# ArcGIS and Database
# Tutorials

# Introduction

This document contains page references to the e-book 'ArcInfo 9, Using ArcGIS Desktop' (see URL below) and hyperlinks to sections of ESRI's ArcGIS 9.2 desktop help website under headings of the functionality they explain, and short descriptions of their content to help find instruction sets for specific tasks.

The information is arranged into three sections;

a. Introduction to ArcMap
b. Advanced mapping and display for visualisation
c. Databases and non-native file formats

E-book – *ArcInfo 9, Using ArcGIS Desktop*:
http://webhelp.esri.com/arcgisdesktop/9.2/pdf/using_arcgis_desktop.pdf

*NB: Page numbers quoted refer to the number displayed in the document navigation toolbar at the top of Acrobat Reader, NOT the numbers printed at the bottom of pages in order to aid navigation.*

# 1. Introduction to ArcMap

This information introduces and explains ArcMap and its core functionality, as well as ArcCatalog, the program normally used for managing datasets and preparing them for use in the rest of the ArcGIS suite. Some general background information on important GIS and geospatial data concepts is also included for reference.

### a. Animated tutorials on navigating the interface and some basic functions
A useful quick-start guide to finding your way around ArcMap. Covers many of the topics listed below, but requires you to sit and watch rather than flicking through.
http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=Getting_Started_Quickstart_tutorial_index

### b. Navigating maps in ArcMap

Key and mouse combinations used to access common navigation features such as panning and zooming. This applies to the whole ArcGIS suite, not just ArcMap.

http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=Quick_ways_to_navigate_maps_and_pages

### c. Identifying features

How to select a feature in a dataset displayed on the screen and open its attribute table to view its attributes. Other functions for highlighting features to aid discrimination are also explained.

http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=Identifying_features

### d. Geographic data

Covers the fundamentals of vector data (the data type generally associated with GIS; points, lines and polygons and their associated attribute tables). Provides some limited information on raster datasets.

http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=Elements_of_geographic_information

### e. Raster datasets

More detailed information on the raster data type, commonly used for remotely sensed imagery and maps not supplied in 'GIS' format.

http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=What_is_raster_data?

### f. Finding and connecting to data

Locating data on local fixed or removable media, networked computers, and websites and creating shortcuts to it for ease of use. **p.91-92**

### g. Collecting, importing, and converting GIS data

Accessing and organising data and workspaces, including importing data into Geodatabases. Converting data between formats supported by ArcGIS and other formats. **p.166-170**

### h. Adding data to a map

Adding data to ArcMap from connections and folders, and importing and plotting data such as *x*, *y* coordinates, for example from GPS units. **p.279-282**


### i. Working with layers

Organising multiple datasets and how they are displayed in ArcMap through the use of 'layers'. **p.283-284** and see also:

http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=Layers,_data_frames,_and_the_table_of_contents


### j. Symbolizing data

Explains options for changing the appearance of geometric data, such as colours, line properties, symbols, transparency etc. Includes information on symbolizing features by attributes, for example creating a thematic map by setting polygon colour to be determined by a population attribute. **p.294-301**


### k. Creating feature classes and tables

Feature classes are the 'containers' for datasets within geodatabases. Tables contain attributes for geographic data, for example descriptions of what real-world objects map features represent, population figures, rainfall data, and the area of a polygon **p.113-118**


### l. Starting and managing an edit session

Edit sessions are used for editing all data in ArcMap, for example creating new polygons or changing the location of points.**p.178-181**


### m. Creating and modifying features

How to create features such as lines and polygons and perform basic editing tasks such as moving and reshaping. For more complex editing tasks, see the subsequent pages. **p.182-186**

### n. Adding and editing attribute data

Adding related data to geographic features, by direct input and by calculating values based on existing attributes. **p.207-213**


### o. Labelling features

How to automatically label features using fields from their attribute tables when creating maps. **p.306-310**


### p. Creating a map layout

Map layouts provide a means for arranging desired datasets and other map elements (e.g. scale bar, North arrow, explanatory text) in their final layout on a page ready for printing or exporting to other document formats (e.g. PDF) **p.315-318**


### q. Adding and arranging map elements

How to add map elements other than datasets to a layout and modify their properties to achieve the desired appearance. **p.319-323**


## 2. Advanced mapping and display for visualisation

This is a selection of some of the advanced functionality we thought might be useful to you, but 'advanced mapping' could cover an incredible amount of the functionality in ArcGIS. If, on reading what we've included, you realise we haven't included information on something you need, please get in touch. This mostly concentrates on adding more elements to a final map and elements of basic geoprocessing which lead on to more advanced analysis, information on projections in case you have datasets from multiple sources, and a section on terrain models and 3D visualisation which is one of the most popular visualisation techniques.

## Querying, grids and calculating geometry

### a. Select by attributes

A function for searching the attribute tables of datasets by applying criteria in the SQL language, for example 'rainfall greater than 1000mm yr$^{-1}$' (although unfortunately ArcGIS doesn't support natural-language querying. If you need any help on more complex SQL queries we can provide links reference material).

http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?id=251&pid=248&topicname=Using_Select_By_Attributes

### b. Select by location

A similar function to 'select by attributes', but this relies on topological criteria (i.e. describing the relative positions of features), e.g. 'select features that are within 500m of a river'.

http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=Using_Select_By_Location

### c. Grids

A common requirement for presentation maps, but quite demanding in ArcGIS, especially to achieve the exact format required, hence their inclusion in this section rather than the previous one.

http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?id=410&pid=409&topicname=Adding_grids_and_graticules_(reference_systems)

### d. Calculating geometry

Many projects require geometry information (such as perimeter and area of features), and some geoprocessing tasks rely on this for derived calculations (e.g. volume). It can easily be calculated automatically.

http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?id=2750&pid=2745&topicname=Making_field_calculations

## Projections & Coordinate systems

### e. Introduction to projections & coordinate systems

Crucial to the display and integration of different datasets and the derivation of correct information from them, this deals with how the ovoid shape of the Earth is represented on a flat plane (i.e. a computer screen or printed map), and the system used to reference positions on it.

http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=An_overview_of_map_projections

### f. Practical implications of coordinate systems & projections

Elements of ArcGIS's functionality that rely on coordinate systems and projections, and what this means in terms of what can be done with data and requirements of datasets.

http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?id=193&pid=186&topicname=Specifying_a_coordinate_system

### g. Defining coordinate systems and projecting datasets

Setting parameters for datasets in ArcCatalog so that they are properly displayed and manipulated in ArcGIS and so multiple datasets can be successfully integrated. **p.243-245**

### h. Reprojecting shapefiles and feature classes

When working with datasets which have different projections, to reduce drawing times and processing overheads (as well as for general convenience) it is often necessary to reproject some of them so that they share the same projections.

http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=Project_(Data_Management)

### i. Reprojecting raster datasets

As above, but for raster rather than vector datasets, which require a different tool.

http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=Project_Raster_(Data_Management)

## Extracting and overlaying datasets

### j. Clipping

If a dataset covers a larger area than is required for a project or map, clipping can be used to reduce its size. Clipping can also trim datasets to a specific shape, for trimming aerial imagery to the area of a nature reserve. **p.369-370**

### k. Overlay analysis – union, intersect, identity, update and erase

Different functionality for combining vector datasets, allowing them to be combined in various ways, subtracted from each other, have their attributes copied etc. Provides scope for deriving new information from the combination of datasets **p.379-384**

## Animation and 3D visualisation

### l. 2D Time-series animations

Animation manager is a surprisingly intuitive and powerful means of creating highly effective visualisations. This covers how it can be used with 2D datasets, in particular animating time-series. **p.333-337**

### m. Creating Terrains

These are the most efficient format for managing elevation and bathymetry data in ArcGIS. NB some common DTM formats require conversion with external software before import to ArcGIS. If required, we can provide further information on this. **p.134**

### n. Working with 3D visualisations in ArcScene and ArcGlobe, and creating animations

Display functionality for 3D data and two different programs in addition to ArcMap that can display it in different contexts. Also covers extra Animation Manager functionality for 3D viewing, such as changing camera angles. **p.325-332**

Also, see Extensions -> 3D analyst and sections therein in the table of contents at
http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=welcome

# 3. Databases and non-native file formats

### a. Introduction to geodatabases

Creating geodatabases from DB designs, setting up domains, ensuring spatial data integrity, importing data, creating topologies **p.102 - 123**

In order to promote data exchange and minimise wasteful repetition of data-collection efforts, the European Union has, through the INSPIRE directive, established data models and metadata standards for geospatial data (known collectively as a Spatial Data Infrastructure or SDI). Information on the INSPIRE directive can be found at http://inspire.jrc.ec.europa.eu/index.cfm. All data collected and created should conform to and be documented in accordance with the relevant standards, which are available from the following sites:

Data standards:
 http://inspire.jrc.ec.europa.eu/index.cfm/pageid/2

Metadata requirements:
http://inspire.jrc.ec.europa.eu/index.cfm/pageid/101

A more readable guide to INSPIRE can be found here:
http://www.esri.com/news/arcnews/spring10articles/building-inspire.html

General information on metadata and data models can be found here:
http://en.wikipedia.org/wiki/Metadata, and here:
http://en.wikipedia.org/wiki/Data_model

ArcCatalog includes an easy-to-use metadata editor, which can create and edit metadata in accordance with a small range of international standards. Instructions on how to use this can be found on **p.97** of *Using ArcGIS Desktop*. Unfortunately, despite being based on the same ISO 19100 series of standards as those natively supported in ArcGIS, the INSPIRE metadata standard is not directly supported in ArcGIS 9.x, although it is supported in version 10.

Several software packages are available to create metadata which conforms to INSPIRE standards, one such application which is freely available is CatMDEdit (http://catmdedit.sourceforge.net/), produced by the Spanish IGN and the University of Zaragoza.

## Database manipulation tasks

Assuming spatial databases conform to standard database design concepts such as normalisation, all data required for some purposes will not necessarily be contained within one table. To make sure all the data are accessible and to hand, joins and relates can be used. An explanation of this concept is given in the first link below, the two subsequent links explain how to join and relate tables, and the third explains a function unique to geodatabases; spatial joins.

**b.  Introduction to joining & relating tables**

http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=About_joining_and_relating_tables

**c.  Instructions for joining tables**

A method for appending information from one table to another table, linked by a common identifier such as a 'feature ID' number.

http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=Joining_tables

**d.  Instructions for relating tables**

A method for making information from one table appears in another, but without permanently moving it there. More temporary than creating a join between two tables.

http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=Relating_tables

**e.  Spatial joins**

A method for joining the attributes of two datasets based on the locations of the features within them.

http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=Joining_the_attributes_of_features_by_location

## Non-native file formats

.dbf files can be handled directly by ArcGIS. In fact, this is the format used by ArcGIS to store attribute information for shapefiles. As for the other file formats on which you requested information, these are both easily used and managed by ArcGIS.


**f.   Working with excel files**

Possibilities for working with files created with Microsoft Excel in ArcGIS, and requirements for how they are formatted in order that data within them can be efficiently used in combination with other datasets. http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=Working_with_Microsoft_Excel_files _in_ArcGIS


**g.   Working with Access files**

Possibilities for working with files created with Microsoft Access in ArcGIS, and requirements for how they are formatted in order that data within them can be efficiently used in combination with other datasets. Includes important information on limitations to data editing that should be performed in both pieces of software to ensure data integrity for the other.

http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=Working_with_Microsoft_Access_fil es_in_ArcGIS