Cartography: Improving Representation Utilizing the Geodatabase

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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?

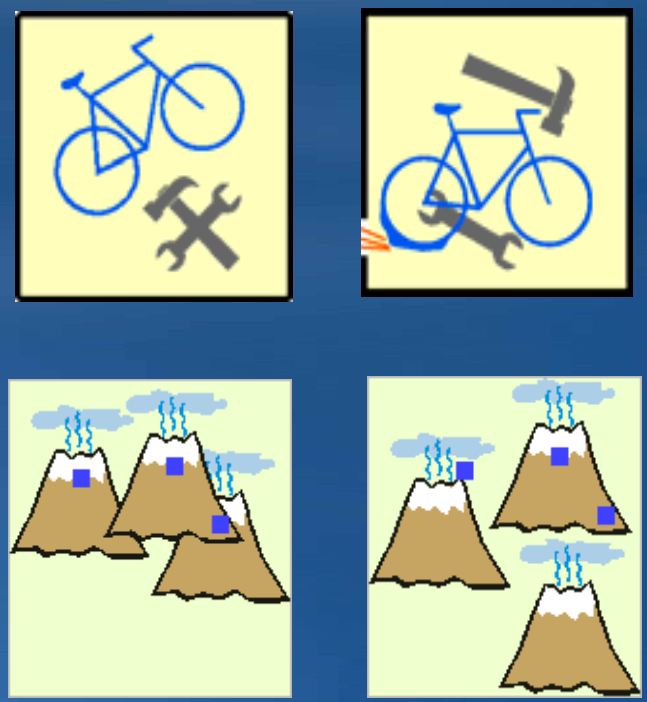
- An intelligent way to symbolize features for cartographic purposes
- A solution to some common cartographic challenges that required workarounds in the past
- A storage model that stores symbol information in the geodatabase for re-use and sharing

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 funtionality 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

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

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

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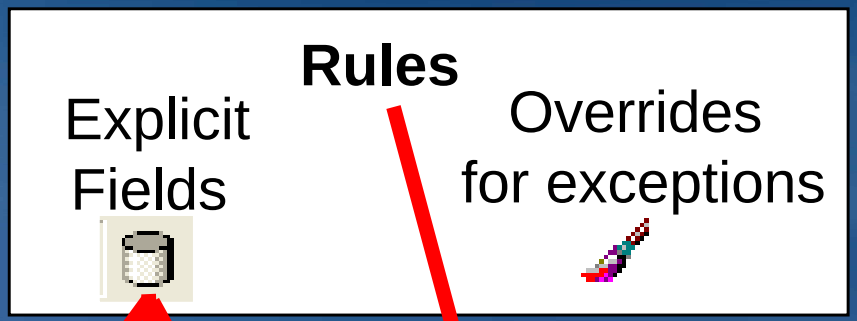
How are representations stored?

Inside the geodatabase



Shape	Field1	Field2	Field3	RuleID	Override

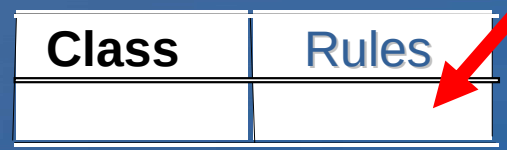
Feature Class attribute table

How are rules stored?

In the feature class extensions table

Feature table

Shape	Field1	Field2	Field3	RuleID	Override



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

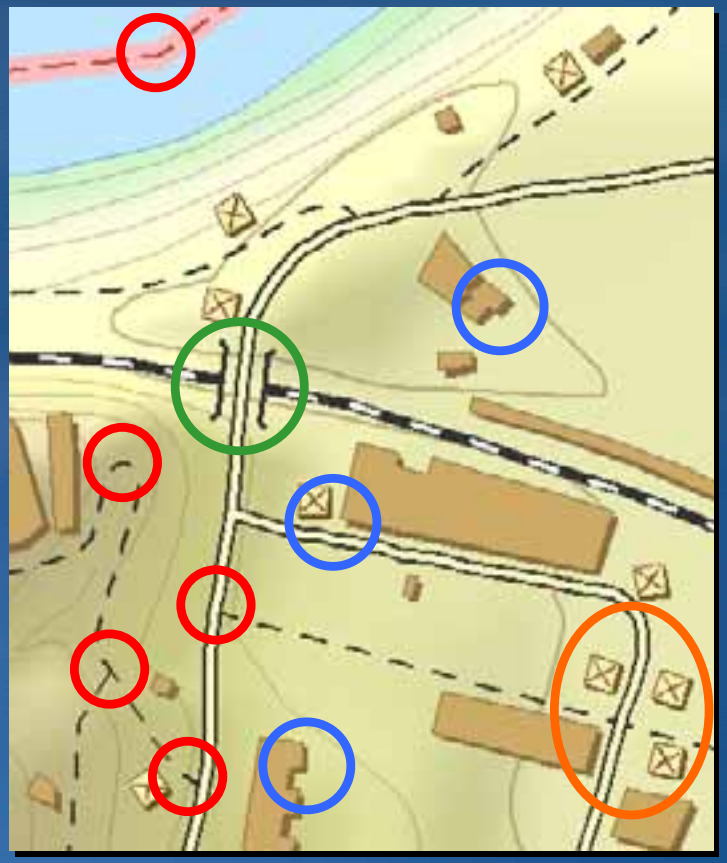
  ArcGIS Explorer

  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

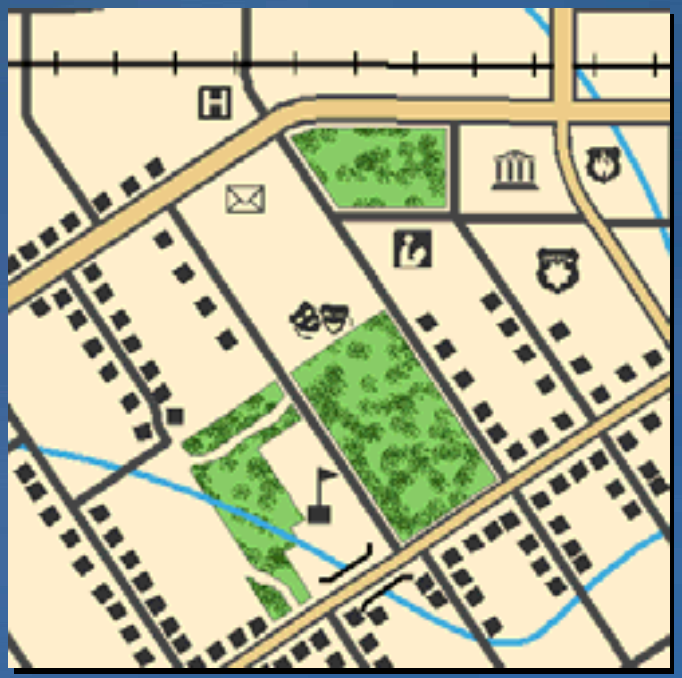
What can representations do?

- **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

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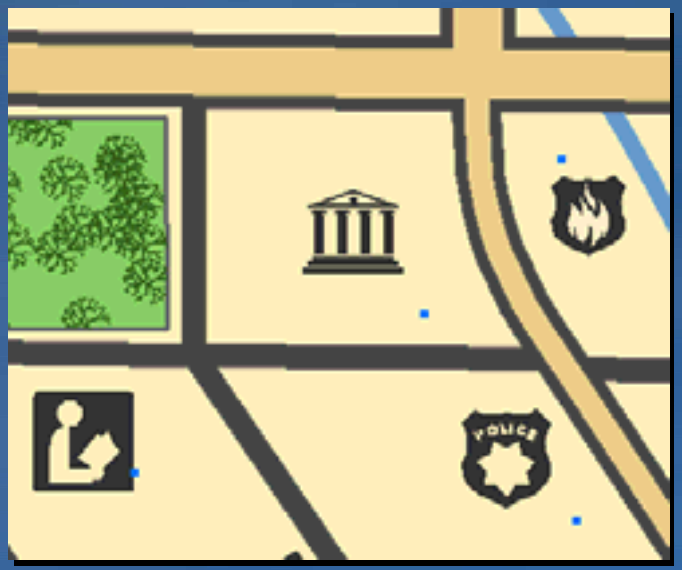
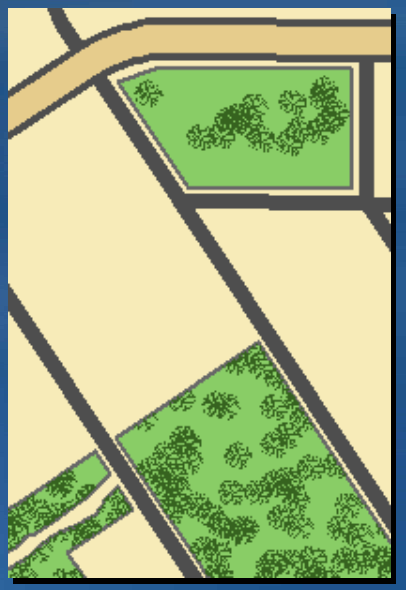
What can representations do?

- **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

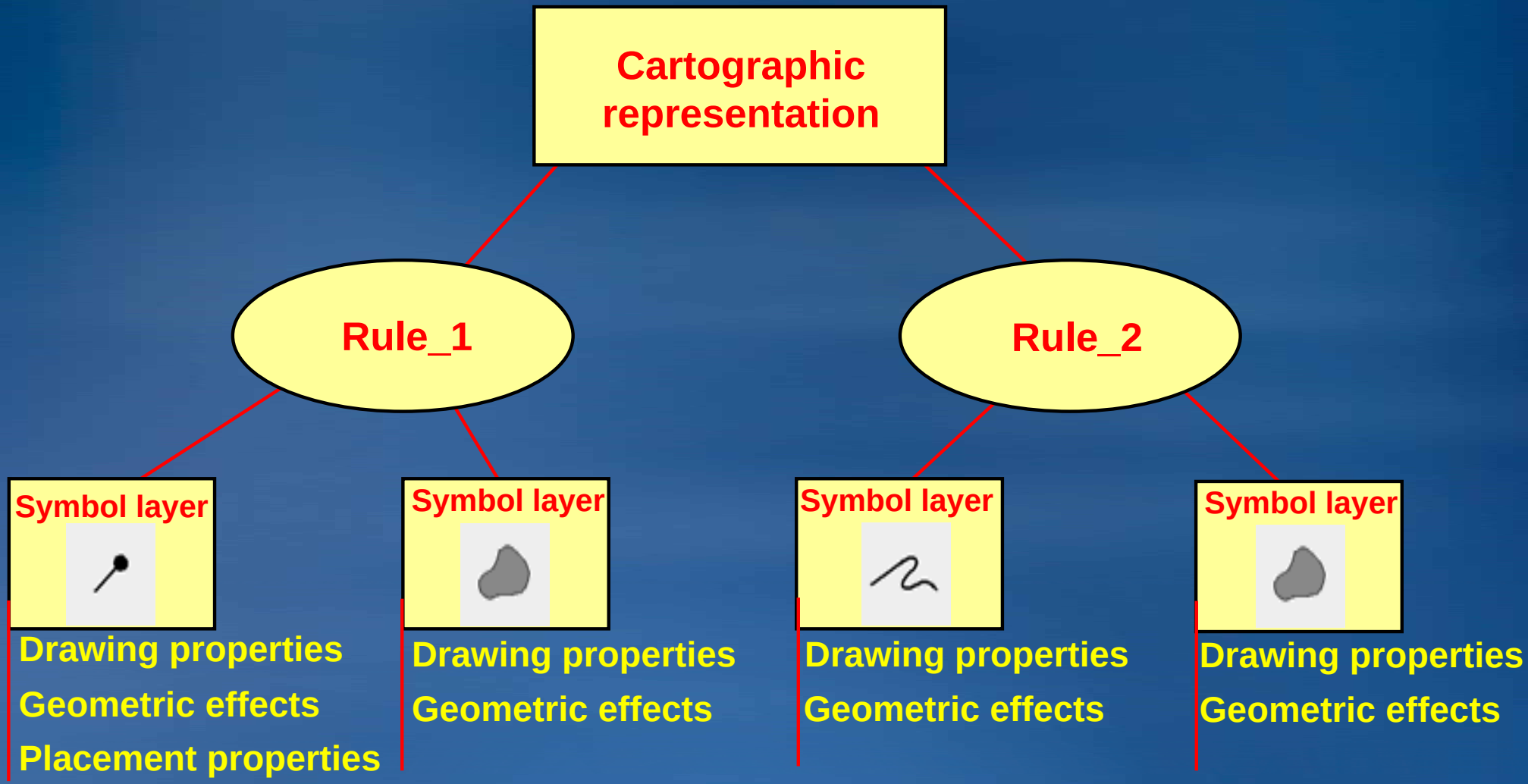
What can representations do?

- **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

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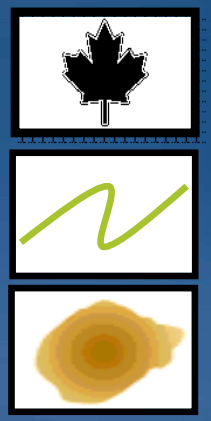
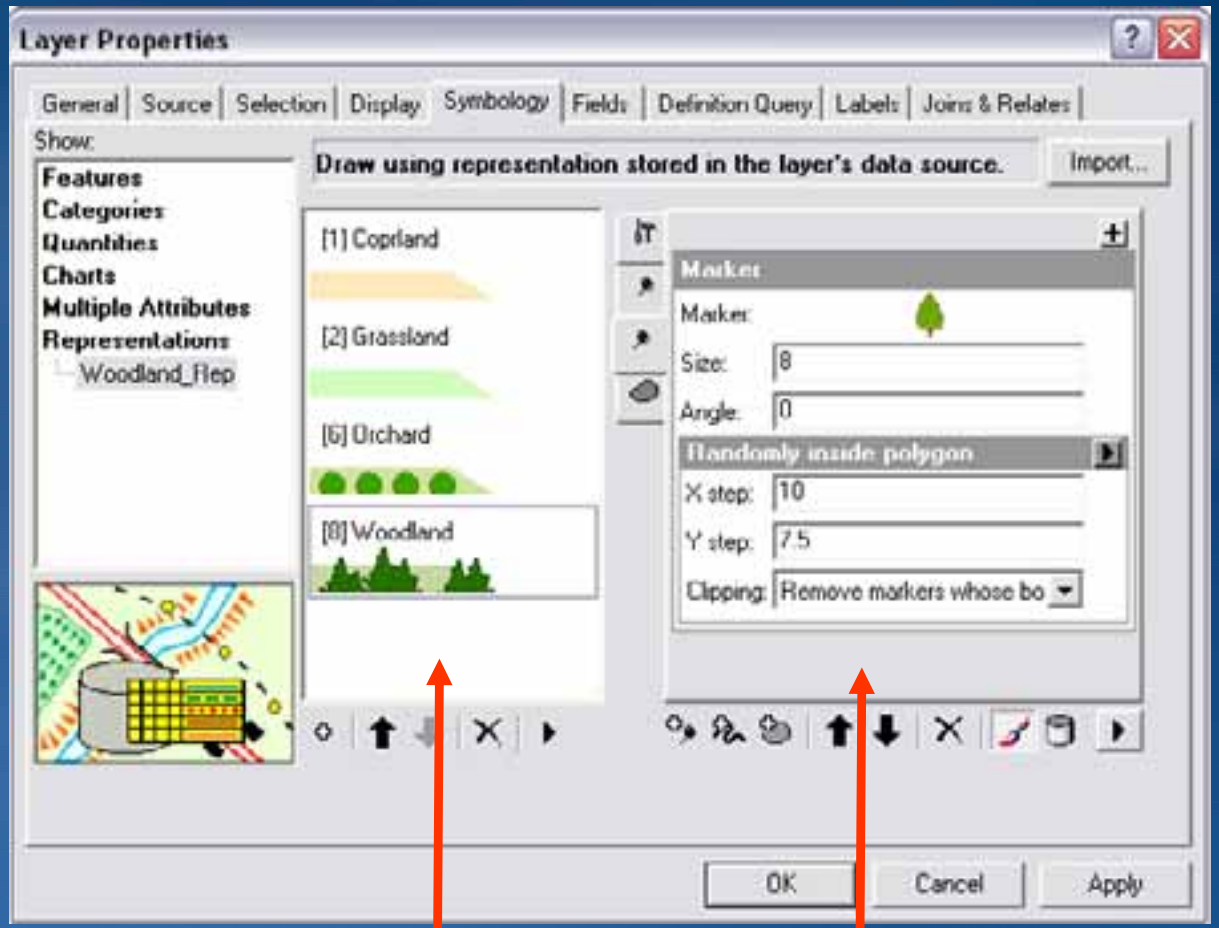
Representation rule properties

- Symbol layers
  - **Marker**
  - **Stroke**
  - **Fill**



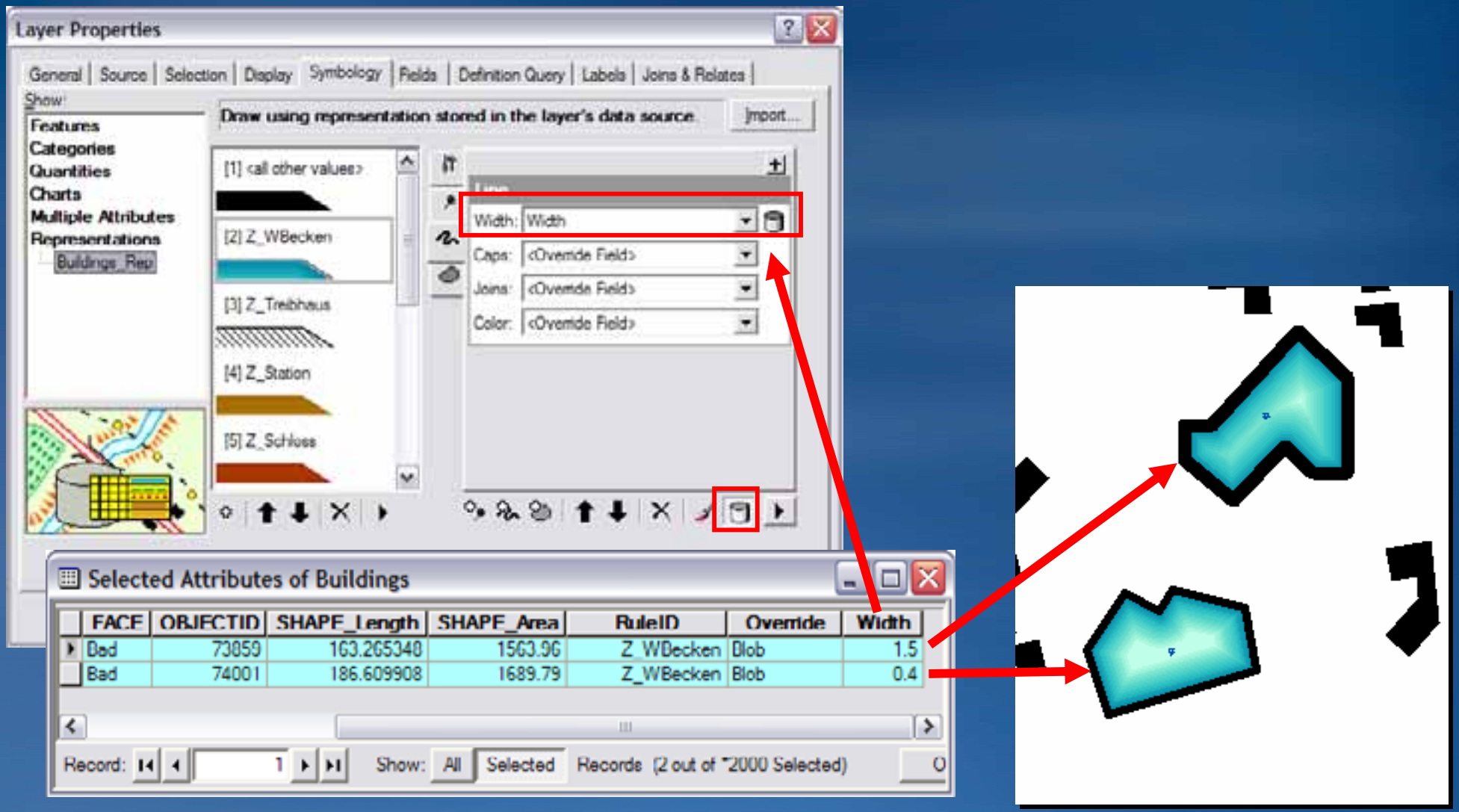
- Geometric effects
  - **Dynamically alter display geometry**
- Marker placement styles
  - **Place representation markers relative to input geometry**
- The building blocks of rules



Representation rules

Representation rule properties

Rule properties can be mapped to fields



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Geometric effects

- **Operations that process representation (symbol) geometry, not feature geometry**

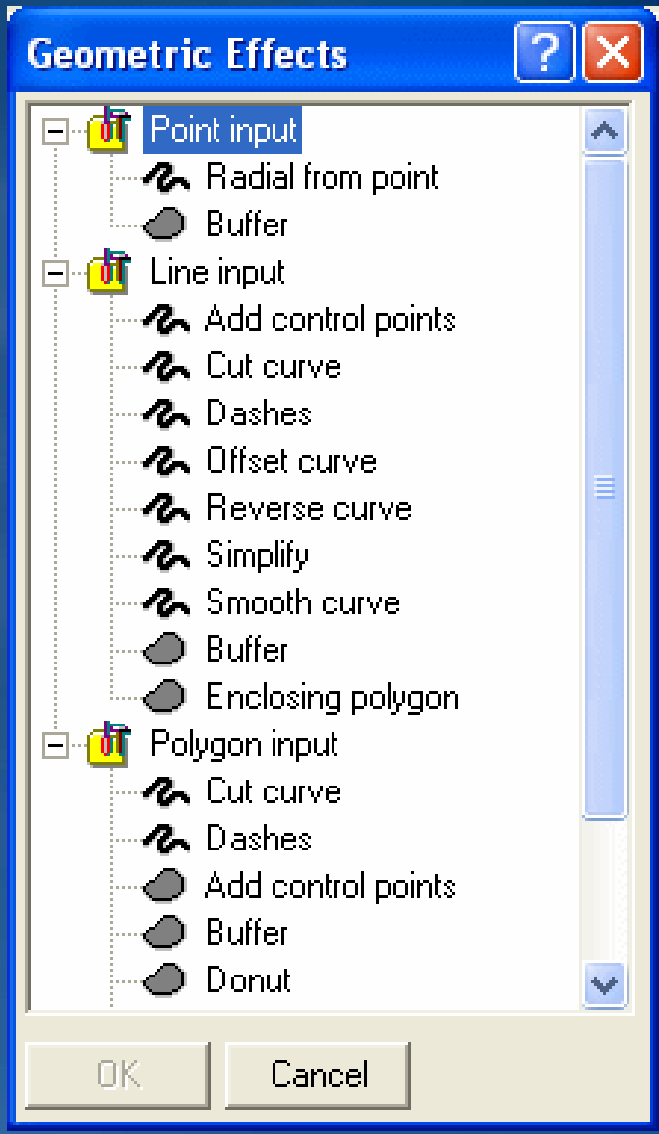
  -Some resemble geoprocessing tools like Buffer, Simplify Line, and Smooth line

  - 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

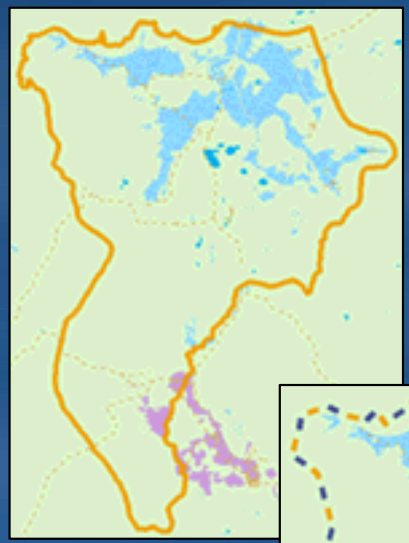
Simplify effect on groves

Before

After

Bear Control Area

No effects



Simplify and Dashes effects

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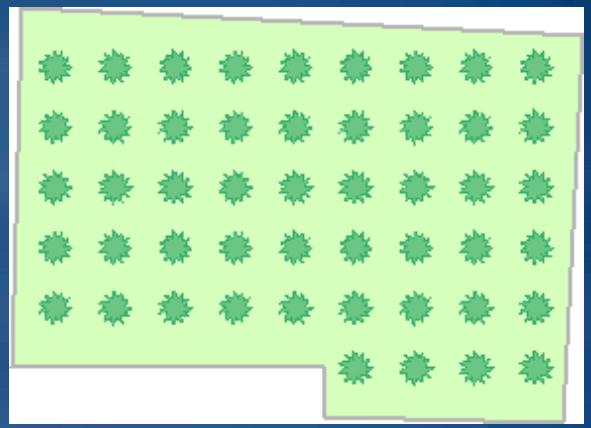
Marker Placement styles

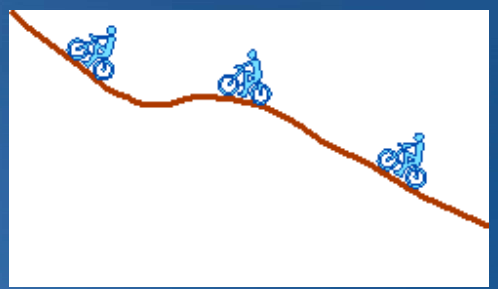
- **Position markers**
  - Along lines and polygon outlines
  - Within polygons
  - In relation to points

Markers spaced evenly inside polygon feature



Markers offset from feature coordinates

Markers spaced evenly along line

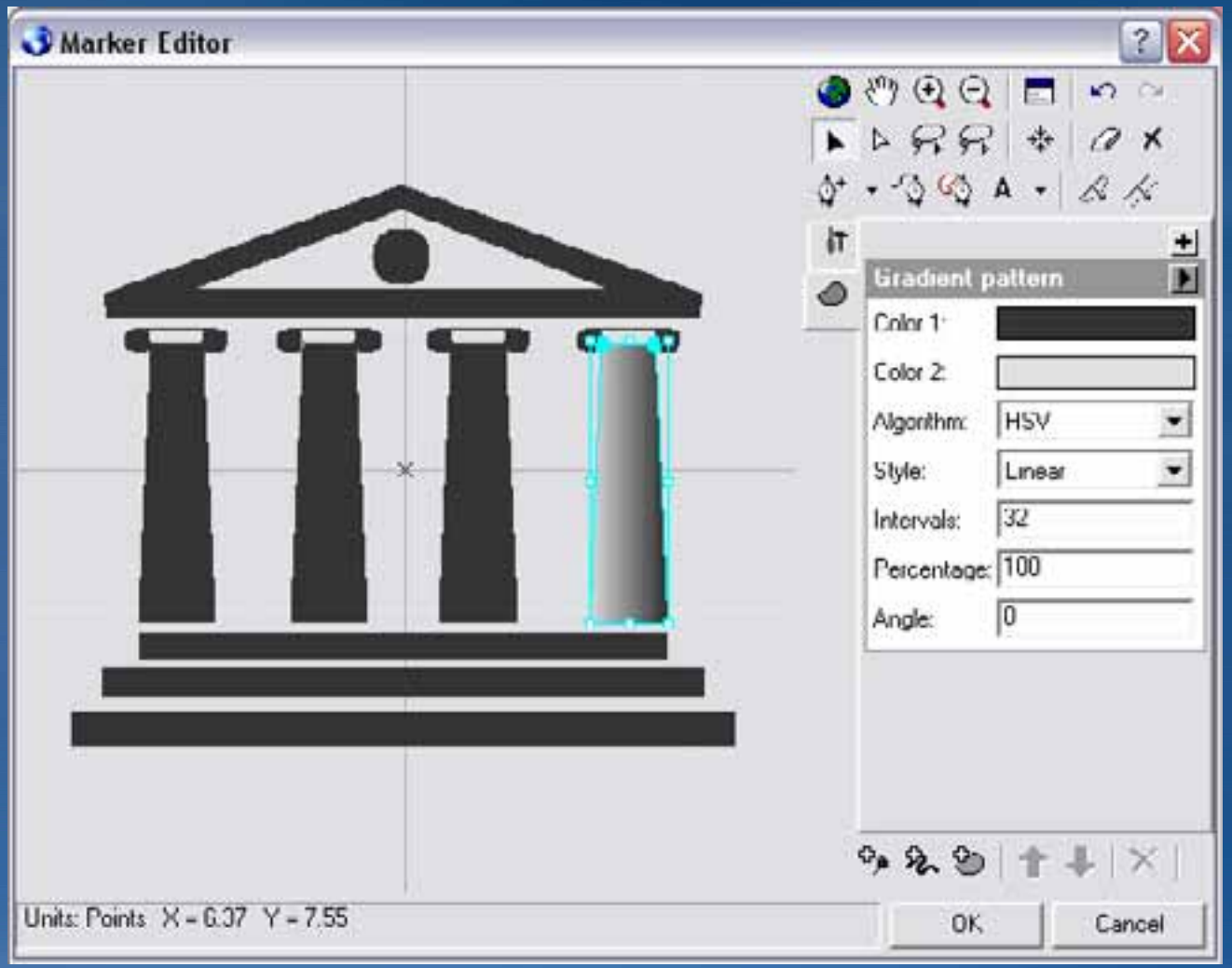


Representation markers

- **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**



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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

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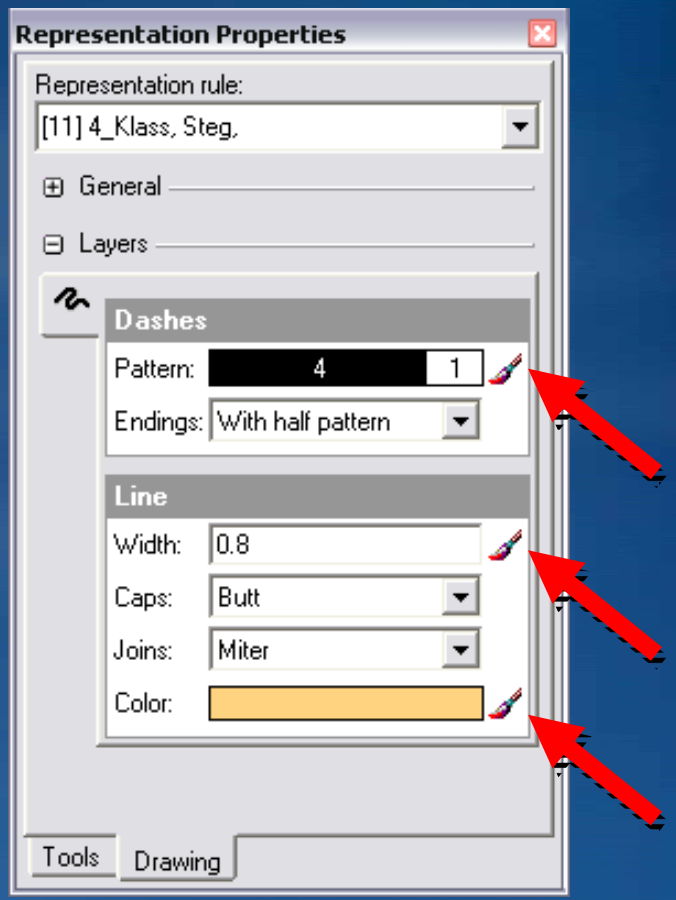
How do you edit representations?

- 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



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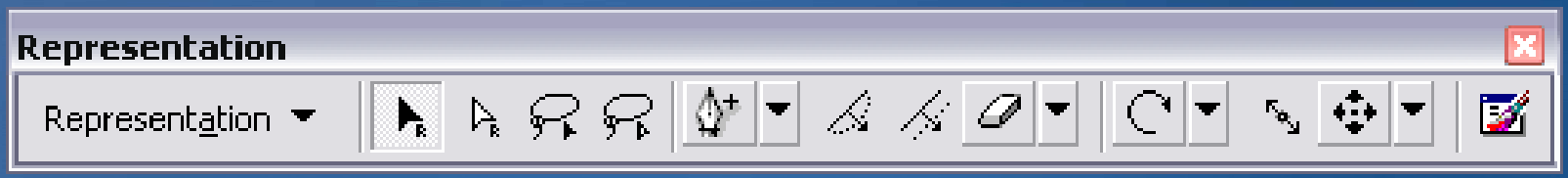
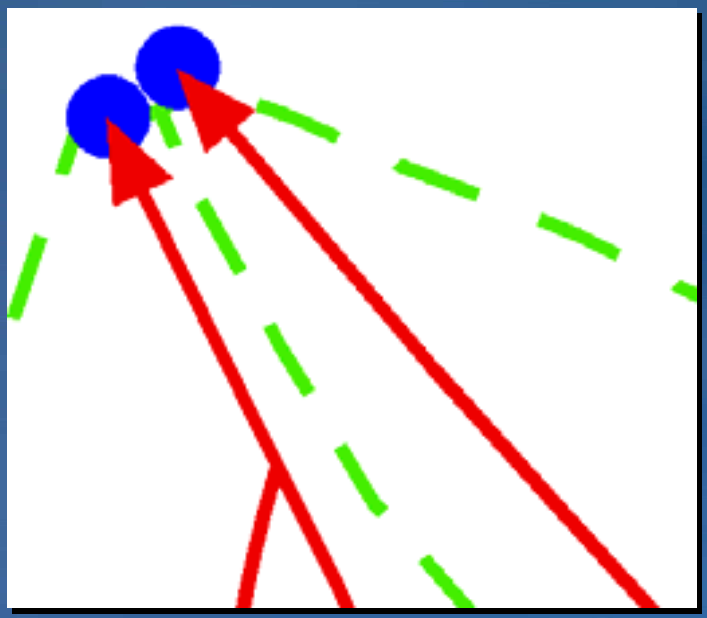
Overriding representation geometry

- 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

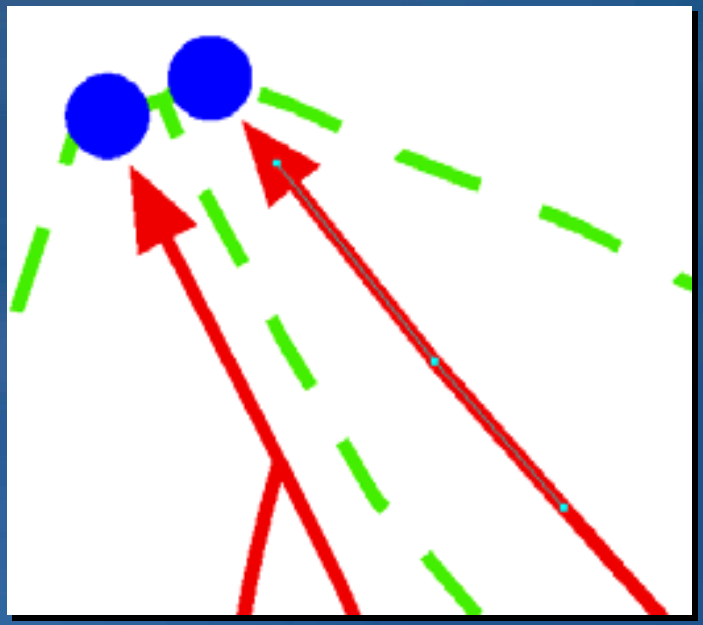


Overriding representation geometry

- **Edit representation geometry without affecting feature geometry**



Default database placement



Representation geometry moved to resolve conflict (shape override)

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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

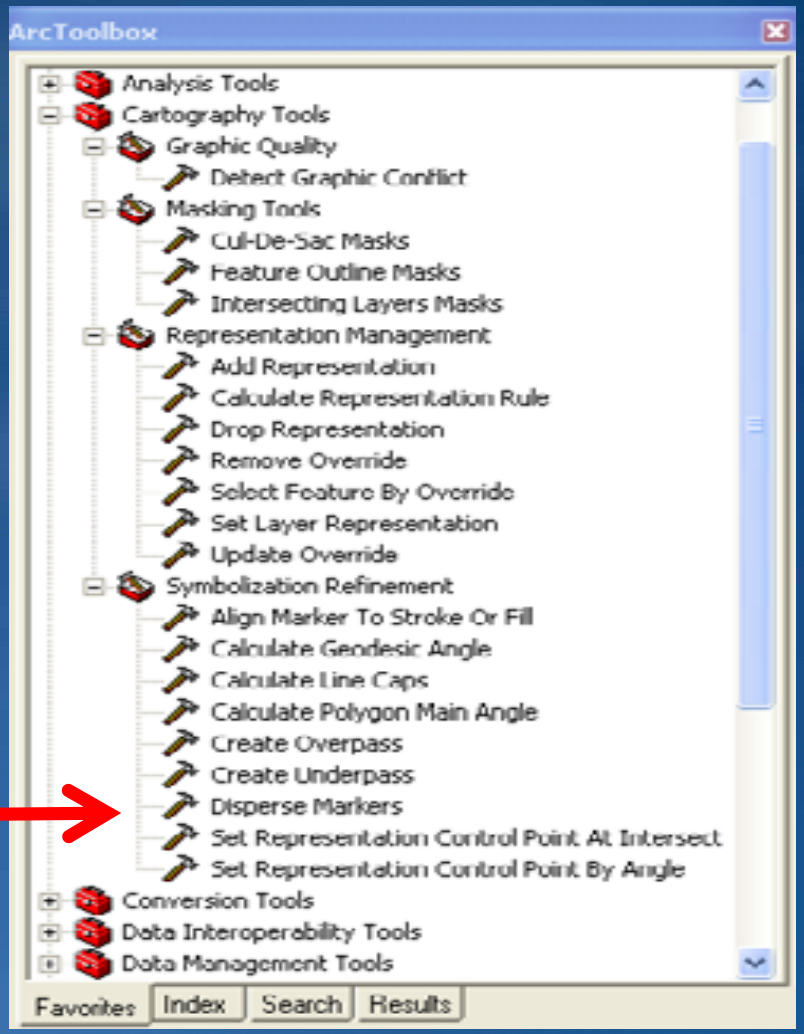
Geoprocessing tools for representations

- 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



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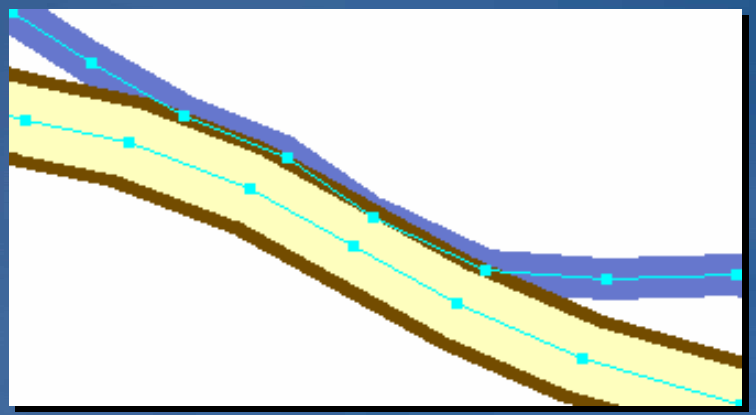
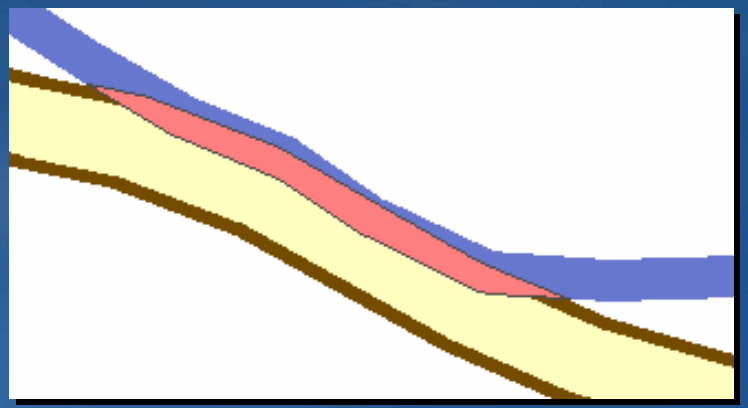
Graphic Quality toolset

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





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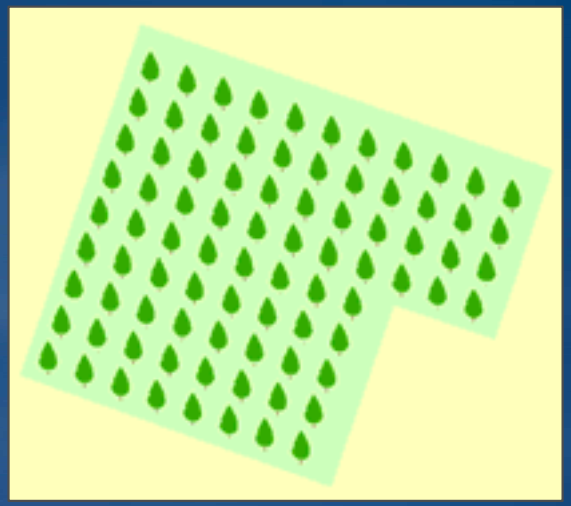
Representation Management toolset

- **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

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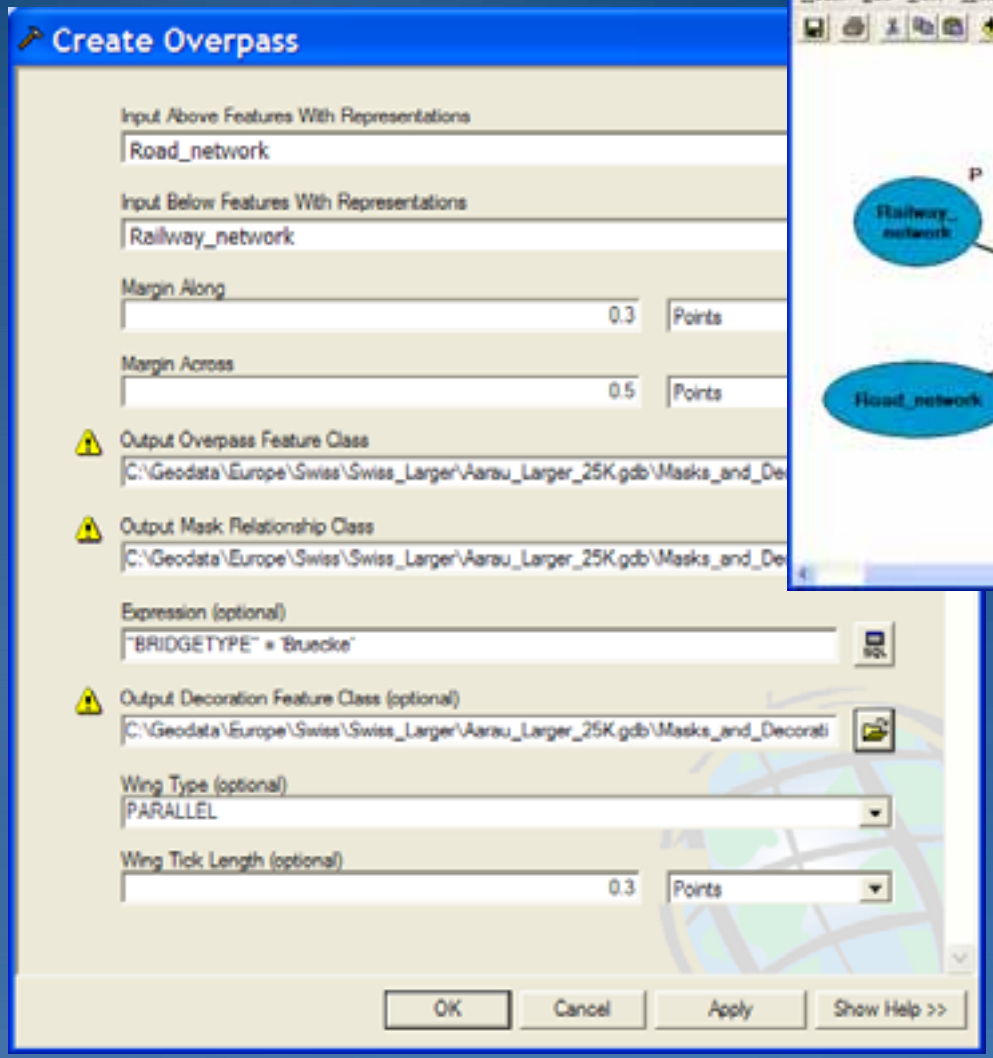
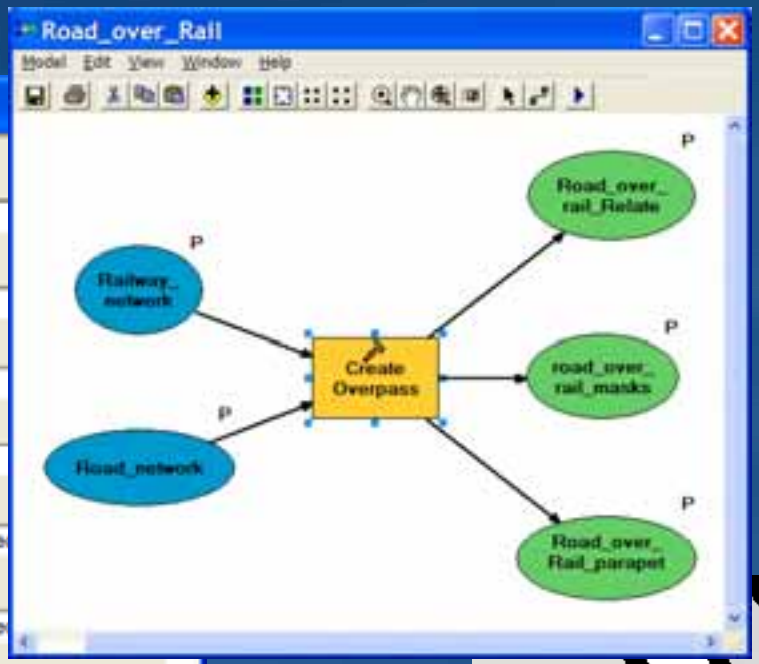
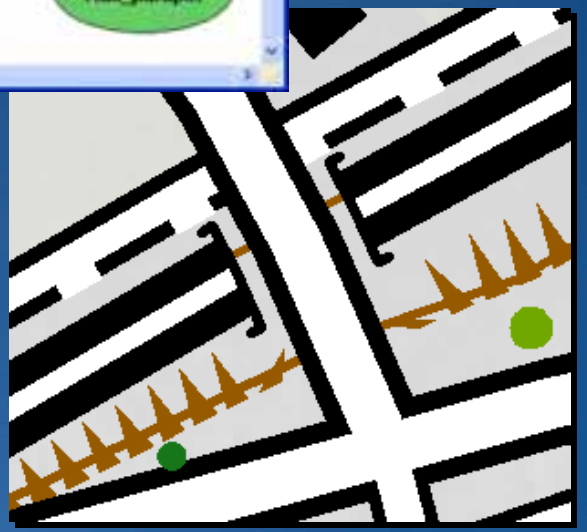
ModelBuilder

- **Good for automation**







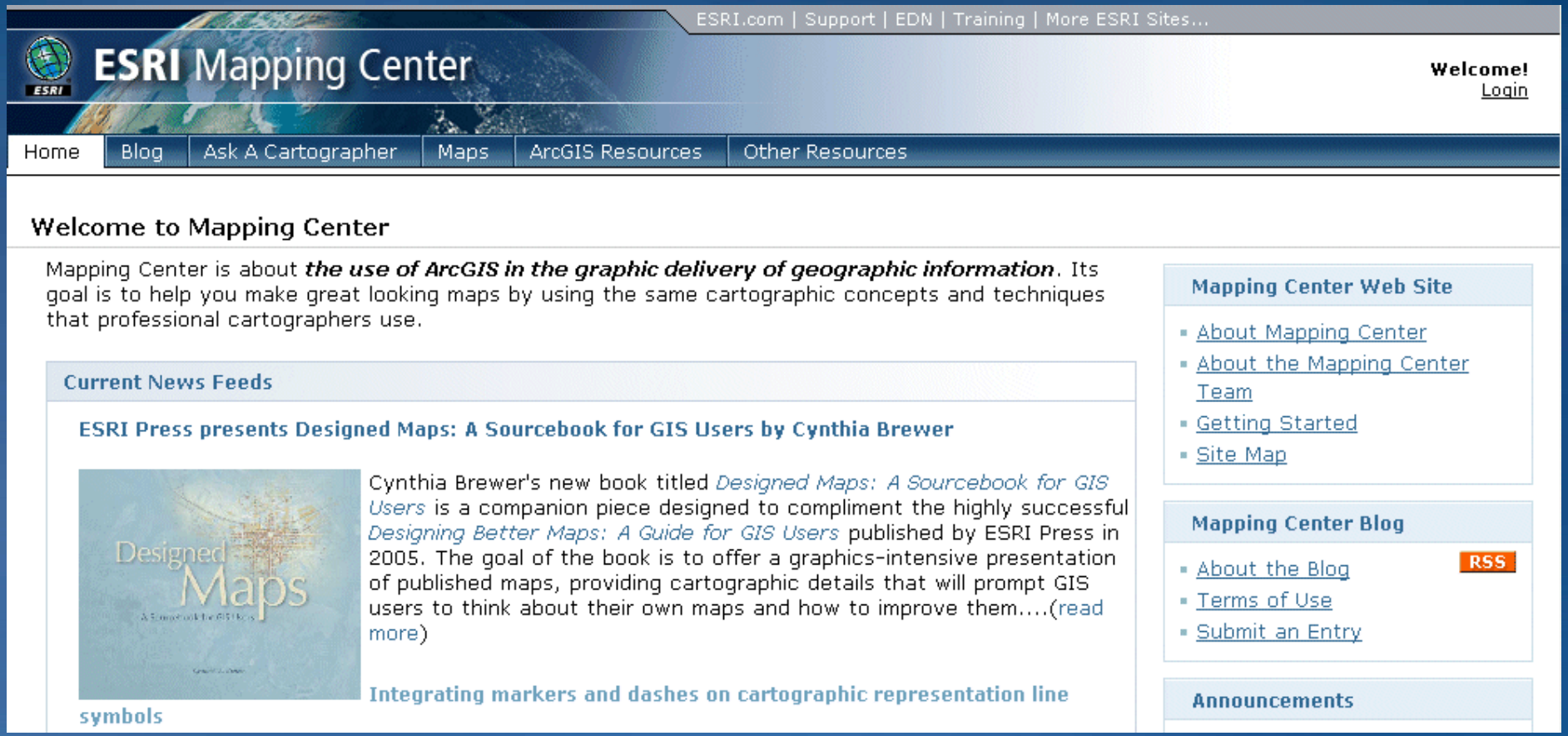
ESRI Cartography Resources: Educational Services

- 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

ESRI Training…Keep critical skills up to date

ESRI Cartography Resources: On the Internet

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



Thank you

Questions and comments?