Introductory courses in Geographic Information Systems and cartography cover the fundamentals of map design. Students are given guidelines for producing a good map, but visual demonstrations are much more impressive. ArcView was used to produce illustrations of bad mapping practices and placed in a Microsoft PowerPoint presentation to demonstrate poor cartographic design. This booklet consists of a choropleth map showing the total number of registered automobiles, 33 variations of this map, and descriptions of common map layout and design errors. (BT)
Destroying the Art of Cartography: Teaching Illustrations Using ArcView

Dr. Miriam Helen Hill
Associate Professor
Department of Physical and Earth Sciences
Jacksonville State University
Jacksonville, Alabama 36265
mhill@jsucc.jsu.edu

Paper presented at the annual meeting of the Association of American Geographers,
New Orleans, Louisiana,
March 6, 2003.
Destroying the Art in Cartography: Teaching Illustrations Using ArcView, Miriam Helen Hill, Jacksonville State University

Introductory courses in GIS and cartography cover the fundamentals of map design. The students may be told guidelines for producing a good map, but visual demonstrations are much more impressive. ArcView was used to produce illustrations of bad mapping practices and placed in a PowerPoint presentation to demonstrate poor cartographic design.

The presentation, “Destroying the Art in Cartography: Mapping Don’ts,” consists of a choropleth map showing the total number of registered automobiles, thirty-three variations of this map, and descriptions of common map layout and design errors. This presentation will be available on line at http://www.jsu.edu/depart/geography/mhill/cart/badmaps.ppt.

cartography education, map design, layouts
Destroying the ART

in CARTOGRAPHY:

Mapping DON'TS

by Dr. Miriam Helen Hill

Jacksonville State University

Jacksonville, Alabama
The purpose of mapmaking centers upon the communication of spatial patterns.

This is best done by maps that have been carefully planned and designed.

Poor layout can destroy an otherwise high quality map product.
A choropleth map of the total number of registered automobiles illustrates errors in map layout and design.

First, the basic map.....

Note: The north arrow should be turned about 6°, and the legend labels should have been larger.
U.S. Automobile Registration: 1999

Number of Automobiles
classification by natural breaks

- 4341182 - 1885744
- 2520717 - 4011725
- 1559972 - 2285392
- 620131 - 1524434
- 195782 - 550537

02/13/01  Dr. M. H. Hill

data from WWW at: http://www.fhwa.dot.gov/ohim/hs99/mvpage.htm
mapped with ArcView GIS  Albers Equal Area Projection
The five map essentials for a good map are:

TITLE

LEGEND

SCALE

DIRECTION

DATE
Generally, the title should be large, bold, and centered above the map. In particular cases, a title may be below the map. Usually this indicates the title is of little importance. In special design cases, the title may be to the left or to the right. This must be done carefully and cautiously.
U.S. Automobile Registration: 1999

Number of Automobiles classification by natural breaks autos

- 4,118,292 - 18,857,441
- 2,541,777 - 2,611,725
- 1,559,972 - 2,285,292
- 620,121 - 1,524,224
- 195,782 - 550,537

data from WWW at: http://www.fhwa.dot.gov/ohim/hs99/mvpage.htm
mapped with ArcView GIS Albers Equal Area Projection

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The title should not be so large that it dwarfs or overpowers the map.

While it needs to be dark and strong, an excess also can overpower the map.
U.S. Automobile Registration: 1999

Number of Automobiles
classification by natural breaks
autos
434,118 - 1,685,741
252,071 - 401,172
155,997 - 226,592
820,131 - 1,524,422
196,762 - 500,937

data from WWW at: http://www.fhwa.dot.gov/ohim/his99/mvpage.htm
Excel file format at: http://www.fhwa.dot.gov/ohim/his99/excel/mv1.xls
mapped with ArcView GIS  Albers Equal Area Projection

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The font of the title should be plain rather than fancy or decorative. The character must be appropriate for the map.
Number of Automobiles
classification by natural breaks

- 434,119 - 1,685,744
- 252,071 - 401,723
- 155,997 - 228,392
- 82,013 - 152,424
- 19,782 - 55,057

data from WWW at: http://www.fhwa.dot.gov/ohim/hs99/mvpage.htm
mapped with ArcView GIS  Albers Equal Area Projection
The title should tell

WHAT

WHERE

and

WHEN
Number of Automobiles
classification by natural breaks

+54 1182 - 11657441
2520717 - 40 11726
1559972 - 2285292
620131 - 1524434
195782 - 550537

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data from WWW at: http://www.fhwa.dot.gov/ohim/hs99/mvpage.htm
mapped with ArcView GIS Albers Equal Area Projection
The legend should be clear and detailed with distinct categories and symbols.

An appropriate amount of generalization is needed.
**U.S. Automobile Registration: 1999**

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<table>
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Data from WWW at: http://www.fhwa.dot.gov/ohim/hs99/mvpage.htm
mapped with ArcView GIS  Albers Equal Area Projection

Dr. M. H. Hill 01/13/01
The legend should give needed details about the symbols and be clearly and easily legible.

It should describe what values are mapped and how these values were classified.
U.S. Automobile Registration: 1999

Data from WWW at: http://www.fhwa.dot.gov/ohim/hs99/mvpage.htm
mapped with ArcView GIS Albers Equal Area Projection
Conventional colors and symbols should be used.

The legend should promote visual harmony and balance.

White usually indicates a low value or no data.
U.S. Automobile Registration: 1999

Total Number of Cars

- Autos: 4341182 - 10057441, 2520717 - 4011725, 1550972 - 2285302, 195702 - 550537

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Data from WWW at: http://www.fhwa.dot.gov/ohim/hs99/mvpage.htm
mapped with ArcView GIS Albers Equal Area Projection
The legend should be placed in an area where it will not interfere with the map.
U.S. Automobile Registration: 1999

Number of Automobiles

- 
- 
- 
- 
- 

Data from WWW at: http://www.fhwa.dot.gov/ohim/hs99/mvpage.htm

mapped with ArcView GIS  Albers Equal Area Projection

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The legend should be prominent but peripheral on the map page.
U.S. Automobile Registration: 1999

Number of Automobiles
classification by natural breaks autos
434,1192 - 1,865,744 1
252,071 - 401,1725
125,9972 - 226,392
620,131 - 152,4424
195,782 - 550,537

data from WWW at: http://www.fhwa.dot.gov/ohim/hs99/mvpage.htm
mapped with ArcView GIS Albers Equal Area Projection
The scale should be given as a graphic scale, because reproduction will change the scale in the same order as it changes the map.

The graphic scale should be properly designed to facilitate use.

Verbal and RF scales, when given, should easily and clearly communicate to the map user.
The scale should have an appropriate boldness and not overpower the map.
U.S. Automobile Registration: 1999

Number of Automobiles classification by natural breaks

- 304,182 - 1,805,761
- 220,717 - 304,181
- 155,997 - 220,716
- 62,311 - 155,996
- 195,762 - 550,527

data from WWW at: http://www.fhwa.dot.gov/ohim/hs99/mvpage.htm
mapped with ArcView GIS Albers Equal Area Projection
Several graphic scales can be given, but care should be taken in design and placement. The design should be consistent. The scales should be grouped together.
U.S. Automobile Registration: 1999

Number of Automobiles
classification by natural breaks

data from WWW at: http://www.fhwa.dot.gov/ohim/hs99/mvpage.htm
mapped with ArcView GIS Albers Equal Area Projection
The scale should not be placed in a prominent position.
U.S. Automobile Registration: 1999

Number of Automobiles
classification by natural breaks
autos
- 434,118 - 1,085,744
- 252,071 - 40,117,25
- 155,997 - 228,509
- 62,013 - 152,442
- 19,762 - 55,037

data from WWW at: http://www.fhwa.dot.gov///ohim/hs99/mvpage.htm
mapped with ArcView GIS Albers Equal Area Projection
The date of the data and the date of production should be provided.

This is crucial information, because it identifies when the data represent and when the data were obtained.
U.S. Automobile Registration

Number of Automobiles
classification by natural breaks

- 434,118 - 1,685,744
- 252,071 - 401,172
- 155,997 - 228,592
- 620,131 - 1,524,24
- 195,782 - 550,537

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data from WWW at: http://www.fhwa.dot.gov/ohim/hs99/mvpage.htm
mapped with ArcView GIS Albers Equal Area Projection
Other essential information includes:

- credits for base map
- credits for data
- map projection
- cartographer identification
Credits should be sized to be legible but not overly prominent.

The positions should be peripheral.
U.S. Automobile Registration: 1999

data from WWW at: http://www.fhwa.dot.gov/ohim/hs99/mvpage.htm
mapped with ArcView GIS  Albers Equal Area Projection
The choice of map projection is critical.

When spatial distribution over the earth's surface is an issue, an equal area projection must be used.

Most projections do not maintain equal area relations.
U.S. Automobile Registration: 1999

Number of Automobiles
classification by natural breaks

-        4341182
-        18857441
-        2520717
-        £011725
-        1559972
-        2285392
-        820131
-        1524424
-        195782
-        550537

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data from WWW at: http://www.fhwa.dot.gov/ohim/h99/mvpage.htm
mapped with ArcView GIS  Robinson Projection
The graticule or grid ticks should assist in location but not dominate.
U.S. Automobile Registration: 1999

Number of Automobiles

- 43,118 - 166,577
- 252,071 - 401,726
- 155,972 - 225,292
- 620,121 - 1,524,634
- 195,762 - 550,526

data from WWW at: http://www.fhwa.dot.gov/ohim/hs99/mvpage.htm
mapped with ArcView GIS Albers Equal Area Projection
Lettering guidelines state that the map should use:

Only one typeface

Several type families (as needed for differentiation)

Between four to six different font sizes
Consider the audience, but avoid excessive and unnecessary labels
U.S. Automobile Registration: 1999

data from WWW at: http://www.fhwa.dot.gov/ohim/h599/mvpage.htm
Excel file format at: http://www.fhwa.dot.gov/ohim/h599/excel/mv1.xls
mapped with ArcView GIS Albers Equal Area Projection
Watch for spelling and labeling errors and omissions.
U.S. Automobile Registraton: 1899

Number of Automobiles
classification by natural brakes
autos

data from WWW at: http://www.fhwa.dot.gov/ohim/hs99/mvpage.htm
mapped with ArcView GIS Alberts Equal Area Projectin

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Blue lines may be invisible during photographic reproduction.

All lines should be done with drawing instruments and guides with overlapping ends removed.

The only freehand marks might be calligraphy which should use guidelines and planning to assist in consistent sizing and spacing of letters.
U.S. Automobile Registration: 1999

Number of Automobiles

classification by natural breaks

- Autos
- 100,001 - 200,000
- 200,001 - 400,000
- 400,001 - 600,000
- 600,001 - 800,000
- 800,001 - 1,000,000

Data from: www.fhwa.dot.gov/.../hs99/mvpage.htm
Mapped with ArcView GIS, Albers Equal Area Projection

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Two, three, or four different line weights are often desirable to help distinguish differences in line features. The widths need to be recognizable, but the total range must fit within comfortable viewing standards. Guides have been developed to help select appropriate line widths.
Maps must have margins.
U.S. Automobile Registration: 1999

Number of Automobiles
classification by natural breaks

- 454,118 - 1,685,744
- 252,071 - 401,725
- 1,539,972 - 2,286,392
- 820,131 - 1,524,24
- 1,951,702 - 5,505,37

data from WWW at: http://www.fhwa.dot.gov/ohim/hs99/mvpage.htm
mapped with ArcView GIS Albers Equal Area Projection
Neatlines act like frames highlighting the interior.
U.S. Automobile Registration: 1999

Number of Automobiles
classification by natural breaks

<table>
<thead>
<tr>
<th>Autos</th>
<th>Count</th>
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</tr>
<tr>
<td>2e20717 - 4e11725</td>
<td>500</td>
</tr>
<tr>
<td>1e155972 - 2e228592</td>
<td>500</td>
</tr>
<tr>
<td>6e20121 - 1e22 ± 2e4</td>
<td>500</td>
</tr>
<tr>
<td>1e195762 - .5e1237</td>
<td>500</td>
</tr>
</tbody>
</table>

data from WWW at: http://www.fhwa.dot.gov///ohim/hs99/mvpage.htm
mapped with ArcView GIS  Albers Equal Area Projection
The weight and number of neatlines should balance with the boldness of the interior.
U.S. Automobile Registration: 1999

Number of Automobiles classification by natural breaks

- 45,118 - 160,574+ 1
- 252,071 - 40,117+ 25
- 155,997 - 326,592
- 820,121 - 1,524+ 34
- 195,782 - 550,507

data from WWW at: http://www.fhwa.dot.gov/ohim/hs99/mvpage.htm
mapped with ArcView GIS Albers Equal Area Projection

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Maps have figure and ground.
The figures must not be lost within the ground.
Number of Automobiles
classification by natural breaks
autos

434,1162 - 1685710
252,9717 - 80,11725
1559972 - 2265292
820131 - 1524424
165762 - 590527

data from WWW at: http://www.fhwa.dot.gov/laloh/mvpage.htm
mapped with ArcView GIS Albers Equal Area Projection

01/13/01 Dr. M. H. Hill
An ordered arrangement of elements is important to the artistic impression of the map.

Alignment and balance are part of this organization.
Number of Automobiles
classification by natural breaks

<table>
<thead>
<tr>
<th>Category</th>
<th>Range</th>
</tr>
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<tbody>
<tr>
<td>autos</td>
<td>4341182 - 16657441</td>
</tr>
<tr>
<td></td>
<td>2520717 - 4011725</td>
</tr>
<tr>
<td></td>
<td>1559972 - 2265992</td>
</tr>
<tr>
<td></td>
<td>820131 - 1524424</td>
</tr>
<tr>
<td></td>
<td>195782 - 5505527</td>
</tr>
</tbody>
</table>

U.S. Automobile Registration: 1999
The map should not have an excessive amount of blank space.
U.S. Automobile Registration: 1999

Number of Automobiles
classification by natural breaks

- Autos
  - 434,182 - 1,885,744
  - 252,071 - 401,175
  - 155,972 - 226,592
  - 620,151 - 1,524,219
  - 195,762 - 550,537

Data from WWW at: http://www.fhwa.dot.gov/ohim/hs99/mvpage.htm
mapped with ArcView GIS  Albers Equal Area Projection

01/13/01 Dr. M. H. Hill
The optical center is located above the center of the page. This is the “strongest” location and should contain the most important map element.

THE MAP.
U.S. Automobile Registration: 1999

Number of Automobiles
classification by natural breaks
autos
434,1182 - 1665744
2527017 - 4011725
1559972 - 2285392
820131 - 15234.2
195762 - 550537

Data from WWW at: http://www.fhwa.dot.gov/ohim/hs99/mvpage.htm
mapped with ArcView GIS Albers Equal Area Projection

01/13/01 Dr. M. H. Hill
Visual scanning of the page goes from top left to the optical center to the bottom right side of the page.
This viewing pattern should be considered when placing elements on the page.
U.S. Automobile Registration: 1999
Most important of all, each map element has a weight. That weight indicates its importance.

The weight is provided through characteristics like size and boldness.

The map, the title, and the legend should be more prominent than the other map elements.
data from WWW at: http://www.fhwa.dot.gov/////////ohim/hs99/mvpage.htm
mapped with ArcView GIS  Albers Equal Area Projection
What is wrong with the following map design?
Number of Automobiles

classification by natural brakes

<table>
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<th>Class</th>
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<td>434,1182 - 1,685,741</td>
</tr>
<tr>
<td>2</td>
<td>252,0717 - 40,11725</td>
</tr>
<tr>
<td>3</td>
<td>155,9972 - 22,65392</td>
</tr>
<tr>
<td>4</td>
<td>82,0131 - 153,4424</td>
</tr>
<tr>
<td>5</td>
<td>19,5762 - 55,5327</td>
</tr>
</tbody>
</table>

U.S. Automobile Registration: 1999

data from WWW at: http://www.fhwa.dot.gov/________/chim/fs99/mvpdf.htm
Excel file format at: http://www.fhwa.dot.gov/________/chim/fs99/excelmv1.xls
mapped with ArcView GIS

Dr. M. H. Hill
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<thead>
<tr>
<th>Title: Destroying the Art in Cartography: Teaching Illustrations Using ArcView</th>
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<tbody>
<tr>
<td>Author(s): Miriam Hill</td>
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<tr>
<td>Corporate Source:</td>
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Organization/Address: Physical and Earth Sciences Jacksonville State University
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Telephone: (256) 782-8063
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