Examining the Cartographic paradigm in web design

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Much of professional practice as a web designer is spent in creating paths to and through information that resides on websites and/or screen based media. Increasingly information is utilised in virtual environments and people have become comfortable using a desktop metaphor in the employment of computers for work and play. As the capabilities and connectivity of our machines expand, the metaphors in use have also expanded to include familiar terms from spatial experiences to relate to the World Wide Web[1]. Thus, one talks about searching for the best deal on eBay, locating the latest news and sport from around the globe, finding a site where one can go to meet like-minded people: - the variations are endless. As this web expands so, the tools one needs to locate onesself in it change. Quite quickly, some conventions have emerged that help users to find their way round.[2] Much work goes into the constructing of clickable interfaces that gets one as quickly as possible to where one wants to go. A quick search on google[3] and a trail can be opened up and a huge range of possible jump off points provided.

In this context a website is said to be 'sticky' if users stay longer than a few minutes and ideally come back for more on a regular basis. Bearing in mind the prevalence of the cartographic metaphors it should be possible to design better screen media by examining the analogies and metaphors related to cartography to see how far they are useful, and in what ways they break down. Designers could gain a useful understanding of how and why cartographic methods work in a traditional sense, followed by a greater understanding of the particular parameters of graphic communication with which they are currently engaged.

This exercise will consist of two parts. The first section will examine arrange of strategies employed in cartography. The mechanics of map-making, and the underlying principles that are employed will be addressed. The second part will examine how others have translated cartographic ideas and attempted to relate them to the particular problems posed by the WWW. A major concern in this section will be the way that information design seems to be considered in two strands - the structural and the visual.

The practice of Cartography

"A map is an abstraction of reality used for analysing, storing, and communicating information about the locations, attributes and interrelationships of physical and social phenomena that are distributed over the earth's surface"[4]

"A diagrammatic representation of a route etc"[5]

This definition of a map refers to a familiar one of mapping the physical environment around us. The process of condensing the complexity of our environment into information that we can use is a powerful one and we can see with the examples that follow that a variety of differing abstractions can communicate in this way. The power of the abstraction is that it enables a large amount of information to be contained in an efficient, elegant and useable way. However, there are many questions that can reveal what lies beneath the surface of the map. To ask just a few of any map will highlight just how much there is to know. Who made it? When was it made? What is its purpose? What is its effect? The list is almost endless.

Before we can consider some of these relevant questions, we must first understand the elements that make up a map. In 'How to Lie with maps'[6] the author, Mark Monmonier identifies three basic attributes of a map.

Scale

The first of these is scale. To represent a reality one must first decide how big ones version it is going to be and how important depictions of scale are to ones intended audience. The hill walker traversing difficult terrain demands a different scale and detail to the fighter jet pilot on low flying exercises overhead. Each choice one makes about scale begins the process of selection about how much or how little information the mapmaker wishes to show.

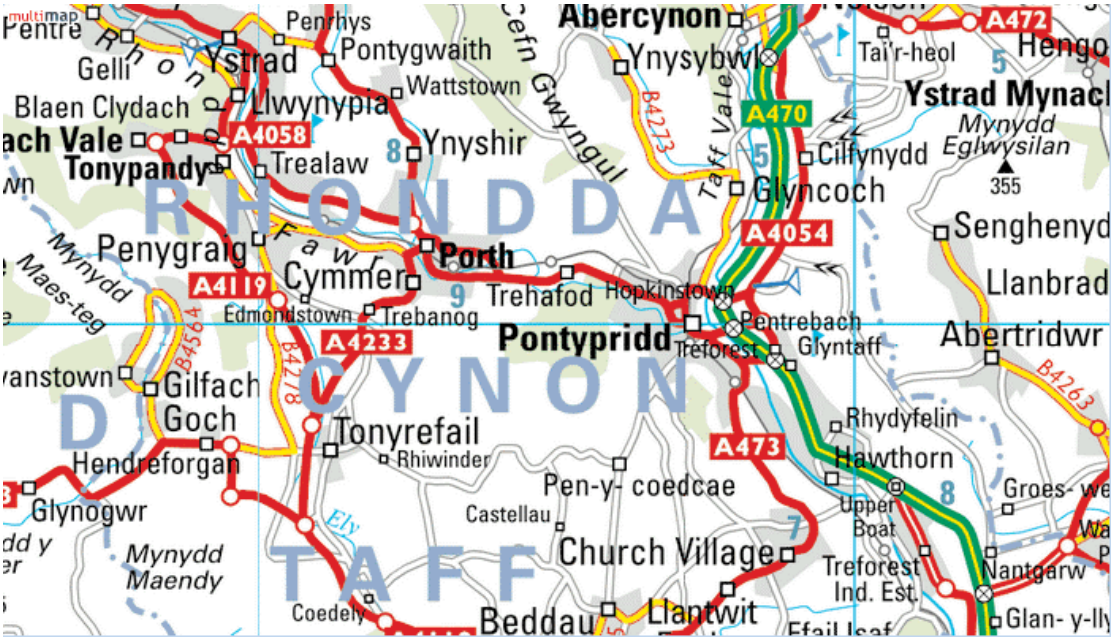


Figure 1 Scale map with major roads and limited topographical detail

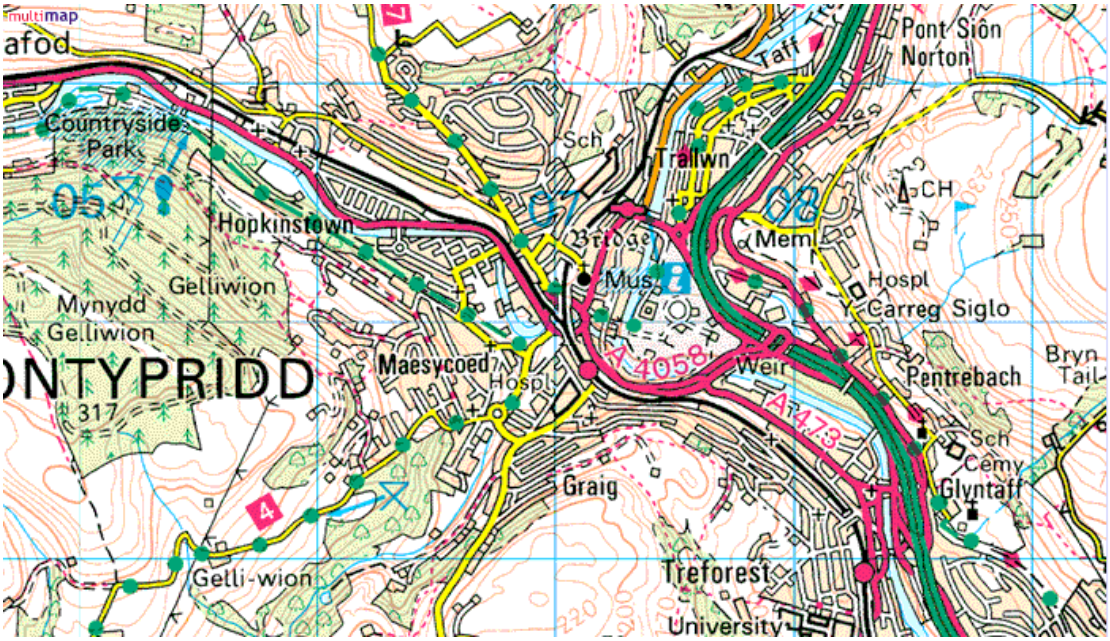


Figure 2 - Densely detailed map of the same area

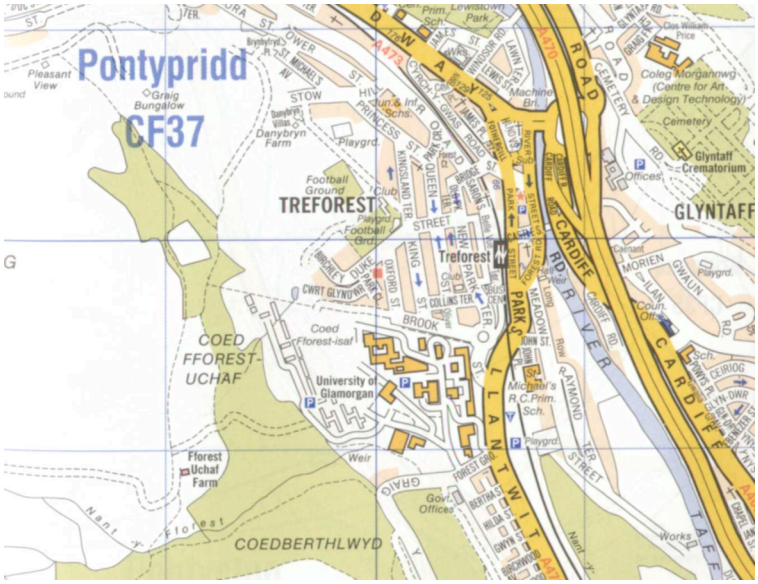


Figure 3 - Further detail

The above three images illustrate how different scales determine how much and what kind of information is displayed. The first map gives a broad overview, with major transport links shown. On the second, one can pick out areas, terrain, more detailed roads, and local landmarks. The third shows individual buildings and footpaths, though interestingly, the terrain detail is simplified at this level of detail.

Projection

This is the technique of translating from three dimensions to two. A major problem throughout the history of mapmaking has been to covert the (almost) spherical shape of the Earth to a flat surface. Many projections that do this in different ways, here are a few.

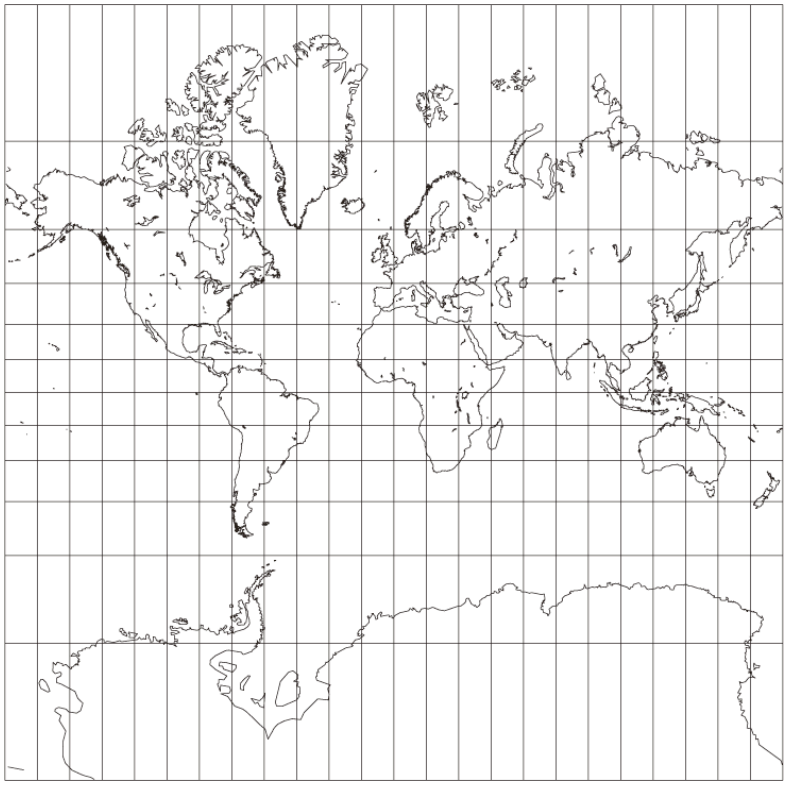


Figure 4 - Mercator Projection

This projection is probably the most familiar to us. Created in the sixteenth century by Flemish cartographer Gerhard Mercator, it faithfully preserves angles, meaning that a straight line drawn out the map gives a bearing that a navigator is able to follow with a compass. Known as a conformal projection, this system then enabled voyages of discovery and conquest throughout the world. The downside however, is the amount of distortion that occurs. For example, Greenland (2.1 million sq km) is shown to be larger than China (9.5 million sq km).[7] This same distortion is further illustrated by this Isotype[8] produced illustration below.

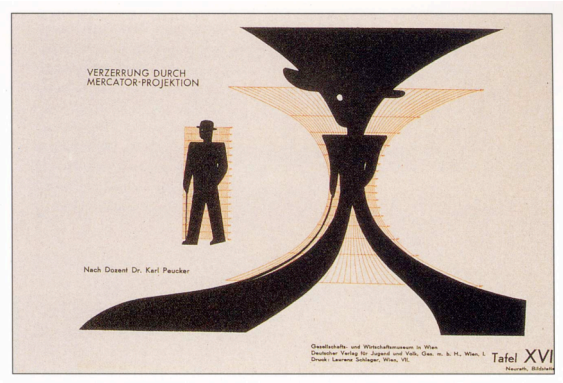


Figure 5- The extent of the Mercator distortion

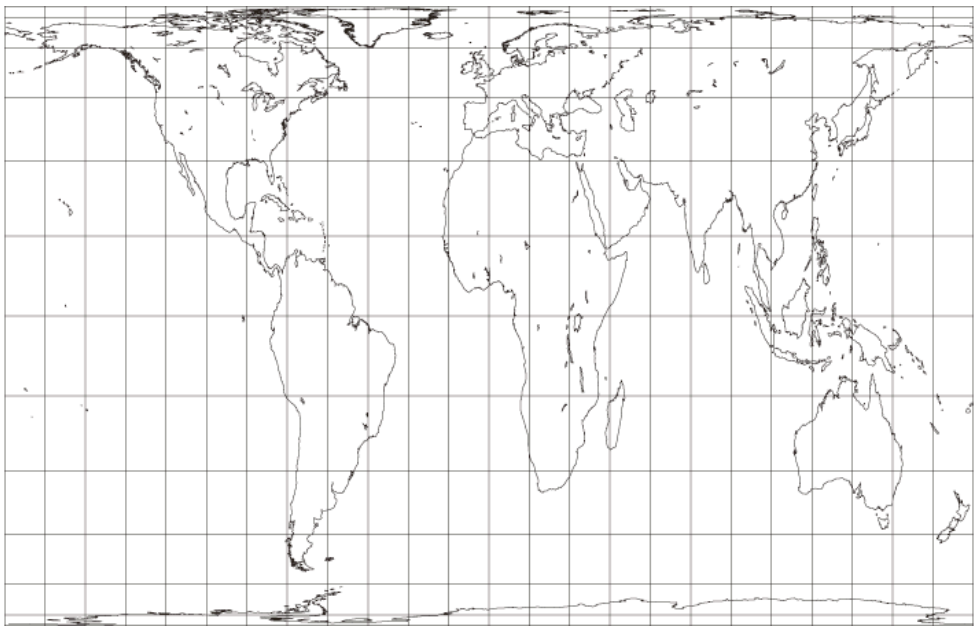


Figure 6 - Gall-Peters Projection

Developed in 1974 by Arno Peters, based on the 1855 work by Rev. James Gall, this equal-area projection seeks to accurately depict the sizes of major continents. With an underlying political agenda of representing a more egalitarian worldview, this controversial[9] projection has become popular, though to our eyes used to the Mercator, it seems strange.

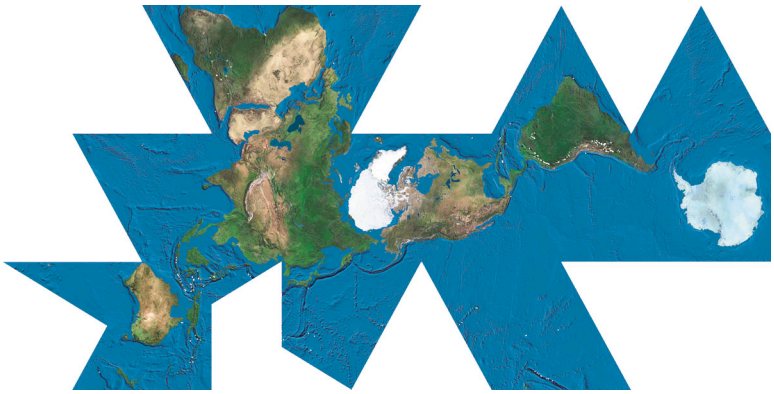


Figure 7 - The Fuller Dymaxion projection

Devised by Buckminster-Fuller in the 1943[10] this projection, composed of 20 equilateral triangles, can be placed together to create a 3d shape called an icosahedron. Too radical to supplant the familiar projections we use in atlases and wall maps, its existence illustrates the point that projections come in many varieties to serve different functions.

Figure 8 - Winkel-Tripel - Now replacing Mercator in US Schools

A standard projection common in US schools, Being neither conformal or equal-area it is nevertheless fit for its purpose.

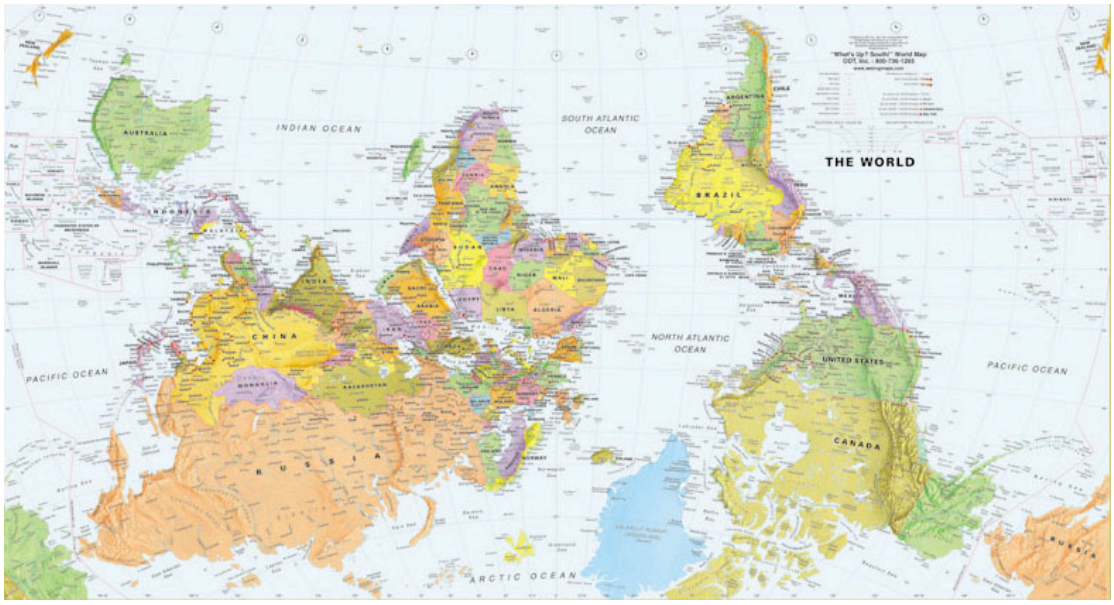
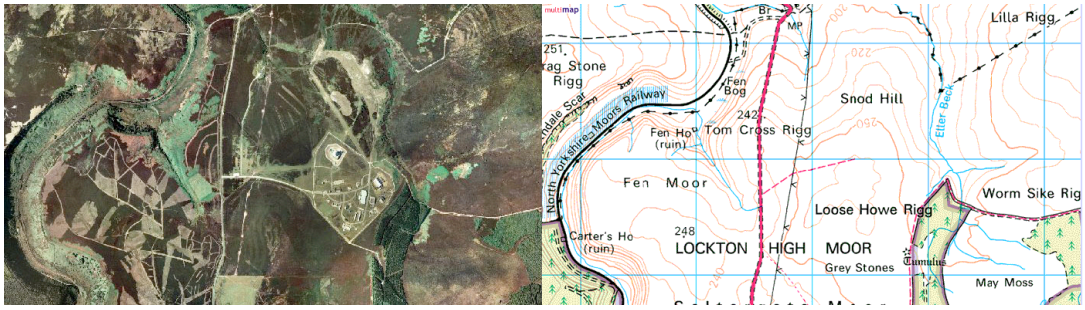


Figure 9 - Quirky ideas to our eyes, so accustomed are we to the 'right' way up

This is an alternative view of the world, which seems odd to us; it demonstrates that the current convention is just a construct that has become dominant through use.

As well as faithfully representing aspects of the world mapmakers can be equally adept at misrepresenting the world. As we can see when we examine the aerial picture of the Flyingdales Early Warning centre in Yorkshire. On the related ordnance survey map, the highly sensitive military site is not depicted. It is perhaps appropriate that such a site is left off a map series whose title betrays its military origins – to survey ordnance across the land.[11]

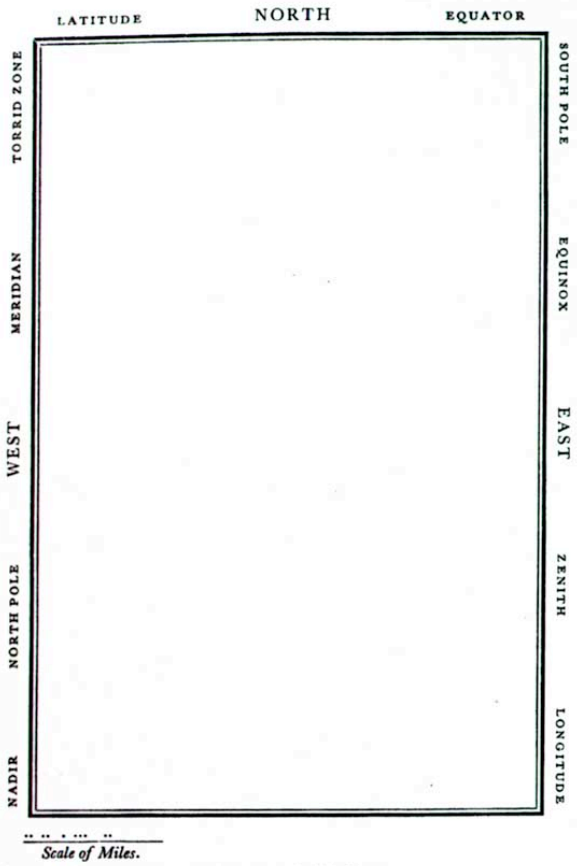


Figures 10 & 11 The Flyingdales Early warning centre on the left, and the map of the same location

The problems of projecting the globe are the focus of the maps above, but at smaller scales, projection of real world data into flatland [12] has necessitated some ingenious solutions to the problem.

Figure 12 - Strip map Carmarthenshire 1736

As shown by the example, the strip map is an old invention, which excludes other data in favour of data that is directly relevant to the traveller and the assumed sequence of events. In this example the map is designed for the primary purpose of getting one from A to B. This map is a map for direction and not exploration. Unlike this next one!



OCEAN-CHART.

He had brought a large map
representing the sea,
Without the least vestige of land:
And the crew were much pleased
when they found it to be
A map they could all understand.

—*Lewis Carroll,*
The Hunting of the Snark

Figure 13

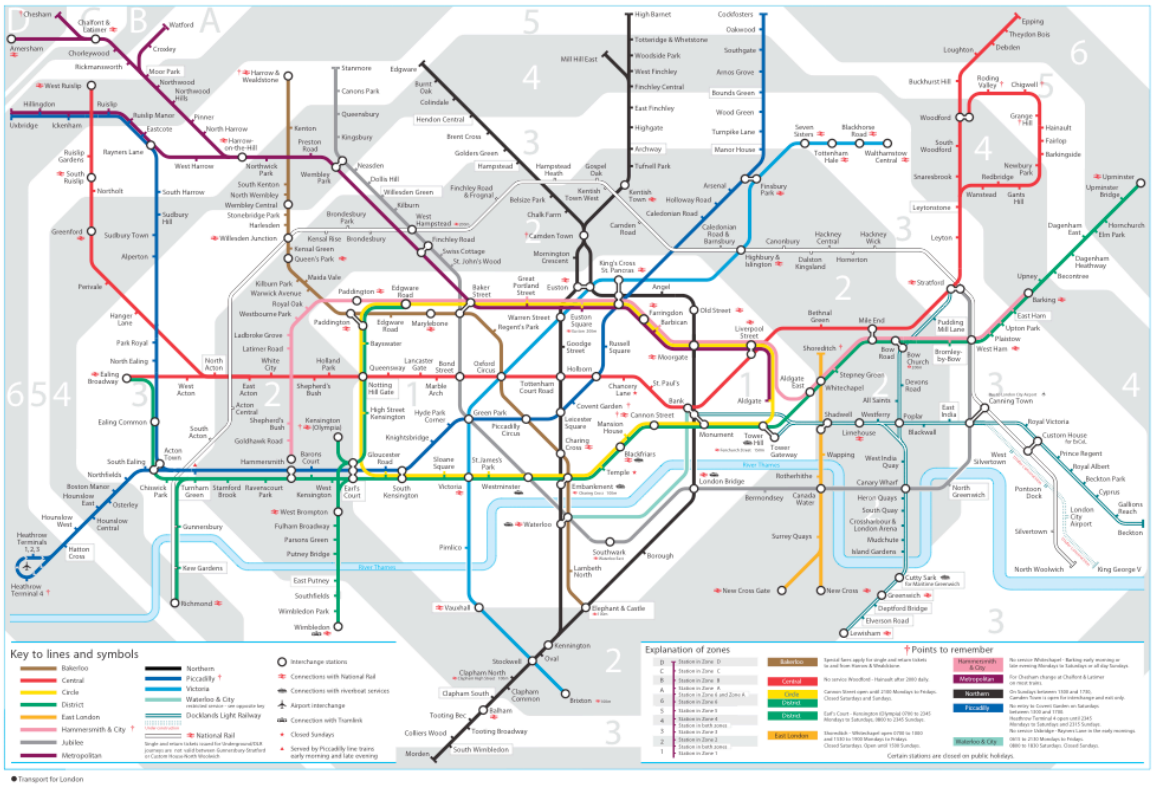


Figure 14 - London Underground Map 2004

A further development is the depiction of a process as well as the relative reality of locations. The London underground map marvellously occupies the boundary between map and diagram.[13] The complicated geography of London's rail network is deemed less important to depict than the relationships between the stations throughout the route. Developed and refined over 27 years by Harry Beck[14] the map forgoes the topographical positioning evident in this example below, and compresses the stations in a format that works as well on a station poster as on a pocket foldout map. It has become an often-imitated design classic by virtue of its ease of use and clarity of purpose.

Figure 15 - The geographical layout of underground stations

Symbols

The third element, symbols, function as the code that enables users to decipher and interpret the layers of representation and meaning that the map contains. The symbols can be widely understood once learnt. Simple lines and colours serve to differentiate roads, streets, landmarks and other places of interest. With repetition and standardisation, these symbols are reinforced in the mind of the map users and makers. The system of coded marks and a key to decipher them have become second nature to the public when using maps. Even if the symbols seem arcane to non-specialists, the system is familiar. The examples here are of patterns that represent geological information. Others are weather symbols or vegetation.

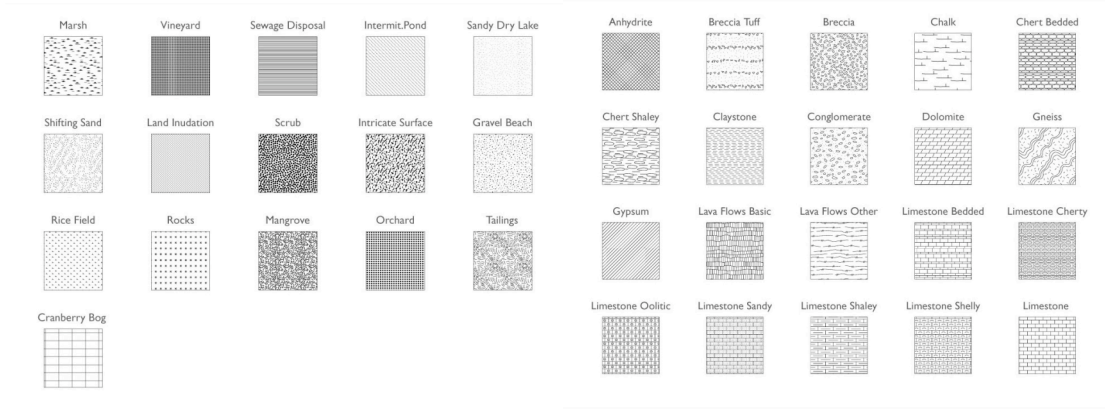


Figure 16 - These symbol libraries help us to decode geological, and US topological maps.

The graphic construction of symbols available to us can be broken down into six principal visual variables and three geometric categories.

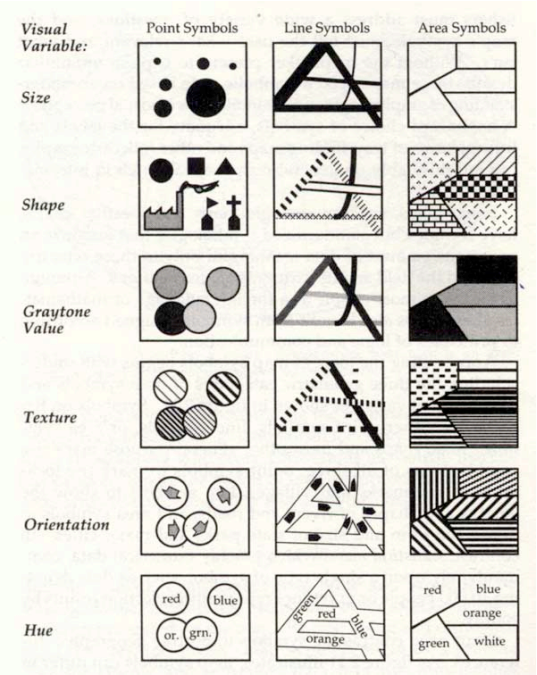


Figure 17 - The six principal visual variables

With appropriate combinations of the above graphic devices, a wealth of information can be stored and acted upon. The versatility of different symbol systems is demonstrated when abstract information from different disciplines are combined to summarize often complex data in a visual form. Statistical information has long be combined with topological information to display relationships in the data.

Initially, different kinds of information were overlaid on the geographical map, until others replaced the axes of latitude and longitude such as quantity and time. A seminal example of this evolution of the map and diagram was the statistical masterpiece of the representation of Napoleon's march to Moscow, by Charles Joseph Minard (1781-1870). It combines a wealth of geographical and statistical data in an elegant and dramatic form. The diagram plots the size of the army, its location, its direction and the temperature on various dates, so one can plainly see the disaster unfold as the campaign develops.

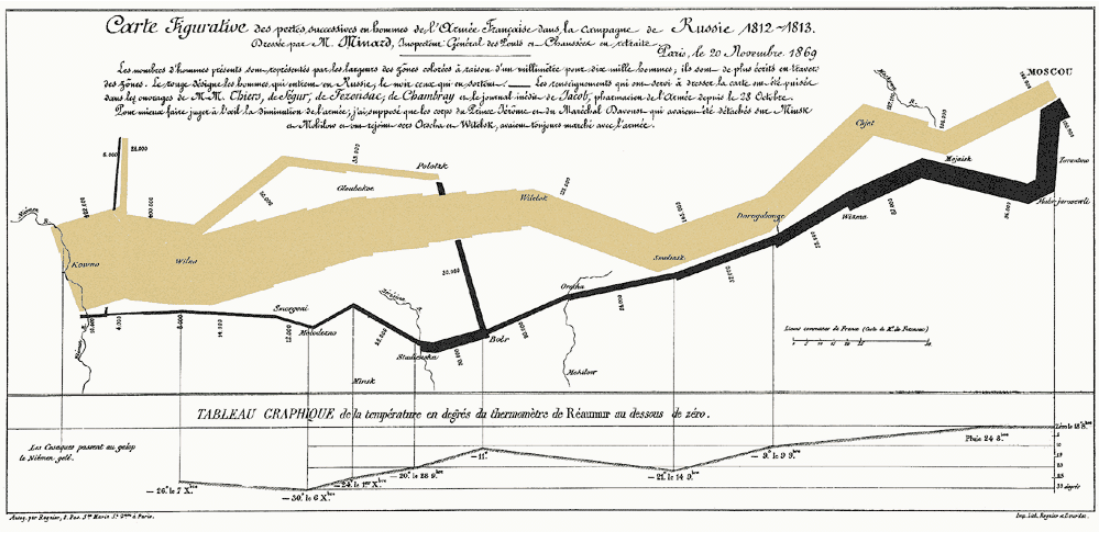


Figure 18 - Statistical visualisation of the data on Napoleon's march on Moscow

Another giant of early information design was William Playfair (1759-1823), an English political economist, who stated his belief in the effectiveness of graphic solutions for the understanding of statistical information. "On inspecting one of these charts attentively, a sufficiently distinct impression will be made, to remain unimpaired for a considerable time, and the idea which does remain will be simple and complete, at once including the duration and the amount." Among the familiar devices he used and popularised are the pie chart, the bar graph and the line graph.

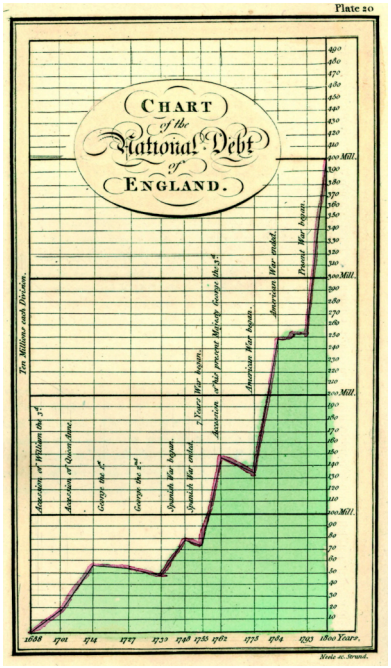


Figure 19 - Playfair's line graph of the regional debt of England,

These examples of information visualisation demonstrate that cartographic principles have a rich and varied history and have developed a powerful set of tools for the communication of data in efficient and elegant forms. Maps and diagrams have changed as the media they exist within have changed. The next section will examine how cartographic principles can be applied to the particular problems of communication and visualisation on the new medium of the www.

Section 2- Mapping Web sites.

Should web sites be mapped? At the beginning of this essay, mention was made of the established metaphors in use on the web; finding, searching, navigating, browsing, and surfing. An aspect of online experience is locating oneself in relation to the information available. In the paper *'Metaphors We Surf the Web By'*[15] it is suggested that users of the web conceive of it as an information space that is travelled through and that we combine metaphors that we are familiar with to make sense of new experiences. Users talk about actively going to the information, rather than it being delivered to them. The authors of the book *Mapping Web Sites* assert, "Visualisation is good information design practice, which is in turn good graphic design practice"[16]. We can see that visualisation works well for an enormous range of topographical and statistical information. Cartographic practice has spread from its functional centre to the margins where its conventions are used as a vehicle for fictional[17], political[18] and artistic[19] expressions. The mapping sensibility of cartography encourages us to look at abstract ideas and spaces in a way that makes them visual. Using technology to manipulate data in novel new ways has enabled us to bring the mapping urge to bear on increasingly complex and difficult to imagine data. For example, the mapping of the human genome, itself demands the data it produces be mapped.[20]

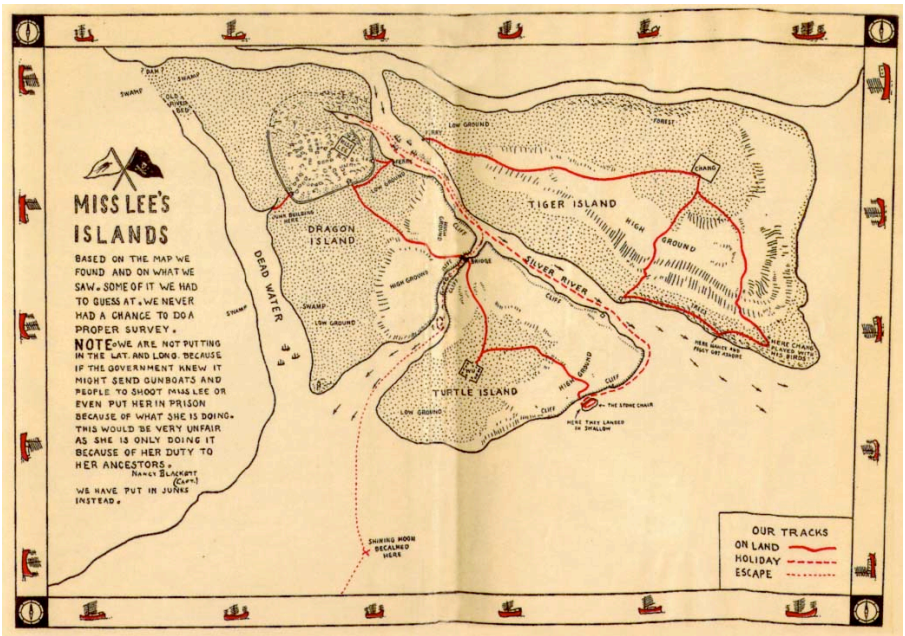


Figure 20 - Fictional map by J Arthur Ransome

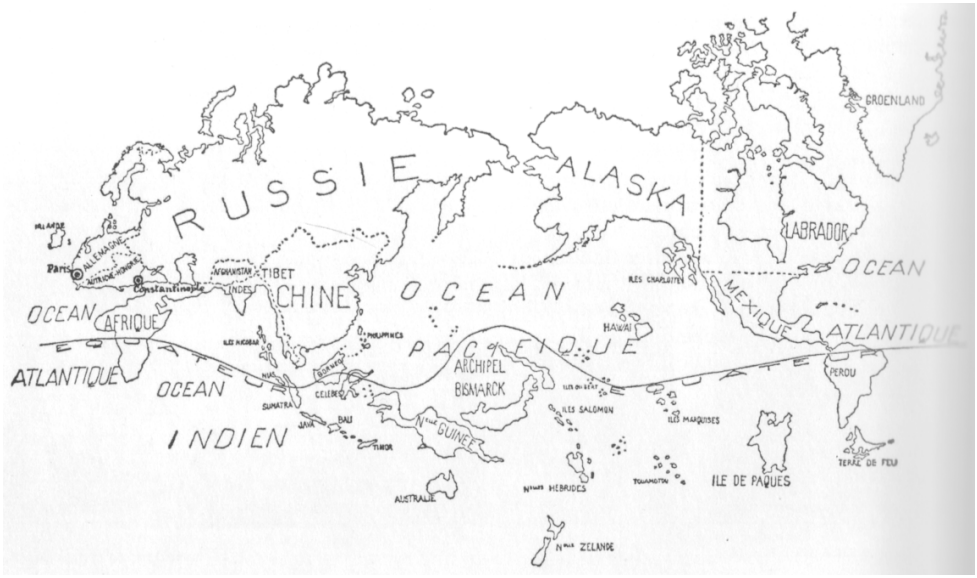


Figure 21 - Surrealist map of the world

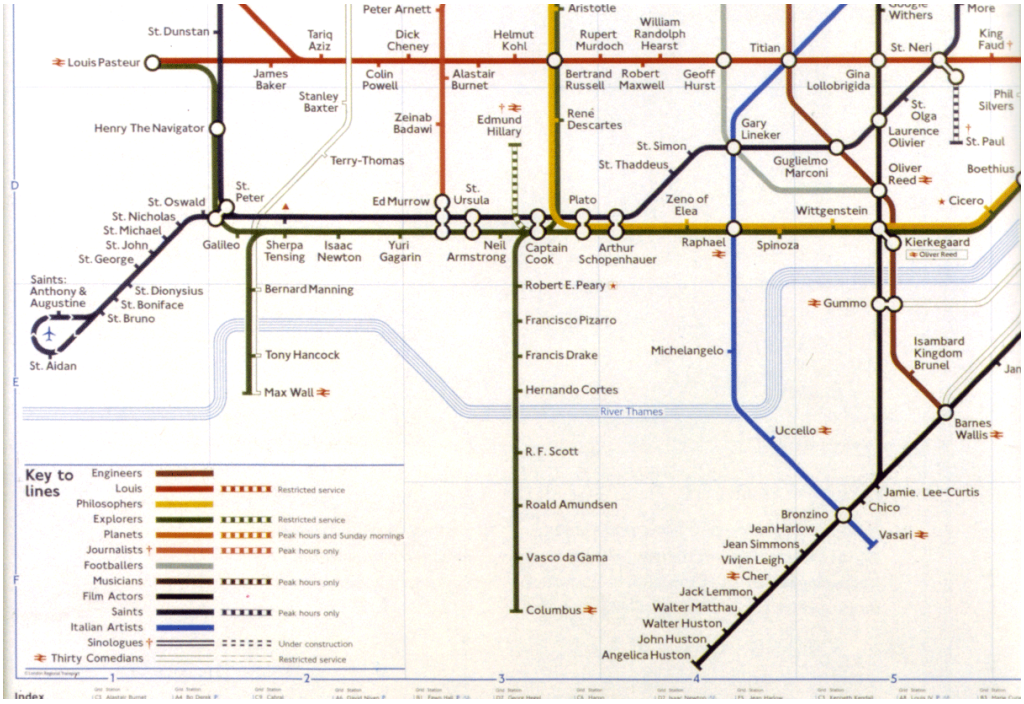


Figure 22 - Detail from Simon Patterson's 'The Great Bear' 1992

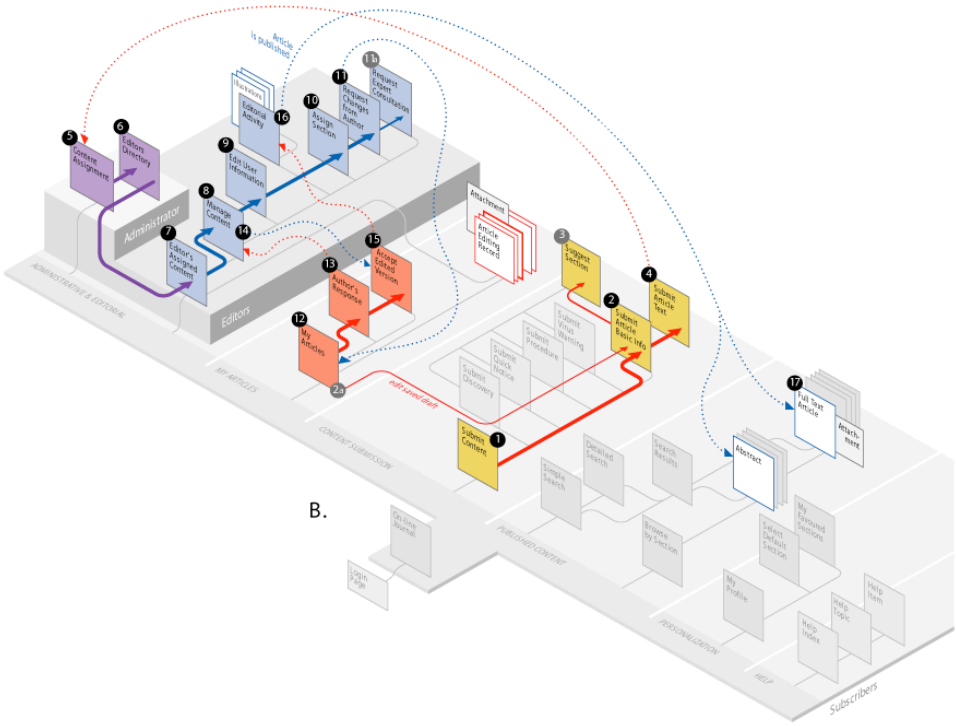


Figure 23 - Dynamics Diagrams method in action

Above is an example of information visualisation that uses cartographic methods to map web site information and processes. The dynamic diagrams[21] approach is to use an isometric projection to facilitate sufficient space to represent the pages of a website on a flat surface. In a research paper[22] describing their technique the authors emphasise that the mapping of a website visually, enabling users and designers to see relationships rather than describe them, makes for better information design. Especially interesting in the paper is their conviction that manually drawn maps, rather than computer generated maps, are crucial in resolving ambiguity. They say, “Maps are a record of differences, not a reproduction of the territory. The target of the map is the most powerful selector, expander and arranger of the differences being communicated: the human mind.” The authors suggest that diagrams like the example here are at their most useful in the planning stage of web site production to enable all the contributors to have a shared understanding of the layout and functions of the site.

Fast paced share price movements visualised at Smartmoney.com.[23] Rising and falling stocks are presented in an irregular grid divided into sectors such as healthcare or energy. Once one is familiar

with the key, one can quickly see which sectors are performing well. Further utility is provided by the ability to interactively change the options. It is possible to alter the timescale that the share price is displayed, display relevant news headlines in the sectors, search for particular companies and alter the colour scheme. In such an information sensitive arena as the stock market, the software assists our natural ability to see and analyse patterns in visual information.

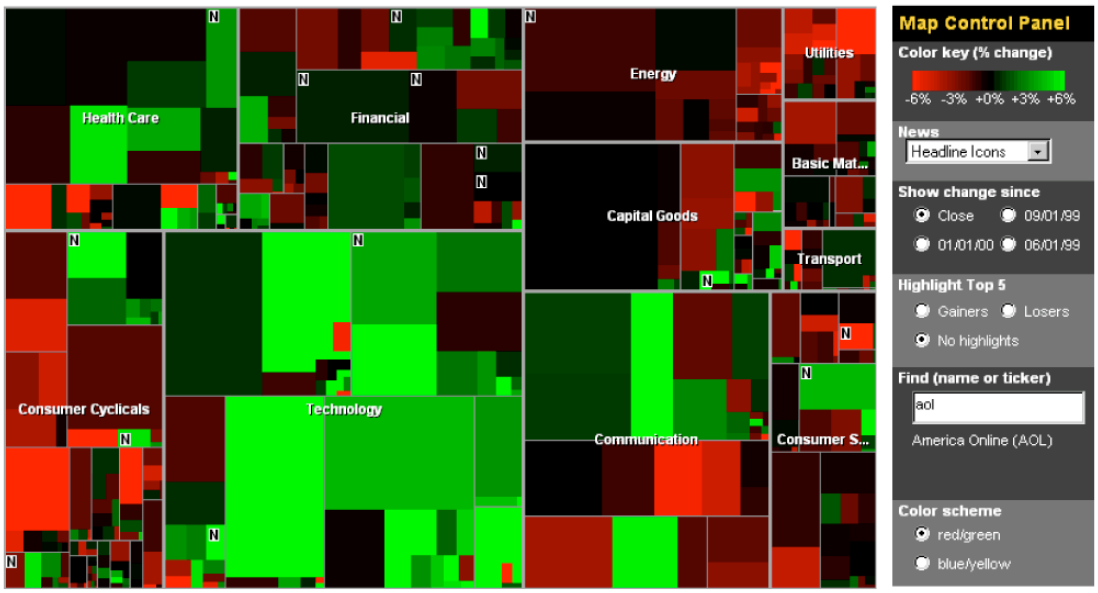


Figure 24 - Smartmoney.com

A more experimental information visualisation technique is demonstrated at www.textarc.org[24], where the text of Alice in Wonderland is displayed in its entirety in an arc on screen. One can then click on a word to uncover its frequency in the text, where it comes, how many times one particular word appears and other aspects of a text.

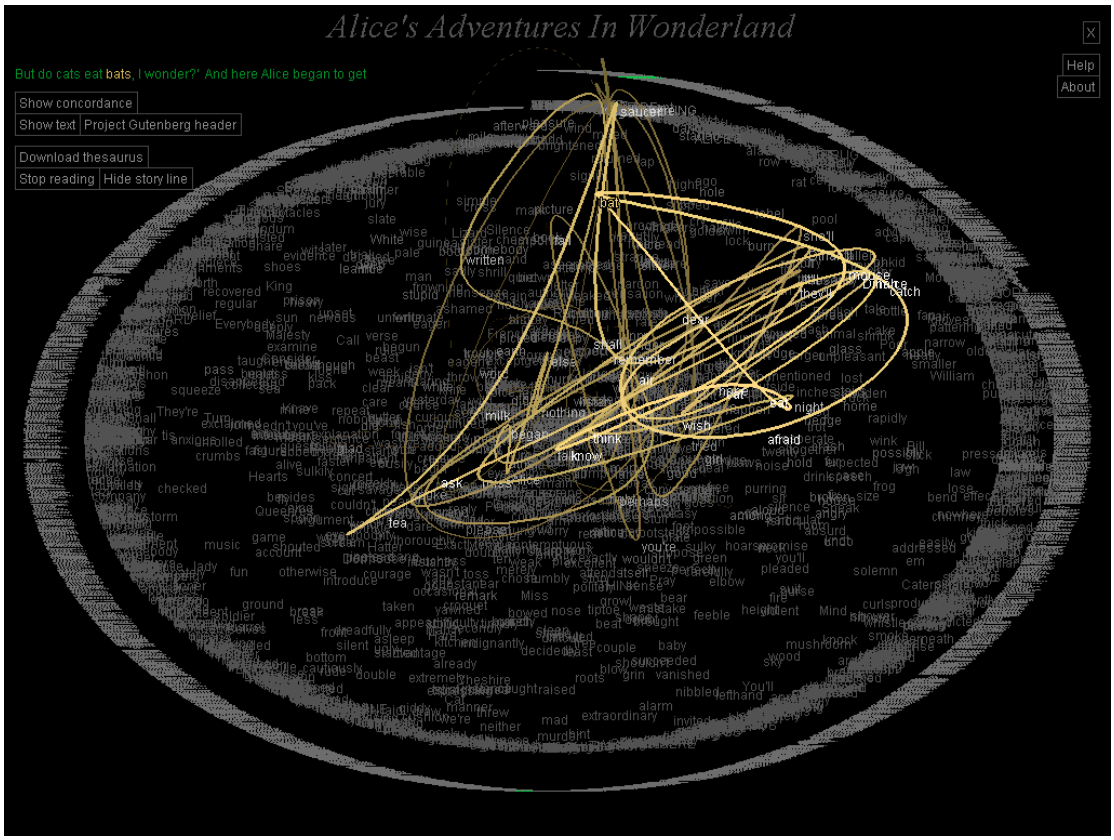


Figure 25 - Textarc Visualisation

There are many other approaches to the challenge of providing context and overview of information delivered via the WWW. Shown below are a variety of visual devices and approaches that aim to employ the efficiency and elegance that a well-realised map can bring. A hyperbolic tree is the term for the distinctive visualisation produced by inxight[25]software (as seen below).

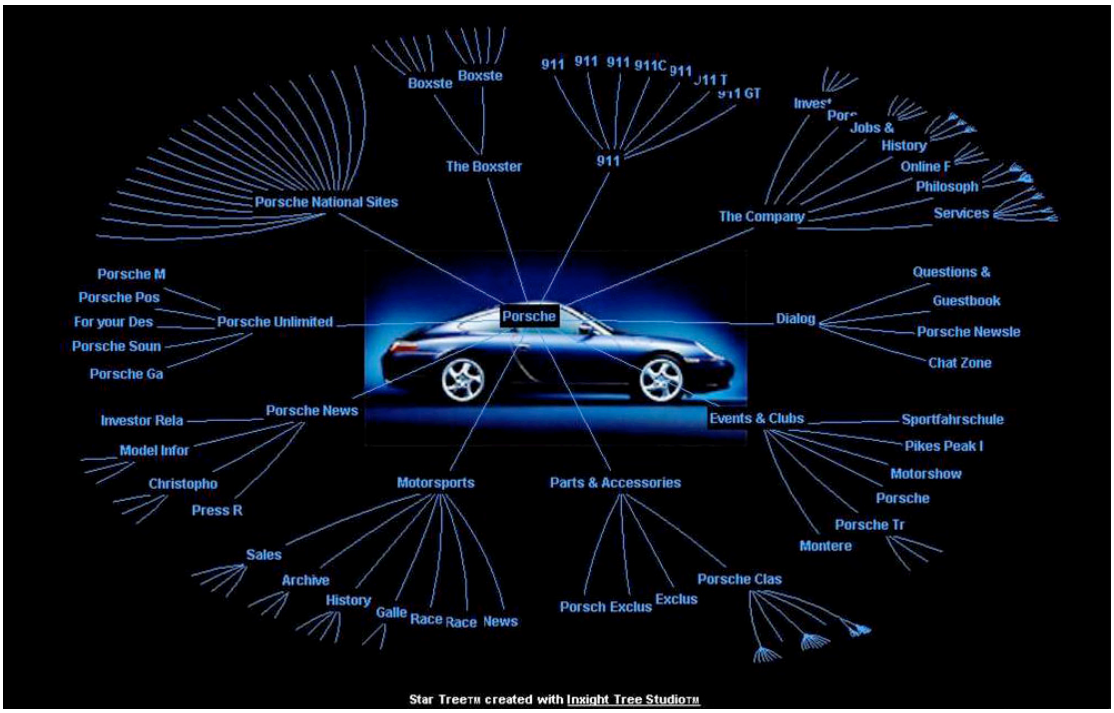
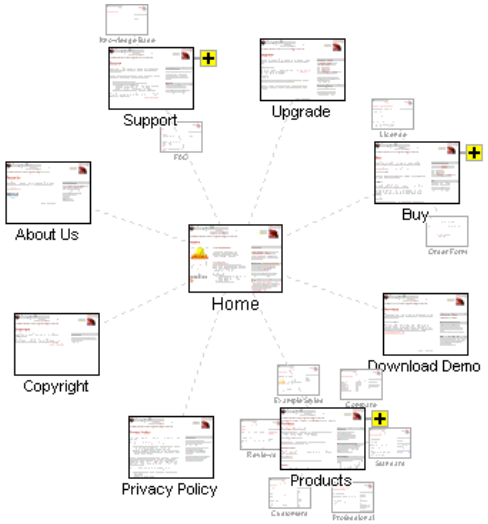
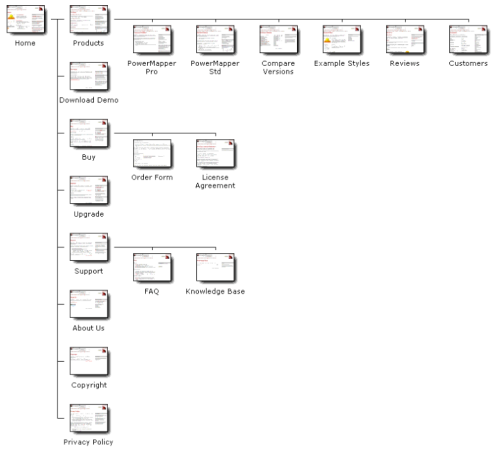


Figure 26 - Inxight visualisation of Porsche website with a hyperbolic tree metaphor

The 'page clouds' and 'electrum' structures created by Powermapper[26], another site visualisation tool, give yet more options.



A 'page cloud'



'Electrum' view

Figure 27 & 27 - Powermapper visualisations

These examples share an intention to enable an overview of the data being presented, but a common problem is the vast array of information and the number of possible aspects of that information that

could be presented. The WWW is so vast and changeable we can see why a resource like Google has become so central to our online experiences, As well as being a commercially successful venture it has entered our cultural life.[27] Once users have received the results of their search thanks to Google's software they then bring all their human preferences, opinions and judgements to bear on the sites that they see. Helping those researching to do this are the cues of typography, colour, imagery, interactivity that have been crafted for us by authors with widely different abilities and attitudes. The conceptual inhabits the same space as the prosaic, the garish as the refined, the utilitarian as the whimsical. At some point the information required is found, additionally not required is invariably provided and frequently information is given that the recipient didn't know they wanted! Now we inhabit the world of the information bazaar, where the visual display attracts or repels us. Having looked at some examples of mapping web sites it is important to consider some of the properties of the new medium.

The WWW is a medium where the technical barriers to authorship inherent in Print or Broadcast are lower. It is increasingly easy to author websites that have the potential to speak in a very direct way with an audience. In this context, it is not surprising that designers have taken the opportunity to become authors as well as learning new skills to understand the limits and possibilities of the medium. However, just as designers became emboldened with thoughts of authorship economic realities caused a shift in emphasis in web design.

During the enormous boom of the www in the late nineties, the strong economy of the new media led to an upsurge of design activity. Consequently, the confidence of the profession was high and so in turn was the ambition. When the dot com bubble burst a high profile casualty was boo.com - a 'global culture style sports magazine'. Amongst its selling points was its highly ambitious graphical design, which following the collapse of the company, acted as a catalyst for an energetic debate about the future. The questions raised provoked a big reaction in the web design world and moved the focus of interest away from experimentation and conspicuous styling to usability and simplicity. This impetus to understand and better appreciate the medium has necessitated a rethink about what the designer's role is in a new context. The skills of interaction and interface design have been added to the traditional designer's toolbox, and need to be learnt to bring the benefits that design can bring. To "give visual

shape and symbolic form to the products and technologies that drive our society"[28] the graphic designer must understand how this is possible in a medium that is so fluid.

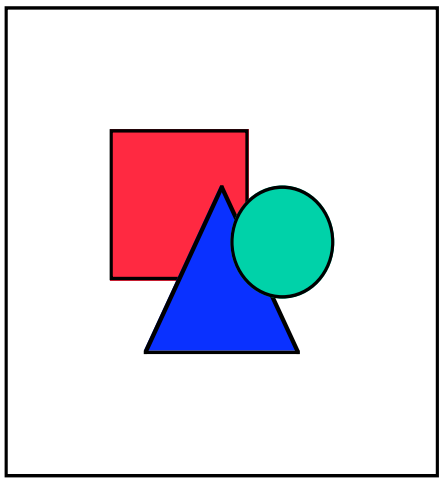


Figure 28 - Multiple views from a renaissance perspective

This new caution of the designer coincides with the rise of the user as the centre of the online universe. The Renaissance perspective revitalised through the screen. A dominant theme currently running through the web design community asserts that interactive design must be user focused if it is to succeed. Accessibility and usability are given paramount importance. Visually, we have a window on the information space of the www and the new challenge to the designer is to shape many different experiences in skilful and sensitive ways to widely differing audiences.

The WWW was born out of a desire to collaborate and make the sharing of information easy, and the most readily available system to enable that to happen was text. The transformation into hypertext has given the written word a new lease of life as the vehicle for commerce and communication all around the globe, but the ease with which people can create and disseminate text creates its own problems. The sheer volume of information means that picking out what one wants or needs becomes increasingly difficult. To cope, our own personal roadmaps and favourites are created. To many sites, the amount of visitors, or 'traffic' is commercially or culturally seen as the indicator of success and so the publishers demand attention. Securing some real estate in the users' mental map of the web is the first step in forging a relationship with the user.

Unlike the shop fronts or billboards of the physical world, designs on the www do not have a shop window to bring a prospective customer to a closer relationship with the product. Instead, the user can

usually arrive at a site by many different means. This might be from a printed brochure, an email or as the result of a search. Often these can be designed adverts, but it is significant that one of the most successful sellers of ad space on the Internet - Google – uses predominately text only ads. At this stage design plays a minimal role. However, once one has arrived at ones destination the designer chooses from many techniques available to make the site memorable, to help one find what one needs and to compel the visitor to stay and/or come back again. This attribute of a site is described as 'stickiness'.

Designers have helped develop web technology in many directions, often to accommodate a welcomed visual element, but unlike designing a book for example, the content has a weaker relationship with the form. The user has a far greater role in dictating the form. It is possible to disable images, change font families, sizes and styles, change backgrounds, disable interactive elements, and view the pages through a variety of devices like PC Screens, Mobile Phones, TV, all of which have their particular properties and limitations. This separation of form and content is continuing, and is a novel experience for designers from other disciplines, when they realize how little control they have over how the final product is produced and distributed. This leads one to question what this means for the designers relationship with the form and the content. With their traditional control over form diminished, it could be argued that designers need to develop a deeper understanding of content in all its contexts.

Recent web sites like CSS Zen Garden[29] and others have shown practical ways in which designers are separating the semantic structure of pages from their visual appearance. Intended as a demonstration of the power of separating form and content, the site powerfully demonstrates how one can meet the new aims of accessibility and usability and still produce visually arresting work.

The designer in professional practice is reminded that one designs for an audience and must deliver appropriate solutions. It is now clear that there is a new audience: - software agents. Separating the visual presentation of a page from its semantic structure is catering to the two broad audiences for that page. The software that crawls the web cataloguing websites needs a semantic, logical structure to extract the information. People can benefit from this logical structure but are also capable of inferring meaning from more ambiguous elements such as images, colour and typography.

Semantics as Solution

The Semantic Web is a term coined by the inventor of the WWW[30], Sir Tim Berners-Lee, when he was expressing a desire that the WWW develop strategies to define information so that it becomes much more usable than it is at present. The belief is that currently, much of the information on the WWW is organised by and for humans, with all their considerable skills in assessing contexts, meanings and many other aspects of the properties of information. This means that much of the WWW lies beyond the reach of software that can help users to organise it. The continuing scale and complexity of the WWW means that the viewer must find ways to manage it. An example – When searching for a book one is usually taken to a site where the book can be purchased, which is fine if that is what one would like to do. However, suppose that one wishes to access other facets of that book such as how many editions there are, the design of different covers, reviews, library availability, author biography and academic opinions of it. It might be possible to find some of this on a bookseller's site, but if all these facets of information were defined and available, the power and precision of one's searches would be much improved. When looking for information, the users define what aspect they are interested in and then because the authors of that information have defined the properties of it, software can then be recruited to find the specific information sought. The technical details of the proposals for the semantic web are beyond the scope of this essay, but brief mention will be made of practical areas where data about data is helping to create interesting new forms.

Folksonomies

"Folksonomy is a neologism for a practice of collaborative categorization using freely chosen keywords." [31]

An informal way that many people are beginning to define folksonomies is by using something called tags. It is best explained by giving an example of it in use. The site http://www.flickr.com is a place where people can upload images to share with the rest of the world. The site has tools to enable the sharing of images with an online audience and offers a free way to do this. Integrating with cameraphones and blogs[32], the ease of use is key. When uploading a picture, one is encouraged to tag it. This means some keywords are added to the pictures that describe some aspect of them. It may be a birthday party, a favourite bicycle, a holiday sunset, anything. Once this is done, the images can then

be made available to the connected community. The power of this approach becomes evident when one realises that very large collections of disparate images can be organised and searched with this method. The images are not constrained to have only one tag. It is possible for an image to have multiple tags each of which serves to highlight a context, or aspect of an image.

A tag contents page then reveals the most popular tags of the moment. This image reflects the popularity of the tags in the size of the text, giving a snapshot of a very fast moving environment. The 150 most popular tags are represented, albeit in a simple way. When a tag is clicked a page full of pictures with that tag is shown and lots more options for refining a search and/or browsing through the images are made available. With this increase of information about information, (metadata[33]), the user has greater opportunities to take an active role in the selection, organisation and interpretation of information. If one chooses not to become an active participant by tagging images the benefits of others doing so are still available.

Figure 29 - Snapshot of Flickr.com

www.technorati.com, a community site for weblogs, has a similar implementation of the technique. In this case, the tags reflect the categories that webloggers (authors of weblogs) are writing about. A

particularly interesting development is the inclusion of non-western characters, hinting at the growing online population whose first language is not English.

Figure 30 - Technorati overview

Figure 31 - Tags in action on del.icio.us

This example is from del.icio.us, a bookmark manager that enables users to store their bookmarks and tag them. One can then compare ways that other people classify the same information, and build up pictures of popular links and subject areas. This is particularly useful in that the same information can be classified in many different ways,that make sense to many different people. However, one can see that the design of this site does not reflect the structure in the same way as the previous examples. There is much discussion about folksonomies and the way that online information can facilitate the

building of online communities. With so much information exchange taking place it is important to consider what the designer's role is in this new model.

Conclusion

It can be seen that cartographic methods have served to visualise topographic and more abstract information. Does the metaphor of the designer as cartographer help to communicate effectively in this medium? To consider this question, it is helpful to be aware of other discourses about the wider role of the designer. The selection of noteworthy aspects of data for presentation necessitates choices. In making those choices, one becomes an author. The primacy of the author in this arena seems clear, and the debates about the role of the designer have suggested designers should become more active in this way. Ellen Lupton describes it – "The word author suggests agency, intention, and creation, as opposed to the more passive functions of consulting, styling and formatting"[34] This willingness to speak up as authors has enabled designers to push and develop the web in many directions as they discover the possibilities of a new medium. The 2004 UK Designer of the year winner, Danny Brown, is an exemplar of this attitude of experimentation and exploration of the medium. His recognition by the mainstream of the design profession is a reward and an encouragement to continue in a role that fits well with Michael Rock's proposition that a possible metaphor for designers' activity is that of performer[35].

The control the cartographer demands as the author over paths through information has also been examined. The cartographic author must select, distil and display, they must choose which particular facet of the available information is important to the intended audience. With the future prospect of the audience more actively defining itself and its preferences the cartographer/designer has to re-examine at what point in the process they shape and present the content. Of course, this is not to suggest that the user will suddenly demand complete control of the means of production and delivery of information, and it seems likely that the audience will continue to accept designers' work as meaningful representations. The designer's roles as interpreter and messenger look set to continue in many other means of production, but particularly on the WWW, the reader, now transformed into the user, seems set to revel in being the centre of attention.

In summary, the cartographic method is of gaining a wider perspective. Creating overviews and maps that provide meaningful and useful visualisations must lead designers to get involved earlier in the whole process of content creation and dissemination. Looking at examples of best practice of the cartographer's art illustrates how much can be learned. The other design disciplines mentioned earlier in this essay, interface and interaction design are opportunities for designers to bring their influence to bear.

"In the longer term, web design practice is likely to be subsumed by interface and interaction design, and we may then no longer distinguish interfaces - web, software, mobile phone - according to the technology behind them. Even these distinct design skills may eventually disappear and become part of every other design discipline, including graphic design."[36]

The bird's eye view of the cartographer is a useful vantage point for designers to look afresh at their practice in a new medium. Being able to organise and structure relationships with audiences, through the interactions and interfaces designed, is increasingly important. The clarity of thought and deed that good cartography demands is something to aspire to in web design.

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