"A picture is worth a thousand words."
Chinese proverb

Chapter 8 Presenting Your Results

How do I say what to whom?

Visualisation

Visualisation is defined as the translation or conversion of spatial data from a database into graphics. These graphics are in the form of maps that enable the user to perceive the structure of the phenomenon or the area represented. The visualisation process is guided by the saying 'How do I say what to whom, and is it effective?' 'How' refers to the cartographic methods that are used for making the graphics or map. ' I' refers to the cartographer or GIS user who is preparing the map. ' Say' refers to the semantics that represent the spatial data. 'What' refers to the spatial data and its characteristics, and the purpose of the map. 'Whom' refers to the map's audience. The usefulness of a map depends upon the following factors.

Who is going to use it?

The map's audience or users will influence how a map should look. A map made for school children will be different from one made for scientists. Similarly, tourist maps and topographic maps of the same area are different in content and look as if they are made for different users.

What is its purpose?

The purpose of a map determines what features are included and how they are represented. Different purposes such as orientation and navigation, physical planning, management and education lead to different categories of map.

What is its content?

Its usefulness also depends upon the contents of the map. Contents can be seen as primary content (main theme), secondary content (base-map information) and supporting content (legends, scale, etc).

What is the scale of the map?

The map scale is the ratio between a distance on a map and the corresponding distance in the terrain. Scale controls the amount of detail and extent of area that can be shown. Scale of the output map is based upon considerations such as the purpose of the map, needs of the map user, map content, size of the area mapped, accuracy required etc.

What is the projection of the map?

Every flat map of a curved surface is distorted. The choice of map projection determines how, where and how much the map is distorted. Normally, the selected map projection is that which is also used for topographic maps in a certain country.

Accuracy

GIS has simplified the process of information extraction and communication. Combining or integrating data sets has become possible. However, this has created the possibility of integrating irrelevant or inconsistent data. The user should be aware of aspects of data quality or accuracy such as 'What is the source of data? Are the places at correct locations? Are the attribute values correct? Are the themes correctly labelled? Are the data complete?'

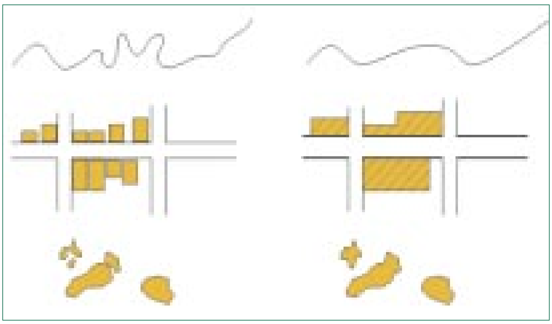
Map design

Map-making is both a science and an art. A beautiful map may be more popular than a plain map even if it is less accurate. Maps influence people's perception of space. This influence is partly as a result of convention and partly as a result of the graphics used. People understand the world differently: they express this understanding differently in maps and also gain different understandings from maps.

Generalisation

Maps contain a certain level of detail depending upon its scale and purpose. Large-scale maps usually contain more detail than small-scale maps. Cartographers often generalise the data by simplifying the information so that the map is easier to read (Figure 8.1). The process of reducing the amount of detail on a map in a meaningful way is called generalisation. Generalisation is normally done when the map scale has to be reduced. However, the essence of the contents of original map should be maintained. This implies maintaining geometric and attribute accuracy as well as the aesthetic quality of the map. There are two types of generalisation—graphic and conceptual. Graphic generalisation involves simplification, enlargement, displacement or merging of geometric symbols. Conceptual generalisation mainly deals with the attributes and requires knowledge of the map contents and the principles of the themes mapped.

Figure 8.1
Generalisation



Graphic variables

Differences in the graphic character of symbols convey different perceptions to the map reader. These graphic characteristics are termed graphic variables and can be summarised as size, lightness or grey value, grain or texture, colour, orientation and shape or form (Figure 8.2). Knowledge of graphic variables and their perceptual characteristics helps map designers to select those variables that provide a sensation that matches the data or the objective of the map.

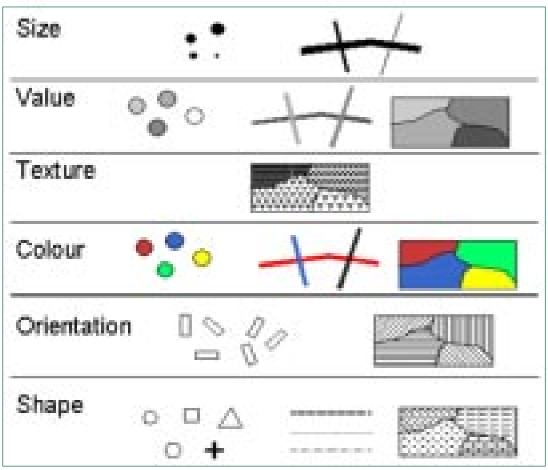


Figure 8.2
Graphic variables

Use of colour

Colour perception has psychological, physiological and conventional aspects. It has been noted that it is difficult to perceive colour in small areas, and greater contrast is perceived between some colours than others. In addition to distinguishing nominal categories, colour differences are also used to show deviations or gradation.

Data analysis, adjustment and classification

Data need to be analysed before they are mapped so that they represent information in correct form. Data are either qualitative—roads, rivers, districts—or quantitative—elevation, temperature, population density, etc. Representation will also depend on the measurement scale of the data such as nominal, ordinal, interval and ratio scales.

For nominal scale, the differences in data are only of a qualitative nature, e.g., differences in gender, language, land use or geology.

For ordinal scale, only the order of the attribute values is known and a hierarchy can be established such as 'more than or less than', 'small, medium, large' or 'cool, tepid, hot'.

For interval scale, both the hierarchy and the exact difference are known but it is not possible to make a ratio between the measurements, e.g. temperature or altitude values. A temperature of 8 °C is not twice as warm as 4 °C; it is only the difference between two temperatures.

For ratio scale, data can be measured on a ratio measurement scale, e.g. the number of children in a family or an income.

Grouping of data can also be done in different ways. Ranges of values may be grouped according to natural breaks, at round numbers, at statistical means or standard deviations. Different grouping or classification schemes give different perception of the phenomena.

Mapping methods

Mapping methods are standardised ways of applying graphic variables based on measurement scale and the nature of the distribution of objects. Various map types are given below.

Figure 8.3(a)
Chorochromatic map

Chorochromatic maps: This method renders nominal values for areas with different colours (in Greek, choros = area, chroma = colour). The term is also used when patterns are used to render nominal area values. Only the nominal qualities are rendered and there is no suggestion of hierarchy or order conveyed (Figure 8.3a).

Choropleth maps: In this method, the values are rendered for areas (in Greek, choros = area, plethos = value). Values are calculated for area and expressed as stepped surface showing a series of discrete values. The differences in grey value or in intensity of a colour denote the differences in the phenomenon. A hierarchy or order between the classes can be perceived (Figure 8.3b).

Isoline maps: Isoline maps are based on the assumption that the phenomenon to be represented has a continuous distribution and smoothly changes in value in all directions of the plane. Isolines connect the points with an equal value, e.g. equal height above sea level or equal amounts of precipitation. Isoline maps show the trends of the phenomenon, i.e. in which direction it is increasing or decreasing (Figure 8.3c).

Nominal point data maps: Nominal data for point locations are represented by symbols that are different in shape, orientation or colour. Geometric or figurative symbols are more common in maps for tourists and schools (Figure 8.3d).

Absolute proportional maps: Discrete absolute values for points or areas are represented by proportional symbols. Different values are represented by symbols differing in size. The primary considerations for these symbols are legibility and comparability (Figure 8.3e).

Diagram maps: Diagrams are used in the maps to allow comparisons between figures or to visualise temporal trends. Line diagrams, bar graphs, histograms or

Figure 8.3 (b)
Choropleth map

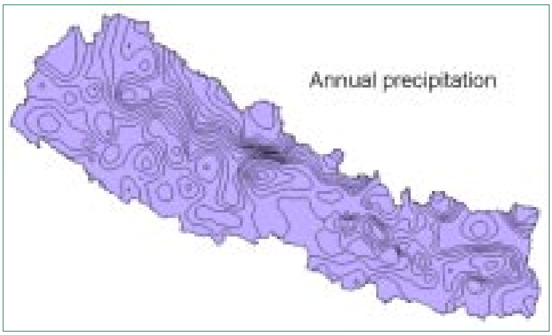


Figure 8.3 (c)
Isoline map

Figure 8.3 (d)
Nominal point data map

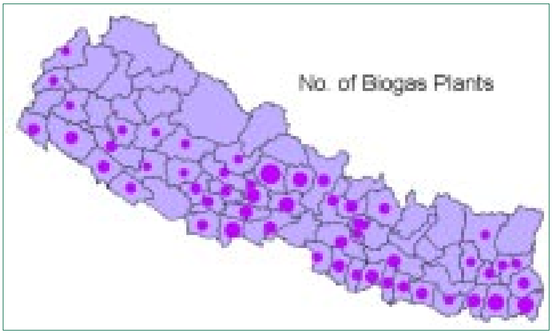


Figure 8.3 (e)
Absolute proportional map

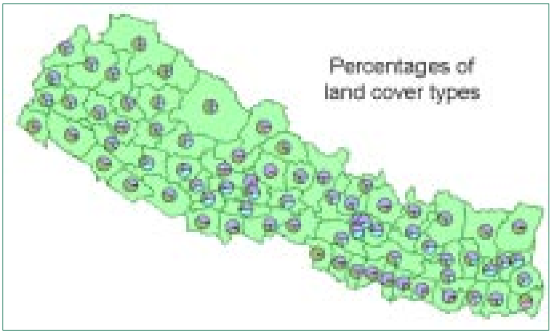


Figure 83(f)
Diagram map

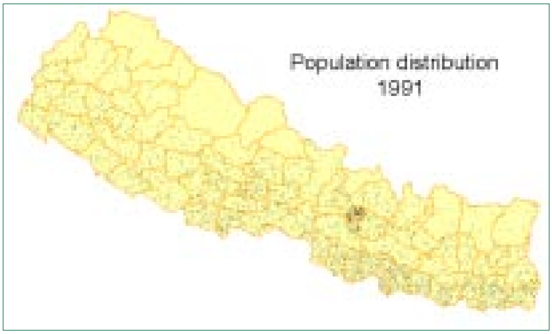


Figure 8.3 (g)
Dot map

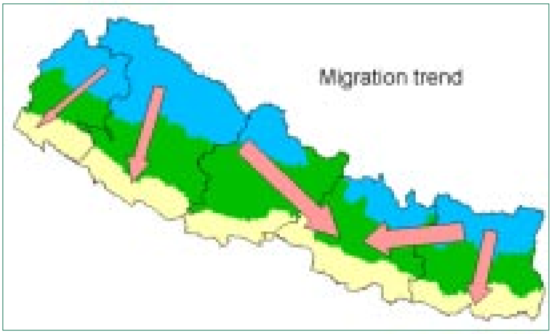


Figure 8.3 (h)
Flowline map

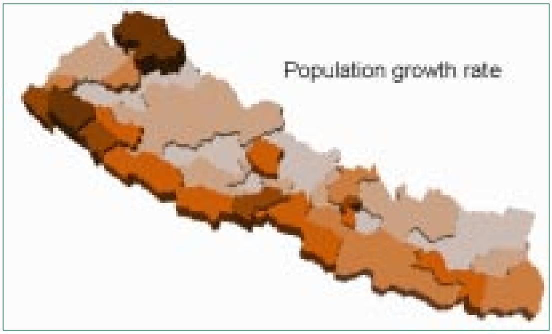


Figure 8.3 (i)
Statistical surface map

pie graphs are normally used on maps. However, care has to be taken that there are not too many distracting features so the image becomes complicated rather than conveying the information clearly (Figure 8.3f).

Dot maps: Dot maps are special case of proportional symbol maps as they represent point data through symbols that each denote the same quantity, and that are located as closely as possible in the locations where the phenomenon occurs (Figure 8.3g).

Flowline maps: Flowline maps simulate movement using arrow symbols. Arrows indicate both route and direction of flows. The volume transported along the route is shown by the relative thickness of the arrow shaft (Figure 8.3h).

Statistical surfaces: Statistical surfaces are the three-dimensional representation of qualitative data such as used in choropleth and isoline maps (Figure 8.3i).

New map output types

With the added potential of computers, new ways of visualisation and using spatial information are being developed. New products such as electronic atlases, cartographic animations and multimedia systems are appearing in the field of spatial information.

Multimedia allows for interactive integration of sound, animation, text and video. In a GIS environment, this new technology offers a link to other kinds of information of geographic nature. These could be text documents describing a parcel, photographs of objects that exist in a GIS database, or a video clip of the landscape of the study area.

Maps on the internet

With new interactive tools and facilities offered by the internet, maps are being used extensively online for various purposes. Apart from their traditional role of representing spatial data, maps can now function as an index of spatial data, a preview of data, and a search engine to locate spatial data. The internet is becoming a major form of map distribution. With the new functions offered by map servers for interactive mapping, the user can define the content and design of maps. This is changing the way visualisation applications are developed, delivered and used.

Figure 8.4
Maps on the internet (Source: www.mapquest.com)