Building tools with ModelBuilder

Dale Honeycutt
Session evaluation – on-line

- www.esri.com/sessionevals
Questions for you

• How many User Conferences have you been to?
• Geoprocessing experience?
  - Little (rarely used)
  - Some (know the basics)
  - Advanced (build your own tools)
  - Guru (anointed or legendary?)
• Platform?
  - 9.3
  - 10.0
Who are you? Analyst? Developer?

• Analyst:
  - Solves the GIS problem
  - “Need to summarize this stuff by these polygons”

• Developer:
  - Solves the software / system problem
  - “We need to run this model on a whole bunch of different data”
  - “We need a tool to do <blah>”

• You’re probably both an Analyst and a Developer, right?
Macros versus Tools

• A macro is tied to a specific set of data
  - A layer with a particular name ("Streets"), geometry type (lines), fields ("CFCC", "Meters")
  - In order to work on another set of data, either the macro code or data must be changed

• A tool parameterizes data
  - It is not hard-coded to a particular set of data
  - It must react accordingly (work with any data)

Macros and tools in ArcGIS

- You can create macros with:
  - ModelBuilder
  - Python Window

- You can create tools with:
  - ModelBuilder
  - Python Scripts
  - ArcObjects

- Tools that you create are called *custom tools*
  - ...and are found in custom toolboxes that you create


Why create tools?

• Reuse
  - Use like a system tool – in models and scripts
  - No need to alter data or code (model) to make it work

• Sharing
  - Works with your user’s data without modification

• Geoprocessing services
  - For web clients

• Productivity
  - Build your own libraries
Today’s agenda – the basics of

- Turning a model **macro** into a model **tool**
  - All about model parameters
- Other techniques you need to know
  - Feature sets (Interactive entry of features)
  - Variable substitution
  - Branching & conditional execution
- Many of these techniques apply to macros as well
  - Start on the road to ninja-hood…
Demo: basics making a model tool from a model macro
Demo review

- Creating model parameters
- Making variables from tool parameters, making variables model parameters
- Specifying output symbology
- Removing default values in variables
  - Doesn’t run in ModelBuilder, only as tool
- Intermediate data
- Environments
- Filters
- A small utility script tool to really polish the tool
Help topics of interest

Demo review: ModelBuilder has a split personality

• ModelBuilder used in two modes:
  - To create a macro
  - To create a tool
Feature Sets

Interactive entry of features
Feature and record sets

- Interactive input of features and their attributes
- Interactive input of table rows

Demo: Feature Sets
Demo review

- Any tool that accepts a feature class or feature layer can be made to use a Feature Set
- To create a Feature Set
  - Right-click existing variable and change data type, or
  - Create new variable
- Feature sets have a schema that defines
  - Fields
  - Symbology
- Use the **Copy Features tool** to copy the in-memory feature set to disk
Variable substitution

%percent%percent%
Variable substitution

- Primarily used for:
  - Building expressions
  - Specifying output data location – using workspace and scratchworkspace environments

Demo: Variable substitution
Demo review

- Used substitution in a select expression
  - So that your user doesn’t have to build an expression
- Used a Value List filter to present a choice list
- Showed the Make Feature Layer with the Select Layer By <Attribute / Location> pattern
  - This pattern used a *lot* in model tools
- Unless the variable is a number, you’ll want quotes outside the percents
  - “%Fire Station Name%”
Branching
Branching uses **Preconditions**

- **Precondition** is a connection between a variable and a tool
  - Tool will execute only if the variable evaluates to TRUE
- Three general classes of variables:
  - Boolean
  - Numbers (0 = false, anything else = true)
  - Everything else – variable must have a valid (non-empty value)

Demo: Branching
Demo Review

- Used **Calculate Value** to output a Boolean variable
  - This Boolean used as precondition
- Used Managed parameters
  - Managed parameters don’t show up on dialog
- Used **Merge Branch** to determine what to output
- Created a choicelist and branched on the choice
  - See *Conversion toolbox > Metadata toolset > Import Metadata* for another example
Other model-only tools

- **Parse Path**
  - Given a pathname, return its components

- **Get Field Value**
  - Returns the value of a field in a table – first record only
  - Sample use: Summary Statistics, find MAX of a field, use **Get Field Value** to retrieve the value

- **Select Data**
  - Returns a child element

- **Collect Values**
  - Creates a multivalue, mainly used with iteration

Demo: Using **Get Field Value**
Demo: Model calling Model
Documenting tools

• Right-click your tool and click Item Description
• Content is used:
  - To generate side panel help
  - Full help documentation

Geoprocessing services

- Geoprocessing services are model or script tools
- Use ModelBuilder to configure the service
  - Decide what parameters to expose with the service
  - Convert Feature Classes and Feature Layers into Feature Sets
Geoprocessing service – the sandbox

Use %scratchworkspace% or %scratchworkspace%/scratch.gdb for all outputs
Web Clients only have a few simple data types

<table>
<thead>
<tr>
<th>Service Parameter Type</th>
<th>Corresponding JavaScript object</th>
<th>Corresponding Model variable type</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPBoolean</td>
<td>boolean</td>
<td>Boolean</td>
</tr>
<tr>
<td>GPDataFile</td>
<td>DataFile</td>
<td>File</td>
</tr>
<tr>
<td>GPDDate</td>
<td>Date</td>
<td>Date</td>
</tr>
<tr>
<td>GPDouble</td>
<td>Number</td>
<td>Double</td>
</tr>
<tr>
<td>GPFeatureRecordSetLayer</td>
<td>FeatureSet</td>
<td>Feature Set</td>
</tr>
<tr>
<td>GPRPRecordSet</td>
<td>FeatureSet</td>
<td>Record Set</td>
</tr>
<tr>
<td>GPLinearUnit</td>
<td>LinearUnit</td>
<td>Linear Unit</td>
</tr>
<tr>
<td>GPRasterData</td>
<td>RasterData</td>
<td>Raster Dataset</td>
</tr>
<tr>
<td>GPRasterLayer</td>
<td></td>
<td>Raster Layer</td>
</tr>
<tr>
<td>GPString</td>
<td>string</td>
<td>String</td>
</tr>
</tbody>
</table>
Session evaluation – on-line

• www.esri.com/sessionevals
Questions?