

Proportional Symbols

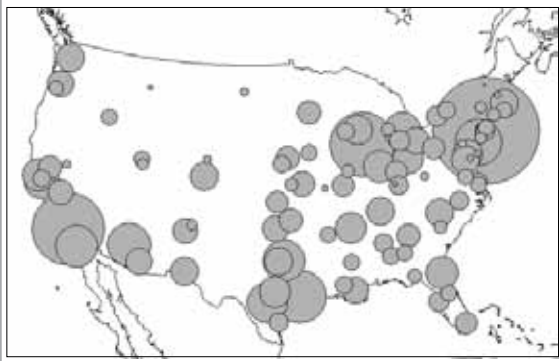
Tip Calculate your own symbol sizes when you want to be sure that the symbols will fit on your map without overlap

Proportional symbols vary in size proportionally to the attribute symbolized. For example, the marker for a town of 10,000 should be ten times larger than the marker for a town of 1,000.¹ Circles are the most frequently used point symbols.

What's wrong with automatically generated proportional symbols?

Mapping software like ArcGIS may offer a choice to display attributes as proportional symbols. This option is useful when there are numerous values and the range of values is not too wide. However, in many cases, the symbols end up overlapping when there is no option of setting a maximum size for the symbol.

The following is an example of the overlapping that occurs when mapping many points located close to each other, as in this attempt to represent major U.S. cities by their populations in ArcGIS.

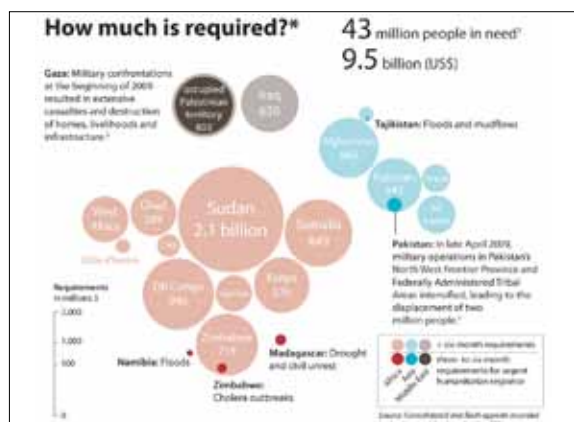


Why calculate your own proportional symbols?

You should calculate your own symbol sizes when you want to be sure that they will fit on your map without overlap or when you want control over the placement of the symbols, as in the example below.



Proportional symbols can also be used to represent figures or statistics in a more visually pleasing manner than charts and graphs, as in the infographic below.



¹ T. Ormsby, E. Napoleon, R. Burke, C. Groessl, and L. Feaster, *Getting to Know ArcGIS desktop*, (Redlands, CA, ESRI Press, 2001), 129 – 158.

Tip

How to calculate the size of symbols (when the range of values is not too wide)

Step 1	Step 2	Step 3	Step 4																								
Decide on the diameter of the largest symbol	Make a list of the elements and the attribute values to be represented	Calculate the square root of each value and use the results from this list in Step 4 result = $\sqrt{\text{value}}$	Calculate the symbol size per the following formula: symbol size = (result/largest result) x max. symbol size																								
For this example, we chose 50 pixels as the diameter of our largest symbol.		The largest value in our example is 52,250; its square root is 228.583.	Hence, in our example, the diameter of each symbol would equal (result/228.583)x50px.																								
<table border="1"> <thead> <tr> <th>City</th> <th>Population</th> <th>$\sqrt{\text{population}}$</th> <th>Symbol Size</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>52,250</td> <td>228.583</td> <td>50</td> </tr> <tr> <td>B</td> <td>488</td> <td>22.091</td> <td>4.832</td> </tr> <tr> <td>C</td> <td>12,356</td> <td>111.158</td> <td>24.314</td> </tr> <tr> <td></td> <td>10,000</td> <td>100</td> <td>21.873</td> </tr> <tr> <td></td> <td>1,000</td> <td>31.623</td> <td>6.917</td> </tr> </tbody> </table>				City	Population	$\sqrt{\text{population}}$	Symbol Size	A	52,250	228.583	50	B	488	22.091	4.832	C	12,356	111.158	24.314		10,000	100	21.873		1,000	31.623	6.917
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Trick

What to do when the range of values is too wide

1 When working with a range of values that is very great, consider whether the full range of values must be symbolized. Presumably, the higher amounts are important, but some of the lower values may be considered trivial and excluded from the symbolization.²

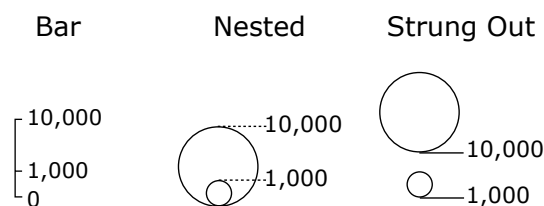
2 If the range of values cannot be reduced, then it's possible to use volumetric scaling for symbolization. This requires using the cube root instead of the square root of each value. Hence, following the steps above, the calculation in Step 3 will be $\sqrt[3]{\text{value}}$ instead of $\sqrt{\text{value}}$.

Tip

Don't forget to make a legend for the symbols!

1 In calculating the elements and values to be represented, remember to also calculate some standard values for use in the legend. (Note the values of 10,000 and 1,000 in the above example.)

2 Common arrangements of legend symbols include³:



^{2,3} David J. Cuff and Mark T. Mattson, *Thematic Maps: Their Design and Production*, (New York, Methuen & Co., 1982), 25 - 29.