Building tools with ModelBuilder

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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
  - 10.1
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 workflow 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)

Documentation: [A quick tour of creating custom tools](#)
ModelBuilder macro vs tool

- **Macro** – can only be run within ModelBuilder

- **Tool** – can be run using the tool dialog
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

Documentation:  

A quick tour of creating tools with ModelBuilder

Tutorial: Creating tools with ModelBuilder
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 ModelBuilder **macro** into a model **tool**
• 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
Demo: making a model tool from a model macro
Demo review

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

A quick tour of creating tools with ModelBuilder
Creating model parameters
A quick tour of filtering parameter values
A quick tour of setting output data symbology
A quick tour of managing model environments
Demo review: ModelBuilder has a split personality

- ModelBuilder used in two modes:
  - To create a **macro**
  - To create a **tool**
Demo: Model calling Model
Demo Review

• Yea, verily, models can call models
  - Done all the time
• Only works if sub-model has parameters
Intermediate data
Intermediate data

- Not needed once the model tool finishes execution
- By default, all non-parameter data variables are intermediate
  - For debugging purposes, you can uncheck Intermediate
Performance: in_memory workspace

• Write intermediate data to the in_memory workspace
• Syntax: in_memory/<name>
Rules for in_memory workspace

• Can contain only simple feature classes and tables
• `in_memory` is a geodatabase workspace
  - You cannot enter `in_memory/temp.shp`
• No subfolders
  - Wrong: `in_memory/planA/identityPoints`
• Use caution for large amounts of data
Feature Sets

Interactive entry of features
Feature and record sets

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

Documentation:  
A quick tour of using Feature Set and Record Set
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

- Feature sets are written to computer memory

- Use the **Copy Features tool** to copy the in-memory feature set to disk
Variable substitution

%percent%percent%
Variable substitution

- Primarily used for:
  - Building query expressions
  - Simple calculations
  - Specifying output locations
- Also known as “inline variable substitution”

Documentation:  
A quick tour of using inline variable substitution
Examples of inline model variable substitution
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
  - ""%Senior Center 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)

**Documentation:**  
*A quick tour of using preconditions*  
*Using If-Then-Else logic for branching*
Demo: Branching
Demo Review

- Used **Calculate Value** to output a Boolean variable
  - This Boolean used as precondition
- 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

Documentation: A quick tour of using Model Only tools
Documenting tools

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

Session evaluation – on-line

www.esri.com/ucsessionssurveys

Wednesday Session ID: 698
Thursday Session ID: 865
Questions?