**Chapter 1 (Planning Maps) Preview Questions**

1. What are the essentials of planning better maps?
2. Why is it important to design a map with a purpose?
3. How do you plan a layout?
4. What are map projections?

**Chapter 1 Summary Notes**

* Ineffective maps can undermine your audience’s ability to understand the information you’re communicating.
* Designing better maps entails thinking carefully about each aspect of the map-design process.
* Size map elements relative to importance.
* Spaces between map elements are as important as the elements themselves.
* The choice of map projection depends on the purpose of the map.
* Projecting the round earth onto a flat surface causes unavoidable distortions that must be minimized.
* The topic and intended audience will dictate many of a map’s characteristics.
* Visual hierarchy is created by designing some parts of the map to appear as background information and other parts to take foreground prominence.
* Maps for non-experts should have a single message that focuses the attention of the reader.
* Maps for experts can be more complex.
* Consider the audiences physical ability to read when designing maps.
* Marginal elements for maps typically include source notes and other supporting information.
* Map design is largely about deciding how prominent to make each map element in the layout.
* Hierarchy is established by an element’s position in the map layout, size, and the amount of open space around it.
* Designing the positions and shapes of empty spaces is a key to good map layout.
* Page layout is about balancing empty spaces.
* Space can be used to break up visually dense information or emphasizing the relationships of map elements.
* Boxes around map elements makes designing with empty space more difficult.
* Strong geometric shapes can unintentionally elevate an element in the visual hierarchy.
* Place conceptually related elements physically near one another.
* Experimenting with element layout can improve a map design.
* Ask other people to judge the draft map layout.
* Choose a projection that relegates distortions to unimportant parts of the map.
* Projection affects the shape of the geographic areas, which in turn constrains the size and layout of the map.
* Projections affect distance scale.
* Choose an equal-area map projection when mapping data distributions.

**Chapter 2 (Basemap Basics) Preview Questions**

1. What is a basemap?
2. How are landforms displayed?
3. How is land use conveyed?
4. What is a vector base?
5. How do you customize base to purpose?
6. What is meant by mapping through scale?

**Chapter 2 Summary Notes**

* The basemap provides useful context.
* The basemap is usually background information.
* Four common ways of representing landform from digital data:
  + Shading terrain
  + Setting colors for elevation
  + Generating contour lines
  + Calculating curvature
* A digital elevation model (DEM) is a raster data type that stores a regular grid of elevation values.
* Fine-resolution DEM is for large-scale, detailed mapping.
* Course-resolution DEM is for broad view of landscape seen on smaller-scale maps.
* Hypsometric tints (hypso) is elevation coloring.
* Contours provide information about the elevation of points on the landscape.
* Index contours are darker or wider than intermediate contours.
* Hillshading calculates artificial lighting of a surface with a specified direction (azimuth) and altitude (angle) of illumination.
* Default hillshading is from the northwest and 45-degrees above the surface.
* Other terms include terrain shading, analytical shading, relief shading, and shaded relief.
* A hillshade is not an image.
* The scheme for hillshading always runs from light to dark.
* Curvature has
  + extreme negative values along concave features
  + extreme positive values at sharp ridges and the most convex areas
  + zero values for flat areas
* Curvature usually uses black-to-white sequence
  + Valleys represented as dark
  + Ridges represented as light
* Orthoimages are images showing the landscape from images corrected to align with accurate mapping.
* Mapping over imagery is challenging because of the many surface colors and full range of dark and light areas.
* Orthoimage does NOT need to be seen at full contrast to be useful.
  + Increase image transparency
  + Overlay the orthoimage with a partly transparent white layer between the image and the overlaying elements.
* Parcel maps are also called cadastral maps.
* Move the vectors to match the physical characteristics that underpin them if those layers ar orthorectified.
* Boundaries may create visual clutter.
* Boundaries from different sources may not perfectly overlay.
* If boundaries overlay well, use a boundary line made up of two lines, one dashed and one solid right below it, and set the solid line the same width or slightly wider.
* Base data should be well matched to the scale of the map display.
* Choose a DEM that will give the best looking terrain.
* Operations for changing the geometry of data to improve the look of a map:
  + Eliminate
  + Reclassify
  + Simplify
  + Aggregate
  + Collapse
  + Merge
  + Smooth

**Chapter 7 (Color Basics) Preview Questions**

1. What is the definition of hue, lightness, and saturation?
2. What are the differences between perceptual color systems?
3. How do you mix colors using CMYK and RGB to create map symbols?

**Chapter 7 (Color Basics) Reading Summary**

* The two basic types of maps are reference maps and thematic maps.
* Color hue is used to symbolize different kinds of features on reference maps.
* Color hue is used for analytical purposes on thematic maps.
* Color is a combination of hue, lightness, and saturation.
* Lightness is the most important dimension for representing quantitative data.
* Hue is what we commonly associate with color names (e.g., dominant wavelength).
* Additive mixture is mixing lights (RGB are additive primaries)
* Subtractive mixture is mixing pigments (CMY are subtractive primaries)
* Lightness (i.e., color value) describes how much light appears to reflect from an object compared to white.
* Variations in lightness are often used to represent rankings on maps.
* Light colors represent low data values and dark colors represent high data values.
* Saturation is a measure of the vividness of a color.
  + Shade (mixes black into a color hue)
  + Tint (mixes white into a color hue)
  + Tone (mixes gray into a color hue)
* Desaturated hues become grayish or pale (i.e., more neutral)
* Saturation alone is not an effect symbol variable.
* Use saturation changes to reinforce lightness changes.
* Use saturation to avoid inappropriate emphasis of map categories.
* Perceptual dimensions of color used to construct three-dimensional color spaces.
* Different systems for representing or specifying color use different dimensions.
* RGB mixes color in light (i.e., additive mixture)
* CMY mixes color in pigments (i.e., subtractive mixture)
* Windows operating systems offer
  + HSL (hue-saturation-luminance)
  + HCL (hue-chroma-luminance)
  + HVC (hue-value-chroma)
  + Ljg (lightness-yellowness-greenness)
  + Luv (luminance, u-axis, v-axis)
  + Lch (luminance, chroma, hue)
  + IHS (intensity, hue, saturation)
* Perceptual scaling is when equal distances in color space produce equal color difference perceptions.
* HSV and HSB are mathematical transformations of RGB without perceptual scaling; they are considered poor approximations.
* In HSV, value specifications between hues are NOT comparable.
* The mixtures of the primaries of CMY and RGB form a regular 3D cube.
* You cannot mix all of the vivid colors of RGB light using CMY pigments because light has a higher purity.
* Create a hue circle comprised of two overlaid triangles forming a six point star. Label first triangle from top point going clockwise R-G-B. Label second triangle from bottom point going clockwise C-M-Y.
* CMY mixtures are specified with percentages of ink.
* RGB mixtures are specified using numbers from 0 to 255.
* Subtractive color mixing uses four inks:
  + Cyan (C)
  + Magenta (M)
  + Yellow (Y)
  + Black (K)
* In RGB, similar proportions produce similar hues.
* Equal steps in RGB do not look like equal visual steps.

**Chapter 8 (Color on Maps) Preview Questions**

1. What are the various types of color schemes?
2. How do you combine scheme types for two-variable mapping?
3. How do you adjust color selections for simultaneous contrast and color-blind readers?
4. What are custom color ramps?

**Chapter 8 (Color on Maps) Reading Summary**

* Perceptual structuring of colors should correspond with the logical structuring in the data.
* ColorBrewer (<http://www.ColorBrewer2.org>) provides guidance for selecting map colors.
* Use lightness to represent ordered (sequential) data.
* Sequential color schemes can supplement lightness with hue.
* Diverging color schemes use a light color for the midrange of the data and varying lightness in two contrasting hues to emphasize divergence from a midpoint.
* Qualitative color schemes represent different kinds of map features or categories that are not ordered.
* Do not be overly concerned with selecting color hues that are naturally associated with a category; use color hue as an abstract symbol and focus on making the colors easy to differentiate.
* Be aware of color associations that may be offensive (i.e., black for African-Americans, red for Native American, etc.)
* Bivariate color schemes represent more than one variable on a map at the same time using a matrix of colors.
* Legend construction is a critical part of creating bivariate maps.
* Overlay semi-transparent data layers is one method for creating bivariate maps.
  + Hard to predict how single-variable schemes will blend.
* Creating nine (9) separate map classes and specifying a color for each class is often a more effective method for creating bivariate maps.
* Sequential-sequential maps visualize two (2) possibly related quantitative variables.
* Diverging-diverging maps visualize one or more variables as diverging in character.
* Qualitative-sequential maps visualize one variable a qualitative (i.e., categorical) and the other as sequential (i.e., ordered).
* Reasons to adjust color selections:
  + The perceived hue, lightness, and saturation can be altered by surrounding colors.
  + Color-blind map readers.
  + Color maps that will be photocopied in black and white.
* Color appearance is affected by context.
* Small colored objects are more difficult to identify than large colored objects.
* You can distinguish fewer colors the smaller the objects.
* Select final colors based on appearance in the final map pattern and intended media; not the legend.
* Desaturated colors (e.g., rust, olive, etc.) are more difficult for people with milder color vision impairments to distinguish than saturated red and green.
* Hue pairs typically not confused by people with the most common types of color vision impairments:
  + Red; blue
  + Red; purple
  + Orange; blue
  + Orange; purple
  + Brown; blue
  + Brown; purple
  + Yellow; blue
  + Yellow; purple
  + Gray; yellow
  + Gray; blue
* Just about any sequential scheme with good lightness contrast between colors will accommodate color-blind readers.
* It is difficult to design qualitative schemes for color-blind readers because they require many different color hues.
* Have a color-blind person review your map.
  + Color-blindness is more common in men than women.
  + Vischeck (<http://www.vischeck.com>) simulates what color-blind people will see on your map.
  + Many people who have mild color-blindness don’t know that suffer from it.
* You can select endpoint colors and automatically ramp between them.
  + Improve the scheme by specifying interim colors.

**Chapter 3 (Explaining Maps) Preview Questions**

1. What is the purpose of the legend?
2. What are hierarchies in text content?
3. What constitutes well-designed marginal elements?

**Chapter 3 Reading Summary**

* The purpose of titles, legends, and notes is to help map readers understand and remember the map.
* The goal is to provide information without disrupting the visual hierarchy that emphasizes the main content.
* The legend enables readers to interpret the map and understand its symbols.
* Omit the more obvious supporting data from the map legend.
* Types of data legends:
  + Choropleth
  + Qualitative area fills
  + Dot density
  + Isolines
  + Proportioned symbols
  + Segmented symbols (e.g., pie charts)
* Basemap themes don’t need to be included in the legend because they are easy enough to understand.
* Customize legend titles, headings, labels, and layouts to best describe the meaning of symbols.
* When you customize a legend you lose the ability to have it automatically update with changes in the map.
* Four strategies for customizing a legend:
  + Convert legend to graphics
  + Add drawn elements and text to an inserted legend
  + Convert map symbols to graphics
  + Construct manually
* With customized legends, you’ll have to manually update the legend elements to reflect changes in the map.
* Annotations added to a map legend clarify the meaning of groups of map classes.
* Communicate map content using a hierarchy of detail.
* Marginal text should be succinct with minimal punctuation.
* Including who, what, where, and when in a map title can make it impenetrable.
* Be sure that your map text says what you mean to say.
* As a check, have others describe the map to you.
* Add an explanatory note is you are having trouble balancing brevity and accuracy in titles and legends.
* Breaks and spaces take over some of the roles of sentence structure and punctuation.
* Map scale is communicated three ways:
  + Graphic bar scale
  + Verbal scale
  + Representative fraction (absolute scale)
* Simple scale bars are more appropriate for thematic maps.
* Detailed scale bars are more appropriate for detailed reference maps.
* A good scale bar uses rounded units that are easy for the map reader to use.
* Direction indicators should not draw attention away from the map content.
* Do not use a north arrow when the direction of north varies across the map.
* When north is multiple directions, replace the north arrow with the graticule to indicate direction.
* Don’t overdo decoration.
* Decorations can be effective additions when use purposefully.
* Do not let the background become too high in the visual hierarchy.

**Chapter 4 (Publishing and Sharing Maps) Preview Questions**

1. Why must you design for final resolution, size, and viewing environments?
2. How do you choose between rastor and vector export formats?
3. How should you list sources for data and graphic elements on a map?
4. Why should you clearly list your copyright or public-use license on the map?

**Chapter 4 (Publishing and Sharing Maps) Reading Summary**

* Many maps are intellectual property protected by copyright law.
* A map or dataset that is freely available is not necessarily free for commercial use or on websites.
* Each mode of display constrains how a map can be made and what it can contain to be legible.
* Resolution measures the smallest marks we are able to create within a display.
  + Pixels per inch (ppi)
  + Dots per inch (dpi)
  + dpi and ppi are roughly equivalent
* It’s best to set for-print dpi to at least 300.
* To retain print resolutions, resize large files without resampling pixels (i.e., lowering dpi).
* Pixel density affects visible image size.
* Changing the ppi for a digital image means changing the pixel dimensions for the image.
* Viewing distance affects map design.
* Maps shown by projectors often require greater color contrast, particularly when they include very light colors.
* Raster export formats
  + JPEG (.jpg)
  + PNG (.png)
  + TFF (.tif)
* TIFF has largely replaced BMP (bitmap) and is widely recognized by multiple operating systems and software packages.
* Vector export formats
  + AI (.ai)
  + PDF (.pdf)
  + SVG (.svg)
* PDF has largely replace EPS (.eps)
* PDF and SVG can be used to transfer vectors between programs.
* TIFF, GIF, and PNG support transparency.
* JPEG, PNG, and PDF are suitable for displaying static map images on the web.
* A slippy map is a zoomable and pannable map on the web.
* Section 508 is a set of laws governing the accessibility of electronic information by people with disabilities.
* Copyright protection applies only to the expression of facts, not the facts themselves.
* Mapmakers must put an appreciable amount of creative work into the map for it to be protected under copyright.
* Original work is assume to be the copyright of the creator.
* Copyright hooks in maps are small streets or extra non-existent locations that will NOT lead the map reader astray.
* Cartography firms sometimes add copyright hooks to their map documents to allow them to identify derivative products.
* All government data is not public domain.
* Best practice is to make clear under what license you intend the map to be used or shared, if at all.

**Preview Questions**

1. How do fonts affect map appearance?
2. How does label size affect map appearance?
3. What are type effects?

**Reading Summary**

* Fonts are the personality of a map.
  + Strokes are lines that make the shape of the letter.
  + Serifs are small finishing strokes on letters.
  + Terminals are the ending strokes on letters that do not have serifs.
  + Baseline is the line on which the letter sits.
  + Cap height is the height of capital letters without curved elements at their tops.
  + X-height is the size of the lowercase x.
  + Descenders are part of the letter that extends below the baseline.
  + Ascenders are the part of the letter that extends above the x-height.
  + Counters are closed spaces inside letters.
  + Bowls are the curved potion of a letter.
* Five basic categories of font:
  + Text – easy to read
  + Display – can be difficult to read
  + Serif – letterforms are generally easier to distinguish
  + Sans serif – designed for on-screen viewing
  + Monospace – each character occupies the same amount of space
* Maps usually only contain one serif font and one sans serif font.
* Fonts with large x-heights are more legible.
* Fonts with thicker strokes tend to remain legible after reproduction and against busy backgrounds.
* Regular, italic, bold, and bold italic are separate fonts that are installed individually on the computer.
* Fonts that differ in appearance may have the same name.
* Avoid typefaces designed for other character sets.
* Always check special characters before exporting to the final format.
* Fonts are miniature programs.
* Unless explicitly noted, fonts are intellectual property that requires a license to use.
* Font substitution may degrade the appearance of a map.
* Larger labels are used for more important map features.
* Ways to change the size of a map text element:
  + Change the size of characters
  + Change the space between letters
  + Change the space between lines (i.e., leading pronounced “led-ing”)
* The leading number in ArcGIS indicates increasing or decreasing from the default.
* Settle on a final typeface early in the map design process.
* Type effects can be used to augment text on maps.
* Callouts use graphic elements to link the label to a point location.
* Shadow effects can increase the legibility of text on maps.
  + By adding contrast with background colors and map features.
  + Use shadows sparingly.
* Halos function like shadows.
  + Called letter casing in cartography
  + Called stroke outlining letters in design software
* When using halos be careful not to obscure important map data.

**Preview Questions**

1. What is the difference between graphic map text, dynamic labeling, and annotations?
2. How do you use labels as symbols?
3. How do you use ambiguity and contradiction in classification with type?
4. What are the key label placement conventions?

**Reading Summary**

* Labels help map readers correctly interpret map data.
* Graphic map text provide general information about a map and are not associated with specific map features
  + Titles
  + Subtitles
  + Sources
  + Notes
* Using graphic text to label map features is problematic.
* Dynamic labeling allows you to automatically label multiple features in a layer.
* The position of annotations are fixed but cannot be moved outside of the data frame.
* Labels can be used as symbols to help map readers find features by characterizing them.
  + Variations in type style
  + Variations in font
  + Variations in posture
  + Variations in color hue
  + Variations in arrangement
* Use characteristics to establish visual hierarchies
  + Point size
  + Weight
  + Scaling
  + Color lightness
  + Text case
* Uppercase lettering is often used for area feature labels regardless of importance.
* Character spacing has a weak effect on visual heirarchy
* Anti-aliasing lessens or eliminates the appearance of pixels by smoothing the edges of objects or letters.
* There is a series of preferred positions relative to the point location for horizontal labels (pp. 116).
* Maintain a consistent distance between labels and their points to keep the map visually appealing and easy to read.
* As a general rule you should break lines for label placement.
* A point label should be on the same side of a linear feature as its point.
* When labeling point features near bodies of water, position labels for coastal and shoreline features wholly in the water or on land.
* Labels for line features should follow along the line and be separated from it by a small gap.
* Use character spacing in area labels to express the extent; DO NOT express extent of area labels by making the point size larger.
* Character spacing is better suited to uppercase text.
* Avoid a series of area labels that are aligned horizontally.
* General guidelines for positioning area feature labels:
  + Suggest the extent of the area by
    - the position of the label
    - using character and line spacing
    - simply curved labels
  + Use uppercase letters when spacing characters
  + DO NOT adjust point size to fit labels into areas
  + Stagger the horizontal alignment of individual labels
  + Adjust label position so gaps fit across features
  + Ensure that individual characters are not mistaken for symbols or features
* Leader lines help in labeling crowded map areas.
* DO NOT place a leader line on every label.

**Preview Questions**

1. How do map designers use point symbols?
2. How do map designers use line and rea symbols?
3. How are visual variables for point, line, and area symbols used to represent ordered data and qualitative data?
4. When do you use multivariate mapping?
5. What are the possible pairings of eight (8) visual variables for bivariate mapping?

**Reading Summary**

* Point symbols can apply to both point and area locations.
* Point symbol size, shape, and angle can be used to represent data.
* Visual variables that may be applied to line and area symbols include size, pattern, spacing, shape, arrangement, and orientation.
* The eight (8) visual variables used to represent map data include:
  + Size
  + Lightness
  + Spacing
  + Saturation
  + Hue
  + Shape
  + Orientation
  + Arrangement
* Size, lightness, spacing, and saturation are well-suited to represent ordered data.
* Hue, shape, orientation, and arrangement are well-suited to representing categorical data.
* Pattern symbols are well-suited to overlay color symbols.
* Combinations within symbols, rather than as overlays, are useful for presenting pairs of data variables for bivariate mapping.
* Figure 9.32 on pp. 200 shows the full set of possible combinations of eight (8) visual variables.