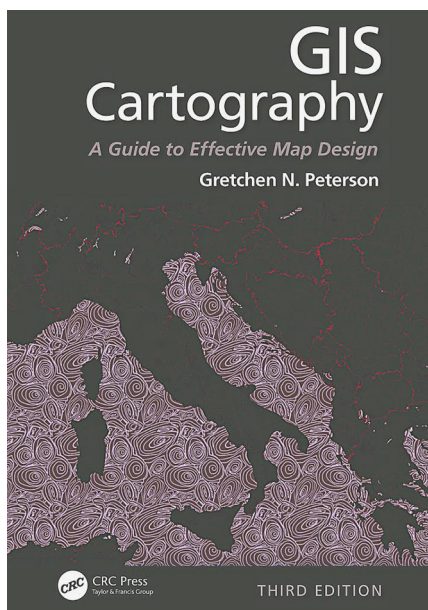


**GIS cartography. A guide to effective map design (third edition)**, by Gretchen N. Pethersen, 2021. CRC Press Taylor & Francis Group, Boca Raton/London; 318 pages, Price £31.99, ISBN 978-0-367-85794-3.



Overall, the current tome seeks to address the problems inherent in the production of maps of good cartographic design. This is the third edition of this practical guide for GIS software users and web designers, which presents a structured approach to mapping many geographical features, represented either as vector and raster spatial data models. Each kind of feature analysed is examined and commented upon in detail. The book is composed of largely discrete sections, comprising nine chapters, two appendices and an index. Unfortunately, the first two and last three chapters are only several pages in length, whereas those on layout design, fonts, colour and mapped geographical features are too long, with numbers of pages ranging between 30 and 98.

The present tome consists largely of explanations of map design standards; however, the main focus is on large-format map layouts ranging in size from 8.5-inch by 11-inch to full posters. The idea of map design as a creative dual process, based not only on the knowledge of mapping standards but also on employing individual creative skills is the

subject of two first chapters. The author emphasises that individual creative skills in graphic design can differ; however, such can be acquired through experience by seeing and doing. In practice, any improvement of design skills can be obtained by compilation of a list of map design elements which have been performed by other cartographers and by application to one's own map, such as colour schemes, emphasis map, placement, title fonts etc.

Chapter 3, entitled 'Layout Design', asks the fundamental question of how to create professional-looking map layouts and arrangement of layout elements into stylistically cohesive compositions. A two-stage procedure is proposed in the present book: stage 1 is to choose appropriate layout elements, starting with a title that succinctly explains the subject of the map. Moreover, information on data sources, author and date ought to be included, besides more obvious layout elements such as scale bar, north arrow, explanation panel and inset map. Stage 2 involves the appropriate arrangement of layout elements that need to be performed. Chapter 3 presents an overview of arrangement rules regarding title, subtitle, legend panel and map window.

The problem of multiple maps in a single layout is analysed in more detail because these are highly informative and offer an on-the-fly analysis by the map viewer, thus making the map more interactive. A weak point is the discussion about placement rules of many maps in one layout, especially maps displaying the general geographic context of more detailed general maps. Noteworthy is the fact that this chapter includes a discussion on the problem of different sizes and irregular geometry of area to be analysed with respect of the square or rectangle extent of the map window. The proposed solutions allow for outlying the area analysed based on clipping or generalisation of map features in the outside area as well as using faded or a semi-transparent look. It is a pity that this portion of the chapter is not illustrated by appropriate figures.

Graphs of several types such as scatter plots, bar graphs, pie charts, histograms, rose diagrams or stereoplots can be important elements of map layout. Graphs directly related to map features can be placed as float map elements. Many graphs provide only ancillary data and therefore more appropriate placement outside of the map is suggested, next to the legend or close to the map margin. Unfortunately, the topics on graphs analysed (very important for professional thematic mapping, especially used in scientific communication), are not illustrated in this book.

There are many publications which underline the significant role that fonts play in graphic design. In Chapter 4, entitled 'Fonts', the author shows how to create professional and one-of-a-kind map layouts based on a study of font theory and techniques for modifying fonts. Diagrams of approximate point sizes to use for map title and body text, depending on expected viewing distance, are very suggestive. The reader will here find explanations of how to provide texts with an emphasis on maps, i.e., by expanding spaces between letters, bold text for titles and certain labelling of geographical features such as city names, italicising text for example for labelling of hydrographic features, as well as by using words composed of more than one capital letter. Of note is that underlining of text is rarely used on map labels and other layout text, with exception of the title. Standard font colours, types and sizes, as well as character spacing used for labelling of geographical features related to topography, hydrography and degree of their importance, are also discussed in Chapter 4.

Placement of labels is described in two ways. Firstly, as a traditional semi-automated process performed by algorithms and then based on manual adjustment by the cartographer. Secondly, taking into account an entirely automated process which is the sole option during preparation of global basemaps. In general, labels are placed above feature symbols; however, there are many cases of label placement directly on lines, e.g., elevation values on contour lines. Unfortunately, comments about rendering of labels overlapping lines are sometimes trivial and not very appropriate. In the case of a thin line the label with no adjusted font weight can appear as crossed-out text. In contrast, if the line is thick then the font size used for labels should be adequately increased to avoid the effect of text overlapped within the wide line. Why does the author not consider another simple possibility by using a halo outside the label in colour matching the map's background colour or by clipping labelled line at some distance in front and behind the placed label?

Chapter 5 (Colour) starts with the statement that colour choices are not the most important aspect of maps and map layouts. More important is the use of colour for providing adequate information about geographical features in well-prepared maps and map layouts, and therefore for helping in the explanation of map symbols in order to make meaningful inferences. Thus, in the above sense the colour is not, by itself, the decorative purpose of mapping process but it serves to understand the content of maps better. The general question asked in this chapter is in what way poor colours can impede our understanding of maps. The author presents some solution to this essential question discussing three aspects of map colours that are more important: theory, rules and inspiration. Two important rules based on figure-ground and viewer's perception ideas are discussed in more detail. The idea of figure-ground relates to map elements which play the role of foreground and background. This idea, together with image continuity, its closure and similarity, is an element in the concept of the so-called 'Gestalt', introduced by German psychologists and then applied to graphic design. The particular usefulness of the figure-ground idea is that it allows to emphasise certain geographical objects or phenomena on maps.

Chapter 5 discusses numerous notable rules for increasing the perception of maps by viewers, for example, the 'five-shade rule', alpha maps, bivariate choropleth mapping or hexagonal binning. Especially impressive is the example that shows how important colour contrast between foreground objects and background can be. This relates to the so-called firefly cartography method used for displaying recent earth dynamics in terms of earthquakes or for mapping of city lights. Unfortunately, this sophisticated method is not illustrated by any appropriate figure. However, an example of the firefly map is given in the next chapter (Chapter 6) to show road density at the scale of the entire United States.

Having read chapter 5, the reader may be disappointed because the problem of colour choices during map preparation with respect to people with colour vision deficiency was analysed without references to well-described appropriate and thus fully universal colour schemes. As a notable example, a rainbow-like universal colour scheme called batlow has been proposed to use in scientific visualisation by Fabio Crameri (<https://www.fabio-crameri.ch/batlow/>). The weak point of Chapter 5 is that there is practically no discussion on colour blending methods which allow to combine colours applied to two or many geographical features overlapping one another. In contrast to traditional col-

our transparency, these methods offer more possibilities to control colour fusions and therefore can be crucial for improvement of map design. This is especially important for preparation of hillshaded topographic or thematic maps. They usually consist of two overlapping map layers: a hillshading grey-scale map and a map of coloured geographical features related to topography, hydrography, soils, geology and many others. To avoid the colour fading effect typical for transparency-based combination of colours, GIS users have now access to many appropriate colour blending methods implemented in commercial and, first of all, open-source softwares (i.e., lighting, multiple, soft light, hard light, screen).

The longest chapter, Chapter 6 (Features), deals with mapping standards and techniques which are commonly used in GIS for visualising geographical features. Not all types of features are discussed here but as the author assures, their proposed visualisations can be an inspiration for map making of another features not listed in the book. Unfortunately, many examples of maps included in this chapter are inconsistent with the main idea of graphic design learning mentioned at the beginning of the book, i.e., 'learning through experience by seeing and doing'.

It is not entirely clear what the author's intention was to analyse in detail the suggested colours for mapping of defined groups of geographical features (such as roads, rivers and streams, bodies of water, cities and towns, elevation and hillshade or geology). These colours (with no detailed description using RGB or hexadecimal notation) are presented at the beginning of each subsection in Chapter 6. The author discusses many examples of incorrect visualisation of geographical features, but often these are trivial and impossible to use by each cartographer who is sensitive to aesthetic issues in map design.

Unfortunately, some information presented in chapter 6 raises serious concerns, probably related to the use of layperson's English in the entire book and avoidance of specialised academic terminology. This may be seen in the section 'Elevation and hillshade'. According to the author, source data which can be used for preparation of hillshading maps are represented by Digital Elevation Models (DEM) or Light Detection and Ranging (LiDAR) data. This is inappropriate in the case of LiDAR data because they represent only one of many possible input data which can be used for DEM preparation besides of the old topographic maps, passive remote sensing data or survey measurements. Hillshading maps are derived directly from DEM represented as raster or TIN models. It is not true that hillshading maps

are calculated using an algorithm that determines the amount of shadow depending on elevation values of raster cells and the location of a predefined light source. The base for hillshade mapping are angles calculated between a predefined light source and normals to surface determined for each raster cells on DEM. It is a pity that the author did not discuss how restricting for map design are hillshading maps which in most software packages are rescaled to the range 0-255. Only few software packages allow to obtain hillshading maps with primary values of angles or their cosines. Such angle values have great potential for modelling of shine effects on DEM surfaces. A professional discussion of hillshading maps cannot be undertaken without the multiple hillshading method as the base for preparation of coloured RGB-hillshading maps. Moreover, this section of chapter 6 has no information on the ambient occlusion hillshading method which in GIS is implemented by simple algorithm of sky view calculations. Hillshading maps based on more sophisticated methods can be crucial for the detection of fine topographic features and therefore may have great potential for environmental studies, to recognise land use in more detail and better management of hazardous areas. This subsection offers a great opportunity to analyse blending methods as the base for hillshading of another map composed of coloured geographical features related to topography, hydrography, soils, geology and many others.

The section 'Geology' in chapter 6 deals with multi-dimensional, usually spatio-temporal data used in geological cartography, where besides of 3D space, the fourth dimension is the time during which rocks or geological structures developed. However, there is no example of any 3D-dimensional visualisation, such as borehole data as a series of vertical cylinders differentiated by colours according to changes in rock lithologies and in addition by radius to show for example porosity of rocks. It is not appropriate in this section to show a colour scheme for rocks of different age that ignores standardised colours published by the International Commission of Stratigraphy and used for the International Chronostratigraphic Chart. Displaying a stratigraphical map, for example, of the Appalachian folded belt, together with a chronostratigraphical chart, would have been very important to illustrate the high level of standardisation of cartographic symbols used in geological cartography.

Online cartography is subject of the last chapter, 'Zoom-Level Design'. There are some reflections about the great role of online mapping which can

also be performed by non-professionals. This chapter focuses on selected problems of scale and generalisation of geographical features modelled in GIS to be viewed at multiple zoom levels.

Summarising, the current tome is too wordy, using layperson's English, and lacking any specialised academic terminology. Unfortunately, maps and map layouts in the book are of variable quality. Therefore, many of these are inconsistent with the main idea of graphic design learning mentioned at the beginning of the book, i.e., 'learning through experience by seeing and doing'. Referring to the content and general nature of this book as a guide to

effective map design, a better-printed format with large square pages would have been used. This is a typical format for art books which has been used successfully in many examples of books on graphic design and scientific visualisation, starting from "Envisioning Information" by Edward Tufte up to "Slide:ology" by Nancy Duarte.

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