you see the
142	other side of the story: That America is far, far worse than China, that
143	China is the biggest polluter but its got what ... 4 times the population. So
144	yes it has more pollution by America, but per person is less than the
145	United States so I think that that is very educational and just being able to
146	see it.... If you see the spreadsheet the whole load of numbers you can't
147	understand if this is very large or very small but when you see it next to each other

In the extract (72) a reframing of the statistical data took place, simple yet fundamentally changing the basis of the argument: in absolute numbers the pollution of China exceeded that of the United States, but with the implementation of the 'per capita' parameter the outcome was overturned, revealing another credible conclusion.

Placing aside the details of the particular example, data can be connected to build an argument in different ways and the inclusion of proportion or analogy can shift even the core meanings of the outcome, imparting critical knowledge to the analyst as well as the reader of graphics.

In a similar way, a different graphic revealed another aspect of a news story that was discussed at the time: the newly elected US president, promised a reduction of military spending, as well as the reduction of the number of troops in Iraq and Afghanistan. The graphic constructed by a series of data coming from different sources unveiled an unseen conclusion: that the troops were not repatriated or reduced but effectively relocated into a different theatre of war. The broadening of the scope of inquiry, reaching to different data sets revealed that the statistics released were a partial truth, pointing to the inconsistency and bringing to the reader a different set of meanings.

58	So we have created a graphic that is very very simple
59	that is essentially a line: The soldiers on Iraq that went that way [gestures
60	the shape of the curve] exactly reversed, mirrored of the soldiers in
61	Afghanistan and this line displayed the displacement I was speaking of
62	earlier: That president Obama promised that troops will be withdrawn
63	from Iraq yet essentially this was a statement that somewhat was hiding
64	what happened in reality. What was happening there was a transfer of
65	troops to... and you can see it easily, this line remains almost constant
66	you can see that the statement was not true.

69	These are combined subjects for me, we have looked into Afghanistan
70	analytically for 2007, 8, 9 and 10 and we placed monthly in circles the
71	attacks that took place... now not looking into military personnel but in
72	non-combatants which in a way displays if the war is over or not. Anyway
73	if it is a safe place to live and we've found out that it's one of the most
74	dangerous places on the planet and when it is time for elections... then it
75	becomes even more dangerous. So what we did in the end... On the top
76	graphic [points at the screen] you can see what happened, and you can
77	realise that on this period we had this, this and that; then you could see
78	the information underneath and all that can be combined.

Similarly a news agency wanting to provide a meaningful presentation of economic data regarding the European economic crisis at a time that the press was providing a heavily saturated coverage in rapid rates, adopted a different stance to process the overwhelming data. Instead of synopsising a continuously growing subject, the agency provided a structure to connect and position the top 20 analyses by leading experts. This enabled the non-specialist reader to gain perspective and understanding of the material that would have been impossible without reframing thinking and re-evaluating means of graphic comparison. An analysis by the designer's behalf prepared the ground for an in-depth framework of well informed content, allowing valid sets of conclusions.

42	the visual solution, our visualisation was based on taking the key
43	words provided by the analysts and the tag keys that were provided by
44	the journalists so these could be presented in a certain way so people
45	would understand, not only our way of presenting the most important
46	from number 1 to number 20 of the economic analyses, but why this
47	structure exists as it is.

A similar tactic is used in the following example (76), bringing a different aspect to the original story by comparison of a different set of data and allowing readers (and often designers) to gain an alternative perspective. The designer was referring to the civil war in Libya during 2011 and how the war impacted fossil fuel distribution to European

countries. This particular case explains some of the rapid reactions of the war on Libya and the alacrity of European intervention which happened before the US forces:

253	Yes because you can see visual connections, for example one of the work
254	of our colleagues was how the oil from Tropoli (Libya) is distributed after
255	the fall of Kaddafi. If you look at it – as we had a picture of what
256	happened from the news in mind – we hadn't realised that the petrol is
257	not going to the United States as many believed. If you look at the final
258	infographic and see who signed the contracts for the distribution of fuel
259	and see which countries participated or resisted the war then you reach
260	to conclusions that you wouldn't reach otherwise. It makes you
261	understand why France was very vocal about the situation, or why Italy
262	wanted the airstrikes. So there are aspects of events that in the general
263	frustration are not easily perceived. The infographic gives you a fresh,
264	different perspective.

This was an element not immediately apparent in the news sphere and the events transpiring at the time, especially decisions about policy and war within the European Union, as the focus of the media discussion was placed closer to political change and democratic rights, away from the continuity of the supply of fossil fuels. Although controversial, revealing aspects of the same story from a different angle can provide an entirely different set of conclusions.

If the subject contains a sizable amount of comparisons, it can reveal even within it areas that new discoveries can take place. When the UK economic budget was presented in 2010 by the xxxxxx newspaper in visual form, an entirely new set of comparisons were observed by the design team. This particular remark relates to the public statements of cost effective use of nuclear energy as a source of electricity. However there was little talk about the cost decommissions of nuclear factories in the public dialogue, therefore the infographic can be a tool where outcomes of analysis can be presented within itself.

241	I remember taking on energy…
242	energy on climate change: £1.1 Bn, and then a lot of this is about energy,
243	and then you look at the nuclear decommission authority… um, £6.9 B,
244	um… that is where it starts to make an argument there… you know how

245	important is energy and the amount of money that go to the
246	decommissioning of (nuclear) power stations it's a huge chunk of money
247	and it is increased by 81.12% ...

It has to be noted that these revealed perspectives are supported by responsible ways to look at and communicate information. Professional ethics and integrity are constant reminders of credible and reliable work as possible errors can bring considerable reactions from the audience. Designers expressed the strong intention to clarify and impart to the audience meaningful information, venturing beyond the obvious.

Extract 78, Impart Complex Analytic Outcomes.

205	I think
206	that is the key if you can. If you can select from the complicated em,
207	resource and ... not just cherry pick the grand standing ...stab ... the
208	shocking, but to able to pull from it into the one.. the one piece to tell the
209	whole story...

The code of **Impart Complex Analytic Outcomes** describes the effort of designers to reveal difficult to see, or even unknown aspects, of a subject to the public. This process of revelation is a constant pursuit, and forms a constant worry on the final phases of forging a narrative. While it is a subject dependant pursuit, tailored to the needs of each news story, it maintains a strong presence on every interview conducted.

The designer effort to pursue, with dedication these unseen perspectives of subjects, reveals also another aspect of practice: the practitioner highly values and incorporates within the design the concept of democratisation of knowledge. The fact that analytic processes go to great lengths to simplify and reveal data of considerable complexity to the wider audience, indicates a willingness to make accessible to the readership information that remains either out of reach, or requires expertise and time consuming interpretation. It is a pursuit well rooted in the field of communication.

From the examples presented by each designer almost everyone had a way to impart a different form of analysis, in subtle ways: reframing, root causes, holistic perspectives, cross-reference and internal complexity were only a part of the possible methods to pursue this task. However even if expressed with plurality, the parameters of this

process were dependant on complexity of subject, connections with context and the time constraints regarding the preparation and publication.

4.4.4 Discussion

Visual Exposition of Content as an emergent theme covers the need of the designer to create mechanisms of guidance for the reader through successive and stimulating steps. Initially designers aim to draw attention to the subject and spark interest on behalf of the reader with effective application of graphics. Subsequently this attention is maintained within the page while gradually unfolds further details on the visual artefact and the act of making connections and verifications. Finally by utilising the same visual means, designers display the 'hidden' meanings of story, those remaining inaccessible witin the body of data, small details that by their revelation the meaning making ability to perceive the data is drastically altered.

The visual nature of the graphic plays a key role on all three codes of this theme, as the intelligent use of space and comparison can be very influential. Impressive but functional schemata, colour coding, transformation of numeric data to meaningful juxtapositions are among the tools used to materialise these concepts.

The sequence of **'Visual Exposition of Content'** is a staged process, working in synergy with the themes of **'Morphology of argument'** and **'Medium Awareness'** to create a series of layers to optimise reader experience, and expose data to the reader via stimulation of interest and curiosity.

4.5 Emergent Identity

From designer narratives, perspectives pointing towards the identity of practice were also established. Participants were invited to describe crucial identifying elements of design activity and, if possible, provide similarities or differences from the conterminous design areas such as graphic design or illustration. Initially, this proved to be a task

difficult to address in detail, as the participants seemed unready and sceptical to provide detailed answers as to what defines practice. However there were two points of agreement for all designers. The first was that editorial information practices was different in essence from other kinds of design practice, and second the connection and deep reliance of information design practice with the data. Designers agreed on the graphic character appearing to have commonalities with disciplines such as graphic design or illustration, but these practices were described as more oriented on impact and passing a quick message, instead of relaying information and knowledge.

Extract 79, Emerging Identity.

4	I can spend hours to find data or think
5	about the appropriate way to display something, or what story I want to
6	present from this data however sometimes we are treated as graphic
7	designers. Sometimes they (public or clients) perceive the graphic as something beautification
8	of the page... um... and this is wrong.

Extract 80, Emerging Identity.

4	This is a bit of a strange question, everybody sees himself in a different way
5	I can't really tell if I do something special, I have abandoned graphic
6	design so this is not what I do.

Information graphics and other forms of graphic visualisation have commonalities, but these seem to rest more on the outcomes than process. For editorial information designers a meaningful conscious process is more important than style.

Extract 81, Emerging Identity.

337	So it's a delicate pathway and so I
338	can see why some people are carried away with that and create
339	Interesting images, but if a fascinating or interesting image stops you
340	getting the point, you are treading a dangerous path there.

Extract 82, Emerging Identity.

56	I think Graphic design and infographic, information graphic design are
57	very different and some people will be at one end of the spectrum, and
58	some people will be on the other end of the spectrum. And graphic
59	design to me – when I was in college- graphic designers had ideas, they

60	knew how colours work, they studied how text look, but seemed to me
61	that has more to do by making advertising, making a product look good,
62	grab attention; rather than the information graphics which can be a very
63	simple way of looking at information or be extremely complicated at
64	explaining a process, that has a huge range in newspaper graphics.

The beautification of the graphic or emphasis on decoration are elements shunned by editorial information designers. While the graphic must be pleasing to the eye, the analytic and communicational qualities take precedence over the descriptive and elaborate graphic patterns.

Editorial information designers also displayed a more direct relationship with readership, displaying a confident awareness and what they think as reliable estimates of the audience. Many parameters of design work were presented in the light of good knowledge of the reader's limitations, habits and inclinations. At the same time they keep an open channel of communication with the reader base to receive any possible criticism, comments and feedback in a regular basis.

In parallel with the above, and whilst on the creation of the visual artefacts, designers displayed another interesting behaviour: they establish to frequent contact with experts to maintain a high standard of output, and being able to withstand strong criticism by the most knowledgeable part of the readership; a pattern different from the known expert client relationships of conterminous graphic disciplines.

4.5.1 Predetermination of Audience

This code emerges from multiple references of designers 'knowing' the preferences of their readership, or attempting to emulate the perceptions of their readers, including perspectives, complexity and aesthetic tastes. In an interesting way, designers seem to predetermine the qualities and capabilities of the readership, even in high circulation newspapers.

The reasoning behind these comments can be justified more by experience than logic, but designers displayed in various ways that working on an infographic creates a mental bridge narrowing the gap between their own knowledge and their audiences. Although

readership in newspapers can be quite diverse, designers speak as they have a particular reader or person in mind, often personalising the situation and directly speaking about a 'very specific' type of audience.

Extract 83, Predetermination of Audience.

| 32 | For me... well I try to make the graphics as I was a reader, as If I was |
| 33 | the reader of a paper. |

Designers even make some strong assumptions about the way that audiences perceive their work and the readiness or availability, expressing gradually a set of presuppositions identifiable within the interviews.

Extract 84, Predetermination of Audience.

182	Yes the audience do not have a lot of time, and needs in the fastest way
183	possible to understand something. That means that I have to provide it in
184	a very simple way.

Extract 85, Predetermination of Audience.

23	When you
24	read stuff in today's medium you should see it at a glance, you cannot
25	expect people to go back and read over it again, this is not the way that
26	people operate with the newspapers... They'll give it a few minutes,
27	if they got it in... then they got it in

The list of presuppositions is extensive and designers were quite vocal on the articulation of reader preferences and interests. They did not reside into a particular activity or belief, and covered parts such as education, perceptions, attention span and time of understanding among others.

Extract 86, Predetermination of Audience.

228	Well... we have, we hope we have quite an educated readership, which is
229	helpful because of the kind of the newspaper that we are. People don't
230	read the xxxxxx unless they have some sort of interest at least and
231	having an education or at least trying to have an understanding of what is
232	going on in the world.

Extract 87, Predetermination of Audience.

256	lots of
257	people will look at the image and say 'that's too busy', 'that's too
258	confusing' to me to get anything, it has to be, we have to make it less
259	scary for them from the start. It seems as they see the image and they
260	have to understand else you are losing them. And that happens before
261	they have read the word from the graphic.

Extract 88, Predetermination of Audience.

25	When you,
26	read stuff in today's medium you should see it at a glance, you cannot
27	expect people to go back and read over it again, this is not the way that
28	people operate with the newspapers... They'll give it a few minutes, if
29	they got it in... then they got it in...

Extract 89, Predetermination of Audience.

62	people has learned to view and understand the aesthetics of a big
63	channel for example... to understand the aesthetics of selecting based on
64	the 'wrapping' of something

The constraints and parameters of an editorial graphic seem to focus in cognitive elements as we have seen in '**Morphology of Argument**', expanding on theoretical notions and practical elements facilitating reader perception. However within **Predetermination of Audience** designers make a bold leap into expressing their knowledge on the reader's habits, knowledge, characteristics and ability to understand. This emerged as a strong code displaying a phenomenon in designer beliefs, but also a discovery raising further questions, given the diversity of audiences a newspaper can address.

4.5.2 Self-correction Perspectives

This code emerges from the designers' description of feedback after the publication of the infographic in print or in the manifestations of a newspaper on the World Wide Web. Feedback emerged as a point of gravity connecting the audience and the designer,

with the former challenging and the latter defending respectively the decisions to display and effectively narrate a story. As the visual mechanics are often experimental in nature and prone to misunderstanding and rarely error, readers are quick to make remarks to the design team, bringing a diverse form of feedback on the infographics.

Extract 90, Self-correction Perspectives.

306	Initially we had some very informative mathematically minded people
307	writing in saying "you can not do this! This is not a conventional way of
308	explaining it!". I know where they are coming from, because in a bar
309	chart you never consider the width, you only consider the length, so the
310	width are the same and they all sit on the same baseline, so are visually
310	looking how further up they can get.
311	The relation of a circle to another is harder to get, and mathematical
312	people will think: "Ah! They are looking at volumes, but we are not.

The connection seems pertinent to the exploratory formulas that editorial information designers use, deviating from the path of established statistics; it is a mechanism of constant input on the evolution of graphics. Of course not every comment is negative or criticising -a number of them can be constructive and beneficial to the designer/design team, bringing new ideas with potential for future projects:

Extract 91, Self-correction Perspectives.

262	Sometimes we take very good feedback, you know, from people on this
263	online... which is I suppose readers can always write to the newspaper
264	and say those things. Those comments are always filtered and sent to
265	us... perhaps online people are more inclined to comment on something,
266	comments are open under the story on the website. Maybe it's easier for
267	people to comment having the piece there, but what they write there is
268	not always positive.

Extract 92, Self-correction Perspectives.

195	There will be things I've never thought before, like the navigator on the
196	left hand side... There was a tweet from someone from Holland saying
197	that people there are mostly right handed and it feels weird to stick the
198	navigation bar on the left hand side... perhaps it would feel more right to
199	have that on the right. And I did through other versions of this it was
200	different, or in other subjects I've used the navigation on the right.

In the code of **Self-correction Perspectives,** designers displayed a way to communicate with the readership on the visual outcomes, becoming a very distinct discussion on the interpretations of the produced artefacts. Unlike other areas, the dynamic nature of the editorial medium encourages the expression of questions, misunderstandings or even objections. The communicational tools of the World Wide Web, social media and website comment sections combined with the high level of exposure of the graphics create a platform that is able to carry quick responses to the designer, potentially minutes from circulation. Additionally editorial mediums as standard practice maintain a correspondence department, replying to the readers' questions and if necessary promote material to journalists or designers within the organisation. The result is a mechanism of self-correction on the production of graphics that has visible effects in daily practice, accumulating knowledge through the passage of time.

4.5.3 Delineation of Personal Knowledge

This code emerges from the designer association with experts to maintain credibility and effectiveness of display on an infographic. As the subjects of a newspaper can have a large variation, a broad spectrum of specialisation and technical expertise is needed to understand and produce graphics.

As designer expertise resides on analytic and visual areas, outside help is frequently necessary. As experts were described in simple cases colleagues specialising in an area, or external contacts with specialised focus when topics of delicate balances were explored. Both these categories aided the understanding of a technical issue and having a critical role: to provide input in the technical parts of an infographic to withstand scrutiny or verify the correctness of information presented. Designers are called to create infographics covering these diverse subjects, often in limited time making the contribution of external support necessary to deliver the infographics.

Extract 93, Delineation of Personal Knowledge.

162	there are terms and
163	concepts very specialised. Someone must be an expert to know that this

164	series of data eg. 'Foreign lanes viz a vis' means that this thing, where
165	something else means the other. So yes if something is exceeding our
166	knowledge, we take advice to be sure that we maintain integrity.

Extract 94, Delineation of Personal Knowledge.

223	and a lot of schools of thought that create
224	graphics insist on that, that the journalist understand a finite number of
225	things and if he is serious about it he should understand that.

The limits of personal knowledge had to be tested and verified with each new demanding task and designers develop personal awareness of the specialised mechanics but also accumulate experience and evolve strategies for future projects.

Extract 95, Delineation of Personal Knowledge.

231	There are things that you learn by reading, looking thinking and analysing
232	but in some of them you must seek the advice of an expert. Yes it has
233	happened in some of my graphics to ask a civil engineer for example:
234	"Tell me if those that I have visualised are correct" or "explain that these here are not
235	wrong".

Extract 96, Delineation of Personal Knowledge.

223	We had to study on that one to understand the vote
224	distribution...as in the previous elections the system also changed, and
225	the new law was very different on reductions... we were trying to apply
226	the previous (election) results to the new law and make comparisons...
227	that was lot of study for us, almost a week or ten days or so... we had to speak with experts
228	and specialists in Law to understand separate (information) and make something
229	reliable and meaningful, because it was a system that we should learn about.

Expert material might initially be mistakenly considered as 'provided' to the designers, yet the tendency of editorial information designers to display a high degree of involvement and analysis for the successful completion of a project has been already observed in **Data Struggle**. On the other hand, designers are clearly not experts in the fields under consultation and neither immediately desire to be. The essential meaning of the code **Delineation of Personal Knowledge** is that designers seek to find the limits of personal knowledge and pursue an optimal exposure on specialist

material. The provided input has a decisive impact on the outcome, establishing foundations for building a graphic that depicts data in solid structural dynamics, following competent lines of reasoning. The outcome, enriched by the process strengthens involvement, simplification and narrative used by designers through various stages of their work.

4.5.4 Discussion

Within this theme, characteristics constituting parts of an identity for this specific branch of information design come into the light: editorial information designers frequently venture to the borders of personal knowledge and seek exposure of the visual outcomes in an effort to improve knowledge on practice and outcomes. As mediators of information and content, incorporation of such activity is essential.

A strong connection with the data, a characteristic essential for information design, exerts a continuous influence throughout the creative process, multi-layered in character. Editorial information designers displayed a different kind of awareness: the designer is constantly maintaining a connection with the reader base, informing the work produced with expert knowledge and reader feedback. This continuity creates a consistent approach on the design process under investigation and setting it apart from other graphic practices.

4.6 Medium awareness

As designers described their personal and inter-departmental practices, a series of concepts emerged from parallel narratives regarding their perspectives on the act of imprinting information within the medium.

The two dimensional plane becomes a field of intense connectivity of information and data that each element acquires graphic form, as already observed. Designers carefully manipulate the elements to both realise aspects of a story as well as present it to the

readership. Yet the process of this creation revealed a set of practices with unique awareness regarding the medium.

More specifically designers acknowledged the possibility of multiple outcomes that a story can have, even when studying limited data sets, displaying notions of subjectivity when translating strict scientific measurements into socially relative information. The data within a set can provide material for multiples stories, leading to conscious selections during visualisation which reflect the responsibly of the accuracy of the data. Essentially designers can provide a well justified perspective of information to their readers, well grounded into the sources and impartial description of facts.

Parallel to the above, information designers view the position of the graphic within the medium not in isolation, but in synergy with the rest of the page, working towards an improved result. Diagram, image and text present to the readers an enhanced medium for communication where all components within the page contribute.

4.6.1 Multiple Outcome Analyses

The code emerges from references on the nature of data collection and data process, a reminder of the potentially hermeneutic character of data interpretation. As data sets are taken to depict or describe a broadly defined situation, it is a frequent phenomenon to discern more than one narrative or set of alternative narratives within the same sets. Designers were quite vocal on this relationship of story, data and the possibilities to be followed from the same source, addressing a variety of similar subjects as facets of the same story (extracts 97-98). Analysing content and data sources unavoidably bring a degree of subjectivity within the development of the argument. Even if practitioners invest on the understanding and formulation of a story, perspectives can ultimately differ and professional constraints ultimately demand decisions on the selection of pertinent parts of the data sets. Although designers strive to offer credible and well justified presentations of data sets, the presentation of aspects of data ultimately involve a human perspective of interpretation.

Extract 97, Multiple Outcome Analyses.

271	Looks at a story a fact as I see it and if
272	he wishes he can insert his own criteria in there. Because nobody sees a
273	story in the exact same way, no description is the same, no matter how
274	you try to write about a story in the end each individual will see it
275	differently on the end. Each individual has its own perspective, it makes
276	sense so what they gain is to see a story, read something in a different
277	way.

Extract 98, Multiple Outcome Analyses.

188	Well you get a, you know, 120 page report and you only have limited
189	space to represent it, or it could be 200 or 250 but we really look at the
190	data that really tells us a story, you know the story is here... perhaps five
191	or six stories...plus more general data, maybe we want to take this
192	general data and convey them to something like this (pointing to the
193	graph) which is a more punchy, very easily digested.

Often the overwhelming complexity of a project is enough for a larger group of
designers or researchers to be involved investigating large quantities of data, bringing a
plethora of possible arguments to be selected and visually developed (extracts 99-100).
It is an essential conversation, choosing which parts of the sets of data should be
presented to effectively shape the story to be told.

Extract 99, Multiple Outcome Analyses.

80	Well there are many challenges on many infographics, but on this
81	particular one I think the most difficult one belonged to the journalists,
82	the researchers, those that had to take 20 in-depth economic analyses
83	that have substantial volume and contain difficult terminology to
84	popularise and build categories with these analyses, because it is difficult
85	for an economic analysis to speak only for a single subject and not for
86	society (for example). Definitely some diffusion of information takes place.

Extract 100, Multiple Outcome Analyses.

173	So this is not my opinion,
174	this is the opinion of the economist, the opinion of the specialist or
175	someone like this... the world bank or something, That's their opinion,
176	that's it. That this diagram that I am showing is not contrary to their
177	information, they will not contest it we all say the same thing. The
178	conclusion that you are coming to might not be the same as theirs, but
179	the facts are.

The code of **Multiple Outcome Analyses** addresses the situation that designer activity exposed into volumes of data has effectively more than one pathway to follow on the display of information, and designers have to manoeuvre through the data and visual forms to produce a narrative. Infographics display an opinion, well justified and researched, based on reliable data; yet the data are voluminous and complex, making each infographic one of many credible outcomes. Interviewees were aware of personal limitations and the time related or medium related constraints while working on a story, and eventually the conscious selections that had to be made from a larger group of sources. From the same material spun similar but not identical stories. The designer needs to clearly address a small cluster of source material to reach conclusions.

4.6.2 Synergistic Visual Node

This code emerges from the designers' description of positioning the infographic within the page, as well as the relationship that the graphic has with the written part and images of the story.

The graphic is placed within the page in a semi-autonomous, yet complementary relationship with the text. An alternation between the two is welcome, with the reader able to shift attention from the visual part of the story to the textual and vice versa, thinking, processing, and further absorbing information.

Extract 101, Synergistic Visual Node - Appendix I, "Participant 7".

215	I consider that yes, up to a point it is
216	easy and useful. But should always be combined with the rest of the
217	package, we shouldn't only focus on the image because then the analysis is lost, I prefer it to
218	be something fast and easily graspable as in a news paper.

Extract 102, Synergistic Visual Node - Appendix I, "Participant 6".

63	occasionally we do standalone graphics but not very
64	often, we do sense of spread graphics which standalone normally at the
65	centre of the paper, with photographs or series of photographs, and

66	occasionally we get um… um… the space a graphic to the whole of the
67	centre spread, but usually they are made to complement a story that a
68	journalist has written.

Extract 103, Synergistic Visual Node.

28	Ah... to me it isn't the one instead of the other, but both of
29	them working very well... should be working well together... so if you are
30	reading something a graphic will help you cement that piece of
31	information that are reading consciously or subconsciously looking at an
32	image: "oh 30% of people at employed, in Germany id 60%... in France is ..."

This type of simultaneous study of a subject primarily allows discovery of different aspects of the story depending on reader preference and capacity to absorb information while raising different questions within the presented matrix. This second serves as an additional point of reference for the reader, aiding the transference of information: often something missed by the textual part will be made clear by the visual and vice versa. The graphic forms a node within the matrix of comparisons, where a simultaneous study of the subject is made possible by consciously directing reader attention to its parts.

Extract 104, Synergistic Visual Node.

255	But you have to take that into account that someone read something and
256	then probably forgotten it, the graphic will remind them of it, so it is
257	about helping them on the process of understanding. To me that's a
258	success.

While visuals facilitate this information transfer, it is not the primary objective of a designer to make things easier in the sense of producing a thinned-down version of the data set; the concept is related to cross-reference and a capacity for comprehension of at least equal standing with the written piece. The strong analytic principles and deep involvement encountered within the previous codes reflect the final outcomes.

Extract 105, Synergistic Visual Node.

63	I do not produce work with the idea that this is
64	going to make it easy to... skim through a complicated issue. I think it
65	should sit alongside the um... you know... the written piece...

91	relaying the data very demonstately, evidentiary, you know there
92	is always a way for a discussion to be had, but if it conflicts with the
93	piece... well it shouldn't work in that way... it should correspond with the
94	written piece, raise the questions that could be asked and then the
95	infographic should back that up.

At this process, the cognitive dimensions of a well-structured infographic prevail, subtly placing in effect methods of analogy and comparison within the page.

The code of **Synergistic Visual Node** provides a perspective on the mechanics of reading an Infographic within a newspaper or related mediums of display within the digital environment. Text and image work in parallel to create opposite but interacting poles of information for the reader. The elements within the page are described with a nodal quality and strong synergy.

4.7 Further Theoretical findings

As the late analytic phase on the formation of codes and themes progressed, concepts of higher theoretical value began to crystallise, addressing practitioner action and motivation in the design process. Rising above the themes but still grounded in the data, these categories are more abstract but meaningful on the perspectives and choices of editorial information designers in practice. Moving beyond the descriptive and acting as incisions and connections on the themes, they bridge the seemingly separate structures of analysis. These themes describe practitioner behaviour and orientation on the field of inquiry and help to understand critical domain-specific operations of information design within the editorial environment, two theoretical structures surfaced.

In the first dual perspective of designing, practitioners displayed a strategy of graphic production with considerable distance from traditional notions of expertise, where the designer adopts a professional status above that of the readers. While being aware of their capabilities and in-depth knowledge, their practices displayed a strong element of

designing also as 'simple' readers of the newspaper, bridging awareness of both ends of artefact production and the designer-reader spectrum.

The second is a series of practice on the process of data interpretation, filtering and meaning making, going well beyond that of the written brief and standardised application. Acquiring strong research characteristics with frequent inversions of method on looking at data-sets, designers unravel the possible meanings of abstract in nature data, using a set of practices to revise the material and create effective visual formulas of meaningful information presentation.

4.7.1 Dual perspective of designing infographics

Designer descriptions on the nature and sequence of stages of the design process frequently met an early silence during the interviews; many senior designers expressed surprise and frustration as to why this lack of recollection took place. As a personalised practice within a complex environment, the constraints of editorial information design were more easily voiced, but the in-depth exploration of the continuum of designing was beyond the verbal description of the informal interview and the available methods of research. However after running a cross theme analysis of the formed grounded theories, another pattern emerged: editorial information designers use a synchronous view of two seemingly opposing perspectives -the expert view of the designer and the layman's view within the news medium. By welding these two seemingly opposing parts, designers create poles of explication and reference that run through the process of creating a graphic. The term synchronous is an approximate denoting the existence of side-by-side of these two initially antithetical perspectives.

The first perspective is supported by the theme of **Data Struggle** while the second perspective is supported by the themes of **Visual Exposition of Content** and **Emergent Identity**, extending on the codes of **Incite Reader Inquiry** and **Nurture and Maintain Analysis** on the former theme and **Predetermination of Audience** and **Self-correction Perspectives** on the latter.

As previously seen in **Data Struggle** the description of the in-depth professional attitude, high standard and research oriented, going well beyond the non-specialist viewpoint. This process of familiarisation with data is pushing personal boundaries and gaining an insightful and comprehensive view on the data -as seen on the code of **Establishing a Personal Connection.**

Extract 35, Establishing a Personal Connection.

43	Yes, definitely! I mean I think that in a science based graphic, I end up
44	correcting the science editor and his written copy, because I've come out
45	and researched it myself independently not just taking the information
46	brought to me because I... you know... I am interested to it. I have to be
47	interested in order to produce something that is visually interesting

In this process there are no particular barriers or limits on comprehension, understanding of breadth and depth are essential as they form foundations upon which the visual schema will be built. It is necessary to have in-depth comprehension of the data dimension and meanings, away from superficial or systematised perspectives:

Extract 40, Establishing a Personal Connection.

114	Yes I think on this example there were specific difficulties and specific
115	strategies... but... the main thing was to understand. Understand
116	ourselves that is if there is a logical explanation to what is happening.

Root causes, effect, implications and correlations are all parts of the inquiry to set the 'expert' part of the design activity, looking into a large amount of data, from which only a smaller part will be used. The subsequent dialogue with the researched and comprehended data further create an awareness on the selected topic. The understanding of dimensions lead to a personalised and multi-layered process of data analysis, intense and open ended, acting as a way to further research the subject and verify the pertinence and validity of the data:

Extract 42, Dialogue with the Data.

96	For example in our research for the London riots, until we find

97	the data regarding the benefits we couldn't reach a valid conclusion,
98	couldn't see something entirely justifiable... it could be something that
99	would end up to the bin. With a lot of effort, a lot of effort and
100	sometimes you need luck also... if the rest of the data fall into place, then
101	you can complete your answers… that.

The sequence of the code **Dialogue with the Data** uses not only the expertise gained from reading data tables, but also employs the various tools that designers use on the creation of infographics. Visual research methods are applied at early stages and are used to judge the nature or even the existence of a subject.

Extract 43, Dialogue with the Data.

257	so these
258	represent the beginnings of each of the riots and there basically we
259	wanted to see if there is some kind of increase of tweeter traffic before
260	the riots started or after... so um, and the xxxxx journalists keyed up
261	to write a story but they didn't knew what to write about, what the story
262	was... they had the data... and they couldn't write a story until they saw
263	the graph... we had get that graph sorted and then see if there was
264	anything else... so the story they told was that there was a kind of a big
265	spike that happened before the riots, so the idea that was social
266	media somehow involved in the sparking of the riots... was maybe exaggerated.

The process is intense and requires a higher degree of alertness and data analysis as it creates layers and hierarchies of information from an experts perspective, allowing patterns of analogical reasoning to develop as potent tools of communication.

Extract 47, Dialogue with the Data.

104	So if you have something like this, then you have for the sake
105	of the idea you have to throw away half of the information then the idea
106	might not be so good. You need really to take all these layers of
107	information and still make it interesting and informative. Some things in
108	order to be simple are in themselves quite complicated, quite complex.

The above testify a sophisticated process, data oriented and information defining on the production of the infographic, balancing multiple factors during the formulation of an argument, prior to visualisation. However editorial information designers do not further their work via an expert approach of 'knowing better', as distant specialists; instead they

balance the above elements by simultaneously adopting views on the capabilities, endurance and limitations of their estimation of the readership. In short the high-end complex material is moderated by the designer ideas on the audience as seen in the theme of **Emergent identity** and **Predetermination of Audience** bringing into the creation of the visual schema a stabilising factor: the designer's perception of the layman view.

Extract 87, Predetermination of Audience.

256	lots of
257	people will look at the image and say 'that's too busy', 'that's too
258	confusing' to me to get anything, it has to be, we have to make it less
259	scary for them from the start. It seems as they see the image and they
260	have to understand else you are losing them. And that happens before
261	they have read the word from the graphic.

Partial explanations as to why this is happening can be found on the code of **Self Correction Perspectives** in which feedback of each graphic can measure the potential impact and acceptance from the readership.

Extract 91, Self-correction Perspectives.

262	Sometimes we take very good feedback, you know, from people on this
263	online... which is I suppose readers can always write to the newspaper
264	and say those things. Those comments are always filtered and sent to
265	us... perhaps online people are more inclined to comment on something,
266	comments are open under the story on the website. Maybe it's easier for
267	people to comment having the piece there, but what they write there is
268	not always positive.

As for the reasons of why this takes place, the theme of **Visual Exposition of Content** can be called upon to aid understanding. The influence of the codes **Incite Reader Inquiry** to initiate a process of graphic exploration and **Nurture and Maintain Analysis** to continue the process until completion are critical – as if the designer fails to understand reader perspectives the two codes the graphic will fail.

The importance of this view on visualisation is best summarised by the following.

| 32 | For me... well I try to make the graphics as I was a reader, as If I was |
| 33 | the reader of a paper. |

Within the theme of **Dual perspective of designing infographics,** the perspective of the expert co-exists with the mirrored perspective of what is expected to be the estimated reader, creating an effective method of bridging the complex meanings of data, with the expectations of the readership in a form of role-play exercise of design thinking.

4.7.2 Multiple visual methods of refinement

Another element emerging from lateral analysis of the themes are the multiple stages of refinement that the data go through during the process of visualisation.

In contrast to what we have observed in the literature so far, the data on editorial information design are far from given, they are carefully selected and analysed independently for each particular case. The theme **Data Struggle** describes the stages in which designers familiarise with the data, establishing personal connection, restructuring, refining and making a critical separation of parameters.

However refinement does not stop at this point, the work on content selection of this particular field continues until the late stages of graphic production. The theme of **Visual Exposition of Content** with the codes **of Multiple Outcome Analyses** persist to the medium to late design stages that affect the design outcome and the contained information. As the graphic is constituted by elements that represent data, modifications on the visual patterns reshape the connected meanings. Changes and possible additions or removals of the visual entities trigger re-thinking on the data with meaning defining implications. In various degrees, changes of patterns equate to modifications on the data.

More specifically after the initial phases described within the codes of **Establishing Personal Connection** and **Dialogue with Data,** designers discover depth and

options in data to choose from for the pursuit of visual presentation. The code **Impart Complex Analytic Outcomes** describes and supports this line of thought as contains situations where content is surfacing by the manipulation of visual formations to emphasise the outcomes of data analysis.

Extract 74, Impart Complex Analytic Outcomes.

69	These are combined subjects for me, we have looked into Afghanistan
70	analytically for 2007, 8, 9 and 10 and we placed monthly in circles the
71	attacks that took place... now not looking into military personnel but in
72	non-combatants which in a way displays if the war is over or not. Anyway
73	if it is a safe place to live and we've found out that it's one of the most
74	dangerous places on the planet and when it is time for elections... then it
75	becomes even more dangerous. So what we did in the end... On the top
76	graphic [points at the screen] you can see what happened, and you can
77	realise that on this period we had this, this and that; then you could see
78	the information underneath and all that can be combined.

As data, often neutral in nature coming from data repositories with no specific influence on meanings, designers while working on the visualisation of a graphic wish to break the surface of description and allow the less obvious meanings of data to come into view and reach the reader:

Extract 72, Impart Complex Analytic Outcomes.

140	apart from the carbon dioxide there will be another part that will say
141	' and here it is by... per capita' per person in that country then you see the
142	other side of the story: That America is far, far worse than China, that
143	China is the biggest polluter but its got what ... 4 times the population. So
144	yes it has more pollution by America, but per person is less than the
145	United States so I think that that is very educational and just being able to
146	see it.... If you see the spreadsheet the whole load of numbers you can't
147	understand if this is very large or very small but when you see it next to each other

The process of illumination acquires graphic form that effectively revises the constituting components of a story through different perspectives and in visual sense. Even after the realisation of the depth and breadth of a story, the possibility of multiple stories or sub-stories, coupled with the limited space of the medium, progresses the action of data refinement even further, looking again into the possible perspectives of presenting a subject:

188	Well you get a, you know, 120 page report and you only have limited
189	space to represent it, or it could be 200 or 250 but we really look at the
190	data that really tells us a story, you know the story is here... perhaps five
191	or six stories...plus more general data, maybe we want to take this
192	general data and convey them to something like this (pointing to the
193	graph) which is a more punchy, very easily digested.

In a similar way of operating the process of the code **Visual/Cognitive**

Resconstruction, a series of pertinent questions are posed upon content, balancing

meaning with simplicity and accessibility. The argument through the breakdown of the

essential components becomes clearer, while the visual reconstruction reaffirms

connections and validity. At the same time, the material within the artefact through the

refining processes outlines incompatibilities and errors, as inevitably clarification

highlights potential weaknesses.

100	So when I am saying to make something simple I
101	do not necessarily mean to cut it to pieces and sew it to fit us or
102	something. Um... you are accepting the fact that to make something very
103	complex into very simple still you might require quite a lot of complexity
104	to do that.

This leads often to alterations of content and additional modifications, previously unseen

on the data selection phase but emerging as a necessary for the successful

materialization of the visualisation.

118	The designer area of
119	the graphic is the next part of the challenge as I am particularly interested
120	in simplicity... it could be one, two or three lines that constitute the
121	graphic and reflect the necessary qualities... all the rest (that is)
122	unnecessary must go.

The above aggregate of codes display narratives of a dynamic connection between the data and representation: a merging of the traditional scientific or mathematical analysis of a data related subject with visual methods existing on the process of designing, prompting a continuous improvement of argument through a transition between these two broad areas. The graphic practice of editorial information design takes advantage of the interconnectedness, and designers are incorporating stages of refinement of the data via the formulas of practice, after the initial decisions are taken from the data tables.

The contents of the graphic and the perspectives of the story are formulated and re-formulated within the visualising process in an act of coordination to produce the most appropriate visual outcome: an interactive process, of data and information presentation.

4.8 Summary

Within this chapter a thorough presentation and analysis of codes, themes and theoretical observations took place, apposed with the relevant interview extracts, providing insight on editorial information design practices and tacit designer knowledge.

In total, fifteen codes emerged from describing practices, actions and strategies that designers displayed within professional activity, forming five themes. The outcomes of the study are grounded theories, crystallised abstract concepts with well specified relations between them (Bryant & Charmaz, 2007, p.25) and theory that can bring to light, an obscured "slice of life within a world that is always in process" (Charmaz, 2000, p.509) from the practices of editorial information designers.

These emerging grounded theories elucidate design operations and offer perspectives on the undocumented practices of editorial information designers, covering essential parts of the knowledge gap as perceived by the study of literature. At the same time capturing through narratives, observation and analysis the critical elements of design activity allow the acquisition of the tacit and personalised designer knowledge, a major objective of this study.

The total of fifteen codes, via inductive, abductive and deductive procedures through the analytic cycles led to the formation of themes, describing practices, actions and strategies within professional activity. The first five were outcomes of the medium to late research cycle, crystallising common patterns and behaviours which imparted critical aspects of activity and knowledge. The last two were outcomes of comparison and analysis of the formed themes themselves, while scrutinised for possible connections and further meanings. The first five are:

Morphology of Argument describes the efforts to create an infographic that contain all the necessary components of the story to be told, enabling the audience to investigate a subject, clarifying potentially complex relationships of data. The tools for this expression are pattern and difference forming analogical tools to enhance reader perception via a non disruptive infrastructure.

Data Struggle describes designer critical interaction with data on a process of intense exposure and familiarisation leading to forms of dialogic analysis of data, subject and connected parameters, by the designer alone or within a design team. The insightful separation of the data is effectively forming the foundation of the graphic and the components of the argument.

Visual Exposition of content explicates forms of passive management of content with critical effect, inciting reader attention and maintaining analytic perspectives enabling exploration of content. Through this application, complex outcomes can be imparted to the readership without mental strain and the reader ventures into content, self-motivated and purposeful on the process of discovery.

Emergent identity describes practice defining characteristics from the designer point of view and how editorial information designer practice is connected with the world outside the design studio. Views of designers about qualities of the readership, connections, feedback mechanisms and ways of outlining personal knowledge limitations are fundamental parts of this theme.

Medium awareness describes how the visual outcome interacts within the designed page in relation to the readership. The infographic is part of a matrix, where information

is placed in context with the editorial practices, linking parts of designer concerns and realisations with the fast paced editorial media and operations.

Finally two theoretical standpoints emerged from lateral analysis of the discovered themes. These are theoretical structures created by further scrutiny of the five original themes, connecting the outcomes of research further and establishing continuity of design activity running through the themes, while still grounded to the data. Effectively the two later themes validate the existence of the initial five, as they provide a perspective of how the emerging themes interact with each other and at what level. The two late themes of higher theoretical value are:

Dual perspective of designing infographics describes the two-fold approach that designers displayed, adopting a synchronous expert and reader perspective while designing an infographic. This method is employed to regulate the application of expertise and complexity within the artefact and maintain balance, appropriate for the audiences.

Multiple visual methods of refinement illustrates the sequential use of visual means by designers to refine content, even after the point of decision upon the direction of how the data will be used. The interconnectedness of the graphic form with the data allow the revisit and re-evaluation of content during the very act of producing the visual artefact.

In the following chapter, a discussion of how these emergent qualities relate to existing literature as well as challenges, limitations and opportunities for future research will be explored.

Chapter 5:

Discussion of Findings

5.0 Discussion of findings

5.1 Introduction

Within the following chapter, a discussion takes place centring and elaborating on the outcomes of the analysis, contextualising the emerging grounded theories and focusing on meanings beyond the narrow confines of the extracts, as presented in the analysis chapter. Through the analytic stages of constant comparison and acquaintance with the field of study, the researcher was able to attain theoretical sensitivity with the gathered material and locate key design practices of editorial information design, recognising the pursued implicit procedures, ultimately making them visible and explicit.

The emerging theories present new knowledge for editorial information design, offering 'a slice of life' of editorial information design and making accessible the previously unseen activity of practitioners. So far, details of methods, strategies and processes, remained hidden from the literature of the discipline and undocumented in research terms. The presented grounded theories allow explicit concepts to be linked with practice, offering insight and drawing designer activity out of obscurity. This knowledge is critical for understanding, analysing and communicating practice, staying clear from problematic elements highlighted on the description of the knowledge gap.

The first issue to overcome was the naturalised concepts, ideas and standpoints that impede productive dialogue within the mediums of discourse; this was dealt with the choice of methods and methodologies that go beyond the descriptive and examine concepts and meanings critically, connecting theory with data, by making deep incisions in the narratives. The second was the personal language of designers, as often encountered within the contemporary literature with vague and often ambiguous, contradicting descriptions, leaving the reader confused and uncertain of the in-depth aims and objectives of information design disciplines; this was dealt by drawing on direct narratives from designers and their colleagues in their natural environments, where via unhindered and casual language, the multi-layered activity of design unfolded with the support of visuals to aid reflection. In such a way the two major issues mentioned during the description of the

knowledge gap are addressed and areas of editorial information design practice become available for discussion.

In the first part of the chapter the first five emergent themes of the study, forming coherent, critical areas of reference for practice will be discussed, outlining a process complex and overlapping. The discussion between the connected meanings offer conclusions grounded to the data, covering areas on communication, argumentation, identity, data handling as well as medium awareness, highlighting the common ground between narratives.

In the second part of the chapter, the grounded theories emerging through a lateral analysis of the original five themes, bring the emerging notions out of conceptual isolation and describe subtle but purposeful and continuous sets of effects happening simultaneously with the analytic and graphic operations of the visual. The two themes describe operations essential for the process. The first reflects the dual perspective that designers adopt in an effort to effectively communicate the content of the infographics with the audience; the second reveals the sequential process of multiple stages of analysis, synchronously modifying data, content and visual form, during the making of the infographic. These two theoretical outcomes emerge as critical and defining operations for editorial information design, allowing comprehension of direction and aims integral to practice.

In the third part of the chapter, the focus on themes and corresponding codes will be further contextualised, looking at correlations and associations of these structures with practice and how they reflect the pursuits of editorial information designers on the materialisation of the visual outcomes. At this point, the discussion between the connected meanings offer useful conclusions emerging from the data: these high value notions offer further information on the role of the designer and necessary activity to meet the needs of creating editorial infographics.

In the fourth and final part a return to the examined literature takes place and a review of the theoretical material under the light of the new findings will be presented, highlighting pertinence or deviation of perspectives encountered through the literature review. This is a response to one of the major challenges initially presented to this study: the difficulty to

locate established discourse on the existing theories and follow a trail of theoretical material for possible theoretical fits on contemporary editorial information design practices.

5.2 Discussion on the Themes and Codes, comparison with the existing literature

5.2.1 Morphology of argument

Morphology of argument as a theme describes a constant pursuit for editorial information designers: the need to form a structure, a platform of expression, which effectively carries data or sets of data in visual form, supporting the story and developing a narrative for the successful communication of content. The term 'argument' does not refer to a linguistic process, but a combination of visual elements representing data to offer a coherent result: a multi-layered way to communicate and explore a subject.

5.2.1.1 Visual/Cognitive reconstruction

The graphic form of the artefact demands a reconstruction of the data elements appealing both in cognitive as well as visual ways to the audience. The designer first analyses content and seeks to create within the page forms and functions which guarantee the transference of relative information; by following conceptual directions such as simplification and accessibility the designer sets objectives for this type of transformation to take place.

This is an effective operation mentioned frequently in design literature both in precursor as well as contemporary theorists. Neurath used the term Transformation and to describe the activity (Burke, 2009, p.211), Bertin (2011, p.3) described something similar while defining the visual system and establishing properties of a platform of communication and a carrier of information. Tufte also expresses similar notions on the

description of the operations of data-ink when describing properties of a subject (2001, p.91), as well as Shedroff (200, p.272) when writing on the continua of information providing insights but not particulars.

However authors so far were either theorising on hypotheses about the design process, or based their theories on personal works which made the examination of these perspectives difficult. Language remained personal and often implicit, making transference of these views to designer audiences difficult, prompting a discovery of ideas through practice. Through this code, supported directly from empirical data, the material is emerging through different groups of designers in simple and unadorned language, permitting better understanding of the design area and design practices.

Visual and cognitive reconstruction is a defining characteristic of editorial information design, validating the connection of the design area through emergence, with information design and relative disciplines of data related visualisation. The application and relevance of these strategies are frequently illustrated with examples and produced artefacts within the literature, connecting the examples lacking explanation with primary data, making this array of concepts explicit and easy to articulate.

5.2.1.2 Establishing Critical Analogy

The graphic output of editorial information design is structured, with multiple layers of information managed by a set of mechanics communicating content. The main method on the construction of artefacts emerging from the present research is analogical reasoning, used intelligently and repeatedly, and creating a web of connections and differences to highlight content to the readership. The questions of quality, quantity and the established relationships are clarified by the use of this conceptual device. Analogy is built upon a twofold structure, both of them being tools of mental interaction. The first is the building of patterns which elaborate on the details and the essential components of the story; while the second was difference, highlighting the essential points of the argument by pointing out inequalities, failed objectives or variation of qualities and

quantities from the expected. The combination of the two makes a potent development of argument, focusing on the essential points creating an environment from which analogical reasoning evolves to a meaning-making process in the reader's mind.

The concepts of pattern and difference has few implicit mentions within the literature: Neurath elaborated on the potency of visual differences on the articulation of his visual argument (Neurath, 1973, 238) yet the concepts were not fully developed, and only posthumously published. Bertin also describes the pattern formation around the 'invariant' and the characteristics that will bring closer to the reader the core argument (2011, p.5) but remains elusive and implicit on the term. Tufte also provides a description of difference on 'The Smallest Effective Difference' (Tufte 1997, 74) but refers only to the extent of how difference is developed visually within the page and without explanation on reasons or a framework of reference. Shedroff makes a brief mention of pattern within his writings on the categories of organisation (2000, p.275) but the description falls short of elaboration or analysis, leaving the reader with unclear views on how these concepts operate and are translated in design terms. More recent descriptions are included on the 'Master Performer' (Macdonald-Ross, 1989) and the more explicit work on patterns in design from Waller, Delin and Thomas (2012).

The above elements and expressed theories point towards the original knowledge gap and how recent designers-authors of the area provide some indications of a tool critical for transference of information. By discovering the concepts of pattern and difference within the narratives and connecting them to the data, a method emerges for editorial information design. **Establishing critical analogy** develops an ecology within the page, presenting cognitive mechanisms of epistemological nature to convey the news story and the relative data-sets. The reader can navigate through pattern and difference and comprehend subject, impact and basic characteristics of a news story.

The combination of these elements with reader cognition to create a network of limited ecologies was overlooked by design theorists: the amount of data contained by the editorial information graphics is a growing web of connections far larger than simple depictions. They create mental interactions based on pattern and difference and subsequently build-up mental connections and realisations for the individual to create opportunities for learning, of higher order within the visual.

Analogical reasoning, with the critical nature of its components, is a core cognitive tool on the expression of editorial information design that lacks proper cover and explicit references within the discipline specific literature. It is the author's opinion that is a new element in design activity, severely under-represented in literature: focus on the code and the connected notions lead to illumination of series of tacit, non-descriptive elements used to specify operations within the design process, establishing much needed epistemological parameters for practice.

5.2.1.3 Underlying structures of non-disruption

A strong characteristic of designers of editorial graphics is the production of work in continuity and addressing the same audiences via specific mediums; allowing the development of familiarity of the audience with visual themes and developing mechanisms of communication. This area of design practice gradually and over time establishes underlying structures for content allowing non-disruption of reader attention and clarity of focus on the topic. By maintaining a continuity of the functional mechanisms within the page, the designer avoids the re-introduction of interaction mechanics within the graphic to the reader; the cognitive effort is reduced and time required for the reader to reach the complex parts of the analysis is lessened. With such effects analogical reasoning is facilitated, as the tools of comparison, although not entirely identical, can be recognised and handled with increased capacity.

From the examined literature, the theorist that clearly expressed concerns about the elements of continuity and functionality was Neurath (Neurath, 2009, p.26), on the development of visual language and the recognition of his isotypes, but has not elaborated on diagrams or complete sets of graphics beyond that. Horn (2000, p.28) also calls for a more systematic approach to establish a more co-ordinated communication with readers, yet provides only starting points on how this can be achieved. Literature at the time of writing lacks explicit mention of these operations, presenting the outcomes individually and ignoring the concept altogether. The

emergent theme, grounded to the data reveals an unseen practice and provides the subtle but strategic use of the theme by editorial information designers.

The application of mechanisms of non-disruption is a new element and a core activity of editorial information design, essential for practice. It is a potent, discipline specific characteristic, in which continuous contact of the designer with the readership establishes mechanisms of communication that map the evolution of practice and evolution of formulas. The editorial information designer is not removed from the audience but nurtures design perspectives and codes to the readership. This aspect of design is lost within daily activity and study of isolated design outcomes, yet remains meaningful and critical for the discipline under investigation.

5.2.2 Data Struggle

The intense interaction of designer with data is essential to transform successfully the data tables into a meaningful and multivariate graphic outcome. In this particular area of design, practitioners displayed specific patterns of interaction, familiarisation and separation of data indicating a deeper, intense connection. Data are not just provided to be transformed or visualised, but the designer becomes intimately familiar with multiple perspectives of the data set: the designer takes into account context and develops a series of time efficient processes to seek and select appropriate content, while engaging in simultaneous data analysis and separation of essential information from data tables. The aim is to present the most efficient and representative aspect of the story to be told. The theme of data struggle is a new area of editorial information design activity that lacks explicit descriptions, revealing an involvement of designers with data, close, analytic and research oriented.

5.2.2.1 Establishing personal connection

Editorial information designers develop a strong tendency to connect with data and establish views on data from multiple perspectives during an intense period of

familiarisation with the corresponding data tables and data sources. The process has a critical and exploratory character with active research characteristics, bringing a personal illumination on the subject that subsequently is used to develop visual outcomes; the intense and exploratory process serves the purpose of bringing refined meanings to the audiences.

Simultaneously, designers, by outlining the data set and by being an active part of the analysis, delineate the main parts of the story in the pre-visualisation phase and gain further acuity of the breadth and depth of the data, going far beyond illustration or simple presentation. The designer during this stage is constantly seeking ways to thoroughly understand the essential meanings of a story to be told.

It is indicative of this connection that designers spend a considerable amount of time available for each task, analysing voluminous reports and understanding the internal connections and mechanisms of the data to establish causality, dimensions, and context. For the editorial information designer, the data analysis aspect of practice is as crucial as the visualisation aspect as the former pre-determines the latter in a continuity of transition from abstract data to the visual. Within the interviews lie strong indications supported by explicit statements that progress are not pursued unless the specific objectives of personal understanding or completeness of data are reached, providing further indication of the uniqueness and necessity of this stage.

The concept of familiarisation with data was originally mentioned by Neurath on the descriptions of Transformer (Neurath, 2009, p.9) and implicitly referenced as an operation in Tufte's data ink (2001, p.91) researching the dimensions of data within the designed page. In both theoretical views a good knowledge of the data is required to make the necessary formulations and transformation of the abstract qualities in graphic forms, yet this is a new process emerging specifically from the activity and methods of editorial information designers.

However the code of **Establishing personal connection** brings to light a thorough description of operations that remained thus far implicit and never connected with evidence from practice. The extent of this commitment and intimate in-depth

knowledge of the subject by designers are elements that emerge with emphasis in contemporary practice and connected with new challenges stemming from the editorial environment.

Editorial information designers displayed a new element: the research of data to cross-examine content from a larger pool of sources, manoeuvring consciously and purposefully through data sets to gather material to further substantiate a graphic piece. A major difference from the existing literature is that editorial information designers negotiate content to a much higher degree and, if necessary, seek new data to compare with the existing material on their pursuit of justified outcomes. There is sufficient evidence that in this area of design, the designer also becomes analyst and researcher of data in order to fulfil the responsibilities towards the professional objectives. The increased alertness of data verification merges the positions of the data researcher and data visualizer, making the designer an active editor of sources.

It is the author's belief that these qualities emerging from the code remain unmentioned or overlooked within literature and are part of the core practices of the design area under investigation.

5.2.2.2 Dialogue with the data

After the initial separation and understanding of the data, designers engage in an active examination of material in a form resembling dialogue through a combination of methods, either working individually or as part of a group. The methods employed can be conversational, numeric or even graphic, utilising the tools of visualisation to test parameters of the initial argument. The material is subjected to critical analysis where errors, incompatibilities or unseen aspects of the story are made visible; the effects are dynamic and immediate, further refining content and shaping the foundations of the visual outcome drastically. The designer at this stage becomes engaged in an active process of data selection and data comparison restructuring meaning from the content of data tables and testing their integrity to enhance the quality of the result.

The process of dialogue with the data has only indirect mentions within existing literature and can be implicitly traced on Bertin's writings and the process of discovering the 'invariant' (2011, p.5) tracing the constituting characteristics, yet remains axiomatic and without a detailed explanation allowing the understanding of the concept.

The operations of dialogue with the data are extrovert and intense as the designer engages multiple perspectives of the subject and if necessary reaches to new content or sources to verify data. This is an emergent activity that is underrepresented within the literature -the intensity of the dialectic pursuit is understated and emerged as an unexpected element during data analysis. Content is not simply provided, but is pursued and researched by the designer.

Dialogue with the data is a characteristic quality of editorial information designers, connected with contemporary practices, employing a series of analytic tools to further examine data and further verify and clarify content. It is the author's opinion that this is a discipline defining activity of editorial information design.

5.2.2.3 Acute data separation

After the multiple analytic phases applied to the data examined and selecting content, designers came to a phase of careful selection of the core components of the argument: representative parts of data that credibly and responsibly reflect qualities and dimensions of the chosen topic. The purpose of this stage within the process is to reduce unnecessary dimensions of a story and ultimately remain with the essential messages to be communicated.

This selection is a crucial point within a project as upon its completion the outline of the data area is selected along with the establishment of groups of data to represent the constituting parts of the argument. These are elements that designers in the following stages will negotiate, formulate and transform, to communicate in visual form to the audience. It is a careful omission of irrelevant data, even if initially deemed essential for the presentation of the story-yet after thorough examination of the data set were

excluded by the final selection. In that sense it is an operation of stochastic critical character, displaying a reflective and conscious pursuit of aims.

The acute selection of data is a known practice of information design with multiple mentions in literature, a nodal point of the process. Neurath describes this part as reduction of information (Neurath, 1973, 240), Tufte mentions similar operations in 'data-ink' (2001, p.136) and Shedroff describes as 'clarity' (2000, p.281). It is the author's belief that through the analysis of the interviews, a similar set of operations have been identified and confirmed within editorial infographics, connected with primary data of the discipline under investigation. The code provides justified connections and a potent description of how this separation is initiated and generated in explicit terms, confirming operations to this new design field.

5.2.3 Visual exposition of content

Forms of narratives and perspectives on effective communication with the readers were also a key point in designer narratives. These directions were conceptual and intricate in nature, concentrating on the creation of visual opportunities for the readership to follow, allowing gradual introduction with content and making the contained information accessible. Editorial information designers were conscious of the narrative aspects of practice and develop specific subtle methods to achieve such a task, by directing and stimulating attention, generating a genuine sense of exploration with efficiency and purpose. The initial momentum is utilised to direct attention into elements that maintain reader's focus into the representative concepts, patterns and analogy, up to the point that the critical elements of the analysis can be reached. Through this visual process the reader can reach complex realisations of difficult to comprehend subjects.

5.2.3.1 Incite reader inquiry

Taking advantage of the attention-capturing qualities of the graphic, designers initiate the process of information transfer by directing reader attention to the infographic. Visual arrangements of data can attract and focus concentration, introducing components of a

story to the audience with immediacy and effect. Infographics are not standalone entities but coexist within the page with image and text components, as equals of articles and news reports. The graphic is used as an inviting point of entry to each of the main articles of the newspaper prompting to further investigation of content. The dynamic visuals incite inquiry, triggering a sense of exploration to the reader, providing more reasons to interact with content and engage the news story. The neutral and non-explicit nature of this operation is a great benefit as infographics guide the audience through the main subjects of the newspaper, but not coming at odds with a personalised non-linear study of the visual and textual parts of the news-story.

The dynamics of graphics to draw reader attention and provoke further exploration are mentioned in the examined literature: Neurath mentions explicitly the benefits of the neutral expression of the graphic and the positive effects on inquiry (1973, p.227, p.232) and Bertin mentions the same operation under the term 'efficiency' (2011, p. 9, p.139), directing attention to the visual, while Horn (2000, p.25) also makes a brief mention of a similar set of qualities of graphics when describing the tensions of information design. However through the emergence of this code the meanings are detected within specific narratives and connected with primary research, allowing a verification of the same principles on editorial information design and context. Through the analytic efforts of this study, what was merely conjecture can now be presented as reliable strategy within practice. The code of **incite reader inquiry** is an important mechanic for designer strategy on editorial infographics, reducing cognitive strain to understand a graphic and drawing attention of the readership.

5.2.3.2 Nurture and maintain analysis

Through their narratives, editorial information designers displayed a concern to maintain the interest of the readership on the graphic and accordingly developed strategies to nurture cognitive aspects of analysis. The purpose of the strategy was two-fold: to aid

the thinking process upon the presented elements and maximise the potential of the reader to stay on a particular graphic, leading to a better understanding of a subject. As reader attention can quickly be disrupted from the page of a newspaper by external factors or willingly changed by re-focusing into another part of the page, article or another graphic, the exposition of content is maintained in subtle ways, providing reasons for the reader to continue reading and consider the meaning of data. The means to achieve focus and continuity on content mainly rests on the capacity of the visual to maintain attention and the intelligent application of visual formulas to gradually release layered forms of content to the audience.

Nurturing and maintaining analysis is a core concept of editorial information design practice, closely connected to the nature of the medium that editorial infographics are published: as infographics of the area are not exposed as single diagrams for study but are part of a competing group of stories, the immediacy of the visual is utilised to make the reader stay on a topic and engage content making a controlled and informing transition through the page.

Through the examined literature there was little mention of the extensive use of this type of operations during the design phase, or mechanisms being specifically placed to maximise the time spend on a particular visual. It is the author's opinion that the contents of the code illuminate a new element of practice in design regarding information rich environments. **Nurture and maintain analysis** is a defining characteristic tailored to the needs and scope of editorial information design practice.

5.2.3.3 Impart complex analytical outcomes

As part of the methods of disseminating information, designers displayed a strong tendency to strive for the revelation of complex analytic outcomes to the readership. Even if concepts of simplicity and clarity were of primary importance and constantly maintained, designers emphasised their intent to provide to the readership with critical

perspectives on data interpretation and outcomes of intense and multifaceted analysis. A substantial number of graphics had lengthy preparation, while some were developed in a purely experimental fashion, without certainty of completion; yet their creators often voiced these exploratory graphics, as primary examples of practice. From the analysis of narratives it becomes apparent that a constant effort to offer to the readership not only the core concepts of data but also results of analysis, relating to deeper understanding and higher complexity.

A closer look on intentions driving the creation of these visualisations also expose an element not included within the literature which relates to democratisation of knowledge. Editorial information designers work towards objectives partially imposed by the environment and medium of expression, connecting the graphic visualisation with practices of exposition and revelation of important data, maintaining efforts to inform the public about crucial matters.

The theorist which explicitly mentions democratisation of knowledge as part of his writings, with possible applications of the visual on the public sphere, was Neurath (1973, p.229) (Nemeth, 2010, p.77) who displayed a remarkable insight of future practices. However the exact manifestations of Neurath's writings in a contemporary practice such as editorial information design remains to be verified by data. The significant time gap, almost 70 years ago opens the possibility that designers have absorbed key practices of ISOTYPE as a basis for their operations. The code brings to light a practice unmentioned by existing literature but remaining strong within designer activity, emerging from primary data on the area under investigation.

It is the author's opinion that the **Impart of complex analytic outcomes** is a defining characteristic of editorial information design practice, as designers of this area purposefully engage more than necessary complex structures to impart difficult to attain information to their audiences. Democratisation of knowledge emerges as a potent part of the agenda of this particular group of designers.

5.2.4. Emergent Identity

Emerging identity as a theme describes notions conferring to editorial information design characteristics a distinct identity, relating to the close connection that designers develop with readership and the gradual insight gained from constant interaction with the reader base. More specifically, an increased understanding of characteristics of the diverse base has emerged from the narrative and capabilities, displaying an increased awareness of the capacity and references of their readership, including tolerance of visual complexity on formulas and mechanisms of information. At the same time designers through their work maintain open communication with readers via correspondence, email, social media, even direct communication, setting a mechanism of correction and feedback from readers; designers purposefully use the comments from readers to co-ordinate further action and improve practice.

In a similar line of thinking, designers, through the intense processes of data analysis and interpretation come, in contact with experts of various fields to comprehend initially the subjects requiring significant technical knowledge and subsequently validate appropriateness and correctness of the diagrammatic representations toward the original meanings. The intentions of this activity were not to simply progress a graphic, but also consciously develop a mechanism of delineating personal knowledge on the subjects of visualisation.

5.2.4.1 Predetermination of audience

A surprising emergent position among designers is the casual acceptance of knowing the readership's capacity, preference and capability and the alignment of the design process to meet the requirements through the visual outcomes. By looking at the numbers and diversity of the audience, questions arise on the validity of this perspective: how can designers have a clear view of the readership? The infographics produced are published in high-circulation newspapers and address a large number of readers difficult to categorise and even more difficult to specify their capability to comprehend.

The ideas contained in this code take considerable distance from the more traditional ideas of expertise and connoisseurship; as designers often attested that they do not necessarily 'know better', indicating a more direct connection of designers and readers relating to the mechanics of communication of the medium and is dependant to the rest of the codes of the theme for its justification. It is a part of a web of operations where editorial information designers evaluate levels of complexity for the graphic via mechanisms of feedback and knowledge accumulated by discussions with experts as well as experience.

This particular element has no reference within the literature as it is closely related with technological innovations on communication, expressing a contemporary use of tools and strategies to reach such a conclusion. It is the author's belief that the code of **predetermination of the audience** acts as a critical element of editorial information designer operations, working in synergy with the rest of the codes of this theme and the theme of **medium awareness** as a component to regulate the complexity of information and establishing levels of knowledge of audience. Appropriateness of use of formulas and interpretation of data sets to create a successful infographic, stem from awareness that derives from multiple layers of communication and activity, unseen to an external observer without in-depth study.

5.2.4.2 Self-correction perspectives

Designers of this area also displayed an increased communication with the public, not only submitting the finished product to the readers' critical eye but also incorporating feedback to improve the quality of work. Using this communication to rectify the potential errors, they defend their position or explain the purpose of some of the most experimental formulas of representation -this practice was of particular importance. The communication infrastructures of the organisations, such as emails, social networking, or direct communication, were used for the purpose: to make this form of dialogue productive and constructive with almost immediate effect.

In such a direct environment of practice, the distance of the design studio with the reader base is shortened via the mentioned communication methods, with commentary, objections and questions coming directly to the producer of the artefact: feedback is employed to inform practice with remarkable speed. As errors in data are truly rare, the conversations taking place revolve around the visual forms, structure and analogies employed with critical character. Readers scrutinise all possible aspects of the infographic with comments of various levels of knowledge and expertise; given the diversity of the readership these can be expert as well as laymen opinions covering often unexpected angles of the subject.

Feedback and self-correction is a potent operation in design practice, yet it is rarely seen within literature of graphic visualisations where the designer remains in isolation from the audience. Editorial information designers through daily practice and exposure to the readership take advantage of the circulation of the artefact and use the increased chance of commentary to effectively place a correction mechanism in practice, providing opportunities for the professional to test content and reflect upon future strategy. The few forms of existing feedback refer to metrics and analyses borrowed from science and relating to environment (Passini, 2000), but not any forms of understanding of the readership. Through the examination of primary data and the descriptions lying in the codes, designers evolved a system of evaluation that runs in parallel with their own practices through dialogue with the readers: a casual but efficient process of constant improvement.

Establishment of forms of self-correction via communication is a core mechanism for the practice of editorial information design reflecting the dynamic character of the discipline. The code displays a new characteristic of critical importance, not apparent in literature which defines practice to a large extent.

5.2.4.3 Delineation of personal knowledge

As the potential subjects of infographics are divergent and often require expertise, designers find it necessary to seek advice and verification of the mechanics behind the most technical of the graphics produced. This operation is necessary to credibly and responsibly depict data, as the understanding of interaction and connections of data are also necessary for the development of substantiated visuals. This acts also as a method for designers to delineate personal knowledge via this operation and balance creativity with a responsible attitude of artefact production: in the demanding rates of delivery for publication of editorial infographics, the designer has to clearly set the limits of understanding and explore the mechanics of subjects to avoid the production of a flawed visual artefact – a much unwanted result.

The code becomes more important when viewed in context with the research practices as observed before, where designers are actively involved on research activity regarding data. The areas of personal knowledge have to be clearly set to avoid structural errors on the creation of visual artefact, hence the code becomes more important when placed in context with the rest of the theme, connecting uneven levels of expertise and complexity where the designer has to balance and describe clearly to the audience for a successful visualisation. This emerged as an important discovery as the designers are experts of their field yet frequently have to venture to areas outside their zone of knowledge to generate outcomes on diverse subjects with high standards. The frequency of generating visual data makes the incorporation of such perspective necessary, with continuous and pro-active character as the types of stories in need of process are often unforeseen and unsuspected.

Active forms of knowledge acquisition in the form of **Delineation of personal knowledge** lack sufficient representation within the explored literature, as authors offer no mention of the subject of evolving designer knowledge and how this is achieved. The code, grounded on primary data, brings to the surface a characteristic and necessary part of activity for the discipline under investigation: the act of delineation is a critical for operations that define practice of editorial infographics.

5.2.5 Medium awareness

Through the analysis of designer narratives, activity describing awareness towards content and medium of expression emerged, thus influencing information practice and affecting operations at fundamental levels. The codes constituting the theme reveal intentions and strategies stemming from reflection on design practice as presented in an editorial information environment. Displaying a deep understanding of the multifaceted news stories as well as the ways that data can be perceived and analysed, deigners offer critical perspectives influenced by principles of exposure and communication, prevalent on editorial medium. Ultimately a story can be analysed in more ways than one, yet designers strive to present the most appropriate way to display a story linked to the data-sets.

Equally influenced by the medium, editorial information designers are conscious of the positioning of the graphic within the page and the synergy developing between the infographic, text and image to offer to the reader an environment with increased interactions leading to better comprehension of data linked to a news story.

Medium awareness describes the characteristic perspectives that designers develop with the medium of publication during practice, subsequently informing operations and shaping strategy of future action. The development of the visual outcome occurs with an awareness of the rapidly changing information environment and perspectives of presentation, while the positioning of the infographic within the page occurs with increased levels of synergy in mind, acting as a node of cross-reference and verification.

5.2.5.1 Multiple outcome analyses

Designers stressed the importance of extensive and credible analysis, seeking precise answers to the critical questions that reveal and explain a subject in graphic form.

However, after the initial intense analytic stages where focus on data sets and subjects were emphasised, designers displayed acknowledgement of the potential hermeneutic character of the analysis as well as the analytical outcomes. The immersion in data allows multiple data interpretations to take place, with conscious selections from data sets and material to produce a credible story for the audience; designers displayed an awareness where slight variations of data and reframing of the basic questions can provide different outcomes, allowing degrees of subjectivity during the visual reconstruction to emerge: the data are rich and interconnected and any attempt to bring perspective, inherently describes a credible and justified view on data – yet a view none the less.

This pragmatic acceptance displays an alignment of design operations and data search that is evidence based and closer to the sets of practices found within an editorial medium: The designer incorporates in the creation of the infographics second order perspectives, understanding that the act of data presentation is accurate but eventually data selection and data refinement remains a subjective practice, offering multiple outcomes.

During the examination of literature, expressions about a context aware and medium aware practice did not surface. Aside of the philosophical background of Neurath's questions of intersubjective language (Cat, 2010) there is little discussion on the nature of these findings. It is the author's opinion that this realisation of multiple outcomes is a discipline defining element of editorial design practices. The plurality of sources and the sheer quantity of data for analysis, in conjunction with the time constraints on the circulation of the news story, necessitate the acceptance of multiple outcomes from analyses.

5.2.5.2 Synergistic visual node

Designers when describing the purposes and function of the infographic displayed an increased understanding of the artefact's positioning within the page, not standing in

isolation as a separate entity of data in visual form, but displaying open synergy with the neighbouring elements within the page. The infographic acts as a node within a matrix of visual and textual components to synthesise into a coherent outcome a parallel examination of the same news story, with fundamentally different types of literacy. The linearity of text with precise statements and syntax, the impressions and immediacy of the image in combination with the hybrid characteristics of the infographic offer different poles to inform the reader on crucial information. The overlap of the three key nodes creates a transition area for the user who is able to verify information and make sense of the offered perspectives. There is no competition or tension between the graphic, textual and image components, as they work in congruence to provide alternative points of reference and cross-examination for the reader, maximising the effect of potential transfer of the essential parts of the story.

Synergy of text and image is mentioned vaguely and abstractly as 'tight coupling' of word and image in Horn's writings (2000, p.27) enhancing the information output of graphics, but without examples or any detail on how this can be achieved, or any method on how this relationship can acquire functional form. Through the emergent parts of the code we have an explicit description of strategy on how the visual and textual elements interact with the infographic, forming entirely new relationships and dynamics in the page. The infographic is an entity existing within the web of critical elements within the page, prompting to a multi-layered connectivity essential and defining for editorial infographics.

However within editorial information design practice, something entirely new emerges: designers take further steps on contextualisation, purposefully expanding the operation to include the infographic into the web of critical elements within the page and raising synergy on to a new and higher level. It is the author's opinion that the domain specific version of synergy, as described through the emerging elements of this study, is critical and necessary to understand design strategy and on practice within the research field.

5.3 Discussion of emergent of cross-theme narratives

The analysis of the first five themes and their examination revealed critical practices of the design area, however in the analysis after the formulation of the theme structure via memoing, constant comparison and progressive sampling, other activities became apparent: practices that maintained constancy throughout the process and persisted in more than one theme during visualisation. These dynamic operations revolved around two elements that designers balanced and revised within the artefact: The first was a dual perspective connecting the gap between layman and expert viewpoints during the output materialisation and the second was continuous data examination of the subject during the design phase. Both aspects have a tacit continuity, making their presence known only by constant comparison of the five original themes.

On the first element, the concern of understanding, examining and developing the visual formulas as a reader permeated the design process, having a simultaneous existence of designer views and what was believed to be the readership's view. The references on the design formulas never entered abstract theoreticals; on the contrary designers displayed a strong intention to remain close to the readers of the news medium, prioritising in favour of transference over an exposure of aesthetic or design elements, expressing simultaneity of perception both as an expert as well a possible reader of the infographic.

On the second element there is a continuous pursuit of data processing and refinement of content with the pertinent data throughout the process of visualisation. Designers continue the process of verification and refinement as the graphic formulation phase continues. Comprehension, simplification, contextualisation continued well past the part of data selection described in **Data Struggle** and was integrated in subtle yet effective forms on the subsequent stages of graphic process. This is a significant deviation from the staged processes presented in the literature where data are provided for visualisation and the designer seeks only an appropriate container for the data: this is new knowledge directly connected with the design discipline under investigation and offers insight on core activities. The continuity of the process is a design response to

the link between numeric data tables and graphic expressions, providing further evidence on the increased awareness and analytical properties of editorial information design practice and designer knowledge.

On the following section a discussion on these two themes will take place, highlighting characteristics and positioning within design activity.

5.3.1 Dual narrative of designing editorial infographics, co-existence of perspectives

The constant references of readership within the majority of codes and the continuous references investigating perception, understanding and analytical thinking of the audiences were closely followed by comments of affirmation about the knowledge of the audience's preferences and capabilities: a series of statements that raised questions when the numbers, diversity on skills, literacy and competence of the readership of high circulation newspapers are taken into consideration. As encountered in the 'Analysis' chapter editorial information designers adopt a dual state of activity while designing infographics, emulating on multiple steps the view of 'the reader' through various stages.

While this state of mind initially seems paradoxical, as a total coincidence of views and pre-knowledge is impossible, the constancy of these references points to an element of significance. By looking closer at the emerging codes, regardless of theme classification, a balance existing between two poles of reference is perceived: The first is the designer and the second the reader. In the following table the number of codes focusing on the designer, the reader or both can be seen:

Code	Focus on:
Visual/Cognitive Reconstruction	Designer and Reader
Establishing Critical Analogy	Designer and Reader
Underlying Patterns of Non-disruption	Reader
Establishing a Personal Connection	Designer

Dialogue with Data	Designer and Reader
Acute Data Separation	Designer and Reader
Incite Reader Inquiry	Reader
Nurture and maintain analysis	Reader
Impart Complex Analytic Outcomes	Reader
Predetermination of Audience	Designer and Reader
Self-correction Mechanisms	Designer and Reader
Delineation of Personal Knowledge	Designer and Reader
Multiple Outcome Analyses	Designer and Reader
Synergistic Visual Node	Designer and Reader

The number of codes that focus on the reader or both the designer and the reader are the majority: even in codes that designers described as forms of professional activity, seemingly introvert and personal, they were made in light of exposure or reference to the readership, or part of a series of steps to communicate the message. By adopting a simultaneous perspective, designers create a connection that places within a holistic view the operations of communicating the contained messages.

In essence, designers operate on an estimated middle ground between designer perception on one hand and reader on the other, seeking ways to form a system of patterns and ideas to expand and explore the subject with informative, incisive and stimulating ways. From the findings, designers try to reach the interstitial space between the two opposing roles: the designer as communicator and creator of the visual artefact and the reader as the receiver and meaning maker of information. The two positions bring different types of questions and insights that radically improve the outcome. Examining the narratives developed within the interviews, the theme becomes clear, revealing the dual perception as a critical aspect of activity.

The theme of **Dual narrative of designing editorial infographics** is an emerging series of operations unmentioned in current literature, displaying previously unknown designer strategies: the extent of intentions on credible and uninterrupted communication, relinquishing notions of the 'expert' or 'guide' standing above the audience. The projection and examination of a subject and the corresponding data is the

primary objective to such extent, where specific mechanisms are placed to ensure and understand the audience.

5.3.2 Multiple perspectives of content refinement

By further analysis of the data of the five initial themes another pattern emerged through various stages of the design process. Activity isolated within the codes was prompting to a further selection and testing of content, venturing beyond the boundaries of a 'given' subject or a 'client brief'. Designers displayed behaviour different from a simple use of pre-determined formulas and given data sets, the process of graphic production on editorial information design is a continuous selective process constantly affecting meaning-making and subject definition.

Regardless of thematic structuring throughout the process of visualisation, out of fourteen codes in total, nine codes refer to direct or indirect verification and improvement of content: a substantial portion of the total described activity. In the following table, codes referring to early stages of content refining processes are presented, related to designer's personal understanding and reconstruction of data.

Early stage codes of data refinement
Visual/Cognitive Reconstruction
Dialogue with Data
Impart Complex Analytic Outcomes
Delineation of Personal Knowledge

The above group of codes describe actions and decisions of designers, during the creation of the infographic, the objective is to secure knowledge of content and context through a multi-positional view wherever is possible. However, another group of codes outline the operations taking place during the mid and late stages of the graphic production, where the coherent logical pattern and visual formulas are used to test the validity of data and coherence of content:

Medium stage codes of data refinement
Establishing critical Analogy
Acute Data Separation
Multiple Outcome Analyses

The above codes display on-the-process qualities and emergent realisations that came as parts of an open and exploratory process to designers, changing or even negating previous suppositions about content. As new elements are discovered and placed or removed from the original design plan, change on the design outcome is inevitable: the connection of the data with the visualised formulas has impact not only on a graphical level but also in deeper levels of cognitive interaction and meaning-making. The changes on the graphic are structural and decisive on the expression of argument of the chosen subject.

At the same time another set of codes remain continuously in effect, affecting designer strategy on a meta-design level further affecting the outcomes and operations.

Later stage codes of data refinement
Underlying Structures of non-disruption
Synergistic Visual Node

The above codes influence subtly but significantly the outcome: analogy through functionality enables the established connections to interact, highlighting any inconsequent connections or non-sensical arguments, while contextual awareness aligns the on-going data processes of graphic production; testing and critically comparing existing data and forms of content.

The theme of **Multiple perspectives of content refinement** is an emerging series of operations unmentioned in current literature, as it reveals continuity and insight on practice; linking designer action with coded data. The theme maintains constancy through the various stages of designing and highlights the interconnectedness of data

and diagram on editorial infographics: the manipulation of components refines and improves the final outcome and is a so far unknown, yet defining characteristic for the practice of editorial infographics.

5.4 Further association of themes, formation of higher categories

Editorial information design practice is characterised by the close connection of the design process and outcome with the data, the multi-layered functions that permeate design activity are closely connected with the understanding, morphology and ways of information transfer towards the reader. Data-finding, data-examination, restructuring and visual formulation describe an immersive strategy where the designer acquires exceptional understanding of data structures and analytical skills to engage content and proceed with the production of the visual artefact. These skills are requirements for practice, taking precedence over aesthetic or decorative values, forming the data realisation aspect of editorial information design practice as described by the theme of **Data Struggle**.

However, editorial information designers also employed specific conceptual structures to develop the desired visual argument, or visual presentation of data. Either implicitly or explicitly they create small 'ecologies' of information with mechanisms to enter, interact and understand content via internal functions made accessible to the audience. The non-linearity and openness of editorial information design artefacts invoke impulsive exploration, encouraging analytic thinking and conclusions from the part of the reader. The infographic is placed in context with the written article and images on the selected topic, aiding further understanding and conclusions on the topic under investigation; these are the visualisation aspects of editorial information design practice constituted by the themes of **Morphology of Argument** and **Visual exposition of Content**.

Context also becomes extremely relevant when looking at the dynamic forms of dissemination of the graphic, allowing commentary, criticisms and possible corrections to be voiced through the communication platforms with the audience. In fact, within the

fast paced editorial environment the producer of the artefact, the artefact and the readership are situated in an interrelationship of almost immediate action and interaction, cause and effect, made available by technology. The response and feedback regarding an infographic supporting an article, is taken into account for the production of the next graphic, even on the following day. This activity evolves practice in rates unknown to current literature describing new operations and activity. These practices form the medium and readership related aspects constituted by the themes of **Emerging Identity** and **Medium Awareness**.

Persistent strategies on visualisations also emerged after the post-formation analysis of the themes, made apparent by a lateral examination of theme structures and retaining continuity throughout the process of graphic visualisation, with two crucial aspects maintaining subtle presence through various stages. Their expression was directed towards two fundamental concerns of the editorial information designer: Readership and data. Both strategies kept designer perspectives focused towards effective communication of content: The first by constantly reminding the capability, competence and capacity of the audience, while the second by placing multiple effective perspectives of content refinement and data scrutiny during the visualisation phase.

Within the following section a discussion on the emerging findings will take place, elaborating on a less data-heavy orientation, discussing and connecting findings from a perspective of linked, contextualised practice and exploring connected cross theme effects and implications, emerging from the analysed material.

5.4.1 Data Realisation aspects of editorial information design (Theme: Data Struggle)

Data is a vital component of the editorial infographic, their presence give additional depth to this particular area of design; in some complicated subjects characterise the activity of designers to such extent, that graphic imprint of the visual is turned to a hybrid activity of statistical literacy and visualisation. The creation of the infographics

becomes a graphic form of research where visual components, inextricably linked with data components, are used to shape and further refine the developing argument of a story. The effect is continuous until the later stages of graphic production, bestowing to the designer not only graphic but also editorial qualities. As the visual is not an embellished visual summary or a beautified version of the article, the designed outcome acts in synergy with the written piece, yet retains enough independence and self-sufficiency to endure extensive scrutiny from the readership.

To reach this point, designers go through intense stages of familiarisation with the data, establishing a personal connection and motivation to pursue inquiry. Depending on the complexity of the subject, the research time of each project is variable: with some projects having short period of development, some others needed long term research to materialise, while others were purely exploratory, without guarantees of completion. The nature of the data drawn from sources are initially abstract, requiring perspectives and parameterisation to form content; as such, an effective response to look into the multiple hermeneutic potentials of the voluminous data, designers developed a cross-examination of the material in dialectic form, employing critical questions and visual schemas in order to gain insight and perspective. Working alone or within a group the crystallisation of the argument through data is an essential part of the process, separating the pertinent material from the redundant elements of the data-set, allowing the structure of the information to surface.

This act of critical selection of content marks the finalisation of the data examination phase where one or more data-sets are placed under scrutiny and marks the commencement of the work on graphic formulas.

5.4.2 Graphic Realisation Aspects of editorial information design (Themes: Morphology of Argument and Visual Exposition of Content)

Development of mechanisms of perception, data reformulation and graphic techniques of meaning-making emerge as subtle but constant, methodical pursuits of designing within the area of study. As designers face an audience of various levels of literacy,

mental capacity and aesthetic preference, every unexpected or unknown element within the page is an issue of concern as they affect a reader's attention, energy and time.

Designers were explicit on their intentions: the audience shouldn't remain for too long on the aesthetic, pleasing aspects that an infographic might have, although creation of high quality graphics was an imperative. The graphic novelty of formulas is balanced by the clear intent of critical interaction with the data, grounding the exploratory and inventive solutions to a very pragmatic determination: that of a transition between data to information and eventually knowledge for the reader. The graphic acts as a medium for this transference, rejecting any unwanted attention and placing visual emphasis on the story to be told.

A number of unseen strategies are set in motion for this purpose, gradually and consecutively guiding the reader towards the introduction and acquaintance with the core meanings. Clear and evoking aspects of visualisation are utilised as means to inspire connections and guide attention, sustaining focus until the underlying structures and functional characteristics of the graphic, transfer the mental focus from the level of perception to cognitive operations. The patterns and differential displays of quantities and qualities build a non-linear argument where complexity is moderated by incremental exploration of content and comparison. The graphic by its nature allows independence on the speed and method of analysis, unlike the mode of linear explication presented by the text of a written article. The strong analogical methods of reasoning as discussed reinforce the presented argument enabling the readership towards self-directed discovery and encouraging further investigation on content and constituting parameters.

The combination of the above strategies; structural, cognitive and visual lead to the imparting of meaningful components of the story that if correctly materialised and properly interpreted, transform information into personal knowledge, as the reader engages active forms of inquiry through visual correlations more than passive reading. The infographic offers a genuinely different form of investigation of the same content, supplementing the successful communication of story and impact.

5.4.3 Medium and readership aspects of editorial information design (Themes: Emergent Identity and Medium Awareness)

Strong contextual awareness was another emerging part of designer practice, exposing designer strategies and practical outcomes to feedback and further inputting in a process of understanding environment, medium of expression, readership and finding potential limitations of technical, subject specific, knowledge.

Readership plays a key role in information design practice and editorial information designers strive to understand, even predict the characteristics and qualities of the readership on a specific design outcome. Although the numbers and diversity of readership causes some scepticism on the issue, when the notion is placed alongside the described processes it becomes sensical, even necessary: The amount of conscious design decisions need to be taken during the course of data separation, data selection and further refinement on visualisation are numerous. The process of simplification, pattern building and argument structuring, require a series of subtle corrections and adjustments taken towards conceptual decisions, making specificity about the audience mandatory. The selection between the variable analytic outcomes and corresponding appropriateness of the choice is an indication of this alignment towards readership. In a similar way the pragmatic acceptance of the graphic as a 'snapshot in time' is descriptive of contextual awareness but also provides justification to a practice modified by time constraints: there is a finite time for completion and an ever increasing body of data to draw upon, making each project critical but also balanced against a wider perspective of a daily news medium.

Context influences editorial information practice also in a different way. Designers seek information from experts to underline limitations of personal knowledge and ascertain the validity of the produced artefact. This practice often exceeds simple verification and displays qualities of strong personal understanding necessary to build the needed web of interrelationships and explanations for a substantiated and valid graphic. At the same time designers are keen to listen to views and opinions from readers via the established methods of feedback, monitoring praise, criticism and proposals on the circulated

visuals. The purpose of the operation that effectively covers the two ends of the spectrum of knowledge is to establish self-correcting mechanisms in terms of knowledge acquisition, levels of complexity of the developed visual mechanisms as well as a measure of impact and successful reception of the designed artefact. The outcome is not produced in relative seclusion with feedback from clients as in other graphic areas: the editorial infographic is formatted to a certain extent by specialists and to a greater degree by the audience, allowing a fresh set of questions to emerge about the limits of this interconnectedness. Editorial information design knowledge maintains a graphic point of origin, yet there is sufficient indication that accepts increasingly multidisciplinary influences and ventures in non-design territories to fulfil the communicational objectives.

5.4.4 Persistent, cross-theme practices of editorial information design (Dual Perspective of Designing and Multiple Perspectives of Content Refinement)

The practices resulting from lateral analysis of themes are research outcomes but also starting points for further research: Their persistent nature on practice brings in return a number of questions in need of investigation, as these concepts are linked to design operations that aren't entirely unfamiliar yet at the same time extend to areas where qualities and dimensions remain unknown. Illumination of these undefined areas can lead to further revelations on epistemology of practice of editorial information design, allowing transference of tacit designer knowledge

On the situation of the synchronous perspectives, while designing there is a understanding of why designers would welcome information about the audience, as most practitioners would do to improve practice; however the interconnectedness of these perspectives with structure of argument, feedback and the balancing effect that delivers on the visual artefact is something entirely new as new dimensions are realised. The information designer takes into consideration a multitude of expert factors, consciously forfeiting impressions for essence and expertise for simplicity. It is an apt

transformation of a design area embracing multidisciplinary perspectives to act as a spearhead on the domain of visual data communication.

Similarly the gradual refinement of content as perceived within practice, displays a merging and a subsequent transition from analysis of scientific ways of reasoning to more visual forms of verification, closer to design perception. Traditionally designers of visualisations communicated a given aggregate of data in graphic form, a pre-set meaning, a finalised outcome of analysis that were called to give form. What emerges from the analysis of the narratives however, is the gradual implementation of methods maintaining the analytic cycles of data working also during the visual process: the connection of function and form acquires multiple dimensions of reference, where all are placed within the two dimensional space to interact during design activity. Designers seem highly aware of the numerical visual forms that data can have and the effects on manipulating both aspects to refine an argument. This is coupled with experimentation and new formulas of presentation worth looking at, from a rigorous research perspective.

Looking at the above, and situating these practices within a wider framework, a second order of observations and further questions follow. The effects of eccentricity, subversion, impact or decoration found in conterminous areas of design are subdued for the sake of effective transference. Even originality, an element frequently receiving high praise, was not presented as a main priority for this group of designers, as the majority of interviewees had only few objections on the use of precedents if well-used formula could deliver the message appropriately; the conveyance of the essential meanings while maintaining data integrity was an unchallenged consensus. These emergent elements indicate a practice where hybrid skills and hybrid ways of reasoning are key drives to reach the desired goals.

The continuity of operations displays integration within practice and a persistence of intentionality manifested within the critical processes, unique to the investigated area. The designer is placed at the core of information production, not just visualisation, as the activity is indicative of a new positioning of practice towards the two dimensional space, insightful, analytic but also anticipatory of reader attention. Adaptability,

multidisciplinary awareness, as well as hybridity of skills and reasoning are key assets and drives to reach the desired communication objectives.

Although these are qualities stemming from tacit practices and approaching the barrier where language faces increasing difficulties for precise description, outlining notions and providing evidence of their existence via rigorous research is a major step in defining the concepts and relationships governing editorial information design practice. Establishing those persistent cross-themed concepts can provide a solid basis on the study of knowledge acquisition and knowledge transference of the research area, allowing access to discussions beyond the descriptive and contribute directly to design epistemology.

5.5 Comparison of examined theory with the research findings

5.5.1 Data and information

Data are the essential primary materials for the construction of infographics and designers described at length processes of reduction of abstraction, intelligent separation and meaning making, focusing on communicating the message in non-specialist and easily understood terms. The information is initially processed and internalised by the designer and then externalised in graphic form in the line of reasoning (Kazmierzak, 2003, p.51; Orna, 2011, p.1), understanding the dimension in human terms before moving into design and graphic phases. It became clear from the analysis that data are indeed the 'building blocks' of the graphic but not the meaning itself (Shedroff, 2000, 270) requiring the active engagement of the designer in a project to provide sets of differences, comparisons and analogy and enable the reader to engage the cognitive infrastructure and achieve understanding.

The above theoretical concepts on data and information can be traced within the analysis on the themes of **Morphology of argument** and **Data struggle**.

5.5.2 Information design as a transition between Data, Information, Knowledge and Wisdom.

Shedroff's (2001) theory of continuity of data into meaningful information through stages of familiarisation and personalisation bears relevancy with emerging design strategies. Centring the design process on the cognitive needs of the readership offers a model on the development of patterns and allows a smooth transition from a state of non-knowledge to a state of understanding. The notions of basing information transfer into the realm of experience, or the creation of an experience to the reader relaying the intended message is closely linked to the same practices of argument development and exposition of content as seen in the analysis, connecting parts of the area of study.

The specific areas of activity connected with this view of information transfer can be traced within the themes of **Morphology of argument**, **Data struggle.**

5.5.3 Designing in two dimensions

The design outcomes were characterised by a diversity of forms and formulas of interaction: the freedom of engaging a design activity by drawing is an essential asset in this particular design practice. The fact that early sketches, potential models and prototypes are developed in continuity within the page, allow continuous restructuring of content until the required communicational and design objectives have been achieved. Editorial information design practices are situated well within the processes of designing in two dimensions (Lawson, 2006, p.26) as every element placed in the page is meticulously improved, often leading to new and unexpected solutions as mentioned by Lawson (2006) and Cross (2007); forming a 'conversation' with the existing materials (Schön and Wiggins, 1992) within the page. Pertinent is also the means to identify and capture these conversations in the form of patterns as explained by (Waller, Delin and Thomas, 2012). The connection of the graphic representation with the data, reveals an interdependency of form and quantity and quality fundamental for the discipline, enabling the editing of material with numeric character in visual ways, reinforcing the research aspects of designing, as the designer reflects on multiple aspects during the design stages.

The above theoretical concepts can be traced within the analysis on the themes of **Morphology of argument**, **Visual exposition of content and Multiple perspectives of content refinement**.

5.5.4 Design as a culture

Editorial information design practice displayed particular relevance with the description of design as a culture by Cross (Cross, 1982, p.222; 2007, p.18) between the sciences and the humanities. There are multiple references from designers on artefact production, methods of modelling, pattern formation and synthesis, displaying common characteristics of the discipline under investigation the three cultures model. At the same time editorial information design acts as a bridge between other cultures as described by Harland (2009, p.3259; 2011, p.30) bringing content of scientific orientation and analysis to the readers and the intuitive, non-linear explanations encountered in the areas of humanities and the arts.

The above theoretical concepts can be traced within the analysis of the themes of **Data struggle** and **Emerging identity**.

5.5.5 Chaos, Order and sense making

Dervin's (2001) theoretical standpoints, while abstract and addressing principles of general understanding but not visual processes, can be associated with practices of editorial information designers on the construction of infographics. The constructivist yet anthropocentric principles of the theory, take into consideration both cultural relativity and personal perspectives on information dissemination. The notions of co-construction of meaning and the position of the designer as a specialist to "assist people to make their own information, their own sense" (Dervin, 2000, p.43) connects with activity through various design stages, especially involving those that deliver meaningful visual formulas to the reader. The original theory, although unrelated to visual

processes, retains pertinence with the most abstract concepts of editorial information design practice due to the connection with the cognitive processes.

Designers tacitly described worries about the qualities and dimensions of understanding in multiple emergent codes, with the most distinguished being **Predetermination of audience**, **Visual/cognitive reconstruction** and **Dual perspectives of information**.

5.5.6 Intentionality

Designer intention, as a principle to explore action is potent and emergent within the narratives. Comparison of this section of literature with the research material, displays the drive of this particular group of designers to reveal specific characteristics, connections and relationships of data in visual form to convey a news story. Within the totality of design process, intention on discovery and dissemination was evident: a non-standard process, exploratory and even opportunistic in nature, having the capability to overturn initial presuppositions and initial planning of a project. The multiple expressions of intentions were a critical tool to establish perspectives on data exploration and subsequently maintain clarity on visual formulas leading to a credible and visually balanced result.

This makes intentionality as described by Heinlgen et al. (2009, p.98) a legitimate perspective to explore editorial information design activity and a vehicle to look into the evolution of the problem solving operations within design work as described by Lawson (2006, p.48-49), refining and simultaneously improving the outcome.

The above theoretical concepts can be traced within the analysis on the themes of **Data struggle, Morphology of argument** and **Medium awareness**.

5.5.7 Diagrammatic cognitive, iconic and linguistic properties

The development of formulas and new ways of dynamic representation were of primary importance to editorial information designers, narrating a wealth of cognitive concepts

during the design process and outlining their importance on the outcome. Yet the description on the properties and the qualities of the diagrammatic was practically non-existent, outside the scope of the pragmatic interests of professional practice.

From the analysis of the conversations and the examination of the themes, a subtle understanding of the processes can be seen but without the required certainty. The specific terminology of the area and the theoretical orientation of concepts of both Krämer (2010) and Kazmierzak (2003) proved to be a significant challenge to be discussed within the context of semi-structured, open ended conversations leading to silence or frustration. Designers retain tacit and personalised connections with this aspect of design knowledge, developing localised methods and ways of communication; incompatible with academic terminology.

5.5.8 Wayfinding

Passini's (2001) concept of wayfinding has a very limited application within editorial information design. Although the elements of orientation and navigation within the diagram are processes essential for understanding, the challenges are lessened when examining two-dimensional spaces; moreover the idea of measurement and verification via scientific means has not surfaced at all by designers raising further concerns on the relevance of this method on information design. However an element relevant to wayfinding was the recognition of the cognitive states and effects of the environment on the individual were expressed by some of the participants, due to portability of the medium, printed or digital. Notwithstanding the appearance of this single element, the research findings had only circumstantial connection with this part of the theory, with no appearance during any of the stages of the analysis.

5.5.9 Information design as a visual language

Horn's (2001) standpoint of information design as a tight coupling of word and image maintain vague familiarity with the research findings and designer methodology. While the strong connection of word and image to produce efficient outcomes is accepted, the

outcomes of information design are leaning heavily towards the diagrammatic side, as there is adequate support of text from the linked artice, providing relevant textual material to the news story. From the designer narrative it becomes obvious that besides numeric values within the diagram, the text is quite limited and the forms containing data exist within the page in a semi-independent state and not rigidly linked as expressed in Horn's (2000) theory.

Furthermore the concept of structured visual language was not a concern for any of the designers interviewed, or was hinted at the analysed material: On the contrary the plethora of design works presents a diversity of form, maintaining some uniformity only on the secondary elements within the page to preserve familiarity with the audience.

5.5.10 Intersubjective communication and visual argument

Neurath's writings can be connected with today's practice mainly through the theoretical material on visual communication to reach the public sphere. The notions of intersubjectivity and the philosophical underpinnings on communication relate to contemporary designer mentality. The cognitive and social dimensions of the visual as described on 'Empiricism and Sociology' (1973) are also insightful contributions, still reflecting a portion of designer worries and objectives on practice. Equally the role of the transformer as an analyst and skilled visual communicator of complex material and the neutral qualities of the visual presentation of content (Neurath & Kinross, 2009, p. 26) are points relevant to today's editorial infographics and are surfacing during the analysis of the emerging themes of **Data struggle** and **Morphology of argument.**

Of particular interest are also the notions of the graphic as a way to democratise knowledge (an objective of the news environment) and 'humanise' information, escaping the expert-layman views on communication and present complicated subjects in clear and cognitively manageable terms, reaching a wider audience without the need of omitting content or detail for the sake of simplicity. The relative areas with this material can be traced on **Visual exposition of content**, **Data struggle** and **Morphology of argument.**

Also relative remain the views on the argumentative nature of the visual while maintaining neutral expression: the presentation of a well-researched, well informed non-linear argument (1973, p. 240) to the audience. Both argument and freedom of exploration emerged as critical points within the analysis of the research data on the themes of **Data struggle** and **Visual and cognitive reconstruction**.

Looking at the examined literature of Neurath it is clear that the visual language proposed originally is no longer in use or followed by designers, apart from a generic visual style, a legacy remaining after decades of use; yet the publications on the purposes of visual communication display a remarkable prescience that remains an influential point of reference in today's practices, often being more open and to the point than contemporary theories. ISOTYPE is by no means representative of the practice of editorial information design, but parts of its theory can provide meaningful context and substantial orientation to characterise today's practices.

5.5.11 The invariant and elevation - Jacques Bertin

Bertin's semiological and analytic approach provides an excellent map of the frequently unseen and tacit practices of designer activity and a way to navigate through multiple layers of information and cognitive operations both affecting the designer and the reader. The descriptions of the operations in reality are more chaotic, as it is often the case when looking at professional design practice, but the models and connections presented provide a method to approach and understand an otherwise difficult to access area.

More specifically the definitions of the visual as two dimensional, monosemic and semiotic (Bertin, 2011, p.2-3) provide a concise description and an introduction to the complex interaction within the page, simultaneously underlining the importance of good design to guide the reader through the confines of the diagram (2011, p.2). As the reading of the graphic "takes place among the given meanings", the structure provides another indication of the locality and limited isolation of the graphic as seen before in **Morphology of argument** and **Visual exposition of content**.

Another conceptual tool particularly relevant to the stages of information analysis is the "invariant" (2011, p.5) as the "common ground connecting all the elements within the graphic" displaying the interdependency of the material both within the page but also the cognitive reflection of the material on the reader's mind. At the same time "elevation" (1989, p.186; 2001, p.7; 2011p,42) and the ways that the concept can be measured and evaluated provides a way to locate qualities that connect the reader with the graphic, providing possible mechanics and properties in which the graphic system is defined (1989, p.186; 2001, p.7; 2011, p.42), a rare contribution in contemporary bibliography.

Bertin offers a structured hierarchical system of plausible connections of concepts, forms and content for explaining the diagrammatic operations. However the general character of the theory as well as the strict focus on the artefact, which underrepresents the designer and associated forms of context, making it difficult to have particular application with the design area under investigation: The processes described in Bertin's writings are rigidly articulated and linear while the sets of concepts emerging from the primary data remain uncertain, opportunistic and changeable allowing partial applications on today's practice.

5.5.12 Data Ink, Escaping the flatland Edward Tufte

Tufte's self-exemplifying strategies and visual presentations offer a way to reflect on tacit elements of design, connecting theoretical notions with selected practical examples. The most pertinent texts from the list of publications in relation to editorial information design are 'data ink', and the visual examples of the 'smallest effective difference'.

In the description of the data ink lays an illustrated and comprehensive example of the operations of simplification and graphic manipulation of the data, necessary to relay information to the audience. The connection of the manipulation of graphic forms with the corresponding data (2001, p.96), provide an excellent description of the continuous operations of data refinement discussed in **Morphology of argument** as well as **Acute data separation** and display potential of synchronous modes of operations both in design/graphic level as well as mathematical/analytical levels. Yet the concept

remains underdeveloped as it follows the line of reasoning that the visual is enough to describe the principle from the scope of personalised practice, which is in itself a grand step of induction; no further research is done or examined through works of other designers.

Similarly the 'smallest effective difference' or the "Occam's razor of information design" (1997, p.73) underlines another element of good practice essential for designers: clearly maintaining difference and contrast within the page, resulting to visual clarity. The visual material creates a bridge between abstract models with intuitive visual examples, but again no explicit descriptions are provided, avoiding specifics –the justification is either implied or presented as evident.

The concept of 'escaping the flatland' offers examples of tensions existing within the graphic, with the designer creating additional dimensions to communicate a subject. The graphic imprinted on the page, becomes a platform, which unfold material with hierarchies and cognitive dimensions where content is better examined and clarified – again without justification.

Looking at the examined literature of Tufte, points of overlap can be observed with editorial information design practice and commonalities with designer narratives, however the material, with the exception of the concept of the data-ink, finds limited application due to the self-evident nature of the analysis on single examples lacking continuity or cross-reference with works from other practitioners. However some of the provided examples are of the most appropriate, found in the totality of examined literature, making the material useful for reference.

5.6 Summary

Through this chapter the emerging themes of research were further explored and contextualised, clarifying the outcomes of the study and connecting them to groups exploring process and meaning. The seven theoretical outcomes in the form of grounded theories, although presented separately during the analysis chapter, retain a high degree of interdependency, with overlaps revealing aspects of design practice grounded to primary data.

Via further exploration and analysis of these crystallised conceptual categories the findings can be grouped into three areas of higher conceptual order describing practice: The **Data Realisation**, **Graphic Realisation** and **Medium and Readership Awareness** areas of editorial information design, which underline fundamental characteristics of design knowledge of the area. In consequence the inquiry of the connections widens the area of practice described even further, as causation within designer activity becomes visible and explicit, escaping the prism of personalised expression. The concepts become clearer and activity better understood when the persistent, cross-theme practices of **Dual perspective of designing** and **Multiple Perspectives of Content Refinement** are taken into account, revealing further direction and purpose of the design process and designer intention. All this is new knowledge for the discipline of editorial information design, offering access to previously unknown practices and activities, providing valid theoretical models via credible research methods and methodologies. They offer a 'slice of life' of designer activity that escapes the isolation of personal practice and move towards a view grounded to data from multiple sources.

Lastly the knowledge gap is further narrowed down and an entirely new set of concepts are established for further discourse on editorial information design, comparing existing theories with the findings and revealing convergences or divergences. This emerged as a necessary action reacting to the discipline's ill-developed literature, where a contribution of pertinent theoretical material with verified connections with the area of practice is necessary. In such a way the epistemological, praxeological and phenomenological perspectives become clear, contributing to the realisation and evolution of the discipline.

Chapter 6:
Conclusion

6.0 Conclusion

Within the following chapter the outcomes of this study will be presented, allowing a quick overview and a summary of findings after the lengthy evaluation within the analysis and discussion chapters. These are meaningful contributions to the knowledge of the discipline under investigation, as previously unknown concepts and practices are offered to the research community.

Initially a review of the aims, objectives and outcomes will be offered, reflecting on how the ideas progressed during the study, solidified through research and acquired their final form as outputs of transferable knowledge through analysis.

Subsequently the outcomes of the Grounded Theory Method, applied on editorial information design will be re-iterated as part of the outcomes of this research. Themes and conceptual drives underneath professional activity and design practice, offering connections between explicit concepts and larger subtle yet potent processes during practice.

Following the emerging themes, the results of the critical examination of existing theory with design practice will be presented with a twofold focus: the first part is a critical review of the three categories of epistemology, praxeology and phenomenology used as areas defining practice; while the second part is the list of theories or methods which retained a high degree of compatibility and pertinence with the design area, after concluding the study. The outcomes of the examination show the compatibility, or lack thereof, of existing material with the emerging concepts from the analytic cycles of the study, contributing critically to the discipline's discourse.

Concluding, a brief mention of limitations and challenges encountered during this undertaking will be presented, sharing these points with future researchers, creating possibilities for further research on editorial information design based on the outcomes of this thesis.

6.1 Review of aims and objectives after the completion of research.

6.1.1 Review of the aims of the study

The initial aim of this research was to gain insight and clarity on design practices of editorial information design by using methods which record and document empirical data from practitioners. Although a major challenge in research design, the task was met with success, with participants being able to share their views on practices and activities, allowing the researcher to overcome the barrier of isolated narratives or personal perspectives as described in the knowledge gap.

The gathered primary data, recorded and transcribed, contained designer knowledge which offered opportunity to critically examine and analyse material which contextualise practice and permit key activities to emerge. Through the chosen methods, bias and pre-supposed concepts were minimised or eliminated via the consecutive analytic cycles of the Grounded Theory Method; it was a necessary process to surface the discipline-specific practices representing a professional reality as perceived through the scope of the study.

A secondary aim also emerged as necessary at the early stages of this research supporting and complementing the initial aim: in order to communicate any findings, a basic framework of theory had to be established and the existing literature had to be examined as to how it relates with editorial information design and which parts can be relied upon to inform both the researcher and audience. It was necessary to confirm compatible material and also to highlight incompatible theories with limited or no application. The extant literature establishes a platform where discussion on the research area becomes meaningful and productive.

6.1.2 Review of the objectives of the study

The main objectives of the study were to generate grounded theories that enable explicitness and specificity on relaying practices of editorial information design. Grounded to data, the new, empirically attained theory is a genuine contribution to

knowledge, bringing to light a 'slice of life' of editorial information designer activity to the research community and illuminating previously unseen methods and operations.

The second objective of the study was to critically review existing literature and as far as a doctoral study permits, compile a body of pertinent existing knowledge that serve as a basis for discourse. Through reflective analysis and the development of theoretical sensitivity with the field of study, a selection of theoretical material is offered. This is again new knowledge, but of a different kind: a critically informed and refined position on available literature, contextualising practice, enabling dialogue and informing researchers and designers on critical points of reference.

6.1.3 Review of the outcomes of the study

The outcomes of the study allow insight and understanding on the previously unseen practices of editorial information designers, and contain in explicit terms and transferable form the new knowledge emerging through the analysis.

The first outcome contains the refined output of the Grounded Theory Method: theories emerging from the rigorous analysis of primary data and expressed by the five core themes of **Data Immersion**, **Morphology of Argument**, **Visual Exposition of Content**, **Emerging Identity** and **Medium Awareness** plus the outcomes of the cross-theme narratives of **Dual Narrative of Designing Infographics** and **Multiple Perspectives of Content Refinement.** These are entirely new concepts with real impact on the description of editorial information design practices. All the above are summarised in **6.2.**

The second category is the critical review of existing theoretical material in relation to editorial information design, as perceived through the study with a twofold focus: Initially a critical revisit of literature of the three areas of epistemology, praxeology and phenomenology, based on the separation of areas as presented by Cross (2007, p.125) in **6.3.1** and subsequently the list of the extant concepts of examined theory after the examination of the research area in **6.3.2.** The second category of outcomes offer a critical perspective, not existing in literature but necessary for the development and discourse of the discipline: how existing theoretical material fits with the practices of

editorial information design, removing the subject area from isolation and making connections to existing material.

6.2 Core themes of editorial information design practice

The outcomes of this research are grounded theories, refined conceptual categories, drawing their properties from analysed evidence, drawn and used to illustrate the potency of the emerged concepts (Glaser & Strauss, p.23). From this reciprocal connection the presented results transcend the descriptive, and address core concepts of design activity that illuminate the unseen and articulate the difficult to describe areas.

Absolute accuracy of data, one that goes beyond doubt is not necessary as the concepts grounded in the data will not change: it can only have its meanings redefined as research evolves (ibid.) In that sense the outcomes of this study will remain pertinent even with the addition of new data and future refinement, making a meaningful contribution to the area of investigation.

Editorial information designer activity focuses on 5 distinct themes describing practices and operations covering stages of data analysis, graphic visualisation, and visual methods of communication, feedback and medium awareness. More specifically:

i. In **Data struggle** the strong connection of practitioners with data and deep involvement is encountered, on a personal level or even group level if necessary. The development of dialectic forms of analysis are observed examining content and allowing acute selections of data to take place, recovering essential elements from data sets and maximising potential for communication.

ii. In **Morphology of argument** the reconstruction of a subject from data into visual and cognitive terms, is perceived, connecting the diagram with thinking operations of the reader. The tools to achieve the successful materialisation of the diagram are pattern and difference leading to presentations of strong analogical reasoning. At the same time designers invest on their audience with the implementation of mechanisms of functional and familiar mechanism to the reader, maintaining non-disruption.

iii. In **Visual exposition of content** the methods of communication stimulating reader attention and curiosity on the visual are perceived;

carefully nurturing continuous reflection and analysis on the contents of the artefact. In such a way, complex notions stemming from the data examination can be imparted, as the readership actively engages the infographic.

iv.   In **Emerging identity** elements that unveil special characteristics of the investigated discipline are underlined. The close connection with the audience and delineation of designer knowledge with the help of experts, place a design self-correction mechanism in motion. Designers use technology and digital media to improve practice within a fast paced, adaptive environment.

v.   In **Medium awareness** the influence of the medium on the process of artefact production is observed, shedding light to another dimension of the discipline specific concerns. Designers of the area accept the pragmatic constraints of a news medium on delivering credible and defendable works of information design as 'snapshots' of a subject on a particular time. At the same time the infographic was acknowledged as a node of reference standing among images and text providing a multi-point approach to disseminate a message within the page.

As the above themes emerged as key concepts during the analytic cycles, two more themes materialised: operations persisting through the visualisation of projects and affected critically the outcome. These two themes, displaying a dual narrative of designing infographics, as well as the multiple perspectives of content refinement during visualisation, deserve separate mention: having characteristic influence to the design process as well as the final result.

vi.   In **Dual narrative of designing infographics** the coexistence of what is perceived by the designer as reader's knowledge, is acknowledged. Capability and capacity, along with designer expert knowledge on the process of formulation and visualisation, becomes a form of Meta strategy for designing: this dual view tempers the innovative and experimental tendencies of practice, towards effective communication properties and clarity of visual formulas.

vii.   In **Multiple perspectives of content refinement** a sequence of refining content and affiliated meanings is traced, persisting even after the stages of data familiarisation and analysis. Designers of the discipline maintain subtle yet effective ways to assess data through the formulation of connections. As the visual components are linked with essential aspects of the story, the re-arrangement of the elements

within the page highlight potential redundancies and discrepancies of the data sets.

6.3 Comparison of emergent elements with literature

Examined theoretical material from general theory as well as information design theory displayed degrees of correlation with activity and practice of editorial information design. The existing material developed and written for conterminous areas of design attains only partial or circumstantial relevance with the area under investigation. Through the course of the research study, the necessity for developing discourse for the area became evident: the need to research and articulate discipline specific material communicating with explicitness and accuracy design concepts is imperative, as currently knowledge remains bound within professional practice, waiting to be discovered in research terms and standards. The presented study offers a significant step towards this direction.

The outcomes of this research also attest to a systematic and exploratory character of the discipline, centring on the cognitive dimensions of designing and credible, justified analysis. Editorial information designers pursued innovation and potent visualisations during practice, with clarity and rational comparisons taking precedence over decoration and impression. Editorial information designers emphasised on analytic, research oriented activity, developing specific strategies within the medium, as well as communicational perspectives to reach an audience.

6.3.1 Epistemological outcomes

The examined literature of epistemology displayed a diversity of theoretical backgrounds focusing on multiple dimensions of designing, both abstract as well as practical. While various degrees of pertinence could be established, some key epistemological material offers a critical basis for the development of discipline-specific discourse, allowing a cornerstone for further theoretical expansion.

From general design theory the concept of Design as a culture of equal standing with the sciences and the humanities (Cross 1984, 2007; Harland, 2011) legitimises the position and practices of the editorial information designer on the use of material from these cultures, creating a connection to bring into life concepts and ideas in the form of the artefact. Also the continuous renegotiation of material and new information to build new solutions in design problems as presented by Lawson (Lawson, 2006, p.48) provides a valid perspective of an evolving discipline.

From information design theory, views converged into the visual structure and the best ways to convey information with clarity, with the designer in the position of a trusted visual communicator. Deliberation of theoretical material also displayed a strong disposition to convey information without force and often allowing freedom of investigation and individual pace on the discovery of meanings. Data and information under the scope of communication is a subject which remains frequently omitted or lightly engaged whilst also essential.

More specifically, Neurath (Lupton, 1987; Burke, 2010; Neurath, 2010; Neurath & Kinross, 2009) and Bertin (Bertin, 2000, p.5; Bertin 1981, p.16) draw directly from methods personally and empirically developed, to construct theory closely linked with the visual outcomes. Bertin's influence from mapping and cartography is evident among his publications, gradually building a coherent structure, with separated components, layers and levels within the page. Neurath on the other hand, more anthropocentric and based on principles of language produces a 'language-like' method of icons and diagrams where messages become naturally recognisable. Both perspectives remain close to the visual artefact, evolving abstract concepts in conjunction with graphic and material transformation, close to the outputs of graphic production. However, these well-articulated theories have considerable distance from contemporary practice: while offering potent descriptions of visualising practices, it is unclear if the same perspectives can be transferred to editorial information design. The knowledge offered is useful but only partial and certainly incomplete, the deeper meaning of these concepts must emerge from primary data.

Shedroff (2000) and Dervin (2000), address the process of designing at an abstract level, negotiating critical parts of practice such as data-information and knowledge; the cognitive blocks of meaning for the visualisation. Shedroff presents a model of transition from the often disinteresting data elements towards information and knowledge, using context as a catalyst to initiate personal interaction. Dervin moves to an even higher level of abstraction, challenging the established forms of information dissemination and meaningful communication by proposing a dual nature on the act of designing: a co-construction of meaning by design practitioners and audiences. Yet both abstract theories cause concerns when connections with practice are attempted: verification or refutation of the concepts in design context are not yet published, leaving the researcher uncertain of their application. Again the input is useful, but to truly judge relevance, verification must come from primary data.

In retrospect, literature on epistemology was the most accessible material of the three areas, with both designers and design theorists offering critical questions and perspectives on designer knowledge, aiding research awareness and forming a basis for the investigation and facilitating designer narratives. Yet for editorial information design, the above ideas have to be separately investigated and verified, avoiding circumstantial connections.

6.3.2 Praxeological outcomes

In the area of praxeology intentionality as a way to locate and explore the process and development of outcomes becomes a potent tool, detecting changes of strategy during the formation of artefacts. The individual perspectives of authors and the tacit nature of practice make praxeology a difficult to engage subject within information visualisation literature and as a result, the area of investigation remains underdeveloped. Intentionality at this point as described by Heyligen et al (2009) becomes a concept where individual perspectives become recognisable, making visible the common ground and articulating the tacit in nature knowledge of designers, informing the researcher and outlining crucial elements of practice.

Passini (2000) argues that wayfinding is a concept central to the interaction with the visual as part of the recipient's perceptions and orientation within a constructed environment. The concept of wayfinding provides the necessary information to communicate the message effectively, as designer practice becomes analytic and proactive with a conscious pursuit in problem solving, testing, and evaluating results for future planning. Although Passini's view offers some solutions and explanations, the fit of these processes to editorial information design is questionable: the reduction of dimensions from a three dimensional model to a two dimensional model, as well as the different setting that affects the problem solving process, causes concerns on application.

Bertin (2000, p.5; Bertin 1981, p.16) and Neurath (Neurath & Kinross, 2009; Neurath, 1973) continue from their epistemological stance, bringing theory closer to visualised outcomes, underlying the importance of parallel evolution of theoretical and practical elements on graphics, and how practice is linked with cognitive processes for the reader. Bertin presents a sequence for the creation of the artefact, yet the subtle exclusion of the designer from the process raises concerns as the process requires numerous decisions by the designer which are essential to examine. Neurath, on the other hand, emphasises the importance of the design as editor and communicator, but focuses on the development of visual forms of language, instead of providing explicit descriptions of the position of the designer. While both theories have merit and are highly valued in information design context, it is unknown how well they stand in editorial infographics. It is necessary to trace the emergence of these theories from primary sources and through credible analysis.

Tufte (Tufte1990; Tufte1997; Tufte 2001) focuses praxeology within two dimensions in alignment to the spirit of his investigations, preferring to analyse particular design examples and draw focused conclusions. Data-ink is based on the exposure of the pertinent data with the simultaneous reduction of non-essential data areas within the graphic, aiming towards continuous improvement and sophistication. However the theoretical material focuses on the outcome, leaving designer views on practice unmentioned; key points remain self-exemplifying

without mention as to why this is considered best practice. Again the relevance of the material has to be evaluated under the scope of the examined discipline.

All four theorists cover an area that remains to a great extent diverse and changing, addressing concerns of paradigm and theory but ultimately excluding the designer from the process. This causes serious concerns as the designer has a central role that cannot be ignored: within a design project numerous choices are taken, all linked with processes connected to design problems. Neurath worked on this direction with the concept of the transformer and it is expected that designers are expected to be influenced by his writings, but to what extent it remains to be verified.

6.3.3 Phenomenological outcomes

In the area of phenomenology links between key mechanisms of information explication, conveying abstract or conceptual knowledge are presented, providing insight on the patterns and processes of receiving and decoding information for the reader. Balancing between content and aesthetics the diagrammatic qualities described by Krämer (2010) and Kazmierzak (2003) offer a basic map of interaction between linguistic, iconic and cognitive areas which the artefact embodies, allowing mental models of interaction and communication to develop. In such a way diverse and seemingly disconnected views on design phenomenology are brought together and examined, informing further the accumulated body of knowledge of the study.

However literature of information design on phenomenology, avoiding complicated terminologies, uses conventional language and metaphor to describe key principles and concepts and reveals the qualities embedded during the design process. This is a behaviour described by Cross (2007) and Lawson (2006) and directly connects with tacit knowledge and personal language that permeate design practice. The literature offers useful but incomplete perspectives communicating phenomenological aspects of designing and offers approaches to the otherwise implicit dimensions. Most views act as successful examples, providing directions for a well perceived visualisation,

describing reader processes while viewing the diagrammatic towards an optimal result.

Horn (2000) maintains that a 'tight coupling' of word and image, with an interconnected and inseparable relationship between text and diagram is a mode of communication that informational graphics should eventually fulfil. As codification of image and text integrates with visual and word elements, this creates a potent way of communication easily perceived by readers. The connected word-image relationships form cognizant structures, subject to continuous improvement by practice. Nonetheless Horn's view remains far from complete or substantiated. Where some examples or works in progress would be expected, none is offered and ultimately what can be considered an inseparable word-image connection, remains a mystery.

Neurath (1973) on his reflection on the principles of visual language suggests that humanisation of knowledge is a perspective that visuals should convey. Avoiding technicality and using intersubjective and naturalistic principles, the visual structures develop forms of non-technical presentation where the subject is explored by the reader and the constructed argument is discovered and accepted rather than forced upon.

Bertin (2000, 1981) and Tufte (2001, 2006) both mention parameters and dimensions of the visual structure and describe the designer tension to develop solutions elevating content from the two dimensions of the surface to cognitive dimensions in the readers mind, through successful presentation of structures within the page. These views act as complementary and address the issue of embodying design attributes within the outcome enhancing and improving the infographic, contributing to a phenomenological pursuit. Yet these descriptions are vague and remain untested in the area of editorial infographics: if they exist, it is necessary to see how the processes are translated into the specific discipline and how they emerge in practice, with tangible examples and testimonies.

Material engaging critically phenomenological aspects of information design was rare when looking into peer reviewed sources and generally presented as self-evident on publications of designer-authors. While making connections with tacit knowledge

and the increasing numbers of visual formulas, the existing theoretical material reaches its limits quickly and fails to provide coherent descriptions on the latent design solutions, or explain in explicit terms why some solutions can be considered as representative examples of good practice over others. It is necessary to look at the qualities emerging from primary data of editorial information design in order to draw any constructive and meaningful conclusions on phenomenological elements.

6.3.4 Extant theoretical material

By reviewing the outcomes of this research and making comparisons with the examined literature, specific theories or parts of theories attain partial relevance with operations and concepts during the design process. Although caution is advised not to fully endorse the underlying ideas, they serve as points of reference and reflection for the researcher or practitioner of editorial information design to reach a set of ideas closer to the design area. It is the output of systematic review of the emerging new knowledge and the literature of conterminous areas: in essence this refinement is new knowledge as it survives contact with the empirical world and thus acquires great significance.

- From Kazmierczak (2003), Shdfroff (2000) and Orna (2011) descriptions of the attitudes of designers towards the concepts of data, information and communication, can be recognised. The establishment of anthropocentric elements of communication and meaning making are of particular relevance to designer thinking.
- From Shedroff (2000) the continuity of data to information and subsequently knowledge becomes clearer, providing a model of explanation on how designers can implement the meaning-making process step by step.
- From Cross (2007), Lawson (2006) and Harland (2011) potent models of positioning can be drawn, placing editorial information design in context, determining connections with the culture of design as well as the connections of practice with the sciences and the humanities.
- From Dervin's (2000) theory stem critical perspectives on the act of designing information, integrating within the artefacts methods that enhance the capability of the reader to make meaning from the presented data.
- From Neurath (1971) and Neurath & Kinross (2009) similarities on the intentions of argumentative aspects of the graphics and 'humanising' communication are observed.

- From Bertin (1981, 2011) forms and dimensions of the outcomes as well as conceptual tools on structure and efficiency can be drawn to understand connections within the graphic and effectiveness of visuals to the audience.
- From Tufte (2001) the operations of data-ink and the maximisation of data ink against the redundant graphic elements reflect operations that designers engage to enhance clarity and impact.

Also as an outcome of this research, areas have emerged that the examined literature does not cover sufficiently or at all. This is either due to the different character of the discipline under investigation or the unavoidable advancements in media and technology that transpired since the time of publication of those theories. More specifically:

- Contemporary theory on the specialist mechanisms of communication and the visual formulas that designers use.
- The feedback mechanisms developed in parallel with the presentation of outcomes to the public sphere and the intention and effectiveness of these mechanisms.
- The processes of data immersion and dialogue with the data, displaying the active research characteristics that designers displayed when examining data sets.
- The mechanisms of transforming the cognitive and visual dimensions of a subject in visual forms. The issue lacks in-depth, grounded descriptions.
- The dual perspective that designers adopt on the visualisation stage, maintaining synchronous designer and reader view.
- The continuous process of refinement of content, persisting through the design stages.

6.3.5 General observations on existing literature after the completion of research

The application of the taxonomy during this study also displayed an uneven distribution of literature addressing the design field: the majority of design publications venturing beyond descriptive and self-exemplifying positions is involved with epistemology and ways that designer knowledge can be transferred. On the other hand the areas of praxeology and phenomenology have significantly less peer-reviewed material available for the researcher to examine and analyse, displaying through their absence a significant gap on development of theory.

While the reasons for this uneven distribution could not be established in this study, this discrepancy on available material is a situation not immediately apparent to a researcher of the area, given the fact that publications are always accompanied with visual outcomes. The visual qualities are often presented but rarely discussed in critical ways, failing to reach the deeper, underlying concepts.

6.4 Limitations of research

A limiting factor in this research has been primarily the scarcity of literature relating to editorial information design and secondarily the newness of the discipline under investigation. While both elements prompted to an emphasis on primary data analysis and understanding of the examined area with empirical methodologies, highlighting the area required significant time, effort and resources from a finite amount.

Of particular note was the challenge on the availability of the research participants as they are part of a high profile group of practitioners, difficult to reach and convince to participate, limiting the duration of interviews as the effects of professional pressure was visible. The researcher had to pursue full-time practitioners for this study, ensuring that the narratives obtained where credible and 'rich' in relative data.

Another complicating element during the interviews was the linguistic barrier, especially when approximating issues of practice and tacit knowledge. As terminology in use was far from uniform, many designers needed time and encouragement to reflect upon basic concepts before providing answers. The tacit nature of designer knowledge, although identified and highlighted early, is a potentially perilous area for the field researcher, as frustration and even annoyance can come from participants during the conversations, jeopardising the integrity of narratives. This dual challenge presented to some of the participants generated unexpected pressure that undermined the quality of communication or even threatened the course of the interview. Unwillingly the interviewees where placed into a position where their expertise and knowledge was required but terminology, language and the tacit dimension of their knowledge, almost robbed them from their confidence in communicating practice. This was an unexpected element to overcome during data gathering and analysis stages, where special techniques

and preparation had to be taken before the interview to establish rapport and facilitate conversations.

6.5 Future research

This study offered insight and understanding to the research community on previously unknown practices regarding the area of editorial information design. Key processes, transitions, connections and arrays of concepts were highlighted via rigorous methods of analysis in explicit terms. At the same time, the understanding of the area and exposure of the researcher with the research environment offered new possibilities for research.

A starting point for future study is to test the application of the generated theories into a different demographic of editorial information designers, in different geographical locations and cultural environments. For example focusing into editorial information residing outside the United Kingdom and investigate how the developed Themes and Codes apply on other cultures with rich background on editorial visualisation, such as the United States. The outcomes of this Study will provide more information on editorial practices, whilst revealing connectivity through digital technologies and patterns commonly used.

Although it is premature to offer detail into the method and methodology, further inquiry on the area will uncover in explicit terms much needed designer knowledge supplementing epistemology, praxeology and phenomenology of the discipline.

Appendix I

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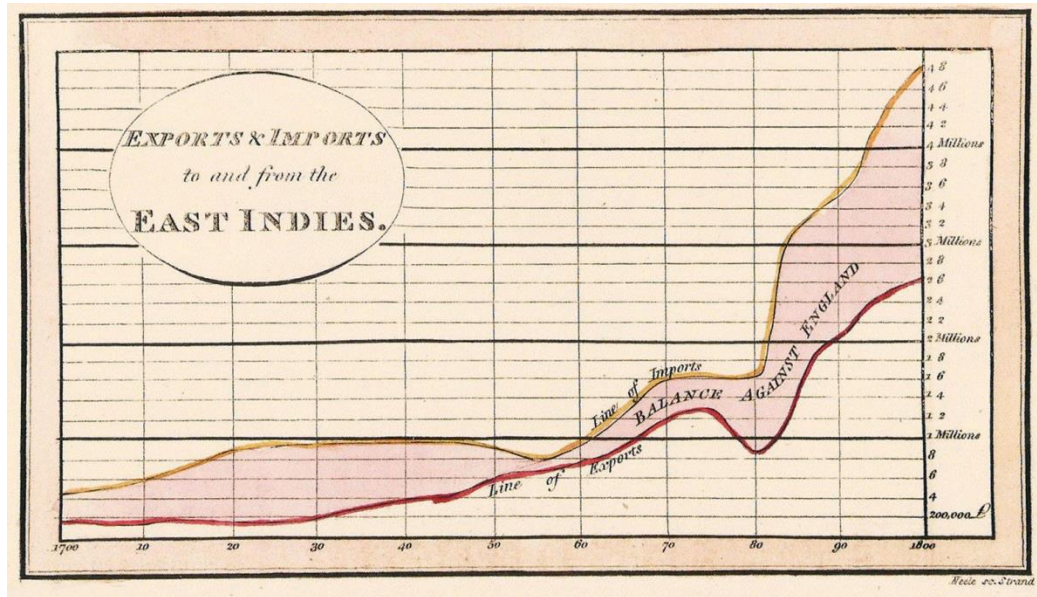
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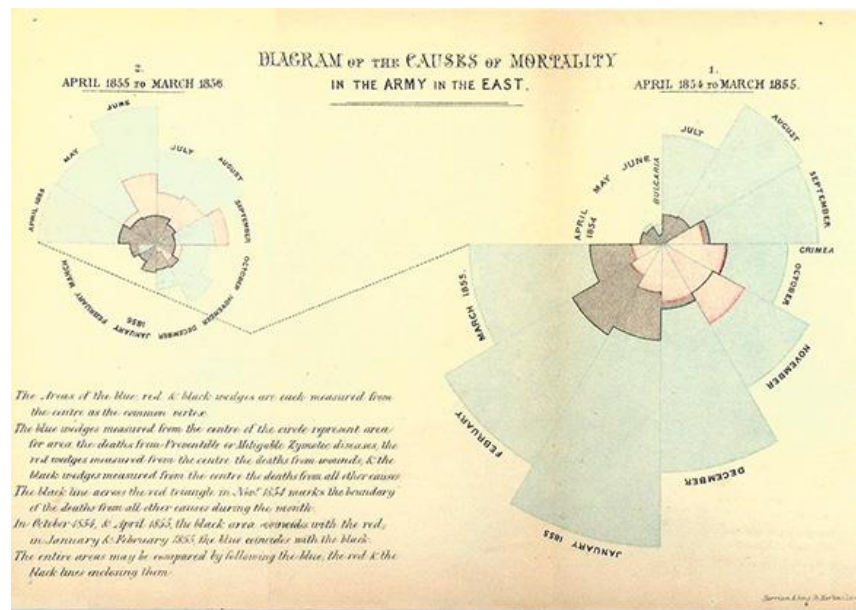
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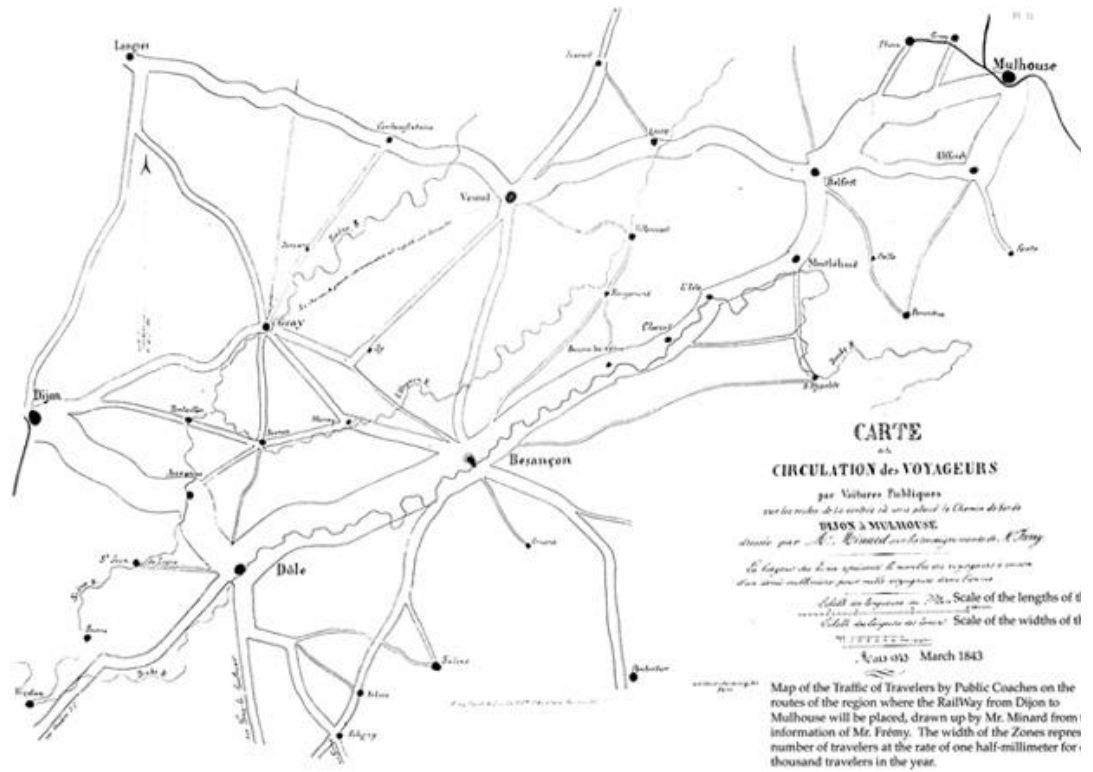
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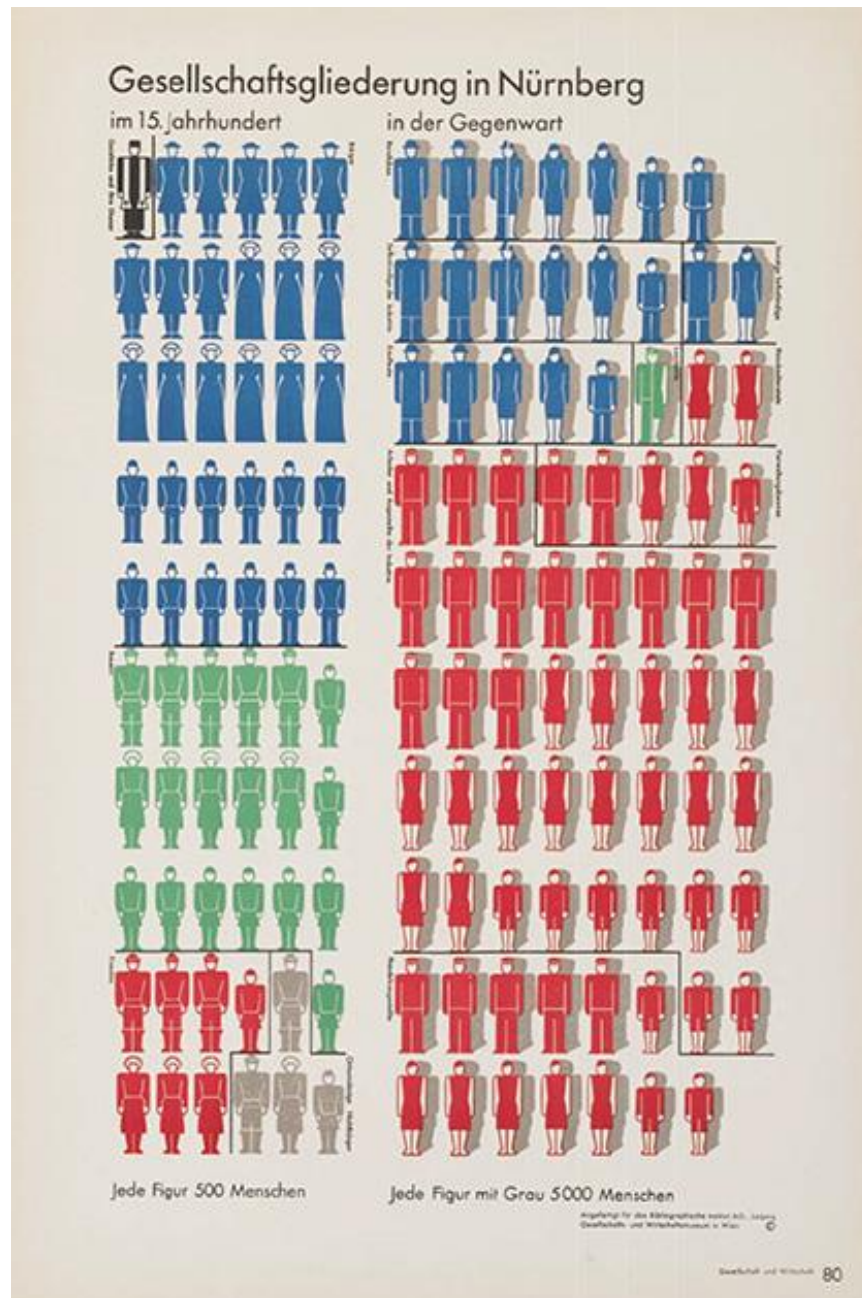
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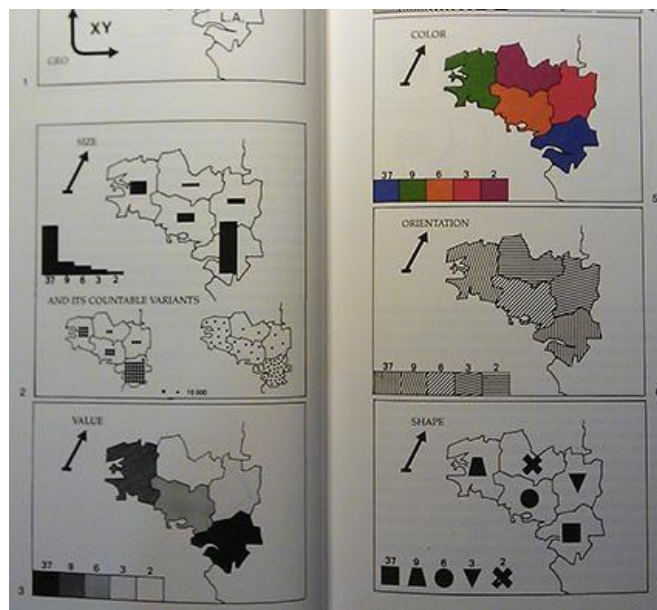
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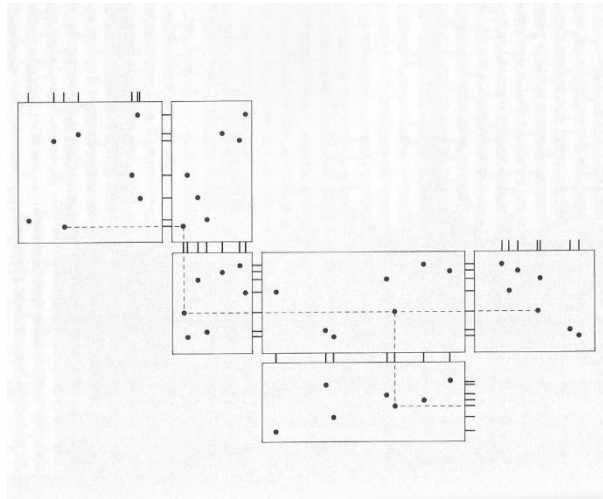
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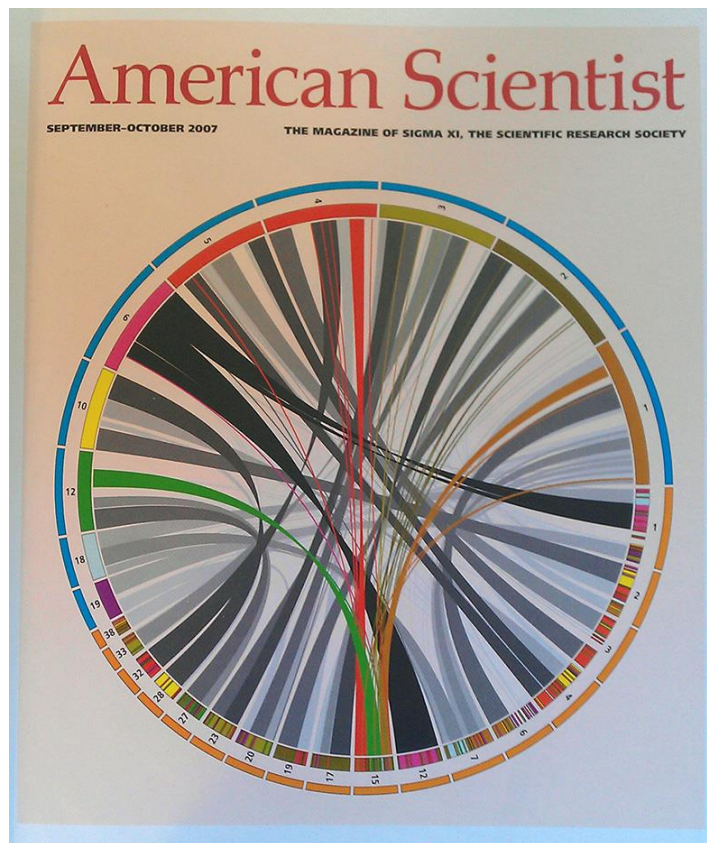
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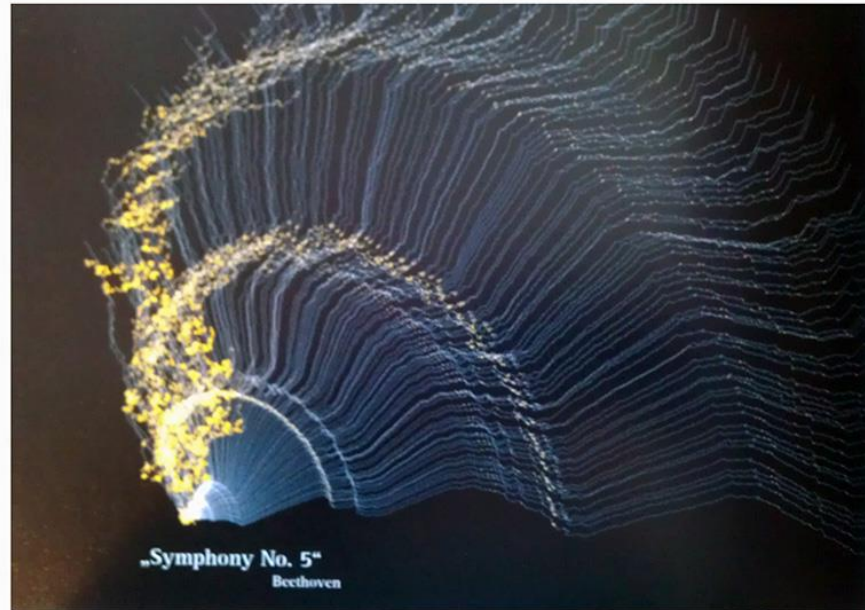
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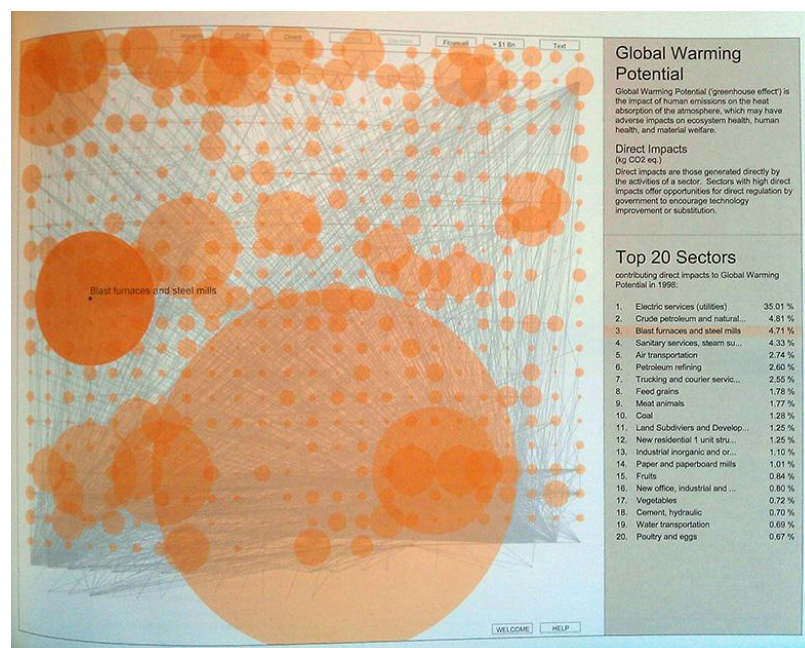
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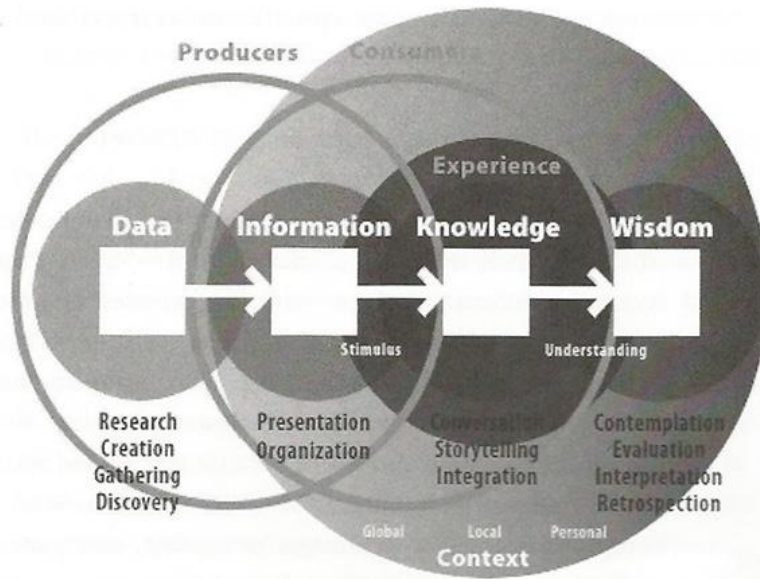
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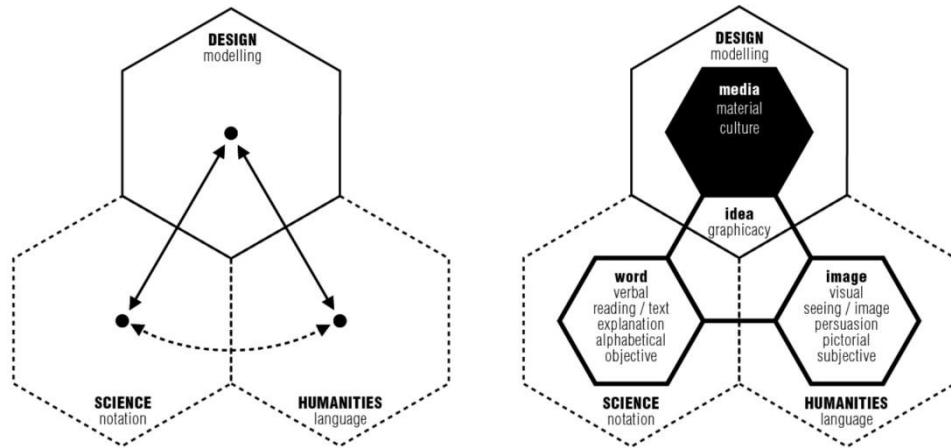
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		PERCEPTUAL SYSTEMS	
		(ear)	(eye)
MEANING attributed to percepts	The system is open to any meaning, it is PANSEMIC	Music	Non figurative image
	The system tends towards the definition of a concept, it is POLYSEMIC	Word	Figurative image
	Transcription of relationships between previously defined concepts. The system is MONOSEMIC	Mathematics	Graphics

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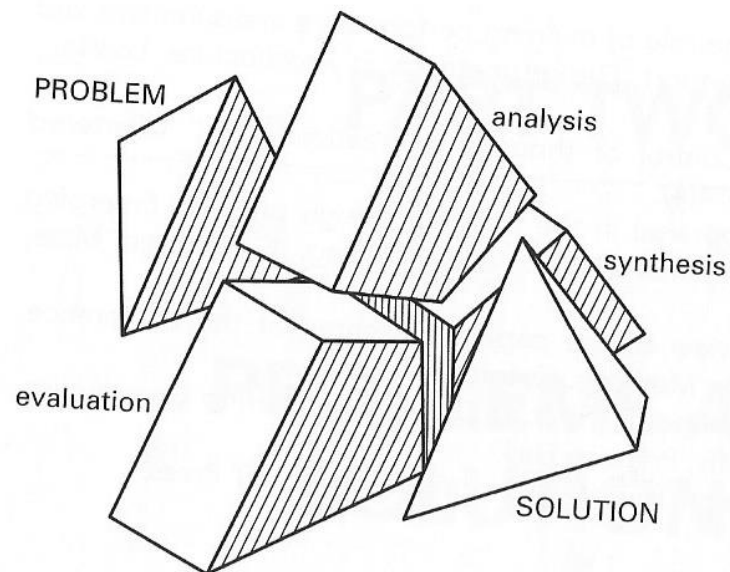
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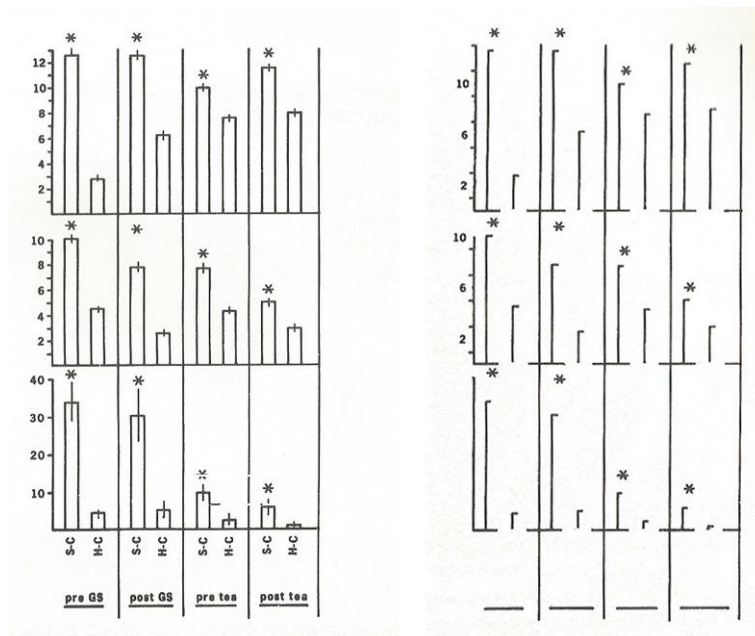
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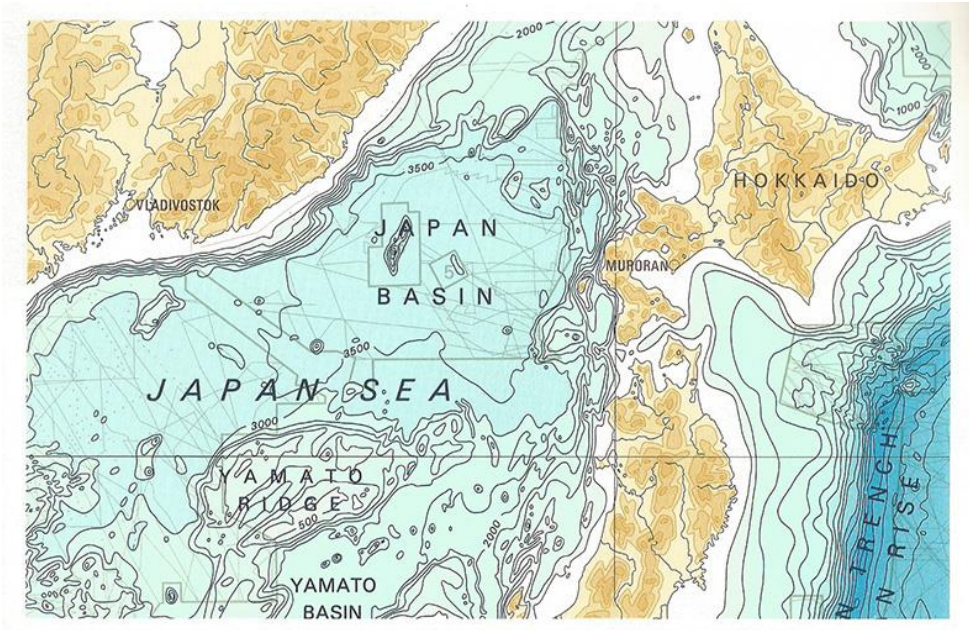
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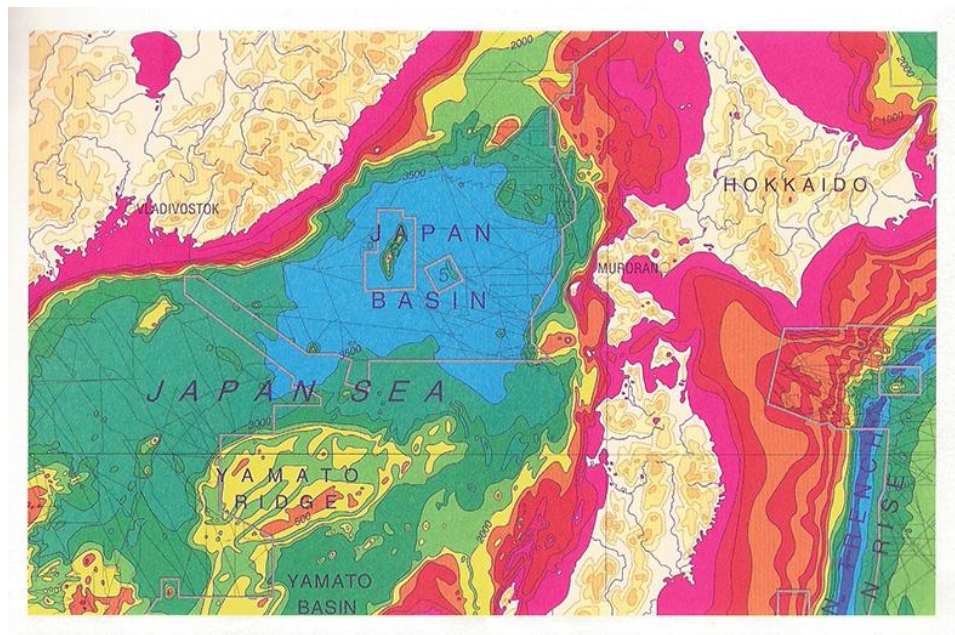
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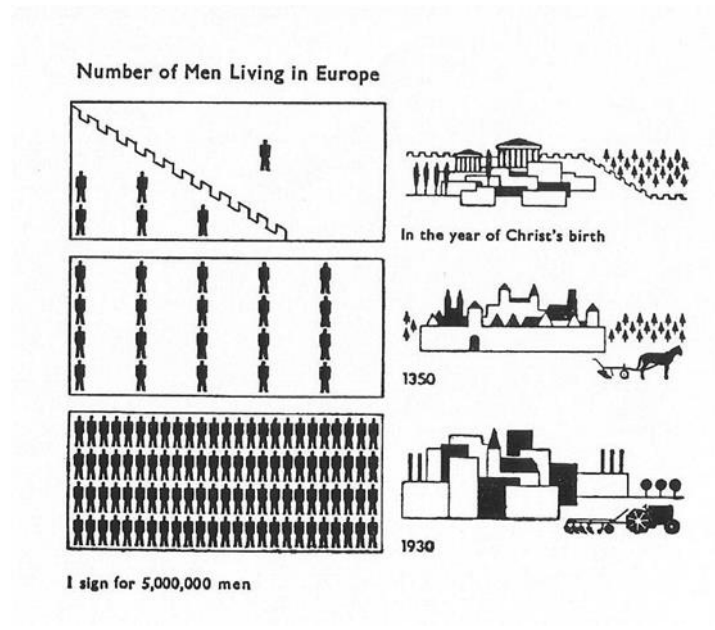
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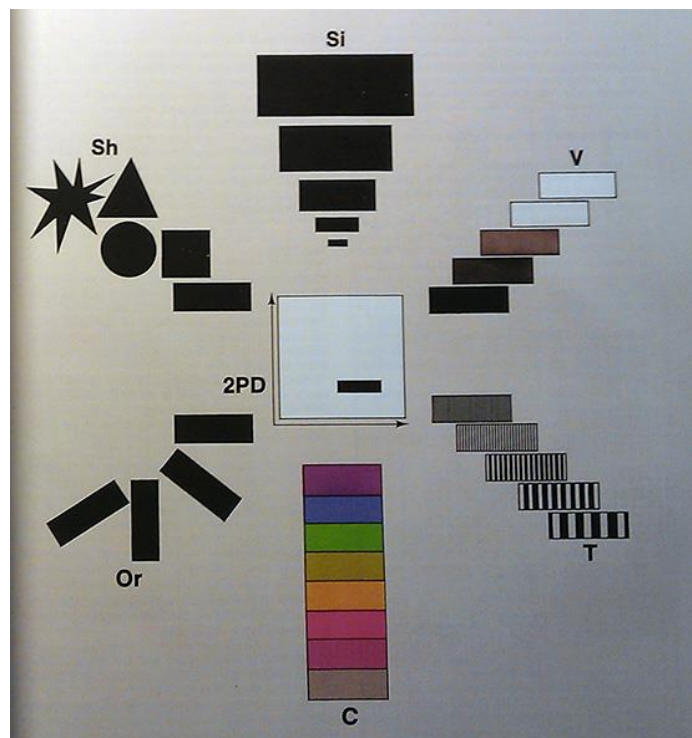
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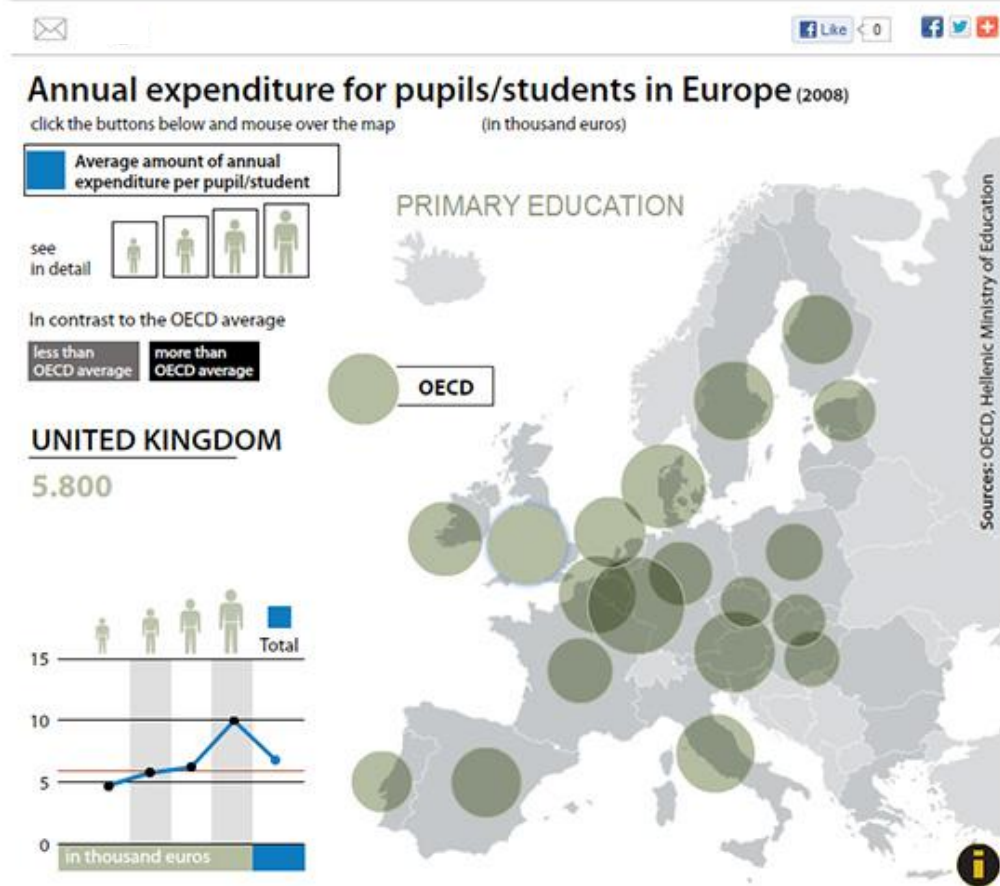
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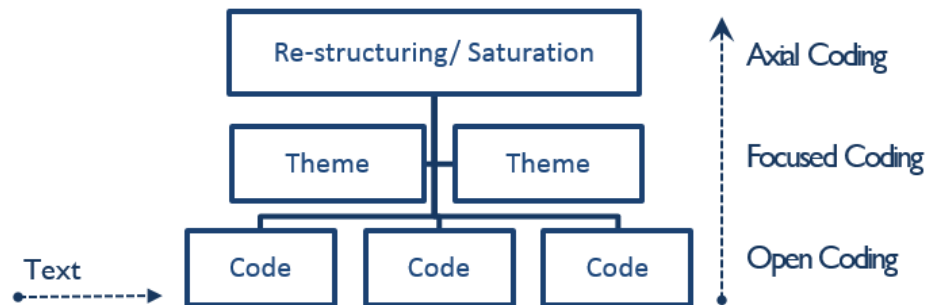
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The cost of education in Europe

9/24/11 20:57

Annual expenditure for pupils/students in Europe (2008)
click the buttons below and mouse over the map   (in thousand euros)

PRIMARY EDUCATION

Average amount of annual expenditure per pupil/student

see in detail

In contrast to the OECD average

less than OECD average   more than OECD average

OECD

UNITED KINGDOM
5.800

Total
15
10
5
0
in thousand euros

Sources: OECD, Hellenic Ministry of Education

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44.000 dead in the Mexican Drug War
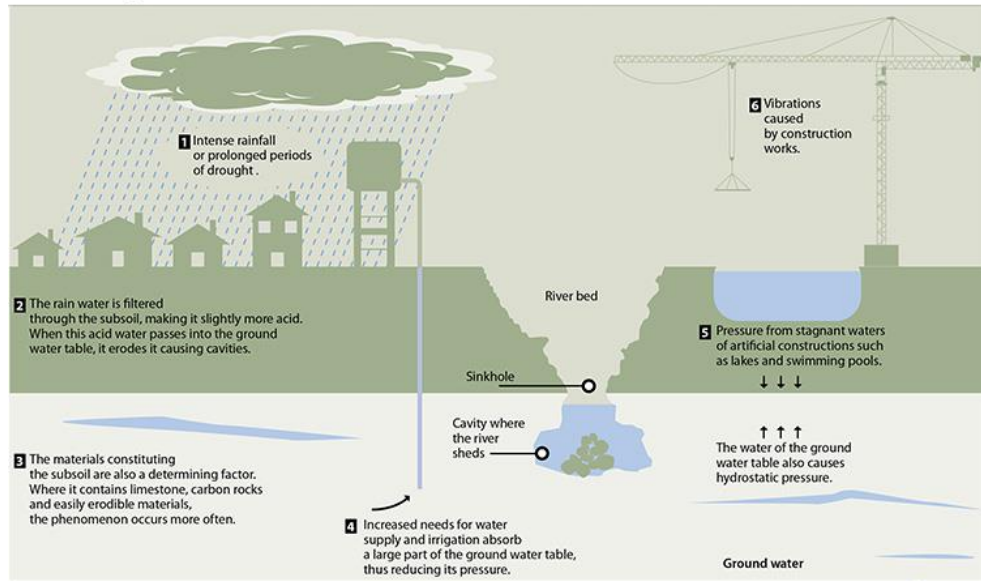
10/25/11 21:04
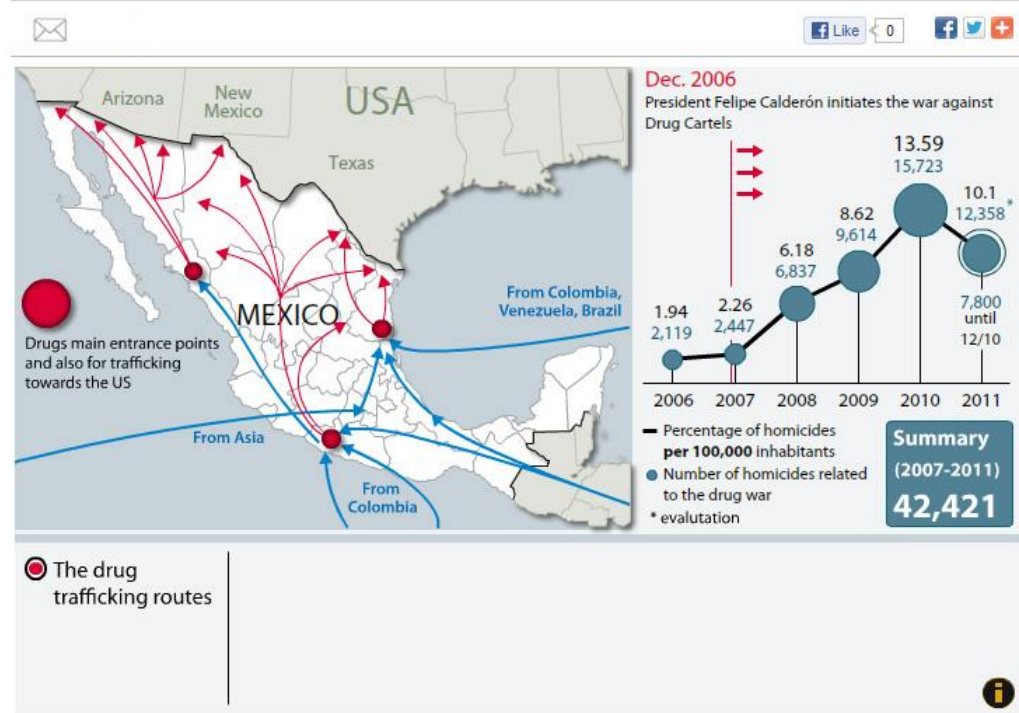
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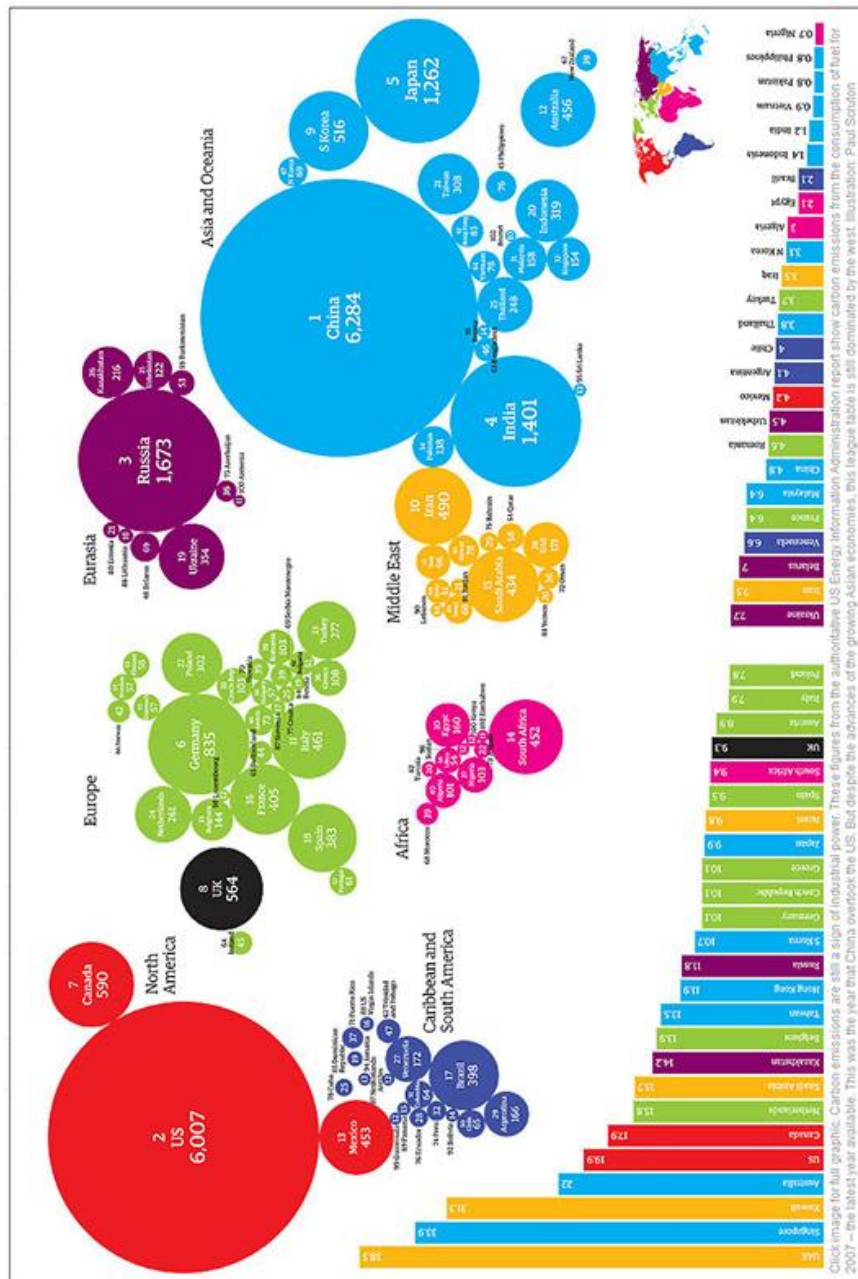
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Factors causing sinkholes

1 Intense rainfall or prolonged periods of drought .

2 The rain water is filtered through the subsoil, making it slightly more acid. When this acid water passes into the ground water table, it erodes it causing cavities.

3 The materials constituting the subsoil are also a determining factor. Where it contains limestone, carbon rocks and easily erodible materials, the phenomenon occurs more often.

4 Increased needs for water supply and irrigation absorb a large part of the ground water table, thus reducing its pressure.

5 Pressure from stagnant waters of artificial constructions such as lakes and swimming pools.

6 Vibrations caused by construction works.

River bed

Sinkhole

Cavity where the river sheds

↑ ↑ ↑
The water of the ground water table also causes hydrostatic pressure.

Ground water

Nuclear force modernisation

| Nuclear weapon nowdays		next decade		
		projected spend on nuclear weapons $	new types of missiles	new submarines
USA	8.500	700 bln	-	12
Russia	11.500	70 bln	3	8
China	240	-	3	>5
France	300	-	-	4
UK	225	-	-	-
Israel	100-200	-	1	-
India	60-80	-	5	5
Pakistan	100-110	-	3	-
N. Korea	- 5-6	-	2	-

- **Fig 3.5-6:** Two charts with different subjects and different narratives. However subtle mechanisms of depiction persist on these two charts: colouration use of typefaces and spacing between components are enabling a reader experience minimising disruption. (Used under permission)
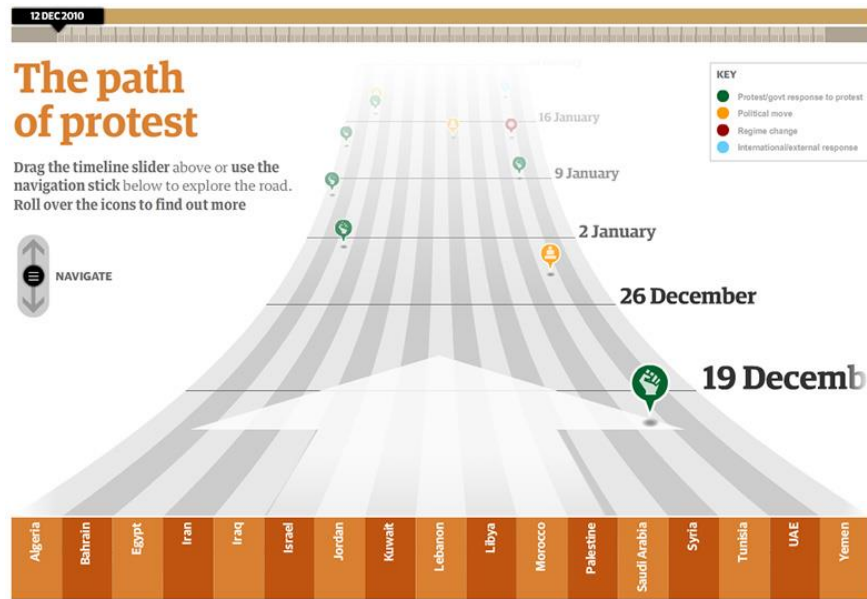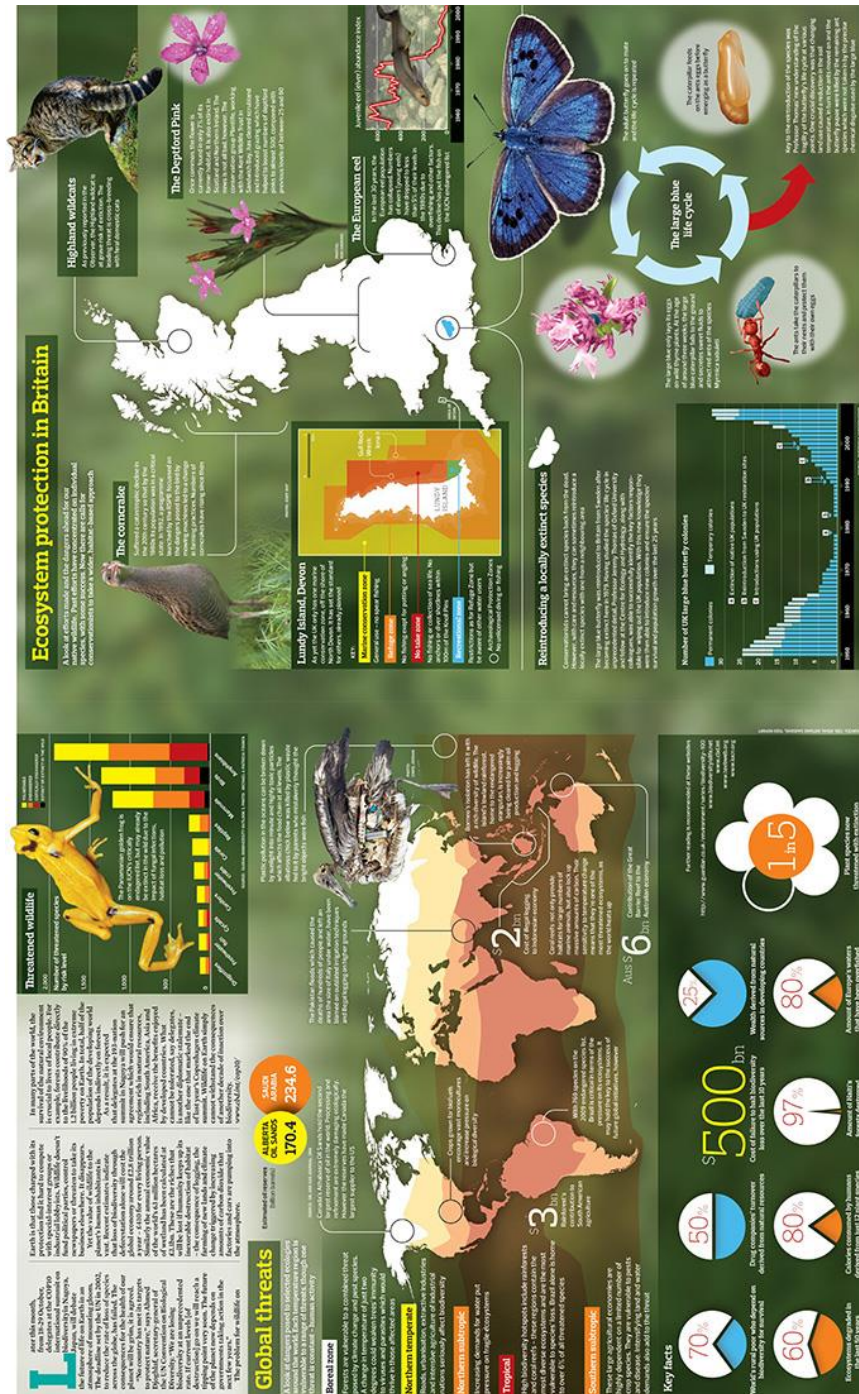
- **Fig 3.7:** An example of 'humanising' information and making content available and inciting further exploration. On this interactive the timeline is sliding towards the reader connecting significant events. (Used under permission)
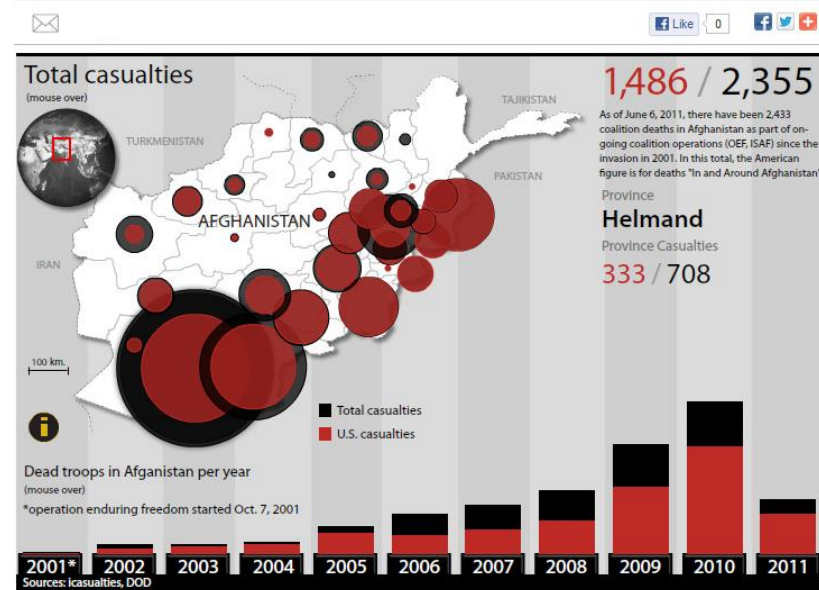
- **Fig 3.8:** An outcome displaying multiple sources of data in the same graphic: US Army, US Department of State, UN. (Used under permission)

Public spending by the UK's central government departments, 2010-2011

- **Fig 3.9:** This infographic on public spending is composed over hundreds of pages of numeric material a task difficult to maintain attention. With the help of colour coding, size comparison and separation of thematic areas within the page the reader is encouraged to participate in exploration. (Used under permission)

- **Fig 3.10:** From this two page infographic, the reader absorbs information in sequence understanding a global phenomenon but also understanding the impact on its own country (UK) step by step nurturing and maintaining the analysis. (Used under permission)

Table 4.1 – Original five Themes emerging from analysis of Codes

Themes	Constituting Codes
1. **Data Immersion**	Visual and Cognitive Reconstruction Establishing Critical Analogies Underlying Patterns of Non-disruption
2. **Morphology of Argument**	Establishing a Personal Connection, Dialogue with the data Acute Data Separation
3. **Visual Exposition of Content**	Incite Reader Inquiry Nurture and Maintain Analysis Impart Complex Analytic Outcomes
4. **Emerging Identity**	Predetermination of Audience Self-correction Perspectives Delineation of Personal Knowledge.
5. **Medium Awareness**	Multiple Outcome Analyses Synergistic Visual Node.

Table 4.2 –Themes emerging from a lateral analysis of Codes and Themes

Themes	Constituting Codes and Themes
6. **Dual perspective of designing infographics**	Data Struggle Visual Exposition of Content Emergent Identity, Incite Reader Inquiry Nurture and Maintain Predetermination of Audience Self-correction Perspectives
7. **Multiple visual methods of refinement:**	Data Struggle Visual Exposition of Content Multiple Outcome Analyses

Appendix II

Interview transcripts and Coding progression

II.1 Sample Interview: Interview with Participant IV

Senior Designer and Head of Graphics

1	**I:**	Cross-publication so it made publications translatable perhaps, in a way
2		publications hasn't been before. So I think he did understand that
3		incredibly well.
4	**R:**	**So you think that he had at least a valid Perspective?**
5	**I:**	Oh yeah! I think we have to look at the work he has done today and most
6		of it is surprisingly fresh. It still stands up, you could get away with most
7		of it... some slightly borderline and racial categories ... maybe pushing the
8		limits (laughs) of what we accept today but other than that it's excellent!
9	**R:**	**Actually your comments here would make a few scholars of the area,**
10		**very-very happy... (laughs). So... How would you briefly describe your**
11		**work?**
12	**I:**	I would try to take ... em... complicated issues and make them as simple
13		as I possibly can, that is probably what we try to do... and if something...
14		em ... everything has premium... space has premium, news has
15		premium... if you can condense some information into a fairly small and
16		impact... ah... a small way that gives it impact... gives it all the information
17		that you need to know, in a very graspable small table... some graft...
18		some comparison between one thing and another.
19		It can take an awful lot of words to explain that written, and even if you
20		read the full piece you are quite likely to not have comprehended it by
21		reading it at one glance. I think most of the graphics we try to produce,
22		we try to make it ... to comprehend the facts at a glance so it should be
23		complementary to the piece and it should also be memorable. When you
24		read stuff in today's medium you should see it at a glance, you cannot
25		expect people to go back and read over it again, this is not the way that
26		people operate with the newspapers... They'll give it a few minutes, if
27		they got it in... then they got it in... and I think that's where graphics really
28		help... Ah... to me it isn't the one instead of the other, but both of them
29		working very well... should be working well together... so if you are
30		reading something a graphic will help you cement that piece of
31		information that are reading consciously or subconsciously looking at an
32		image: "oh 30% of people at employed, in Germany id 60%... in France is
33		..." and you see people are really confused. So who is first, who is second,
34		who is third? Where (in the) graphic poom, poom, poom is there! First,
35		second, third ... they it to see, use it to refer back to, use it to get into
36		your consciousness. So I think is that fitting or visual elements that can
37		be done visually, and are most sensibly done visually help people
38		understand it, help people remember it and help people evaluate... it will
39		be really really good thing if you keep on those. Would that be good?

40	R:	**Yes fantastic (laugh). So does in a way the visual educate or popularise**
41		**in a sense? Because there is a tendency for designers to …**
42	I:	It should, it should… I think if you are relying on the technique or the
43		gimmick, or the style of the drawing… um it's not really an infographic,
44		it's more of an illustration. Nothing wrong with that, that is very nice but
45		you can not look into illustrations to tell you details, they are more likely
46		to give you a concept or a feeling, or an atmospheric, complementary
47		element to go with a piece to tell you about your "impending doom!"
48		(laughs) you can not really make a statistical analysis with figures and
49		facts… Unless you got the figures and facts… um… if you got the figures
50		and facts then you can create the information to substantiate the piece…
51		So this is not really working in a way that an illustration does, its
52		complementary…
53	R:	**So can we consider these visualisations as a learning experience for the**
54		**readers?**
55	I:	If they are good yep! (laugh)
56	R:	**Do you think that this help people with little scientific or social literacy?**
57	I:	Yeah, again: If they are good!
58	R:	**Do you think this helps the tired adult?**
59	I:	Yeap
60	R:	**Actually it was Neuraths term, to find something into very little time…**
61	I:	Yeap this is very, very important, if the graphic is too complicated then it
62		is possibly failing
63	R:	**I .. I also belive that, some times graphic don't serve their purpose**
64	I:	There is a big debate by professionals that some graphics are um… visual
65		feasts for the persons creating them than really serving any diagrammatic
66		purpose, and yet there are people that stray down these paths, and it's
67		like any other profession, some people are not as good as others. That's
68		just the way it is
69	R:	**Do you think sometimes their self-indulgence or the way they seek to**
70		**make a name for themselves? Is there a danger to…**
71	I:	This is a possibility, or just in reflection that they are not good designers.
72	R:	**Ah yes, (laughs) to the point! (both laugh)**
73	I:	One of the things that I think is important it is to be simple, that is really,
74		really easy to understand. Sometimes in doing that you make it so simple
75		that people do not give it a great deal of attention. They just got it, just
76		like that. In my terms that's 101% success. Other people want to pay
77		attention… I would rather pay the price in order to people use it, like it,
78		even not knowing that they use it and liking it, it is just taken for granted.
79		Um… because it goes in so quickly, I know a lot of examples for that but if
80		you want it to be "ah I want to attract people's attention, I want people
81		to remember me" then perhaps your agenda is slightly different and not
82		necessarily following that simplifying view. There are these logos these

83		fantastic very, very memorable logos that very few people know who did
84		them or even remember them but are instantly recognisable and that's
85		the thing... it's doing that incredibly well... (pause) And that's actually
86		very good design! [very exited]
87	**R:**	**So could these visual maps can be considered a form of argument on**
88		**their own? Beeing slightly different from the text? Just to give an**
89		**example: In this interactive about the state budget expenses there are**
90		**figures, that someone couldn't even imagine...**
91	**I:**	Yeap (nods emphatically)
92	**R:**	**You realise that there are some bubbles that...**
93	**I:**	Yeap (nods with understanding looking the chart on his office)
94	**R:**	**Do you think that there is something going on there a form of a visual**
95		**argument developing there?**
96	**I:**	Yes! Yes I think you can you tell, you can surprise people, you can inform
97		people of the already important things... Yeap..uh... (short pause) and
98		with something there is quite a lot of information and takes a lot of real
99		space in order to do that, but it comes from a very, very complex object
100		from the first place. So when I am saying to make something simple I
101		does not necessarily mean to cut it to pieces and sew it to fit us or
102		something. Um... you are accepting the fact that to make something very
103		complex into very simple still you might require quite a lot of complexity
104		to do that. So if you have something like this, then you have for the sake
105		of the idea you have to throw away half of the information then the idea
106		might not be so good. You need really to take all these layers of
107		information and still make it interesting and informative. Some things in
108		order to be simple are in themselves quite complicated, quite complex,
109		but it depends were we are coming from this came from a huge numbers
110		of annual reports, incredibly difficult to penetrate. One piece of
111		information was difficult to compare with another as the way to express
112		it was different, so the first level of that was to place all this information
113		into a compatible level to be able to make that comparison and think of a
114		reasonable way to present that secondary volume of information. A good
115		example to begin with is a spreadsheet... a spreadsheet is a very, very
116		economic, very simple very well designed information piece but sadly it is
117		very BORING!
118	**R:**	**(laughs) (Both laugh)**
119	**I:**	Perhaps if you look at that you will get it, and you will probably get no
120		one looking at that... You know its like not many people read the
121		telephone book, they only read it when they need it. You come with one
122		thing in mind 'I need someone's number', if it would take a day to find
123		out it would be a rubbish product, it is very very good at its job – but it is
124		a boring read! So define what you want to do and this is a very important
125		thing and whatever you are designing, think what you are supposed to be

126		doing, what this is about, what is this piece of information. In my case it
127		is about transferring information from source to the reader or the client,
128		whatever. That's your primary task, so how can you make that as simple
129		as possible? [lost in thought] And hopefully we can do that with that. ... I
130		think this a big step forward from the spreadsheet, it is a lot more
131		interesting, a lot more engaging, you can make lots of comparisons.
132		Looking at a spreadsheet you can make one comparison, you have one
133		thing to compare with another. Mentally I don't think people can
134		compare more than 3 separate figures, 4separate figures and making that
135		comparison of a spreadsheet. Most mental people can grasp that
136		information but others need some visual help to do that.
137	R:	**What about the visual formula? How this is developed and selected?**
138		**What influences the decision about a specific visual formula? For**
139		**example why this one?**
140	I:	I work mainly on the process of elimination that there are some very
141		basic things to do with: pie charts, bar charts, proportional relationships...
142		so if the question what you ask yourself is what is I try to convey? Is
143		comparison between large expenses or small expenses? Then you have a
144		choice between this method or perhaps a bar chart. Bar chart is pretty
145		god, very good but visually is usually little better than a spreadsheet if we
146		look at it... (smiles) So heading down the path of the bar chart quite often
147		means that it is not going to get very much space in your publication,
148		most people's expectations will be ' oh well that's too much!'. Will they
149		follow it? Will they read what's important? Will they investigate? That's a
150		matter of choice ... and this environment sometimes we have to pursue
151		nurturing the curiosity of the public to enjoy this stuff, you do have to
152		sometimes to have an element of impact, an element to encourage
153		people to investigate it visually compared to other methods and this type
154		of method offers that. Hopefully people will have the point of it instantly
155		and secondly will take to trouble to investigate it. If in that time they find
156		something interesting they will stay interested for a little bit longer, and I
157		think that is what success is.
158	R:	**So if I understood correctly, this is not just a display but also a way to**
159		**explore content by peers and colleagues?**
160	I:	Yeap! (Nods emphatically). Yeap, I would hope so, I would see that as
161		relatively successful if I had that kind of response.
162	R:	**What about the scientific knowledge that comes in the process of**
163		**communicating these visuals, were there any unknown elements? A**
164		**point that designers seek an expert advice? Or you have people that just**
165		**take care of it?**
166	I:	Sometimes, I don't think you can assume that everything is correct, so
167		you check your source material, it is really important that it comes from a
168		source that you can totally trust or you need to get it validated by

169		someone that you do trust. Various sources, Wikipedia perhaps is not the
170		most valid source of information but a very good starting point, if it
171		agrees then don't stop... but look for a better source... Two sources, three
172		sources even more, if they all agree then you have validation to go ahead
173		and you have to quote all that in your sources. So this is not my opinion,
174		this is the opinion of the economist, the opinion of the specialist or
175		someone like this... the world bank or something, That's their opinion,
176		that's it. That this diagram that I am showing is not contrary to their
177		information, they will not contest it we all say the same thing. The
178		conclusion that you are coming to might not be the same as theirs, but
179		the facts are.
180	R:	**So there is this element of responsibility.**
181		Yea, Yea it is very important to quote and show the source, so the people
182		feel when you show that source, the confidence ...and be able to
183		investigate themselves if they like. Thats what you are telling them: "Go
184		look here" and they will see the same things. You are giving the people
185		good information then and if things get spread, and I think they do by
186		word of mouth, then the information spreads and spreads good and this
187		is not just an information that 'fits' with the story.
188	I:	**So how would you call this process, is there a transformation or**
189		**simplification as you mentioned?**
190	I:	The process of taking information and putting visual information, is it that
191		process? This isn't really related to that content more the process right?
192		I think it is probably boring, but probably practice: You just get better at it
193		by the more you do it. It's very straightforward, as Palmer a great golfer,
194		someone said to him "when you hit from the bank and you hit the hole
195		it's a pretty lucky shot". And he replied: "the more I play that shot the
196		luckier I get" [both laugh]
197		That's a totally brilliant response as he was playing golf more than anyone
198		else on their lives so he got better at doing stuff, doesn't matter if some
199		people start and are brilliant they can be absolutely unbelievably brilliant
200		when they have lots of experience and put that back in fantastic practice.
201		Nothing helps you solve problems more than solving problems. So the
202		more problems you solve the better you get at it. And you learn skills, and
203		be open to look stuff that other people do and their solutions.
204	R:	**Is there sometimes an approach of 'not knowing the subject' looking**
205		**from a non-specialist point of view helps this kind of process?**
206	I:	Yeap, yea, if you can, it can possibly be overrated, but I don't know most
207		of the things I am doing! Years ago I did work on astronomy, knew
208		nothing about astronomy! [emphasis] The same with medicine, knew
209		nothing about medicine, but I hoped that the person that were telling
210		me, were really-really good at it, they were not really good at drawing.
211		They were really good at astronomy or whatever they did, writing or

212		contributing this information to me. It is my contribution to it, that I can
213		help convey that information. And hopefully their input on it, their
214		information is not as important as the information they bring, my input is
215		what I can do with it. I think complementary these two work quite well
216		together. I think that's what we do, there is every day a challenge on the
217		paper: You have a story, you got some facts, will this help it tell a story? In
218		most cases I think it will. There are other factors, for example are there
219		breathtaking pictures? That will really, really help. The way the story will
220		be written too, it is going to convey huge amounts of information too, so
221		they really play part of telling a story which is the most important thing.
222		In this environment.
223		Sometimes when you go and get a piece of furniture from IKEA, you are
224		not really that interested in going and reading a lot of interesting things
225		about this furniture, you just want to put the thing together [laughs] so if
226		you put a chair together you can read about the wonderful qualities of
227		the chair together when you build it, but you need to build it properly
228		first.
229	**R:**	**So there are a lot of empirical, tacit elements in design, so you develop**
230		**a characteristic skill.**
231	**I:**	This again has a lot to do about the job you are after, the question you
232		have to answer, what you want this to give? You want to implement
233		something? Or you want to do the whole bit? With the IKEA piece of
234		furniture is primarily doing the whole bit. You want people to understand
235		really, really easily and you want them to succeed. If they cannot put it
236		together, then this is not a good diagram. [both laugh] It is failed and you
237		got a very unhappy client and no chairs [both laugh]. It failed! It failed on
238		every ground! It's really a diagram, a piece of information, so visually it
239		doesn't need to be very clever, but it does have to be very clever, as it has
240		to be very simple. Again going back to what you said earlier on, that
241		embellishment of the drawing can get in the way in most cases? Almost
242		certainly.
243	**R:**	**In a way the diagrammatic knowledge that we get from such an**
244		**artefact, from the design is a different sort of knowledge, incorporating**
245		**these elements that cannot be described?**
246	**I:**	Yes the example of that is how to tie a bowtie. I don't know if you have
247		seen that in words but it's substantial, its probably 1000 words if not
248		more, it's also totally useless. I don't think anyone can possibly tie a
249		bowtie however beautifully written from the words, you need the
250		images. And also with the images alone you can do that because you
251		know where you got it wrong and at that point it will be there to help
252		you: " I got stage one – right", "stage two – right" you will need five
253		stages to tie a bowtie, it will still take you a number of times.
254	**R:**	**Absolutely [Laughs]**

255	I:	But you have to take that into account that someone read something and
256		then probably forgotten it, the graphic will remind them of it, so it is
257		about helping them on the process of understanding. To me that's a
258		success. It doesn't have to be in a whole page to get it.
259	R:	**Right, wow your experience and knowledge is vast, I am taken aback. I**
260		**don't know if you had the time to go through literature for design but I**
261		**can think I can remember at least 10 books that you verify what people**
262		**say there, linked directly to what you say.**
263	I:	Hopefully they were reading books! Yes some very good people.
264	R:	**Does your daily practice allow you to study information design**
265		**literature?**
266	I:	No, no my job does not really allow me an awful lot of time to do that.
267		But this is what I am interested in and I have to find the time to do that
268		when I get back home. I have brought to my wife the most boring sets of
269		bookshelves back home [both laugh]. Mostly symbols diagrams and stuff
270		like that.
271	R:	**Are these diagrams, in the context of a newspaper or webpage are**
272		**forming a visual language in a way that includes the aesthetics, but also**
273		**go beyond that? Do you build a visual language?**
274	I:	Yes I think so, in this area that I think you've touch an area of 'branding'
275		which means is a style which means is very important to what we talked
276		about. People can recognise a certain style of drawing, or a style
277		associated to a publication. If they think this graphic is part of this
278		publication and value that publication then it covers that same picture, so
279		they comfortable recognise it. If it is just a photocopy, or something stuck
280		in the publication, then they might wonder a little bit: "Whats that? Why
281		they've done it that way? Why they haven't taken the trouble to do it
282		probably?" I would ask that question.
283		The other thing that I think it's important is that you can begin to stretch
284		people's understanding, that will help them understand. Most people
285		probably know a pie chart, probably need a number to be divided up to
286		those parts, if you add up all parts it will come to a certain number for
287		example 100 percent. Yes so people are comfortable with that: "49
288		percent, so thats almost half of that, thats a lot of that pie" so they are
289		happy with how that works, they understand it. Flying charts they can
290		figure out, some things go up, some things go down, they are happy with
291		that. So I kind of think that with more complicated ... [pause] or as you
292		start to get all these charts they have been around long enough to
293		understand that now. I think with information graphics you can build that
294		language a little bit more. You can do that with colours, as you can make
295		one colour stand out or here for instance [The Chart that we were
296		discussing earlier] that this is an important piece of information. I am
297		drawing this to say that this is more important because this is a much

298		brighter colour. "Why they used blue, grey or red on that bit? What did
299		they try to tell me?" [Thinking] Yeah! you are following this style of
300		information so the reader can be drawn into that from the style within
301		that publication, the brighter and the stronger piece of information, the
302		bolder type is telling me something as a pointer. It is a device in this
303		publication that points at something within the publication to tell me
304		something and I think a regular reader would understand that and follow
305		that.
306		Initially we had some very informative mathematically minded people
307		writing in saying "you can not do this! This is not a conventional way of
308		explaining it!". I know where they are coming from, because in a bar chart
309		you never consider the width, you only consider the length, so the width
310		are the same and they all sit on the same baseline, so are visually looking
311		how further up they can get.
312		The relation of a circle to another is harder to get, and mathematical
313		people will think: "Ah! They are looking at volumes, but we are not. We
314		are using that on the same way [as a bar chart], but they used to look at
315		circles as volumes, instead the public sees it differently: If you put a shoe
316		next to a little shoe it says nothing of volume, its a little shoe! [both
317		laugh]. I know it's not a bar chart, but I can look at that, I can see that I
318		can understand that, people are quite... bright! They can work that out,
319		they can make that jump ... and they are not bothered by mathematical
320		formula. Providing you are visually showing that a big dot in the middle is
321		money and this one here is small everyone will understand what this is all
322		about. All these circles are proportionate, although not all readers might
323		not get that. They are looking to see the big and the little ones, who has
324		the most money, how has the less money? who's up, who's down? Is this
325		good news is this bad news? Thats what they want, that's the quick
326		information they want to get, they don't really want to know the
327		mathematical formula about the relationship between these. Anyone
328		looking at a bar chart or a line chart they need to look at the spreadsheet
329		to understand what they are looking for, they will accept it because it
330		feels right. And in this case it feels right, so very, very, few people wrote
331		back, mainly mathematicians saying that perhaps a bar chart might work
332		better.
333		Yet the government offices never said that, they took these charts and
334		pinned everything on their walls and said 'oh this is actually really good!
335		We couldn't have said that with a bar chart'
336	**R:**	**...Indeed...**
337	I:	...Or by just looking the spreadsheet... So it's a delicate pathway and so I
338		can see why some people are carried away with that and create
339		interesting images, but if a fascinating or interesting image stops you
340		getting the point, you are treading a dangerous path there.

341	R:	**Out of curiosity, how readers accepted your visual language? You have**
342		**more or less complaints now? People understand better now?**
343		Well it's a funny thing because the Guardian are very good at that, they
344		allow a lot of people to write in, take a lot of notice, we read the letters,
345		we have a readers department, we reply to those letters. We look at the
346		worthy complaints, that is always part of a paper... I always thought that
347		responses are really good even if they were negative [laugh] Well
348		someone has taken the trouble to really look into this thing in a
349		meaningful way, and write it down, and send a letter... it is always worthy
350		of a response, of a reply. Quite often we write to them that this is a very
351		interesting point, but we chose to do it this way, for this and this and this
352		reason and they write back saying: Oh yea I see, really good, thanks –
353		They kind of got it out of their chests!
354	R:	**Ah I see**
355	I:	And they wanted to engage, sometimes we get something wrong and
356		people are so angry, hopefully we don't get many of those because we do
357		checks in every step of the way. Of course there is a human error every
358		now and then , but that doesn't make people angry because they can
359		relate to that. Yes a decimal point can be a very important thing but they
360		can see what happened – if they are bright enough.
361	R:	**So often omission of information, while retaining the truthfulness of the**
362		**information is essential for the visual outcome?**
363	I:	I mean this is about asking all the right questions at the beginning, what
364		this is about? Is the source material good? You can deal with the criticism,
365		it is not a problem, if you ask those questions the criticism is quite often
366		just a matter of taste. You could argue about these things for ever, that's
367		fine that's just a debate. It's not something that you can categorically say
368		this is right or this is wrong, this is just an opinion. I mean if you can
369		create a debate, that's great, I found out that when we first started
370		creating diagrams. So if you are talking about things not very scientific
371		perhaps the amount of chocolate that they ate, they don't think of that
372		scientifically, so you could just as easily do it like that. In that type of
373		image on a piece that would be amusingly written is about chocolate
374		might seat more comfortably with the content of the information that is
375		given, than a scientific analysis. Sometimes you are looking at what would
376		work with the audience, how that would relate with them. So there is a
377		kind of a visual element here too that is going on which is about: Are
378		people going to be interested? Will they be able to grasp this or they will
379		be switched off by it? Because it looks dry and dull, sometimes you can
380		add just a little bit of dynamics to it and humour! Um... in which case you
381		could do chocolate drops you know, why not?
382	R:	**I see...**
383	I:	Um... because you are not afraid of it, it's a fact and you are just telling

384		through a fact. And if the fact is genuine then again you should have your
385		source here. But the method does not have to look scientific for it to be
386		correct. Information should be correct.
387	**R:**	**So this specific example is about the transfer...**
388	**I:**	Ah ... yea... [nods in approval]
389	**R:**	**The understanding of knowledge? Well epistemology but that sounds as**
390		**a fancy word, but essentially ...**
391	**I:**	Yes that's it...
392	**R:**	**But if we say change is perceivable difference, then you are making sure**
393		**that the visual formula maximises this change?**
394	**I:**	Yes, yes, so you are looking at that piece of information and saying what
395		it is telling me? Was that a 100 years ago? Has it gone through some
396		eventful changes? Not really, it has steadily gone up, you can go from the
397		beginning to the end of something, with just one jump. If this is like these
398		[points to a chart with stable, expected increase. But if it is like this:
399		[points to a chart with steep variations and fluctuations] involving wars,
400		diseases, things that can change, if that involves elements of this story,
401		those elements can be included to telling that story. If they don't affect
402		anything they are not part of the story, it is not information it is not
403		relevant. So I think in terms of telling that story is about identifying the
404		facts that we need to tell, are they crucial to tell that story? Are the
405		events of a timeline significant? In our case there were no events don't
406		look in between there were no events [laughs] [both laugh]
407	**R:**	**Would you like to add something that you might think is important and**
408		**we haven't covered so far?**
409	**I:**	For me the crucial thing is, what I believe is that good design is to make
410		things incredibly simple to understand and that's the most crucial thing of
411		what we are trying to do. We all get a bit carried away sometimes which
412		we make things decorative instead of telling that story.
413	**R:**	**Do you think that a framework, not a complete formalistic framework in**
414		**infographics could evolve? Would that help?**
415	**I:**	More than help, but it's essential our organisation has a style sheet, has a
416		very strong style approach and for me I think it's very [emphasis] for one
417		reason: I don't really want people to think about the size of the
418		typography of the heading, we have already done that, we looked at that
419		a number of times, so we should have made up our minds about what
420		size should that be. If it is a little chart for example we make the maps in
421		the same background colour, the style of the key, where the map is,
422		where the area is, labelling in the same way, the size of typography...
423		Some of these are pre-designed to free the graphic designer and at the
424		time we choose what is the best size, what is the best colour, what would
425		be the most readable... So all these decisions are made, so when you
426		come to it your decision as a designer is what is all about, you want to

427	show what is important on the map, that's all you have to make the
428	decision off one big decision instead of 100 small decisions. You make
429	that one decision, hopefully you make that one right. So getting a style
430	sheet doesn't limit people's creativity or imagination. It focuses on the
431	problem, and over here we have a short time to do things, not a lot of
432	time to sit around and all discuss about what we should do, we basically
433	have a lot to get out of that day. Some of them are repetitive decisions
434	that you have to formalise and focus under the key issue of what this is
435	about, how best to do that by doing a bar chart, a line chart, a pie chart or
436	whatever and when you got that is there a better way of doing that? If
437	you reach a point and say 'well that's good!', could it be better? If you
438	design having to think of every little category... you probably haven't got
439	time. You probably have enough time to get it done. So the more style
440	guideline we have, the more time we have to answer the first question
441	what is this about and more importantly how can I make it better? You
442	create a tie... you have a real chance to make an important quantitative
443	design decision [thinking] ..., so rather than limiting peoples creativity it
444	focuses it. So in this type of environment they are very very good!
445	

II.2 Samples of Coding progression through various stages

II.2.1 First stage: In-Vivo or 'Open' Coding

The above image is an early example of coding the initial interview transcripts. At this stage the coding process was part a struggle to understand the concepts emerging from the

interviews and part ideation: 'pushing' the existing boundaries of knowledge and generating drive for the researcher to delve deeper into the concepts of the area under investigation.

Interview transcripts were placed into a document with three columns: the important areas within the text were highlighted and quick notations were made in the second column. In such way concepts emerging from each interview were recorded and then the researcher scanned the documents for similarities.

After the completion of a number of interviews, the transcribed material was also inserted into a CAQDAS (Computer-assisted qualitative data analysis software) to aid the analysis of extracts. For this research, QSR Nvivo 9 was selected.
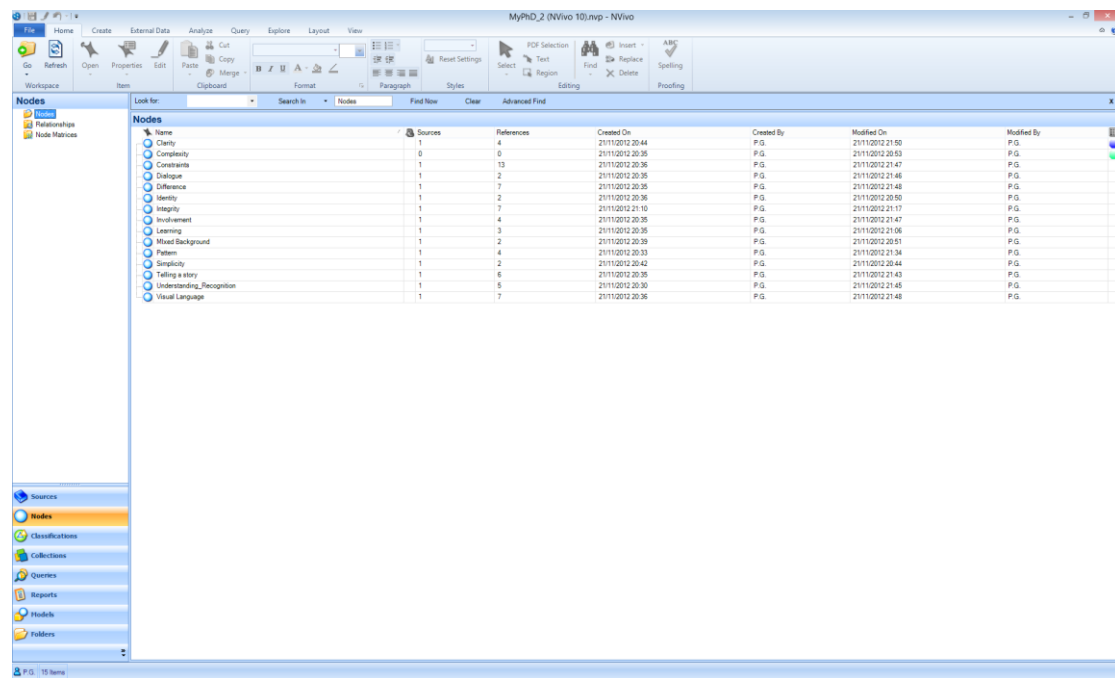
For this stage the analysis was done primarily from hardcopies, as notations and comparisons with field notes allowed a 'closer' view of the material.

II.2.2 Second stage: In-Vivo or 'Open' Coding

Line	Transcript	Code	Notes
377	I, I think some things work well with circle sizes which		
378	is a real Guardian go to point, and we use that a lot		
379	and works very well in most cases, not outside the		
380	Guardian it is always within the Guardian which		
381	involve answers we particularly get: 'oh we have seen		
382	that before' but the reader gets used to a language or	VISUAL LANGUAGE	EXPOSE CONTENT
383	a formula and they can think yes I have seen this	UNDERSTANDING	IN POTENT WAYS?
388	before, I am used to it, there is no surprise there, why		
389	do squares if the circles work so well? That's one of		
390	the things we've got a lot of limitations of space, of		
391	different space. Some of them have a very very tiny	CONSTRAINTS	AWARENESS OF
392	space where others have a double page spread, um	SPACE.	THE MEDIUM
393	we have a lot of languages there. You see we cannot		
394	use circle sizes by a single bar or a not very tall chart.		
395	Bar charts are universally known and can be used to		
396	describe some things better than the circle charts.		
397	You've got to make the choice depending on the area		
398	that you've got and what you are trying to say. If	VISUAL FORMULA	FAMILIARITY?
399	numbers on a chart range from one to twenty then a		FUNCTIONALITY?
400	bar chart would be perfect if numbers change – going		
401	back to the carbon emissions- range from 6 million to		
402	twenty then a bar chart won't be any good at all. Then		
403	troop numbers and things, you can use the little figure		
404	of a person to represent a number of the advancing		
405	troops let's say. Again a lot of people will go straight	RECOGNITION	ACCESIBILITY
406	on the chart... as far as you keep consistency in		
407	anyone graphic that's, thats good. You have to vary	①UNDERSTANDING·	MORE THAN ONE
408	things just from the point of view to keep people	(NURTURE)	STORY WITHIN THE
409	interested in the story, let's say it was six charts that	②PATTERN	DATA
410	we've put together for some reason. Instead of six bar		
411	charts you might choose two bar charts, two pie		
412	charts, a circle size chart and maybe a proportional		
413	figure of person suitable for it. But we'll never use ...		PATTERN / DIFFERENCE
414	um... other newspapers might use. We'll try not to		
415	use big dollar bills to represent money these are real		
416	clichés that we try to avoid. But it really depends,	③DIFFERENCE·	MEANINGFUL COMPARISON
417	people will always like to know how big is something		DRAW PEOPLE IN
418	compared to a double decked bus in London,		
419	sometimes you can't avoid it. And also scale is very		
420	important, how big is something? For example let's	④DIFFERENCE	
421	say stretch to the moon and back, as most people can		A PERSPECTIVE OF
422	visualise the distance to the moon or money that		INFORMATION
423	would buy the entire NASA space program for the last		
424	30 years. That's a more accessible way of talking		
425	about very big numbers.		
426	Another way to understand things right?		

The above image is an early example of the second stage of coding. At this stage all the material was transcribed and codes with strong presence across interviews were identified, allowing understanding and theoretical sensitivity. In the third column the most important elements were noted and processed, allowing a natural progression of concepts.

Focus coding allowed the most salient categories to emerge and offered a crystallised view of participants experience: even with temporary names the codes were reflecting potent aspects of the reality of design practice. It has to be noted that initially a large number of codes, above twenty were noted down, at the end of the second cycle less than 12 survived.

At this stage, all transcribed material was inserted into the CAQDAS software as the amount of text and extracts was increasing. The computer software allowed quick review of concepts, as well as comparisons between extracts.

Also during this second stage, the codes started to form groups. leading to the first versions of the Themes, in parallel with memo writing.

However primary focus at this stage was the refinement of codes, examining the meanings contained within the transcripts and locating the strongest and most impactful concepts to convey.

II.2.3 Third stage: Axial Coding

During this stage the surviving codes were crystallised and attained critical relevance within the emerging themes. The CAQDAS software proved very useful at this stage, as the rearrangement of each code and all supported extracts could easily take place: merging, separating and restructuring with ease.

The codes at the start of this phase kept a degree of independence, cautiously taking steps towards the most appropriate categorisations. The image below gives an early summary of the codes entering the third stage – some of them with work in progress titles.

Name	Sources	References	Created On	Created By	Modified On	Modified By
A way to research content.	7	21	08/12/2012 20:00	P.G.	28/01/2013 20:20	P.G.
Dialogue with the data	7	33	08/12/2012 19:59	P.G.	28/01/2013 20:11	P.G.
Draw people in.	7	48	08/12/2012 20:05	P.G.	28/01/2013 20:11	P.G.
Ease workload, focusing on the 'essential' parts.	6	16	08/12/2012 20:09	P.G.	28/01/2013 20:11	P.G.
Feedback.	3	7	08/12/2012 20:09	P.G.	28/01/2013 20:11	P.G.
Giving form into an area	6	20	08/12/2012 19:34	P.G.	28/01/2013 20:11	P.G.
Hold the page, Hold the interest	6	29	08/12/2012 20:06	P.G.	28/01/2013 20:11	P.G.
In depth knowledge of subject and Personal involvement	7	33	08/12/2012 19:43	P.G.	28/01/2013 20:11	P.G.
Information Design Identity	6	18	08/12/2012 20:03	P.G.	28/01/2013 20:13	P.G.
More than one story on the data set.	7	20	08/12/2012 19:52	P.G.	28/01/2013 20:11	P.G.
Omission to maintain clarity of the perspective.	5	15	08/12/2012 19:55	P.G.	28/01/2013 20:11	P.G.
Pattern - Difference	7	30	08/12/2012 19:19	P.G.	28/01/2013 20:11	P.G.
Presenting a perspective of information.	7	31	08/12/2012 19:54	P.G.	28/01/2013 20:11	P.G.
Reliance on experts.	7	9	08/12/2012 20:10	P.G.	28/01/2013 20:11	P.G.
Reveal the truth of the data.	7	27	08/12/2012 19:53	P.G.	28/01/2013 20:11	P.G.
Simplification - Accesibility	7	63	08/12/2012 19:21	P.G.	28/01/2013 20:11	P.G.
Stand alone, yet also complementary.	4	9	08/12/2012 20:06	P.G.	28/01/2013 20:11	P.G.
Strong assumptions of the readership.	6	14	08/12/2012 20:10	P.G.	28/01/2013 20:11	P.G.
Visual language, Functionality.	7	39	08/12/2012 20:08	P.G.	28/01/2013 20:11	P.G.

As the connections between codes were investigated with exhaustive cycles of analysis, the initial five themes of **Data immersion, Morphology of argument, Visual exposition of content, Emerging identity, Medium awareness,** came to life. Axial coding helped remove the concepts from the necessary initial isolation and view them again as part of a greater whole.

With the use of Axial coding, the discovery and identification of two previously undetected themes was made possible: The **Dual narrative of designing infographics** and **Multiple perspectives of content refinement,** both describing persistent behaviours of designers during practice.

It has to be noted that after the crystallisation of codes, , the researcher used software programs as well as written notes, diagrams and sketches to explore the potential of Theme arrangements. The purpose was to cycle focus through the available repositories of primary data and see the hierarchies in context, escaping the relatively linear solitude in which each code initially resided within the software hierarchy.

The image below offers an example page from the researcher's notebook where codes and themes were structured, allowing the re-visit of hardcopy coded extracts, as well as previous stages of analysis.
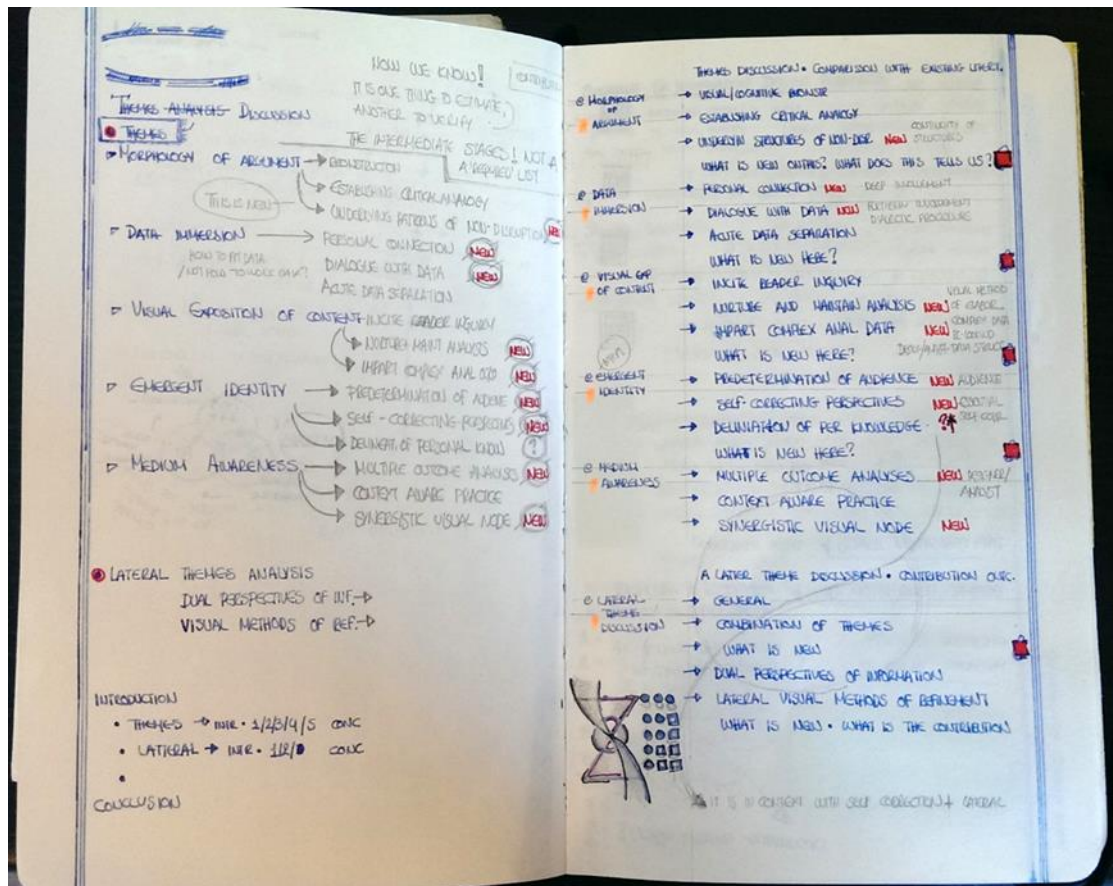
Appendix III

Samples of Analytic Memos

III.1 Analytic Memo Sample I

14 May 2012

Code definition: **Dialogue with the data**

"This is quite strange, this is something not exactly recorded in literature (?!). These designers from the XXXXXXX newspaper, were vivid on descriptions and there was a lot of "back and forth" within their explanation on how they did it. This is far from a review of figures to put into effect or just 'visualise'.

Especially the occasions were the designer was informing the journalists that something else jumps out of the data… no… There is something else here… It is not given… it seems like they were looking for an entry point an intense discussion of sorts: As if someone 'talks' through it to find a convincing argument… A tactic persistent and consistent, and potentially important. The designer escapes the page and looks into the data <u>in-depth</u> … he goes through it … not with it."

The attempt to understand this code was done early within the study when the intense negotiation and understanding of designers with the subject and associated data sets became apparent. This memo (written in a spare piece of paper shortly after conducting some interviews) helped me understand the first fundamental difference of how editorial information designers view the available data.

III.2 Analytic Memo Sample II

7 January 2013

Emergent patterns. Theme: **Data struggle**

"Designer narratives are far from distanced attitudes of the graphic designer or the illustrator… there is little casual approach or drifting through the aesthetics.

No, the designers "suffer" when they go through the examination phase, it sounds almost 'push and pull' it is a personal and intense situation and feels a bit of a strenuous situation for them. They "need" to know, "all" the details because they need to make sense and then simplify for their audiences… No, they also need to know for themselves (?) they take pride on it.

Almost like using a scalpel to cut through the Gordian knot of data. Bit of an angry talk, a bit of a fight and definitely building an intimate connection through all this. It becomes almost a controlled fixation. Whatever it is, it is certainly beyond the comfort zone."

The pattern emerging eventually refined and narrowed focus on the concepts contained within the codes of Establishing a Personal Connection, Dialogue with the data, and Acute Data Separation, attributing them to a larger process described by designers.

III.3 Analytic Memo Sample III

15 April 2013

Emergent patterns. Theme: **Data struggle**

"I can see it more clearly now: the three codes come closely together forming a phase, a significant portion of the continuum of activity during the early stages of creating an infographic.

These are segments of a greater whole, somewhat more implicit from the exactness of the codes, but it is 'there': Designers **<u>Struggle</u>** with the data.

There is no comfort, no lengthy and frivolous engagement with the data set, as the time constraints for the big news stories are painfully short. This area is constituted by three parts The first by **establishing connection**   the designer comes close and personal with the subject and understands the dimensions, the second **dialogue with data** explores and evaluates all details and possible outputs, while on the third **acute data separation** the designer begins the phase of separating content to highlight the point of the story, the essential aspect of the dataset that needs to be told

This is absolutely part of an area of 'high gravity' within the narratives, a theme on its own right!"

This is written during the final stages of analysis, after all interviews were finished and the Theme begun to crystalize. By connecting the 3 underlying codes (here presented with work-in-progress names) into a bigger structure the theme revealed a critical aspect of designer activity. The one that is described within the analysis chapters as **Data Struggle.**

Appendix IV

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Appendix V

Ethics Documentation

FORM UPR16

Research Ethics Review Checklist

Please complete and return the form to Research Section, Quality Management Division, Academic Registry, University House, with your thesis, prior to examination

Postgraduate Research Student (PGRS) Information		Student ID:	436018
Candidate Name:	Panagiotis Galanis		
Department:	ADM	**First Supervisor:**	Jenny Walden
Start Date: (or progression date for Prof Doc students)		Feb 2010	

Study Mode and Route:	Part-time ☑ Full-time ❏	MPhil ❏ MD ❏ PhD ☑	Integrated Doctorate (NewRoute) ❏ Prof Doc (PD) ❏

Title of Thesis:	Designing with Data in Mind – Revealing Complexity: Designer Perceptions on Visualising Data within Editorial Information Design Practice.
Thesis Word Count: (excluding ancillary data)	Approx. 76.000 words

If you are unsure about any of the following, please contact the local representative on your Faculty Ethics Committee for advice. Please note that it is your responsibility to follow the University's Ethics Policy and any relevant University, academic or professional guidelines in the conduct of your study

Although the Ethics Committee may have given your study a favourable opinion, the final responsibility for the ethical conduct of this work lies with the researcher(s).

UKRIO Finished Research Checklist:
(If you would like to know more about the checklist, please see your Faculty or Departmental Ethics Committee rep or see the online version of the full checklist at: http://www.ukrio.org/what-we-do/code-of-practice-for-research/)

a)	Have all of your research and findings been reported accurately, honestly and within a reasonable time frame?	YES
b)	Have all contributions to knowledge been acknowledged?	YES
c)	Have you complied with all agreements relating to intellectual property, publication and authorship?	YES
d)	Has your research data been retained in a secure and accessible form and will it remain so for the required duration?	YES
e)	Does your research comply with all legal, ethical, and contractual requirements?	YES

*Delete as appropriate

Candidate Statement:	
I have considered the ethical dimensions of the above named research project, and have successfully obtained the necessary ethical approval(s)	
Ethical review number(s) from Faculty Ethics Committee (or from NRES/SCREC):	FO: 05/10-0044
Signed: (Student)	Date: 18 Jan 2015
If you have *not* submitted your work for ethical review, and/or you have answered 'No' to one or more of questions a) to e), please explain why this is so:	
Signed: (Student)	Date:

From Wendy Powell <~~~~~~~~~~~~~~~~>   ↩ Reply ↩↩ Reply All ▾ → Forward 📥 Archive 🔥 Junk 🚫 Delete
Subject **Re: Full Ethical Review documentation.**   15/10/2013 13:06
To Me <~~~~~~~~~~~~~~~~~~>
Cc Sarah Eaton <~~~~~~~~~~~~~~~~>   Other Actions ▾

Hi Panos,

I think that this all sounds fine. The interviews were conducted according to the information given, and the change is not substantive enough to have implications for the consent that was given.

I will send you a formal letter acknowledging that you have notified me of the change in focus - could you confirm the name of your first supervisor so that they get a copy.

Sarah: Could you please kindly make a note on our current application spreadsheet that Panos has notified me of a change of project title to **Cognitive aspects of the process of the Graphic Design and Typography** , with a concommittant change in focus from Graphic Design to Editorial Content design.
The project was given a favourable outcome on 25/05/2010, number FO: 05/10-0044, and I confirm that this favourable opinion is still valid for the changes.

Regards

Wendy

On 15 October 2013 12:57, Panagiotis Galanis <~~~~~~~~~~~~~~~~~~~~> wrote:
Dear Wendy,

Everything was properly done with the documentation at the time, complying with the given guidelines. I can confirm that as I was extremely careful on every step.

The reason for the change of research direction is that I had a large number of interviews from a specific group of participants, allowing me to focus on a specific area of design which I already had particular interest.
The acquired data (casual semi-structured interviews) were then analysed towards the new research direction. It is the same material, used in very similar way - just focusing on a specific sub-discipline.

I cannot provide an updated abstract at the moment (was a bit left behind with the focus on writing the chapters) but can offer a short outline of what I did that might help: My PHD research focused on a knowledge gap of editorial information design, and how I can articulate tacit designer knowledge through the use of grounded theory methodology. I use designer discussions to illuminate missing areas (aims,objectives and methods) from the existing literature and provide in the end a theoretical outcome of relative grounded theories.

I hope the above help, please let me know if you need more details for any of the above.

many thanks,
Panos