Take-Home Messages on Projections and Transformations

1) On-the-Fly-Transformations:

ArcGIS does an on-the-fly transformation when it can recognize the datum compatibility (e.g. between NAD27 and NAD83), but sometimes this doesn't work (e.g. between NAD27 and WGS84). When the on-the-fly transformation doesn't work, and for *temporarily displaying the data* (it will not work if you open the data in a different Map document), you can do a Datum Transformation (using the "Transformations" tab) via the Data Frame Properties under the View Menu (see figure below). Keep in mind that the source data (original data) is not being modified – you are not creating a new shapefile here, nor is the layer's projection being modified – just the Map Frame Document is being changed.



2) Geographic versus Projected Coordinate Systems

Four types of errors:

 Unknown Coordinate System (e.g. says "Unknown" under Properties – Source) Solution: You need to define it using the "Define Projection" tool. Think about the data (where it is in the world), and what Geographic or Projected Coordinate System would make sense to use. You can always be sure of using WGS1984.

S Define Projection	
Input Dataset or Feature Class Coordinate System	Define Projection
	(map projection and datum) stored with a dataset. The only use for this tool is for datsets that have an unknown or incorrect coordinate system defined.
	All geographic datasets have a coordinate system that is used throughout ArcGIS to display, measure, and transform geographic data. If the coordinate system for a dataset is unknown or incorrect, you can use this tool to specify the correct coordinate system. You must know the correct coordinate system of the dataset before using this tool.

2) Different Geographic or Projected Coordinate System than the one defined in your Data Frame (e.g. Data Frame is WGS84 UTM 13N, when layer is in NAD27 State Plane New Mexico Central)

Solution: You want to use the "Project" tool to change the projection of the shapefile you are trying to add (e.g. NAD27 State Plane New Mexico Central) to the Data Frame's projection (e.g. WGS84 UTM 13N).

Project	
Input Dataset or Feature Class	^ Project
Input Coordinate System (optional)	Projects spatial data from one coordinate system to another.
Output Dataset or Feature Class	
Output Coordinate System	
Geographic Transformation (optional)	
	GCS_GRS_1980 Scale: 1:16,500,000

3) Inconsistent extent (e.g. the layer might be defined as Geographic when it is actually a Projected Coordinate System)

Solution: Since you know the layer is actually in a Projected Coordinate System, then you first want to wipe out (clear) the projection the layer has using the "Define Projection" tool and then selecting "Clear". Then you need to make an educated guess as to what type of projection is appropriate. Once you select a projection, use the "Define Projection" tool to give it a Projected Coordinate System.

	Z Coordinate System	
Name: N/	AD_1927_UTM_Zone_13N	
Details:		
Projection: Tran False_Easting: False_Northing	nsverse_Mercator 500000.000000 : 0.000000	-
Central_Meridia Scale_Factor: 0 Latitude_Of_Or	n: -105.000000).999600 rigin: 0.000000	E
Geographic Coc Angular Unit: D Prime Meridian:	ter (1.00000) ordinate System: GCS_North_American_1927 egree (0.017453292519943295) Greenwich (0.00000000000000000) h. American_1927	
Spheroid: Clar	ke_1866	-
Select	Select a predefined coordinate system.	
Select	Select a predefined coordinate system. Import a coordinate system and X/Y, Z and M domains from an existing geodataset (e.g., feature dataset, feature class, raster).	
Select Import	Select a predefined coordinate system. Import a coordinate system and X/Y, Z and M domains from an existing geodataset (e.g., feature dataset, feature dass, raster). Create a new coordinate system.	
Select Import <u>N</u> ew • Modify	Select a predefined coordinate system. Import a coordinate system and X/Y, Z and M domains from an existing geodataset (e.g., feature dataset, feature class, raster). Create a new coordinate system. Edit the properties of the currently selected coordinate system.	
Select Import <u>N</u> ew • Modify	Select a predefined coordinate system. Import a coordinate system and X/Y, Z and M domains from an existing geodataset (e.g., feature dataset, feature dataser, resture (assay, rester). Create a new coordinate system. Edit the properties of the currently selected coordinate system. Sets the coordinate system to Unknown.	

4) Geographic Coordinate System Warning – this can either be one of two things: a) the datum of the Data Frame and the Shapefile are different (refer to 2 above for solution), or b) If the distance between the newly added shapefile and the layers you already have in the Map document are more than 100 meters apart then it is not a datum conflict and you need to see if the layer is being defined as a Projected Coordinate System and is actually a Geographic Coordinate System.

Solution: If option b, then you first explore the Extent and make sure it is a Geographic Coordinate System based on the numbers (not the units) rather than a Projected Coordinate System (if it should be a Projected Coordinate System, refer to 3 above for a solution). Use the "Define projection" tool to define its Geographic Coordinate System. Again – you are safe using WGS1984.

Genera	Source	Selection	Display	Symbology	Fields	Definition Query	Labels	Joins &	Relat
- Curles									
Exte	nt		Top:	32.358287 n	n i				
Lef	t: -106.563	975 m				Right: -106.556	674 m		
			Bottom:	32.352057 n	1				
Di Sł G	Data Type: Shapefile: Geometry Type:			Shapefile Fea Y:\Class3_Pro Point	iture Cla ojection_	ss Transformations	2_Align_D	ata\gr	
Pr	ojected Coo	ordinate Sys	stem:	NAD_1927_U	TM_Zon	e_13N			
Pr	Projection:			Transverse_Mercator					
E	alse_casung	i:		0.000000000	0000				
C	entral_Meric	lian:		-105.000000	00				
S	ale_Factor:			0.99960000					*
•	_			111				•	

Coordinate system	No. of digits	Negative values?	False eastings / northings?	Unit of measure
Geographic	1-3	Yes	No	Angular (degrees)
Projected	5-8	No	Yes	Linear (feet, meters, etc.)