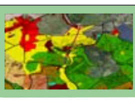


Cartographic visualisation in GIS

Antal Guszlev
ga@geo.info.hu
College of Geoinformatics
University of West Hungary

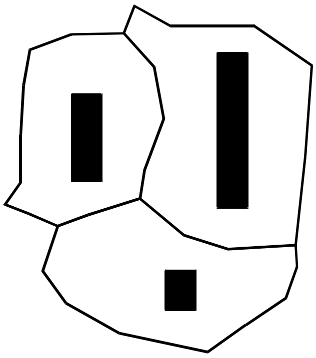
Contents

- Why use maps?
- Visualisation process
- Visual variables
- Cartographic generalisation

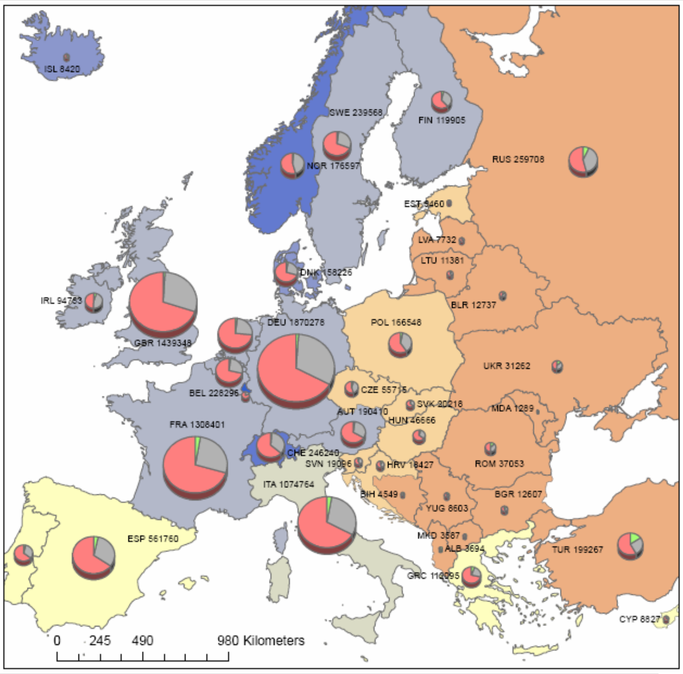
Why use maps?

Maps give an instant and complete overview of spatial phenomena

x	y	value
213	325	5000
179	424	10000
341	413	20000

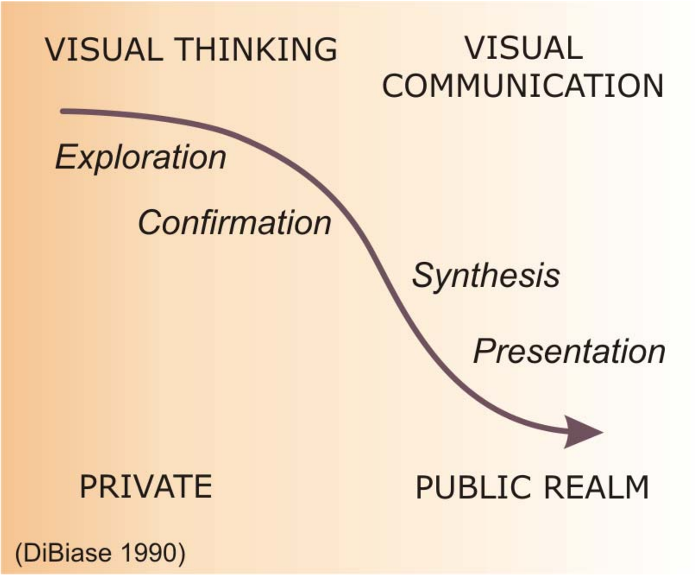


Why use maps?



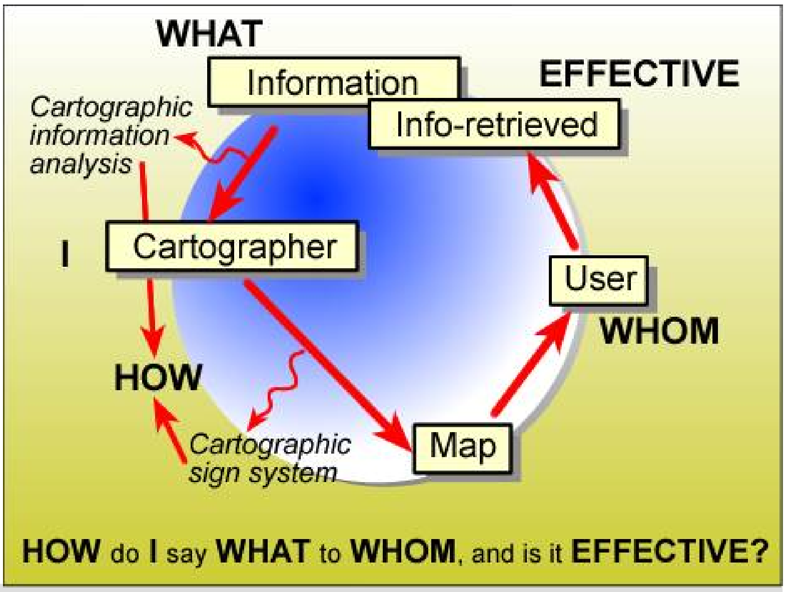
The map user can locate geographic objects, while the shape and colour of signs and symbols representing the objects inform the user about the characteristics. The map reveals spatial relations and patterns, and offers the user insight in and an overview of the distribution of particular phenomena.

Visualisation process

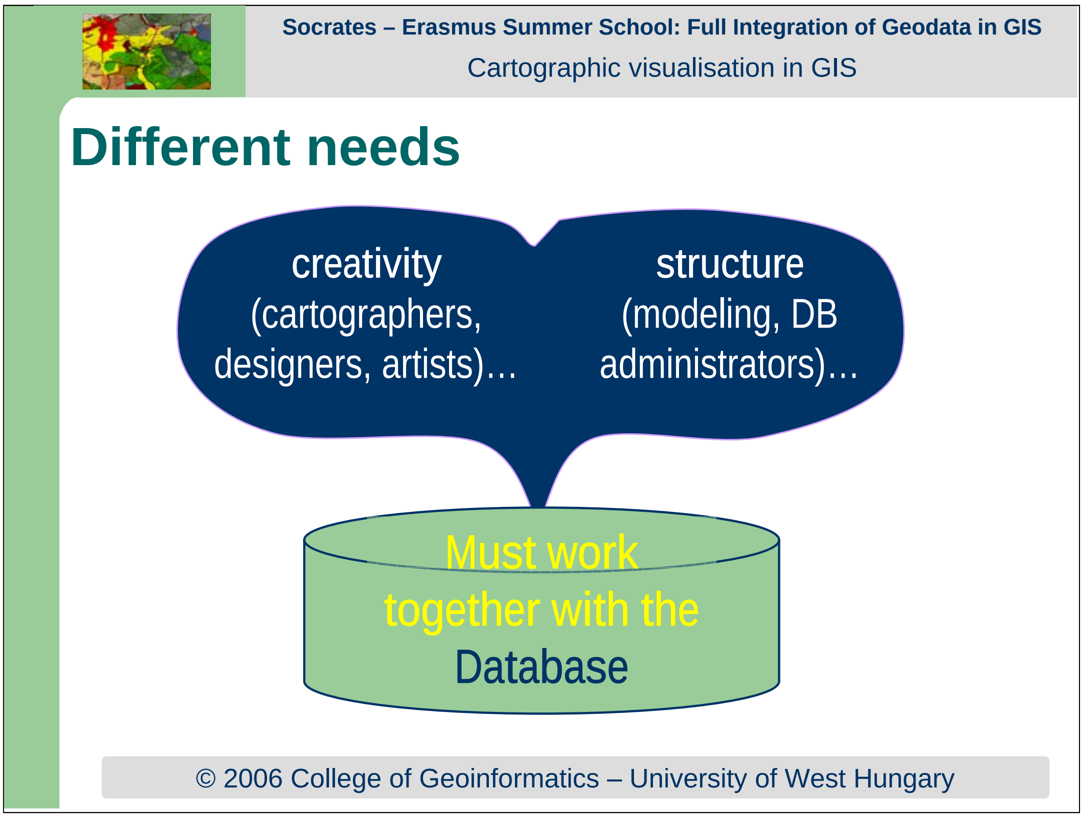


DiBiase's (1990) model of the role of maps in scientific visualization. This model focused on the need for cartographers to direct attention to the role of maps at the early (private) stages of scientific research where maps and map-based tools are used to facilitate data sifting and exploration of extremely large data sets.

Visualisation process



How well does map communicate to your audience?
What is the motive, intent, or goal of the map?
Who will read the map?
Where will the map be used?
What data is available for the composition of the map?
What resources are available in terms of both time and equipment?



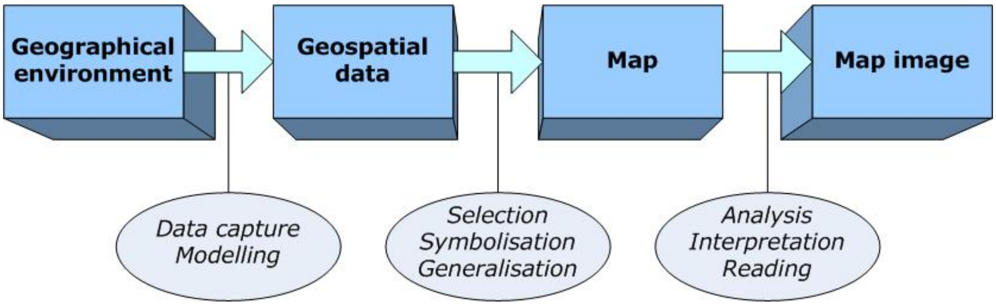
GIS

- Geography
- Database & data models
- Data combination and analysis
- Maps as thematic visual reports

Cartography

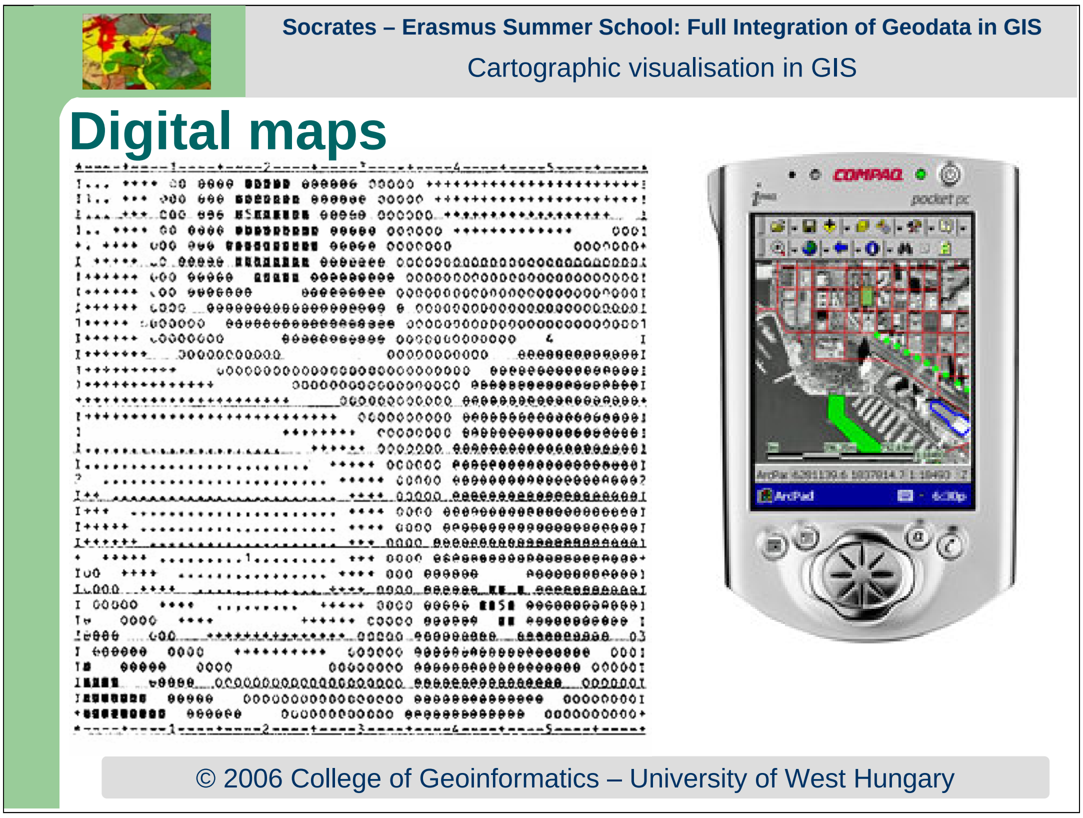
- Map as a communication medium,
- Clarity is as important as content
- Consistency of style is important …
- … but freedom to override the machine is vital
- Map is result of execution of choices and the reflection of the interpretation of the cartographer.

Information transformation



Developments in digital cartography

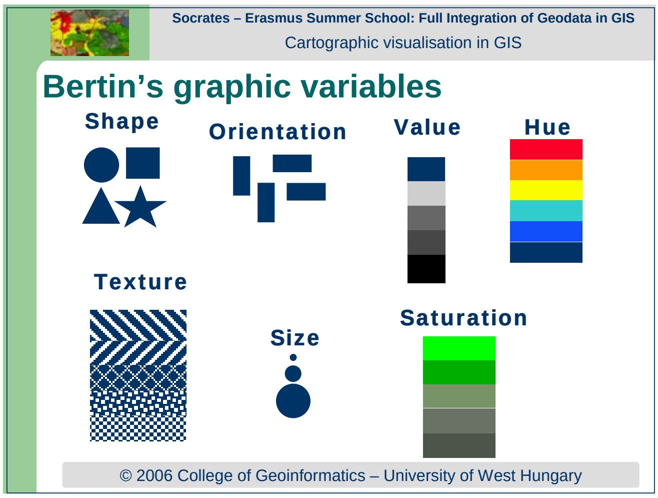
- **1950’s**
  first computer maps
- **1960’s / 1970’s**
  automation of existing tasks (line drawings)
- **1980’s**
  computer-assisted map production
- **1990’s**
  full integration of maps in GI
  (scientific) visualization
  from supply to ‘demand’ driven mapping
  CD and Internet / Web environments
- **2000’s**
  location-based services in mobile environment
- **2010’s …**



Left: SYMAP (Synagraphic Mapping System) from 1965 – first real demonstration of ability of computers to make maps

Right: ESRI ArcPad software from 2003 – mobile mapping

Graphic variables

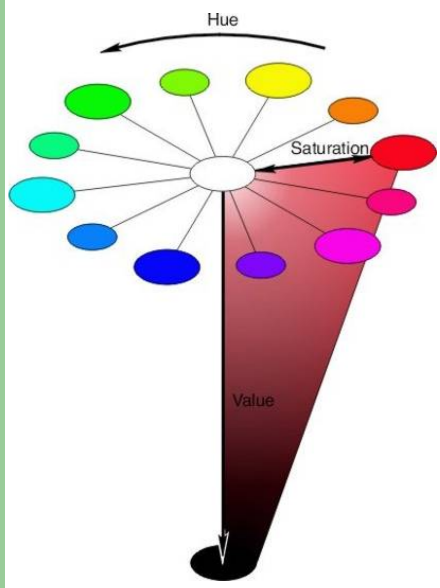


Jacques Bertin, whose monumental Semiology of Graphics (1983) systematically classified the use of visual elements to display data and relationships. Bertin's system consists of seven visual variables: position, form , orientation, color, texture, value, and size, combined with a visual semantics for linking data attributes to visual elements.

Graphic variables on maps

	Point	Line	Area
Colour (hue)	7	7	8
Value (brightness)	3	4	5
Size	4	4	5
Texture	2	4	5
Orientation	4	2	-
Shape	-	-	-

Dimensions of colours



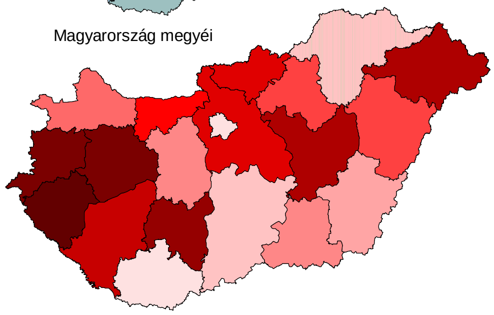
- Hue → dominant wavelength
- Value (Brightness) → how light or dark a given hue is
- Saturation → purity of hue (range of reflected wavelengths)

Note: It is impossible to exactly replicate colors shown on soft-copy and hard-copy since monitor colors are created by additive mixing (RGB, HSV) and printer colors are created by subtractive mixing (CMYK)

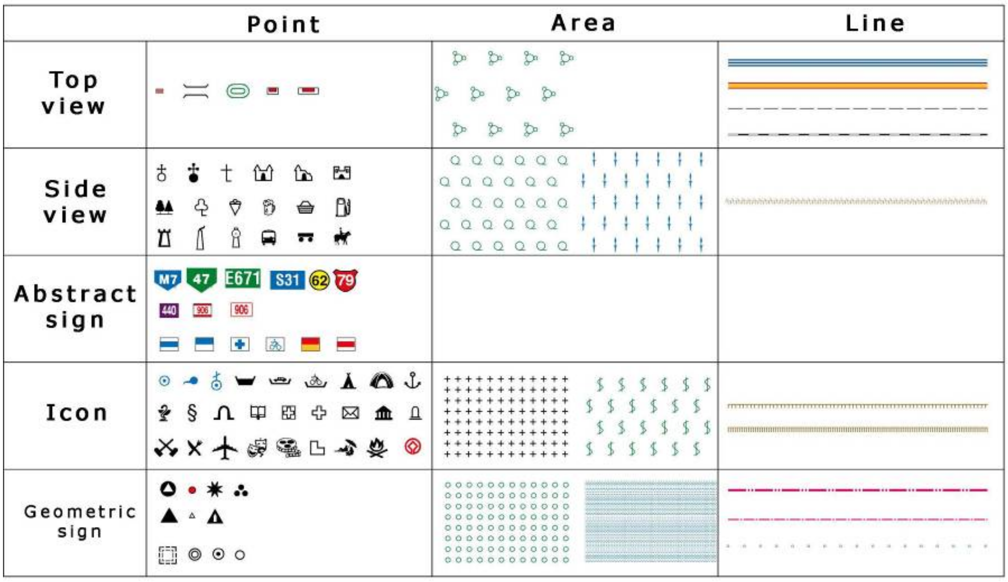
Qualitative / quantitative data

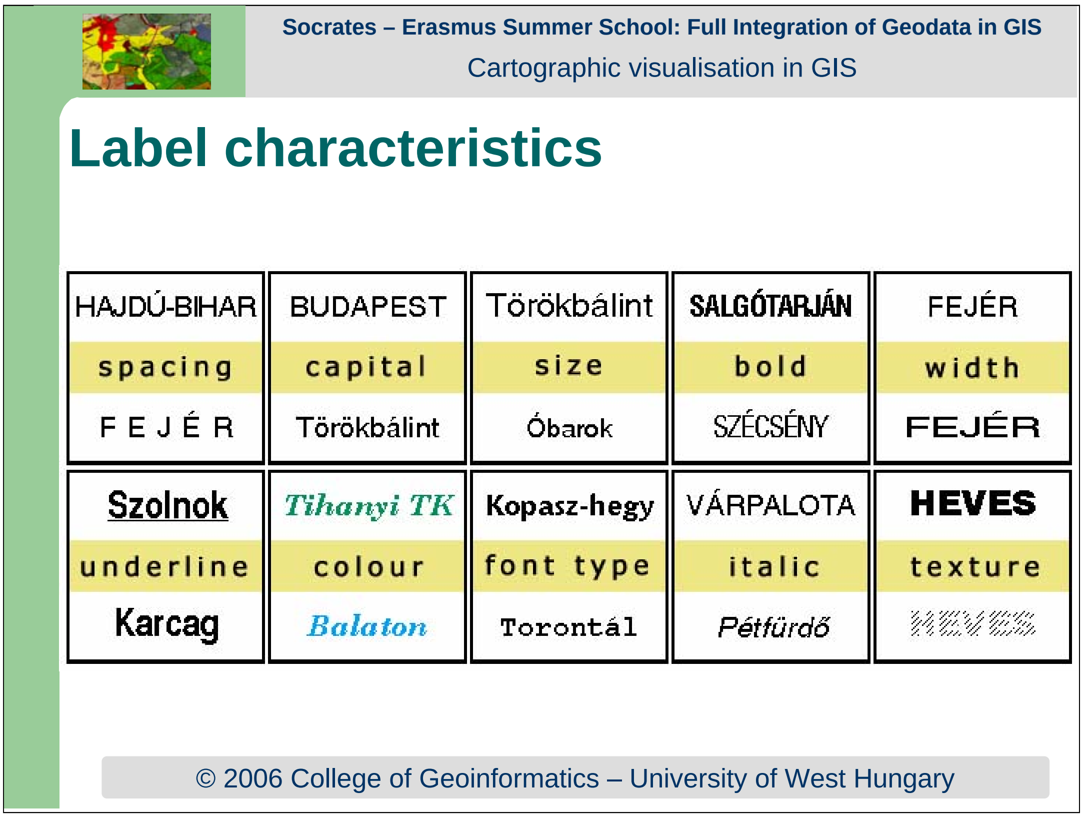
- Hue is generally used to indicate **qualitative** (nominal) differences across the map area

- Value and saturation are typically used to represent **quantitative** (ordinal, interval, or ratio) differences across the map area



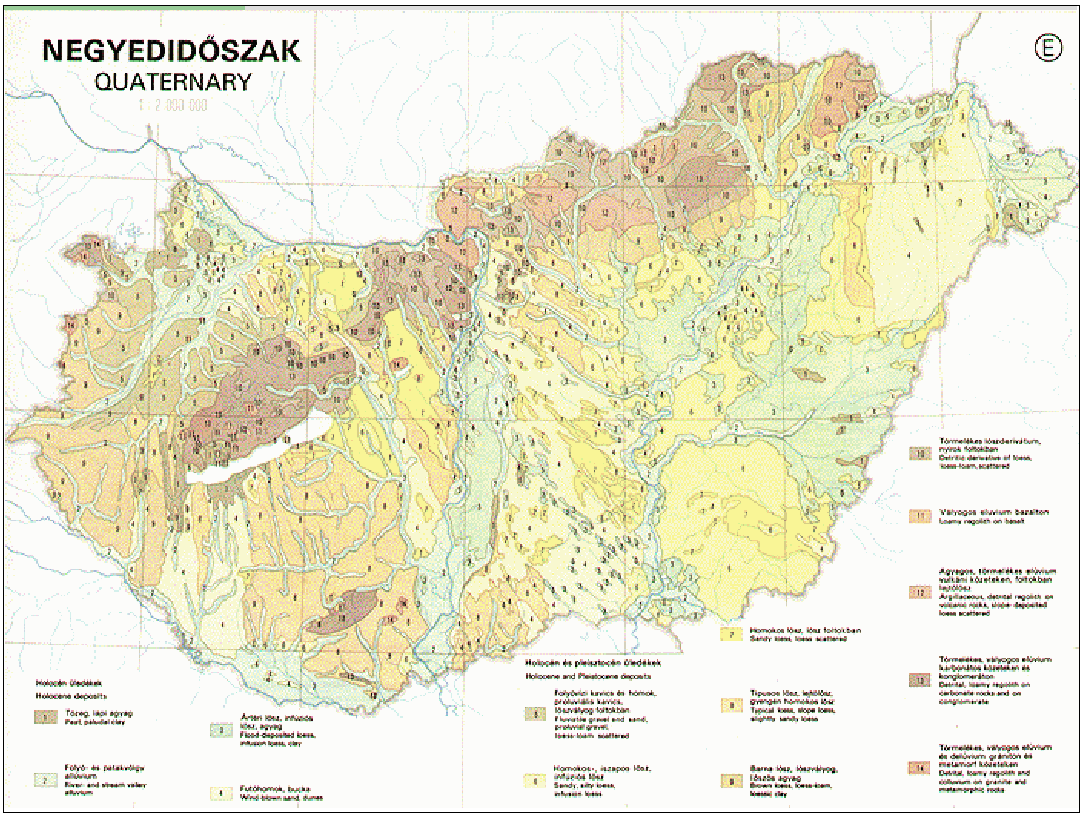
Shapes


Point
Area
Line
Top view
Side view
Abstract sign
Icon
Geometric sign
M7
47
E671
S31
62
79
440
906
906



Descriptive text is used to give a map its title, to explain the legends and label features.

Texts in GIS databases are usually stored as attributes or sometimes as ‘graphics’



Thematic map samples: tints, signs, isolines, diagrams, …

Generalisation

Cartographic generalisation

- When geographic data are gathered at a scale that is larger than the scale at which they are presented, it is necessary to reduce the complexity of the data to make the resulting map more readable and aesthetically pleasing.
- Generalization ensures that geographic data are presented at a scale appropriate to the purpose of the map and the application requirements of the user.
- This process is difficult to automate

Not all elements or details have a bearing on the pattern or process being studied and so some are eliminated to draw the reader's attention to those facts that are relevant.

Too much detail can even hide or disguise the message of a map

The amount of detail that can be included is very much dependent on the scale at which the map will be produced

Statistical generalisation

- Depict the underlying distribution of the data
- Difficult task because the whole point of displaying the data cartographically is to generalize the data to facilitate the search for spatial patterns
- Strike a balance between remaining true to the underlying data distribution and generalizing the data sufficiently to reveal intrinsic spatial patterns

Types of generalisation

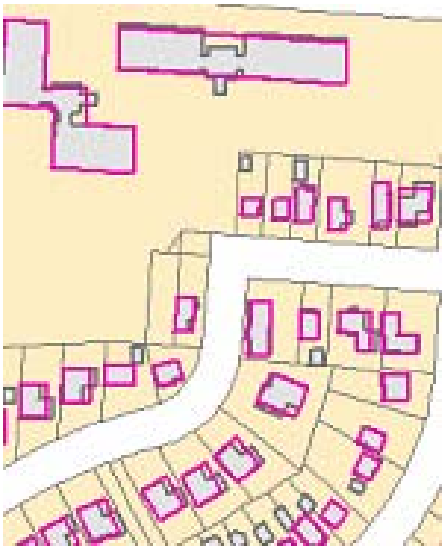
- Simplification
- Smoothing
- Aggregation
- Amalgamation
- Merging
- Collapse
- Refinement
- Typification
- Exaggeration
- Displacement
- Classification

The challange: huge areas with loads of data, shown on a small screen only. Challange for both map producers and map readers

Socrates – Erasmus Summer School: Full Integration of Geodata in GIS

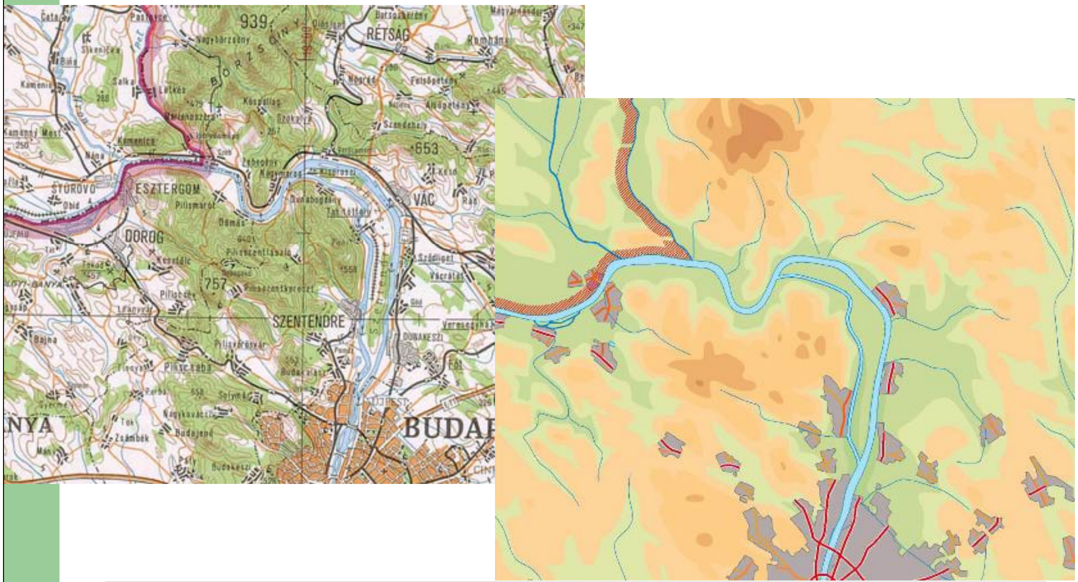
Cartographic visualisation in GIS

Simplification

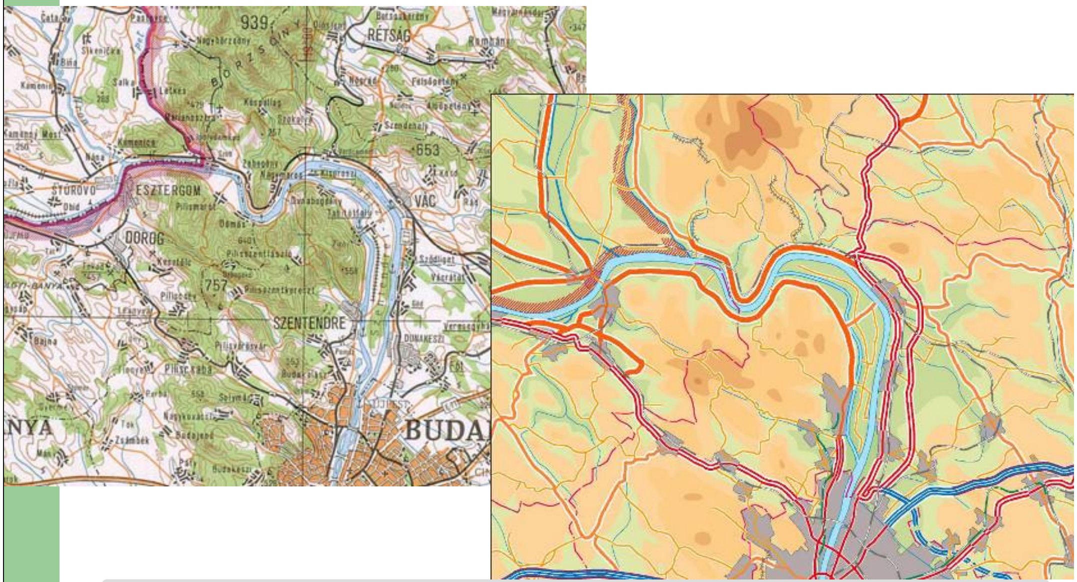


Simplifying the geometry of the objects, omitting unnecessary details

Smoothing settlements

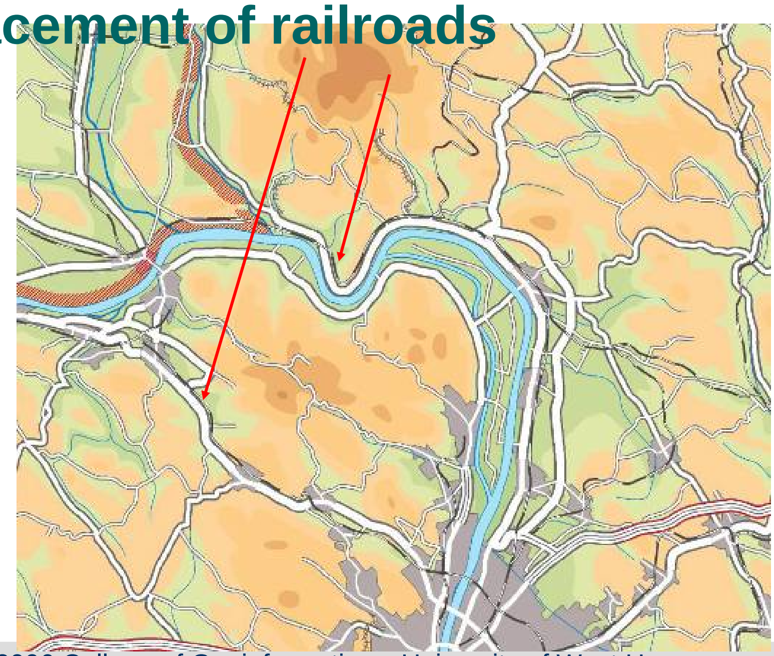


Exaggerating road network



Important features should be shown and emphasised, even over the actual scale

Displacement of railroads

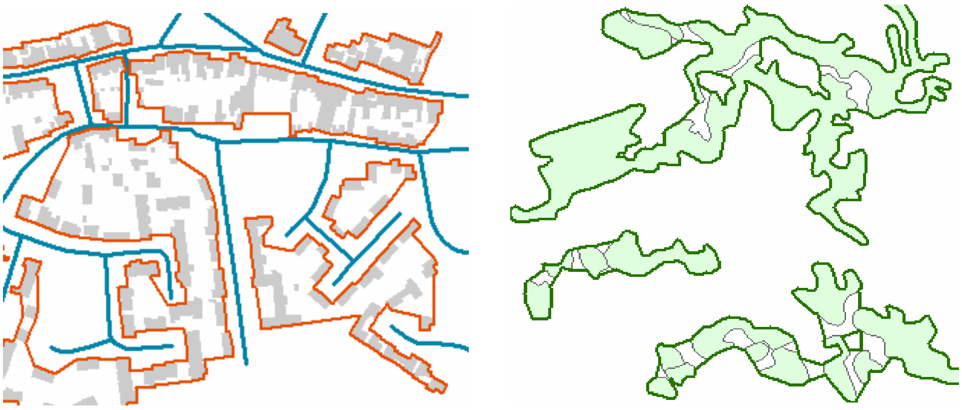


Displace objects parallel to each other to visualise neighbourhood characteristics

Merging water cover

Merge similar types of objects: reed

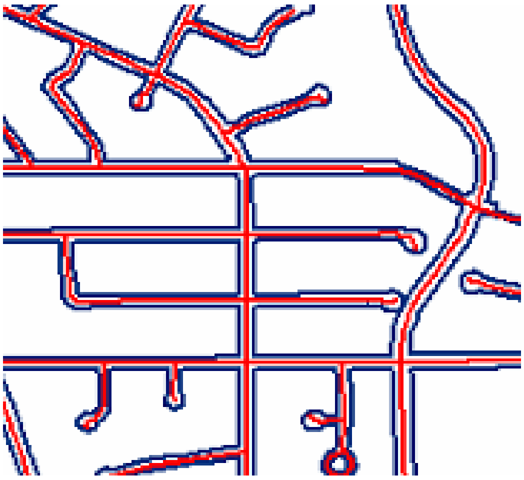
Aggregation



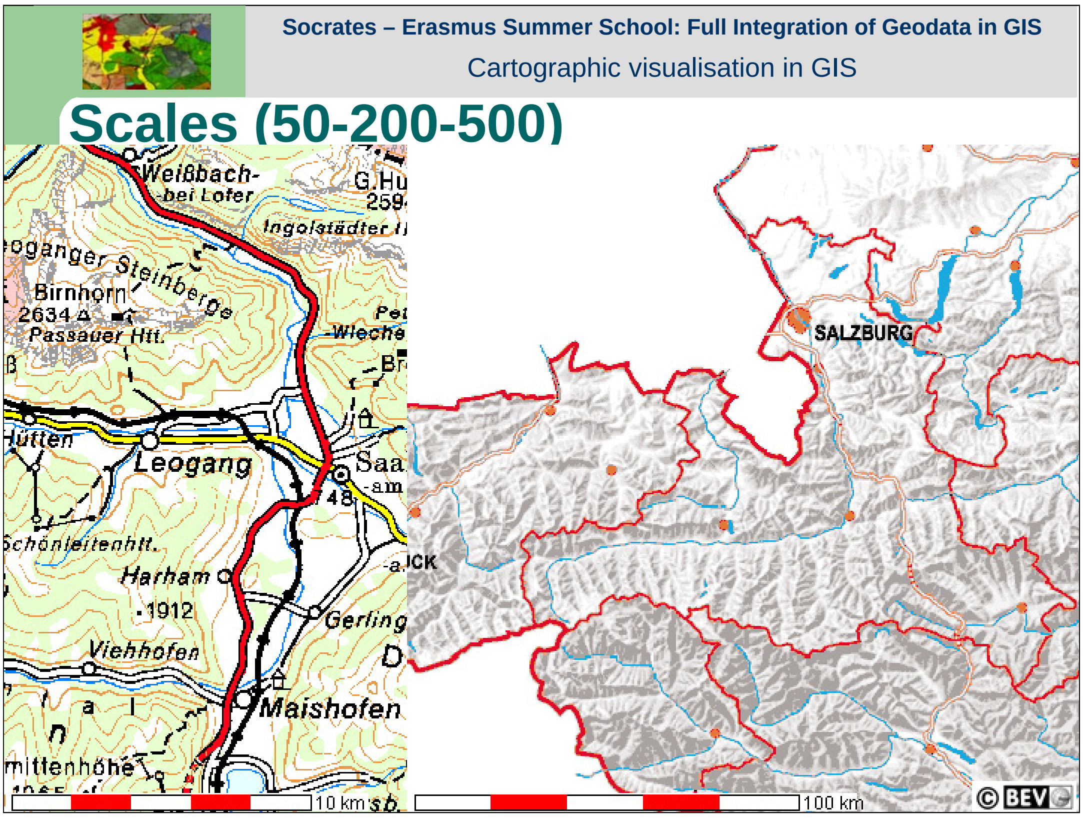
Aggregate buildings into blocks.

Aggregate polygons.

Collapse



Collapse double-line roads to centerlines



Comparison of topographic map sheets from Austria. Scales: 1:50 000, 1:200 000, 1:500 000. Small-scale topographic maps are derived from larger scales, while applying several generalisation methods.

Last slide: however difficult the process may be, in huge GI systems it is necessary to automate generalisation. You need solid geographical knowledge of the given region to judge whether the results of generalisation are correct.