



The Value of Coding for GIS

49th Annual Alaska Surveying & Mapping Conference
February 19th, 2015

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PROFESSIONAL DEVELOPMENT

Encouraging innovative thinking



Welcome to GISPD.com

Our mission: We endeavor to support GIS professionals by providing informative resources on our website, organizing and participating in professional gatherings and conducting training events.

Upcoming Events

- FEB** The Value of Coding for GIS
- 18** Presentation to be given at the 49th Annual Alaska Surveying & Mapping Conference
- 2015** David Howes, David Howes, LLC



Contributors

- Bill Dollins - Zekiah Technologies, Inc.



- Jeff Berry - Erlandsen, Inc.



- Jason Pardy - NewfoundGEO Consulting



NewfoundGEO Consulting

- Aaron Paul - First American Title



First American

- Matt Stevenson - CORE GIS



- Eldan Goldenberg - DRiVEdecisions



- Karsten Vennemann - Terra GIS



- Mike McGuire - Ascent GIS, Inc.



- Igor Talpalatski - Azimetry



Python Scripting

```
Python
>>> # Import the arcpy and os modules.
... import arcpy
... import os
... # Input feature classes to buffer.
... inFCs = "C:/temp/VirtualCampus/PythonDesktop10/Data/Shapefiles/Schools.shp"
... # Output workspace.
... outWS = "C:/temp/VirtualCampus/PythonDesktop10/Data/Westerville.gdb"
... # Buffer distance.
... dist = 1000
... # Split input feature classes into separate feature classes.
... inFCs = inFCs.split(";")
... # Loop through each feature class and create buffers.
... for inFC in inFCs:
...     # Figure out the name of the output feature class.
...     (filePath, fileName) = os.path.split(inFC)
...     dotInd = fileName.find(".")
...     if dotInd <> -1:
...         newFC = fileName[0:dotInd]
...         outFC = newFC + "_buffer"
...     else:
...         outFC = fileName + "_buffer"
...     # Create the buffer feature class.
...     arcpy.Buffer_analysis(inFC, outWS + "\\\" + outFC, str(dist) + " Feet")
... 
```



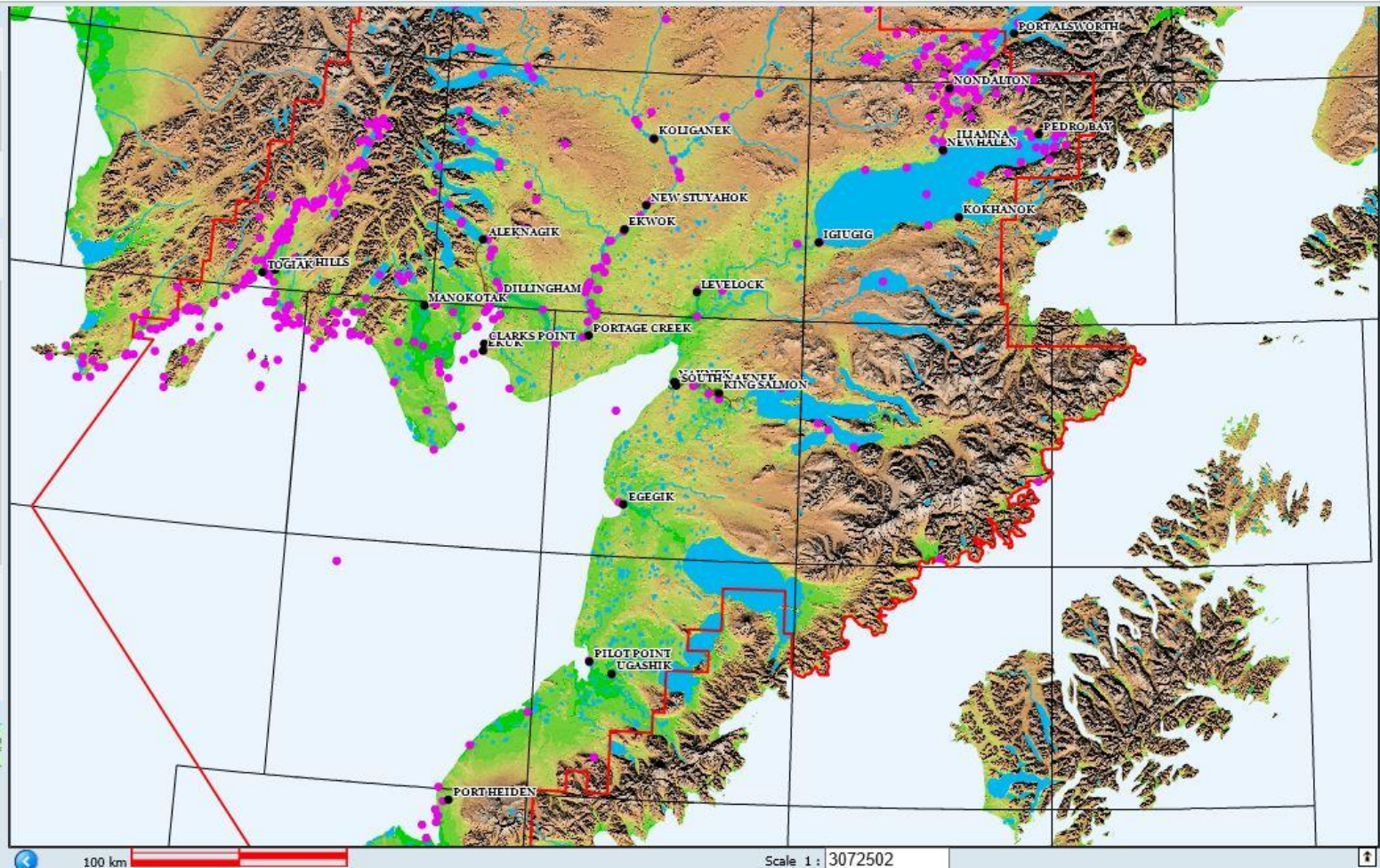
- Maps
- Native Place Names
 - Native Place Names
- Land Status

Legend

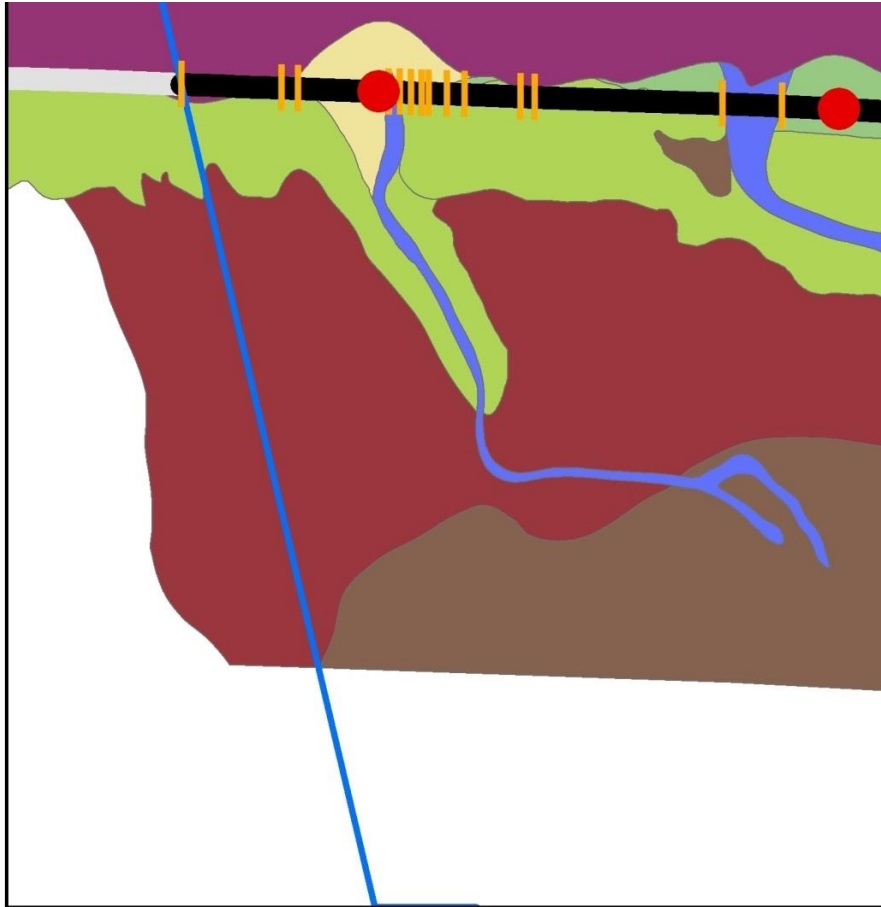
Display Order Groups

- Villages Labels
- Villages
- Native Place Names
- BBNC boundary
- USGS Quads
- Roads
- Orthophoto_Community
- Orthophoto_Area
- Topo Maps (1"=1mi.)
- Topo Maps
- Lakes
- Rivers area
- Rivers line
- Ocean
- Topography - shaded
- Alaska

Update Legend | Cancel Changes



.NET - Beyond Data-Driven Pages



LANDCOVER	Hab-Ba	Ea	A	Mpd	Faa
	Mpd	Faa Ea Mpd	Ea	Mpd	Mpd + Faa Hab-Ba If Gac
NOTES	Note 1				Note 2

Map Series Development Tools

Setup

Setup file path: C:\Temp\Map Series Dev Inputs.txt Select

Setup values:

Map document - C:\Temp\Demo\Demo.mxd
 Map data file geodatabase - C:\Temp\Demo\Demo.gdb
 Index layer - index_polygon
 Index layer group ID - 1
 Land cover route layer - landcover_alignment Update

Element Definition

Map: < > Update index only Current index: 21 Update Extent Set Map Index

Databand type: Land Cover Apply to all Build Load Delete

Adjust label position: Get Element Selected element name: <None selected>

Relative position: X adjustment factor: 1.00 Update

Y adjustment factor: 1.00

Element definition: Clear Save Dynamic text: Update Custom map center: Set Reset

Map Export

Start Index: End index: Set Current Map Output type: PDF Resolution: 300

Overwrite existing file Load data bands? Export Map(s) Reset

Messages Show Info Clear Messages Reset Form

What is “Coding”?

- See *How Coding Works*, [codeconquest.com](http://www.codeconquest.com)
<http://www.codeconquest.com/what-is-coding/how-does-coding-work/>
 - Simple - instructions that tell a computer what to do
 - Complex - binary sequences of 1s and 0s that turn transistors on and off
- Language types:
 - Low level languages - operate close to binary code (e.g., C++)
 - High level languages - operate far away from binary code (e.g., Python)
 - In between - e.g., C#, Visual Basic



Why Code?

“Coding is the hottest skill on the job market, the modern-day language of creativity, and a powerful force in the economy”

“coding is ... an innovative and artistic process”

Madeline McSherry, New America Foundation - *Why Everyone Should Learn to Code: An Event Recap*

http://www.slate.com/blogs/future_tense/2013/03/29/codecademy_hacker_school_why_everyone_should_learn_to_code.html



Why Should Coding Be Important?

- Personal development perspective

Why should coding be important to you?

- Professional growth
- Expanded toolbox
- Streamline workflows



- Policy perspective

Why should coding be important to your employer?

- Return on investment
- Standard operating procedures
- Leveraging/freeing up resources



Do You Need to Code?

- Not necessarily, but it can really help
- It depends on your job
 - Very valuable for analysts
 - Helpful for managers (increasing need to understand role of coding)



Levels of Coding

- **Scripting and tool development**
 - GIS analyst
 - E.g., data manipulation, map-making, glue code
- **Application development**
 - GIS developer
 - E.g., add-in, plugin
- **Software engineering**
 - Computer scientists/IT professionals
 - E.g., Microsoft Office

Industry Needs

See *Yes, You Need to Code* - Bill Dollins, geoMusings.com



“I am very publicly on the record that I think some form of coding skill is essential for any GIS analyst entering the workforce today”

GEOSPATIAL

YES, YOU NEED TO CODE

🕒 JANUARY 30, 2013 👤 BILL DOLLINS

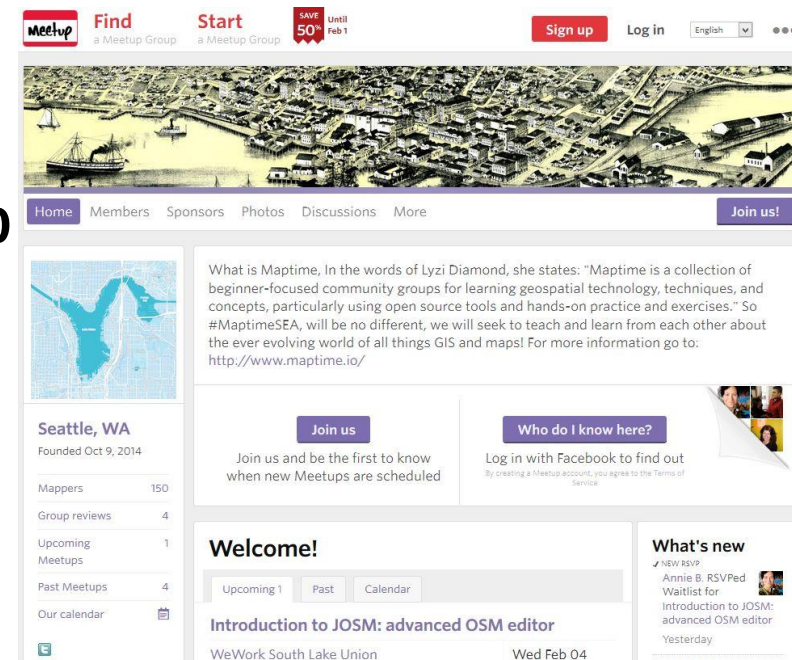
Over the past year, I've been involved in searching for GIS analysts a number of times. As a result, I've noticed a few patterns:

<http://blog.geomusings.com/2013/01/30/yes-you-need-to-code/>

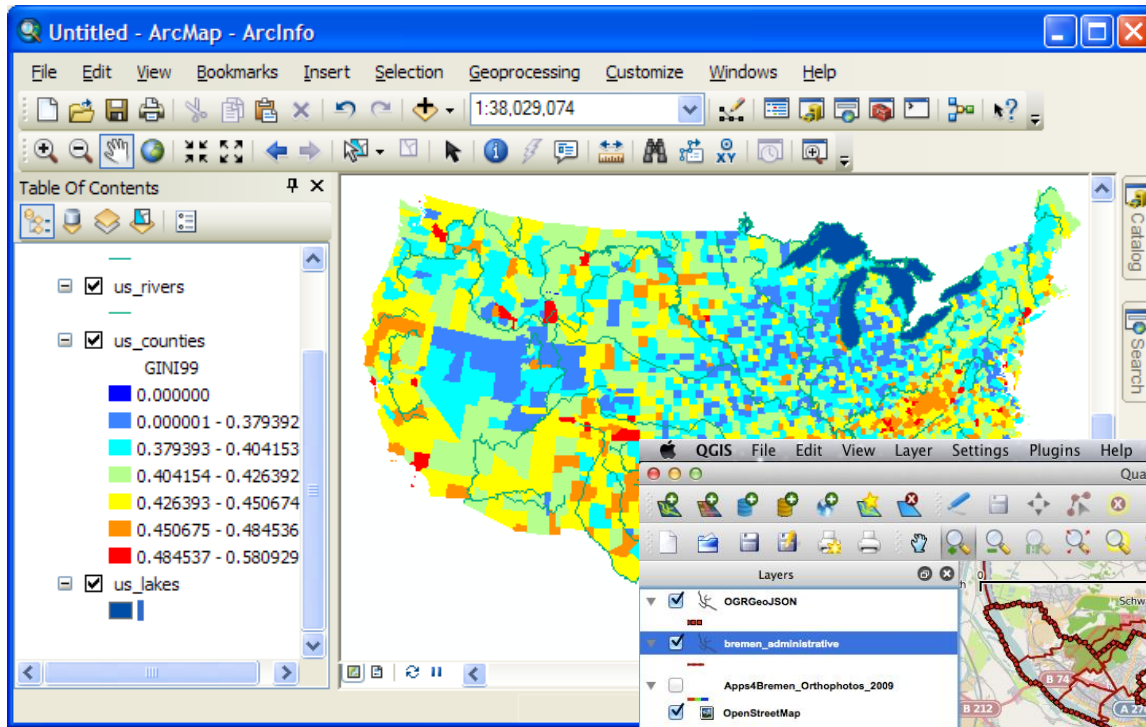


Technology Trend

- Coding has always been valuable for GIS
- Increasing emphasis on coding
- Example: MapTime Seattle (Meetup group)
 - Making a web page and a web map (HTML5, CSS, JavaScript, Leaflet.js)
 - Git & GeoJSON
 - Mapping with D3.js



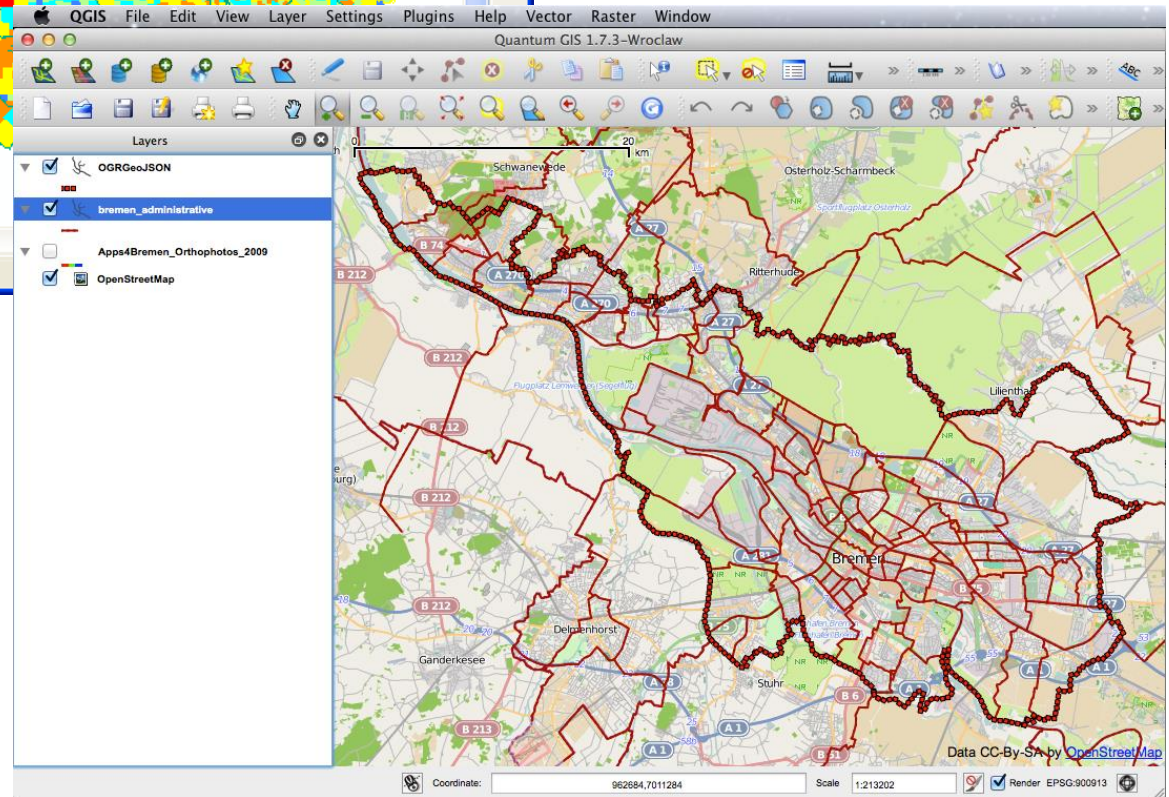
The screenshot shows the Meetup page for MapTime Seattle. The page features a header with navigation links (Home, Members, Sponsors, Photos, Discussions, More) and a 'Join us!' button. A large aerial photograph of Seattle is displayed at the top. Below the photo, there is a section titled 'Seattle, WA' with a small map and statistics: 'Founded Oct 9, 2014', 'Mappers: 150', 'Group reviews: 4', 'Upcoming Meetups: 1', and 'Past Meetups: 4'. The main content area includes a 'Welcome!' section with a 'Join us' button and a 'Who do I know here?' section with a 'Log in with Facebook' button. A 'What's new' section on the right highlights a recent event: 'Introduction to JOSM: advanced OSM editor' by Annie B. RSVPed, which took place at WeWork South Lake Union on Wednesday, February 4th.



“software tools expose less than 10% of their full capability through their default interfaces”

Bill Dollins, geoMusings - *Yes, You Need to Code*

Being able to take advantage of extensibility options can really set you apart as a GIS professional



Coding Types

- Programming

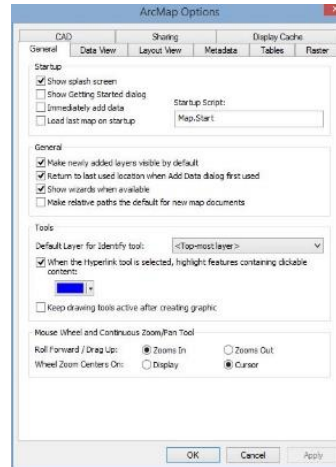
- Creating an executable formulation of a computing problem

(http://en.wikipedia.org/wiki/Computer_programming)

- Scripts, programs, add-ins/plugins

- Configuration

Setting values to adjust base functionality



- Customization

- Either
- Hybrid

```
private void LoadLayerNames()
{
    //3/6/14

    try
    {
        //Get layer names for data frame
        if (cboDataFrame.SelectedItem == null)
        {
            return;
        }

        string dataFrameName = cboDataFrame.SelectedItem.ToString();

        //Get layer names
        Utils.ArcGIS.MapDocument mapDocumentUtils = new Utils.ArcGIS.MapDocument();
        List<string> layerNames = mapDocumentUtils.GetLayerNamesForDataFrame(dataFrameName);
        mapDocumentUtils = null;
        if (MessageHandler.StopForMessage())
        {
            throw new System.InvalidOperationException();
        }

        _LayerNames.Clear();
        for (int i = 0; i < layerNames.Count; i++)
        {
            _LayerNames.Add(layerNames[i]);
        }

        if (_LayerNames.Count > 0)
        {
            cboLayerName.Text = "<select a layer>";
        }
    }
    catch (Exception exception)
    {
        string methodName = System.Reflection.MethodBase.GetCurrentMethod().Name;
        int messageCode = 0;
        MessageHandler.CreateMessageDetails(methodName, messageCode, exception);
    }
}
```

```
<ESRI.Configuration xmlns="http://schemas.esri.com/Desktop/AddIns"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <Name>Field Update Tool</Name>
  <AddInID>{66a7514a-3b68-4f83-93d8-11a07d02a8ef}</AddInID>
  <Description>Tool for updating attribute table field values.</Description>
  <Version>1.0</Version>
  <Image>Images\FieldUpdateTool.png</Image>
  <Author>David A. Howes</Author>
  <Company></Company>
  <Date>4/29/2014</Date>
  <Targets>
    <Target name="Desktop" version="10.2" />
  </Targets>
  <AddIn language="CLR" library="FieldUpdateTool.dll" namespace="FieldUpdateTool">
    <ArcMap>
      <Commands>
```

Importance of Coding

“If you choose to get by with just using the GUI tools, you are doing yourself two disservices:

- 1. You are placing yourself at the mercy of others who can code to get around to building the customizations you need.**
- 2. You are allowing your skills to erode by not using a significant amount of capability.”**

Bill Dollins, geoMusings - *Yes, You Need to Code*

“If you don’t code you risk settling for what you’re given, which may not be the best solution for the task at hand”

Ralph Straumann, in response to *Yes, You Need to Code*



Benefits of Coding

1. Satisfaction
2. Efficiency
3. Repeatability & validation
4. Freedom
5. Enablement
6. Creativity
7. Clarity & logic
8. Documentation & organization
9. Integration & interoperability
10. Employability

Benefits of Coding - Efficiency

- **Tasks can be quantified**
 - Level of effort
 - Cost
 - Value
- **Justifies creation of streamlining tools and processes**



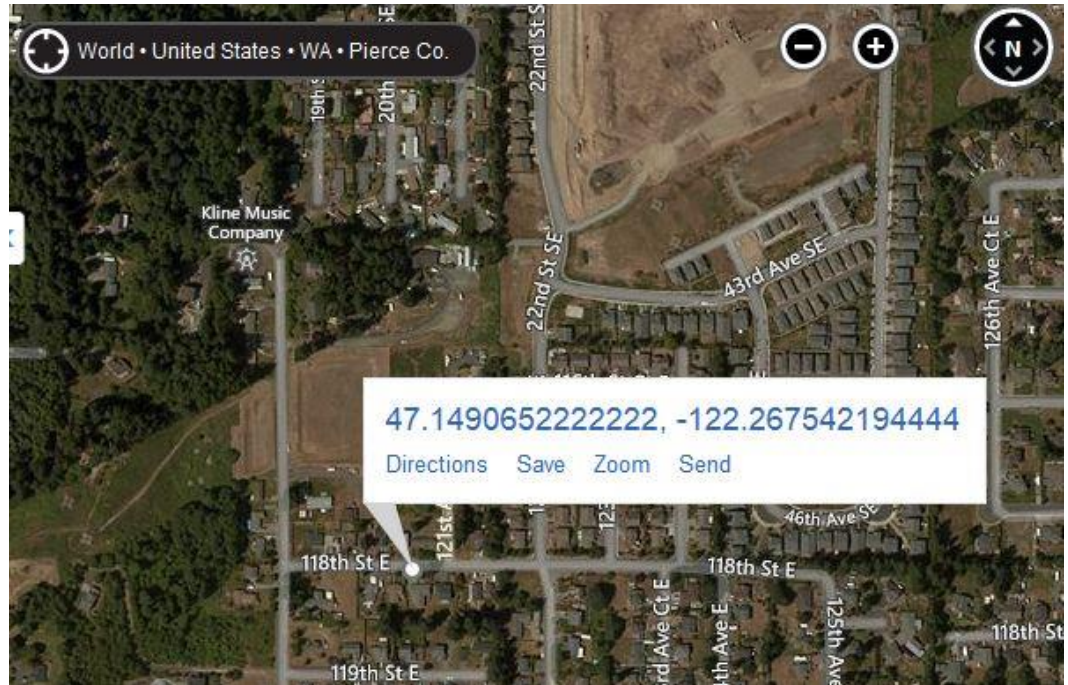
Copy Map Point Tool (Python Add-In)



47 8 56.6348 N, 122 16 3.1519 W



```
56 class CopyMapPoint(object):
57     """Implementation for CopyMapPoint_addin.copy_map_point (Tool)"""
58     def __init__(self):
59         self.enabled = True
60         self.cursor = 3
61
62     def onMouseDownMap(self, x, y, button, shift):
63         """Copies map x,y to the clip board in degrees, minutes, seconds."""
64
65         # Get the spatial reference from the data frame.
66         mxd = arcpy.mapping.MapDocument('current')
67         map_sr = mxd.activeDataFrame.spatialReference
68
69         # Get the clicked point and reproject it.
70         map_point = arcpy.PointGeometry(arcpy.Point(x, y), map_sr)
71         wgs84_sr = arcpy.SpatialReference(4326)
72         transformation = arcpy.ListTransformations(map_sr, wgs84_sr)
73         if transformation:
74             wgs84_pt = map_point.projectAs(wgs84_sr, transformation[0])
75         else:
76             wgs84_pt = map_point.projectAs(wgs84_sr)
77
78         # Set the hemisphere indicators.
79         if wgs84_pt.firstPoint.X > 0:
80             east_or_west = 'E'
81         else:
82             east_or_west = 'W'
83         if wgs84_pt.firstPoint.Y < 0:
84             south_or_north = 'S'
85         else:
86             south_or_north = 'N'
87
88         # Get the lat/long values in the required format.
89         x_dms = dd_to_dms(wgs84_pt.firstPoint.X)
90         y_dms = dd_to_dms(wgs84_pt.firstPoint.Y)
91         add_to_clip_board("{} {} {} {} {} {}".format(x_dms[0], x_dms[1], x_dms[2], east_or_west, y_dms[0], y_dms[1], y_dms[2]))
92
93         # Our new wrapped versions of os.startfile and webbrowser.open
94         startfile = run_in_other_thread(os.startfile)
95         open_browser = run_in_other_thread(webbrowser.open)
96         open_browser("www.maps.google.com")
```





Resources

You are here: [Home](#) > [Resources](#)

Presentations

#	Date	Presenter(s)	Title	Type/Venue
1	10/15/14	Howes, D.A. and Pardy J. 2014.	<i>Extending ArcGIS for Desktop: Python and .NET Add-Ins in a Nutshell</i> (abstract)	Session conducted at 2014 Northwest GIS Conference, Lynnwood, Washington, USA
2	10/20/14	Howes, D.A. and Stevenson M. 2014.	<i>Opening the Door to Open Source GIS</i> (abstract)	Session conducted at 2014 Northwest GIS Conference, Lynnwood, Washington, USA

Code Samples

#	Date	Item	Type	Description	Download Link
1	10/20/14	Get Map Point Tool	.NET	ArcMap 10.2 .NET (C#) add-in tool to allow the user to click on the map and obtain a lat/long string representing the clicked location. Based on a code snippet created for a client project and used with permission.	GetMapPoint
2	10/20/14	Copy Map Point Tool	Python	ArcMap 10.2 Python add-in tool to allow the user to click on the map and obtain a lat/long string representing the clicked location.	CopyMapPoint



ArcMap Field Update & Feature Navigation Tools (.NET Add-Ins)

The screenshot shows the 'Field Update Tool' dialog box. It has a title bar with a close button. The main area is titled 'Field Value Update'. It contains several dropdown menus: 'Data frame:' set to 'Layers', 'Layer:' set to 'WA_Counties', and 'Destination field:' set to 'COUNTY'. Below these, it shows 'Field Type: String' and 'Length: 50'. There are two radio buttons: 'Provide value' (unselected) and 'Copy field' (selected). Below that is a 'Source field:' dropdown set to 'FIPS'. At the bottom, there are two radio buttons: 'Selected records' (selected) and 'All records' (unselected). There are two buttons: 'Apply to Selected Records' and 'Undo'. At the bottom of the dialog, there is a 'Messages' section with a text box containing the message: '1/31/2015 9:40:28 AM Apply to Selected Records 4 records updated.' Below the messages are two buttons: 'Clear Messages' and 'Reset Form'.

The screenshot shows the 'Feature Navigation Tool' dialog box. It has a title bar with a close button. The main area is a listbox containing a list of county names: Adams, Asotin, Benton, Chelan, Clallam, Clark, Columbia, Cowlitz, Douglas, Ferry, Franklin, Garfield, Grant, Grays Harbor, Island, and Jefferson. Below the listbox are two buttons: '<' and '>'. There are three checkboxes: 'Apply Definition Query' (unchecked), 'Select Feature(s)' (unchecked), and 'Allow Multi-Select' (unchecked). Below these are three buttons: 'Select Multiple on Map', 'Zoom to Selection', and 'Map > Listbox'. Below that are two buttons: 'Get Map Selection' and 'Clear Definition Query'. At the bottom is a button: 'Reset Tool'.

Extending ArcGIS for Desktop Using Python and .NET Add-Ins, 2014 Washington GIS Conference

<http://gisspd.com/training>

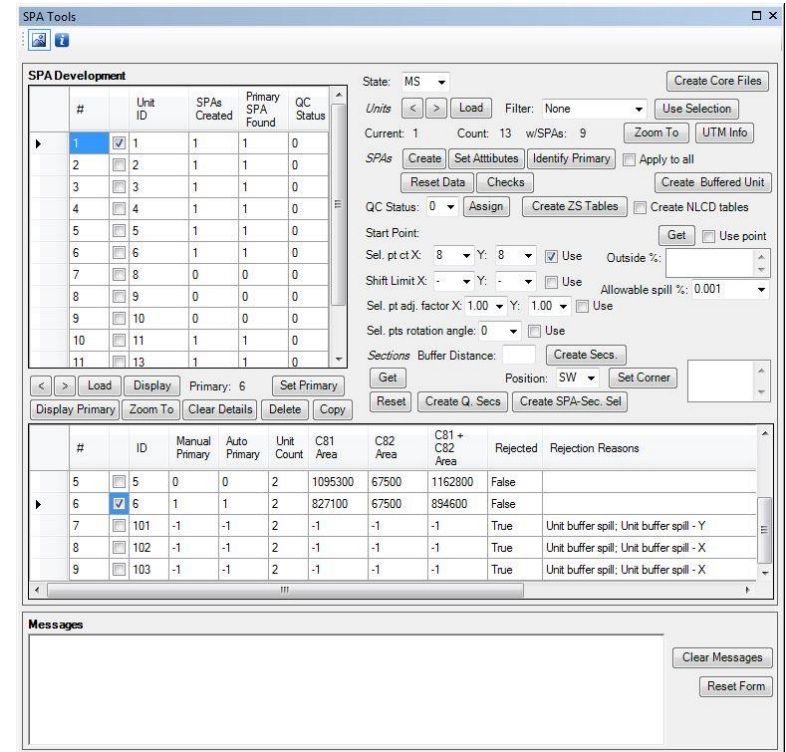
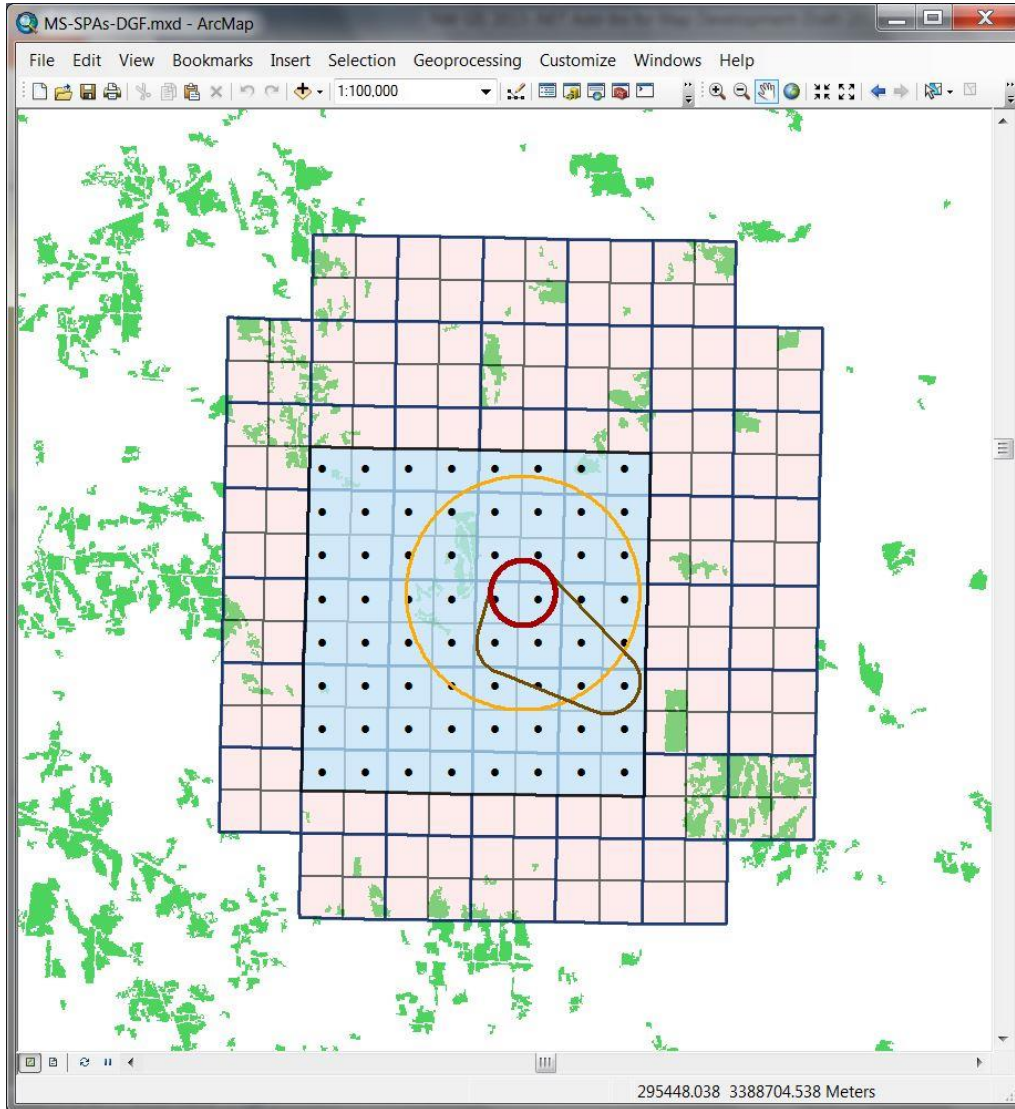
Benefits of Coding - Repeatability & Validation

- Allow for re-running processes and custom validation procedures
- Increases confidence in methods and results
- Crash-resistant processing

E.g., Species Protection Area tools



Species Protection Area Tools



.NET add-in & external code

Species Protection Area Tools - Operation

The SPA Development tool interface includes a table of units and various configuration options. The table below shows the unit details:

#	Unit ID	SPAs Created	Primary SPA Found	QC Status
1	1	1	1	0
2	2	1	1	0
3	3	1	1	0
4	4	1	1	0
5	5	1	1	0
6	6	1	1	0
7	8	0	0	0
8	9	0	0	0
9	10	0	0	0
10	11	1	1	0
11	13	1	1	0

Configuration options include State (MS), Units (Current: 1, Count: 13, w/SPAs: 9), and various buttons for creating and managing SPA files.

Log File-SPAs.txt

```

1
2
3
4
5
6
7
8
    
```

Log file

Setup file location file

SPATools-Setup File Location.txt

```

C:\Temp\SPAs\SPATools Inputs-MS.txt
C:\Temp\SPAs\SPATools Inputs-AL.txt
C:\Temp\SPAs\SPATools Inputs-MO.txt
C:\Temp\SPAs\SPATools Inputs-GA.txt
    
```

Setup file

SPATools Inputs-MS.txt

```

StateCode | MS
DataFrameName | Layers
UTMZoneName | 16N
UnitFileGDBPath | C:\Temp\SPAs\Dusky Gopher Frog.gdb
UnitFeatureClassName | DuskyGopherFrog
UnitWhereClause | "UNIT_ID" > 0
UnitBufferDistanceMiles | 1.0
BufferedUnitFeatureClassName | BufferedUnit
SPAFileGDBPath | C:\Temp\SPAs\MS-SPAs.gdb
SPAFeatureClassName | SPA
SelPtsFeatureClassName | SelectionPoints
BufferedUnitLLCornerPointFeatureClassName | BufferedUnitLLCornerPoint
SPALogFilePath | C:\Temp\SPAs\Log File-SPAs.txt
SPAAttributesLogFilePath | C:\Temp\SPAs\Log File-SPA Attributes.txt
SPANLCDFileGDBPath | C:\Temp\SPAs\MS-NLCD.gdb
SPANLCDPrepFileGDBPath | C:\Temp\SPAs\MS-NLCD-Prep.gdb
SectionFileGDBPath | C:\Temp\SPAs\PLSS.gdb
SectionFeatureClassName | GIS_PLSSSection_poly_UTM16
UnitQSecFileGDBPath | C:\Temp\SPAs\MS-Quarter Sections.gdb
UnitSectionFeatureClassName | UnitSections
UnitSectionSelectionBufferMeters | 1700
UnitSectionLogFilePath | C:\Temp\SPAs\Log File-Sections.txt
UnitSectionPointsFeatureClassName | UnitSectionPoints
UnitSectionCornerPointsFeatureClassName | UnitSectionCornerPoints
UnitQSecFeatureClassName | UNITQuarterSections
UnitQSecCornerPointsFeatureClassName | UnitQSecCornerPoints
MinNumSelPtsX | 6
MinNumSelPtsY | 6
UnitQSecAllLogFilePath | C:\Temp\SPAs\Log File-Quarter Sections-All.txt
UnitQSecSuccessLogFilePath | C:\Temp\SPAs\Log File-Quarter Sections-Success.txt
UnitQSecFailureLogFilePath | C:\Temp\SPAs\Log File-Quarter Sections-Failure.txt
NLCDFileGDBPath | C:\Business\Projects\Monsanto\ES_Support-201308\Data\NLCD\NLCD_2006.gdb
NLCD11RasterName | C11
NLCD18RasterName | C18
NLCD82RasterName | C82
    
```

Name	Date modified	Type	Size
Code	10/13/2013 2:17 PM	File folder	
MS-Quarter Sections.gdb	10/13/2013 2:25 PM	File folder	
MS-SPAs.gdb	10/13/2013 2:25 PM	File folder	
MS-SPAs-DGF.mxd	10/13/2013 1:18 PM	ArcGIS ArcMap Document	2,439 KB
SPAs-MS-DGF-20131013-1420.zip	10/13/2013 2:20 PM	Compressed (zipped) Folder	1,078 KB
SPATools Inputs-MS.txt	10/13/2013 2:11 PM	TXT File	2 KB
SPATools-20131013-1415.esriaddin	10/13/2013 1:18 PM	Esri AddIn File	265 KB

Benefits of Coding - Freedom

- Work with command line
- Build sequences of instructions using libraries of functions, e.g., GDAL
- Build your own...



Benefits of Coding - Enablement

- Learning to code
 - Opens new doors
 - Advance your professional capabilities
 - Increases your standing
- Access (more) open source options
- Open source experience makes you a better proprietary software user

See

- *Opening the Door to Open Source GIS*
- *Explorations into Open Source GIS*
- *Treading Into Open Source GIS*

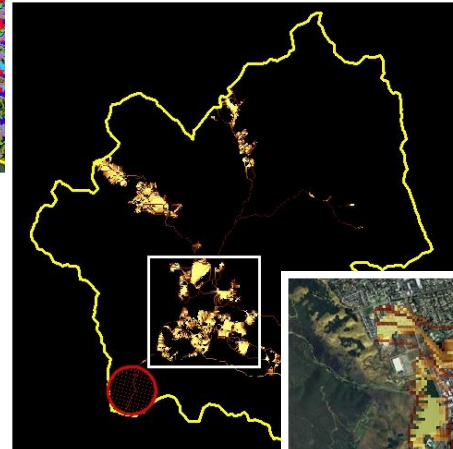
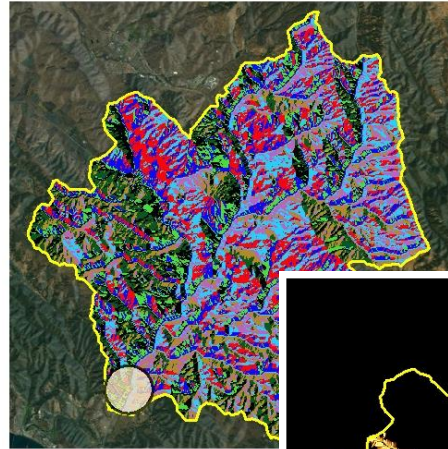
<http://dhowes.com/presentations>, <http://gispd.com/events>



Benefits of Coding - Creativity

- Required functionality may not exist
- Develop new processes, & procedures

E.g., extended flow accumulation computation



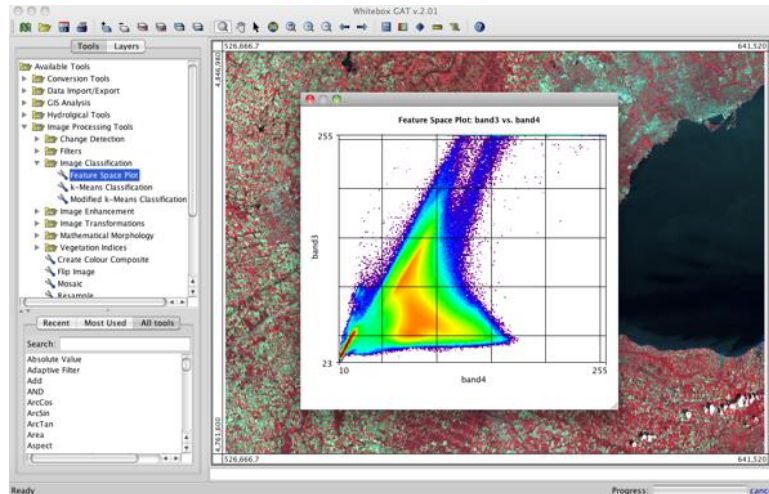
See *The Value of Automation: Geoprocessing with .NET and ArcObjects*, 2008 Washington GIS Conference

<http://dhowes.com/presentations>

Benefits of Coding - Clarity & Logic

- Coding helps you think clearly and logically about problems
- Understand what's really happening under the hood

E.g., Whitebox



<http://www.uoguelph.ca/~hydrogeo/Whitebox/index.html>



Benefits of Coding - Documentation & Organization

- Create a record of actions
- Allow for reproduction of results at any time
- Build a repository of methods

See

How Good are Your Data and Analyses? Communicating Quality. Part 3 of 3: Analysis, 2014 Washington GIS Conference

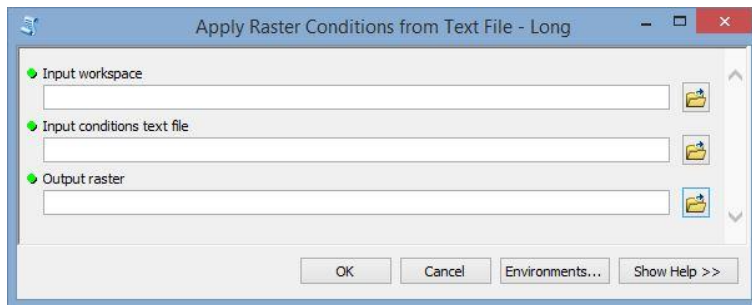
<http://dhowes.com/presentations>



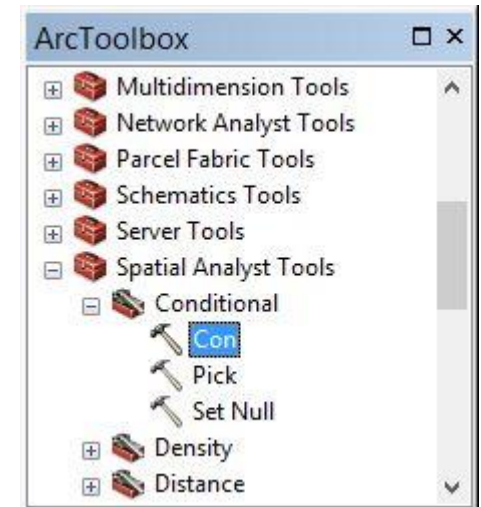
Benefits of Coding - Integration & Interoperability

- Don't come to a halt if a few core programs won't do everything you need them to do
- Bring together the best of all worlds

E.g., using data from R in ArcMap



```
sh_model_long.txt
1) root 281 21.36000 0.32300
2) BGW3_MEAN < 92.6113 41 1.37700 0.86840
4) BGW3_MEAN < 85.7 21 0.08730 0.97510 *
5) BGW3_MEAN > 85.7 20 0.79970 0.75640
10) BGW2_MEAN < 115.375 13 0.32090 0.84450 *
11) BGW2_MEAN > 115.375 7 0.19050 0.59280 *
3) BGW3_MEAN > 92.6113 240 5.70400 0.22980
6) BGW3_MEAN < 105.116 57 1.20900 0.39220
12) BGW1_MEAN < 143.755 47 0.88280 0.36490
24) BGW2_MEAN < 114.504 2 0.03632 0.63280 *
25) BGW2_MEAN > 114.504 45 0.69660 0.35300 *
13) BGW1_MEAN > 143.755 10 0.12690 0.52050 *
7) BGW3_MEAN > 105.116 183 2.52300 0.17920
14) BGW4_MEAN < 158.219 132 1.52700 0.21660 *
15) BGW4_MEAN > 158.219 51 0.33520 0.08251 *
```



Benefits of Coding - Employability

- Look at most GIS analyst job openings?
- Ability to code demonstrates interest in
 - Your career
 - Advancing yourself
 - Investing in your capabilities
- Demonstrates appreciation for GIS investment



Coding Recommendations - 1

- Start small
- Be realistic & don't overdo it
- Resist the temptation to start coding too soon

Help others and learn from them

Coding Recommendations - 2

- Be persistent
- Keep plenty of backups
- Use code storage systems (repositories)
E.g., Subversion, GitHub



Coding Recommendations - 3

- Consider re-use and readability
 - By yourself
 - By others

- Keep code neat, simple, clean

- Use plenty of comments

```
//This comment will save me a lot of grief later
```

Coding Recommendations - 4

Follow style standards

- Python PEP 8 Style Guide

<https://www.python.org/dev/peps/pep-0008/>

- C# Coding Conventions

<https://msdn.microsoft.com/en-us/library/ff926074.aspx>

- Conventions for your language of choice

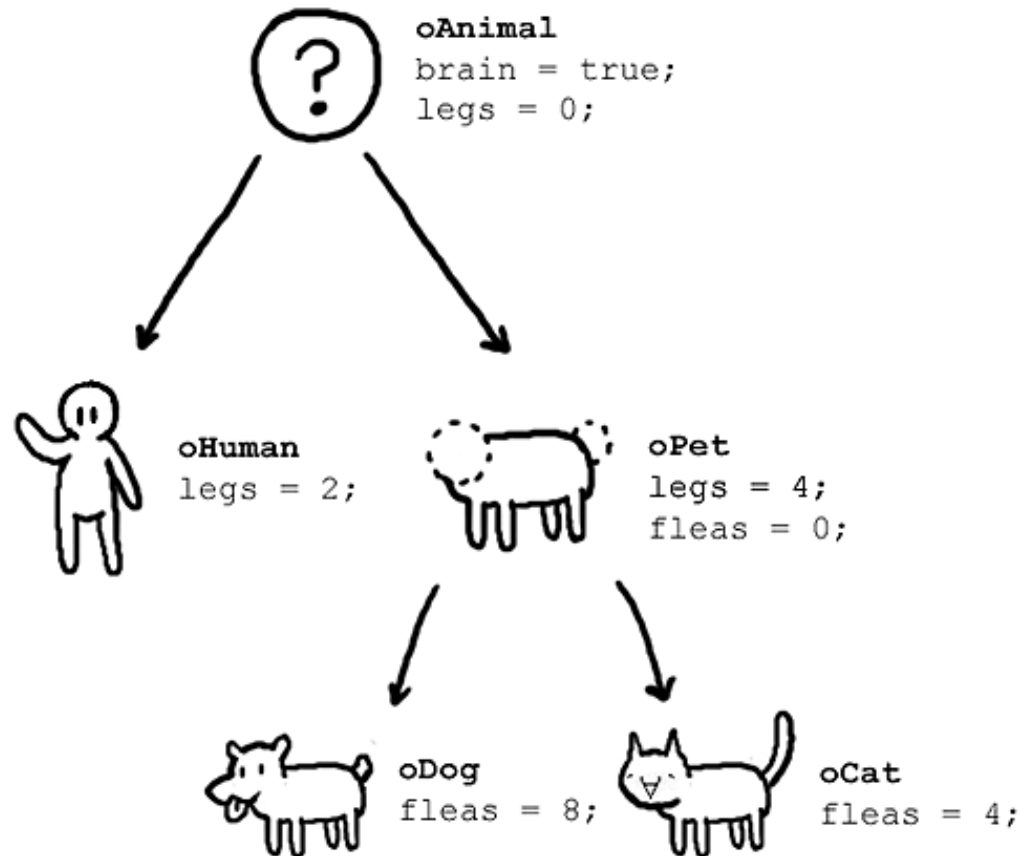


Coding Recommendations - 5

Think in terms of objects

Object-oriented code

- Professional
- Re-usable
- Clean



Coding Recommendations - 6

- Adopt a cookbook approach - create code “recipes”
- Get each piece working in turn
- Think of all the ways something can fail and cover for them as required

Coding Recommendations - 7

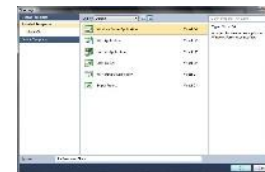
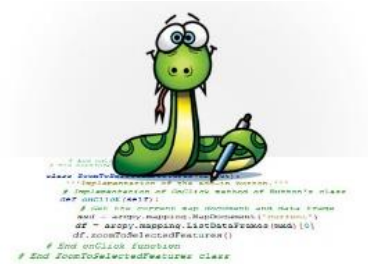
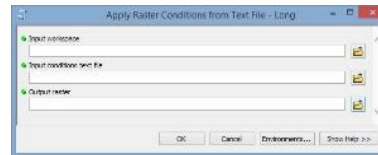
- Think about how your tools could be misused
- Handle errors cleanly
- Develop strong testing methodologies
E.g., unit tests



Path for Growth - ArcGIS for Desktop

- Python command line in ArcMap
- Standalone Python scripts
- Create a geoprocessing tool
- Create a Python toolbox
- Create a Python add-in
- Create a .NET Windows form application
- Create a .NET ArcGIS for Desktop add-in

```
... # Run the Python script from the command line...
... # The following code will run the script from the command line...
... # The script will be run from the command line...
... # The script will be run from the command line...
... # The script will be run from the command line...
... # The script will be run from the command line...
... # The script will be run from the command line...
... # The script will be run from the command line...
... # The script will be run from the command line...
... # The script will be run from the command line...
... # The script will be run from the command line...
```



Path for Growth - Open Source GIS

- Write a spatial SQL query

<http://postgis.net/>



- Write a Python script that uses the GDAL library

<http://www.gdal.org/>



- Create a Leaflet.js (JavaScript) webmap

<http://leafletjs.com/>



- In QGIS

- Write a Python script
- Create a Python plugin

- <http://plugins.qgis.org/>

- http://www.qgisworkshop.org/html/workshop/plugins_tutorial.html



Resources

- Interactive Development Environments (IDEs)
 - [PyScripter](#)
 - [Microsoft Visual Studio 2012 Express](#)
 - [Eclipse](#)
- [Esri ArcGIS Resource Centers](#)
- Open source GIS help pages
- Blogs (e.g., [geoMusings](#), [GISPD.com](#))
- [FOSS4G](#)
- [GISPD.com](#)
- [MapTime Seattle](#) (Meetup group)
- [CUGOS.org](#)



Education

- University of Alaska Anchorage - Geomatics
<http://www.uaa.alaska.edu/geomatics/>
- King County GIS Center
<http://www.kingcounty.gov/operations/GIS.aspx>
- Coursera
<https://www.coursera.org/>
- edX
<https://www.edx.org/>
- Penn State
<http://open.ems.psu.edu/courseware>
 - GEOG485 GIS Programming and Automation
 - GEOG585 Open Web Mapping
- GISPD.com
<http://gispd.com>
 - Extending ArcGIS for Desktop Using Python and .NET Add-Ins
 - Extending ArcGIS for Desktop with Python and .NET: Geoprocessing Tools and Add-Ins



Questions?

Slides available at <http://gispd.com/events>



Thanks for Coming

Please Stay for

**The (not so) Secret (but very necessary) Skills
of GIS Professionals**

Slides available at <http://gisspd.com/events>



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