



# Cartography: Improving Representation Utilizing the Geodatabase

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**Please!**

Turn **OFF** cell phones  
and paging devices



# Presentation Overview

1. **Introducing cartographic representations**
  - What are they and how are they stored?
2. **Working with representations**
  - How do I symbolize my data with them?
3. **Editing representations**
4. **Using geoprocessing tools with representations**
  - Managing representations
  - Refining symbology

# **1. Introducing cartographic representations**

# What is a cartographic representation?

- An intelligent way to symbolize features for cartographic purposes
- A solution to some common cartographic challenges that required workarounds in the past
- A storage model that stores symbol information in the geodatabase for re-use and sharing

# What is a cartographic representation?

- **Representations are:**
  - property of a feature class
  - stored in the geodatabase
  - sometimes called *feature class representations*
- **Representations store symbology without the creation of new data objects or file types**

# What can you do with representations?

- Create custom symbols
- Move symbols to resolve crowding
  - Maintain feature coordinates
  - No conversion to graphics
- Convert and enhance existing symbology easily and accurately



# Why should I use representations?

- To produce a better map with intelligent symbology
- To generate multiple cartographic products from a single set of master feature classes
- Better map production process  
(everything happens in ArcGIS)
- Database management – use geodatabase functionality to store and manage symbology

# Scope of representations

- **Point, line, and polygon geodatabase feature classes**
  - Not designed for other vector formats or for raster data
- **Designed for qualitative symbology (categorical data)**
- **Representations and traditional ArcGIS symbology will coexist for the foreseeable future**



# The Representation symbology model

- **Rule-based structure**

- Rule: a set of drawing instructions for features
- Think of a rule as a category of features
- Multiple categories of features translates to multiple rules
- Stored as feature class attribute values



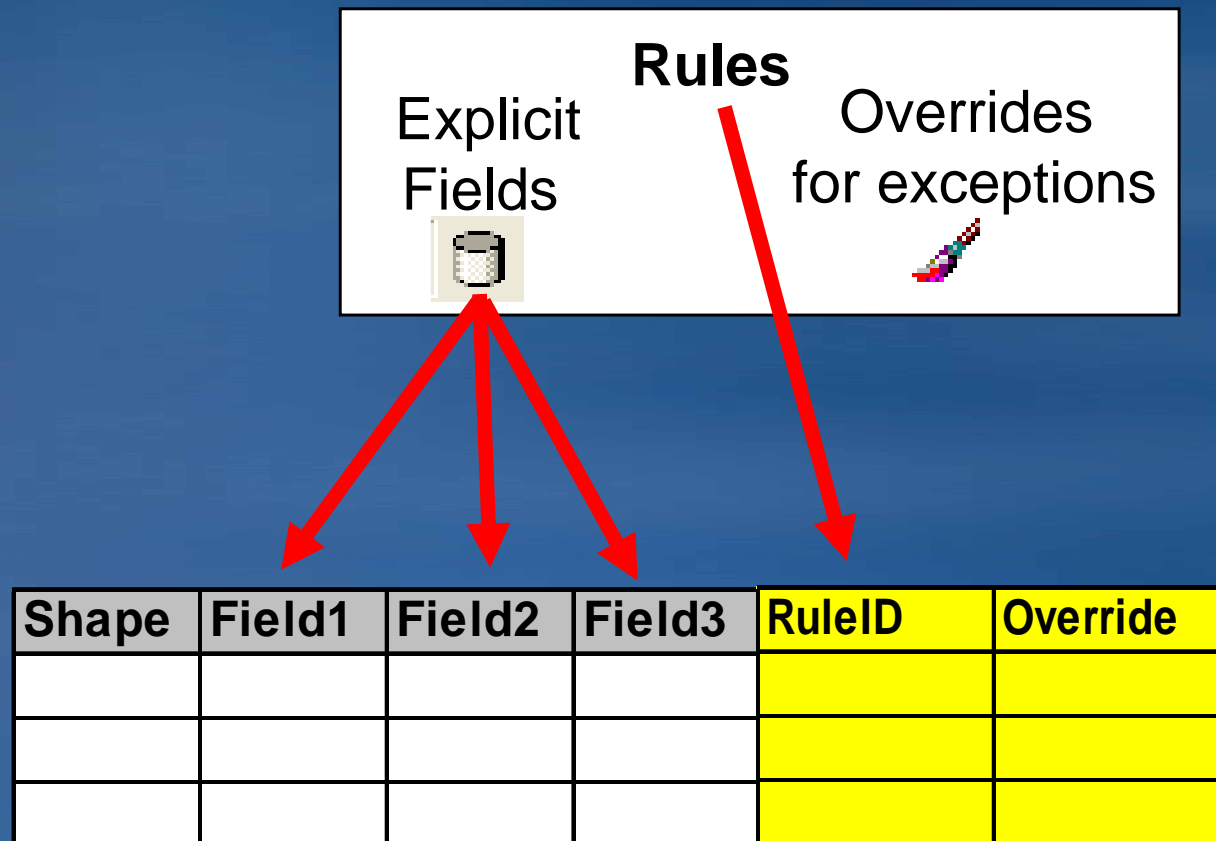
- **Software components**

- Symbology renderer and interface
- Symbol drawing environment
- Toolbar to place and edit symbols
- Geoprocessing tools to manage and automate cartography

OBJECTID	SHAPE	RuleID
4	Polygon	Elm
5	Polygon	Oak
6	Polygon	Oak
7	Polygon	Pine
8	Polygon	Elm
9	Polygon	Pine
10	Polygon	Oak
11	Polygon	Elm

# How are representations stored?

## Inside the geodatabase



Feature Class attribute table

# How are rules stored?

In the feature class extensions table

Feature table

Shape	Field1	Field2	Field3	RuleID	Override

Class	Rules

Feature Class Extensions table

## **When would I not use representations?**

- **When standard symbology is sufficient**
- **When data and map are still in progress**
- **Data grouped by numeric ranges or proportions**
- **When I want to web publish it using ArcIMS**

# Representations in the ArcGIS product family

- **ArcEditor or ArcInfo needed to create or edit representations**
- **Recognized by all ArcGIS products**

ArcView, ArcEditor, ArcInfo

ArcGIS Server

ArcGlobe, ArcScene

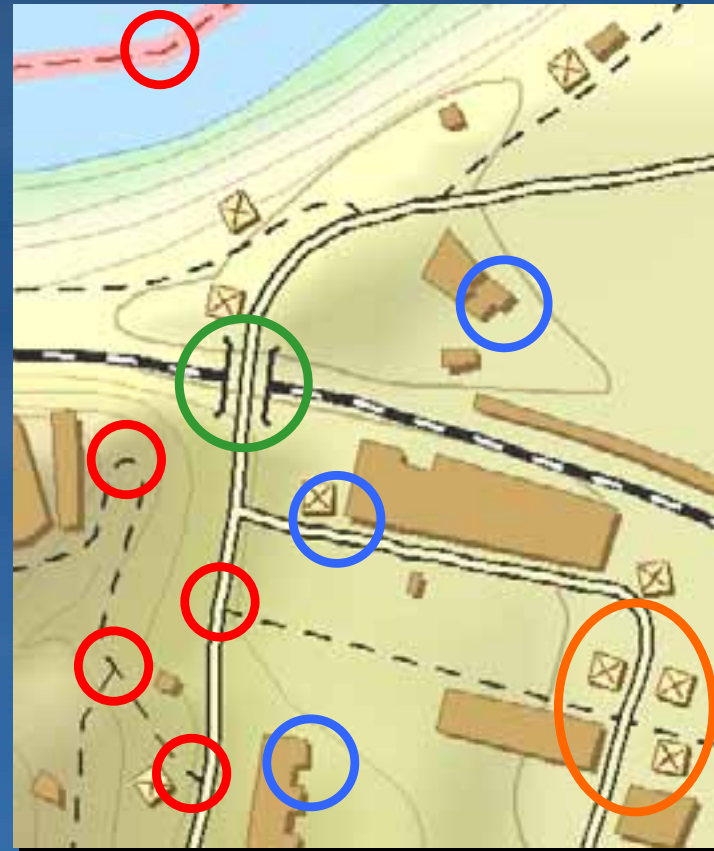
ArcGIS Explorer

ArcReader

## **2. Working with representations**

# What can representations do?

- Representations are an advanced way to **symbolize** features cartographically according to rules



*Data courtesy of Gobierno de la Rioja*



# What can representations do?

- Representations can draw features differently from their spatial geometry



*Rivers are drawn smooth  
although geometry is jagged*



# What can representations do?

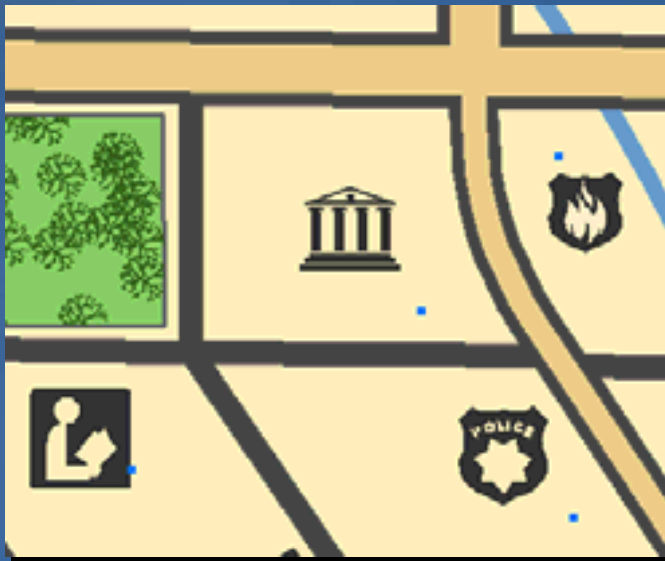
- Feature classes can support **multiple representations** to display features differently on different maps without creating additional files



*The same data represented two ways  
Both versions are stored in the data, not in map documents or layers*

# What can representations do?

- Representations can be tailored for individual features by **overriding properties** of the rule to improve the cartographic display



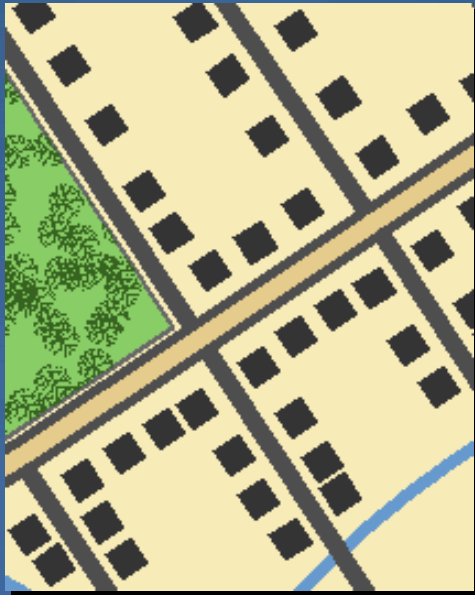
*Symbols are offset from their spatial location to avoid conflicts*



*The rule for one park is changed to not draw trees near the park edges*

# What can representations do?

- Making maps with representations can be **automated** using geoprocessing tools

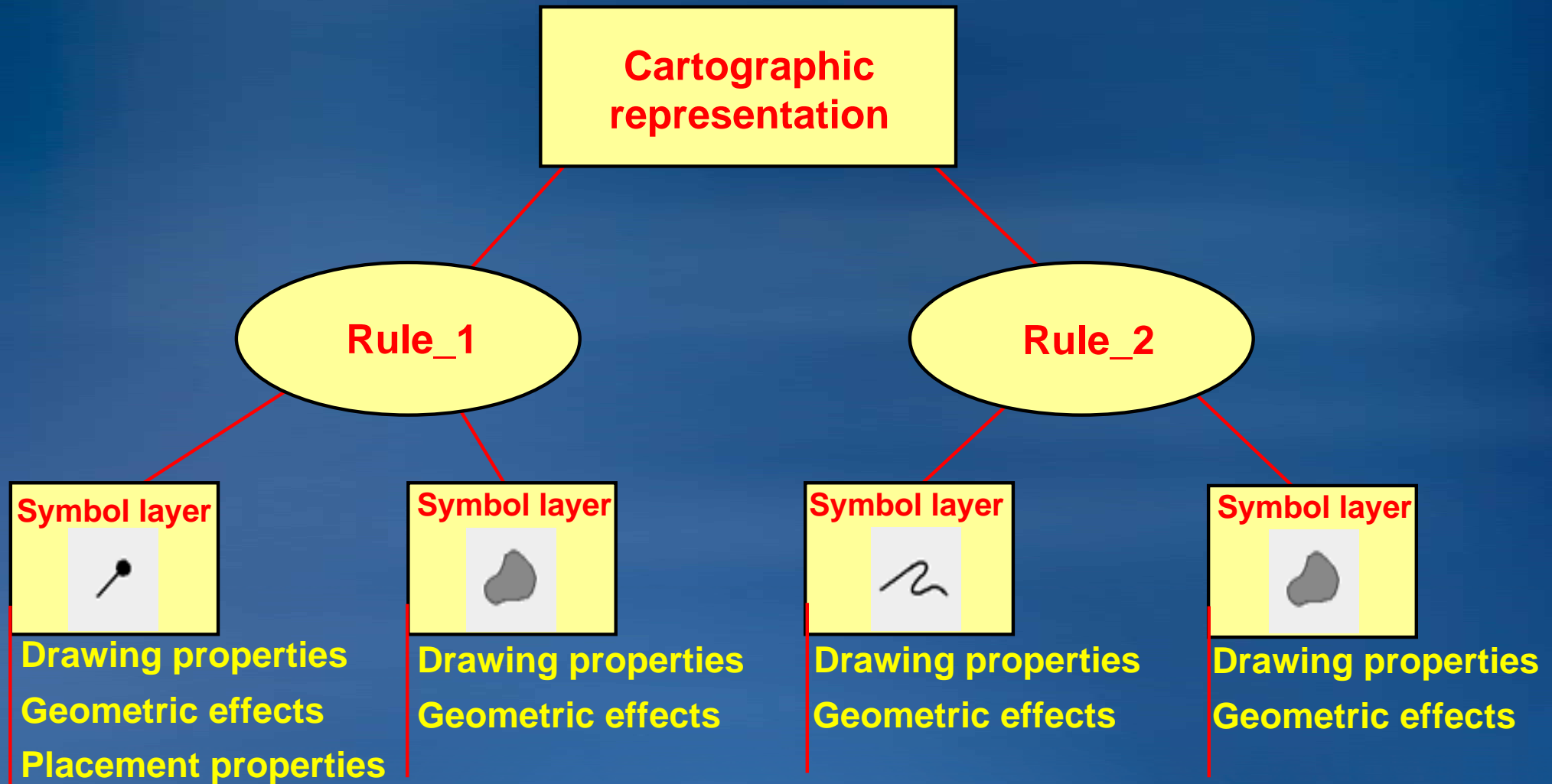


*Buildings oriented to the nearest linear symbol*



*Bridges created at intersections and rivers automatically masked*

# The structure of representations



# Representation rules

- A representation is a collection of rules or drawing instructions for feature classes
  - Convert existing symbology to rules
  - Build new representation rules
- Rules create and symbolize dynamic geometry independent of spatial geometry
- Rules can be managed in ArcCatalog or ArcMap
- Representation rules can be shared **using styles**



# Representation rule properties

- Symbol layers

- Marker



- Stroke



- Fill



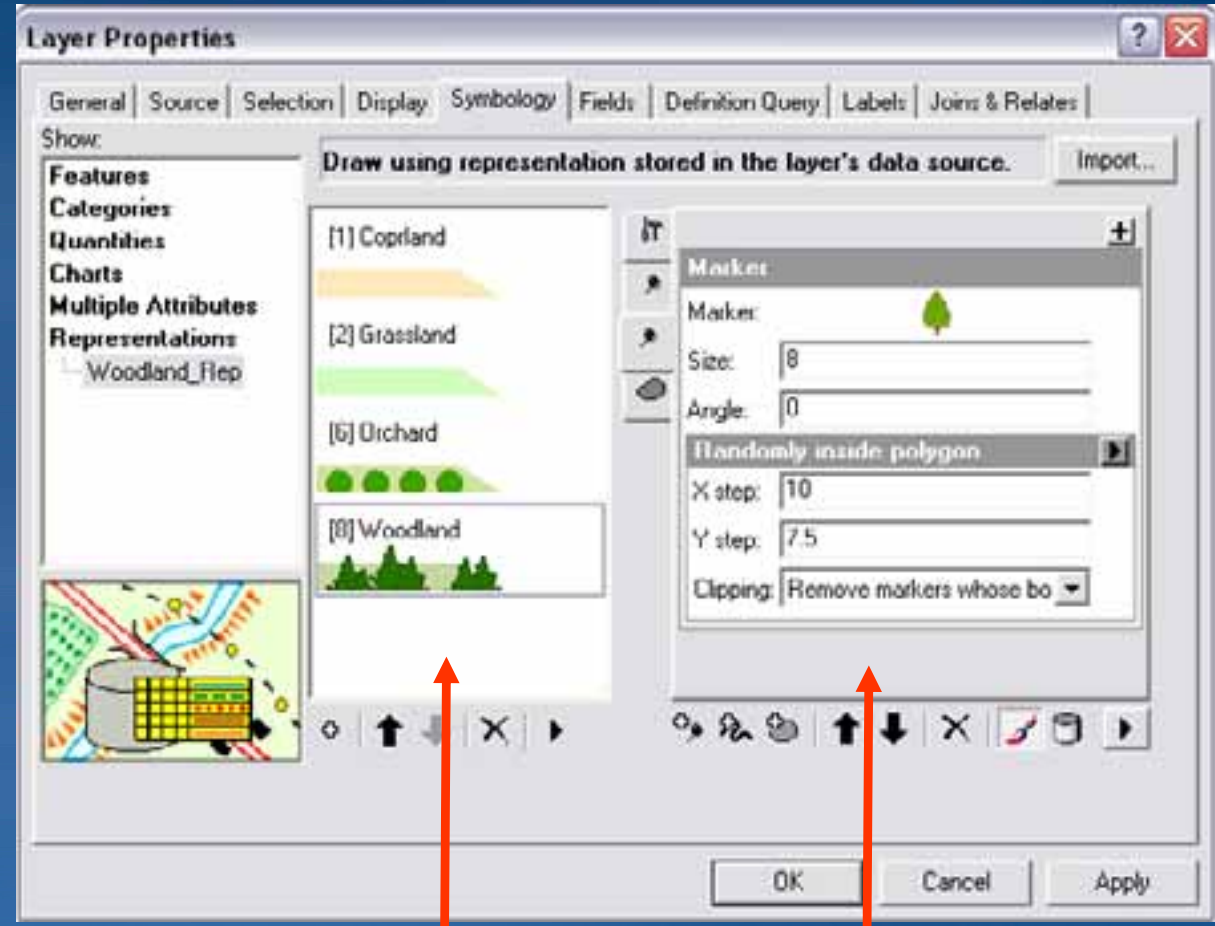
- Geometric effects

- Dynamically alter display geometry

- Marker placement styles

- Place representation markers relative to input geometry

- The building blocks of rules



Representation rules

Representation rule properties

# Rule properties can be mapped to fields

Layer Properties

General | Source | Selection | Display | Symbology | Fields | Definition Query | Labels | Joins & Relates

Show:

Features  
Categories  
Quantities  
Charts  
Multiple Attributes  
Representations  
Buildings\_Rep

Draw using representation stored in the layer's data source. Import...

[1] <all other values>

[2] Z\_WBecken

[3] Z\_Treibhaus

[4] Z\_Station

[5] Z\_Schloss

Width: Width

Caps: <Override Field>

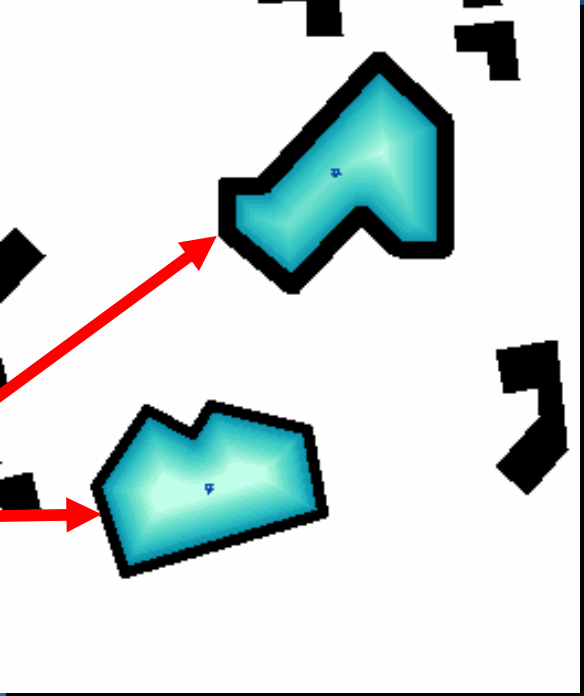
Joins: <Override Field>

Color: <Override Field>

Selected Attributes of Buildings

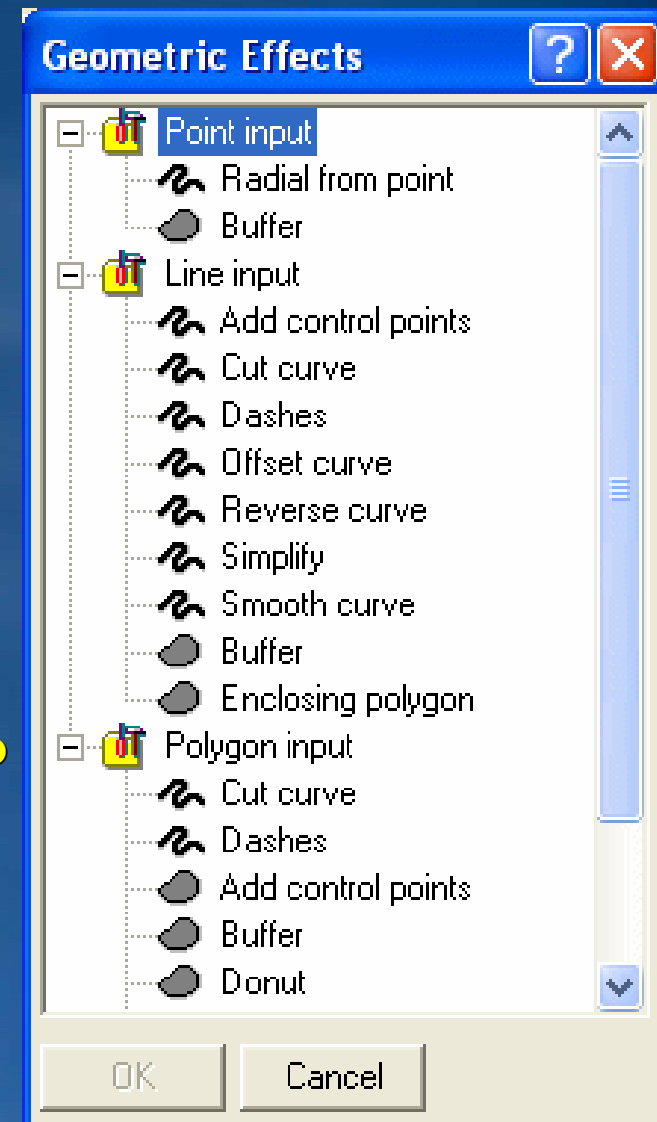
	FACE	OBJECTID	SHAPE_Length	SHAPE_Area	RuleID	Override	Width
▶	Dad	73859	163.265340	1563.96	Z_WBecken	Dlob	1.5
▶	Bad	74001	186.609908	1689.79	Z_WBecken	Blob	0.4

Record: 1 Show: All Selected Records (2 out of ~2000 Selected)



# Geometric effects

- **Operations that process representation (symbol) geometry, not feature geometry**
  - Some resemble geoprocessing tools like Buffer, Simplify Line, and Smooth line
  - Others resemble editing tools like Flip, Trim, and Copy Parallel
- **Used for cartographic purposes**
  - When the output is for appearance, not for analysis
  - Think of representation geometry as a symbol property to manipulate (like color, size, angle or width)





# Sample geometric effects

Before

Simplify effect on groves



After



Bear Control Area

No effects



Simplify and  
Dashes effects

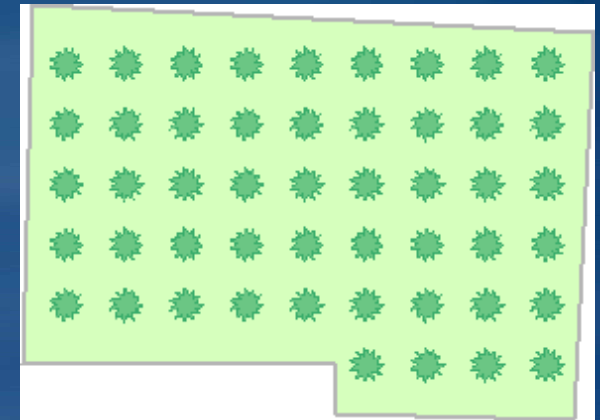


# Marker Placement styles

- **Position markers**

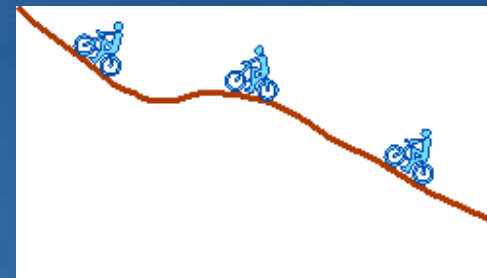
- Along lines and polygon outlines
- Within polygons
- In relation to points

**Markers spaced evenly inside polygon feature**



**Markers offset from feature coordinates**

**Markers spaced evenly along line**

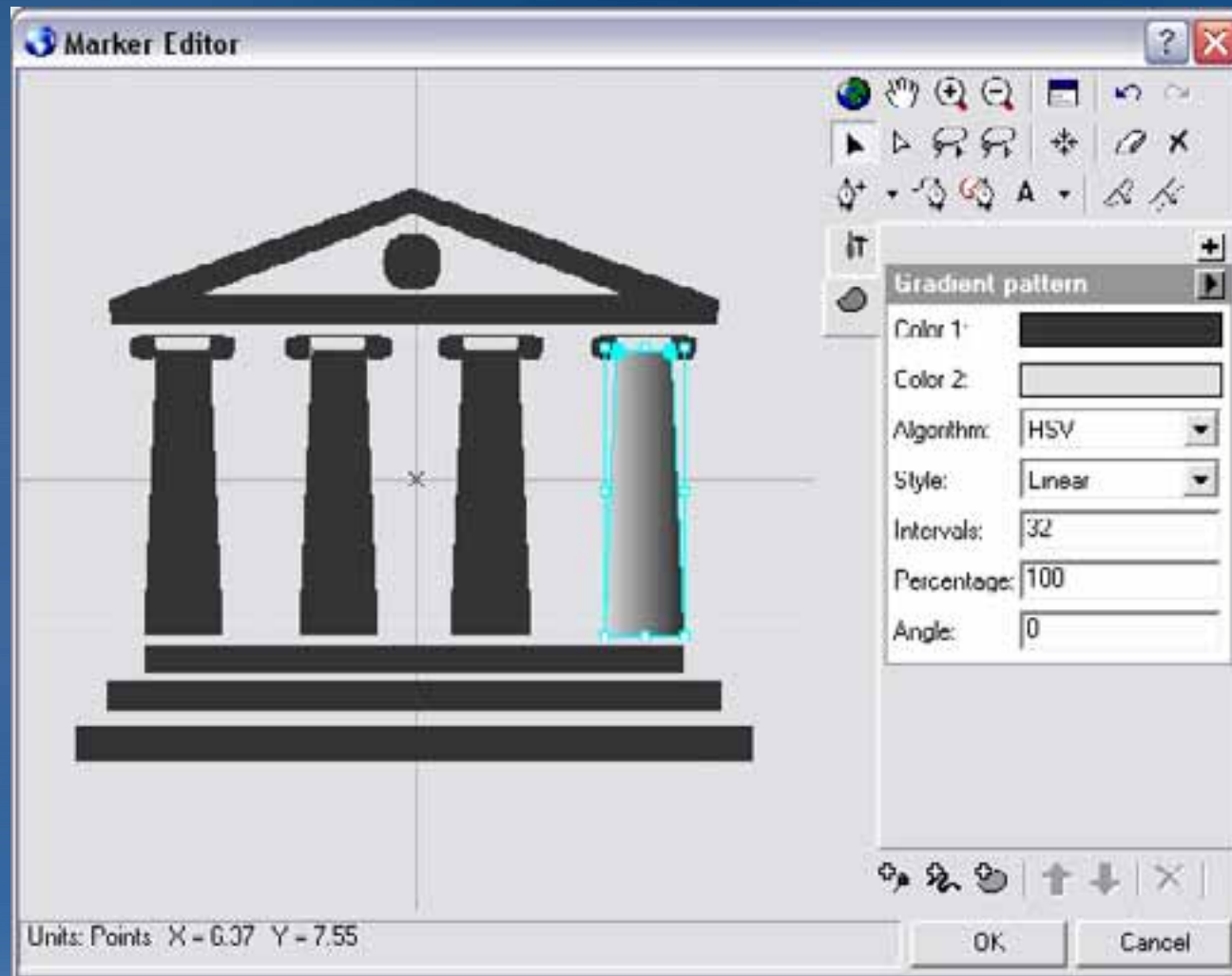


# Representation markers

- Representation markers symbolize:
  - point representation geometry
  - significant locations in line or polygon representations
- Representation markers can be created and modified using the **Marker Editor**
- Representation markers can be stored in a style, then managed using the **Style Manager**

# The Marker Editor

- Interact with all elements of a representation marker



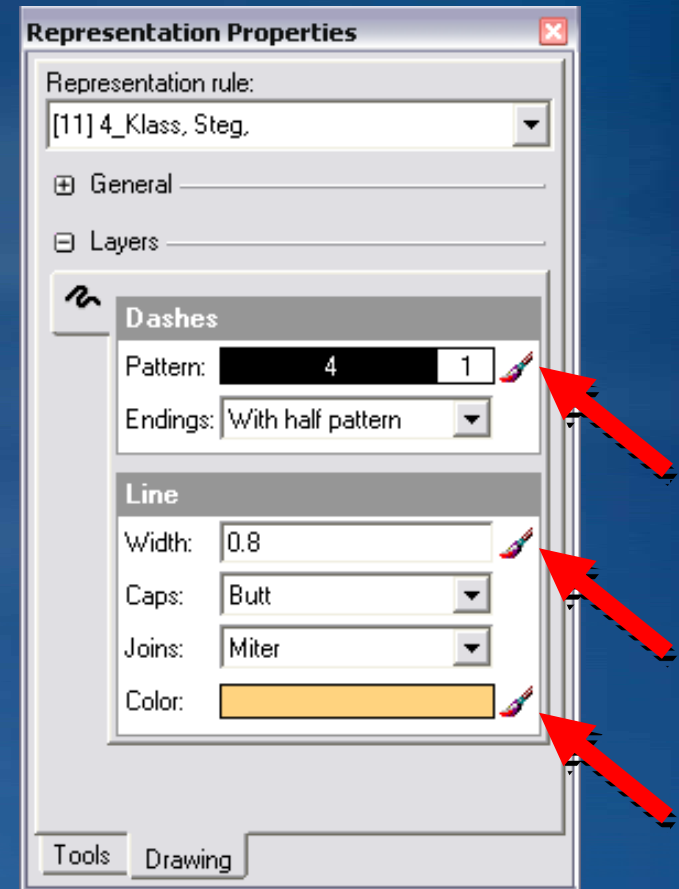
### **3. Editing representations**

# What is a representation override?

- Overrides are exceptions to the rules
- Overrides are made while editing
- Property overrides (appearance)
  - Examples include changing the size, color, width or angle of the feature representation
- Shape overrides (location)
  - Change the shape or position of the feature representation independently of the feature's geometry

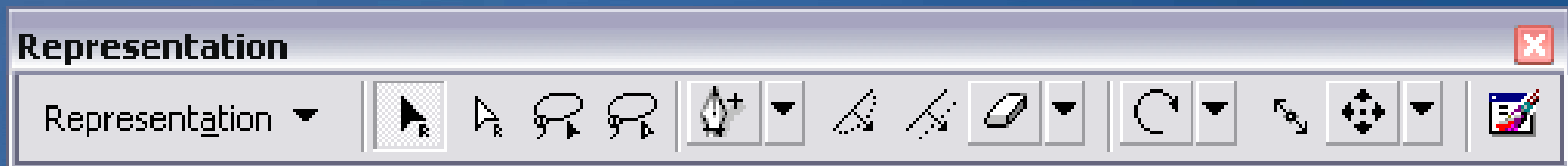
# How do you edit representations?

- The representation rule properties of individual features can be modified in an edit session
  - update rule properties by typing new values
  - or, interactively with the representation editing tools
- Each modification becomes an **override** to the representation rule
  - shown with a paintbrush icon



# Overriding representation geometry

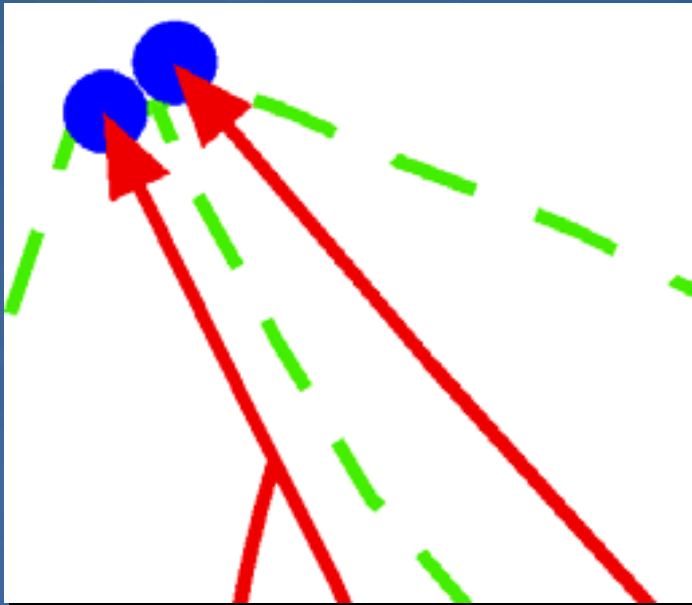
- **Geometry can be edited using the tools on the Representation toolbar**
- **Stores an override copy of geometry in the Override field, or (unusual) modifies feature geometry in Shape field**
  - Only makes sense for specific data model and workflow
  - This setting is a property of the representation; it is set when the feature class representation is created



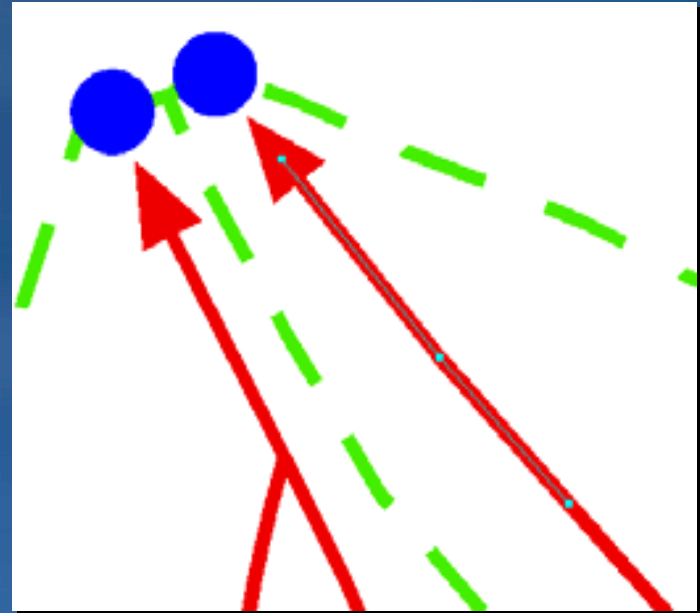


# Overriding representation geometry

- Edit representation geometry without affecting feature geometry



Default database placement



Representation geometry moved to resolve conflict (shape override)

# More symbol control: Free representations

- Use a free representation when rules and rule overrides can't capture the graphical depiction of the feature as desired on a map
- Unique representation for a feature
  - For complete control over feature display
  - Disengages feature from rule
  - Independent copy of the rule in the Override field
  - Try more complex rules and overrides first

Representation following a rule



Free representation



# Editing representations:

## When to edit representations?

- **Only edit/override once rules are right**
  - Decide which layers in the map could be improved with more control over the symbols
  - Convert the existing symbology of those layers to feature class representations
  - Adjust the representation rules to refine the depiction
  - Map properties to fields to customize
- **Now do edits**
  - Override as necessary
  - Create free representations as a last resort

## **4. Processing representations**

# Geoprocessing tools for representations

- In ArcGIS 9.3, ArcToolbox has two new geoprocessing tools inside of the Cartography toolbox

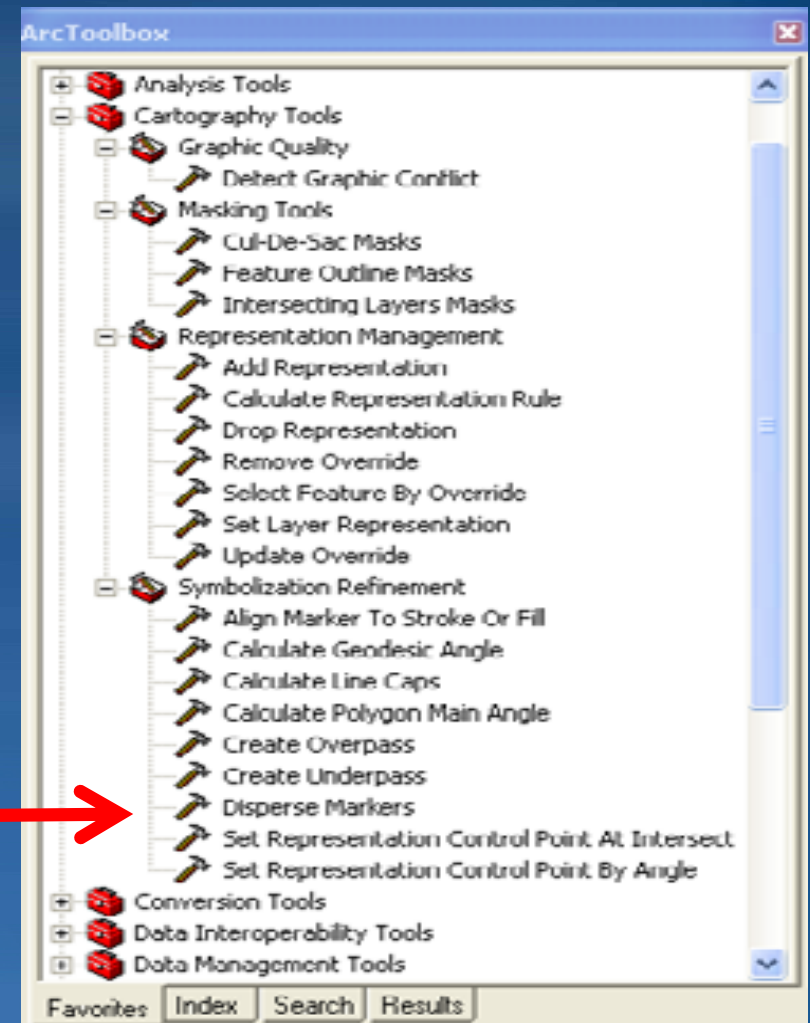
## Symbolization Refinement toolset



Disperse Markers

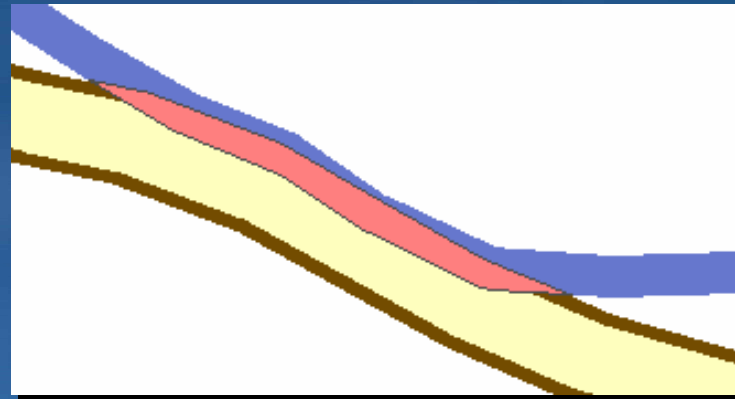
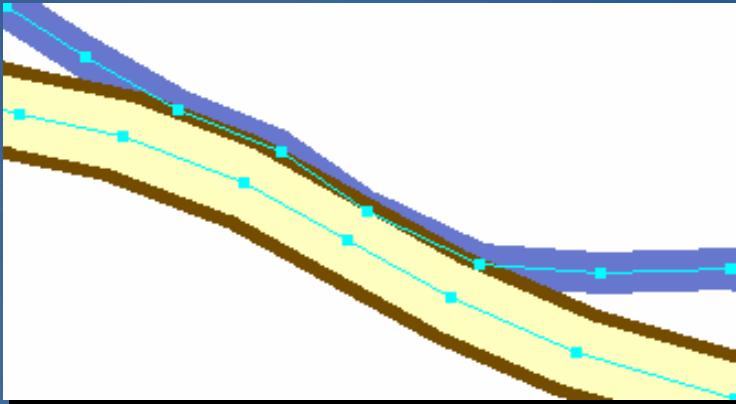


Set Representation Control Point at Intersect



# Graphic Quality toolset

- Detect Graphic Conflict tool
  - Finds areas where representation **symbology overlaps**, even if data does not



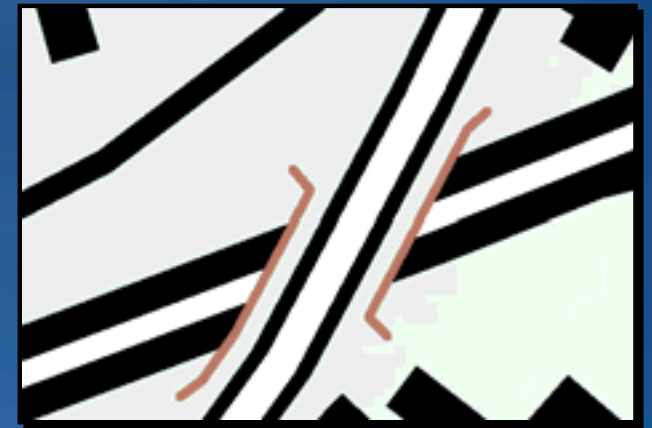
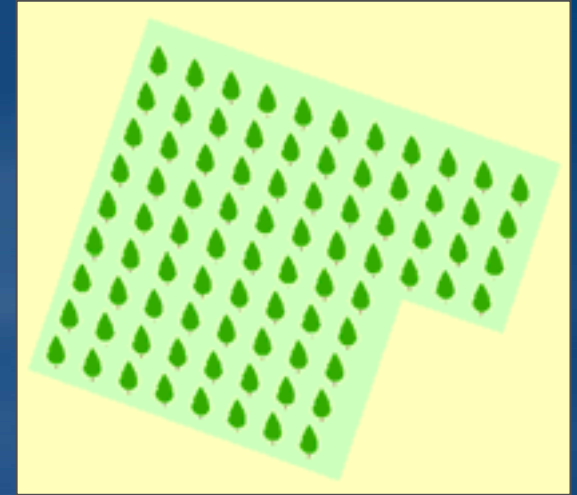
# Representation Management toolset

- **Select Feature by Override tool**
  - Select features that have property overrides, shape overrides, or both
- **Update Override tool**
  - Moves overrides from the Override field into the explicit fields as defined by the representation rule
- **Plus lots more:**
  - Create Representation
  - Drop Representation
  - Remove Override



# Symbolization Refinement toolset

- **Calculate Polygon Main Angle tool**
  - Finds dominant direction of a polygon
  - Adjusts marker symbols to follow the main polygon angle
- **Create Overpass tool**
  - Creates overpass masks and builds parapets





# ModelBuilder

- Good for automation

**Create Overpass**

Input Above Features With Representations  
Road\_network

Input Below Features With Representations  
Railway\_network

Margin Along  
0.3 Points

Margin Across  
0.5 Points

⚠ Output Overpass Feature Class  
C:\Geodata\Europe\Swiss\Swiss\_Larger\Aarau\_Larger\_25K.gdb\Masks\_and\_De

⚠ Output Mask Relationship Class  
C:\Geodata\Europe\Swiss\Swiss\_Larger\Aarau\_Larger\_25K.gdb\Masks\_and\_De

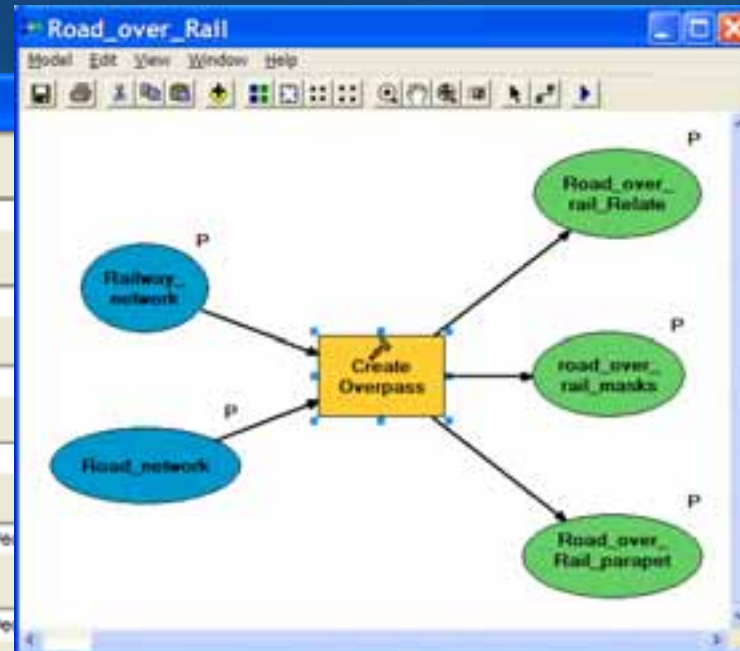
Expression (optional)  
"BRIDGETYPE" = 'Bruecke'

⚠ Output Decoration Feature Class (optional)  
C:\Geodata\Europe\Swiss\Swiss\_Larger\Aarau\_Larger\_25K.gdb\Masks\_and\_De

Wing Type (optional)  
PARALLEL

Wing Tick Length (optional)  
0.3 Points

OK Cancel Apply Show Help >>




# ESRI Cartography Resources: Educational Services

- Training: : <http://training.esri.com>
  - Two day course: Working with Cartographic Representations
  - Three day course: Creating and Publishing Maps with ArcGIS
  - Free podcasts:
    - Best Practices: Working with Cartographic Representations
    - Planning Your Geodatabase for Cartography with ArcGIS 9.2
    - Using Geoprocessing Tools for Cartographic Representations

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# ESRI Cartography Resources: On the Internet

- ESRI Mapping Center: <http://mappingcenter.esri.com/>



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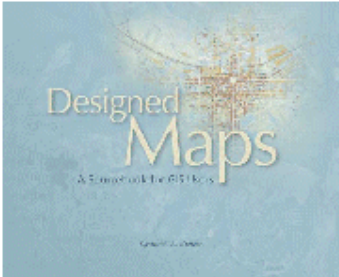
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Cynthia Brewer's new book titled *Designed Maps: A Sourcebook for GIS Users* is a companion piece designed to compliment the highly successful *Designing Better Maps: A Guide for GIS Users* published by ESRI Press in 2005. The goal of the book is to offer a graphics-intensive presentation of published maps, providing cartographic details that will prompt GIS users to think about their own maps and how to improve them....(read more)

**Integrating markers and dashes on cartographic representation line symbols**

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