Historical lava flows are shown in red.

Prominent terraces - orange and yellow - illustrate the larger size of the islands in the past.

Fields of blocky debris, such as Ko'olau's Nu'uanu Slide, were created by catastrophic landslides, which carried large parts of some volcanoes as much as 200 kilometers across the seafloor.

By Barry W. Eakins and Joel E. Robinson.
Lecture 3

Tabular Data Design, Functions, Pitfalls

But first........
Housekeeping

Lab is Long

Quiz on November 22 – Vacation Plans

October 11th = Project Progress Report
Develop your question

Est. the Significance

Identify the data layers you would need to answer the question

ASK the Geographic Question

ACQUIRE the resources / data

EXPLORE Geographic Data

ANALYZE the Data

ACT on the Knowledge
Develop Your Question(s)

• Where is the best place in Anytown, USA to locate an outdoor fitness trail?

• Is the distribution of health clinics in Anytown accessible to low-income residents? What can be done to improve access?

• What is the favored habitat of the Ring-tailed lemur? Are these habitats decreasing? Why?

• What will the local reservoir look like if it is drawn down to treat for milfoil infestation? How much water is removed? Where are we going to put the water that is drained? How much is it going to cost to transport it?

What Data (spatial and non-spatial) Is Needed
Tips of the Day

Making other data types visible in ArcCatalog

Editing Legends

Positioning Data Frames

Adding Base Maps from the Cloud
Functions

• Contain all the information about geographic features
• Symbology
• Labeling
• Queries
• Create spatial data (coordinates, addresses)
• Augment spatial data
• Create reports
• Create graphs
• Hyperlinks (images, web sites, macro)

Formats (Vector)

• Shapefile: dBase IV (.dbf)
• Coverage: INFO (.pat, .aat)
• Geodatabase: unique (.gdbtable)
Components

- One record for every feature
- FID / Object ID / ID
FID and ObjectID Fields

- Fields maintained by ArcGIS
- Guarantee unique IDs for each row in the table

Shape Field

- Holds the actual shape of the feature
To See Format of An Existing Attribute (Column / Field)

ArcCatalog
File Name > Properties > Fields

ArcMap
Attribute Table > Right click attribute > Properties
Right click Layer > Layer Properties > Fields

Alias – you can “display” a column heading by a different title does not change the storage
Attribute Tables.....
Format of Attributes (Columns / Fields)

1. Qualitative (Descriptive/Categorical)
   a) Text
      • Long enough to accommodate longest value (default = 50)
      • All text
      • Numeric
      • Alphanumeric

Table

<table>
<thead>
<tr>
<th>FID</th>
<th>Shape</th>
<th>ID</th>
<th>SECCLASS</th>
<th>NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>Point</td>
<td>10144074</td>
<td>UNCLASSIFI</td>
<td>WATCH HILL FIRE DEPARTMENT</td>
</tr>
<tr>
<td>36</td>
<td>Point</td>
<td>10143984</td>
<td>UNCLASSIFI</td>
<td>PROVIDENCE FIRE DEPARTMENT ENGINE COMPANY 7/ LADDER COMPANY 4/ RESCUE 5</td>
</tr>
<tr>
<td>37</td>
<td>Point</td>
<td>10144046</td>
<td>UNCLASSIFI</td>
<td>PAWTUCKET FIRE DEPARTMENT STATION 3</td>
</tr>
<tr>
<td>38</td>
<td>Point</td>
<td>10144018</td>
<td>UNCLASSIFI</td>
<td>PAWTUCKET FIRE DEPARTMENT STATION 1</td>
</tr>
<tr>
<td>39</td>
<td>Point</td>
<td>10143977</td>
<td>UNCLASSIFI</td>
<td>PROVIDENCE FIRE DEPARTMENT HEADQUARTERS</td>
</tr>
<tr>
<td>40</td>
<td>Point</td>
<td>10143971</td>
<td>UNCLASSIFI</td>
<td>NORTH SCITUATE FIRE DEPARTMENT</td>
</tr>
<tr>
<td>41</td>
<td>Point</td>
<td>10144054</td>
<td>UNCLASSIFI</td>
<td>WOONSOCKET FIRE DEPARTMENT STATION 1</td>
</tr>
<tr>
<td>42</td>
<td>Point</td>
<td>10144043</td>
<td>UNCLASSIFI</td>
<td>NORTH PROVIDENCE FIRE DEPARTMENT STATION 3</td>
</tr>
<tr>
<td>43</td>
<td>Point</td>
<td>10143962</td>
<td>UNCLASSIFI</td>
<td>NORTH PROVIDENCE FIRE DEPARTMENT STATION 4</td>
</tr>
<tr>
<td>44</td>
<td>Point</td>
<td>10143996</td>
<td>UNCLASSIFI</td>
<td>CUMBERLAND HILL FIRE DEPARTMENT</td>
</tr>
<tr>
<td>45</td>
<td>Point</td>
<td>10144052</td>
<td>UNCLASSIFI</td>
<td>WEST WARWICK FIRE DEPARTMENT STATION 3</td>
</tr>
<tr>
<td>46</td>
<td>Point</td>
<td>10143900</td>
<td>UNCLASSIFI</td>
<td>WEST WARWICK FIRE DEPARTMENT STATION 2</td>
</tr>
</tbody>
</table>
Attribute Tables....

Format of Attributes (Columns / Fields)

2. Quantitative (Measurement / Count)
   a) Short Integer: \(-32767 > 32767\) (no decimals)
   b) Long Integer: \(-2,147,483,648 > 2,147,483,648\) (no decimals)
   c) Float: 7 significant digits \(123456.7\) (up to 6 decimal places)
   d) Double: 15 significant digits \(5423049.230984\)
      (decimal places as needed)
Attribute Tables….

Format of Attributes (Columns / Fields)

2. Quantitative (Measurement / Count) - Continued

- Precision = the total number of digits you are going to need
- Scale = the total number of decimal places (be reasonable!)
Attribute Tables….  

**Format of Attributes (Columns / Fields)**

3. **Date**: dates/times, or dates and times. Format mm/dd/yyyy (useful for animations)

4. **Blob**: Binary Large Object
   - Only for a feature class inside a Geodatabase
   - You can’t “see” what this is without another piece of software

5. **Raster**: A picture
   - Only for a feature class inside a Geodatabase
   - Useful for inventories, etc.

6. **GUID**: Global ID
   - Only for a feature class inside a Geodatabase
   - Only for feature classes that might be edited simultaneously
Format of Attributes (Columns / Fields)

Considerations when choosing the type:

• Cannot be changed easily

• File size and speed

• Numbers stored as text cannot be used in calculations

• Numbers stored as text cannot be used to symbolize with graduated colors/symbols
Create Tables

ArcToolBox >

Data Management >

Table >

Create Table

Template or “Attribute Schema”
Create Tables

Export selected rows/columns from an existing table
Import / Read “External” Tables

From other software applications:

.dbf (dBase IV)
.csv (comma-delimited text)
.txt (tab-delimited text)
.mdb and .accdb (MS Access)
.xls and .xlsx – drill down to the Sheet
Import / Read “External” Tables

Microsoft Access Files

Requires an “OLE DB connection”
Import / Read “External” Tables

Microsoft Access Files
Import / Read “External” Tables

Microsoft Excel Files

.xls and .xlsx – drill down to the **Sheet**$
Attribute Tables.....

JOINS

• Augment the spatial data file with data from an external table
  • Symbolize, query, graph, report with attributes from external table
• Via a “Key Field”
  • Cell values must match exactly
• Temporary (within .mxd) or permanent (export to new spatial data file)
• One record to one record OR Many to One
Attribute Tables.....

**JOINS**

One record to one record

![Attribute Table](image)

<table>
<thead>
<tr>
<th>Shape</th>
<th>FID</th>
<th>County</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polygon</td>
<td>1</td>
<td>Atoka</td>
</tr>
<tr>
<td>Polygon</td>
<td>2</td>
<td>Kiowa</td>
</tr>
<tr>
<td>Polygon</td>
<td>3</td>
<td>Nowata</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>County</th>
<th>Rain</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atoka</td>
<td>1.80</td>
<td>10.16</td>
</tr>
<tr>
<td>Kiowa</td>
<td>2.94</td>
<td>13.67</td>
</tr>
<tr>
<td>Nowata</td>
<td>1.62</td>
<td>11.90</td>
</tr>
</tbody>
</table>

![External Table](image)

**ONE TO ONE**
Many Feature Records to One External Table Record

**JOINS**

Many records in the attribute table join to the same record from the external table.
Attribute Tables......

Relates

• Augment the spatial data file with data from an external table
  • Cannot Symbolize

• Via a “Key Field”
  • Cell values must match exactly

• Temporary (within .mxd)

• One to Many
What's wrong with this table?

<table>
<thead>
<tr>
<th>ParcelNumb</th>
<th>OwnerNm</th>
<th>OwnerAddress</th>
<th>PostalCode</th>
<th>ZoningCode</th>
<th>ZoningType</th>
<th>Date / AssessedValue</th>
</tr>
</thead>
<tbody>
<tr>
<td>673/100</td>
<td>Jeff Peters</td>
<td>10 Railway Cuttings</td>
<td>114390</td>
<td>2</td>
<td>Residential</td>
<td>2002 220000</td>
</tr>
<tr>
<td>673-101</td>
<td>Joel Campbell</td>
<td>1115 Center Place</td>
<td>114390</td>
<td>2</td>
<td>Residential</td>
<td>2003 545500</td>
</tr>
<tr>
<td>674-100</td>
<td>Dave Widseler</td>
<td></td>
<td>114391</td>
<td>3</td>
<td>Commercial</td>
<td>99 249000</td>
</tr>
<tr>
<td>674-100</td>
<td>D Widseler</td>
<td>452 Diamond Plaza</td>
<td>114391</td>
<td>3</td>
<td>Commercial</td>
<td>2000 275500</td>
</tr>
<tr>
<td>674-100</td>
<td></td>
<td>452 Diamond Plaza</td>
<td>114391</td>
<td>3</td>
<td>Commercial</td>
<td>2001 290000</td>
</tr>
<tr>
<td>670-231</td>
<td>Sam Camarata</td>
<td>19 Big Bend Bld</td>
<td>114391</td>
<td>2</td>
<td>Residential</td>
<td>2004 450575</td>
</tr>
<tr>
<td>674-112</td>
<td>Chris Capelli</td>
<td>Hastings Barracks</td>
<td>114392</td>
<td>2</td>
<td>Residential</td>
<td>2004 350000</td>
</tr>
<tr>
<td>674-113</td>
<td>Sheila Sullivan</td>
<td>10034 Endin Mansion</td>
<td>114391</td>
<td>2</td>
<td>Residential</td>
<td>02 1005425</td>
</tr>
</tbody>
</table>
Principles of efficient and effective database design
(your attributes)

1. Only one value in each cell at the intersection of a row and column

2. All values in a column are about the same subject

3. Determine ahead of time what “valid” entries are for categorical data
   - water vs. H2O vs. Hydro vs. Lake vs. Pond
   - medium vs. middle vs. kind of in the middle
4. Each row is unique – there are no duplicate records
   • Exception: if you can be happy with a “relate”
   • Consistent formatting

5. Watch out for typographical errors

OwnerNam Like Widseler vs. OwnerNam Like Widselor

6. Watch out for data entry errors

2 ≠ Residential
7. Attribute Headings:

- When importing, top row becomes attribute
- Short (10 characters or less for .dbf)
  - More for .txt *but* you cannot edit .txt files
    - Options -> Add Field will be grayed out
    - You’ll get a non-intuitive error message
  - Export to .dbf is okay, but long headings will be truncated or altered

- As Descriptive as possible
- Do not duplicate
- No spaces
- Do not start with a number
- No special characters
- Examples

  - % D.O. Vs. PctDO
  - Block group number Vs. BG_Num
8. Other:

- Eliminate borders, colors, shading, typeface (bold, italics, unusual fonts)
- Make sure you have saved and closed the table from any other applications before trying to add them to ArcMap
- Don’t leave Empty Cells