Map symbols

Objectives

- Symbol Basics
- Visual Variables
- Types of Data
- Data evaluation and classification

What are map symbols?

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Maps give us a lot of information and there is not much room for labels. So we use symbols to save space and make the map easier to read.

Symbols may be simple drawings, letters, shortened words or colored shapes or areas.

process of selecting symbols

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- Cartographer considers the following in his process of selecting symbols and preparing maps:
  - the intended use of the map;
  - the map user requirements;
  - available map reproduction method(s);
  - the map scale.

Symbol basics

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Cartographers use symbols on maps to represent various geographic phenomena involving location, distance, volume, movement, function, process, correlation, etc.

These phenomena can be classified into four basic categories:

- point (non-dimensional data),
- line (one-dimensional data),
- area (two-dimensional data),
- volume (three-dimensional data)

The challenge in cartographic symbol design is that four categories of data must be represented on maps by only three basic symbol types: *point*, *line*, and *area*.

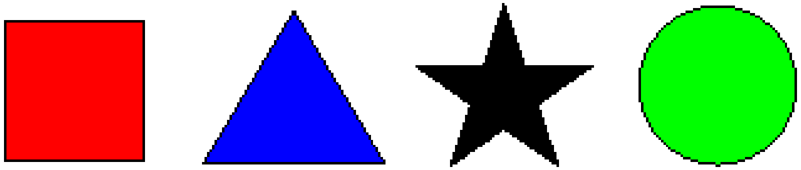
Point Symbols

- In general, there are two basic symbol designs that may be used to portray information on maps, pictorial and abstract.
- Symbols that are pictorial look like the features that they represent.

Pictorial map symbols

- Symbols described as abstract may be any geometric shape assigned to represent a feature.

Abstract map symbols



Line Symbols

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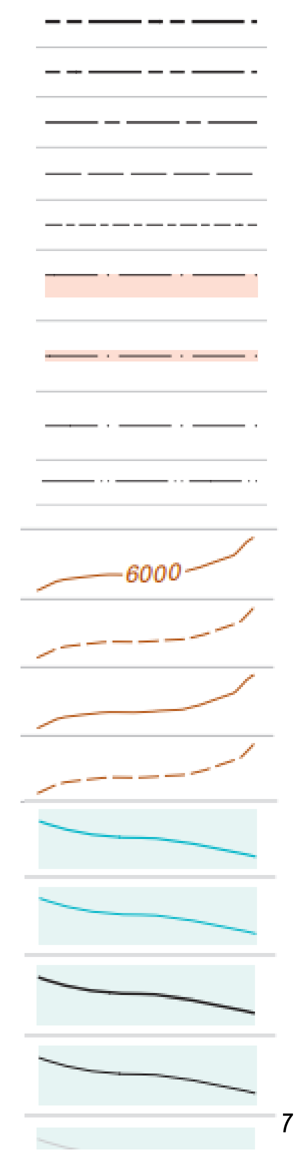
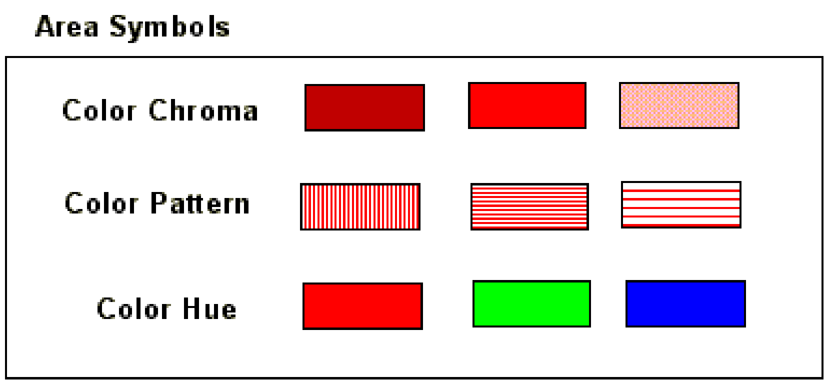
- Many features are shown by lines that may be straight, curved, solid, dashed, dotted, or in any combination. The colors of the lines usually indicate similar classes of information: topographic contours (brown); lakes, streams, irrigation ditches, and other hydrographic features (blue); land grids and important roads (red); and other roads and trails, railroads, boundaries, and other cultural features (black).



Area Symbols

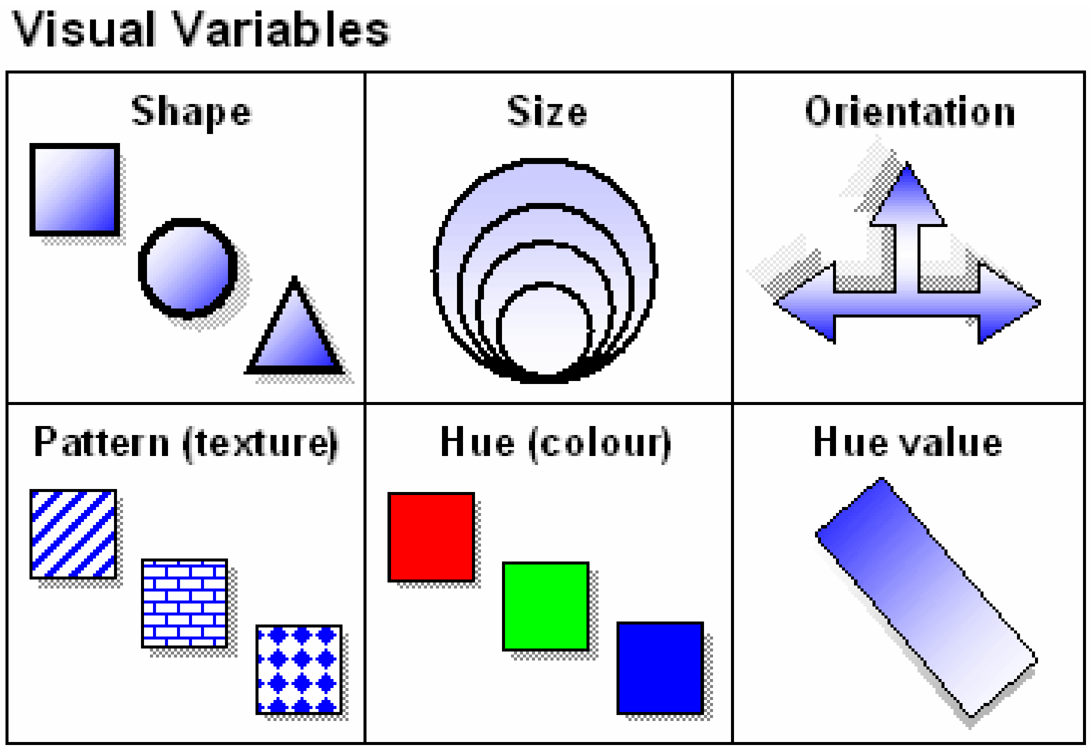
- Take the form of shading, coloring, crosshatching, and dot patterns, and represent features such as uniform regions, identify areas with common traits, to identify areas entities



Visual Variables

Visual Variables

- These variables, individually or in combination, may be applied to map symbol design. However, not all variables apply equally well to the symbolization of all types of geographic phenomena or data sets.



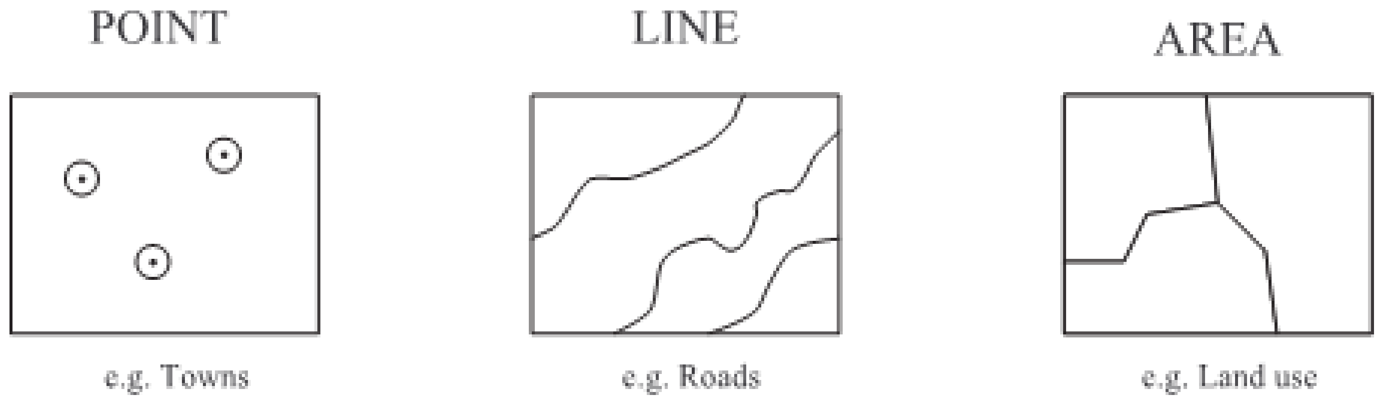
Visual Variables

In Cartography, the seven symbol variations are called visual variables which are used in the construction of symbols:

1. Position
2. Form
3. Orientation
4. Colour
5. Texture
6. Value
7. Size

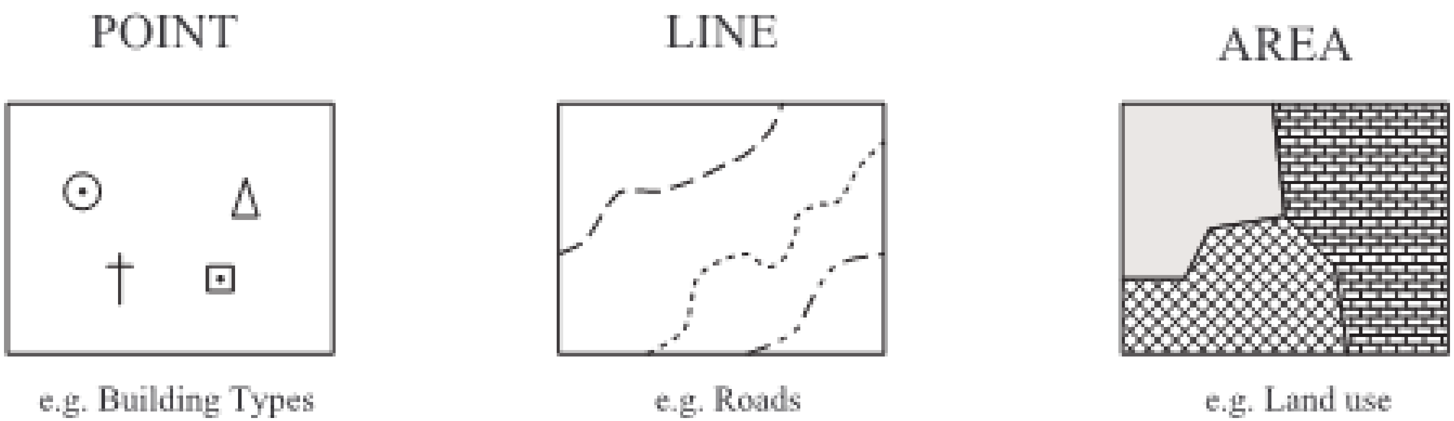
POSITION (Location)

- POSITION refers to the x, y, (and z) location of the information being mapped which determines the phenomena's place on the map. All symbols used on a map makes use of this visual variable,
- therefore, POSITION always has to be used in combination with one or more of the other visual variables.
- POSITION visual variable is applicable to point, line and area primitives



Form (Shape)

- FORM refers to symbols which differ only in shape.
- FORM differences are easy to draw and the variations are almost unlimited.
- FORM is applicable to point, line, and area symbols, however, with respect to line and area symbols FORM refers to the individual elements with which the symbol is constructed and not the overall form of the line or area feature,



Orientation

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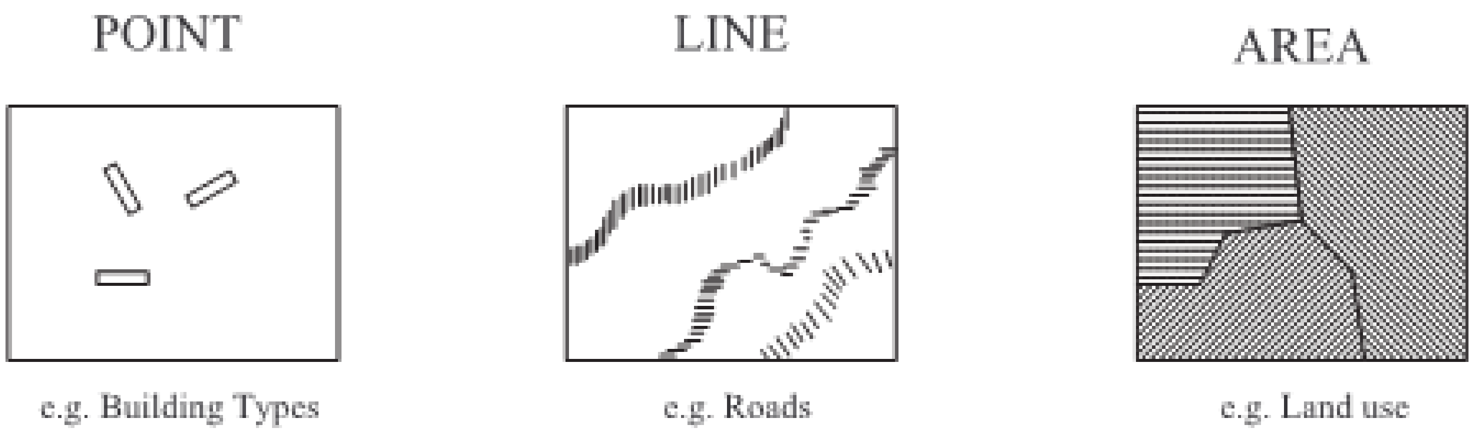
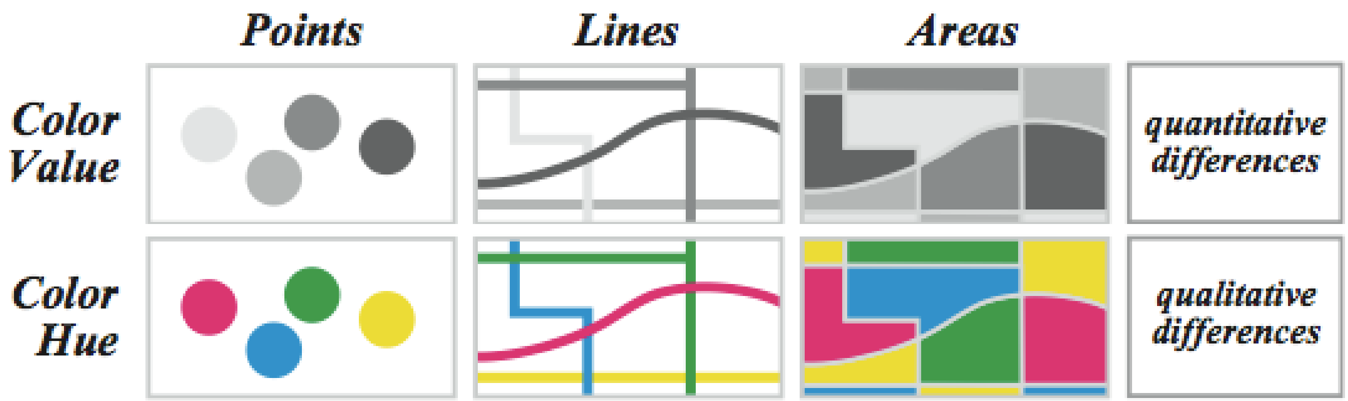
- ORIENTATION refers to the direction in which symbols are placed.
- Depending upon the individual elements used, ORIENTATION has its limitation in terms of the number of angles each element can be rotated



Colour

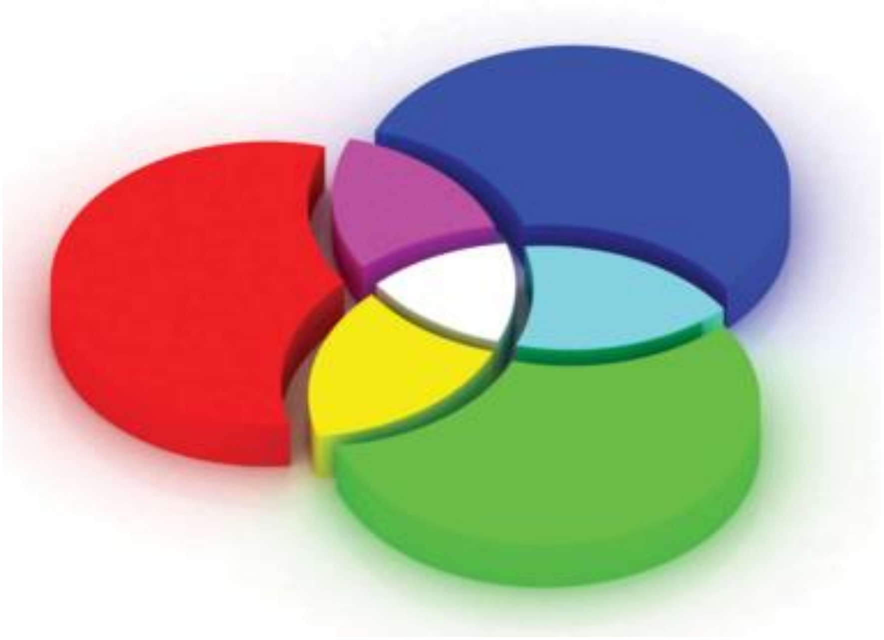
- COLOUR is perhaps the most powerful and most frequently used visual variable in symbol design.
- COLOUR is applicable to the three primitives (point, line and area)



The RGB model

- Colors are specified based on the intensity of red, green, and blue color
- Related to the method of softcopy color production
- Common notions of hue, saturation, and lightness are not inherent to the model
- Equal steps in the RGB color space do not correspond to equal visual steps

Additive Color Models: RGB



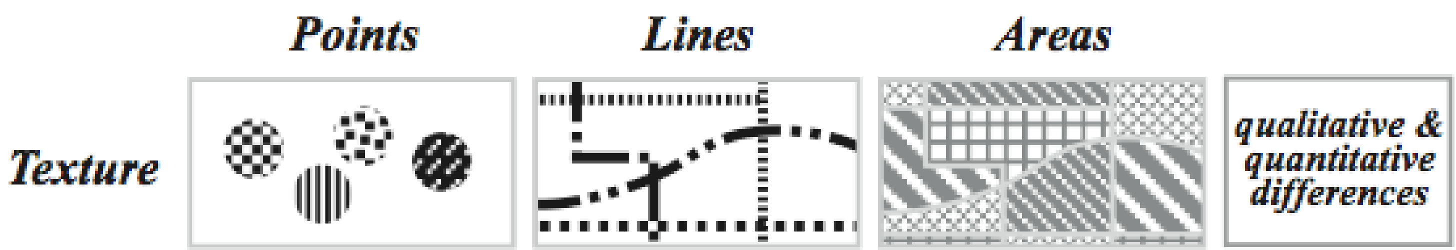
The CMYK model

- Colors are specified based on the portion of cyan, magenta, yellow, and black dyes
- Related to hardcopy color production
- Shares the same limitation as the RGB model

Subtractive Color Model: CMYK

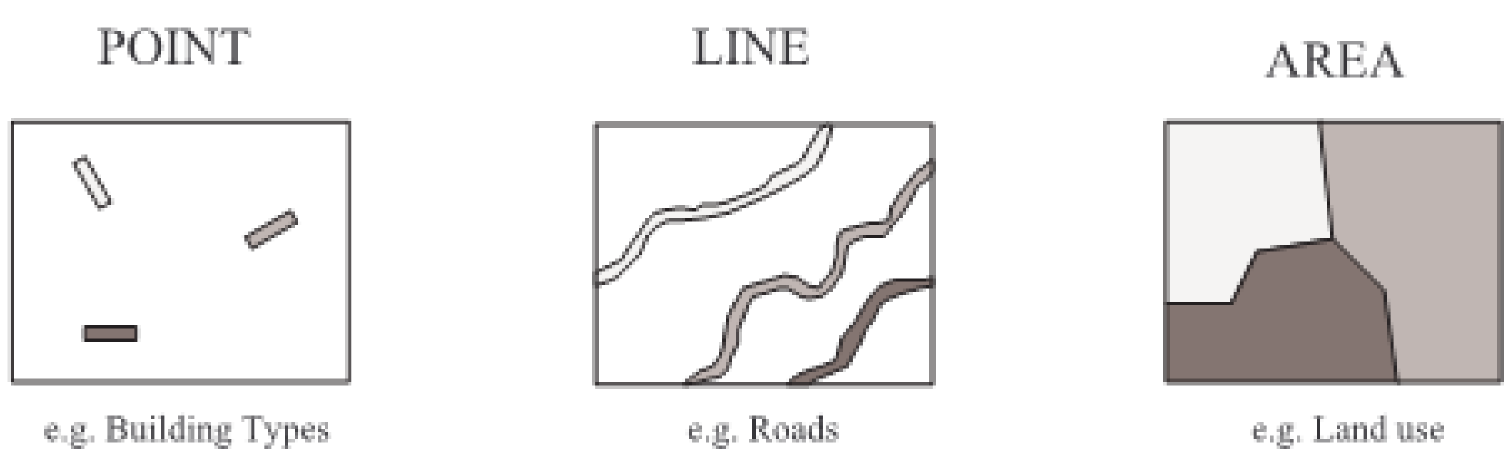
Texture

- TEXTURE refers to the variation in density of the graphic elements forming the overall symbol.
- TEXTURE is applied to the three primitives but it is less effective for point and line primitives unless they are exaggerated



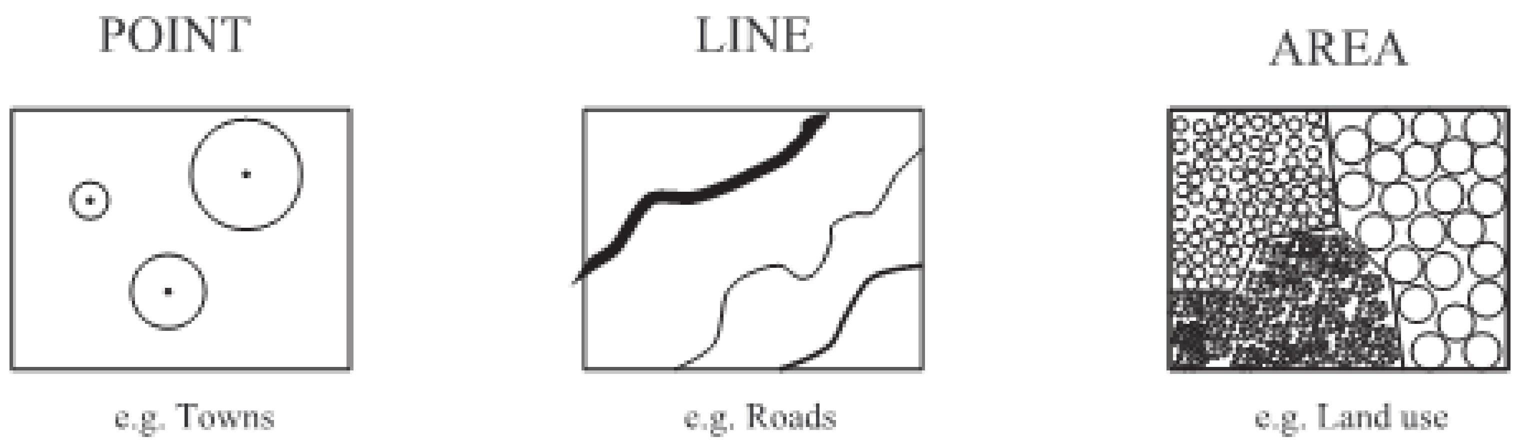
Value

- Refers to values on the grey scale ranging from white to black.
- VALUE is measured in terms of the ability to reflect light.
- VALUE can also be applied to COLOUR visual variable.
- VALUE is applicable to the three primitives but predominantly used to represent area primitives

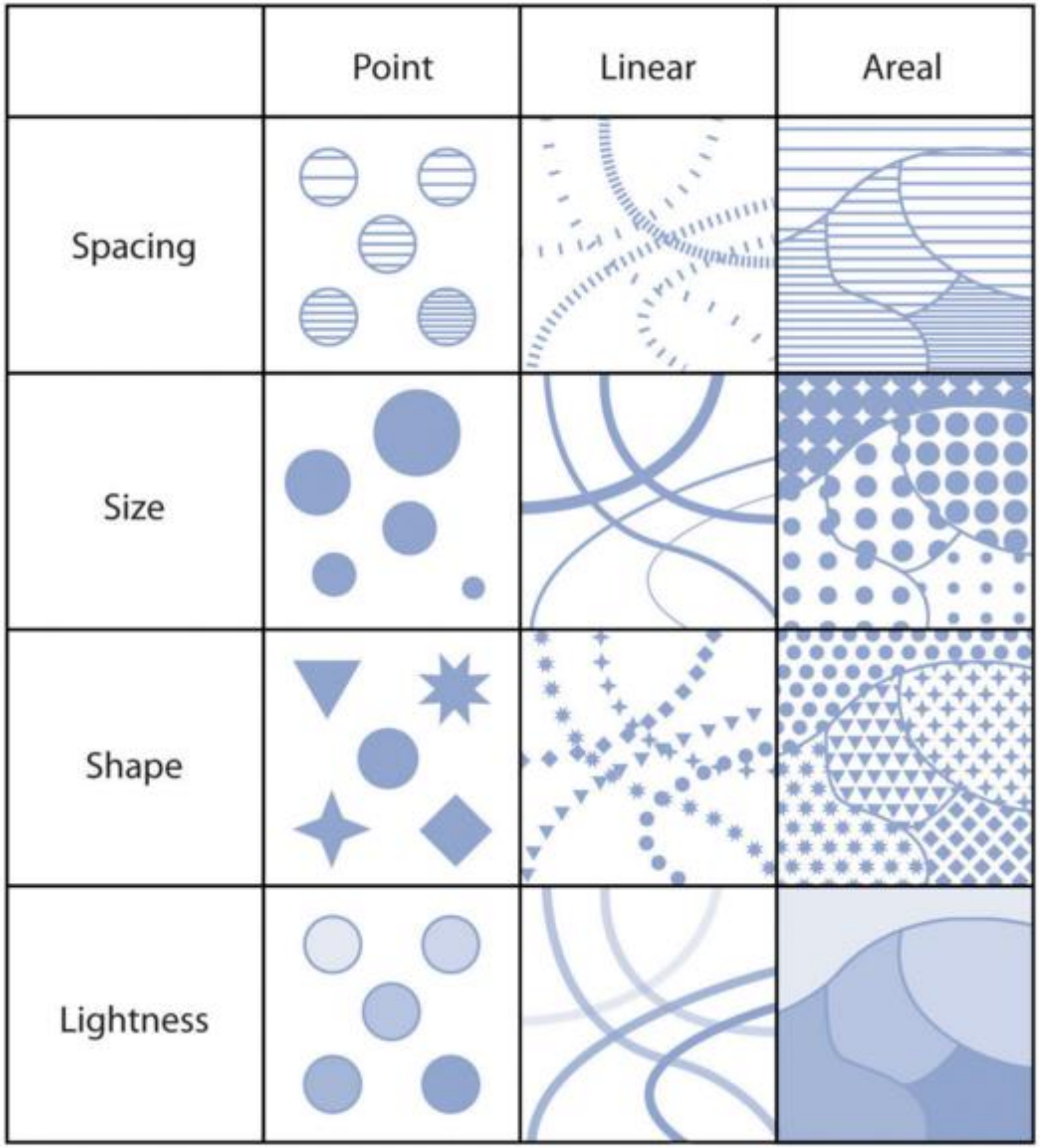


Size

- SIZE refers to the dimensions of the symbols or in the case of area symbols, to the dimensions of the individual elements with which the symbol is built up. SIZE is applicable to all three cartographic primitives however, commonly used for line and point primitives.



Principles of Symbolization



Types of Data

Nominal, Ordinal, Interval and Ratio

Types of Data

- There are four measurement scales (or types of data):
  - nominal
  - ordinal
  - interval
  - ratio.

Example	data
Room 105, 602-510-1669, and section 3b are examples of	nominal data
First, second, third are examples of	ordinal data
Tempature in Celsius are examples of	intervol data
degrees Kelvin, weight, height, the time it took each racer to complete the race are examples of	ratio data

Nominal

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- Nominal scales are used for labeling variables, without any quantitative value.
- A good way to remember all of this is that "nominal" sounds a lot like "name" and nominal scales are kind of like "names" or labels.

What is your gender?
- M – Male
- F – Female

What is your hair color?
- 1 – Brown
- 2 – Black
- 3 – Blonde
- 4 – Gray
- 5 – Other

Where do you live?
- A – North of the equator
- B – South of the equator
- C – Neither: In the international space station

Ordinal

- With ordinal scales, it is the order of the values is what's important and significant, but the differences between each one is not really known.

- Take a look at the example below. In each case, we know that a #4 is better than a #3 or #2, but we don't know–and cannot quantify–how *much* better it is.
- For example, is the difference between "OK" and "Unhappy" the same as the difference between "Very Happy" and "Happy?" We can't say.

How do you feel today?

- 1 – Very Unhappy
- 2 – Unhappy
- 3 – OK
- 4 – Happy
- 5 – Very Happy

How satisfied are you with our service?

- 1 – Very Unsatisfied
- 2 – Somewhat Unsatisfied
- 3 – Neutral
- 4 – Somewhat Satisfied
- 5 – Very Satisfied

Interval

- Interval scales are numeric scales in which we know not only the order, but also the exact differences between the values.
- The classic example of an interval scale is Celsius temperature because the difference between each value is the same.
- For example, the difference between 60 and 50 degrees is a measurable 10 degrees, as is the difference between 80 and 70 degrees.
- Time is another good example of an interval scale in which the increments are known, consistent, and measurable.

Interval >>>

- Interval scales are nice because the realm of statistical analysis on these data sets opens up.
- For example, central tendency can be measured by mode, median, or mean; standard deviation can also be calculated.
- Like the others, you can remember the key points of an "interval scale" pretty easily. "Interval" itself means "space in between," which is the important thing to remember–interval scales not only tell us about order, but also about the value between each item.

true zero

- Here’s the problem with interval scales: they don’t have a “true zero.”
- For example, there is no such thing as “no temperature.” Without a true zero, it is impossible to compute ratios.
- With interval data, we can add and subtract, but cannot multiply or divide.
- Confused? Ok, consider this: 10 degrees + 10 degrees = 20 degrees. No problem there. 20 degrees is not twice as hot as 10 degrees, however, because there is no such thing as “no temperature” when it comes to the Celsius scale.

Ratio

- Ratio scales are the ultimate nirvana when it comes to measurement scales because:
  - they tell us about the order
  - they tell us the exact value between units
  - AND they also have an absolute zero–which allows for a wide range of both descriptive and inferential statistics to be applied.
- Everything above about interval data applies to ratio scales + ratio scales have a clear definition of zero.
- Good examples of ratio variables include height and weight.

Data Evaluation and Classification

Qualitative & Quantitative data

- When a data set is large, it is not practical to assign a unique symbol to each data record.
- Therefore, for mapping it is essential that data is classified or grouped. There are several methods of classifying data.
- In choosing the right method, the level of measurement and the underlying distribution of the data set must both be considered.
- Data may be described and/or mapped as *qualitative* or *quantitative*.

Qualitative data

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- **Qualitative data** are data that are grouped in classes according to differences in type or quality. Qualitative data have no numerical values attached. *Nominal data* comes under this category.

Quantitative data

- **Quantitative data** are data that contain attributes indicating differences in amount and can be expressed as numerical values. Included in this category are *ordinal*, *interval*, and *ratio*

Classifying Nominal Data

- The symbolization of nominal or qualitative data is usually the least difficult.
- The variables of shape, pattern, and hue may be used for qualitative data.

Point	airport	town	mine	capital
Line	river	road	boundary	pipeline
Area	orchard	desert	forest	water

Classifying Ordinal Data

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- The symbolization of quantitative data is more complex, often there is a need to show data as a logical progression. Here, the variables of size and color value are more important.

Point	**Airports** international national regional	**Oil well production** high medium low	**Populated places** large medium small
Line	**Roads** expressway major local	**Drainage** river stream creek	**Boundaries** international provincial county
Area	**Soil quality** good fair poor	**Cost of living** high medium low	**Industrial regions** major minor

Classifying Interval and Ratio Data