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"Ordnance Survey and cartographic style: keeping the good view (part 1)"

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The Charles Close Society was founded in 1980 to bring together all those with an interest in the maps and history of the Ordnance Survey of Great Britain and its counterparts in the island of Ireland. The Society takes its name from Colonel Sir Charles Arden-Close, OS Director General from 1911 to 1922, and initiator of many of the maps now sought after by collectors.

The Society publishes a wide range of books and booklets on historic OS map series and its journal, *Sheetlines*, is recognised internationally for its specialist articles on Ordnance Survey-related topics.

Ordnance Survey and cartographic style: keeping the good view (part 1)[1]

Alexander J. Kent

This article is based on a lecture given at the CCS AGM held in Ludlow on 16th May 2009.

"And in all cases, the official topographic maps issued by any one nation express something about that nation's ethos and character, as clearly do art (other forms of art that is!) and music." Larsgaard (1993)

As members of the Charles Close Society, we are familiar with the look and feel of Ordnance Survey maps, especially familiar, perhaps, with those alluring covers inviting us to consume the rich vocabulary of symbols in the paper landscape beyond. The cartographic language of topographical mapping has evolved over thousands of years and Ordnance Survey's peculiar dialect is instantly recognizable to us. Yet how often do we gaze at topographic maps produced by other national mapping organizations and wonder why they look so curiously different to our own? And what constitutes that difference; the use of colour, symbology, lineweight, font, toponymy, or all of these – and more?

There is, I would argue, something quite unique about the relationship between a state topographic map series and its subject – the national landscape – which is articulated through the way it is symbolized. The nationally-specific selection and representation of features gives state topographic maps a certain quality that, as Larsgaard suggests above, is capable of expressing something much more than the physical landscape.

Clearly, this is a vast topic and I cannot attempt to offer any more than a brief scamper here. What I aim to do in this article is therefore to demonstrate succinctly what makes Ordnance Survey's cartographic style distinctive amongst its European counterparts and to explore what might influence its evolution. To achieve this, I will draw from a recent investigation to analyse the cartographic styles of official 1:50,000 topographic maps from 20 countries and from further research that compares the stylistic development of British and Irish mapping.[2]

Understanding cartographic style

Style is a term that enjoys widespread use among the arts; in music, painting, literature, sculpture, architecture, and fashion to name but a few. It is often regarded as meaning a certain way of doing something, but more specifically, I would say it is a certain manner

[1] Part 2 will appear in *Sheetlines* 88

[2] For a more detailed explanation of the theoretical framework, methodology, and results upon which this article is based, see Kent (2008a), Kent (2008b), Kent (2009), and Kent and Vujakovic (2009).

or expression arising from choices (whether these are made individually or institutionally) that are involved in the creative process. When we talk about something belonging to a particular style, we recognize certain shared characteristics which indicate membership of a group (whether they are associated with a period, location, school, individual, and so on). A strategy that aims to preserve these characteristics during origination or revision therefore serves to reinforce the identity of that group. Where style is comprised from greater numbers of distinct characteristics, these are often perceived as an ensemble, rather than as a series of isolated, disconnected elements. Borrowing an example from music, while different instruments have contrasting timbres, a composer's particular use of orchestration, melody, and harmonic structure (especially tonality), makes it possible to identify the sound, for example as a piece of European music belonging to a specific period (Classical), composer (Beethoven), phase (Early Period), and date (before 1802).[3]

The recognition of any style will obviously depend on the strength of association with its ingredients and whether this is successful depends to some extent on shared experience. One might agree when presented with a scene of the Place du Général de Gaulle in Lille (fig.1) that it appears to be French – or at least definitely not British – through the impression created by the design of its buildings. But we do not need such architectural splendour (or even pronounced clues) to recognize such an authentic sense of difference. An inconspicuous street scene in Calais (fig.2), for example, still seems 'French' to me; the proportions of the windows, the angles of the roofs, the colours of the pavements, the textures of the façades, are successful in communicating this impression because, quite simply, these ordinary things look different.

Figure 1 Place du Général de Gaulle, Lille, France *Figure 2 Rue de Varsovie, Calais*

In cartography, style is introduced through the process of symbolization: the deliberate and specific ordering of graphical form to present the character of a feature in an abstract way. As the degree of abstraction – and hence generalization – is suggested by scale, cartographic style, especially that of topographic maps, is primarily derived from choices concerning *what to show* (including the amount of detail in which features should be shown), e.g. roads and classes of roads; buildings and types of buildings; vegetation and types of vegetation, and *how to show it* (generally through graphical variables such as size, shape, colour, texture, orientation, and so on). These fundamental choices are very rarely

[3] With any stylistic evolution, many characteristics are common to adjacent phases and their divisions are therefore arbitrary to some extent and while it lies among the least material of the arts, music provides no exception.

made by individuals in the realm of institutional map-making, though there are some exceptions. Eduard Imhof (1895–1986), for example, influenced the design of the Swiss topographic map series through his own style of mountain relief cartography. Nevertheless, the successive preservation of these choices by individual or institution whenever new maps are created or earlier editions revised strengthens the parameters of stylistic membership and their power of association.

A homogenous style is one of the defining features of a national series of topographic maps, where the national landscape (as a state-supported good view[4]) is symbolized through a standardized range of cartographic symbols. This range forms the state cartographic 'vocabulary' with which users become familiar. As topographic symbology is learned and accepted, its characteristics – which result from choices over what to show and how to show it – become naturalized, constructing a sense of what the cartographic portrayal of the national landscape should look like. (This is reiterated by Ordnance Survey's scheme to issue free maps to 11 year olds, which has been running annually since March 2002.) Depending on the user's degree of familiarity with the state symbology, it seems plausible that even slight variations would create an altogether different impression because the 'ordinary things' will look different. It is tempting to borrow the metaphor of orchestral music to suggest how the interplay of topographic symbols on a map creates an ensemble effect which facilitates stylistic association. More significantly, however, this ensemble effect has the capacity to communicate a more holistic characteristic – the national landscape – and with it, an impression of its sense of place. The power of expression that lies in the symbology of topographic maps perhaps explains something of the rationale behind Larsgaard's (1993) assertion above.

Comparing European styles of state topographic mapping

Before attempting to understand where Ordnance Survey's cartographic style fits within the broader context of European state topographical mapping, it is important to question why there should be any stylistic diversity at all. Modern state topographic maps continue a cartographic heritage that was galvanized by a tradition of scientific survey during the Age of Enlightenment; they are produced under its hegemony of positivism that champions accuracy and objectivity. If their role is to faithfully record the landscape (Sylvester, 1952), where variations in their appearance simply correspond to variations in the surface of the Earth, why should contemporary examples be stylistically different from one another?

It is not difficult, however, to observe that topographic maps of the same geographical area which are covered by the national series of more than one mapping organization *do* vary in appearance and content (compare two topographic map sheets covering the same part of the Alps, for example, or just the territory surrounding an international border). Europe has wide variation in terrain, climate, and vegetation but it

[4] A landscape is a selective, 'good' view of the land, which serves the interests (both aesthetic and ethic) of the patron. In state topographical mapping, features tend to be chosen (and those choices preserved) according to their relevance as perceived by the national mapping organization. Their portrayal is subsequently aesthetically conditioned through institutional cartographic praxis. Of course, the exact circumstances of production vary (e.g. political, technological, and financial constraints), but ultimately the cartographic success of any map depends on its aesthetic and functional resonance with the user.

is also culturally diverse. Some features have more importance within certain cultures, so they may be classified differently, meaning that they exhibit higher detail (e.g. number of symbols per feature) or certain features may be symbolized differently, meaning that they are emphasized (e.g., through shape, colour, size, or texture), exhibit greater abstraction, or are even designed to have more aesthetic appeal.

On the level of individual symbols, while each is designed – however mimetically – to denote a certain type of feature, this will vary with time and culture. A black 'point' symbol comprising a cross on top of a filled square on an OS map denotes a church with a tower in Great Britain, and, depending on their particular experience of British churches with towers, the user will have some understanding of what is being symbolized without having seen the feature itself. But OS is not the only national mapping organization to utilize such a symbol, as figure 3 illustrates, and the feature denoted by another nation's use of this symbol may vary to some extent (compare figures 4 and 5).

Fig 3(left) Symbols used generically to denote a church on various European 1:50,000 topographic maps

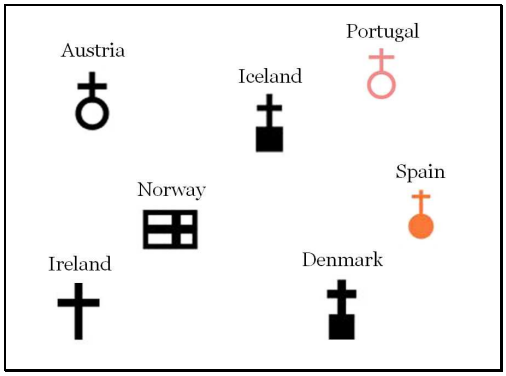


Fig 4(centre) A British church with tower (Lyminge, Kent) Fig 5(right) An Icelandic church (Reykjavik)

Moreover, while each symbol might denote the existence of a particular feature (e.g., a zoo, a nature reserve, an air museum) by using a particular object (an elephant, a duck, and an aircraft propeller, respectively), it is possible for each symbol to suggest different *connotations*, which may vary culturally and personally. In Great Britain, for example, an elephant has the exotic connotations we might associate with a zoo, the duck might connote local wildlife, and the propeller an older aircraft or an event such as the Battle of Britain. Our personal connotations may involve these and/or other associations, derived from the imaginative use of memory and experience.

Similar cartographic symbols can therefore give rise to different connotative associations when employed within different cultures, as users draw from their personal experience, memory, and imagination in reading maps; the realms of which are of course in turn also influenced by culture.[5] To be successful, therefore, topographic map symbols also have to induce connotations which are customary, i.e. generally agreed, within the culture for which they are determined for use.

[5] These connotations help to construct our biographical associations with maps. As symbols, maps are open texts which invite free play of the imagination and the creative manipulation of experience; aerial photographs and satellite images are closed texts that do not leave as much scope for this. As Ernst Gombrich (1995) put it, the painter must leave the beholder something to guess.

As cartographic symbolization therefore involves the selective omission of detail and preservation of character, it provides a means for discriminating between styles. The initial stage of this process relates to the classification of landscape, i.e., which features are selected from the land and the amount of detail in which they are classified. When comparing these classifications, it is crucial to ensure as much consistency as possible and consult the maps themselves. The scale of the samples therefore needs to be identical, as scale has a huge influence over the choices that are made regarding cartographic generalization and representation. Although derived from larger scale material, 1:50,000 is both versatile and widespread as a topographic map scale across Europe. Furthermore, different scales serve different purposes and this scale offers something of an equilibrium between abstraction and mimesis – and with it the intention to serve the general as opposed to the specific user. In terms of the medium of production, as paper maps preserve the choices made by the map-makers and limit the user's control over visualization (e.g. turning layers of information on or off), they are more suitable for such a comparison. Moreover, there is widespread variation in the availability of digital topographic data across Europe.

The investigation includes maps from 20 European countries (Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Great Britain, Iceland, Ireland, Italy, Latvia, The Netherlands, Norway, Poland, Portugal, Slovenia, Spain, Sweden, and Switzerland), which were acquired either by written request or personal visit. Only current, official, state topographic maps accessible to the public and designed for general use (i.e. not special versions) were selected, with a view to ensuring consistency and facilitating further study.

In order to explore and measure stylistic diversity, the method involves analysing the legend symbologies of state topographic maps as presented to the user. This vocabulary is independent of the area covered by the map sheet and represents the mapping organization's classification of the national landscape. A typology is constructed in order to compare the various classifications of national landscapes and to generate quantitative and qualitative data. In compiling the typology, every discrete and complete graphical symbol is sorted into mutually exclusive classes. The number of classes evolves as the symbologies are classified in an attempt to establish the lowest level of commonality at the highest level of detail between symbologies (figure 6). The resulting 19 classes are then aggregated hierarchically into a further two levels (figure 7), allowing additional analyses to be performed.

While there are of course limitations with any classification, this method aims for a consistent approach that allows the proportions of symbols constructing each national symbology to be compared. In addition, the classification of symbologies is complemented by a comparison of the use of colour, lettering, visual hierarchy, and 'white' space to offer a comparison that encompasses both content and appearance. The typology is therefore designed to engage with the most fundamental ingredients of cartographic style and to make the identification of supranational groupings possible.

After classifying 2,388 symbols from legends appearing in 17 different languages, the extent of the stylistic diversity of European topographic mapping starts to emerge. Slovenia, with a vocabulary of 218 symbols has the greatest number, while Ireland, with

Figure 6 The initial level of classification with examples of features represented by symbols in each class (© The British Cartographic Society)

Level Three Class	Examples of Features Symbolized
Road	Motorways, roads, tracks, bus stations, parking, junctions, tree-lined roads, and road tunnels/bridges
Rail	Railways, railway stations, cargo railways, and railway tunnels/bridges
Paths	Footpaths, bridleways, passes, ski-tracks, and footbridges
Canals	Canals, locks, canal beacons, trafficable dykes and aqueducts, and canal water level gauges
Cycle Tracks	Cycle tracks, cycle routes, and cycle bridges
Other Transport	Trams, ferries, ports, docks, airports, and helipads
General Built-Up Features	Residential buildings, schools, hospitals, post-offices, police stations, town halls, farms, towers, fences, walls, and sheepfolds
Administrative Boundaries	International, national, district, province, canton, and county boundaries
Religious Features	Cathedrals, monasteries, churches, chapels, and shrines
Industry, Communications, and Power	Quarries, peat-cuttings and huts, factories, fish farms, oil/gas stores, radio masts, windmills, watermills, pylons, and power stations
Water Management and Utilization	Reservoirs, fountains, dams, dykes, levees, irrigation canals, weirs, water towers, groynes, sluices, and sewage treatment facilities
Navigation and Military Features	Triangulation pillars, cairns, isolated objects as reference points, beacons, lighthouses, shipwrecks, and military camps
Tourist and Sport Facilities	Hotels, campsites, golf courses, ski-lifts, cable-cars, sports centres, and football pitches
Historical Features	Castles, ruins, ancient earthworks, burial mounds, and monuments
Managed Land	National parks, nature reserves, cemeteries, gardens, and parkland
Hydrology	Bodies of water, submerged rocks, rivers, streams, springs, currents, and bathymetric depths
Terrain and Relief	Contours, spot heights, escarpments, natural escarpments, rocks, scree, sand, cliffs, caves, glaciers, and snowfields
Vegetation	Woods, forests, grassland, open land, shrubland, heathland, meadows, hedges, orchards, vineyards, and arable land
Non-Landscape Features	Graticule intersections

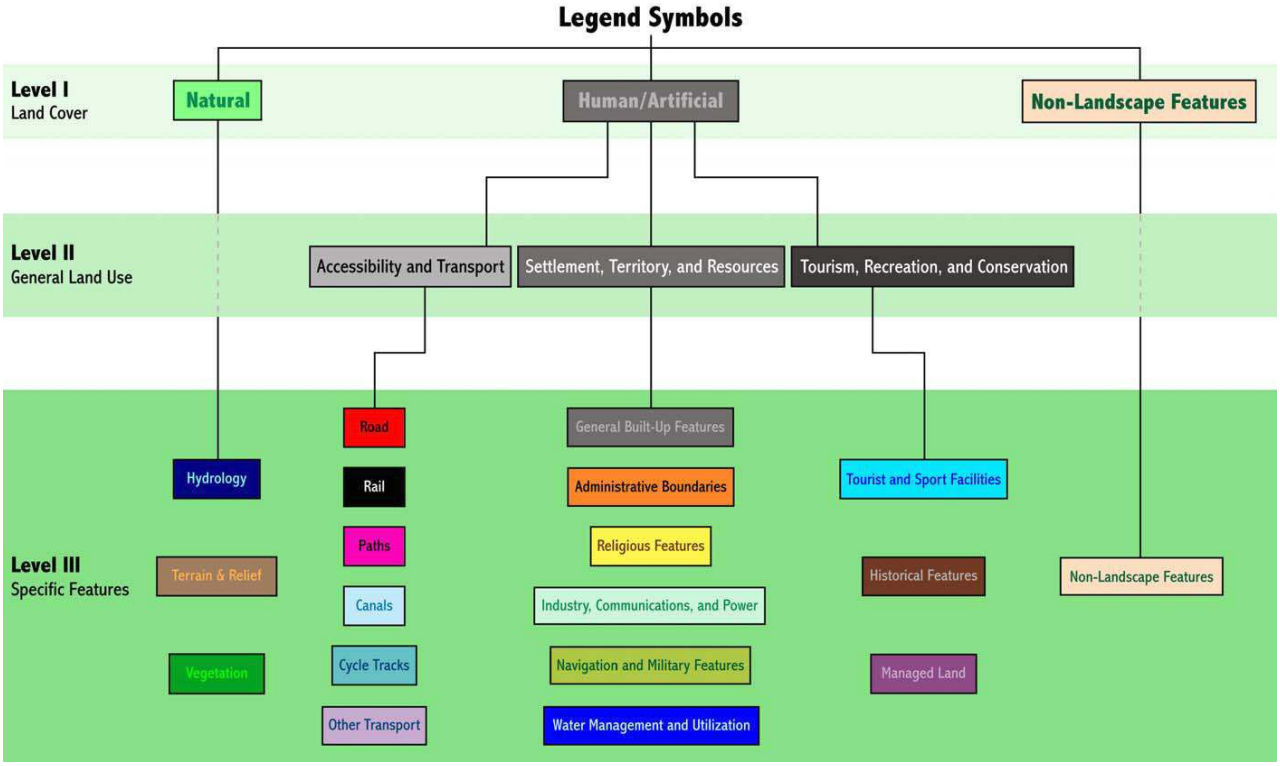


Figure 7 The hierarchical structure of the classification of legend symbologies (© The British Cartographic Society)

73, has the fewest. Figure 8 illustrates the range of symbols across the 20 countries, from which it is possible to speculate about a geographical core-periphery arrangement, where, very generally, countries employing a total number of distinct cartographic symbols tend to be located towards the geographical fringes of the sample.

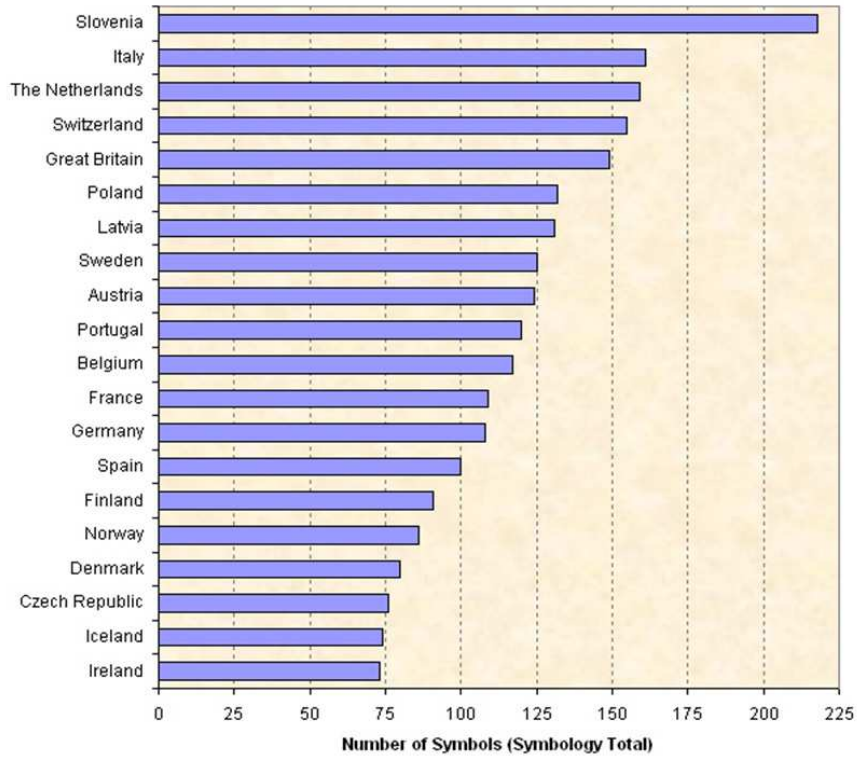


Figure 8
A ranked bar chart showing the comparative total numbers of symbols employed by the national mapping organization in each country
(© The British Cartographic Society)

As the quintessential process of topographic mapping is deciding what to show, it is plausible to examine the classifications of landscape, and, in particular, the relative proportions of symbols used to describe various features, to identify stylistic groupings. Pie charts are a useful medium for the visual comparison of these differences as they capture a sense of the relative proportions that make up the whole (fig 9). A better way to make visual comparisons between these data, however, is the star plot (fig 10), as it has the ability to capture something of the distinctive character of their subject by its shape.

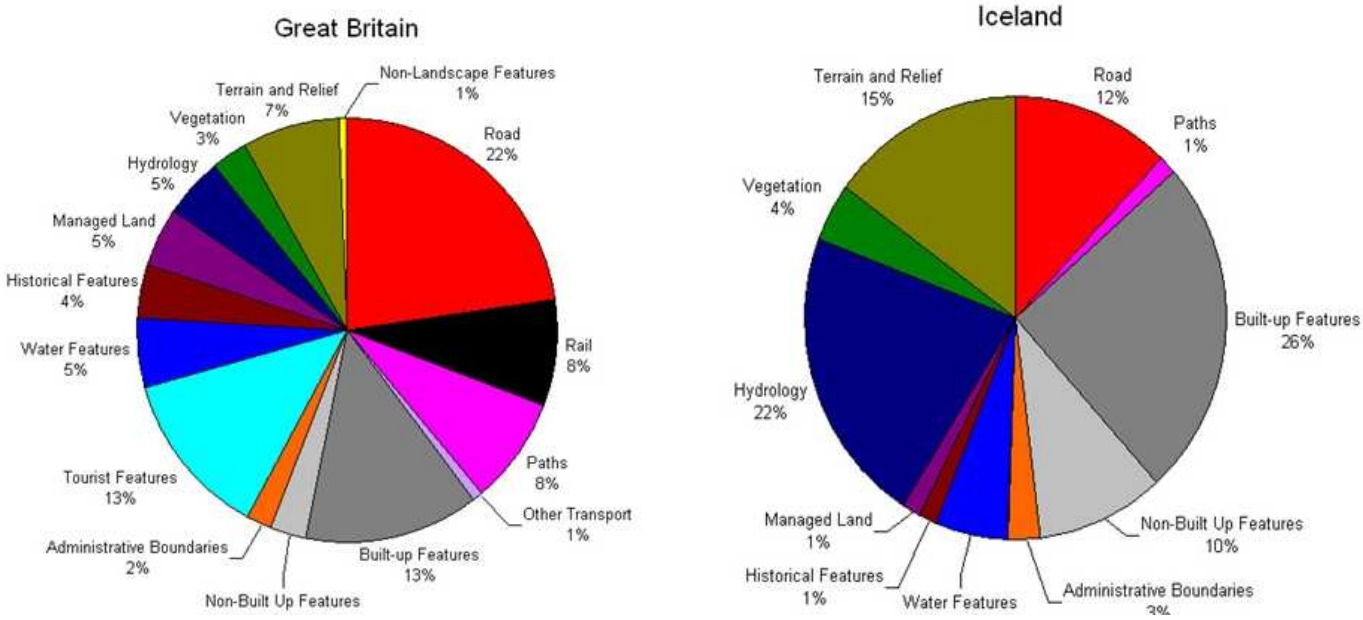
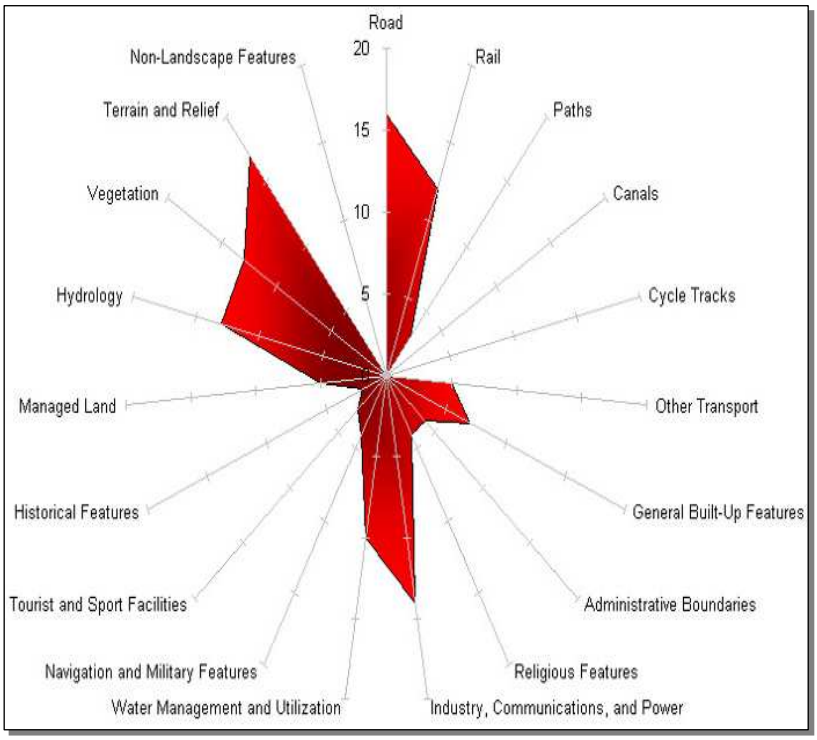


Figure 9 Pie charts showing differences between the British and Icelandic maps in the proportions of their symbologies used to represent different types of feature (© The British Cartographic Society)



Although visually effective, the more rigorous method of cluster analysis was introduced to identify stylistic groupings, whereby the relative proportions of symbols are analysed in terms of their numeric difference. I will not explain the technique in any detail here, but essentially the process starts with the maximum number of clusters (symbologies representing countries in this case) and proceeds to mathematically 'fuse' clusters together based on their similarity (percentages of the total symbology devoted to each type of symbol).

Figure 10 Star plot of Polish symbology, where the numbers on the axes represent the number of symbols per class (© The British Cartographic Society)

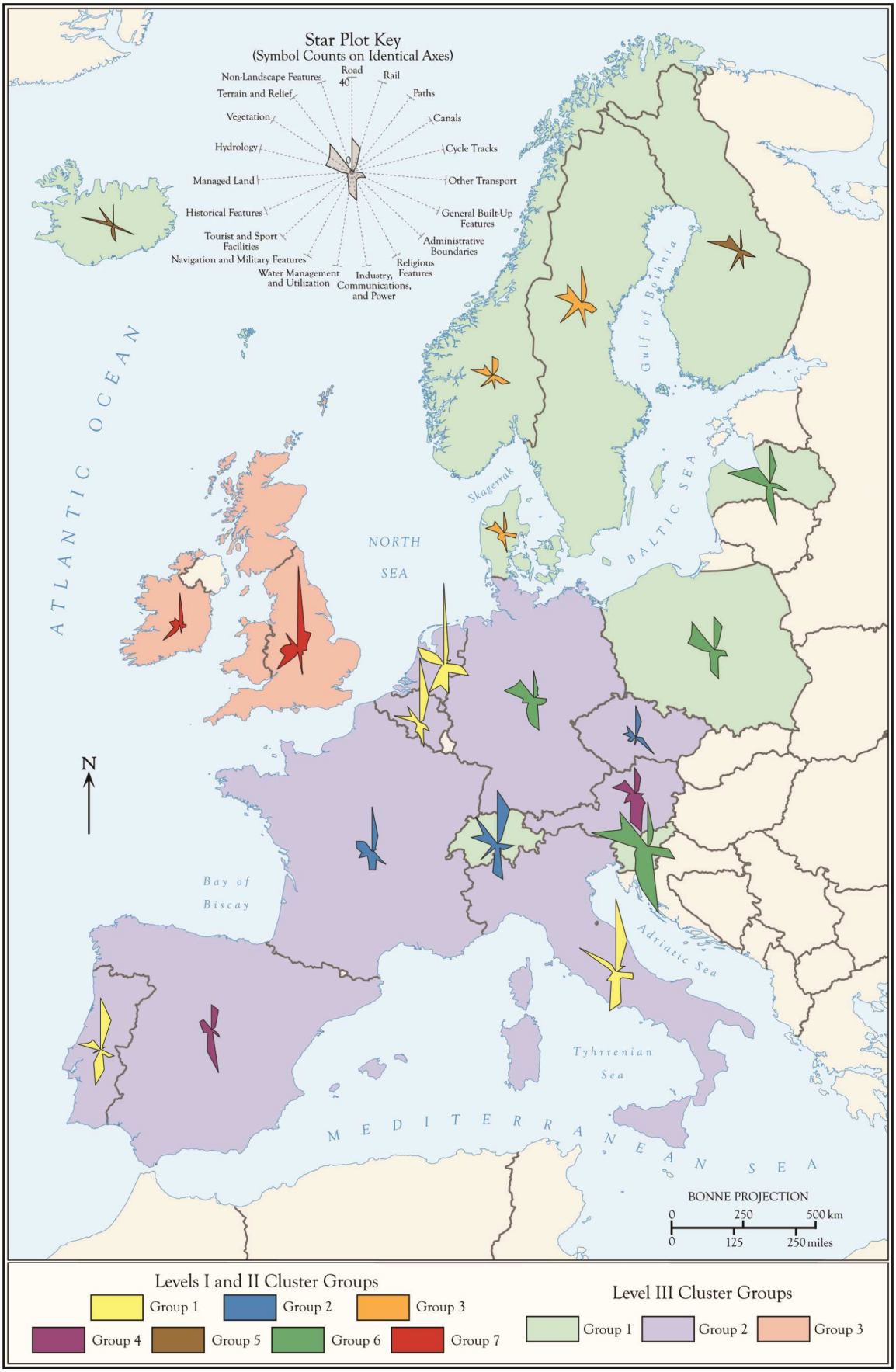


Figure 11 Map summarizing the results of the quantitative star plots with identical axes based on national symbologies and coloured according to cluster grouping (© The British Cartographic Society)

It was possible to establish supranational groupings using this technique, whether applied to the broader or more detailed levels (see figure 7), but the clusters pertaining to the latter were harder to fuse together. Indeed, it was clear that national mapping organizations show considerable differences in their topographic classifications, suggesting that they choose to define their subject in their own way. The map in figure 11 illustrates the results of the stylistic groupings arising from the cluster analysis, also incorporating the star plots.

Each of the groupings warrants further research, but some findings seem to make immediate sense. One of these is the consistent ease with which the clusters representing the British and Irish maps fused together (and yet did not show very much inclination to join the rest of Europe!). Ordnance Survey conducted the topographical mapping of Ireland as proposed by the Spring-Rice report of 1824. After Ordnance Survey's methods of survey, landscape description, and portrayal were established in Ireland, it is therefore likely that some of its legacy remains in the design of current Irish topographic maps.

In terms of the qualitative comparisons between national symbologies, some interesting observations were made. Most countries use black for built-up features and utilize several colours for roads, which also tend to be the most visually dominant type of feature (suggesting fairly convincingly that the 1:50,000 scale is perceived by the national mapping organizations as being useful to road users). Moreover, Britain and Ireland are again distinctive in this respect, in that they continue to use colours which reflect road signage to some extent (e.g. cyan for motorways). As would be expected, most countries depict vegetation using green (although Finland uses orange and white!), blue for hydrology, and brown for contours, leaving white to be used for 'white' space (symbolizing what the user is left to assume). Alpine countries tend to be more conservative in their state topographic map design, utilizing fewer colours but a greater proportion of serif fonts (which arguably carry connotations of tradition and heritage).

To summarise, stylistic similarities were identified in terms of the maps' content (classification) and appearance (colour, lettering, and so on), but there were no strong cases which clearly possessed both. While the British and Irish examples were consistently classified in similar ways, their appearance did not share the same level of consistency. European state 1:50,000 topographic maps are therefore stylistically diverse, with conventions over the portrayal of landscape features extending little further than basic cartographic 'grammar', i.e. using a point, line, or area symbol for certain features (e.g. a linear road symbol), and the persistent use of certain colours for various features, e.g. black, blue, green, and brown. A scale as large as 1:50,000 would seem to require enough detail to classify the landscape in a distinctive, authentic way, and to command enough abstraction to entertain a creativity that national institutions are proud to preserve.

It has regrettably been necessary to reduce the size of some images in this article. The original versions may be seen in The Cartographic Journal, volume 46, number 3, August 2009.

Part 2 'What makes Ordnance Survey's cartographic style so distinctive', together with references will appear in Sheetlines 88.