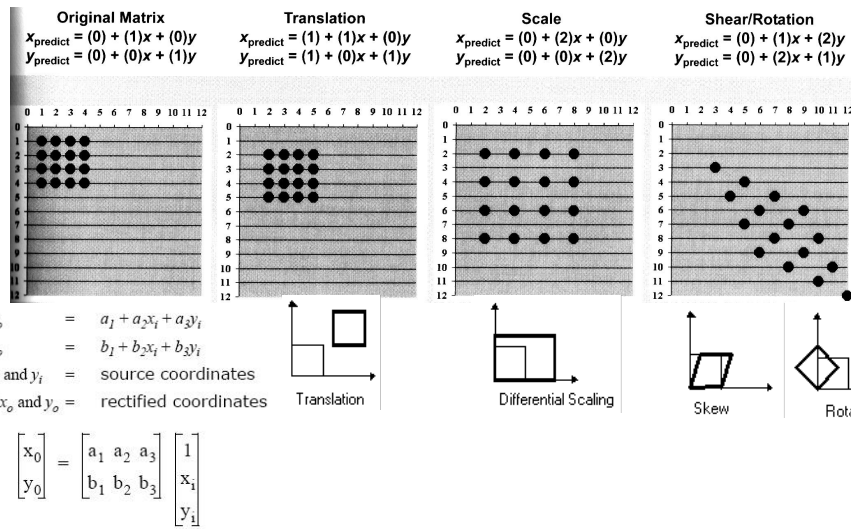


# Geometric Transformation

## Affine Transformation

- aka linear or first-order transformation



## Rectification Steps

- Locate GCPs
- Calculate and evaluate a transformation
- Apply the transformation. Pixels must be resampled to conform to the grid.

## Locate GCPs

- Ideal location: road intersections, corners of landscape objects, or single pixel objects dispersed evenly on the image.
- Source and reference coordinates.

## # of GCPs

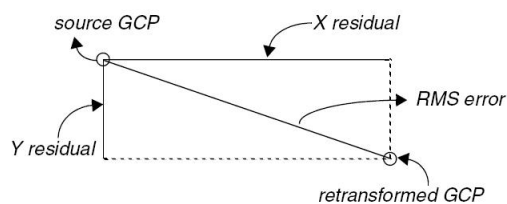
- The more the better.
- 16 (Bernstein et al. 1983)

$$\frac{(t+1)(t+2)}{2}$$

Order of Transformation	Minimum GCPs Required
1	3
2	6
3	10
4	15
5	21
6	28
7	36
8	45
9	55
10	66

## GCP Evaluation

- Residual
- Error per GCP (R)
- RMSE (T)
- Error contribution by point (R/T)



# Transformation equations and coefficients

1<sup>st</sup>-order polynomial equations

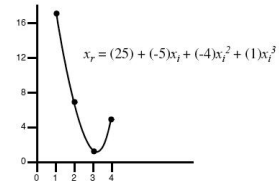
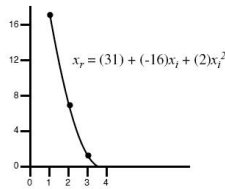
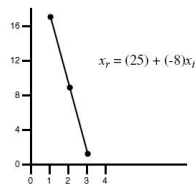
$$x' = a_0 + a_1x + a_2y$$

$$y' = b_0 + b_1x + b_2y$$

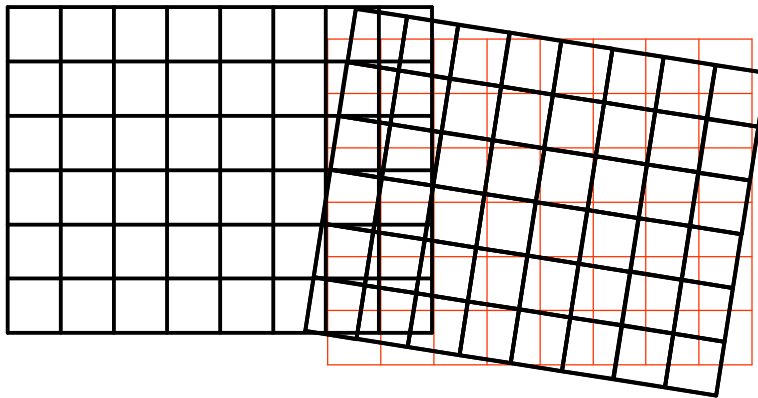
2<sup>nd</sup>-order polynomial equations

$$x' = c_0 + c_1x + c_2y + c_3xy + c_4x^2 + c_5y^2$$

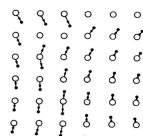
$$y' = d_0 + d_1x + d_2y + d_3xy + d_4x^2 + d_5y^2$$



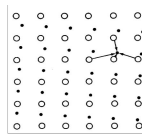
# Transformation & Resampling



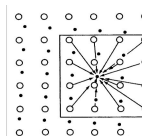
Nearest neighbor



Bilinear interpolation

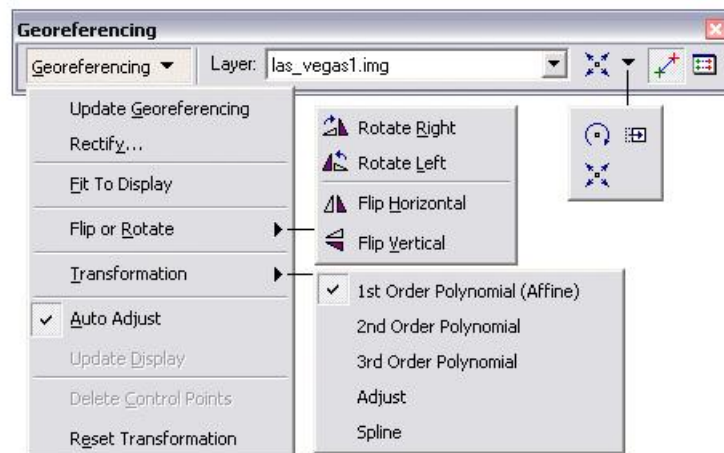


Cubic convolution



# Georeferencing in ArcGIS

- Spatial Adjustment tools (lab 5)
  - For vector data only
  - Transform (affine, similarity, projective)
  - Rubbersheet
  - Edgesnap
- Georeferencing tools (lab 7)
  - For raster data only
  - Flip or rotate
  - Transform

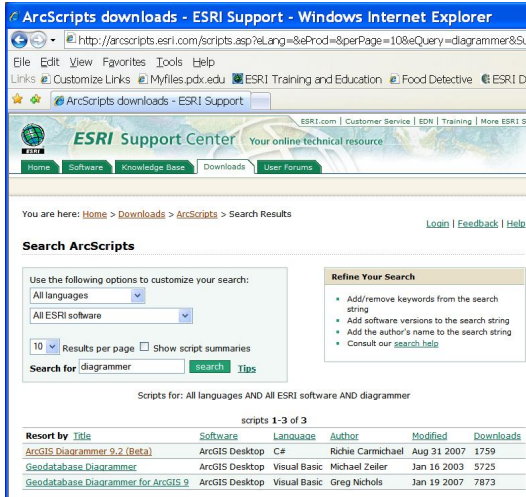


## Update Georeferencing vs Rectify in Raster Dataset

- Rectify: Permanently alters the spatial referencing information of a raster dataset by a transformation, which also alters the orientation of the pixels.
- Update Georeference: doesn't alter the orientation of pixels, instead it creates a "persisted transformation" with the raster dataset. The persisted transformation is stored within a geodatabase or as a .aux.xml and a .xfm file.

## ArcGIS Diagrammer 9.2/9.3

- ArcScripts (<http://arcscripts.esri.com/>)



The screenshot shows the ArcScripts website search results for the keyword 'diagrammer'. The page is titled 'ArcScripts downloads - ESRI Support - Windows Internet Explorer'. The search results are for 'All languages AND All ESRI software AND diagrammer' and show 3 results. The results table is as follows:

Resort by	Title	Software	Language	Author	Modified	Downloads
	<a href="#">ArcGIS Diagrammer 9.2 (Beta)</a>	ArcGIS Desktop	C#	Richie Carmichael	Aug 31 2007	1759
	<a href="#">Geodatabase Diagrammer</a>	ArcGIS Desktop	Visual Basic	Michael Zeller	Jan 16 2003	5725
	<a href="#">Geodatabase Diagrammer for ArcGIS 9</a>	ArcGIS Desktop	Visual Basic	Greg Nichols	Jan 19 2007	7873

**ArcGIS Diagrammer 9.2/9.3**

[download](#) | [contact author](#) | [download help](#) | [add bookmark](#) | [view bookmarks](#)

Author	Richie Carmichael
File Name	ESRI ArcGIS.Diagrammer.Setup.92.20091007.zip
Language	C#
Last Modified	Nov 10 2009
Status of work	ESRI Attribution and Licensing Agreement
Software	ArcGIS Desktop
File Size	3128.97 kb
Downloads	13491

**report inappropriate content** ArcScripts is intended for the free exchange of scripts and tools related to ESRI software products. Please alert the moderator if this script is a demo, trial-version, or an advertisement for a retail product.

**Summary**  
[SOURCE CODE INCLUDED]

**INTRODUCTION:**  
ArcGIS Diagrammer is a productivity tool for GIS professionals to create, edit or analyze geodatabase schema. Schema is presented as editable graphics in an environment familiar to users of Microsoft Visual Studio 2005. Essentially ArcGIS Diagrammer is a visual editor for ESRI's Xml Workspace Document which are created by ArcCatalog, the management application in the ArcGIS Desktop product suite.

After installing ArcGIS Diagrammer it is strongly recommended that you view the demonstration video and the user guide.

**TUTORIALS:**  
<http://maps.esri.com/diagrammer/createschemareport.htm>  
<http://maps.esri.com/diagrammer/addidentifiers.htm>  
<http://maps.esri.com/diagrammer/addsubtype.htm>  
<http://maps.esri.com/diagrammer/creatingrelationships.htm>  
<http://kiwiqis.blogspot.com/2009/08/how-to-create-data-report-with-arcgis.html>

**VIDEO:**  
<http://www.youtube.com/watch?v=6cG1rLhFQQ0> (low quality)  
<http://maps.esri.com/diagrammer/arc2007/0504.wmv> (high quality)

**HISTORY:**  
<http://maps.esri.com/diagrammer/history.txt>

**PREREQUISITES:**  
 1) ESRI ArcGIS Desktop 9.2/9.3,  
 2) Microsoft .Net Framework 2.0,  
 3) ESRI .NET Support,  
<http://mirrchie.spaces.live.com/blog/cns!DD16C3F34F4D913E1582.entry>

**HOW TO INSTALL:**  
 1) Download zip file,  
 2) Unzip the download  
 3) Double click on msi file. Follow wizard.

**DISCUSSION FORUM**  
<http://forums.esri.com/forums.asp?c=141>

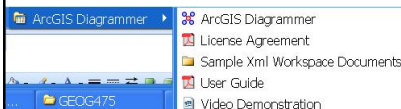
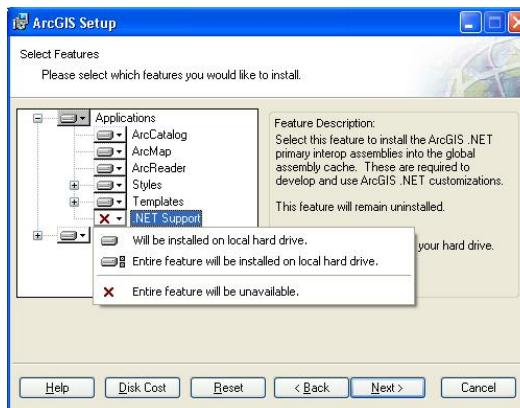
**BLOG:**  
<http://kiwiqis.blogspot.com>

**USER GUIDE:**  
<http://maps.esri.com/diagrammer/userguide.pdf>

**IMPORTANT INFORMATION ABOUT DIAGRAMMER AND SPATIAL REFERENCES**  
<http://forums.esri.com/Thread.asp?c=141&tid=14158&cid=2763&Source=Windows&id=637662>

# Installation

- ArcGIS .NET Support must be installed to use ArcGIS Diagrammer.



← The User Guide has tutorial exercises.

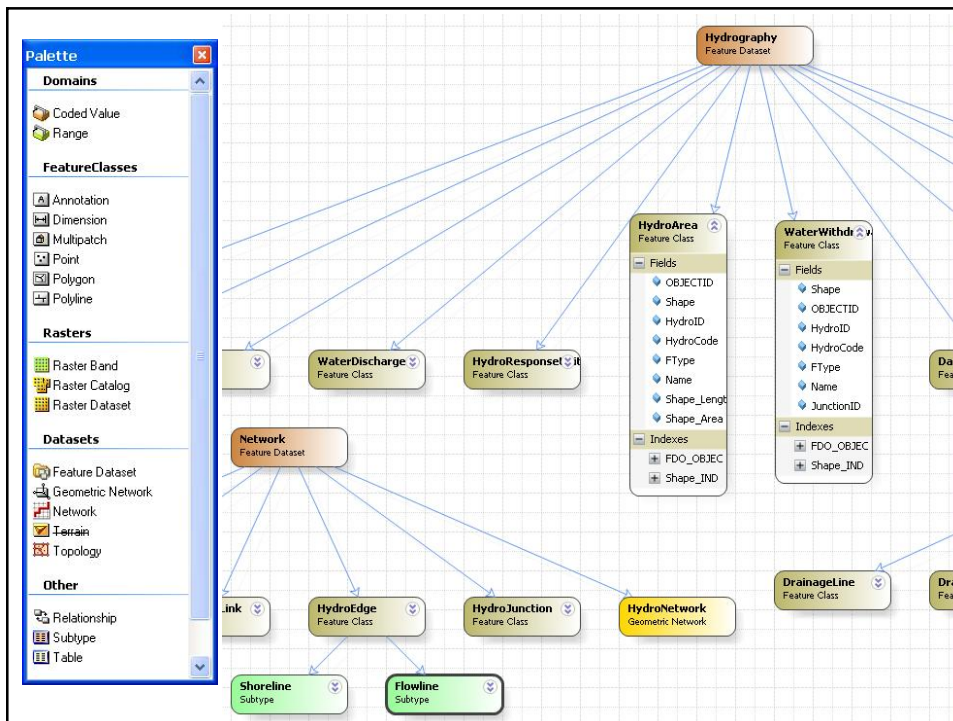
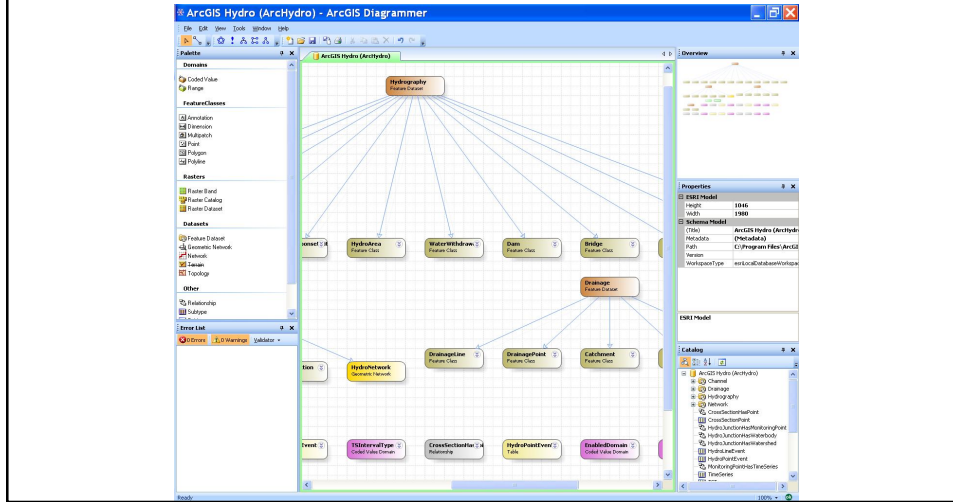
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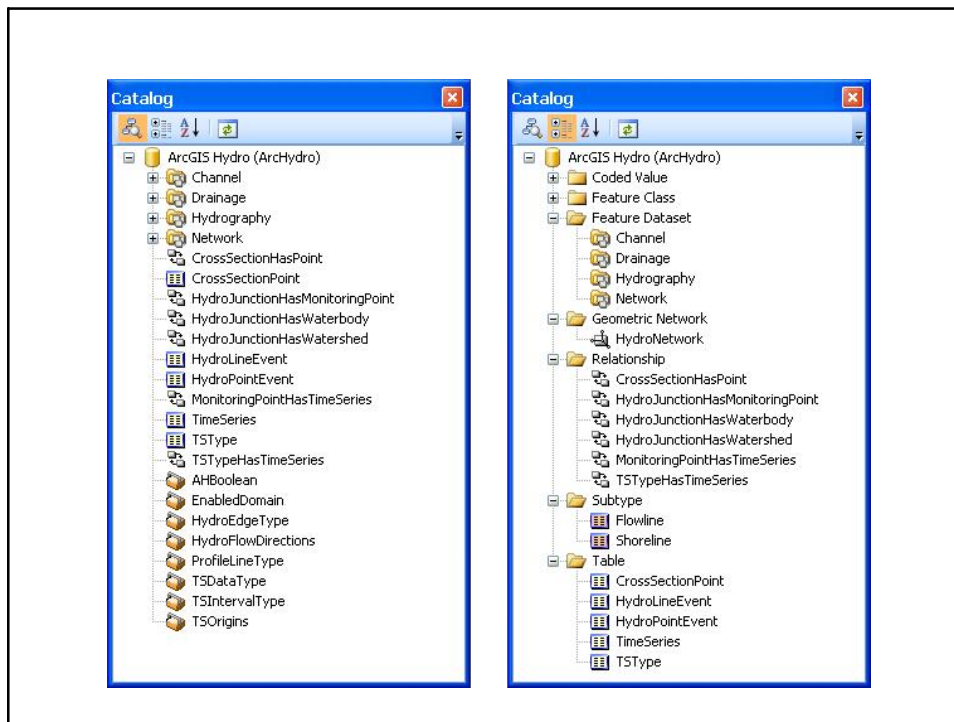
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## Modifying Existing GeoDB Schema

- ArcCatalog: import/export

