NEW IDEAS IN THE INTERPRETATION OF COMPLEX RAIL NETWORKS

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Abstract

The iconic status of Harry Beck's Tube map has prevented innovation in the graphic visualization of local travel systems as they have become more complex. The map designer should endeavour to show the individuality and personality of the network being depicted, rather than force it to follow traditional abstract rules. A design of a map for the railways of Great Britain gradually evolved, discovering that maps at national, regional and local level can share a common theme. Online access now presents opportunities for interaction and access to detail not possible with the traditional poster map. Arguably, the map is the brand. It is core to the identity of train operating companies and passenger transport organizations, yet is invariably low profile. Much more investment should be made, not only to provide improved understanding and legibility but beautifully designed and crafted maps, full of personality and even fun.

Background

Like many I was fascinated from an early age by the London Tube map (or diagram, as we should more properly call it). I had a go at my own designs - I still have them - made with felt-tip pens and poster paint. But as the underground system grew I became aware of the map's many shortcomings. Harry Beck's original idea of enlarging a central area where stations are closer together and reducing outlying branches on a relatively simple system worked in the '30s. But as the system expanded and became more complex, the distortions of reality have got more problematic. For example, when the creation of the new financial sector on the Isle of Dogs gave birth to the Docklands Light Railway, a new centre was created to the east of London's traditional central focus (the Circle Line). The distortion of the connections between the two centres has caused the lines around London Bridge to be stretched.

Other problems continue as the Tube map is developed by other designers. Lines that are straight often have to be made crooked (an enemy of clarity) because of the limitation caused by the 45° maximum angle. Interchange stations suffer by having multiple interconnecting nodes that bear no relationship to the ease or difficulty of a change - purely for the cartographer's convenience - and the dominance of the interchange symbol (which is too big for its boots) over the tick distorts the importance of stations, which is questionable. The map also leaves unsolved the issue of different lines sharing the same route, shown inconsistently as either touching or separated. Furthermore, the Beck formula does not work when applied to many other systems. For example, using his formula to the Paris map gives a result that is no more helpful in planning a journey than the geographic approach.

Innovation, Craft, and Geography

The simplicity of using just horizontal, vertical and 45° lines had much to be admired, but over time the Harry Beck's design has prevented innovation and its iconic status has made imitation endemic. Now, too much map design is based slavishly on the principles of the London Underground map and not enough new thinking goes into the interpretation of complex modern travel systems. The aim should be to make what is unclear on the ground easier to understand, yet what is straightforward on the ground is often made to look less practical. Frequently, maps are just badly crafted with no effort to improve readability or legibility and time and again they are tucked on the back of a small leaflet as a token gesture, with their type rendered at an unreadable point size.

The map designer should not force a network to follow someone else's set of abstract rules that may have worked then, but should look for clues on the ground to show the individuality and the personality of the area being depicted – which can even contain humour.

For example, London has the Thames and the droopy coke-bottle shaped Circle Line that defines the shape of the West End and City; Europe has radial routes from Paris and the Rhone Valley with its distinctive arrow shape having the point at Frankfurt; Manhattan has its characteristic tilt; and there's a tilted parallelogram that links Liverpool and Manchester together. The axis of a major thoroughfare, river or coastline forms the shapes and angles that help the userto identify with a map.

Towards a New National Railway Map

At the privatization of British Rail in 1994, I realized that there were no satisfactory diagrams of the British rail network. There was a geographic map issued with the



Figure 1 The basic structure for creating a new national railway map

National Rail timetable which had schematic maps on the back showing service patterns relating to the timetable page; there was an Inter-City map with limited detail trotted out in diaries; and maps by individual passenger transport organizations (including the Tube map, for example). When one considers the high profile of the Tube map, why does one never see a national rail map at British railway stations? Why are the railways so different to the Tube? Was it too difficult? Had anyone ever tried?

So one day I had a go at designing one. The aims and principles were to:

- Create a map that would benefit public transport with an integrated image, overview and icon;
- Simplify routes as much as possible into straight lines, removing the effects of topography where these are a handicap, but retaining alignments that reflect the character of Britain;
- Show better the system as a network, improving the appearance of cross-country routes in particular;
- Reflect the geographical relationships between countries, major conurbations and regions more closely; and
- Pay particular attention to interpreting complex networks (e.g. Cheshire–Lancashire, Yorkshire, and Strathclyde).

The key to the solution was the establishment of a grid to simplify the complex Lancashire–Yorkshire network and a triangle for the critical London–Derby–Bristol 'belly'. Adding a new 22.5° angle (even 11.25° occasionally) enabled all mainlines to radiate from London and the East Coast and Midland mainlines to flow with the slanted shape of Great Britain (which also reflects the Pennines, the backbone of Britain), as shown in Figure 1.

The priority in the design was to keep the mainlines as straight as possible – the 'bones' of the network – so that when viewed from a distance one could clearly understand the underlying structure of the network, with regional lines linking at a secondary level and local lines filling the gaps or radiating from their respective cities.

The map uses a method of showing locations with multiple stations on different lines to avoid station name repetition, the coloured ovals also giving focus to major centres (Figure 2).

The map also uses curves with a large radius, for example, for the Cumbrian coast and north-east Scotland (why force gently curving routes into jerky lines just to retain a fixed radius?). This has become an important aspect of the map's design, with softer curves leading to a more pleasing appearance, particularly on the outer edges. Stations are shown as nodes without the correct bifurcation of routes, as modern multiple-unit trains often reverse to complete their journeys.

Interestingly, I discovered that over time, all design problems can eventually be resolved – what I considered impossible became possible. First, I was able, after all, to label all London termini in their right positions. Later, I was able to show all the TOCs (Train Operating Companies) in colour.

But at no time did I allow this structure (the 'bones' of the network) to be compromised by local detail. This map was developed into a smaller, diary-size map showing only main routes. Both sizes showed only a selection of stations as it was impossible to include all of these on an A2 sheet or A6 page.

Other Innovations

Many of my new maps have been designed to improve on existing maps that I consider to be badly crafted pieces of cartography, often in response to releases in the rail press: "x passenger transport executive has published a Tubestyle map to make it easier for customers to understand our services" (or perhaps not!).

With maps based on a major conurbation, an important but self-evident idea is to put the centre of the city in the middle of the map – but this is surprisingly uncommon. Some show services, which is better for local area networks, and some show routes, which is better for national networks (detailed examples can be seen at www.projectmapping.co.uk).

The Merseyrail map uses 30° and 60° angles which help to shrink the size of the map to a square and reflect how the network looks. The balloon loop under Liverpool's city centre is shown as such and not forced into squares with the corners rounded off as depicted by



Figure 2 The national rail network diagram



Figure 3 Map showing the national rail train operators



Figure 4 The Merseyrail network map

Merseytravel. Ticket areas are described better.

The Manchester map indicates the city centre by the use of a large capital M (as seen on roundabouts approaching the city), shows the platform layout at the divided Piccadilly station and also represents the GMPTE (Greater Manchester Passenger Transport Authority and Executive) ticketing area using a simple oval.

The Railteam map shows all stations in Paris, a new way of showing the routes and a much more effective use of space.

The London Overground map interprets the orbital nature of the four disparate lines that formed this politically created network by the use of very shallow curves; a new way to show the central London focus and a different way to show the Thames. Revealing the underlying structure shows the repetition of shapes and that London is a fried egg.

The Valleys map reflects the nature of the South Wales valleys and has English and Welsh versions to avoid the pitfalls of a bilingual map.

The Great Britain 'All Stations' Map

I received some criticism from people who couldn't find their own station on the main rail maps, which do not show all stations because the maps were designed to be a summary of the system.

But as PDFs on the Internet, without the restrictions of printed material, size is no longer an issue as you can zoom-in on the maps. I have just completed an 'all stations' map (Figure 10 shows just the London section).



Figure 5 The Manchester network map



Figure 6 The Railteam network map



Figure 7 The London Overground network map

demonstrates that national, regional or conurbation maps can use the same design.

While not wishing to deny designers creative freedom, the utilization of different designs cannot be helpful to the user. For example, the Dublin tourist leaflet shows three maps for Irish Rail Commuter, DART and Luas tram, but where the maps show the same lines completely different styles and orientations have been used, which surely causes confusion (see http://www.projectmapping.co.uk/Europe%20World/Resources/Dublin%20tourist%20map.jpg).

For my map, although the two 'summary' maps use nodes for stations on a grid, interestingly, the 'all stations' map shows the correct bifurcation at junctions. I was surprised to discover that an enlarged map allowed the flexibility to do this, keeping the overall structure more-or-less the same and giving the three maps the same underlying structure.



Figure 8 The London Overground network map (design framework)



Figure 9 The Valleys network map

Maps on the Internet

My skills don't extend to creating interactive maps or automatic maps from geographical datasets. But surely there is so much that can be done; the surface of the possibilities has hardly been scratched. For a start, when searching for a journey on a website, the results could be presented as a graphic route instead of (or as well as) the long lists of text currently provided. Graphic route cards could be given with tickets. Lines and stations could be clicked-on to reach timetables or station information.

Website

As a graphic designer, not a professional map-maker, I started to develop my ideas for maps and established my website in 2008. The website was intended as a resource portal (including over 650 diagrams) for education, to stimulate debate, present new ideas, criticize, and congratulate. All the examples described in this article can be seen (as well as other designs mentioned by the train operating companies and passenger transport executives) at http://www.projectmapping.co.uk. Traffic to my website has climbed to around 300 hits a day and this year, I finally got two maps onto the National Rail Enquiries website, where they currently enjoy 1000 hits a day.

The Map is the Brand

The map is core to the identity of train operating companies and passenger transport organizations. It's what makes one operator distinct from another. Those corporate identities – symbols, logos, and colour schemes – may provide identity and recognition, but are they just wallpaper?

Only the map can ever present the individuality of the operator in a graphic form and so should be promoted positively as a major component in the corporate identity – instead of being hidden away. The map needs deep thought and craft to develop into an icon, so that customers and industry alike can rally around them.



Figure 10 'All stations' map

Biography

Andrew Smithers lives in Stone, Staffordshire and has been producing rail maps for about 15 years. A graphic designer by training and a Member of the Chartered Society of Designers, he ran his own consultancy until 2006, since when he has concentrated on map design. His Project Mapping website was established in March 2008 as a promotional and resource portal and regularly achieves 300 hits a day. Andrew's Great Britain rail maps were accepted for use on the National Rail Enquiries website in 2009.

A version of this paper was presented at the 2009 Society of Cartographers Summer School in Southampton.