

From GIS data sets to Cartographic Presentation

Boris Stern* Lorenz Hurni[†] Samuel Wiesmann[‡]
Helmut Flitter[§]

May 9, 2016

*ETHZ stern@karto.baug.ethz.ch, Overall

[†]ETHZ hurni@karto.baug.ethz.ch, Concept

[‡]ETHZ wiesmann@karto.baug.ethz.ch, Revision

[§]UNIZH helmut.flitter@geo.uzh.ch, Specials

Contents

Table Of Content	2
1 From GIS data sets to Cartographic Presentation	3
1.1 Map Presentation of GIS datasets	4
1.1.1 Map Creation from GIS datasets within GIS	5
1.1.2 Map Layout settings with GIS datasets within GIS	7
1.1.3 Map Output with GIS datasets within GIS	10
1.1.4 Map Creation with GIS datasets within CAC software	12
1.1.5 Map Presentation with GIS datasets within CAC software	13
1.1.6 Map Layout settings with GIS datasets within CAC software	15
1.1.7 Summary	16
1.2 Solutions for Digital Mapping	17
1.2.1 What Digital Mapping is	18
1.2.2 Digital Mapping Specificity	19
1.2.3 What Dynamic Mapping is	26
1.2.4 Software, Languages and Formats for Dynamic Mapping	28
1.3 Solutions for Analog Mapping	29
1.3.1 GIS Paper Map Production	30
1.3.2 The Printing process	31
1.3.3 Printing Presses	35
1.3.4 Raster Image Processor	38
1.3.5 Printed Media versus Electronic Media ?	39
1.3.6 Analog Mapping Self Evaluation	42
1.4 Summary	43
1.5 Recommended Reading	44

1 From GIS data sets to Cartographic Presentation

A mapmaker holds different versions of a map in his computer memory, and views them as necessary on the screen. From these different pictures, he can consider at best 2-3 of them; this is enough to have a new knowledge from the comparison, or to discover differences. Essential advantages of working on the screen, are that we can get separate details out, on which to them underlying data can fall back or carry out changes directly in the graphic or in the data. It is also possible to vary the picture construction in manifold of ways or reshape the whole symbolisation.

Personal computers are more and more involved as publishing systems that produce maps, but also newspapers and magazines. In this lesson, we will give you an overview of the concepts, tools and processes that are known to print maps and other graphics well.

Learning Objectives

- Know what are, and how to use map templates within a GIS
- Know how to create and present GIS data sets within GIS and CAC software well
- Know what exactly digital mapping is
- Tell the difference between a dynamic map and an animated map
- Master map design for screen maps
- Know the software, languages and formats for effective dynamic mapping
- Know the main used PrePress File Format as well as the main printer characteristics
- Know what exactly a Raster Image Processor is

1.1 Map Presentation of GIS datasets

Map Presentation

As we saw in the previous unit, mapping software can be divided in two types: Geographic Information Systems (GIS) and Computer Aided Cartography (CAC) software. As a map presentation with GIS datasets consists mainly of conveying with a mapping software some complex thematic information to the map user in an exact, clear, and easily readable manner, this unit will introduce in the map creation process within those two mapping software.

Thus, in this learning unit, you will learn how to create and present well GIS data sets within GIS and CAC software.

1.1.1 Map Creation from GIS datasets within GIS

Map Creation within GIS

With GIS, it is easy to create maps to convey your message. Indeed, most GIS provide several tools to put data on a map and display it in an effective manner. Furthermore, GIS gives you quick results without having to read hundreds of documentation pages. Thus, if your goal is to complete your tasks while investing a minimum amount of time and effort, mapmaking with GIS is your solution. However, as seen in the previous lesson, most of the maps created semi-automatically within GIS are disappointing, or even false.

As for each map creation process, before you sit down to create a map, you need to think about its purpose:

- What do you want your map to show?
- Does the map need to stand on its own, or will it be part of a larger presentation?
- Who is the audience for the map?
- Etc.

Answering these questions will help you determine how to organise and present the information on your map. You can find some further information about the map conception stage in the unit “Map Conception” of the lesson “Cartographic Data Representation.

No matter what kind of map you want to make and what kind of GIS you use, you always begin the same way, by creating a new map document. Then, you can either create an empty map with nothing on it or use a map template as a starting point. Map templates typically contain a predefined page layout that arranges map elements such as North arrows, scale bars, and logos. This means you just have to add your data and can then immediately print your map. Otherwise, you have to follow the entire map creation stage.

What kind of map creation tools are provided by GIS?

Discover in the following animation the map creation tools provided by most of GIS.

Please note:

Only pictures can be viewed in this version! For Flash, animations, movies etc. see online version. Only screenshots of animations will be displayed.

Figure 1: Map creation within GIS, image source: [?]

1.1.2 Map Layout settings with GIS datasets within GIS

Map Layout settings within GIS

GIS provides several tools to lay out your map in an effective manner. Furthermore, GIS lets you work in data view or layout view:

- Data view focuses on a single data frame: useful for exploring or editing data.
- Layout view shows how the map page looks: useful for composing and printing a map for display. For example, you can change the size and orientation of the page in the layout view.

Map templates

If the map is part of a series, you may have a template to work from, or you may create a new template for the series. Map templates make it easy to produce maps that conform to a standard, and they save time by letting you do the layout work for all of the maps in the series at once. You can also use the map templates that come with GIS to quickly make a map that looks good, with a minimal amount of layout work on your part. Just choose a template that has the look you want, add your data, and make whatever changes you want, and your map is done. Map templates make it easy to reuse the same layout or even the same data on a series of maps. You can use the templates that come with GIS to make maps quickly. All you need to do is add data, a title, and any other supporting information that you choose. Templates can also contain data, special symbols and styles, custom toolbars, and macros such as Visual Basic forms and modules. GIS comes with many predefined templates to choose from when making your maps. Also, any map you make can be saved as a template.

Example of map templates

The left picture presents you the map template as define in the GIS, whereas the right picture shows you a map created automatically with this map template.

Setting up the page

GIS makes it easy to change the size of the page if needed, but it is wise to have the final product in mind when you begin designing the map. If the virtual page does not match the page size and orientation you have planned for your map, you can change the page setup. Usually, the virtual page size is the same as your system printer default page size, but

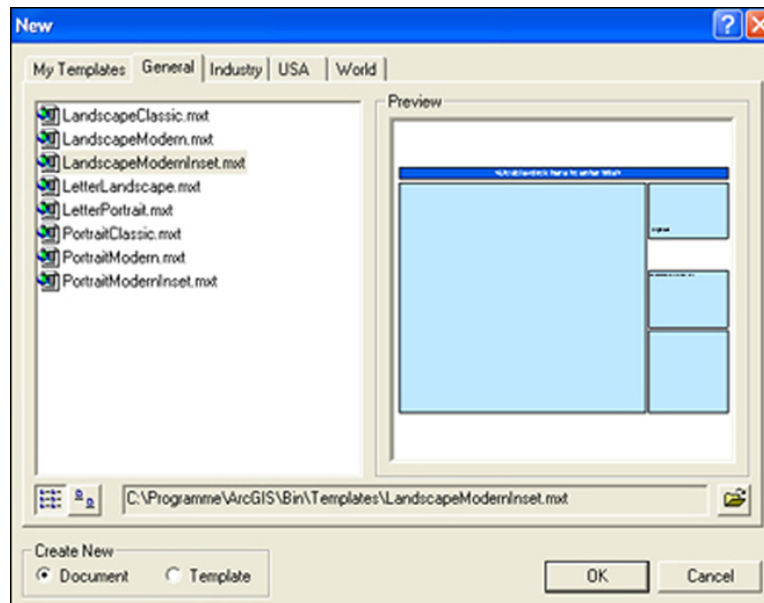


Figure 2: Map template

you can set the page to be one of many standard sizes, or you can define a custom page size for your map. You can optionally visualise the following PDF: [setting_up_the_page.pdf](http://www.gitta.info/GISDataPres/en/multimedia/Setting_up_the_page.pdf) (www.gitta.info/GISDataPres/en/multimedia/Setting_up_the_page.pdf) (15 Kb) to get more information about the possibilities of setting up your map within a GIS.

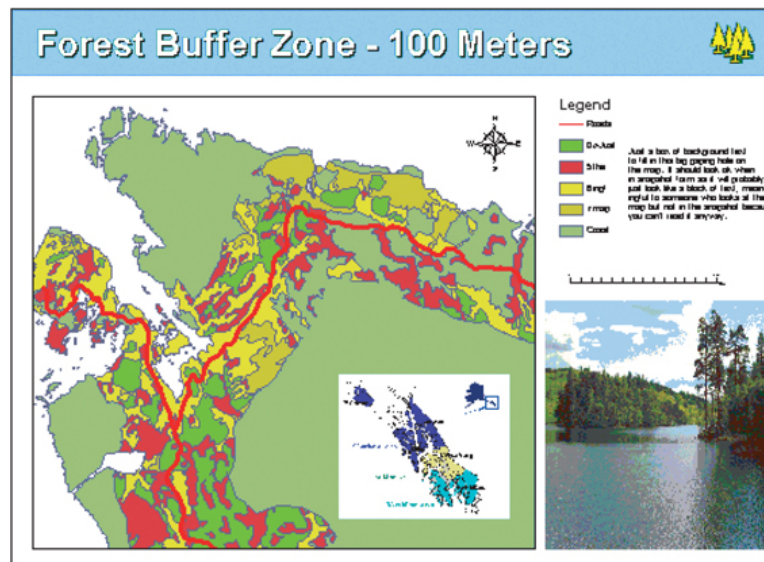


Figure 3: Map template example [?]

1.1.3 Map Output with GIS datasets within GIS

Showing the results of your work is easy with GIS. You can create great looking publication-quality maps and create interactive displays that link charts, tables, drawings, photographs, and other elements to your data. But also embed them in reports, publish them on the Web, export them to standard formats, or print them out to hang on the wall.

Print a map

Once you have created a map, you will probably want to print it. But before you start the printing, it is better to preview it in order to be sure that the map page and printer page sizes are correctly matched. If you want to print a map that is not set to be the same as the printer page size, there are two scenarios:

- If the map is smaller than your printer page size, go ahead and print or choose a smaller page size on your printer.
- If the map is larger than the printer's default page size, you have several options. You can change the page size of the printer, change the printer that you're using, or change the page size of the map.

Export a map

Once you have created a map, you may want to export it from a map document to another file type. You can export maps as several types of image files. These include:

- EMF (Enhanced Windows Metafiles) are Windows native vector, or vector and raster, graphics. They are useful for embedding in Windows documents because they can be resized without distortion.
- BMP (Windows Bitmap) files are simple, native Windows raster images. They do not scale as well as EMF files.
- EPS (Encapsulated PostScript) files are primarily used for vector graphics and printing.
- PDF (Portable Document Format) files are designed to be consistently viewable across different platforms. They are commonly used for distributing documents on the Web.
- JPEG (Joint Photographic Experts Group) files are compressed image files. They are commonly used for images on the Web because they are more compact than many other file types.

- Etc.

GIS Export Functions

Find below a screenshot of the export functions from a GIS. This screenshot shows you the export format possibilities.

Please note:

Only pictures can be viewed in this version! For Flash, animations, movies etc. see online version. Only screenshots of animations will be displayed.

Figure 4: GIS export functions example

1.1.4 Map Creation with GIS datasets within CAC software

As we have seen it in the lesson “Mapping with GIS and Cartographic Software, the CAC software, which are the ideal and optimal software for high-quality mapping, do not allow the intrinsic use of GIS datasets. You need some special, and sometimes very expensive, plugins to allow spatial data files to be used to create maps inside these vector graphics programs. These plugins allow all cartographic tasks to be performed where they should be done, in a powerful graphics environment. Find below two examples of such plugins:

- Mapublisher from Avenza: <http://www.avenza.com/mapublisher> (www.avenza.com/mapublisher)
- GIS data publishing with Loric-Sotware: <http://lorienne.com/en/portfolio-item/gis-data-publishing/> (lorienne.com/en/portfolio-item/gis-data-publishing/)

What kind of map creation tools are provided by GIS-CAC plugins?

Discover in the following animation a list of plugin categories to import GIS data into CAC software. Click on them to see the GIS and cartographic functionalities they allow within the CAC software.

Please note:

Only pictures can be viewed in this version! For Flash, animations, movies etc. see online version. Only screenshots of animations will be displayed.

Figure 5: MaPublisher [?]

1.1.5 Map Presentation with GIS datasets within CAC software

The key to making maps with CAC software are the GIS data file formats the GIS-CAC plugins supports. GIS files are precise geographic data files that contain vector information and associated data attribute values. GIS-CAC plugins' ability to import such files into CAC software, while retaining both geographic vector and attribute information make it very easy to produce high quality maps. Indeed, all GIS data attributes and geographic parameters are maintained during import and are fully accessible and editable during map creation. Some classic industry leading GIS file formats, which should be imported, are:

- ArcInfo Export (.e00)
- ArcInfo Ungenerate (.lin, .pnt, or .pol)
- ArcView Shapefile (.shp + .dbf + .shx)
- AutoCAD (.dxf)
- MapInfo(.mid + .mif)
- MicroStation DGN (.dgn)
- USGS DLG - SDTS (.ddf)
- MicroStation DGN
- DXF format
- ASCII point files
- Georeferenced JPEG and TIFF files
- Etc.

Data Considerations

When importing GIS data within your CAC software, there are a number of important considerations to keep in mind:

- When receiving data it is especially important to obtain as much metadata about the files as possible, especially concerning projections. Some information which should always accompany the data are:
 - Units of measure (meters, kilometers, miles etc.)
 - Projection name

1 FROM GIS DATA SETS TO CARTOGRAPHIC PRESENTATION 14

- State plane
 - Ellipsoid
 - Central meridian and central parallel
 - UTM zone
 - Latitude of true scale
 - Etc...
- If you receive projected data you must be aware that when importing projected data you should select the same units as were used in the projection process.

1.1.6 Map Layout settings with GIS datasets within CAC software

CAC software themselves do not provide any tools to help you to lay out maps in a correct manner. This is properly done by the plugins. They help you to create:

Legend

Map legends include tools for quickly and accurately creating legends from the data found in the map attribute table, but also to apply strokes, fills and fonts to map elements according to user specified legend criteria. You can create a custom legend for your map based on its attribute information using the parameters you have defined. You can also assign legend info automatically in order to create a custom legend for your map based on its attribute information. This does not require you to specify a criteria or expression for each legend element.

Map Labelling

One of the most useful features, is the ability to create labels for map objects using values from the attribute tables. There are two methods of adding labels to your map:

- One way is to first select all the features you want labelled and label all of them by a specified attribute value.
- An alternate method involves applying labels individually.

Some other Layout settings tools are, for example:

- Automatic scale bar creation: Allows to include a dedicated scale bar creation tool that makes it easier to quickly and accurately add a scale bar to your map, complete with captions and subintervals.
- Automatic map index creation: Makes the tedious process of map index creation easy. Allows the automatically generation a text file counting each labelled attribute and its corresponding cell location. This text file can then easily be imported into various software.
- Map Scale Tool: mathematically converts the earth's curved, three-dimensional surface to flat map sheets; the transformation feature converts the native coordinate system to scaled map sheets.

1.1.7 Summary

We saw in this unit how easy it is to create maps with GIS and CAC software. Nevertheless, even if you get quick results, you should never forget the main objectives of your map.

1.2 Solutions for Digital Mapping

Digital Mapping

Maps are an indispensable form of information display. Until recently, maps were exclusively designed and constructed to be printed on paper. The printing of maps on paper was economical, and this facilitated their distribution. However, paper maps may not represent the best way to convey information. Computers have been used for many years to assist the cartographer in making maps on paper. Nowadays the computer is being used directly for the display of maps. Indeed, computers are making more interactive and dynamic methods of map display possible.

In this unit, you will discover what digital mapping is, but also see how the computer can be used to create a more dynamic form of map use.

Most of the presented text are a compilation of the following publications:

- [?]
- [?] .
- [?]

1.2.1 What Digital Mapping is

Beginning in the early 1960s and concurrent with research in cartographic communication, cartography was greatly influenced by computer technology. The adaptation to this new technology occurred very quickly, even though early methods of graphic output produced crude depictions. But until recently, the computer has been used primarily to automate the production of maps on paper, therefore it was mainly viewed as a tool to make the creation of maps easier for the cartographer. This view of the computer changed around 1980. Computer mapping software begins to incorporate an interactive, in some case animated, form of cartography - a type of map use that is not possible with the printed map. The computer is being used not only as a tool to help make maps on paper but as a medium of communication. So finally, what is Digital Mapping?

Digital Mapping is a computer technology that generates, stores, and processes maps in terms of two states: positive (1) and non-positive (0) in order to display them visually on an electronic medium like a monitor, a beamer, etc. Digital Mapping consist:

Please note:

Only pictures can be viewed in this version! For Flash, animations, movies etc. see online version. Only screenshots of animations will be displayed.

Figure 6: Digital mapping description

Attention: A digital map differs from a virtual map, in that, according to Moellering, that a virtual map is a digital preliminary, that is not yet completed or permanent.

Example of Dynamic Digital Mapping

Discover the following example of dynamic digital mapping with your mouse: select meta-information by rolling over the map with your mouse.

Please note:

Only pictures can be viewed in this version! For Flash, animations, movies etc. see online version. Only screenshots of animations will be displayed.

Figure 7: Datasource: [?]

1.2.2 Digital Mapping Specificity

Digital Mapping Limitations

The visual limitations of the computer monitor are immediately apparent when compared with a finely printed image. Until computer screens get closer to producing images as fine as on paper, you have to use new techniques and overcome these limitations by seeking solutions through innovative map design. We are going to depict here the restrictions of digital map display, but above all see how to overcome them with adapted design techniques.

Screen Dimensions

While nowadays most desktop computers are capable of displaying 1280 by 1024 pixels with 32-bit colour, the default settings on these machines out of the box are usually 1024 by 768 or even 800 by 600. The average user will not change this, so you are forced to design digital maps with the low-resolution user in mind.

With limited resolution, many designs can end up looking clunky. A judicious use of colour can minimise some of these problems along with concise data selection and deliberate typography.

Overall the best way to make digital maps clear and readable is to reduce the map elements shambles.

Pixel size and screen resolution.

Discover how screen size, pixel number, and resolution are interrelated by pushing the three buttons with your mouse.

Please note:

Only pictures can be viewed in this version! For Flash, animations, movies etc. see online version. Only screenshots of animations will be displayed.

Figure 8: PixelSize_ScreenResolution.swf

Screen colours

Computer monitors are poor imitators of nature. Indeed, the additive colour space of RGB (Red Green Blue) does not come close to covering the gamut of colours perceivable to the human eye. Furthermore, you might be surprised

by the colour restitution when viewing your map on a different computer. In fact, colours are not rendered in the same way on different monitors.

The following hardware related reasons can be identified:

- According to www.thecounter.com, around 3% of all clients surf the web with a monitor set to display only 256 different colours (8-bit), 40% view web pages with thousands of colours (16-bit High Colour), and the rest uses millions of colours (24 or 32-bit True Colour).
- There are differences in the quality and design of the hardware between monitors of different manufacturers and different types (CRT or flat screen).
- The age of the monitor; different monitor adjustments (brightness, contrast, colour, temperature, etc.); and the ambient light.

Other reasons are software related:

- Operating systems use different gamma curves. This mathematical function maps RGB colour values to voltages of the display card. The gamma value mainly influences the brightness of the image. Colours on a Windows PC appear darker and more intensive (gamma value of approximately 2.2) than on a Mac (gamma value of 1.8).
- Different web browsers and plug-ins can interpret colour values differently.

You cannot foresee any of these factors. The following recommendations can at least partially solve this problem:

- Design your graphics for the most widespread combination of operating system and web browser used by your targeted audience. Currently, around 90% of all web surfers use a combination of some variant of Microsoft Windows and Internet Explorer [?] .
- Determine whether systems with only 256 different colours must be supported. This may be a requirement, if an important part of the targeted audience originate from southern countries. If support for 8 bit systems is not needed, ignore the web-safe colour palette that was very useful with Internet Explorer and Netscape Navigator a few years ago.

- If the majority of your audience uses Microsoft Windows to view your digital map, you should adjust your monitor to simulate an average office PC with a mediocre screen (gamma value of 2.2, with millions of colours); and use the RGB colour space if supported by your graphics software.
- Clearly differentiate colours for thematic mapping, i.e. use larger colour contrasts for screen maps than for paper maps. The reason is again the unpredictable colour rendering: Two close colours might appear very distinctive on a certain screen, but might be hardly discernible on another. To better differentiate succeeding thematic classes with grades of colour, you may also reduce their number.

Some general advice concerning colour design for digital mapping:

- Always preview your map at various resolutions and bit depths, and when possible on different monitors.
- As much as possible, try to find muted or light colours.
- Do not feel the need to use black for all labels; try a dark maroon or a muted dark blue instead.
- Use colours close in value to each other to make some map elements recede to the background.
- Look for colours in the same basic hue range to tie themes together.
- Avoid saturated colours of different hues that are close in value, as they will produce visual vibration.

Colour differences between Mac and PC

The following pictures show you the colour differences between Mac and PC operating systems.

On the left, the map viewed on a Mac screen seems to be lighter than the map viewed on a PC screen (on the right).

Screen and antialiasing

For screen display, vector data are converted to raster images. Simple algorithms used for rasterizing vector data create an aesthetic step effects in edges. The “antialiasing correction consist relatively complex mathematical operations that create semi-transparent transitional borders at the edges of objects and thereby produce a more appealing appearance. However, the conversion process from vector data to raster image is much more time consuming when antialiasing is used.

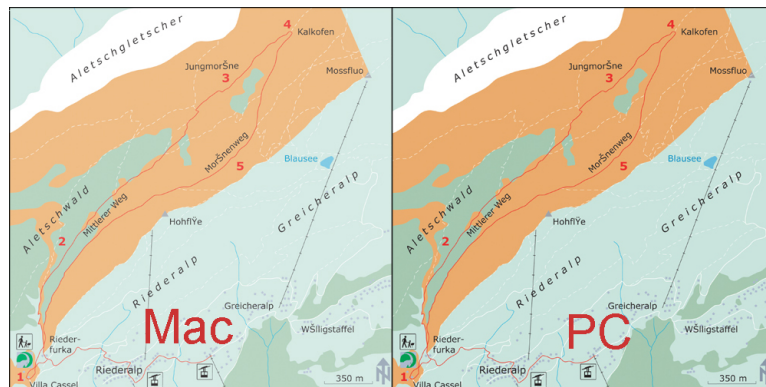


Figure 9: Colour differences example between Mac and PC (Kartenquelle: Studentenarbeit FHBB)

Antialiasing on a map.

The following pictures show you the difference between a map excerpt with and without antialiasing. The readability of the map without antialiasing (left) is not very good, whereas the right map with antialiasing is easy to read.



 <p>Excerpt from MapQuest's web map of Zurich without antialiasing</p>	 <p>Same excerpt with antialiasing (rendering with Adobe Illustrator).</p>
-----------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------

Table 1: Legend missing

Screen and fonts

The selection of an appropriate font for a web map is a difficult task, since a balance between often contradicting criterions has to be found. Therefore, you have to analyse existing fonts for their suitability to be used for web maps. As for paper maps, a font must be easily legible and should also be optically pleasing. You can find some further information concerning fonts for digital mapping in the unit "Typography of the lesson "Layout Design (Basic Module)".

Please note:

Only pictures can be viewed in this version! For Flash, animations, movies etc. see online version. Only screenshots of animations will be displayed.

Figure 10: Screen fonts [?]

The symbolisation of graphical objects for digital maps has to be adapted to the peculiarities of screens. Line widths, minimum sizes for point symbols and minimum distances between graphical elements have to be larger than on paper maps in order to be optically well discernible. This is a consequence of low screen resolution and the use of antialiasing.

Reference values for sizes and distances will be suggested in the following paragraph. However, the suggested values do not replace visual control of the map when displayed with the respective software program or plug-in. The future will certainly provide us with better monitors, improved browsers, and more advanced viewer technologies. Therefore, you must constantly update your knowledge.

Lines width on the screen

Sometimes, you might be surprised not to see the expected difference of the width of two lines on the screen. Indeed, the quality of the antialiasing algorithm can differ between distinct graphics programs and browser plug-ins. The following example shows Bézier curves with increasing width rendered with by the Macromedia Flash Player and the Adobe SVG Viewer. The SVG Viewer on the left renders lines that are narrower than half a pixel more accurately than the Flash Player (on the right).

Please note:

Only pictures can be viewed in this version! For Flash, animations, movies etc. see online version. Only screenshots of animations will be displayed.

Figure 11: SVG Bézier curves

Please note:

Only pictures can be viewed in this version! For Flash, animations, movies etc. see online version. Only screenshots of animations will be displayed.

Figure 12: Flash Bézier curves [?]

Furthermore, with the Adobe SVG Viewer, line widths do not increase linearly, but grow irregularly. Lines between 0 and 0.14 pixel are always rendered with the same width and in grey colour. Between the pair's 0.22/0.24 pixel and 0.3/0.32 pixel differences of the apparent line width become recognisable. Other renders may have completely different characteristics.

Map design and screen

Because the distance the user keeps to the display device when studying a digital map is approximately 80 cm, whereas a paper map is typically held at a distance of only 30 cm:

- Distances between map elements and minimum sizes of signatures should be chosen larger rather than smaller.
- Information density should be adapted according to the enlargement of the symbolisation. Spiess recommends a reduction of the information density by a factor of 2 to 3.
- Since the entire map cannot be displayed on the computer screen in three times its size on paper, lines, areas and point signatures as well as text labels have to be adapted respectively.
- The geometry of map elements must be much more generalised for screen display.

Notice in the following example, the very distinctive density of information between the paper map and the digital map.

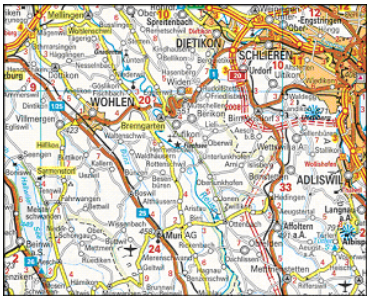
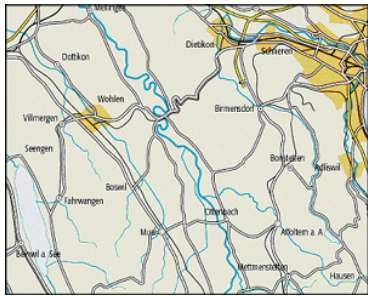
 <p>Traditional road map on paper</p>	 <p>A similar map that was optimised for screen display.</p>
--------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------

Table 2: Legend missing

Discover in the following animation, the minimum dimension and the minimum distance in a digital map.

Please note:

Only pictures can be viewed in this version! For Flash, animations, movies etc. see online version. Only screenshots of animations will be displayed.

Figure 13: Min_Dist_Dim.swf

Please note:

Only pictures can be viewed in this version! For Flash, animations, movies etc. see online version. Only screenshots of animations will be displayed.

Figure 14: Digital_Mapping_Test.swf

1.2.3 What Dynamic Mapping is

Dynamic mapping

Dynamic mapping can be considered as digital pro-active mapping, which is sufficiently well integrated to be presented via a single interface, or manipulated by a single program. The purpose for exploring spatial data via dynamic mapping is to reveal unknowns and is typically accomplished via a high degree of human interaction; animation is frequently an important component of data exploration. However, standalone spatial data exploration is also possible.

Interactive Mapping

Interactive Mapping is a special form of digital mapping, where the map changes according to the user inputs (interaction object). This is why the interactive map is characterised by an intuitive user interface consisting of graphical icons, pointing devices, and the near instantaneous display of maps. It includes “tools to further zoom in on the map or open different areas. The types of interaction with a map can be categorised as graphic attribute-based:

- Interacting with a graphic could involve travelling through a map display, or make the map larger.
- Attribute-based interactions involve the manipulation of the map features through a separate database. For example, the display of a particular street by clicking on the street name.

Types of map interaction:

- Change in scale: zoom-in or zoom-out display,
- Change in symbolisation: size, colour of a symbol.
- Change in perspective: oblique view, etc.
- Etc.

Example of SVG based map interaction

Find below an example of SVG based map interaction. Click on the map to get the interactive map and explore the various interactions with your mouse.

Please note:

Only pictures can be viewed in this version! For Flash, animations, movies etc. see online version. Only screenshots of animations will be displayed.

Figure 15: Example of SVG based map interaction, Designd by Y. Isakowski, IKA ETH Zürich

Animated Mapping:

Animation is a “graphic art that occurs in time. It is a dynamic visual statement that evolves through movement or change in display. The most important aspect of animation is that it depicts something that would not be evident if the frame were viewed individually and this without any user inputs after the departure of the animation. A basic distinction can be made between temporal and non-temporal cartographic animation:

- Temporal animations are limited to the display of change over time.
- Non-temporal animations include all other forms of animation in cartography.

The animation variables include both graphical manipulations and sound (sound can be used to accentuate an animation). The graphical variables of animation could include size, shape, position, speed, viewpoint, distance, scene, texture, pattern, shading, colour, etc.

Animated Map Example

Find below an example of animated map.

Please note:

Only pictures can be viewed in this version! For Flash, animations, movies etc. see online version. Only screenshots of animations will be displayed.

Figure 16: Animated Map Example [?]

1.2.4 Software, Languages and Formats for Dynamic Mapping

Computers offer a variety of tools for the creation of interactive and animated maps. These tools are existing programs in computer mapping, graphic design, image processing multimedia, and computer animation. In addition, tools are also computer languages for scripting or programming.

Software, Languages and Formats Examples

Discover the most important software, languages and formats for dynamic mapping creation on the following animation. Push over the graphic elements with your mouse to get further information.

Please note:

Only pictures can be viewed in this version! For Flash, animations, movies etc. see online version. Only screenshots of animations will be displayed.

Figure 17: DynamicMapping.swf

1.3 Solutions for Analog Mapping

Analog Mapping

Printing technology has caused revolutionary changes in the printing industry in the 1990s with more computer control, newer printers, etc. Designing maps requires careful planning to accommodate sophisticated printing technology, and needs to work closely with a service bureau to successfully reach design goals. We cannot adequately approach a design task without at least an elementary knowledge of how maps are printed out after they leave the office, and this requires some background information on printing technology.

Because map production and reproduction play an important role in the overall design process, you will be introduced in this unit to the analogue mapping characteristics and needs.

1.3.1 GIS Paper Map Production

Map Production

GIS outputs are rarely mass production, frequently only one copy is demanded. Nevertheless sometimes only a printed map or a copied plan remains as the single alternative. Nowadays, an important rule is played by qualitatively pleasing coloured "hard-copy" or plots, which come directly from screenshots. But such maps suffer from the low resolution which corresponds to that of the screen. Better resolutions can be reached with real plots, whose quality is only limited by the resolutions of the plotter.

1.3.2 The Printing process

Printing Process?

The printer is one of the most important peripherals of your GIS because it allows you to print out data on paper. The choice of printers is huge, ranging from modest black and white ink-jet printers, to heavy-duty colour laser or high resolution imagesetters capable of reproducing negatives for use in high-quality printing. We are going to study here the printers and printing technologies that exist on the market, so that you could determine at the end of this lesson the best printing method, according to your quality and quantity objectives.

Production Methods

Discover the low and the high quantity production methods by clicking on the grey buttons with your mouse.

Please note:

Only pictures can be viewed in this version! For Flash, animations, movies etc. see online version. Only screenshots of animations will be displayed.

Figure 18: Printing_Systems.swf

PrePress

Prepress refers to the preparation of digital files for printing. It comes after the design and page layout stage and concerns the fundamentals of digital imaging, font and file management, and desktop publishing.

PrePress File Format

Before submitting a digital file for printing, confirm what file formats your printer can accept. Some printers prefer application files but may not be able to accept files from all applications or all versions. In lieu of original application files, most printers can accept (and some prefer) PostScript or PDF files.

- PDF files: PDF stands for Portable Document Format. As the name implies, it is a data format that can be used to describe documents. In prepress, PDF is used more and more as a format to exchange data between applications and to proof material before going to press. You

can for example, convert your map to PDF in order to see a rough proof on screen.

- PostScript files: Postscript is the page description language that includes the instructions for an imagesetter to replicate pages on your computer to film, printing plates or even laser printers. These instructions can include fonts, printer's marks, text, graphics and halftones.

Learn more (optionally) about PrePress on : [http://desktoppub.about.com/\(desktoppub.about.com/\)](http://desktoppub.about.com/(desktoppub.about.com/)) (accessed the 26/04/2004)

The Printer Characteristics

Resolution

The resolution of a printer is synonym of the printing quality. This resolution is measured in dots per inch (dpi). Take the example of a printer having a resolution of: 1400 X 720 dpi (dots by inch). The first value indicates the number of dots present on a horizontal line having a length of one inch. So, the horizontal line of one inch of length will consist of 1400 dots. The second value indicates the number of dots present on a vertical line having a length of one inch. So, the vertical line of one inch of length will consist of 720 dots. You will have understood that the higher the resolution of the printer is high, better the quality of printing is.

A good printing resolution will be higher than 600 X 600 dpi.

Printing Speed

The printing speed indicates the speed in which the printer prints a page. This speed is expressed in page per minute (ppm). Take the example of a ink-jet printer having the following characteristics:

- Speed of printing in monochrome mode: 6 ppm
- Speed of printing in colour mode: 2 ppm
- Speed of printing in mode photo: 1 ppm

The first value means that the printer can print text with a speed of six pages per minute. The second value means that it can print in colour, a mixture of texts and graphs or drawings with a speed of two pages per minute. The third value means that the printer can print a colour photo with a speed of one page per minute.

Ink-Jet Printers and Plotters

Ink-jet printers can be black-and-white or with colours. They allow a good sharpness and precision work (in black and white or in colour). Some models allow printing of photography quality images. The Ink-jet technology is used for standard printers size (dinA3 or dinA4 paper), but also for plotters (dinA0 paper).

Some Ink-Jet Printers advantages and inconveniences are:

- Advantages: They offer low-cost quality colour outputs and do not create a lot of noise.
- Inconveniences: The print quality of ink-jet printers is lower than that of laser printers, and they tend to be very slow. However, they provide a low-cost solution for printing colour maps.

How Ink-Jet Printers work

Please note:

Only pictures can be viewed in this version! For Flash, animations, movies etc. see online version. Only screenshots of animations will be displayed.

Figure 19: Animation of an Ink-Jet Printer, according to [?]

Laser Printers

Laser printers have a very good precision, are fast, and print in black-and-white and in colour. However, laser printers are more expensive than ink-jet printers.

Some Laser Printers advantages and inconveniences are:

- Advantages: Laser printers offer a very good printing quality, are fast and can print out 25 pages per minute.
- Inconveniences: Laser printers are generally in black-and-white because colour lasers cost too much.

Laser printers are the workhorses of desktop publishing, and they are getting faster and cheaper all the time.

How Laser Printers work

Please note:

Only pictures can be viewed in this version! For Flash, animations, movies etc. see online version. Only screenshots of animations will be displayed.

Figure 20: Laser.swf

1.3.3 Printing Presses

Printing Presses ?

If your publication requires more than 800 or so copies, it's almost certainly cheaper to print it on a printing press than it is to reproduce it by photocopying or other means. Printing presses must be prepared for a print job: plate must be done and mounted on the press, so it is not economical for short runs, although the break-even point is changing as presses become more automated.

The Imagesetters

Imagesetters use essentially the same technology as laser printers do, but they print at a much higher resolution on photosensitive paper or film, instead of using toner on plain paper. These films are used by printers (the men, not the hardware) to create the plates that go on the printing press.

How Imagesetters work

There are imagesetters of the flat bed design, capstan imagesetters, and internal and external drum imagesetters. In all of them, exposure takes place with the laser beam, spot by spot across the whole area being exposed. The following illustration describes the functioning of a Capstan Imagesetter. Click to enlarge.

"[...] the laser beam strikes the photosensitive paper or film directly. The unexposed film is stored in a roll in the light-tight supply cassette. It is pulled through the path of the laser beam by capstan rollers. " [?, p. 140]

The Direct-to-Plate Imaging

Direct-to-plate imaging cuts out the time and expense of making film negatives by producing the printing plates directly from the digital data, using a device very similar to a laser printer.

In spite of the volume of investment required, it is expected that this technology will be used more and more in the printing companies.

How Direct-to-Plate Imaging Works

The following illustration describes the functioning of a Direct-to-Plate Imaging system. Click to enlarge.

"The publication files are produced as they would be for final film output [1], but instead of being sent to an imagesetter, they are sent to a digital

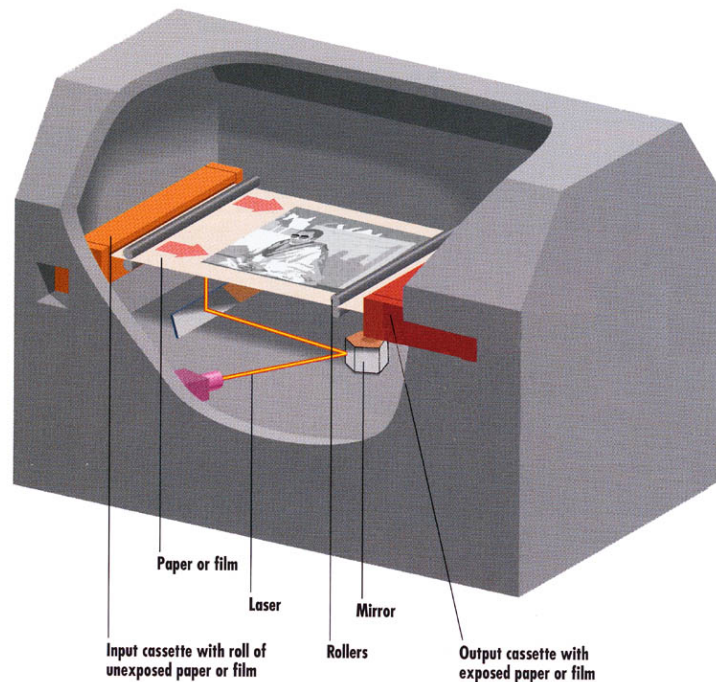


Figure 21: How an Imagesetter works [?]

platemaker [2]. The platemaker works like a laser printer but uses a special photosensitive plate material” [?, p. 178] to produce printing plates that are ready for mounting directly on the press [3].

The Direct-to-Press Imaging

In Direct-to-Press Imaging, the plates are produced in-line, inside the press: blank plates are mounted on the press, then imaged in place. The data for the print job is used to generate the printing plate via a direct job process with the appropriate imaging system and plate materials.

How Direct-to-Press Imaging Works

The following illustration describes the functioning of a Direct-to-Press Imaging system. Click to enlarge.

The publication files are prepared for final output [1], and send to the press computer for the RIP [2], which send the appropriate data to the imaging head for each colour. ”*Special blank plates are mounted on the press, and then the imaging heads burn the page onto the plate*” [?, p. p178] [3].

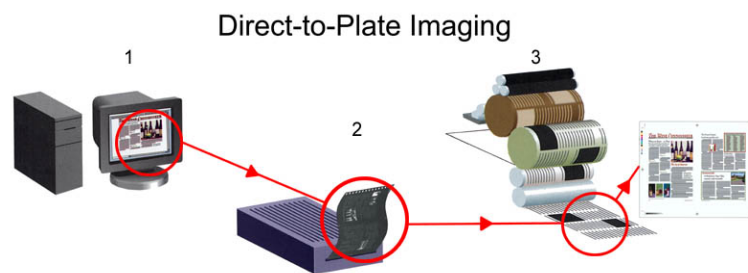


Figure 22: How a Direct to Plate System works, according to [?]

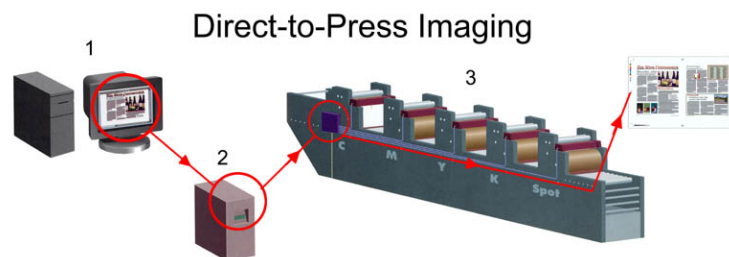


Figure 23: How a Direct to Press System Work , according to [?]

1.3.4 Raster Image Processor

RIP structure and functions

Dynamic mapping can be considered as digital pro-active mapping, which is sufficiently well integrated to be presented via a single interface, or manipulated by a single program. The purpose for exploring spatial data via dynamic mapping is to reveal unknowns and is typically accomplished via a high degree of human interaction; animation is frequently an important component of data exploration. But standalone spatial data exploration is also possible.

The vector image is converted by a Raster Image Processor (software or hardware) to be readable for the printer. While the raster image can be directly read by the printer.

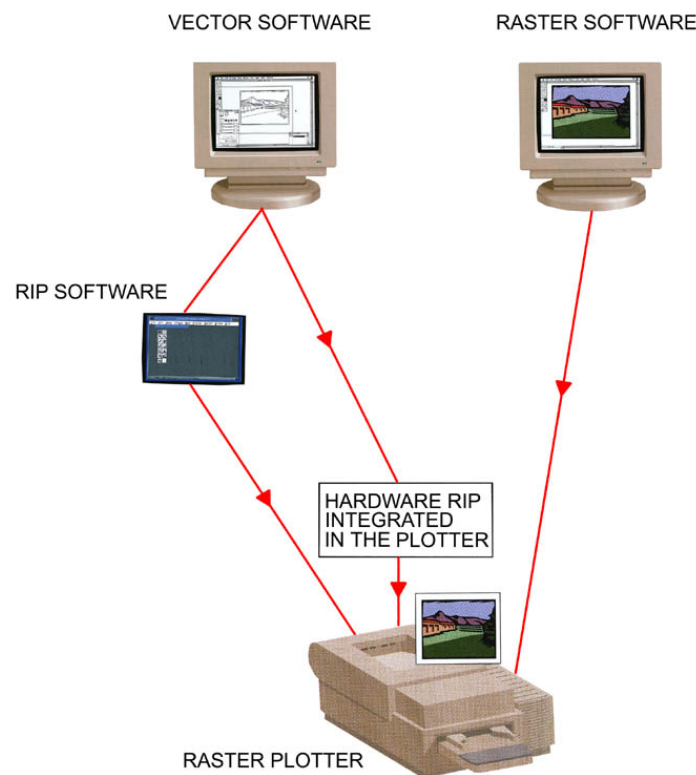


Figure 24: RIP Processing [?]

1.3.5 Printed Media versus Electronic Media ?

Printed Media and Electronic Media in the Present

Production technologies for Printed Media enable high quality and economic production. Moreover, Printed media are particularly easy to use in many locations and almost every environment, without recourse to any special equipment. Nevertheless, the information content of print media is static/fixed and cannot be quickly changed interactively. In comparison, Electronic Media, which include the latest developments in the internet and World Wide Web, allow the integration of audio and video, which is speech, music and animations, into the information document along with text, graphics, and image information. This gives the user many ways of interacting with the information: it is possible to make selections and add components - the content is dynamic. Special equipment, however, is required for using electronic information. The transfer of information via electronic media creates a varied array of interesting and useful applications. Therefore, with the following example, electronic media provide innovative alternatives to print media.

The Rocket eBook (NuvoMedia), has a convincing, user friendly size. Its memory capability is sufficient to download extensive electronic books from networks or data storage machines [?, p. 1114] .

Printed Media and Electronic Media in the Future

Because of innovation and changes in technology, business and society, the demand for information via printed media and electronic media is clearly increasing world-wide. But, the ratio between the market shares of print media and electronic media is becoming more balanced. There is now a strong move towards electronic media, and long term predictions point to a 50:50 ratio between print media and electronic media.

However, it is appropriate to conclude with a few statements made in the past, which spoke against the spread of print:

- Around 1920: Radio will replace print
- Around 1950: TV will replace print
- Around 1980: The computer will replace print
- Around 1990: The Internet will replace print

As we know today, these predictions soon turned out to be glaringly incorrect. Each of these statements was based on a fascination with new



Figure 25: ebook [?]

technologies, which eventually led to speculative, one-sided predictions that new media would replace the old.

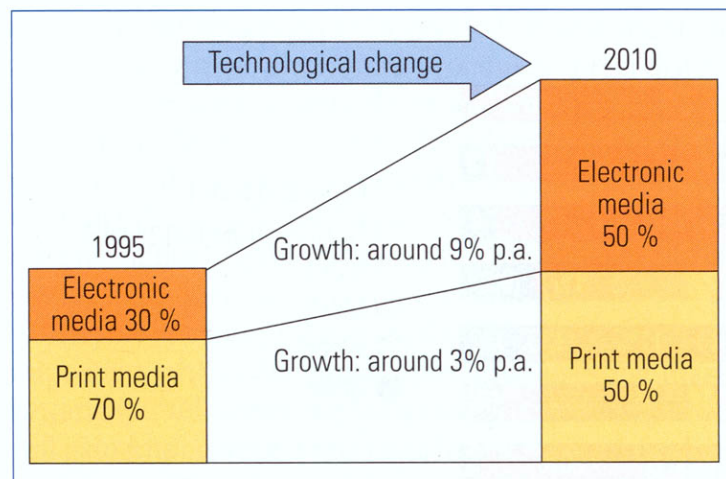


Figure 26: conclusion [?]

1.3.6 Analog Mapping Self Evaluation

Please note:

Only pictures can be viewed in this version! For Flash, animations, movies etc. see online version. Only screenshots of animations will be displayed.

Figure 27: StandClass_Self_SolAnaMap.swf

1.4 Summary

The purpose of this lesson has been to introduce you to some of the many aspects related to Cartographic Presentation. However, you must know that electronic map production does not replace the creative design efforts.

1.5 Recommended Reading

- DENT, B. D., 1999 *Cartography - Thematic Map Design* [?, Especially Chap. 16 and 17.]
- ESRI *ESRI Tutorials on Geostat Center: Reference Resources* [?]
- KIPPHAN, H. , 2001 *Handbook of Print Media* [?]