The London Underground Diagram

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There are a number of reasons for choosing a diagram as a subject for analysis: diagrams employ a variety of means to encode information; the signs they contain are intentional and clearly presented; therefore, diagrams are relatively simple to decipher compared to paintings. In a diagram the functional features of the image can be readily distinguished from the non-functional whereas in a painting this may not be such a straightforward task (for example, when a viewer studies a modern painting he or she may have difficulty in deciding whether scratches in the paint surface were made by the artist or whether they are accidental; additions).

A valuable characteristic of objective human knowledge (objective in the sense that it exists in the public domain) is that macrocosmic systems which are only fully comprehended by a few specialists are made known to ordinary citizens by means of microcosmic models. This feature of knowledge, so familiar that it is taken utterly for granted, is exemplified by the London Underground Diagram (henceforward 'LUD') a two-dimensional model which, through the agency of reproduction, is made available to the general public for consultation at any point both within and without the London Underground railway network (the macrocosm).

Millions of travelers make use of the LUD millions of times every week, yet no one appears to pay it any special attention: passengers look through it rather than at it. Although this indifference can be interpreted as a tribute to the superlative functionalism of its design, one might have expected some sign of appreciation from British art critics since most of them reside in London, and since the diagram is, arguably, a masterpiece of twentieth century graphic art. Until now the only substantial article on the LUD and its designer Henry C. Beck (1901-74) is a factual account of its development by the graphic artist Ken Garland. (1).

The Underground diagram is also commonly referred to as an Underground map but the former description lacks certain features typical of maps (though, as we shall see later, diagrams and maps do share some characteristics). In order to elucidate the distinction between diagram and map it is necessary to state some obvious features of maps: most maps are graphic representations of the whole, or part, of the Earth's surface, they reduce a three-dimensional world to a two-dimensional plane. Because they depict curved surfaces on flat pieces of paper, distortions occur and because the size of each piece of paper is much smaller than the size of the area it maps, great reductions of scale occur. In spite of their distortions maps exhibit a high degree of isomorphism with the areas they represent graphically: if an accurate map of a relatively small, flat region of the Earth were enlarged until it was equal in size to that region then it would fit over it exactly.

Such is not the case with the LUD: if enlarged to the actual size of London it would diverge markedly from the geography of the terrain for the simple reason that it is a highly schematic representation of the Underground system and furthermore, unlike a map, it is not drawn to scale. These aspects of the diagram can mislead passengers who try to use it as a guide to the location of surface features or as a guide to the actual distances between stations; they soon discover how approximate the diagram is in relation to the actual surface topography of London. The radical difference between map and diagram can be seen at a glance if the first route guide to the Underground - a map designed by F.H. Stingmore in use from 1919 to 1933 - is compared to Beck's design.

Beck conceived the idea of the diagram in 1931 and though it was originally rejected as 'too revolutionary' it replaced Stingmore's map in 1933. From 1933 to 1959 Beck was responsible for the design of the diagram and its numerous revised editions. The current diagram, designed by Paul E. Garbutt, is heavily indebted to Beck's classic design and London Transport ought to acknowledge this fact by printing a credit to Beck on the diagram. Revisions of the LUD were (and still are)

necessitated by the opening of new tube lines but new versions were also produced in order to incorporate additional information suggested by staff or members of the general public. Many revised versions were abandoned as failures because the Improvements' tended to overcomplicate the design.

Beck was by profession a draughtsman and it was during a period of unemployment, after having been made redundant by London Transport, that it occurred to him that he could "tidy-up" the old "Vermicelli" map of Stingmore's "by straightening the lines, experimenting with diagonals and evening out the distances between stations." As Garland has pointed out, Beck's three most significant innovations in 1931 were: (1) substitution of diagram for map; (2) restriction to three directions of lines (horizontal, vertical and diagonal); and (3) enlargement of the central area. The design problem which prompted these innovations was that of accommodating within a limited rectangular space all the lines radiating towards the outlying directs of London and, at the same time, maintaining clarity in the overcrowded centre. The problem was aggravated every time a new tube line was introduced. Beck realized that clarity and geographical truth were antithetical to one another and that geographical accuracy had to be abandoned in favor of clarity. In other words, Beck's choice of diagram rather than map was the result of an evaluation of different modes of representation in relation to the needs of the travelling public.

There is a general lesson here: no representation tells the whole truth about reality, every representation is partial and selective in what it depicts; every picture conceals as much as it reveals. Consequently, an artist's choice of representation must be based on what he or she considers are in the best interests of those he or she has chosen to serve.

Before consideration can be given to the pictorial conventions and coding mechanisms of the LUD it is necessary to tabulate its components:

(1) Network: the diagram consists of a number of lines converging towards a central core delimited by the Circle line. The lines intersect at various points to form a network structure. To ensure clarity this network is inscribed on a uniformly white ground.

(2) Ground: the rectangular poster is displayed vertically like a painting but, unlike a picture, its four dimensions have directional properties, that is, top/bottom and left/right are implicitly understood by the viewer to represent North South and East/West. In one version of the diagram a north-pointing arrow was introduced but it was quickly realised that this symbol was redundant).

(3) Border: most large posters of the diagram have borders consisting of a thick blue line while diagrams printed as pocket-sized folders have borders consisting of a narrow black, or blue, line.

(4) Grid: the ground of the current diagram is divided into squares by a co-ordinate grid which, when used in association with a list of station names, enables strangers to London to pinpoint the location of stations on the diagram.

(5) Colour: each tube line is assigned a distinctive colour which enables them to be easily distinguished and memorized. Names and colour codes of all the lines are given in a key
contained in a bix placed in a corner of the diagram. At one stage the coloured lines also incorported their names in printed form but this awkward piece of design contradicted the colour coding system (though it did have one advantage; when the diagram was printed in black and white the lines could still be identified.

(6) River: the only surface feature represented on the LUD is the River Thames which is depicted by means of a blue band. This band includes the words !River Thames' and it narrows progressively from right to left to indicate downriver -

upstream. As a result
of the process of geometricization the natural undulations of the Thames have virtually disappeared in the graphic symbol. Another departure from reality is that the tube lines which pass under the river are printed over it in the diagram.

(7) Stations: these are indicated by square ticks on the lines and by circles (some of which are interlinked to indicate interchange stations).

(8) Language: the diagram contains a number of English words and phrases: names of stations and lines, explanatory statements; title of diagram; name of designer.

(9) Miscellaneous symbols: a zig-zag line to show an escalator connection: the [use of a dot notation] to indicate Underground stations which link-up with British Rail stations; red crosses and stars to indicate stations whose opening hours are different from the rest; a plan view of an aircraft to indicate Heathrow Airport; a circle intersected by a horizontal bar - the symbol of London Transport.

It has already been established that the LUD does not represent its object in the manner that maps normally do but nonetheless the diagram is, to a degree, an iconic representation of the Underground system. Charles Morris remarks:"a sign is iconic to the extent to which it itself has the properties of its denotata"; and since both the diagram and the tube system are networks of lines the first is, in this respect, an icon of the second. Essentially the diagram depicts a set of points and the way they are joined up. The terminology of graph theory is a "finite connected graph." Consequently, it reproduces precisely those properties of the Underground system which are of most significance to the traveller and ignores other properties which are of little significance to the traveller. Network analysis is now a commonplace technique of business management, its purpose is to solve network outing problems by finding the optimum paths between nodes in relation to such factors as time, distance and cost. Every time a traveller on the Underground uses the diagram to work out the best and cheapest route from starting point to destination he or she is unwittingly solving a network routing problem. The value of the diagram is that it makes it possible for the traveller to journey to his or her destination in logical space (by alternative routes if necessary) before her or she commits himself or herself to travelling to it in physical space. Leonard Penrice points out that in making railway journeys travellers "play a kind of game according to certain rules … They start and finish journeys ...stations: they count, and recognise the name of, stations they go through and they change from one line to another at certain points." (4) Penrice argues that Beck's achievement was to design a diagram on which an identical game could be played according to essentially similar rules." The relation between railway and diagram is not, according to Penrice, a static resemblance such as one finds in a photograph; the diagram and the traveller "together constitute a kind of working model of the railway and not a static representation."

All copies of the LUD inside the Underground system represent their own location (this is one characteristic which the LUD shares with maps). Charles Sanders Peirce explains, "on a map of an island laid down upon the soil of that island there must [be isomporhism] … under all ordinary circumstances there must be be some position, some point, marked or not, that represents qua place on the map, the very same point qua place on the island."(5) Thus once we are inside the Underground our position is always locatable on the diagram. When we consult it on a station platform our first taks is to establish our positon in relation to the rest of the network. At one time diagrams contained an arrow and the phrase 'you are here' to single out the station in question. As a sign, the directional character of the rectangular ground is purely conventional: the diagram as a stimulus object does not contain any symbol indicating the fact that its top edge is 'North'. This property is imputed to the diagram by the traveller whose interpretation of the diagram is governed by the context of transportation and general knowledge concerning the .conventions of map reading. In an art gallery the 'same* rectangular ground would involve a different set of conventions.

In logic the purpose of a linear enclosure, and in art the purpose of a frame , border or mount, is to establish the boundary of a particular universe of discourse', to isolate a domain from the flux of

experience. But since the edges of the poster literally demarcate the limits of the domain, the presence of a graphic border in the LUD might seem an unnecessary move on the part of its designers. However, by repeating graphically the rectangular shape of its support, the border emphasises that the domain it encloses is a metaphorical one not a literal one.

Just as the diagram functions as a key or index to the underground system, the grid used for locating stations and the box explaining the colour coding operate as keys to the diagram. They are signs within a sign. Clearly the grid does not denote anything exterior to the diagram; it merely divides the ground into equal segments. Cross referencing is achieved by the combination of two arbitrary codes: the alphabetic and the numerical. These devices are printed along the vertical and horizontal axes of the grid. Since the key to the diagram is a meta-sign (a sign about a sign) the purpose of the frame which encloses it is, like quotation marks in a conventional text,to mark the boundary between object-sign and meta-sign, so that the viewer does not confuse the two in reading the diagram.

While the colour coding of the lines is totally arbitrary and monosemic (in the LUD 'yellow[1] has no meaning apart from 'Circle Line') it is inevitable that for regular travellers the colours will acquire connotative meanings aparts from their denotative ones. The emotional assocations developed in response to the colours of the lines will vary from person to person; their potentiality for meaning is infinite. However, the sense of inappropriateness which most Londoners feel when they learn that the red Central Line was once orange in colour demonstrates how closely each line becomes identified in our minds with its tincture. Exceptionally, the hue of the Central Line does seem to extend beyond the realm of the arbitrary in that this line is compositionally one of the most important, since it functions as the base-line or spine for the rest of the network. Its structural importance is signaled by the fact that it is assigned the most dynamic colour in the spectrum.

Turning now to the respresentation of the river Thames. Water is naturally colourless but according to the conventions of map-making, it is always blue. At first sight this seems a purely arbitrary coding but it is in fact 'relatively motivated[1] (to use Saussure's terminology), that is, on cloudless days water is blue. Furthermore, blue is generally experienced as a 'cool' colour; therefore it signifies the coldness of water. The narrowing of the graphic river from right to left indicates, of course, the narrowing of the river which occurs from East to West.

Of great importance is the fact that the meaning of the graphic image is mediated linguistically. Imagine the diagram bereft of all names of stations and lines and without the explanations given in the key. It would still display the structure of the Underground system but its effectiveness as a guide would be nullified. As Roland Barthes has pointed out, one of the chief functions of linquistic elements accompanying images is to anchor their meaning. (6) Without a title on the LUD a stranger to London would not know what system the diagram represented.

Subsidary signs found within the diagram, such as the logos of London Transport and British Rail, are symbols (according to Peirece's triad of signs: index/icon/symbol), that is, conventional signs standing for large-scale transportion enterprises. On the other hand, considered in isolation each logo has iconic features; for example, the two horizontal lines in the British Rail logo obviously represent railway lines. The iconic features of the London Transport logo are more problematical. Various interpretations of it have been offered it represents the wheel of a railway engine; it represents London (the circle) and London Transport's ability to criss-cross the city (the horizontal bar). The London Transport logo reminds us that the LUD is but a single unit in a much larger system of signs encompassing the whole of London's tubes and buses. Taking a narrower view, it can be readily appreciated that the LUD Is the 'mother[1] of a whole series of route diagrams depicting parts of the network, that is, those displayed in station passageways and inside tube trains.

In addition to its denotation 'Underground system', the LUD has acquired a supplementary signification in the years since it was introduced; as a decorative motif on gifts and souvenirs produced for tourists, the diagram functions, like the images of St. Paul's, the Tower, the Houses of Parliament, etc., as a symbol for London. Since the LUD was consciously composed it necessarily signifies a set of

aesthetic values, in this instance, certain principles of design historically associated with Classicism; namely, order, unity, harmony, stability, purity, clarity, economy, anonymity of finish, and rationality. These values are not communicated via symbols; on the contrary, they are signalled by the perceptual characterstics of the sign vehicles themselves; for example, the impression of clarity is achieved by the use of lines with hard edges rather than blurred edges and by the use of a range of colours which are highly differentiated from one another. Similarly, the impression of purity is achieved by the use of saturated hues.

In conclusion, a few remarks about the utilty value of the LUD. Frank Pick, for many years an administrator for London Transport, dedicated himself to improving the quality of design for the Lodnon commuter by commissioning leading modern architects to build new stations and leading graphic designers to produce typography and posters for the Underground. Beck's diagram was not commissioned by Pick, it was a lucky bonus which matched the philosophy of utilitarianism – Bentham's concept of the greatest happiness for the greatest number - which I take to be the ideology of the London Transport executive in the 1930s. Utilitariansim can be criticized on the ground that it permits dicatatorship - providing it is benevolent - and perhaps today a designer would feel it necessary to encourage public participation in the decision making process leading to a design solution, rather than producing a design on the public's behalf, without consultation.

Marx claims, in Das Kapital, that "the utility of a thing makes it a use-value." Things which have use-value for others bedies the person who made them have social use-value. However, the fact that the LUD has social use-value does not mean that it escapes being a commodity. Clearly the original design which Beck produced while employed as a wage labourer by London Transport could now be sold as commodities, but even the copies of the diagram given away 'free[1] by London Transport are commodities: they have no use-value except for those travelling via the Underground and this service costs money, therefore the use of the diagram is included in the price of tickets.

What is important about the LUD Is that it is a sign of exceptional richness and social utilty. It is a work of graphic design which literally works every day, and evolves year by year to meet changing circumstances, hence it provides a model for the role of art in a future society. Designers generally tackle specific problems which are set by others, consequently they rarely have the opportunity to question the broader context within which the design problems are posed. This is the factor which limits the usefulness of the LUD as a model for current art practice.

References:

1 Kan Garland 'The design of the London Underground Diagram,' Penrose Annual vol. 62: ed. by H. Spencer (Lund Humphreys, 1969) pp. 68-82.
See also Ken Garland 'Obituary: Henry C. Beck' Design (312) December 1974, p. 86.
There are two further short articles: Arthur Berger 'London's Underground as a work of art,'San Francisco Chronicle, 12th June 1975, p. 21; Leonard Penrice 'The London Underground Diagram' Graphic Lines (1) 1975 pp. 19-22.

2 Typewritten statement by Beck in possession of Ken Garland.

3 Chalres Morris Signs, language and Behaviour (New York: Braziller, 1955) p. 23.

4 Op. cit.

5 Peirce quoted in Peirce's concepts of signs by D. Greenlee (The Hague/Paris: Mouton, 1973) p. 55.

6 Roland Barthes "Rhetoric of the Image," Working Papers in Cultural Studies (1) Spring 1971.