New Topographic Mapping

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ABSTRACT

Current technologies have given us opportunities to explore and develop the graphic communication of topographic mapping. This paper presents some developments within a New Zealand mountain context, and challenges cartographers to further improve effective communication through total map design.

Keywords

mountain mapping – topographic – technology – symbol design – map design

BACKGROUND

Much has been written about the use of computer technology to improve the quality and timeliness of topographic map production, resulting in more uniform products at nominally lower cost. Less has been written (or even explored?) about the potential for improving the maps through better symbol design. There has been an assumption that what exists meets the users' needs. Most national mapping organisations have sought to emulate hand drawn mapping which has evolved over hundreds of years, and still retains evidence of early handcrafted technologies. Cartography has always exploited current technologies (Aitken 2006). The author has sought to apply the strengths of current graphic and printing technologies to a series of thematic topographic maps of mountain environments to improve the legibility of the map and the comprehension of the user.

CONCEPT

NewTopo's 30 sheet series has its origins in 2002 with a personal investigation into New Zealand topographic map design, convinced that even a successful product like the national 1:50 000 topographic series (Series 260, as it was then known[1]) can be improved further with modern technologies and design knowledge. Before setting out on this adventure, several months were spent analysing the perceived 'deficiencies' of published mapping in New Zealand's mountain recreation areas and comparing its content and design with what is done overseas in similar environments.

This led to a determination to explore visual variables in the topographic domain, and to produce an exploratory prototype. With the collaboration of Lorienne[2] in Paris, and their cartographer-friendly software, two maps[3] were published in 2005 to illustrate some possibilities. (Refer also: Aitken 2006).

DESIGN PRINCIPLES

As a result of the comparative study, a set of principles was deduced, logically reasoned, and refined over time.

Principles for the Visual Hierarchy

- Continuous features should be portrayed by continuous symbols
- Conversely, discontinuous features should be portrayed by discontinuous symbols
- Accurately defined features should be clearly defined graphically
- Conversely, less accurately defined features should be less clearly defined visually
- Relief shading should be used subtly in a way that integrates, and makes geographic sense of, all map elements and should not influence other colour choices
- The use of too many contrasting lineal map elements should be avoided. (This facilitates decoding and assists the geographic integration of the map image. The use of colour tints without lineal edges for some areal features assists this aim)

1 From September 2009 known as the Topo50 series.

2 Lorienne SA, 14 rue de la Beaune, 93100 Montreuil, Paris, France.

3 The maps were Wellington Walks and Tararua Tramps. Both at 1:75 000 scale.

- The over-use of the black colour for linear features and text should be avoided as it negatively affects the use of other colours in the visual hierarchy
- The traditional uses of symbols derived from old (or very old) technologies should be re-evaluated and new semiologic structures built using Bertin's principles (Bertin, 1983)
- Symbol families should be simplified in content and graphic complexity as scale decreases

These principles may be considered debatable; and debate in exploring design functions and permutations is encouraged. It is noted that some of these 'principles' are similar to those identified by Patterson (2002 p9).

The author contends that historic and 'traditional' cartographic practices need **not** encumber future geographic understanding and the exploration and development of new topographic products.

DESIGN FOR USERS

NewTopo maps are intended to encourage and assist people to walk on the many tracks in the mountain regions of New Zealand with enjoyment and safety. Map sizes and scales vary to suit the region or track, allowing focus on each location.

The user-content within the mountainous geographic context varies in complexity and content. Typically, larger-scale small-format maps are simpler in content and presentation, and a smaller investment in time and money.

Legibility depends upon balance. NewTopo maps try to balance the underlying topographic information, which illustrates the mountain environment, with the user-oriented thematic information which is somewhat bolder.

An attractive map was actively sought with a high degree of legibility to encourage map use by those who are, perhaps, less familiar with map reading. A similar objective to the 'enhanced realism' expressed by Patterson (2002, p3, p8).

The map design focussed on paper map production and dissemination. No attempt was made to consider other media.

This thematic user information is portrayed boldly within the topographic base-map visual environment. Typical content includes:

- Foot tracks: foot paths, tramping tracks, marked routes
- Accommodation: location of public huts (including the number of bunks and hut elevation), campsites and shelters
- Information notes: walking times between huts, sites of local or historic interest
- Point symbols: car parks, public telephones and toilets, viewpoints

Graphic specifications are fairly uniform throughout the series, although they are adapted to unique situations where further clarity of communication is required. The specifications have changed over time as a better understanding of user requirements has been obtained and technical opportunities offered by the software have been mastered.

Subtle textures have been added to flat tints to better illustrate the nature of some area symbols. In particular, textures have been added to: sand, swamp, scree, shingle, mud, reefs, and more recently, to areas of exotic forest.

All maps are GPS compatible, although at the smaller scales this is a dubious advantage.

There is some differentiation among users. Large format maps tend to be used many times by local outdoor enthusiasts; small format maps are often for a single use by visitors.

TOPOGRAPHIC SYMBOLS

Balance between the thematic and the essential topographic information is achieved by subduing the underlying landform to a degree where the image has sufficient clarity, form and coherence while allowing the overlaying thematic symbols and text to be clearly read.

Landform

The components of the landform (relief, contours, rivers) are balanced to give a graphic image of the mountain topography – the geographic context for the adventure. At smaller scales the detail of the landform is apparently less specific than at larger scales, even though the same specification and content is used. Where cliffs and river terraces are not easily interpreted by the close proximity of the contours, a brown graduated asymmetric line symbol has been developed to replace the too-prominent black 'sharks teeth' symbol

that has survived the last 300 years. The new symbol blends into, and is part of, the landform (Figure 1a).

Rivers

There is (perhaps) less room for symbol development in the rivers and streams. However care has been taken to increase line weights away from river sources to emphasise larger rivers, with their likely dangers, and to preserve braided rivers where they occur. A new waterfall symbol has been developed to emphasise these prominent features. Hot springs are a welcome feature of some mountain valleys. A bolder symbol has been developed emphasising the occurrence and position of these features (Figure 1b) which are often only found by following one's nose.

Textures

To break up flat tints on features which have uneven surfaces, coarse random dot patterns have been overlaid on the tint. Features whose tints have been modified are: shingle riverbeds, mountain screes, coastal reefs, swamps. A more orderly '^' pattern has recently been introduced on exotic forest tints where the trees are typically pine.

Road Network

Precision of definition has been avoided to reduce visual complexity. The road classifications depend on a visual hierarchy to convey their status and physical characteristics.

In the design of topographic map symbols in use today there is evidence of very old map reproduction technologies. Some of these symbols are considered 'classic', and shouldn't be touched or improved; but this attitude is thoughtless and lazy! Every generation has to learn what these symbols stand for because the symbol image does not always lend itself to intuitive recognition or decoding (Aitken 2008).

THEMATIC SYMBOLS

Many of the maps are used within a National Park context and the Department of Conservation (DOC), as a major client and distributor, put pressure on the initial design to adopt their international symbol set on the maps. Though internationally recognised, many of these pictorial symbols are far from satisfactory in the complex visual environments of the topographic background, and do not enable accurate GPS positions to be deduced.

Many of these symbols are derived from simplified profiles whereas more generic plan symbols are preferred. In the visually complex landform environment both need labelling as to name and/or purpose, but the planimetric symbol gives a more precise location. A conscious effort will be made towards simpler symbols over the next few years.

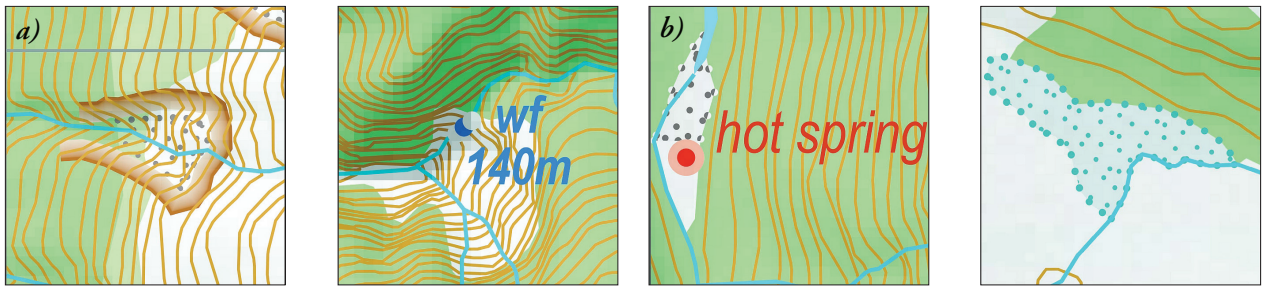

Figure 1. NewTopo 30 sheet series and LINZ NZ260 symbols for a) cliffs / waterfalls, b) hot spring / river terraces.

The use of planimetric versus profile symbols debate lives on… final decisions will always rest on the graphic environment and map purpose.

RELIEF

In mountain mapping the relief is a major factor in its own right and does not merely reinforce other geographic elements. This vital graphic element is specially produced for NewTopo by Geographx[4] from their proprietary-developed digital terrain model. The relief is supplied as a .jpg usually with a pixel size of 20m. This resolution meets the level of detail required to illustrate the variations in terrain within most of the map scales in use. As well as supplying additional information on the nature of the terrain, the relief provides a unifying image, drawing the map elements together in a comprehensible geographic context.

4 Geographx, The Dominion Observatory, 34 Salamanca Road, Wellington, NZ 6012. www.geographx.co.nz

The graphic file is manipulated by Geographx to be as close as possible to a specified range of tonal values in cyan, magenta and yellow (CMY, no K if possible). Typically flat areas are 10C, 7Y, 7M, 0K and in the steepest deepest shadow 40C, 30M, 25Y, 4K. This almost neutral grey reduces influences on other colours to a minimum. Black is avoided (except in the steepest shadows) so that it does not inhibit the legibility of other detail, especially coloured text.

A full CMYK relief is difficult to manage through the print process and often results in a 'muddy' appearance, hindering design effectiveness and reducing essential legibility. There are many examples of this in New Zealand commercial mapping.

In the final publishing process it was found that the pdf-maker used by Lorienne in LorikPublisher™ combined some of the relief tones to a 'grey' screen of black, so Lorienne wrote a special script to overcome this difficulty by keeping the cyan, magenta and yellow tones separate, enhancing the legibility.

PRINTING

The flexibility and precision of modern printing technology allows the map designer a breadth of creativity that was earlier unimaginable – and certainly unachievable.

NewTopo maps are printed by Format Print[5] in Petone near Wellington. The large format maps (840x630mm) are printed on a five-colour Heidelberg 102CD, with coater, using mineral-free inks. The printing plates are produced direct from the digital files, and are recycled after use.

Small format maps are printed on an HP Indigo 5500 digital press which produces complete A3 full-colour images in a single pass. Short print-runs are very reasonably priced.

Quality papers are used to give the best dot reproduction. Large format maps are printed on 94gsm HWS Rag Map Litho paper (a high wet strength paper with 20% cotton – made in Australia) and the small format maps are printed on 113gsm Sumo Matt paper (an environmentally 'friendly' paper - made in South Korea).

The maps are trimmed and folded to 120x210mm by Format, and offered for sale in clear vinyl wallets for protection. A network of more than fifty retailers and visitor centres sell the maps to the public. A full list of retailers is on the NewTopo website. Sales over the web will be introduced in 2012 to service buyers who cannot get to a retailer.

5 Format Print, 81 The Esplanade, Petone, New Zealand 5045. www.format.co.nz

CONCLUSION

Sales are one measure of acceptance by the market. Over the past four years annual sales have increased from 185 (six maps) to 5035 (27 maps). Although some maps have phenomenal sales it is clear that others have not yet found their market.

When it comes to the design and execution of mapping, cartographers are never satisfied, although appreciation shared by colleagues is always welcome.

Everything in communication can be improved using current technologies for the contemporary social environment. Our challenge is to apply modern learning and technologies so that evolution will continue…

It is hoped that this paper will contribute to the discussion, exploration and evaluation of this evolution.

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