

# Mapping Horizons

the common sense of here

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## Introduction

I am a maker and a thinker. I make to think and think to make. My work seeks to understand "common sense", the well understood and the shared. I want to know where the horizon is; I want to understand our sense of "here".

Since I was a child maps have fascinated me - that I can take the perspective of a God. Scale still confounds me. Through my work and my travels I seek to grasp it tangibly, and fail.

I am appalled by our parochialism, our narrowness and our disregard of our neighbours. I want to change that, perhaps through design. I want to live in what Brian Eno calls the "Big Here"<sup>1</sup>.

This is my motivation. The first task is understand how people form their common sense of "here" and this dissertation contributes towards that. Specifically it deals with the relationship between people and maps, how mass printing has embedded popular iconic maps into the culture and how new electronic forms create disparate representations tailored to the individual. A central question is to what extent a shared representation creates a shared understanding.

Firstly, I considered the nature of maps, specifically as the result of a mapmaker's process, which I shall argue embeds the values of the maker.

Secondly, representations of the World map are discussed, with the peculiar challenges of projecting a sphere onto a two-dimensional surface. Evidence will be cited to argue that popular representations of the World change the way in which people related to it and their place within it. The concept of an individual's mental map is introduced with a discussion of how this representation of the World is informed and support by the printed map.

Thirdly, by changing to the city scale I look at how everyday experience of a space shapes the mental map and the extent to which printed maps play a role. I take London as an example and

<sup>&</sup>lt;sup>1</sup>How could you not think of where I live as including at least some of the space outside your four walls, some of the bits you couldn't lock up behind you? I felt this was something particular to New York: I called it 'The Small Here'. I realised that, like most Europeans, I was used to living in a bigger Here.

Brian Eno, "The Big Here and the Long Now", The Long Now Foundation, http://longnow.org/essays/big-here-long-now/ (accessed 29<sup>th</sup> September 2011)

consider the iconic status of the London Underground map, critically examining the design of it, arguing that it shapes London for tourists and residents alike.

Finally, I look at the recent history of electronic mapping. The key observation I make is that highly personal and contextualised maps can now be generated by the computer for each and every interaction and that no two maps will be the same. This leads us to question to what extent this breaks down the basis of shared understanding. I argue that with the emergence of a more social and contributory Internet, electronic mapping can in fact support a common sense of the Big Here.

### Maps

Any serious discussion of mapping will start by reminding the reader that the map is an abstraction from reality, that the cartographer is actively selecting the features to include and exclude, setting them down according to largely artificial graphical conventions. I do not depart from this. However, a *good* map has a power and authority that readers too often find difficult to question, despite their knowledge of the artifice of maps, leaving them with false certainty. This is discussed at length elsewhere<sup>2,3</sup>.

I will focus on maps of real physical spaces and the attributes of that space, be they quantitative or qualitative. These are maps for locating oneself when moving in the World, maps for planning future movements and maps as a graphical backdrop to our everyday lives. Every map and reader has intentions, whether these match will determine if the information provided is more or less useful, or indeed distorted.

In subsequent sections I shall discuss maps at two scales, for the World and for a city. For printed maps, large-scale information excludes small-scale details and requires selectivity to make salient information visible. The choice of scale very much depends on the task at hand. For movement the speed and mode of transport determines this. The pedestrian needs a much finer grain knowledge of the environment, than does the motorist. The sailor or aviator has far fewer physical constraints on their movement and passes through the space at a greater speed.

A reductionist's analysis of maps concludes that they allow the traveller to judge paths between two locations and estimate the resources needed for that journey, usually the time or money required, often proportionally deriving from the physical distance. It is not always the case that the most expedient or direct path is chosen by the traveller.

The mental map is a key concept that I shall return to frequently. It is most simply put as the intuition of a space that remains when someone is in another place and maps are out of sight.

<sup>&</sup>lt;sup>2</sup> Denis Wood. The Power of Maps (London: Routledge, 1993).

<sup>&</sup>lt;sup>3</sup> Denis Wood, Ward Kaiser and Bob Abramms. Seeing Through Maps. (Oxford, England: ODT Inc, 2006).

## Maps of the World

Men have been drawing maps of the World for as long as they have been able to make marks. The boundaries of these worlds have grown with the maker's knowledge, from the vicinity to the island, to the continent, to the World. World maps, as drawn by Europeans, were only *complete* in a modern sense, after the mapping of Australia in the 17<sup>th</sup> Century. These maps are charming in their naiveté, staggering in their detail and belie the countless stories of bravery and barbarity that contributed to them. However, before the science of cartography matured in the 18<sup>th</sup> Century, World maps were largely illustrative, after this they become documents of enormous political power and propaganda.

Comprehensive and fascinating histories of mapping are to be found elsewhere<sup>4</sup>.

The popular modern era of mapping, from the 19<sup>th</sup> Century, is of interest here. Advances in printing technologies, specifically the introduction of steel rather than copper plate engraving, enabled far larger runs at reduced cost. This coincided with social reforms that finally lead to the introduction of free and compulsory education for children, at least in the United Kingdom. The geography of the World and in particular of the British Empire was part of every scholar's curriculum and a map, specifically Mercator's, a feature of every classroom wall.

Gerardus Mercator's World map was first published in 1569. This map and more importantly the process for creating this map represented a breakthrough in mapmaking of the World. The spherical nature of the globe requires the details to be unwrapped onto the two-dimensional surface of the map. Mercator presented a method for accomplishing this, which was later formalised mathematically. The name for such a translation is a projection.

<sup>&</sup>lt;sup>4</sup> Denis Wood. The Power of Maps (London: Routledge, 1993).



Figure 1. The World shown in Mercator's projection

While it is attractive to consider spherical representations that require no projection, many mapping tasks need the whole to be visible at once. Ptolemy recognised this in the 2<sup>nd</sup> Century and Lennart Berggren & Jones report that he "*refers to the two kinds of map, spherical and plane, and points out that although maps on spheres keep the earth's spherical shape and consequently preserve perfectly the relative proportions of intervals on the earth, they are usually too small to show all the things one wants to map, and they cannot be surveyed by the eye in a single glance."<sup>5</sup>* 

Different mathematical projections result in quite different maps and views of the World. It is important to consider that unlike a small town, which may be observed from a nearby church tower or hill, there was no *objective* truth against which a World map could be compared until 1968. The Earthrise photograph, taken on the Apollo 8 mission and later the Blue Marble, taken

<sup>&</sup>lt;sup>5</sup> J. Lennart Berggren and Alexander Jones. Ptolemy's Geography: An Annotated Translation of the Theoretical Chapters. (Princeton, USA: Princeton University Press, 2000), p. 31.

on from Apollo 17 in 1972, became icon images of a unified World. Even today the change from human to global scale requires a leap of imagination. For these reasons we can accommodate and accept a wide variety of maps as being *true* representations.

The Mercator projection has, particularly in the 20<sup>th</sup> Century, been criticised for the manner in which it represents the World, specifically the relative size of landmasses. Often cited the underrepresentation of Africa, the artificial domination of Europe and the incredible enlargement of Greenland. Alternatives such as Gall's Orthographic Projection of 1885 are equal area projections designed to address the deficiencies of Mercator, but they do this at the expense of distorted shapes. Many attempts have been made in history to create the *perfect* projection that does not distort either shape or area, but this is a fruitless endeavour.

Wood, Kaiser and Abramns<sup>6</sup> persuasively argue that in addition to the selectivity a cartographer must exercise when drawing a map, a series of trade-offs must inevitably be made too. These will be motivated by the map's purpose; the reason the map was drawn in the first place. Returning to Mercator's map we discover its original title, "Nova et Aucta Orbis Terrae Descriptio ad Usum Navigantium Emendata" or the "New and Augmented Description of Earth Corrected for the Use of Sailors". The map ingeniously ensures that any compass bearing set will appear as a straight-line on the map, but in doing so the areas of the land become distorted.

When Arno Peters, presented his Peter's Projection in 1974<sup>7</sup>, he labelled the Mercator map as racist and imperialist. This claim resonated at time of social change and liberalism. His projection was based on Gall's orthographic projection, originally published in 1855, one that preserves area at the expense of shape accuracy. Since then representations of the World have somewhat diversified. Most frequently the so-called compromise projections are used today. These try to balance area and shape preservation, examples of these are: Van der Grinten, Robinson and Winkel Tripel.

The trade-off between shape and area preservation is not the only decision to be taken by the cartographer when designing a map. With a projection of a sphere any point represents a legitimate centre and this choice forces other places to the edges. The orientation of the map is

<sup>&</sup>lt;sup>6</sup> Denis Wood, Ward Kaiser and Bob Abramms. Seeing Through Maps. (Oxford, England: ODT Inc, 2006), p. 19-20.

<sup>&</sup>lt;sup>7</sup> Denis Wood, Ward Kaiser and Bob Abramms. Seeing Through Maps. (Oxford, England: ODT Inc, 2006), p. 22.

also a design decision, by convention with North aligned to the top of the page. Following the International Meridian Conference in 1884, a graphically and politically pleasing image of the World is formed centring the map at zero degrees of longitude and latitude. Europe and specifically the United Kingdom is at the centre of the map, "on-top" of the World, with a neat divide at the Bering Strait and through the Pacific Ocean and along the International Date Line. Maps centred on the Americas and Japan do occur, but the dominant popular image has been Eurocentric.



Figure 2. The Surrealist Map of the World (1929)

The Surrealist Map of the World (Figure 2) drawn by an unknown artist in 1929, parodies both the choice of centre and relative size of countries.



Figure 3. McArthur's Universal Corrective Map of the World (1979)

The McArthur's Universal Corrective Map of the World<sup>8</sup> (1979) presents a "south up" map and is accompanied by the following text:

At last, the first move has been made - the first step in the long overdue crusade to elevate our glorious but neglected nation from the gloomy depths of anonymity in the world power struggle to its rightful position -- towering over its northern neighbours, reigning splendidly at the helm of the universe.

Never again to suffer the perpetual onslaught of "downunder" jokes -- implications from Northern nations that the height of a country's prestige is determined by its equivalent spatial location on a conventional map of the world.

This map, a subtle but definite first step, corrects the situation. No longer will the South wallow in a pit of insignificance, carrying the North on its shoulders for little or no recognition of her efforts.

Finally, South emerges on top.

Spread the word. Spread the map! South is superior. South dominates!

Long live AUSTRALIA -- RULER OF THE UNIVERSE !!

<sup>&</sup>lt;sup>8</sup> Denis Wood, Ward Kaiser and Bob Abramms. Seeing Through Maps. (Oxford, England: ODT Inc, 2006), p. 51.

The flag of the United Nations designed by Donal McLaughlin in 1945, also emphasises the political nature of choice orientation and centre, technically an azimuthal equidistant projection about the North Pole.

Historically maps have been oriented in a variety of ways, indeed the word derives from the Latin *oriens* meaning east, the direction of the rising sun. The ancient T-O Maps presented the known World with east at the top of the page. Where the Mediterranean, Nile and the Don form the T, dividing Asia, Europe and Africa. The O denotes the surrounding ocean.

In these maps the viewpoint of the reader is invariably at 90 degrees to the surface of the Earth and as such height is compressed, represented only with illustrative peaks of mountains or will abstract contour lines. This is again arguably the product of maps intended for sailing, where all is at sea level.

While a study of the design and politics of mapping is fascinating, I must not elaborate further. I am seeking to understand how these decisions change the attitudes and behaviours of those exposed to them in their everyday lives. Psychologists and Geographers have long studied the *mental maps* that people hold in their heads, the internal representation of space used to reason about the World when the map is out of sight. A common technique in probing these is to ask the participant to draw a map on paper of region of their local environment or the World, from memory. Unsurprisingly these maps are most detailed and centred at the subject's immediate vicinity, becoming more abstract towards the edges. No two people will draw exactly the same map, but the agreements and common misconceptions can reflect the common sense of a place.

In Saul Steinberg's cover for the New Yorker in 1976, "The World As Seen From New York's 9th Avenue", he satirises the narrow worldview of a stereotypical New Yorker<sup>9</sup>.

<sup>&</sup>lt;sup>9</sup> Frank Jacobs, "The World As Seen From New York's 9th Avenue", Strange Maps, 7<sup>th</sup> February 2007, http://bigthink.com/ideas/21121 (accessed 29<sup>th</sup> September 2011)



Figure 4. Saul Steinberg's, "The World As Seen From New York's 9th Avenue", The New Yorker, 29th March 1976

Professor Thomas Saarinen, of the Department of Geography at the University of Arizona, has studied the mental maps held by people across the World. In 1986, his team asked first-year geography students, from every continent, to sketch maps of the World from memory. In the first analysis of these drawings, "Centering of Mental Maps of the World"<sup>10</sup>, they found a bias to create Eurocentric maps regardless of the author's origin and attributed this to the dominant image of the world centred about zero degrees of longitude and latitude. **Figure 5** shows the distribution of Eurocentric maps drawn according to the longitude of the maker.



Figure 5. Saarinen's Graph of Percentage of Eurocentric Sketch Maps by Longitude

A further analysis described in "Relative Size of Continents on World Sketch Maps"<sup>11</sup> found a surprising conclusion. As predicted the home continent was in general exaggerated in size with respect to the others. However, they also found that Europe was consistently exaggerated and Africa diminished in size regardless of the origin of the mapmaker. The size of Greenland was often also enlarged. The authors squarely attributed these findings to the pervasive Mercator projection:

<sup>&</sup>lt;sup>10</sup> Thomas Saarinen. "Centering of Mental Maps of the World." National Geographic Research 4(1) (1988): 112-127.

<sup>&</sup>lt;sup>11</sup> Thomas Saarinen, Michael Parton and Roy Billberg. "Relative size of continents on world sketch maps." Cartographica 33(2) (1996): 37-47.

The mental maps indicate that we live in a Eurocentric World. Not only do these maps tend to be centred on Europe (Saarinen 1988), but the size of Europe was exaggerated and much greater detail was included for it. This is hardly surprising. The concept of world maps first originated in Europe. The most popular of the world maps used to date, the Mercator projection, tends to exaggerate the size of Europe. Furthermore, in much of the world, the textbooks containing geographic information originate in Europe.

Saarinen's conclusions clearly support the political analysis of Mercator that Peters had made and indicate strongly that mental maps of the World are informed by the maps to which we are exposed. In 1986 when Saarinen's data was collected for many the Mercator image would have still been dominant, as the switch to compromise projections continued. Their argument clearly demands data on how mental maps changed since then. I would expect the relative sizes of the landmasses to be better reflected, but that other features such as Eurocentricism and orientation to be unchanged.



Figure 6. The Author's Map of the World (2011)

In order to better understand the mental maps which are the basis of Saarinen study I drew my own map of the World from memory (Figure 6). This map was produced quickly and its incorrectness and naiveté are readily apparent to any observer and its maker. The act of creating an image like this makes public all ignorance and uncertainty, it is an extremely selfconscious act. As I previously stated it is impossible for an individual to again such a viewpoint on the World. It rapidly became apparent that the task was to reproduce the maps I had seen before, as accurately as I could. I had no other way to conceptualise the task. The regions of most familiarity are most detailed, others simply an ill-defined landmass. Some coastlines are supported with a strong simile, the boot of Italy and the nose of France. Some lines are just indicative, the islands of Greece, others specific. However each line communicates with the same confidence. The act of committing the image to the paper requires that the spatial arrangement of places be compromised, that the map fills the page and the aspect ratio is satisfied.

In completing this exercise myself, I both conclude that maps utterly shape my conception of the World and that the resulting drawing hides much of its subtlety and the uncertainty. Like any map it is a compromise.

## Maps of the City

The challenges and conventions for mapping urban spaces share much with depicting the World, but there are significant differences too. Most obviously the change of scale allows far greater detail to be shown, yet there the mapmaker still editorialises the space. The choice of centre is again telling, but the selection of the boundary is far more important as it leads to places literally being off the map.

Many urban maps subtly manipulate the orientation of the map in response to the plan of city. The grid system of roads in Manhattan is grounded in the language of the compass; however it deviates considerably from North. In fact the remnants of a prior grid system aligned to True North can be found to this day in the south of the island. Charles Petzold<sup>12</sup> calculates that the deviation is around 29 degrees. Maxwell Roberts<sup>13</sup> finds that London is rotated 12 degrees and Paris 22.5 degrees according to their respective subway maps.

Urban maps not only reflect a space as it is, but are a key tool in planning how it will become. Denis Cosgrove discusses in his essay Carto-City<sup>14</sup> how the technology of mapping begins to be reflected in the nature of the city. This is most obvious for new towns and those undergoing major rebuilding programmes, where the image of the map can be most successfully imposed. A curious example of this is Ciudad Evita in Argentina, here a residential district was built forming the profile of Eva Perón.<sup>15</sup> More conventionally city plans can help to assist the transfer of people through the space, giving the city a legibility and order. The ideology of the grid system is particularly dominant in American cities, especially in the west, where grids were imposed over any landscape, supporting the values of Capitalism and the automobile.

The urban map is predominantly a map of voids and private space, of the outdoors. Only the pavements, roads and railways are accessible and the line that the crow-flies is almost always impossible. The city may too have impenetrable geological features, such as river or cliff. The

<sup>&</sup>lt;sup>12</sup> Charles Petzold, "How Far from True North are the Avenues of Manhattan?", July 2005,

http://www.charlespetzold.com/etc/AvenuesOfManhattan/ (accessed 29th September 2011)

<sup>&</sup>lt;sup>13</sup> Author interview with Dr Maxwell Roberts, Department of Psychology at the University of Essex, 14th July 2011.

<sup>&</sup>lt;sup>14</sup> Janet Abrams and Peter Hall. Else/Where: Mapping New Cartographies of Networks and Territories. (Minnesota, USA: University of Minnesota Design Institute, 2006), p. 155.

<sup>&</sup>lt;sup>15</sup> Frank Jacobs, "The Face That Launched 1,000 Pavements: Ciudad Evita", Strange Maps, 13th December 2008, http://bigthink.com/ideas/21399 (accessed 29th September 2011)

distance between two points on the map is therefore not the length of the line between them (mathematically the Euclidean Distance), but is always a longer path through adjoining public network (be it path, road or rail). Moreover in a city, restrictions due to congestion or timetabling further complicate the *distance* between two places. It can be more instructive to consider the duration of travel between locations, give the time of day and mode of transport. There is a complex relationship between space and time in the city.

As noted in the previous section it might be expected that an individual familiar with a town or city will have an accurate mental image of its layout. Further that there might be viewpoints that can be visited from where that map is verifiable.

In Kevin Lynch influential book of 1959, "The Image of the City"<sup>16</sup>, he presents a study of three American cities: Boston, Jersey City and Los Angeles. He wanted to understand how the inhabitants made sense of each of them and around; Lynch's study is one of the seminal works in the study of mental maps. To this end he and his team interviewed thirty people in Boston and fifteen in both Jersey City and Los Angeles, who lived or worked in the area in question. Each city had a different form and character.

Through these interviews Lynch began to gain an insight on the *imaginability* city, how apparent, legible or visible its form is to the resident. He comments:

If our sample is representative, almost any Bostonian can tell you much of his city. Equally likely, he could not describe some other things, such as the triangular area between the Back Bay and the South End, the no-man's land of North Station, how Boylston Street runs into Tremont Street, or what is the pattern of paths in the financial distinct. (page 20)

With repeated interviews, photograph recognition tasks and by seeking directions from strangers in the field, Lynch identified areas in each city that are consistently more and less difficult for people to imagine and describe. His analysis then considers why this might be so. His central contention is there exists a public image of the city, which considerably overlaps with the images held by individual denizens and that this public image is a product of the physical and perceptual features of the city.

<sup>&</sup>lt;sup>16</sup> Kevin Lynch. The Image of the City. (London: M.I.T. Press, 1960). **24** 

Lynch introduces five categories that he finds sufficient to code the elements of a city. Those are: paths, edges, districts, nodes and landmarks.<sup>17</sup>

*Paths* are the channels along which the observer customarily, occasionally, or potentially moves. They may be streets, walkways, transit lines, canals, railroads. [...]

*Edges* are the linear elements not used or considered as paths by the observer. They are boundaries between two phases, linear breaks in continuity: shores, railroad cuts, edges of development, walls. [...]

*Districts* are medium-to-large sections of the city, conceived of as having two-dimensional extent, which the observer mentally enters 'inside of,' and which are recognizable as having some common identifying character. [...]

*Nodes* are points, the strategic spots in a city into which an observer can enter, and which are intensive foci to and from which he is traveling. They may be primary junctions, places of a break in transportation, a crossing or convergence of paths, moments of shift from one structure to another. Or the nodes may be simply concentrations, which gain their importance from being the condensation of some use or physical character, as a street-corner hangout or an enclosed square. [...]

Landmarks are another type of point-reference, but in this case the observer does not enter within them, they are external. They are usually a rather simply defined physical object: building, sign, store, or mountain. [...]

Through this model of mental maps Lynch was able to code and identity the common problems that residents and visitors encounter with each city.

Again to understand better this process I have produced the map in Figure 7. This shows Ipswich, the town in which I have lived for thirty years. The town has an area of approximately 15 square miles and there exists no popular graphical representations of it. Intuitively I should have a practically perfect mental model of the town, however the abstract process of producing an urban map proved very difficult, much more difficult than the World map. While I had a clear picture of most junctions and a concept of the road's course, the constraints of the page forced these local features to become reconciled into a holistic pattern. Creating a consistent scale was quite problematic. As a result the drawing produced is a modification of my instinct. However, the exercise did highlight areas of Ipswich that I do find difficult to visualise and find difficult in planning routes. My intention is not to discount this method of probing mental maps, but simply to pull into focus the artifice and the need to record the process and dilemmas of the participant.

<sup>&</sup>lt;sup>17</sup> Kevin Lynch. The Image of the City. (London: M.I.T. Press, 1960), p. 47.



Figure 7. The Author's Map of Ipswich

The question of concern here is to what extent can a map inform and support or contradict the mental map of a city. To do this we shall consider the city of London.

One may sail easily round England, or circumnavigate the globe. But not the most enthusiastic geographer...ever memorized a map of London. Certainly no on ever walks round it. For England is a small island, the world is infinitesimal among planets. But London is illimitable.<sup>18</sup>

Ford Madox Ford wrote this in 1905, today it is even truer, perhaps with the exception of the licensed taxi drivers who have passed the Knowledge, no one can know London. In fact neurological studies of these cabbies show an unusual development of the hippocampus area, associated with navigation, which grows larger the more experienced they become.<sup>19</sup>

In Mapping London (2007), Simon Foxell wrote. "London by its very complexity and size demands travel maps".<sup>20</sup> He contends that the three most significant and enduring representations of London are the London Underground diagram by Harry Beck (1931), the A-Z by Phyllis Pearsall (1936) and the London edition of the Monopoly board game published by John Waddington Ltd (1936). As Foxell notes the coincidence of these events is curious. The aerial view of the river Thames at the Isle of Dogs and Greenwich Peninsula may arguably be added to this list, forming the opening sequence of the BBC's Eastenders since 1985. The London Underground Map is the only one of these to present a single holistic image of the city.

The London Underground map is today used by millions of tourists and denizens alike. It is rightly regarded as "design classic". I want to consider here to what extent has it become their understanding of London. Excellent histories of the network and the map are available elsewhere<sup>21</sup>.

<sup>&</sup>lt;sup>18</sup> Ford, Ford Madox. The Soul of London. (London: Duckworth, 1905), p, 15.

<sup>&</sup>lt;sup>19</sup> BBC Online, "Taxi drivers' brains 'grow' on the job", BBC, 14th March 2000, http://news.bbc.co.uk/1/hi/677048.stm (accessed 29th September 2011)

<sup>&</sup>lt;sup>20</sup> Simon Foxell. Mapping London - making sense of the city. (London: Black Dog Publishing, 2007), p. 125.

<sup>&</sup>lt;sup>21</sup> Garland, Ken. Mr. Beck's Underground Map. (London: Capital Transport Publishing, 1994).



Figure 8. Unknown artist, "Absolutely Simple." Punch Magazine, Volume 136 (1st September 1909) page 162.

By the early years of the 20<sup>th</sup> Century the London Underground Railway had grown rapidly and the complexity of navigating the network was well acknowledged. This cartoon appeared in Punch magazine in 1909<sup>22</sup>.

Early tube maps experimented with multiple ways to show the new underground network. Designers quickly started dispensed with the above ground road network (see Figure 9). I am convinced this is an extremely significant decision, far more than regularly acknowledged. It reflects the nature of underground travel that passengers move through darkness, anonymous voids between brightly lit stops. It is almost a cinematic or dreamlike experience.

With the external world removed, speed and therefore distance travelled is more difficult to judge. Time past becomes a better measure. For Zone One at least, many Londoners count the stops along the route and use a "two minute per station" rule to estimate journey times and therefore distance. Bearing is also largely unknowable.

By 1927 many of the features we associate with the modern Tube Map were already apparent (see Figure 10). The association between the stations and physical geography of London had already been loosened, with different lines identified by distinct and consistent colours. The Waterlow & Sons map of 1908 (Figure 9) had even introduced a disproportional scaling, stretching the map east-west. I therefore prefer to see Beck's 1931 diagrammatic map (Figure 11) as a logical, yet inspired, extension of previous mapping practice. When introduced it offered a clear improvement over Stingemore's map (Figure 10) that had previously been in circulation and the public, as Ken Garland puts it, started "devouring the map"<sup>23</sup>.

 <sup>&</sup>lt;sup>22</sup> Unknown artist, "Absolutely Simple." Punch Magazine, Volume 136 (1st September 1909) page 162.
<sup>23</sup> Janin Hadlaw, "The London Underground Map: Imagining Modern Time and Space." Design Issues, Vol. 19, Issue 1 (2003): 25 - 36.



Figure 9. The London Underground, Waterlow & Sons Ltd (1908)



Figure 10. The London Underground, Stingmore (1927)



Figure 11. The London Underground, H. C. Beck (1931)



Figure 12. The Tube Map, Transport for London (2011)

Beck's design rules are deceptively simple, that a line may run horizontally, vertically or at a 45 degree angle and only the lines are to be shown, identified by distinct colours.

To understand Beck's design I went to meet Maxwell Roberts, a psychologist at the University of Essex who studies underground maps of the World and who explores and evaluates alternative designs. In doing so he understands well the design challenges presented by London.

Roberts calls Beck's rules those of "octolinearity", that that a line may continue in one of eight directions. He wants to create the "the periodic table of map design" and to accomplish this creates redesigns of maps using modified versions of the rules. For instance where only four path directions are allowed or where the angle is at 60 degrees.

In talking to Roberts he highlights specific areas of the London map that become problematic. The implicit rule that each station must be labelled, using the same sized font and that the label must not cross a line creates a tension immediately in the crowded centre of the map. Here long names are common, for instance Tottenham Court Road. In addition the map should fill the page and appear well balanced. For London the presentation has always been in landscape. The effect of this foreshortens the extremities of the network and expands the centre. Again map-making is a complex process of resolving a logic puzzle of interdependencies.

It is no mistake that the centre of the map lies in the area of Covent Garden and Leicester Square, the heart of tourist London. As previously noted the orientation of the map is adjusted by approximately 12 degrees.

The map has changed only gradually over 80 years since Beck and its reproduction is tightly controlled and authorised only by Transport for London (Figure 12). The image is culturally embedded and rightly considered a "design classic". Our familiarity with the form of the map is exploited in Simon Patterson's Great Bear (1992) where station names are replaced with people from history, the lines are themed for instance philosophers and interchanges suggest interesting juxtapositions. Another artwork, David Booth's Tate Gallery by Tube (1986) abstracts the map to reflect only its shape.

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Having spoken to Roberts I suspect that the Underground Map was designed with any explicit political motivation far less than I had previously. The rules once set create a very few set of graphically pleasing "solutions", within the confines of the page. The map does however certainly have socio-political outcomes, not least the drawing-in of the suburbs.

Criticism of the Tube Map is commonly direction at the misrepresentation of distance between stations, Bill Bryson expresses this view in his Notes from a Small Island<sup>24</sup>:

Here's an amusing trick you can play on people from Newfoundland or Lincolnshire. Take them to Bank Station and and tell them to make their way to Mansion House. Using Beck's map [...] they will gamely take a Central Line train to Liverpool Street, change to a Circle Line train heading east and travel five stops more. When eventually they get to Mansion House they will emerge to find they have arrived at a point 200 feet further down the same street.

Now take them to Great Portland Street and tell them to meet you at Regent's Park (that's right, same thing again!), and then to Temple Station with instructions to rendezvous at Aldwych.

This kind of analysis of Beck's map is grounded in a very specific judgment of the value of time. Bryson's hypothetical tourists do after all end up safely at their destinations. As Robert Levine reminds us in "A Geography of Time"<sup>25</sup> concepts of time, of lateness and of now change across the World. No doubt the modern city operates at a very different tempo to the London of the 1930s that Beck knew.

Bryson also implies that Londoners do not make these kinds of navigational errors. While this may appear to be common sense, Zhan Guo, an Assistant Professor of Urban Planning and Transportation Policy at New York University, found evidence to the contrary. He studied journeys made on the London Underground between 1998 and 2005, looking at route choice, concluding:<sup>26</sup>

The case study on the London Underground confirms that a schematic transit map indeed affects passengers' path choices. Moreover, the map effect is almost two times more influential than the actual travel time. In other words, Underground passengers trust the tube map (two times) more than their own travel experience with the system. The map effect decreases when passengers become more familiar with the system but is still greater than the effect of the actual experience, even for passengers who use the Underground five day[s] or more per week.

<sup>&</sup>lt;sup>24</sup> Bill Bryson. Notes from a Small Island. (London: Black Swan, 1996), p. 54.

<sup>&</sup>lt;sup>25</sup> Robert Levine. A Geography of Time. (Oxford, England: Oneworld Publications, 2006).

<sup>&</sup>lt;sup>26</sup> Zhan Guo. "Mind the Map! The Impact of Transit Maps on Path Choice in Public Transit." (Transportation Research Part A: Policy and Practice, Vol. 45, 7, (2011): 625–639), p. 638.

#### Guo later considers how transit maps may further shape our sense of the city.<sup>27</sup>

However, the impact of the transit map likely goes well beyond the transit system. Transportation networks often act [as] a backbone in people's cognitive map (Lynch, 1960). A transit network, the subway in particular, could potentially reshape the mental map of an urban space in at least two ways. First, underground travel substitutes surface travel and "deprives" the passenger of a chance to form a spatial cognition through one's own experience. Second, a transit map often offers alternative "assistance" with a clear, simplified, stable, and widely-published depiction of the urban structure. Deprivation and assistance, acting as push-and-pull forces, often occur at the same time and place, reinforcing the impact of the transit map on spatial cognition.

Specifically, a transit map may affect three elements of a cognitive map: boundary, landmark, and perceived distance. Subway lines often act as boundaries of different areas in a metropolitan region. A circumferential line might become the unofficial definition of a downtown or urban center (e.g., London, Chicago, Moscow, Berlin, Beijing). When different fare zones are adopted, they often become a proxy of different real estate markets. Major subway stations often become new or reinforce existing landmarks in a cognitive map. In some cases, the number of stations, rather than the number of miles or kilometers, is used by the public to measure distance.

The degree to which the Underground map shapes mental maps of London is further developed by Janet Vertesi of Cornell University in her paper, "Mind The Gap" (2008). In this study she asked people to "draw me London" and discussed the maps are they were drawn. The subjects had access to both the A to Z and the Underground map for reference. Vertesi reports:<sup>28</sup>

It quickly became clear that the Tube Map unquestionably influences how Londoners and visitors conceptualize London's above-ground layout.

For many subjects, the Tube Map defines what is and what isn't London, giving a sense of what is 'on' or 'off' the map. One subject even began her mapping exercise by drawing a large square and declaring, "*This is the Tube Map, the big one that they have on the walls in the stations*". The map may define city limits, as in Zone 1 (central London) or up to Zone 6 (where Heathrow is located), or simply identify London neighbourhoods through station names; one subject stated, "*It's on the Tube Map, therefore it must be London*" and claimed she chose her apartment not so that she would be "*on the map*."

As noted previously an urban scale map needs to define the edge of the map, what is on and off the map. The tube map further emphasises presenting a complete form that is completely contained within the page. There is no suggestion of places beyond. The extent to which this

<sup>&</sup>lt;sup>27</sup> Zhan Guo. "Mind the Map! The Impact of Transit Maps on Path Choice in Public Transit." (Transportation Research Part A: Policy and Practice, Vol. 45, 7, (2011): 625–639), p. 630.

<sup>&</sup>lt;sup>28</sup> Janet Vertesi. "Mind The Gap: The 'Tube Map' as London's User Interface." (CHI 2005 Workshop on "Engaging the City" (2005)), p. 2.

separation is embedded in the culture is suggested by Stephen Walter's map of London 'The Island' (2008) parodies the isolation of London forming a literal coastline.

Vertesi continues:

Interestingly, while many interviewees began by drawing the Thames as the "*backbone*" of the city, all confessed that they did not know exactly "*how the river goes*." Thus the Tube Map's abstract and geometric pattern for the Thames, its only above-ground feature, informed mappers that it was there and essential, but not how it actually 'goes'.

The River Thames has been a constant on the map and the only geological feature represented. However, as shown it does follow Beck's rules of octolinearity, with the only the key bends preserved. Functionally it presents the traveller of a geographical barrier that must be negotiated when on foot, creating distance between otherwise nearby stations. Anecdotally apart from the meander at Greenwich, popularised by Eastenders title series, the few Londoners have a good model of the river's path. The existence of the northerly heading section at Westminster is often a surprise.

When in September 2009 the river was removed from the map this was met with a public outcry, drawing attention from the Evening Standard<sup>29</sup> and an intervention by the Mayor of London. It was rapidly returned. The icon of the city, that is the London Underground map, is jealously guarded by Londoners. Vertesi notes this:<sup>30</sup>

Alternatives to the Tube Map have been proposed by map enthusiasts and Transport for London alike, the most recent designs attempting to make better use of psychological principles to present a map that is easier to read and truer to London's geography, or to display wheelchair accessibility and walk times between stations. Resistance to these alternate maps, however, is extremely strong, because these alternate designs fail to appreciate the deep structural and practical role the current map plays as the interface to the city.

However, as Maxwell Roberts pointed out in our interview, the Tube Map is today under pressure as it strains to incorporate the increasing complexity of the network. Transport for London now regularly show the full mainline and underground map for Greater London at stations, drawn according to Beck's rules. While it feels familiar, the detail is bewildering. Even

<sup>&</sup>lt;sup>29</sup> Ross Lydall and Katharine Barney, "Boris Johnson puts River Thames back on the map", London Evening Standard, 17th September 2009, http://www.thisislondon.co.uk/standard/article-23745427-boris-johnson-puts-river-thames-backon-the-map.do (accessed 29th September 2011)

<sup>&</sup>lt;sup>30</sup> Janet Vertesi. "Mind The Gap: The 'Tube Map' as London's User Interface." (CHI 2005 Workshop on "Engaging the City" (2005)), p. 4.

the simple colour-coding of lines fails to scale to this complexity, with indistinct dashes and textures needed to supplement the set. For the core network the Crossrail link is to become operational in 2018 will require significant alternations to the northern path of the map. In addition Transport for London wish to relieve congestion on the underground network by promoting bus and bike travel. A map following Beck's rule, integrating all of these would surely fail. Roberts has tried breaking Beck's rules:<sup>31</sup>

As urban rail networks around the world grow and develop, so the challenge to designers to create attractive usable maps increases. What are the hallmarks of a well-designed map versus a poorly designed one? Are Henry Beck's rules (horizontal and vertical lines and 45 degree diagonals) really the optimum means of achieving the best possible design? What happens if we break the rules? There will be many surprises: the quality of design seems to matter more than the rules, and different rules suit different networks.

Roberts has created a set of Tube Maps following different variant of Beck's rules and applied them to different cities of the World. Some rules he finds better suits the underlying city. His most successful map of London he calls the "Curvy Map" (Figure 13) which seeks to eliminate corners. This work is summarized in his 2009 article, "Henry Beck Rules, not OK?"<sup>32</sup>. In experiments Roberts' curvy map performs favourably in comparisons with octolinear representations with faster journey planning and fewer errors made.<sup>33</sup> For Roberts to seriously challenge the existing map, will I think be as big a change as the introduction of the Beck map in 1931 and no doubt be meet by polarised opinion. For myself I find the curvy map unsettling and spidery. Maxwell points out that subjective judgments do not necessarily predict objective performance. It is unclear how this map would alter our sense of the city.

While there is resistance to change the rise in Electronic Mapping suggests this may not be intransient. That is the subject of the next section.

<sup>&</sup>lt;sup>31</sup> http://privatewww.essex.ac.uk/~mjr/underground/lectures.html (accessed 29th September 2011)

<sup>&</sup>lt;sup>32</sup> Maxwell Roberts, "Henry Beck Rules, not OK? Breaking the Rules of Diagrammatic Map Design", 2009,

http://privatewww.essex.ac.uk/~mjr/underground/Breaking\_the\_rules.pdf (accessed 29th September 2011) <sup>33</sup> Maxwell Roberts, Elizabeth Newton and Fabio Lagattolla. "Objective and Subjective Measures of Metro Map Usability: Investigating the Benefits of Breaking Design Rules". Unpublished manuscript (2010).



Figure 13. Roberts' Curvy London Underground Map (2008)

# **Electronic Maps**

In 1942 John Wright wrote, "*Maps are drawn by men and not turned out automatically by machines*".<sup>34</sup> He was highlighting the subjectivity of maps and the dispassionate objectivity of the machine. Today in 2011 many of our maps are electronic creations of the machine, but they are nonetheless subjective and embedded with values of men.

For the past thirty years mapping has become increasingly electronic. Organisations initially digitised their assets for internal use and latterly provided digital content directly to the consumer.

For example the Automobile Association (AA) fully computerised their Home Routes Service in 1984, followed by the Overseas Routes Service in 1987. By 1999 the new AA website offered free route planning service.<sup>35</sup> The Ordnance Survey (OS) completed digitisating their maps of Great Britain in 1995, the first country to accomplish this. The OS has since offered a range of data products under licence.<sup>36</sup>

As the Internet became more pervasive in the 1990s and into the new century websites for producing maps and directions became essential fixtures in the online landscape. Notably MapQuest (1996), Multimap (1996), Google Maps (2005) and Google Earth (2005). Today in 2011 Google dominates the electronic mapping market, providing the traveller with a view of their journey, whether printed (typically A4 or Letter sized paper) or displayed on the screen of a mobile device.

The combination of mapping and routing technologies with global position has been a powerful one; key to this the American GPS (Global Positioning System). GPS was developed in 1973 for the exclusive use by the military. A free, yet degraded, signal became available for civilian use after President Regan ordered it in 1983. He was responding to an incident where a Korean Air Lines flight strayed into prohibited Russian airspace and was shot down, with the loss of 269

<sup>&</sup>lt;sup>34</sup> Wright, John. "Map Makers Are Human: Comments on the Subjective in Maps." (JSTOR: Geographical Review, Vol. 32, No. 4 (1942): 527-544), p. 8.

<sup>&</sup>lt;sup>35</sup> http://www.theaa.com/motoring\_advice/about\_aa/history-of-aa-routes-service.html (accessed 29<sup>th</sup> September 2011)

<sup>&</sup>lt;sup>36</sup> Wikipedia contributors. "Ordnance Survey", Wikipedia, http://en.wikipedia.org/wiki/Ordnance\_Survey (accessed 29th September 2011)

civilian lives. In 2000 this policy of "Selective Availability" was ended and a free high-precision signal was globally available.<sup>37</sup>

The availability of GPS occurred just as the price and size of receivers continued to fall and as a consequence public use flourished. The technology was adopted first by maritime users, then for cars and latterly for pedestrians. In 2002 Tom Tom released its first navigation product for car drivers, using a combination of on-screen graphics and a spoken synthesised voice. Routes were automatically calculated, given a start and end position, with the driver taken through a series of turn-by-turn directions. Pedestrian use of location-based services, via smart phones with embedded GPS, is now in the pockets of millions and growing rapidly.



Figure 14. Google Earth

Many features of electronic maps are familiar to us and are historically routed; others are quite radical departures from what came before. One of the most striking differences is the arbitrary amount of detail that can be shown, the ability to zoom in or out from a location, often with a seamless transition. The designers of Google Maps and Earth acknowledge the influence of the

<sup>&</sup>lt;sup>37</sup> Wikipedia contributors. "Global Positioning System", Wikipedia,

http://en.wikipedia.org/wiki/Global\_Positioning\_System (accessed 29th September 2011)

short film, Powers of Ten, made by Ray and Charles Eames in 1968<sup>38</sup>. Jason Farman draws our attention to the photographic quality of these images: <sup>39</sup>

While photographs are often associated with a photographer (the 'witness' snapping the shutter in a specific moment in time), satellite and aerial photographs used in programs like Google Earth are more commonly associated with the machinery that produces them than the person or organization capturing or compiling them. This association between machine and product distances maps like Google Earth from a sense of subjectivity and instead emphasizes the objective nature of photographic representations of Earth.

Unlike the foldable reconfigurable paper map, the small screens of today's mobile devices restrict the view, arguably removing context. However, the now practically ubiquitous *Slippy Map* interface alleviates this to some degree, allowing the user to push the map off the screen to expose an unseen area. The ability to store and instantly access remote data also makes electronic maps vastly more portable than their paper counterparts. This means that relevant maps can be with the user throughout their journey, always at hand. No longer does the traveller have to commit their route to memory. Psychologists know this as *Distributed Cognition*.

The ability to filter specific attributes of the map depending on the task, means a route may be created that excludes all but the roads and landmarks of concern. Related to this arbitrary information, if *geo-located*, can be included on the map. This can include sensor data and other real-time feeds that as Owen and Collingridge<sup>40</sup> phrase it "inhabit the map", creating a model of space in its current state.

The inhabited map may display real-time traffic, weather or pollution information that a traveller may use to inform their journey. It may also include the real-time positions of other individuals, potentially their friends and associates. Services such as Google Latitude and Grindr point to this. Where data on crowds of people is collected this can inform a real-time understanding of how people interact with a space. Foxell<sup>41</sup> describes the work of Space Syntax and the Intelligent Space Partnership who in 2006 both created maps of how pedestrians where moving

<sup>&</sup>lt;sup>38</sup> Powers of Ten, Charles and Ray Eames, 1968.

<sup>&</sup>lt;sup>39</sup> Jason Farman. "Mapping the digital empire: Google Earth and the process of postmodern cartography." (New Media Society 12 (2010): 869), p. 11.

<sup>&</sup>lt;sup>40</sup> Roger Fawcett-Tang. Mapping Graphical Navigation Systems. (Mies, Switzerland: RoboVision, 2008), p. 67.

<sup>&</sup>lt;sup>41</sup> Simon Foxell. Mapping London - making sense of the city. (London: Black Dog Publishing, 2007), p. 139.

around London. Through this key arteries were be identified, which lead to some surprising insights on how the city really worked. This kind of understanding can feed directly back to urban planning.

The digital representation of mapping data: roads, buildings, terrain etc allows the data to be rendered in a variety of forms, not only graphically, but verbally and acoustically. Research continues into electronic tactile maps, particularly for blind and particularly sighted users<sup>42</sup>. Forms of Virtual and Augmented Reality allow people to be placed directly into the map.

To return to the central question of this dissertation, how the popular use of these maps changes the ways in which people relate to space. I spoke with psychologist Emily Webber<sup>43</sup>, a researcher at Nottingham University:

Research has shown that the use of such navigation aids negatively affects our memory for, and representation of the environment around us; users become device focused and develop a reduced disembodied understanding of the environment. This understanding of space is not built on the rich, contextual information that comes from environmental engagement, but rather, a more superficial and abstract representation relayed from device to user. That's not to say we don't look at the environment around us, we just don't need to engage with it in the same way. However, mobile navigation aids *are* good at what they do – they get us from A to B with minimal stress and (usually) maximum efficiency.

Webber is arguing that the necessity for a rich mental map is being diminished by technology.

However, what we consider to be new often have arguably superior precedents. The driving directions of Google Maps and Tom Tom are not so far removed from the pilgrim routes described by John Ogilby<sup>44</sup> or the hill walking maps of Wainwright<sup>45</sup>. Both of which are undeniably richer than their electronic counterparts, the product of their designer's desire, rather than an algorithmic rendering.

Today in 2011, the mapping and travel direction services offered by Google lead the market, both for Personal Computers and on smart-phones, specifically the iPhone and Android

 <sup>&</sup>lt;sup>42</sup> Andrew Hardwick, Stephen Furner and Jim Rush. "Tactile display of virtual reality from the World Wide Web – a potential access method for blind people." (Displays, 18, (1998): 153-161).
<sup>43</sup> Author interview with Emily Webber, Human Factors Research Group at the University of Nottingham, 11h August

<sup>&</sup>lt;sup>43</sup> Author interview with Emily Webber, Human Factors Research Group at the University of Nottingham, 11h August 2011.

<sup>&</sup>lt;sup>44</sup> Simon Foxell. Mapping London - making sense of the city. (London: Black Dog Publishing, 2007), p. 116.

<sup>&</sup>lt;sup>45</sup> Alfred Wainwright. A Pictorial Guide to the Lakeland Fells. (Kendal, England: Westmorland Gazette Ltd, 1966).

platforms. Conservatively there must surely be hundreds of thousands of actions taken on a daily basis visualised through a standard set of views and under the control of a small set of deterministic algorithms.

With the widespread adoption of computationally and graphically capable smart-phones, there has been a proliferation of Apps (applications) that provide users with maps. The practice of software development encourages reuse and abstraction, that well-described components can be plugged together to create an application or service. In this way apparently complex systems can be engineered and tested by an individual programmer and components can be shared for reuse with other people. The consequence for applications that present a map interface is that most programs will use the same underlying map data and presentation. For the iPhone and Android platforms in 2011 the Google Maps predominate.

Ownership of smart-phones is by no means universal with users drawn from quite narrow socioeconomic groups. The question of who has access to this technology is extremely important.

The mishaps of motorists under instruction from their satellite navigation systems are well documented, with ad hoc signs imploring drivers to "IGNORE GPS!" a feature of many villages across the United Kingdom. In my own practice I have explored some of the relationships between the traveller and the algorithm. In 2010 with the Curiosity Collective I walked between Ipswich and Newcastle according to the directions from Google Maps, a five-day journey via the Dutch coast, including two ferry crossings. Musing on the motivation for this I wrote:<sup>46</sup>

We have wondered from the beginning to what extent this is a commentary on Google and our deference to it. To some extent it is. The vagaries of an algorithm replace common sense. The projected journey time of 1 day 15 hours has no regard for eating, sleeping, grumpiness, sore feet or ferry timetables.

Alternatively, Google had presented us with an entirely new way of approaching the journey, one we chose to take and reinterpreted to our own ends and ultimate enjoyment.

This is consistent with the rhetoric of recent Computer Science lead cartography, that the map and algorithms must become increasingly complex and complete until the map reflects the state

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<sup>&</sup>lt;sup>46</sup> http://atob.curiositycollective.org/ (accessed 29<sup>th</sup> September 2011)

of the World as it exists at any moment in time. Owen and Collingridge<sup>47</sup> continue this reasoning:

Knowledge of a navigator's identity, location and intention is the holly grail of signage designers but something that in reality they can make only crude assumptions about. If we were to make the ideal sign or map, we would know these things. And likewise, we would reintegrate the inhabited three-dimensional landscape with the two-dimensional map so that they became one thing.

Digital technology brings us much nearer to reintegrating the sign, map and landscape, in the form of the mobile phone. Third generation mobile technology is not only capable of downloading video and cartographic data, but is also location sensitive, knows the identity of the user, and may through customisation or personalisation know or infer specific intentions at one point in time.

The rhetoric of personalisation has been pervasive in Computer Science for at least the past 30 years<sup>48</sup>. In 1995 Nicholas Negroponte, director of the MIT Media Lab, described "personal filters" and particularly how it might be applied to newspapers, a concept he called The Daily Me.<sup>49</sup> Much of this vision has been realised today in for instance the use of Twitter feeds.

Speaking in an interview with the Wall Street Journal in 2010, Eric Schmidt Executive Chairman of Google said "it will be very hard for people to watch or consume something that has not in some sense been tailored for them."<sup>50</sup> However, Schmidt does not refer only to the explicit user defined personalisation that Negroponte advocated. He includes the filtering that is driven by algorithmic inferences of past online behaviour, which companies such as Google use to direct people towards purchase. The degree to which the companies we interact with implicitly filter information is of quite a concern. In Eli Pariser's TED talk<sup>51</sup> in March 2011, he described this trend and observed we were beginning to live in "Filter Bubbles".

The notion of a Filter Bubble extends equally to the realm of electronic mapping. Trivially this may be to the inclusion or exclusion of a restaurant chain on the map, through to the explicit censorship of a whole category of information, without the knowledge of the user. In the

<sup>&</sup>lt;sup>47</sup> Roger Fawcett-Tang. Mapping Graphical Navigation Systems. (Mies, Switzerland: RoboVision, 2008), p. 67.

<sup>&</sup>lt;sup>48</sup> Stewart Brand. The Media Lab – inventing the future at M.I.T. (London: Penguin Group, 1988), p. 36.

<sup>&</sup>lt;sup>49</sup> Nicholas Negroponte. Being Digital. (London: Hodder and Stoughton, 1995), p. 152.

<sup>&</sup>lt;sup>50</sup> Holman W. Jenkins Jr., "Google and the Search for the Future", Wall Street Journal August 14th 2010, http://online.wsj.com/article/SB10001424052748704901104575423294099527212.html (accessed 29th September 2011).

<sup>&</sup>lt;sup>51</sup> Eli Pariser, "Beware online 'filter bubbles'", TED Conferences, 2011, http://www.youtube.com/watch?v=B8ofWFx525s (accessed 29th September 2011).

previous sections I have argued that maps do not have to be badly motivated to have undesirable consequences.

Pariser asks how the algorithms that filter our exposure to information and embed the implicit values of the corporation and programmers who created them be called to account? This is an extremely important question and one we have no good answers to currently.

The dynamic, generative nature of these maps also represents a change of emphasis for the designer. They now create a *space* in which maps exist, rather than the maps themselves, defining the rules by which they are drawn. This is an evolving art.

Owen and Collingridge observe that: <sup>52</sup> "we may no longer be using shared maps – as are the thousands of identical multiple-run printed maps – but ones that are unique to ourselves, with levels of access to information and control over the space of the city that varies according to all sorts of factors such as our personal selection, our credit card status, our phone company or our technical ability. Individuals may develop radically different viewpoints on the same location."

Is this the end of shared representation of space and the popular graphical forms of maps that I have surveyed throughout this dissertation? When I first read this I felt a profound sadness, the fading of images that have drawn us together and given us a common sense. Through my exploration of this area I now feel that instead that there are many reasons to be optimistic, that a diversity of viewpoints can be extremely positive. I will develop that argument now.

Wood, Kaiser and Abramms are quite clear:<sup>53</sup> "We want you to accept that different things can be seen from different points of view and to take as many points of view as possible. This acknowledges not only that different things can be seen from different perspectives, but that the world exceeds any single point of view. To see the world at all means to see it from many perspectives."

<sup>&</sup>lt;sup>52</sup> Roger Fawcett-Tang. Mapping Graphical Navigation Systems. (Mies, Switzerland: RoboVision, 2008), p. 67.

<sup>&</sup>lt;sup>53</sup> Denis Wood, Ward Kaiser and Bob Abramms. Seeing Through Maps. (Oxford, England: ODT Inc, 2006), p. 24.

The development of the Social Web gives me optimism. The term "Web 2.0" and the technologies on which it relies came to prominence in 2004<sup>54</sup>. The new generation of websites including Flickr (2004), Youtube (2005), Twitter (2006) and Facebook (2004) defined a step-change for the Internet user, incorporating far more multimedia content and greater opportunities for social interaction than ever before. At the same time Internet adoption grew dramatically and users were drawn from a much wider demographic.

As previously discussed the practice of component reuse in software engineering removes some of the diversity in applications. Many Web 2.0 websites allowed data to be reused using the XML (Extensible Markup Language) format and programmers created hybrids of websites in so-called "mash-ups". Many of the mash-ups used the imagery from Google Maps (2005) to put content such as photography and video on a map.

In February 2011, police authorities began to publish crime maps for England and Wales, showing incidents to a street-level scale<sup>55</sup>. These are available for public inspection, with each crime located on a Google map, categorised and colour-coded according to type. Incidents are also clustered together to allow comparison of criminal activity in different areas. In turn these maps have feedback into the traditional public-shared discourse offered by journalists.<sup>56</sup>

The Guardian Newspaper is notable for using open-data sets and creating info-graphics, frequently maps, as part of their journalist process. <sup>57</sup> Most notoriously in collaboration with the WikiLeaks group.<sup>58</sup>

The use of XML and mash-ups allows communities to contribute to and share information, in socalled crowd-sourcing. The fixmystreet website<sup>59</sup> uses reports from local residence of problems in their neighbourhood that are collated in a map and presented to the local authority. In another example, during the winter of 2010 Ben Marsh used the Twitter micro-blogging website to

 <sup>&</sup>lt;sup>54</sup> Wikipedia contributors. "Web 2.0", Wikipedia, http://en.wikipedia.org/wiki/Web\_2.0 (accessed 29th September 2011)
<sup>55</sup> http://www.police.uk/crime/ (accessed 29<sup>th</sup> September 2011)

<sup>&</sup>lt;sup>56</sup> Graeme Wilson, "Millions crash new crime website", The Sun Newspaper, 1st February 2011, http://www.thesun.co.uk/sol/homepage/news/3382709/UKs-online-guide-to-crime-hotspots.html (accessed 29th September 2011)

<sup>&</sup>lt;sup>57</sup> http://www.guardian.co.uk/data (accessed 29<sup>th</sup> September 2011)

<sup>&</sup>lt;sup>58</sup> http://www.guardian.co.uk/media/wikileaks (accessed 29<sup>th</sup> September 2011)

<sup>&</sup>lt;sup>59</sup> http://www.fixmystreet.com/ (accessed 29<sup>th</sup> September 2011)

collect people's observations of snow in the UK. For each tweet that contained the tag #uksnow, their location and a rating for the amount of snow a symbol was added to the map<sup>60</sup>.

In one of the most impressive initiatives of crowd-sourcing the OpenStreetMap (OSM) community<sup>61</sup> have created a freely available and highly detailed map. See Figure 15. In addition to a suit of algorithms and applications for rendering, routing and editing the mapping data. Steve Coast founded the project in 2004 as a reaction to the restrictive and costly licences required to publish maps and use mapping data from the Ordinance Survey and international map owners. By 2010 pressure from this group and others led to the release of the OS OpenData set<sup>62</sup>. This was part of a wider open-data programme<sup>63</sup> from the British Government, which also included transport and travel data.



Figure 15. OpenStreetMap London, ITO World

With OpenData novel maps are beginning to emerge. Mapumental<sup>64</sup> is a service that shades the map according to the public transport commute-time to any location. In combination with an overlay of house prices it can provide surprising insights that can cause sharing and discussion with others.

<sup>60</sup> http://uksnowmap.com/ (accessed 29th September 2011)

<sup>&</sup>lt;sup>61</sup> http://www.openstreetmap.org/ (accessed 29<sup>th</sup> September 2011)

 <sup>&</sup>lt;sup>62</sup> http://www.ordnancesurvey.co.uk/oswebsite/products/os-opendata.html (accessed 29<sup>th</sup> September 2011)
<sup>63</sup> http://data.gov.uk (accessed 29<sup>th</sup> September 2011)

<sup>&</sup>lt;sup>64</sup> http://mapumental.channel4.com/ (accessed 29<sup>th</sup> September 2011)

In addition Mapumental uses data from OpenStreetMap to draw the underlying map, rather than reusing the Google Map imagery. The access that OpenStreetMap gives should allow a host of new applications to draw maps that are specific to their requirements in terms of the geometry and features of the map.

Within the context of a Social Web the multiple perspectives that electronic mapping promises should, I hope, extend our common sense of *here*.

# Conclusion

This dissertation charts the journey I have taken in thinking about and with maps. Initially I was reminded just how many ways there are to draw a map, the trade-offs that must be made, the explicit and the implicit decisions to be taken. By then looking at the ways in which people see their world, at a global and city scale, I came to understand how dependant we are on the maps that are familiar to us. In looking at electronic mapping, I was initially dismayed to think that these icon graphical forms might become part of history. However, as I found these single perspectives have promoted powerful and often unhelpful concepts of *here*. There are, of course, many concerns that must be addressed in electronic mapping. However, I am profoundly optimistic that these new maps will give individuals a greater sense of their world and an appreciation of the worlds others. The Big Here.

# **Bibliography**

### Books

Abrams, Janet and Hall, Peter. Else/Where: Mapping New Cartographies of Networks and Territories. Minnesota, USA: University of Minnesota Design Institute, 2006.

Berggren, J. Lennart and Jones, Alexander. Ptolemy's Geography: An Annotated Translation of the Theoretical Chapters. Princeton, USA: Princeton University Press, 2000.

Brand, Stewart. The Media Lab – inventing the future at M.I.T. London: Penguin Group, 1988.

Bryson, Bill. Notes from a Small Island. London: Black Swan, 1996.

Fawcett-Tang, Roger. Mapping Graphical Navigation Systems. Mies, Switzerland: RoboVision, 2008.

Ford, Ford Madox. The Soul of London. London: Duckworth, 1905.

Foxell, Simon. Mapping London - making sense of the city. London: Black Dog Publishing, 2007.

Garland, Ken. Mr. Beck's Underground Map. London: Capital Transport Publishing, 1994.

Harmon, Katherine. You are Here: Personal Geographies and Other Maps of the Imagination. New York. Princeton Architectural Press. 2004.

Jacobs, Frank. Strange Maps - an atlas of cartographic curiosities. London: Penguin Group, 2009.

Levine, Robert. A Geography of Time. Oxford, England: Oneworld Publications, 2006.

Lynch, Kevin. The Image of the City. London: M.I.T. Press, 1960.

Monkhouse, Francis and Wilkinson, Henry. Maps and Diagrams. London: University Paperback, 1963.

Negroponte, Nicholas. Being Digital. London: Hodder and Stoughton, 1995.

Wainwright, Alfred. A Pictorial Guide to the Lakeland Fells. Kendal, England: Westmorland Gazette Ltd, 1966.

Wood, Denis. The Power of Maps. London: Routledge, 1993.

Wood, Denis; Kaiser, Ward and Abramms, Bob. Seeing Through Maps. Oxford, England: ODT Inc, 2006.

### **Papers**

Farman, Jason. "Mapping the digital empire: Google Earth and the process of postmodern cartography." New Media Society 12 (2010): 869.

Guo, Zhan. "Mind the Map! The Impact of Transit Maps on Path Choice in Public Transit." Transportation Research Part A: Policy and Practice, Vol. 45, 7 (2011): 625–639.

Hadlaw, Janin "The London Underground Map: Imagining Modern Time and Space." Design Issues, Vol. 19, Issue 1 (2003): 25 – 36.

Hardwick, Andrew; Furner, Stephen and Rush, Jim. "Tactile display of virtual reality from the World Wide Web – a potential access method for blind people." Displays, 18, (1998): 153-161

Roberts, Maxwell; Newton, Elizabeth and Lagattolla, Fabio. "Objective and Subjective Measures of Metro Map Usability: Investigating the Benefits of Breaking Design Rules". Unpublished manuscript (2010).

Saarinen, Thomas. "Centering of Mental Maps of the World." National Geographic Research 4(1) (1988): 112-127.

Saarinen, Thomas, Parton, Michael and Billberg, Roy. "Relative size of continents on world sketch maps." Cartographica 33(2) (1996): 37-47.

Vertesi, Janet. "Mind The Gap: The 'Tube Map' as London's User Interface." CHI 2005 Workshop on "Engaging the City" (2005).

Wright, John. "Map Makers Are Human: Comments on the Subjective in Maps." JSTOR: Geographical Review, Vol. 32, No. 4 (1942): 527-544.

#### Internet

BBC Online, "Taxi drivers' brains 'grow' on the job", BBC, 14th March 2000, http://news.bbc.co.uk/1/hi/677048.stm (accessed 29<sup>th</sup> September 2011)

Brian Eno, "The Big Here and the Long Now", The Long Now Foundation, http://longnow.org/essays/big-here-long-now/

Frank Jacobs, "The World As Seen From New York's 9th Avenue", Strange Maps, 7<sup>th</sup> February 2007, http://bigthink.com/ideas/21121 (accessed 29<sup>th</sup> September 2011)

Frank Jacobs, "The Face That Launched 1,000 Pavements: Ciudad Evita", Strange Maps, 13<sup>th</sup> December 2008, http://bigthink.com/ideas/21399 (accessed 29<sup>th</sup> September 2011)

Holman W. Jenkins Jr., "Google and the Search for the Future", Wall Street Journal August 14th 2010, http://online.wsj.com/article/SB10001424052748704901104575423294099527212.html (accessed 29<sup>th</sup> September 2011)

Ross Lydall and Katharine Barney, "Boris Johnson puts River Thames back on the map", London Evening Standard, 17<sup>th</sup> September 2009, http://www.thisislondon.co.uk/standard/article-23745427-boris-johnson-puts-river-thames-back-on-the-map.do (accessed 29<sup>th</sup> September 2011)

Eli Pariser, "Beware online 'filter bubbles'", TED Conferences, 2011, http://www.youtube.com/watch?v=B8ofWFx525s (accessed 29th September 2011)

Charles Petzold, "How Far from True North are the Avenues of Manhattan?", July 2005, http://www.charlespetzold.com/etc/AvenuesOfManhattan/ (accessed 29th September 2011)

Maxwell Roberts, "Henry Beck Rules, not OK? Breaking the Rules of Diagrammatic Map Design", 2009, http://privatewww.essex.ac.uk/~mjr/underground/Breaking\_the\_rules.pdf (accessed 29th September 2011)

Wikipedia contributors. "Global Positioning System", Wikipedia, http://en.wikipedia.org/wiki/Global\_Positioning\_System (accessed 29<sup>th</sup> September 2011)

Wikipediacontributors."OrdnanceSurvey",Wikipedia,http://en.wikipedia.org/wiki/Ordnance\_Survey (accessed 29th September 2011)

Wikipedia contributors. "Web 2.0", Wikipedia, http://en.wikipedia.org/wiki/Web\_2.0 (accessed 29th September 2011)

Graeme Wilson, "Millions crash new crime website", The Sun Newspaper, 1st February 2011, http://www.thesun.co.uk/sol/homepage/news/3382709/UKs-online-guide-to-crime-hotspots.html (accessed 29<sup>th</sup> September 2011)

http://atob.curiositycollective.org/ (accessed 29<sup>th</sup> September 2011)

http://data.gov.uk/ (accessed 29<sup>th</sup> September 2011)

http://www.fixmystreet.com/ (accessed 29<sup>th</sup> September 2011)

http://www.guardian.co.uk/data (accessed 29th September 2011)

http://www.guardian.co.uk/media/wikileaks (accessed 29<sup>th</sup> September 2011)

http://mapumental.channel4.com/ (accessed 29th September 2011)

http://www.openstreetmap.org/ (accessed 29<sup>th</sup> September 2011)

http://www.ordnancesurvey.co.uk/oswebsite/products/os-opendata.html (accessed 29<sup>th</sup> September 2011)

http://www.police.uk/crime/ (accessed 29<sup>th</sup> September 2011)

http://privatewww.essex.ac.uk/~mjr/underground/lectures.html (accessed 29<sup>th</sup> September 2011)

http://www.theaa.com/motoring\_advice/about\_aa/history-of-aa-routes-service.html (accessed 29<sup>th</sup> September 2011)

http://uksnowmap.com/ (accessed 29<sup>th</sup> September 2011)

### Interviews

Author interview with Dr Maxwell Roberts, Department of Psychology at the University of Essex, 14th July 2011.

Author interview with Emily Webber, Human Factors Research Group at the University of Nottingham, 11h August 2011.

#### Magazines

Unknown artist, "Absolutely Simple." Punch Magazine volume 136 (1st September 1909) page 162.

### **Film and Television**

Beauty of Maps (BBC), Stephen Clarke, 2010.

The Image of the City, Evan Mather, 2006.

London, Patrick Keiller, 1994.

Maps: Power, Plunder and Possession (BBC), Jerry Brotton, 2010.

Robinson in Space, Patrick Keiller, 1997.

Powers of Ten, Charles and Ray Eames, 1968.

### Exhibitions

Sense and the City, London Transport Museum, London, 1st July 2011 – 18<sup>th</sup> March 2012.

