The Decade of Diagrams

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***Abstract*—Schematisation techniques have been applied to maps for centuries, but came to the fore with designs for urban rail networks. Here, the dual role of maps as both wayfinding aids and also publicity meant that there were advantages in creating easy-to-understand representations with implications of speed and ease of travel. With modernism firmly established in the 1930s, alongside network modernisation, this decade was particularly fertile for the creation of schematised maps.**

Keywords—schematic mapping; schematisation; history; 1930s; modernism; Henry Beck.

I. SCHEMATISATION AS A PACKAGE OF CARTOGRAPHIC METHODS

Schematisation of transport maps encompasses a variety of techniques. These are intended to improve the legibility and understandability of designs, particularly for more complex networks, and include:

- *Removal of surface details*. The most obvious candidates for deletion are minor streets, but at an extreme everything can be removed except stations, lines and interconnections.
- *Simplification of line trajectories.* With the focus being the entry/exit points to the network, the lines that link them, and interconnections between them, the precise routes taken become less important, especially if these are underground and the exact paths are difficult to discern.
- *Linearisation.* On the basis that the shortest pathways are straight lines, these may replace curved trajectories. The range of angles available may be limited so as to facilitate the *coherence* of a design [24, 25]
- *Global scale distortion.* this is usually implemented by expanding dense central areas in order to assist legibility, and by compressing sparse suburbs.
- *Local scale distortion.* The relative spatial positions of nearby stations may be altered if this enables simplification of line trajectories.

Since their derivation, schematisation techniques have been applied to individual designs in different combinations and to varying extents. The intention is to improve usability from the perspective of navigating a transport network, but a side-effect is that an abstracted representation is created, disconnecting the design from the structure of the city itself, both in terms of absence of visible topographical detail, and lack of accurate spatial correspondence. However, it makes little sense to try to categorise individual maps as to whether or not they qualify for the title *schematic*. Instead, an analysis is warranted as to the extent to which schematisation has been applied [4, 23, 24]. This was widespread even during the early 20th Century, and

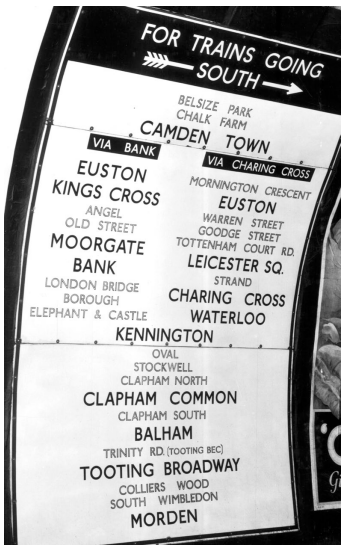


Fig. 1. The Northern Line on the London Underground was bifurcated from 1926 onwards, and the station plate here is effectively a highly schematised map in which even the lines are deleted. The photograph was taken in 1932 but the sign is clearly not new.

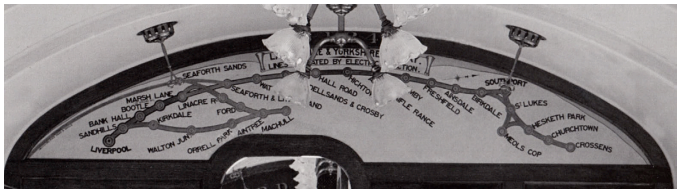


Fig. 2. The earliest-known British train strip map is from the Lancashire & Yorkshire railway for the Liverpool-Southport routes. This photograph is dated 1910 but electrified services on the line commenced in 1904. The actual route is orientated north-south, and had to be rotated by 90º to fit in the available space.

the techniques have origins that go back even further [22]. To obtain the fullest picture, it is necessary to look not just at network maps, but also wayfinding and publicity material: for both of these it was soon appreciated by transport operators that schematisation techniques could yield improvements in understandability, memorability and impact [4, 24].

II. EARLY 20TH CENTURY SCHEMATISATION

With the introduction of mass transit, passengers, in large numbers, required clear, effective signage to ensure that they would distribute themselves en-masse rapidly, and without making errors [24]. In London, verbose instructions were replaced either by less detailed ones, or more structured versions (see Fig. 1). The confinement of new electric trains to particular routes also permitted simplified strip maps to be introduced, so that passengers could identify progress and interchange points. Often, available panels were awkwardly-shaped, such that any attempt by the designer to preserve topographical accuracy would be futile, and schematisation was adopted almost by default (Figs. 2 and 3) [4, 24].

The other requirement for mass transit operators was the economic need to encourage additional off-peak journeys [24].

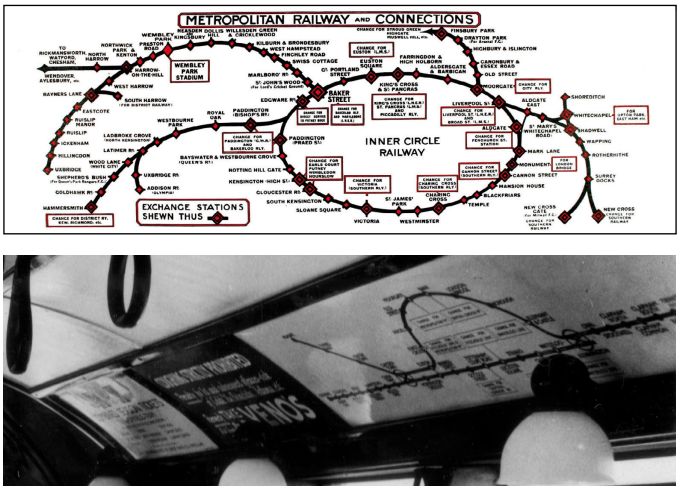


Fig. 3. Top: mid 1920s train map for the Metropolitan Railway (now the London Underground Metropolitan Line). Lower: 1928 train map for the Mordern-Edgware Line (lower, 1928, now the Northern Line). Between them they display every aspect of schematisation.

For many networks, this became a matter of urgency almost as soon as they commenced operations. Hence, schematised maps not only provided simple-to-understand, memorable messages, but also had the benefit of implying speed and simplicity of use (Figs. 4, 5). In the early twentieth century, the most dramatic examples targeted individual destinations, or else publicised network additions. The system map itself also had a role to play in publicising travel opportunities but schematisation of these, in London at least, developed slowly. Any individual innovations – such as simplification of line trajectories – were often not maintained [17, 24]. Hence, official Underground pocket maps created by F.N. Stingemore (Fig. 7) depicted no surface features except the River Thames, and also exercised global scale distortion to include network extremities, but they had more complex line trajectories compared with earlier designs (Fig. 6). Probably the most innovative London map in the 1920s was the 1924 British Empire Exhibition map. It was

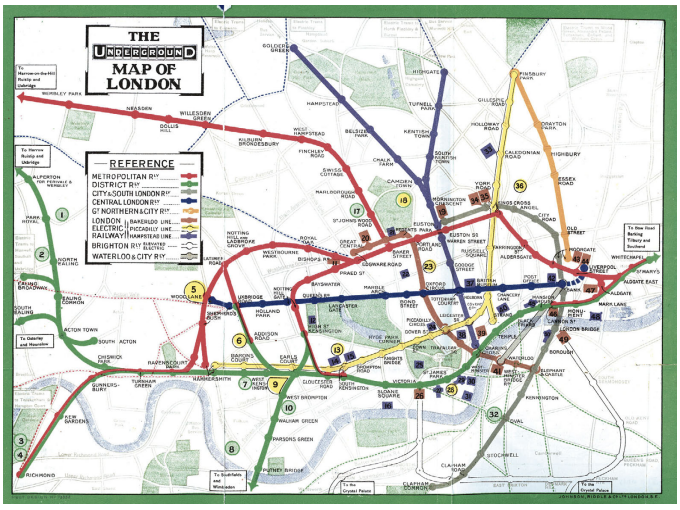


Fig. 6. [Above] The first official London Underground network map to show simplification of line trajectories. It was issued in 1911.

Fig. 7. [Right] Subsequent to the design that is shown in Fig. 6, pocket Underground maps by F.N. Stingemore, issued from 1925 to 1932, depicted more fussy, topographical line trajectories.

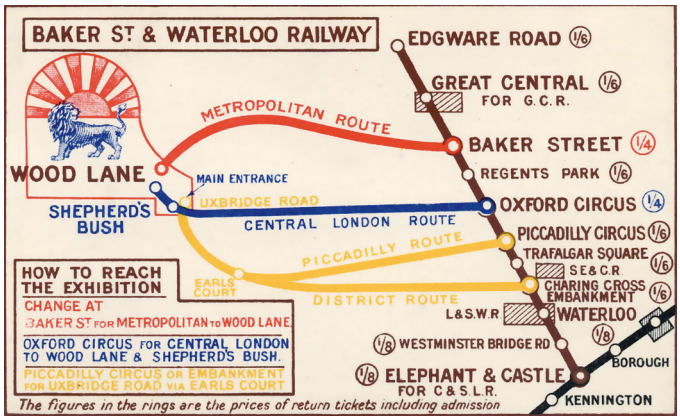


Fig. 4. The Baker Street & Waterloo Railway (now the London Underground Bakerloo Line) is highly schematised in this pamphlet, advertising connections to the 1908 Franco-British Exhibition.

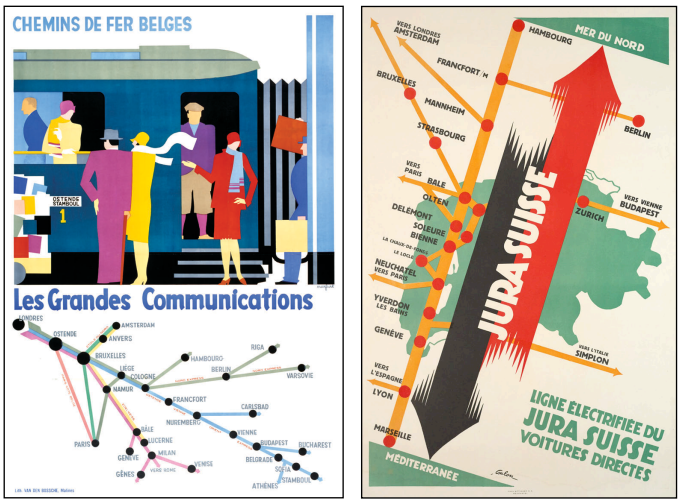
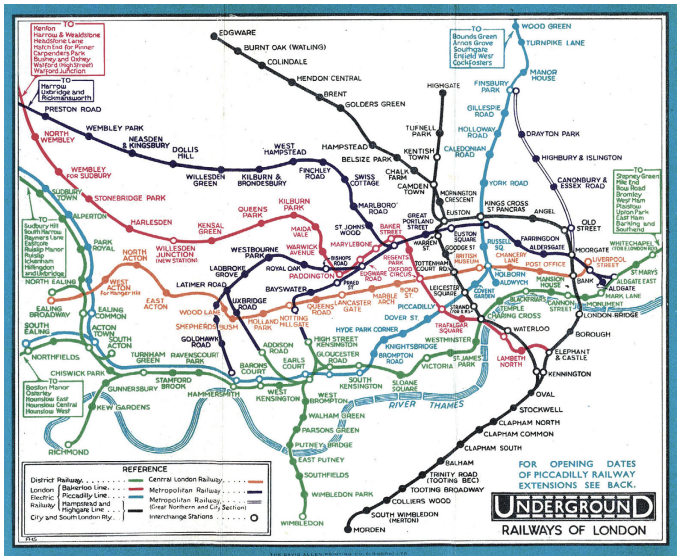


Fig. 5. Examples of 1920s posters that implement dramatic schematisations. Left: a 1928 poster created by Leo Marfurt for Belgian state railways to advertise trans-European services; note the use of colour-coding. Right: a 1929 poster by Eric de Coulon depicts a straight line across the Alps to advertise direct electric rail services.



designed by Kennedy North (Fig. 8), whose massively schematised depiction of London even included a perfectly circular inner circle service (today's Circle Line).

III. TOWARDS THE DECADE OF DIAGRAMS

By the end of the 1920s, schematisation techniques were in use internationally, often in combination, for the purposes of wayfinding assistance and publicity for transport networks. For system-wide network maps, it was far rarer for many, let-alone all techniques, to be applied. Within the next ten years, however, the situation was transformed to the point that there are almost too many examples to include in the context of a short paper. What underlies this development?

There is a popular narrative, in which the invention of the schematised network map is credited as being a single-handed work of creative genius by one single man, i.e., the London Underground network map designed by Henry Beck and first issued in 1933 [e.g., 10, 11]. It is occasionally, grudgingly admitted that a few instances of schematisation existed prior to his work (e.g., Fig. 9) but, nonetheless, 1933 is taken to be a pivotal year, in which a design innovation was produced that inspired all subsequent schematised creations around the world. The are a number of difficulties with a belief along these lines. Comprehensive research into the history and development of transport cartography is extraordinarily difficult. There are, indeed, some famous designs, widely available, from which some conclusions can be drawn, but a genuinely representative overview requires extensive photographic records, and also intact archives, both problematic because of the turbulent events of the twentieth century. This is especially the case as maps, signage and pamphlets are not always considered to be priorities for archiving in the preservation of history for future generations. In this context, serendipity becomes the major means by which knowledge is advanced. In a few instances, there are definite cases in which sources of inspiration have been documented, or can be readily inferred but, beyond these, evidence is lacking and guesswork comes to the fore.

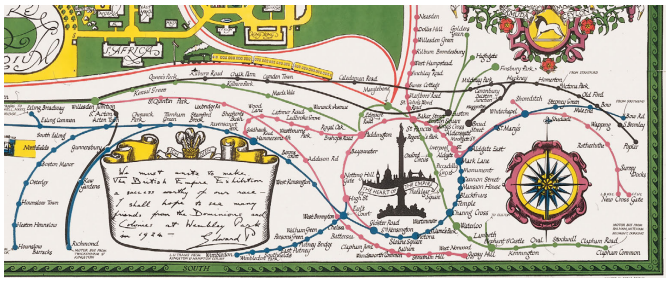


Fig. 8. Section from the Kennedy North 1924 British Empire Exhibition map. The topographical distortion and simplification of trajectories is probably greater than for any other multi-line map prior to this.

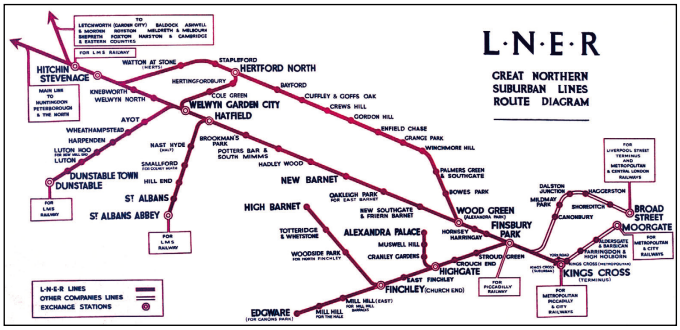


Fig. 9. 1n 1929, George Dow commenced a series of highly schematised maps for display on LNER London area steam commuter trains. This particular design would have been placed in the trains serving the railway stations nearest where Henry Beck lived at the time.

If schematisation techniques were applied rarely, it would be easier to assert that there exist pivotal inspirational designs, but this even is less defensible when considering the prevailing Zeitgeist. Various forms of *modernism* were proving to be massively influential worldwide, such as the *de Stijl* movement in the Netherlands [8], and the *Bauhaus* school of Germany [6].

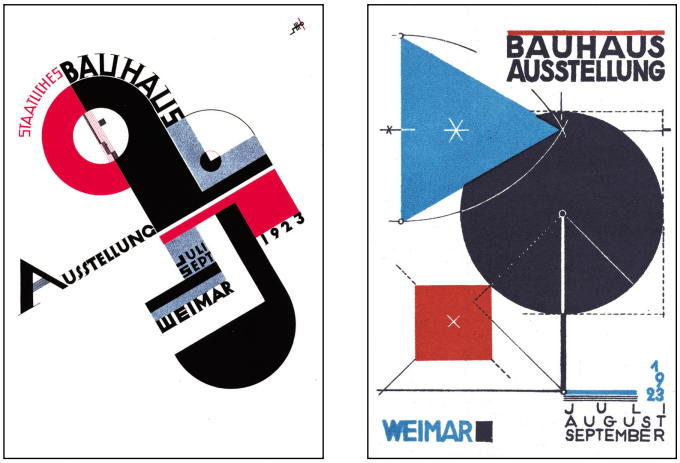


Fig. 10. [Above] Posters advertising the first official Bauhaus exhibition at Weimar in 1923 by Joost Schmidt (left) and Herbert Bayer (right). Note the abstract representations, dominated by simple shapes and non-seriffed lettering.

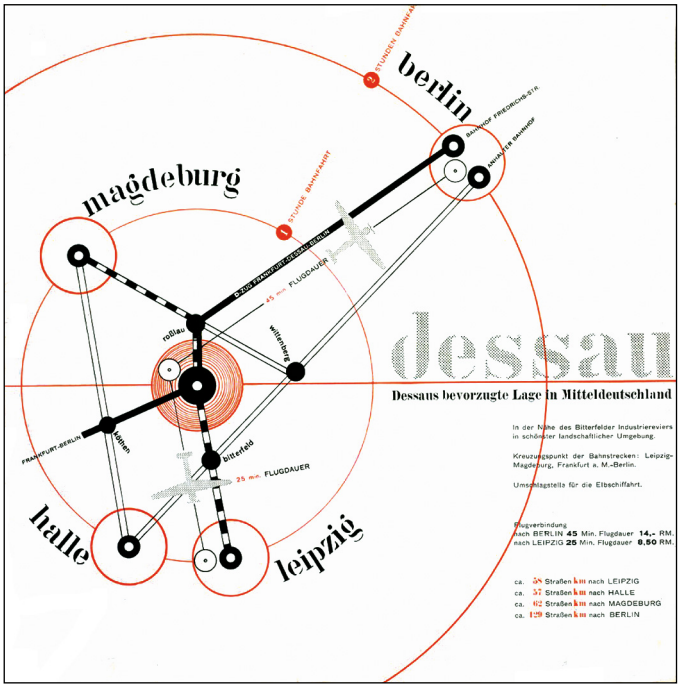


Fig. 11. [Right] A remarkable schematisation, designed by Joost Schmidt in 1930, showing road, rail, and air connections to Dessau, the location of the Bauhaus design school.

Fig. 12. The most enduring visual legacy of the massive Berlin S-Bahn rebuilding and electrification of the 1920s to 1930s is the striking modernistic stations, especially those along the Wannseebahn [5]. Feuerbachstraße was completed in 1932, in a style very similar to Southgate station on London's Piccadilly Line, which was completed the following year.

These advocated wholesale stripping away of unnecessary detail, simplification of form to basic shapes, abstractedness, and the eschewal of frivolous decoration that performed no functional purpose. These wide-ranging doctrines encompassed graphic design [9, 7, 28], typography [1, 2, 13], furnishing [6] and architecture [3, 5, 16] and are highly influential to this day [18]. It is scarcely surprising that, as their tenets became better known and embraced, so they became more widely applied. Schematisation techniques were already in use by the time of the push towards modernism, and it would only be expected that they might now be applied even more zealously and comprehensively than before. In the absence of evidence to the contrary, we must consider the possibility that international designers were perfectly capable of schematising their network maps without the need to be aware of events in London.

The other contextual drive for schematisation came from the massive renovation programs that took place throughout the 1920s and 1930s. Obsolete old steam engines were replaced

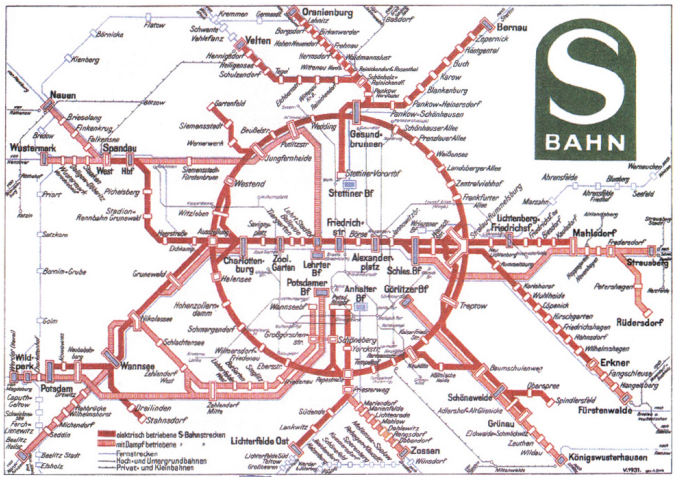


Fig. 14. This Berlin S-Bahn network map was issued in 1931, and featured octolinear lines and a perfect, circular *Ringbahn*. It was nicknamed the *Netzspinne*; a play on words in which the German for system/ network (*Netz*) can also mean web, hence *spiderweb*.

Fig. 13. An atmospheric 1932 photograph of Bounds Green Underground station on the Piccadilly Line, on its new projection into North London. To place what is effectively an enlarged train map on the side of the station is an interesting experiment, but such a map fails to show how the new extension relates to the rest of the network. Its use possibly indicates dissatisfaction with network maps of the time.

with modern electric trains, often with automatic doors. Not only this, but many stations were rebuilt in striking modernistic style, based on simple shapes such as boxes and cylinders, and with minimal decoration. Publicity for the modernised railways was similarly appropriate. Nineteenth century cartography would have looked utterly out of place in such an environment (Figs. 12 and 13). When researching innovations in mapping, the archives of rail networks that were being reconstructed during this era are worth targeting.

IV. THE DECADE OF DIAGRAMS

A. The First Wave

Early attempts at schematisations of entire networks (as opposed to components of a network, such as individual lines) are known for Berlin (1931, Fig. 14), London (1933, Fig. 15), Copenhagen (1934, Fig. 16) and Chicago (Fig. 18, 1936). Three of these are associated with network modernisation (London) alongside electrification (Berlin and Copenhagen). Horizontal and vertical lines feature in all of these but, whereas London and Berlin are true *octolinear* designs (all diagonal lines at 45º), the Copenhagen map radiates angles outwards subtly. The Berlin BVG archives were destroyed during the Second World War, and so very little is known about the circumstances surrounded the introduction of the S-Bahn map. It is signed A Dietz, and continued in use throughout the 1930s, updated to include the new cross-city North-South line, but a topographical design was re-introduced after the war.

More is known about Henry Beck's famous 1933 design thanks to extensive documentation of its creation and history [11]. Beck himself reported no modernism influences on his work, merely attempting simplification of line trajectories and enlargement of the centre. However, the background context in which this work took place must be considered. The first submission was famously rejected in 1931, but a subsequent quote by Frank Pick (Commercial Manager for the Underground Electric Railways of London company), from a

speech given 10th August 1932, is telling in this respect [24]: *Let us put into maps and signs and notices as much care and skill as we put into advertisement. [...] Everything must be designed to fit a proper place. There must be neatness and orderliness in display.* The octolinear angles chosen by Beck proved particularly enduring and, with a few exceptions [11, 23, 24] have continued in use for the London Underground map to this day.

More is also known about the Copenhagen design, which was introduced as part of the 1930s suburban railway (S-tog) electrification, and continued to be updated and issued until the 1960s. It was created under the direction of the Danish State Railways (DSB) architect, Sigurd Christensen. The close connections between DSB and Deutsche Reichsbahn, at the time, account for the similarities in design with the Berlin map (Jernbanemuseum, personal communication, 2018).

Worthy of note is the continuing work of George Dow, the most creative of the 1930s designers in terms of output and diversity of design rules implemented. The 1935 map of LMS London area suburban railways is unique for the period, being a tetralinear (or rectilinear) design, i.e. with only two angles, but rotated away from cartesian axes (Fig. 17). Unfortunately, no copies are known to exist [4] although there is photographic evidence of its display at stations [24]. It makes an interesting comparison with the, also rare, more conventional Chicago Elevated Railways map, which is effectively tetralinear south and west of the loop. This is undated but referred to in a 1936 memo giving instructions for applying it to trains (Illinois Railway Museum, personal communication, 2018). Unlike the other cities in this section, the Chicago network was not being modernised at the time of issue and, indeed, it was under receivership. However, the underlying grid city structure means that little topographical distortion was necessary to create it.

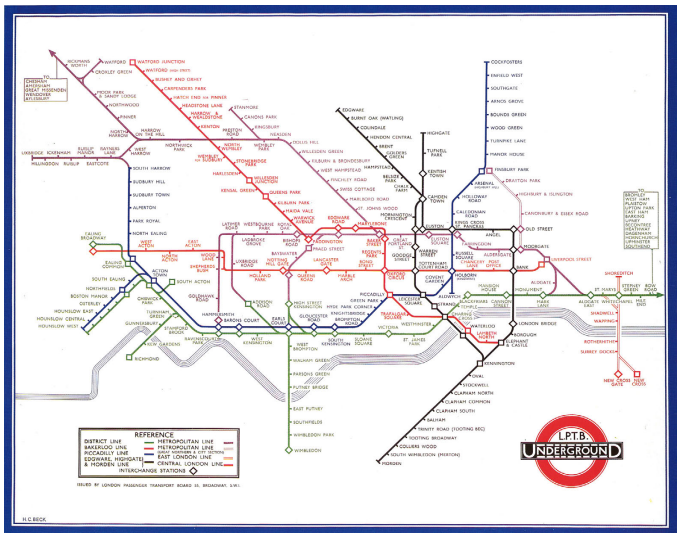


Fig. 15. London Underground station poster from 1933, the second design created by Henry Beck (a pocket map, with a slightly different configuration, precedes this by a few months). Although the innovation exhibited in Beck's work map is exaggerated [10, 11], the quality of the design is less debatable [26].

B. *Schematising the Airways*

Although sleek modern electric trains and Bauhaus-inspired architecture might provide the perfect backdrop for schematised mapping, it is also important to note that, by the time of the 1930s, international air travel was beginning to establish itself as an alternative, albeit an expensive one, to considerably slower journeys by rail or ocean liner. The 1935 Douglas DC-3, seating 32 passengers, is credited as being the

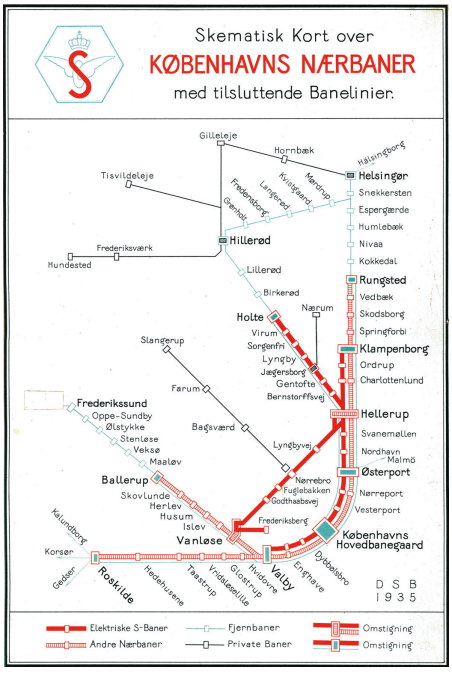


Fig. 16. Copenhagen S-Tog map of 1935, to a design first issued in 1934. Rather than fixed 45º angles, the diagonal lines radiate outwards from the focus of the network.

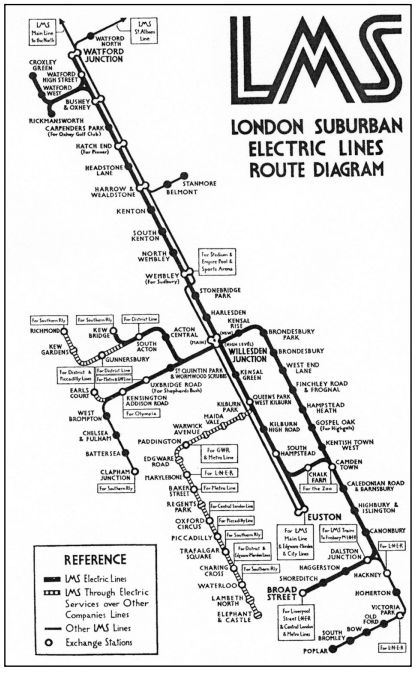


Fig. 17. LMS London area suburban map of 1935 by George Dow. No copies exist, other than a monochrome *Railway Magazine* reproduction [4].

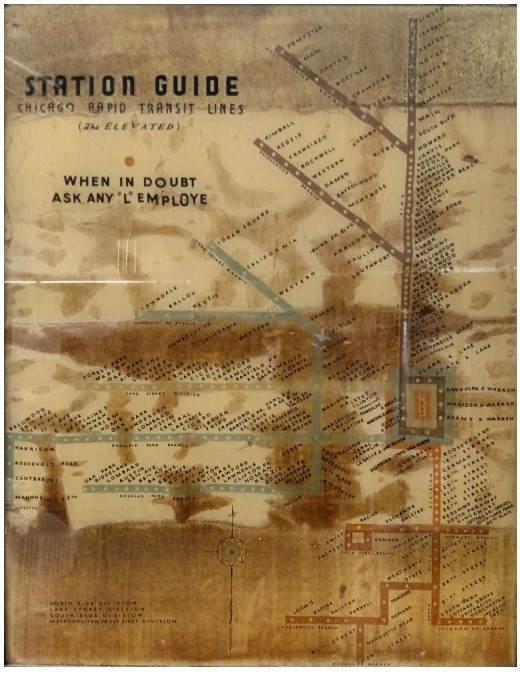


Fig. 18. Chicago Elevated Railway map of 1936. Chicago is the only grid city in this section, hence the most highly schematised-appearing map in this paper is also the one with the *least* topographical distortion.

Fig. 19. A Japanese poster (left), possibly dating from as early as 1930, advertises a highly schematised route between Manchuria and Japan. Many European airlines adopted schematisation techniques. Two timetable maps are shown here for the Belgian airline, SABENA. The 1933 version (top right) is a very abstract plan but, by 1937, (lower right) this had been embellished with airbrushed clouds.

first passenger airplane that could be operated profitably without government subsidy [21]. The precise air-corridors that connected cities (where these had been established) would have been invisible to travellers, cartographers and designers, and so the freedom to schematise maps would have been even greater

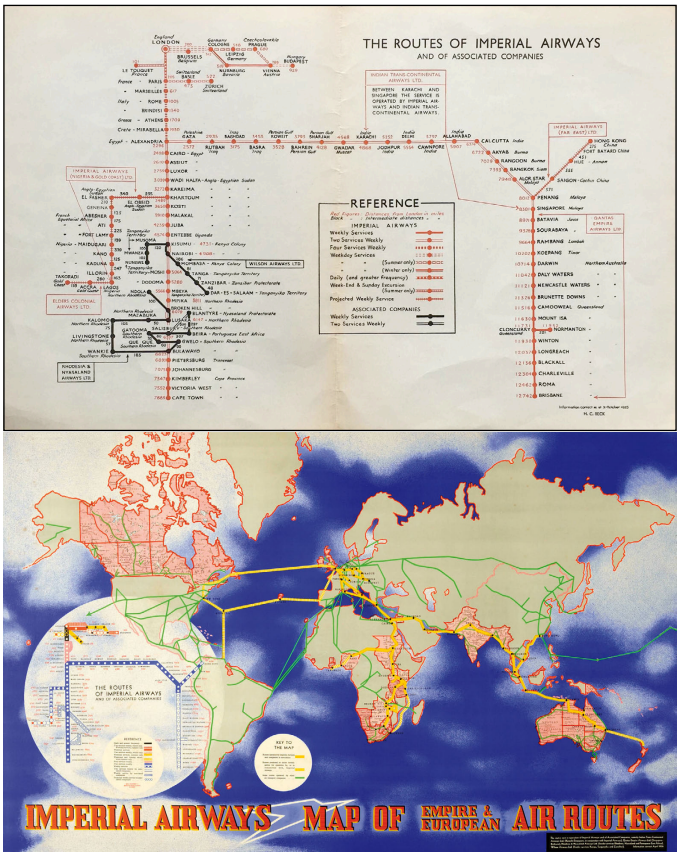


Fig. 20. A design bearing Henry Beck's name and dated 1935 (upper) seems to have formed the basis of Imperial Airways' publicity and timetable graphics of the 1930s, such as the inset on the 1936 poster (lower).

than for underground railways. Many examples of schematised airline service maps exist (Fig. 19) although, in keeping with expense of air travel at the time, sumptuous Art Deco embellishments were commonly used to add glamour to publicity, against the ethos of modernism [15, 21].

Interestingly, a direct line to Henry Beck can be proven for some designs at least. The British airline, Imperial Airways, was one of the most prolific users of schematised maps during the 1930s [14], and the basis of these recently surfaced at an auction, with a highly schematised plan of services stretching across the world from Europe to the tip of Africa and Australia, and dated 1935 (Figs. 20 and 22). Whether this, in turn, influenced Pan American Airways for its own timetable map is an open question (Fig. 21). The earliest known version was issued in July 1936, a very short time after the Imperial Airways designs could have become widely known.

C. A Flood of Creativity

The earlier urban rail network maps of the 1930s showed a distinct tendency towards octolinear or even tetralinear/

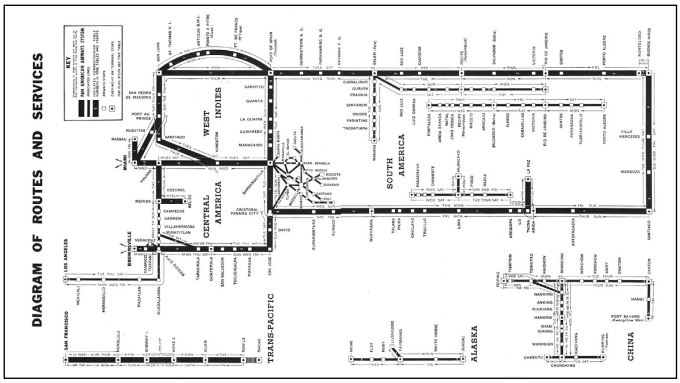


Fig. 21. 1936 Pan American Airways timetable map of South American services. This is shown in its original orientation. Whether the Imperial Airways works inspired this design is an open question.

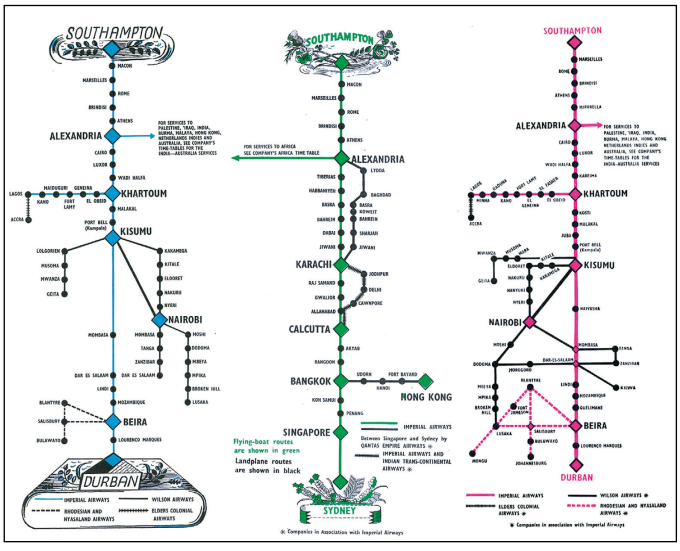


Fig. 22. Imperial Airways timetable maps dating from 1938 (left, centre) and 1939 (right). As per train strip maps, the route to Sydney (centre) is very distorted. Note the Arts & Crafts style embellishment on the first two maps, not strictly compatible with a modernistic approach.

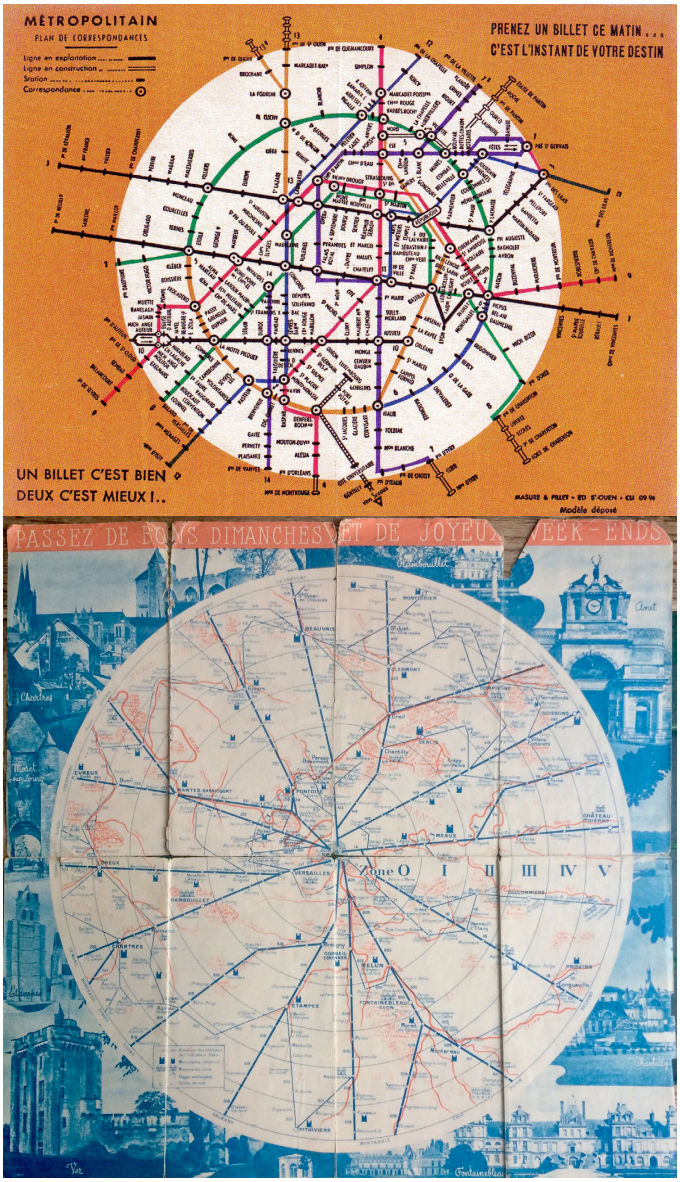


Fig. 23. Two superficially similar 1938 French schematised maps, dominated by circles. The Paris Metro map (top), issued by Loterie Nationale, shows the orbital route (todays Lines 2/6) as a perfect circle, but the multiple angles of the other lines (making this a *multilinear* design) cause problems with *coherence* [24]. The SNCF national railways map (lower) uses circles to depict journey times, and the clear centre makes the multilinear line depictions somewhat less incoherent.

rectilinear designs. Not only are there many more examples of schematised network maps in the second half of the decade, but the approaches to this are far more diverse, particularly various French examples (Figs. 23 and 24). The Paris Metro network, which is uniquely dense and convoluted, has been a frequent target for unusual design rules [19]. RATP issued a particularly effective official topographical map, drawn by F. Lagoutte, which survived, with updates by Georges Redon, until the 1970s, but also created linear train maps for all the lines [19, 24]. The gentle tilt to Paris makes the network difficult to depict using octolinearity [24], hence some of the more experimental approaches taken by independent designers in an attempt to fit design rules to network structure (Fig. 23).

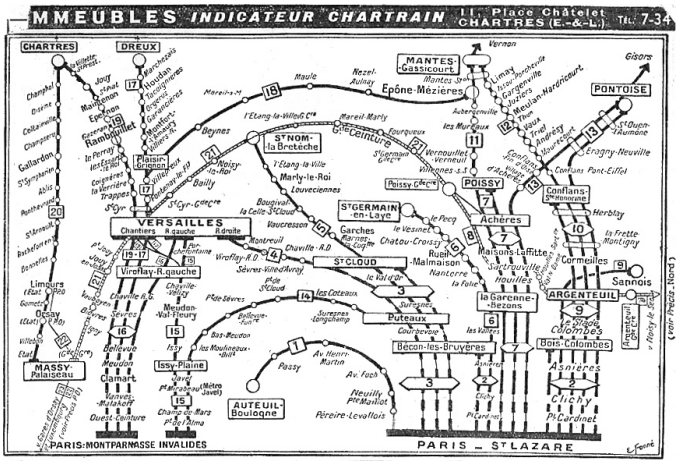


Fig. 24. Curvilinear schematisations are less likely to evoke suspicions of topographical inaccuracy. This 1938 timetable map, for the Ouest Railway company suburban services, rotates Paris by 90º.

Other designs are more conventional, but no less ambitious, such as an anonymous Italian map of 1938 showing European mainland rail services colour-coded by class of travel available (Fig. 25). George Dow's octolinear combined LNER London

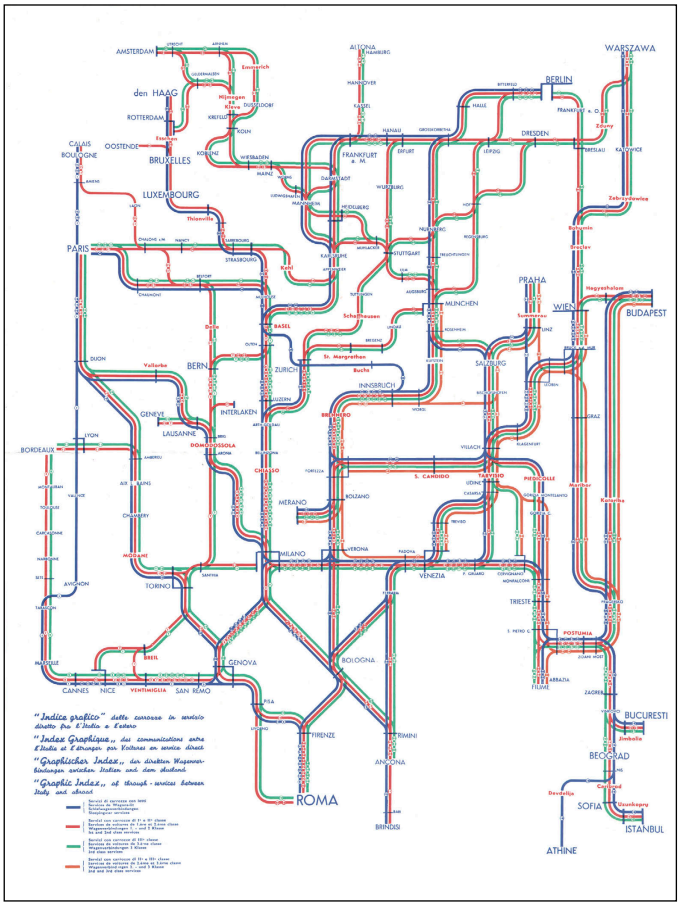


Fig. 25. Possibly the most ambitious map from this compilation, a *graphic index* from a 1938 Italian tourist guide shows mainland Europe as an octolinear schematisation. Dominated by horizontal and vertical lines, it anticipates Henry Beck's movement in this direction by fifteen years. The designer is unknown.

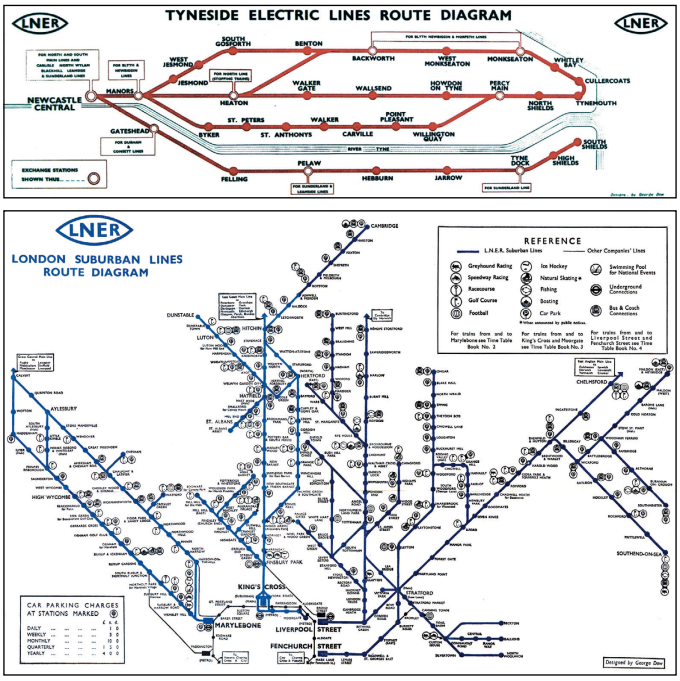


Fig. 26. Beyond the second half of the 1930s, George Dow focused on octolinear designs, albeit *irregular* if this was appropriate for a network, as per the 1938 train map of LNER Tyneside suburban services (upper). The octolinear approach is exemplified by his most ambitious map to date (lower), showing all LNER London area suburban services. This was first issued as an internal document in 1935. The version here, from a 1939 timetable, introduces pictograms.

suburban railways timetable map (Fig. 26) includes over 250 stations, alongside pictograms, to indicate local facilities and attractions. His LNER Tyneside suburban railways map adopts shallower diagonals as a better match to network structure than 45º. This is an octolinear design with variable-sized rotations between the four implemented angles, hence *irregular*

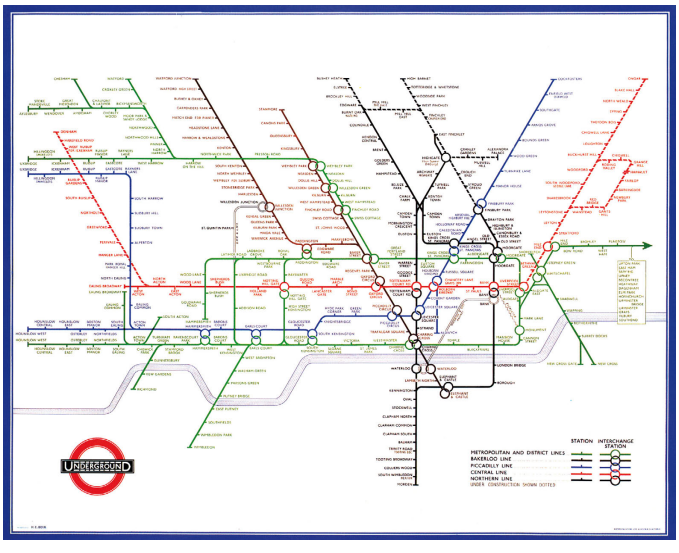


Fig. 28. Just beyond the decade, but clearly a product of it, Beck's use of 60º diagonals on this *irregular octolinear* map was an attempt to save space horizontally. Other design innovations, less effective, make the utility of this difficult to evaluate. The design survived just one issue.

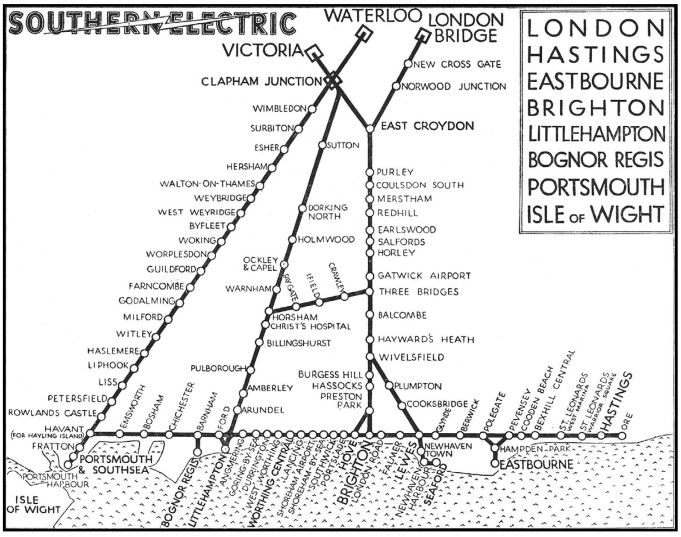


Fig. 27. 1938 Southern Railway timetable map showing electric services extending all the way to the south coast of England. The multilinear approach is used to good effect, with perfect straight trajectories to imply fast journeys, far more direct than in reality.

octolinear. These contrast with the *multilinear* Southern Electric timetable map (Fig. 27), where the designer chose varied angles so that line trajectories could be perfectly straight.

Henry Beck himself also attempted an irregular Octolinear design for the London Underground map, using 60º diagonals in an attempt to allow space for the forthcoming east London additions to the network (Fig. 28), although the benefits of this innovation were diluted by over-large interchange rings, and duplicated line-coloured station names, heightening congestion at the centre of the map (the most complicated region). In contrast, a Berlin S-Bahn service-pattern map of the same year

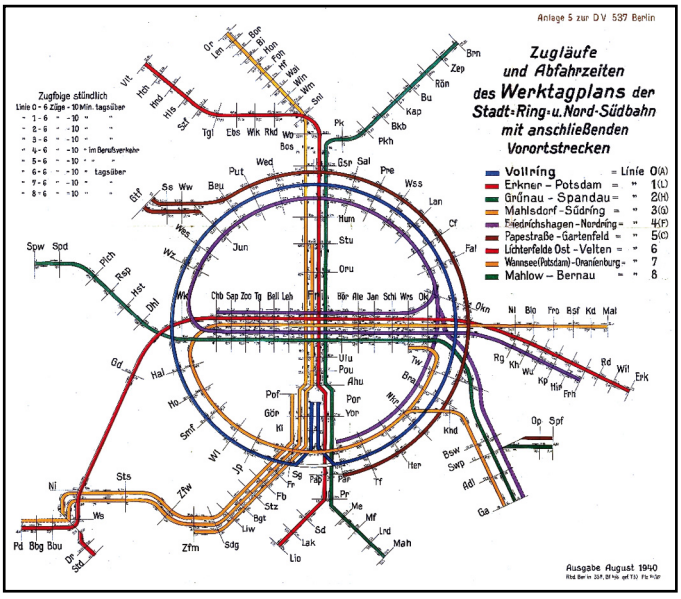


Fig. 29. 1940 Berlin S-Bahn services map, with shortened station names, enhances clarity to better emphasise the basic network structure of a circle crossed by north-south and east-west lines, although the trajectories of these are, in reality, considerably less direct.

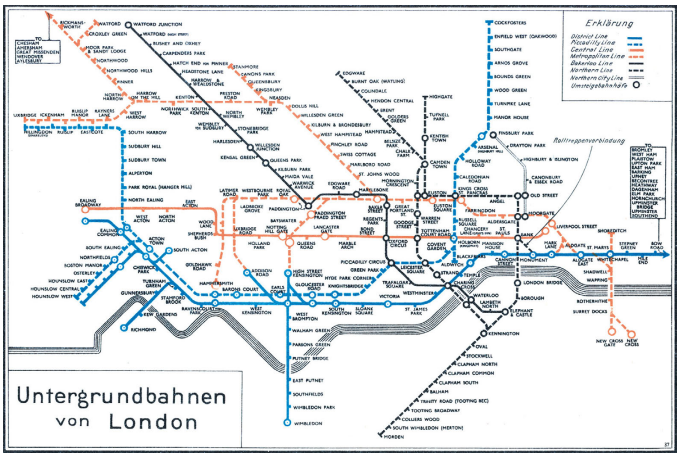


Fig. 30. Grieben, publishers of the German language *Reiseführer* travel guide to London, included an official monochrome London Underground map in the 1934 and 1936 versions. For the 1938 guide, the map was printed in three colours, but was clumsily redrawn for this purpose, resulting in what might be the first ever international intellectual property violation of the official Underground map.

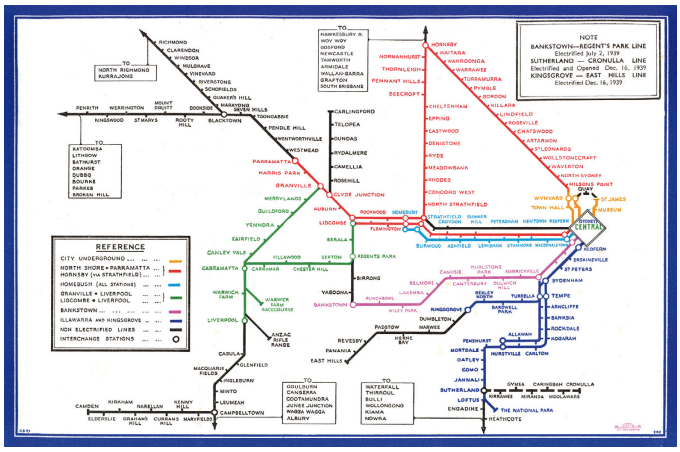


Fig. 31. The Sydney suburban railways map of 1939 is closer to the London Underground design than any other discussed in this paper. In particular: station marks; interchanges; and the general look and feel (note the blue frame for example). The appropriation of the London underground roundel for the cover confirms the direct inspiration, but the purpose of the map remains a mystery.

(1940, Fig. 29) shows the benefits of reduced-length station names, with more orderly typography than the 1931 version, and clear emphasis on the underlying network structure, although octolinearity is dispensed with beyond the circular *Ringbahn*.

D. Direct London Influences

Other than the Imperial Airways designs (Figs. 21, 22), none of the network maps discussed can be said to have an unambiguous, direct link to Henry Beck's own work. It is possible that some of the designers were aware of its existence, it is possible that some were not. However, there are two further examples where the lineage is obvious: an intellectual property violation; and a design whose purpose is not clear and, indeed, might have been created as a thank-you gift.

The *Grieben Reiseführer* map of 1938 is a straightforward recreation of the London Underground design (Fig. 30). The publisher had previously included monochrome official maps in travel guides to London but, presumably, now desired a colour version. The lack of availability of suitable printing plates – their line-colour combinations do not match any officially produced Underground map of the time – led to their recreation of the map in Germany, most notably resulting in the ungainly twist of the line to Hammersmith in west London (where the orange-dashed line is closest to the river). Today, most licensors of intellectual property include no-alterations clauses. It is not known whether London Transport were aware of this map, nor whether its publishing was in violation of terms and conditions of any written licence that may or may not have existed, but it is safe to say that had officials known about this, they would have been reluctant to condone it.

The Sydney suburban rail map of 1939 is an enigma. The version is unusually reminiscent of Henry Beck's own designs (Fig. 31), and the cover features a London Underground roundel modified, advertising the *City Underground Railway*. However: modernisation and electrification had been largely completed by 1932; the map seems not to have been displayed on platforms or distributed to the public; and the roundel was not used in any official capacity in tandem with the map. There had been no rail-related special events, such as conferences or celebrations, in Sydney that year (New South Wales Railway Museum, personal communication, 2011). The only known relevant detail is that A.G. Denniss, Chief Traffic Manager, had visited the UK in 1938. This provides a route by which the London map arrived in Sydney, and one hypothesis is that the Sydney version was produced as an expression of appreciation of hospitality. The reason for the existence of the pastiche, therefore, might be goodwill, rather than an appropriation of information design techniques.

V. CONCLUSIONS

This paper has presented, probably, the largest written compilation of 1930s schematised network maps to date. This was a decade of considerable creativity in the design of these, both in terms of quantity, and also diversity of approaches. Indeed, compared with todays maps, where the vast majority are either topographical, or else are octolinear schematisations [20], the design landscape then was relatively more varied and colourful. Some ideas quickly fell by the wayside. Others, most notably octolinearity, have been pursued to the point at which they have become almost *design standards* [24]. After the Second World War, there was a long pause in the march of schematisation, with the New York City Subway being the next major network to offer a highly schematised design, created by George Salomon and issued in 1958 [27]. This is a creation whose lineage to Henry Beck can be directly traced: Salomon emigrated to New York City via London, and was horrified by the differences in information design standards between cities.

The schematisations discussed in this paper have not been collated as a result of systematic research. In many cases simple good luck led to discoveries, most frequently internet sightings (e.g., Figs. 18, 20, 21) and communications from collectors (e.g., Figs. 23, 27). Very occasionally, serendipitous findings take place. For example, the Italian design (Fig. 25) was a chance discovery at the shop of a Brussels poster dealer. One hope with this paper is that publicising the current state of knowledge might flush out more examples currently held in

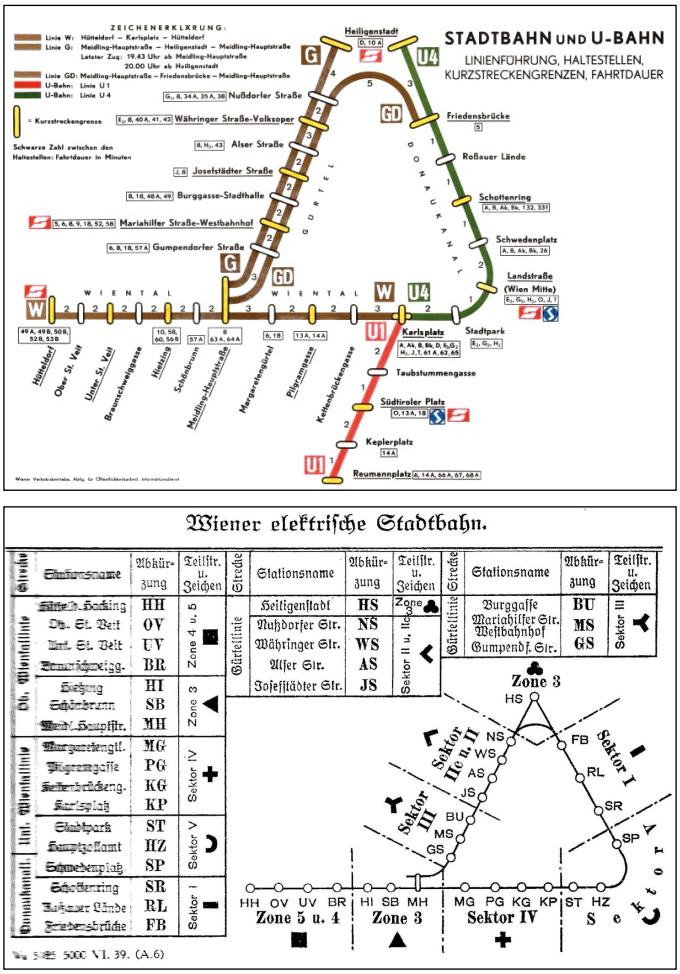


Fig. 32. Until the opening of the Vienna U-Bahn lines, the maps of the *Stadtbahn* depicted a classic triangle configuration. The example (top) is from 1978. However, recently discovered on the internet, a 1939 fare table/zonal map suggests that this has a longer history than previously suspected.

private collections, or otherwise not available to the general public. Even if the topic of the development of schematisation was researchable via comprehensively deposited artefacts held in archives, the number to be consulted would overwhelm the resources of most historians. Hence, research must be targeted, directed in particular towards cities with early underground or electric city railways, such as Boston, Budapest and Tokyo, and also steam-operated networks that were electrified during the time period. Clues garnered from internet sightings suggest, for example, that the Vienna *Stadtbahn* system appears to be a good candidate for further research (Fig. 32).

What then was the source of the unprecedented surge in network schematisations during the 1930s? With so many examples, some not attributable to Henry Beck for the simple reason that they preceded or were concurrent with his work (Figs. 4, 5, 8, 9, 11, 14, 19) or were clearly inspired by other non-Beck designs (Figs. 16, 29), the *pivotal design hypothesis* is undermined somewhat. And, although his direct influence can be traced with certainty in some cases (Figs. 20, 22, 30, 31), the sources of inspiration for the remainder must be open to question, especially where notably different design rules were implemented, or else a known designer already had a track record in this domain (Figs. 17, 23, 24, 26, 27). This leaves just three maps (Figs. 18, 21, 25) where it is definitely plausible that designers were inspired by Henry Beck's work, and drew upon his principles for their own versions. But, the evidence is no more than circumstantial, and with the powerful forces of modernism sweeping worldwide, alternative explanations: that inspiration came from more general international inclinations towards simplification and abstractedness, should also be taken very seriously.

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