Maptime Boston's Cartographic Design Tips

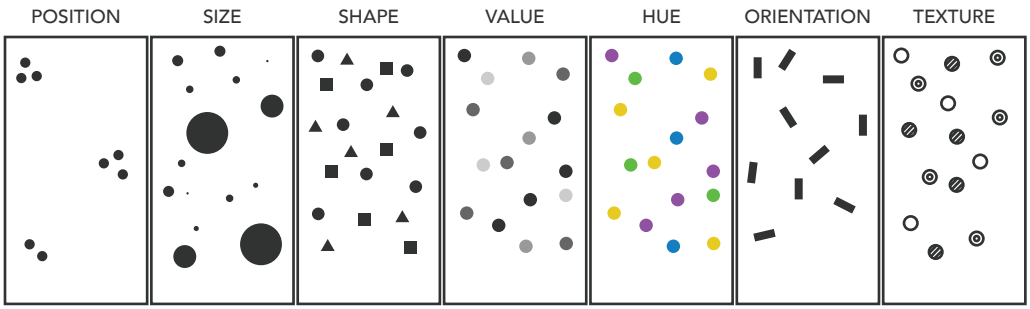
For more information and links to further resources and examples, visit github.com/maptimeBoston/cartographic-design

Do you need a map? Does it need to be interactive?

It's always good to ask whether your data or story even has a spatial component. If geography is not important, a map is probably not the best way to show it. Additionally, if you're working on the web, think about how much your map benefits from interactivity, if at all. Just because you *can* add interaction and more data doesn't mean you *should*—it requires a lot more design work from you, and potential difficulty for your audience.

Visual variables

Visual variables are the basic ways in which graphical marks vary.
Some allow quick visual grouping of symbols: for example symbols are easily grouped by *hue*, but not *shape*.
Some are perceived as naturally ordered, such as size and value (lightness).
Does the data you're mapping have order (or quanitity)? Are there groups that should stand out? Be mindful of the appropriate visual variables to use in your symbolization.

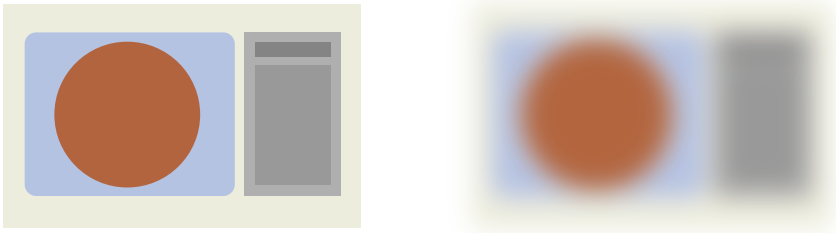


The seven "retinal variables" proposed by Jacques Bertin in Semiology of Graphics *(1967). Later cartographic researchers have expanded the list.*

Visual hierarchy

Good *visual hierarchy* is crucial to overall effective map design. Visual hierarchy is the organization of design such that some things seem more prominent and important, and others less so. Visual hierarchy should match *intellectual* hierarchy—what are the most important things in your map, conceptually? Those should stand out. Visual hiearchy depends on *figure-ground relationships*. Figures are the things that stand out; ground is the rest. (Think foreground and background.) Contrast is the key. In general, larger and darker things appear as figure.

Try the *squint test*. If you stand back or squint to blur your map, do the key components still stand out?



Color

Color is an important component of good map design, and while true mastery of color takes a designer's eye and experience, there are some general guidelines to follow:
• Keep in mind cartographic conventions you've seen: blue for water, etc.
• Avoid red–green color schemes, as a significant population is colorblind and can't discern these.
• Think about whether your colors imply relationships, and whether relationships actually exist in what you're mapping. If two things are not related, it may be best to color them with different hues.

For choropleth mapping, use color ramps appropriate to the nature of your data.
If there is no natural order of your data classes, use a *qualitative* color scheme.
If the data have order in one direction, use a *sequential* color scheme.
If the data have order and can be divided above and below some meaningful breakpoint, use a *diverging* color scheme.

Classifying and normalizing data

Most choropleth maps use a classification scheme to group data values into bins, ideally 3–7 of them. This can make it easier to read the map—but different classification methods can produce *vastly* different looking maps. They all have their advantages and drawbacks. Try to use one that is both understandable and clarifies real patterns in the data. A few common methods:

- Equal interval: divide data into groups of equal value ranges
- Quantiles: put the same number of data observations in each class
- Natural or Optimal breaks: find natural groupings, maximizing similarity within groups and differences between groups

Equal interval. No values at all in the third (purple) class!

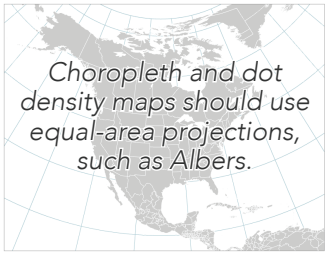
Quantiles. Does that outlier at the end really belong with the other green dots?

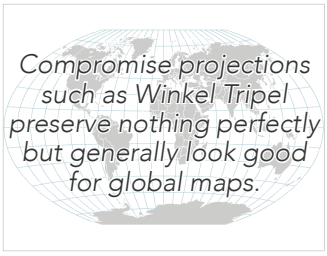
Hypothetical natural breaks. Looks good but can be hard to understand.

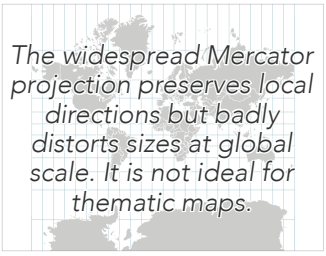
Choropleth maps should also be *normalized*, that is, some kind of ratio rather than raw counts of things. Otherwise you just get http://xkcd.com/1138/. For example, population *density* or GDP *per capita* are more meaningful than just population or total GDP.

Map projections

Displaying a round earth on a flat map, i.e., *projecting* the map, requires distortions. Map projections can accurately maintain local angles (shape, more or less), sizes, directions, or distance—but never all of them.







Text and labels

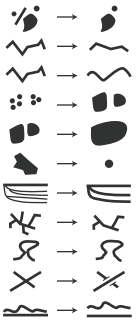
Type can convey information through words, but characteristics of type can also communicate meaning. Type on maps is found not only in labels, but also in supplemental information, such as legends and sources, and in blocks of prose. *Do not take typography for granted!* Your choices of typeface, style, etc. can have a strong impact on the clarity, meaning, and tone of the map.

- *Be consistent.* A good rule of thumb is to choose two fonts: one serif font, and one sans-serif.
- Encode information in different weights and styles (bold, italic, regular, light, etc.).
- Use principles of your *visual and intellectual hierarchy* with text. Make important things bolder and bigger, and less important things smaller and lighter (or even, off the map!).
- A convention is to label physical features (water bodies, for example) with a serif font. Water labels are often italicized.

Hypothetical label styles and hierarchy

Scale and generalization

At its core, cartography is about *abstraction*. We don't show data in its raw form; we *clarify* it in a variety of ways, often by removing things. A big reason is *scale*, that is, the size of the map compared to the size of the real world. It simply isn't possible to show every tiny detail! Data and graphics should be *generalized* appropriately to the map scale: at a large scale ("zoomed in") you can have more detail. Typical generalization operations include:



Selection: choosing which objects to include on the map
Simplification: reduce the number of vertices in an object
Smoothing: reduce sharp angles to smoother curves
Aggregation: group points into areas
Amalgamation: group areas into larger areas
Collapse: reduce a detailed object to a point symbol
Merge: grouping of line features
Refinement: select only portions of an object to display
Exaggeration: amplify a part of an object
Enhancement: add detail that visually elevates an object
Displacement: increase separation between objects